Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

THIRD ANNUAL REPORT

Prepared for

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Overview

In 2012, the Centers for Medicare & Medicaid Services (CMS) awarded $162,622,080 to 24 health care organizations to demonstrate impacts on health care quality, cost, and outcomes over a 3-year period. Established as part of the Health Care Innovation Awards (HCIA) for Community Resource Planning, Prevention, and Monitoring (https://innovation.cms.gov/initiatives/Health-Care-Innovation-Awards/), these awardees were diverse in the type of organizations represented, as well as the focus and scale of innovations. Some awardees tested processes and tools to improve coordination of care across multiple health care settings, while others tried to improve patient care via innovative health information technology, decision support tools, or changes to the composition of the health care workforce.

In an effort to identify and understand the models that could be expanded on a broader scale, the Center for Medicare & Medicaid Innovation (CMMI) contracted with RTI International to evaluate the 24 HCIA Community Resource awardees (HCIA awardees). The evaluation draws upon qualitative and quantitative methods to assess the impact of the awardees' innovations on three overarching goals of the Affordable Care Act of 2010 (ACA): smarter spending, better care, and healthier people. This executive summary of the third annual report presents the awardees' progress and impact over the 3-year funding period from 2012 to 2015. We provide an overview of the HCIA awardees, evaluation design, and key findings organized by the specific evaluation questions that we addressed:

- To what extent have HCIA Community Resource awardee innovations affected each goal of the Affordable Care Act: smarter spending, better care, and healthier people?
- How did each awardee and similar awardees transform the health care workforce, and what factors affected their ability to do so?
- How effective have awardees been in implementing their innovations, and what similarities were evident across awardees in implementation effectiveness?

Our overall key findings highlighted in this report:

- Five awardees had statistically significant reductions in spending.
- Nine awardees had statistically significant reductions in emergency department (ED) visits and inpatient admissions.
- Seven awardees had improvements in health outcomes.
- More than two-thirds of awardees achieved high reach, and half provided high-intensity dose.
- Effectively integrating the community health worker role into a clinic setting requires organizations to prepare for this role, define and value the role, and use the role in ways that reduce clinic burden.
- Provider satisfaction with the innovation depends on four critical factors: (1) engagement in the implementation; (2) perception of a benefit of the innovation; (3) integration into clinical workflow; and (4) sufficient resources dedicated to implementation.
- The combination of organizational priority with either high-level leadership support or prior history with the innovation led to effective implementation.
- Two-thirds of the innovations achieved high levels of sustainability on one or more components.

Awardees

The HCIA Community Resource awardees included five federally qualified health centers (FQHCs), three academic institution, two health plans, two integrated health systems, two hospitals, and 10 other health care organizations. Each awardee received on average $6,743,861 to implement their innovations, which targeted various components including coordination of care, process of care, health information technology, decision support, provider payment reform, direct health care and dental services, and health care workforce. See ***Figure ES-1*** for an overview of the types of innovations the awardees implemented in addition to their organization type, target population, state, payer, and funding amount.

Figure ES-1. Summary of HCIA Community Resource Awardees

Awardee	State	Innovation Types	Participants	Organization Type	Funding Amount	Payer Type
Altarum Institute (Altarum)	MI	Coordination of care; Process of care; Health information technology	Providers	Evaluation/research organization	$8,366,178	Medicare; Medicaid
Asian Americans for Community Involvement (AACI)	CA	Coordination of care; Health care workforce	Adult Patients	Federally qualified health center	$2,684,545	Medicare
Ben Archer Health Center (BAHC)	NM	Coordination of care	Adults Patients with chronic condition	Federally qualified health center	$1,270,845	Medicare; Medicaid
Bronx Regional Health Information Organization (Bronx RHIO)	NY	Health information technology; Health care workforce	Patients (all ages)	Health information exchange	$12,689,157	Medicare; Medicaid
Children's Hospital and Health System (Children's Hospital)	WI	Coordination of care	Patients (all ages)	HMO health plan	$2,796,255	Medicaid
Curators of the University of Missouri (Curators)	MO	Coordination of care; Health information technology; Decision support	Adult Patients	Integrated health system	$13,265,444	Medicare; Medicaid
Delta Dental Plan of South Dakota (Delta Dental)	SD	Coordination of care; Direct health care/dental care	Children; Infants	Dental health plan	$3,364,528	Medicaid
Eau Claire Cooperative Health Centers (ECCHC)	SC	Coordination of care; Direct health care/dental care	Adults Patients with chronic condition	Federally qualified health center	$2,330,000	Medicare; Medicaid
Finity Communications (Finity)	PA	Coordination of care; Health information technology; Decision support	Patients (all ages)	Health technology firm	$4,967,962	Medicaid
Imaging Advantage (IA)	IL	Process of care; Health information technology; Decision support	Providers	Health technology firm	$5,977,805	Medicare; Medicaid
Intermountain Health Care Services, Inc. (Intermountain)	UT	Health information technology; Decision support; Provider payment reform	Providers	Integrated health system	$9,724,142	Medicare; Medicaid
Mary's Center for Maternal & Child Care (Mary's Center)	DC	Coordination of care; Health information technology; Provider payment reform	Adult Patients	Integrated health system	$14,991,005	Medicaid
Michigan Public Health Institute (MPHI)	MI	Coordination of care; Provider payment reform; Direct health care/dental care; Health care workforce	Adults Patients with chronic condition	Evaluation/ Research Organization	$14,145,784	Medicare; Medicaid
Mineral Regional Health Center (Mineral Regional)	MT	Process of care; Health information technology; Provider payment reform; Health care workforce	Health systems	Hospital collaborative	$10,499,889	Medicare; Medicaid
National Health Care for the Homeless Council (NHCHC)	Multi	Coordination of care; Direct health care/dental care	Adult Patients	Nonprofit organization	$2,681,877	Medicare; Medicaid
Northeastern University (NEU)	MA	Health information technology; Direct health care/dental care	Health systems	University	$8,000,002	Medicare; Medicaid
Prosser Public Hospital District (Prosser)	WA	Coordination of care	Adults Patients with chronic condition	Critical access hospital	$1,470,017	Medicare; Medicaid
Regional Emergency Medical Services Authority (REMSA)	NV	Coordination of care; Process of care; Decision support	Patients (all ages)	Emergency medical services provider	$10,824,025	Medicare; Medicaid
South County Community Health Center (South County)	CA	Coordination of care; Process of care; Direct health care/dental care; Health care workforce	Patients (all ages)	Federally qualified health center	$7,060,843	Medicare; Medicaid
Southeast Mental Health Services (SEMHS)	CO	Coordination of care; Health care workforce	Patients (all ages)	Mental health provider	$1,405,924	Medicare; Medicaid
University of Chicago (U-Chicago)	IL	Coordination of care; Health information technology; Decision support	Patients (all ages)	University	$5,862,027	Medicare; Medicaid
University of Miami (U Miami)	FL	Coordination of care; Health information technology; Provider payment reform; Direct health care/dental care	Children	University	$4,097,198	Medicaid
Women and Infants Hospital of Rhode Island (W&I)	RI	Coordination of care	Infants	Acute care hospital	$3,261,494	Medicaid
YMCA of the USA (Y USA)	Multi	Coordination of care; Health care workforce	Adult Patients	Nonprofit organization	$11,885,134	Medicare
				Total	**$163,622,080**	

Innovation Types

Coordination of care
Planned organization of patient care activities and exchange of information between two or more individuals responsible for that care, including patients and caregiver(s). Revisions of clinical processes, procedures, protocols, and practices, both formal and informal.

Process of care
Modifications to clinical processes, procedures, protocols, and practices (formal and informal) to improve efficiency, quality, safety, and cost of health care.

Health information technology
Information processing that uses computer hardware and software to support health care delivery. Examples are electronic health records, personal health records, and health information exchange.

Decision support
Person-specific information, intelligently filtered and presented at appropriate times, to enhance health care decision making by patients or providers. Examples include tools, paper or electronic decision aids, and computerized alerts and reminders.

Provider payment reform
Use of payment methods to foster greater, efficiency, and quality while reducing unnecessary spending in health care. Examples include accountable care organizations, bundled care/episodic payment, and value-based purchasing.

Direct health care/dental care
Medical or dental care provided by a licensed health care professional.

Health care workforce
Training and deployment of personnel to work in new or expanded roles in a health care setting. Examples include community health workers, data analysts, and systems engineers.

Participants

- **Adult Patients**
- **Adults Patients with chronic condition**
- **Patients (all ages)**
- **Children**
- **Infants**
- **Providers**
- **Health systems**

Payer Type

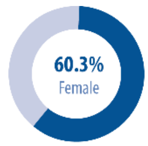
- **Medicare**
- **Medicaid**

Source: 2014 & 2015 Site Visits, *Q12 Narrative Progress Report*.
HMO = health management organization.

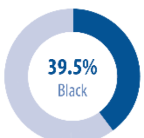
The HCIA awardees specifically focused on the needs of vulnerable populations. More than half of awardees targeted patients covered by Medicare, and nearly all awardees enrolled patients covered by Medicaid in their innovations. Awardees also targeted racial/ethnic minorities, children, families, patients with special health conditions, and those living in rural regions. See ***Figure ES-2*** for the demographics of individuals who participated in the innovations.

Figure ES-2. Demographics of Participants in HCIA-Community Resource Innovations

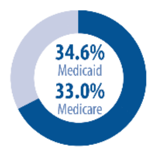
Age	Number of Participants	Percentage of Participants
< 18	96,181	18.7
18-64	**257,584**	**50.0**
65+	154,753	30.0
Missing	6,875	1.3
Total	515,393	



Sex	Number of Participants	Percentage of Participants
Female	**310,917**	**60.3**
Male	182,961	35.5
Transgender	2	0.0
Missing	21,513	4.2
Total	515,593	



Race/ethnicity[1]	Number of Participants	Percentage of Participants
White	76,051	27.1
Black	**110,880**	**39.5**
Hispanic	16,793	6.0
Asian	5,171	1.8
American Indian or Alaska Native	7,377	2.6
Native Hawaiian or Other Pacific Islander	617	0.2
Other	5,703	2.0
Missing/refused	58,117	20.7
Total	280,709	



Payer category[2]	Number of Participants	Percentage of Participants
Dual	10,709	3.1
Medicaid	**118,960**	**34.6**
Medicare	**113,232**	**33.0**
Medicare Advantage	3,920	1.1
Other	46,059	13.4
Uninsured	21,279	6.2
Missing	29,161	8.5
Total	343,320	

[1]IA, Intermountain, and REMSA were unable to provide race/ethnicity data, so are excluded.
[2]IA was unable to provide payer category data, so is excluded.

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[2] IA was unable to provide payer category data, so it is excluded.

Methodology

1. Evaluation Data Sources

The evaluation of the HCIA awardees includes individual evaluations of each awardee's innovation and a cross-cutting evaluation that synthesizes findings across the 24 awardees. The findings presented in the report and this executive summary draw from and integrate **five key data sources**:

- **Awardee documents**, including quarterly progress and performance reports documenting innovation activities, accomplishments, expenditures, staffing, and other organizational information. These documents were obtained through the final quarter of operations, which extended through June 2015 for awardees completing their initiatives within the original award period and through December 2015 for awardees given extensions.
- **Interviews** with project staff leading and participating in the innovations, which were conducted in the final quarter of operations through March 2016.
- **Claims data** including health care spending and utilization for each Medicare and Medicaid beneficiary, which were submitted to CMS through December 2015.

- **Secondary data from awardees**, such as administrative or electronic health record data, used to monitor the innovations, which were collected through December 2015.

- **Survey of providers** directly affected by the innovation through a new tool or process, which was conducted March–April, 2015.

2. Claims Data

a. Core Measures

Using definitions specified by CMMI, we calculated the following measures through analysis of Medicare and Medicaid fee-for-service claims:

- Total health care spending per patient,

- All cause hospital admissions,

- Hospital unplanned readmissions, and

- ED visits not leading to a hospitalization.

As described in the individual awardee sections, some innovations (e.g., dental care for children) may not have directly impacted these measures. Innovations that addressed specific conditions or procedures (e.g., diabetes, imaging) may have had significant impacts on these health care spending and utilization measures. However, these effects may not be statistically detectable at the aggregate level because the targeted condition or procedure represented only a small fraction of total spending, inpatient admissions, hospital unplanned readmissions, and ED visits at that site.

b. Data Availability

Claims data collection was a multistep process that began with obtaining patient identifiers (e.g., SSN, HIC) from the awardee and matching these identifiers to beneficiary claims in the Chronic Conditions Data Warehouse. When Medicare and Medicaid claims could not be matched to the patient identifiers, we secured Medicaid claims data directly from the awardee (e.g., Finity, Mary's Center, and SEMHS). Once we created patient files, we constructed comparison groups and carried out descriptive and regression analyses.

Awardees enrolled patients in their innovations on a rolling basis, which means that we are still receiving and analyzing data for those who entered at a later point during the 3-year period; we will include those findings in the final report addendum. We do not anticipate that the additional data will result in a large change in the results for the Medicare awardees because we included claims data through December 2015 in this report. However, there may be more volatility in the Medicaid data because we only included Medicaid claims into 2015 for two awardees, and additional data may change the results for those with limited data in this report.

As shown in ***Table ES-1***, this report presents descriptive Medicare claims findings for 18 awardees and regression [difference-in-differences] findings for 15 awardees. These 15 awardees had patient identifiers RTI could match with existing data in the Chronic Conditions Data Warehouse *and* also had a matched claims sample of at least 20 beneficiaries for descriptive analyses and 100 beneficiaries for regression analyses.

Availability of Medicaid claims varied by the state where awardees were located; these ranged from the last quarter of 2013 to the last quarter of 2015. In total, we present descriptive Medicaid claims findings for 19 awardees who met the same criteria (patient identifiers and a sample of 20 beneficiaries or more) and 15 who met the criteria for regression analyses (patient identifiers and a sample of 100 beneficiaries or more).

Table ES-1. Claims Data Available for Analyses Presented in the HCIA Community Resource 2016 Annual Report

Awardee	Medicare Descriptive	Medicare Difference-in-Differences	Medicaid Descriptive	Medicaid Difference-in-Differences
AACI	●	●		
Altarum	●	●	●	
BAHC	●	●	●	●
Bronx RHIO	●	●	●	●
Children's Hospital			●	●
Curators	●	●	●	●
Delta Dental			●	●
ECCHC	●		●	●
Finity			●	●
IA	●	●	●	●
Intermountain	●	●		
Mary's Center			●	
Mineral Regional	●	●	●	●
MPHI	●	●	●	●
NHCHC	●		●	
NEU	●	●	●	●
Prosser	●	●	●	●
REMSA	●	●	●	
SEMHS	●	●	●	●
South County	●		●	
U-Chicago	●	●	●	●
U-Miami	N/A	N/A	N/A	N/A
W&I			●	●
Y-USA	●	●		
Totals	18	15	19	15

N/A = not available.

c. Analysis

Comparison Groups. For each awardee, where possible, we developed a comparison group to assess what would have happened in the absence of the innovation. We aimed to select similar comparison groups and innovation groups (during the baseline period and then matched them based on their propensity scores, which estimate the probability of participation in the innovation.

Descriptive and Regression Analyses. After the comparison groups were selected, we descriptively plotted the core four spending and utilization measures over time for both the comparison group and the innovation group. We could then examine the trends both before and after the innovation started. In addition, we statistically examined the differences in the growth rates before and after using a difference-in-differences analytic approach. We also used quarterly fixed effects models to report the performance of the innovation group on a quarterly basis and overall.

3. Secondary Data from Awardees

a. *Core Measures*

To determine the impact of the innovation on patient health, we collected and analyzed measures of clinical effectiveness and health outcomes based on secondary data from the awardees' electronic health records and administrative databases. We also used these secondary data on patient recruitment, enrollment, and service utilization to determine reach and dose of the innovation. Data include patient-level measures of clinical effectiveness (e.g., adherence to standards of care) and health outcomes related to specific disease conditions. We reviewed each awardee's self-monitoring measurement plan and identified clinical effectiveness and health outcome measures that would be useful to include as part of our evaluation.

As shown in ***Table ES-2,*** this 2016 annual report presents outcomes for the 17 awardees that were able to provide data on one or more measures related to diabetes, hypertension, asthma, weight control, mental health, or other health outcome. The most commonly reported measures related to diabetes (11) and hypertension (10). Smaller subsets of awardees had measures related to weight control (7) and mental health (3). One awardee reported asthma and chronic obstructive pulmonary disease (COPD)-related outcomes. Five awardees had outcome measures other than those specified in the table, including items related to radiation exposure, pregnancy, and mortality.

Table ES-2. Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes Presented in the HCIA Community Resource 2016 Annual Report

Awardee	Diabetes	Hypertension	Asthma/COPD	Weight Control	Mental Health	Other
Altarum						●
BAHC	●	●				
Bronx RHIO	●					
Curators	●	●	●			
ECCHC	●	●		●	●	
Finity	●	●		●		●
IA						●
Intermountain	●	●		●	●	
Mary's Center		●				
MPHI	●	●		●		
NHCHC	●	●			●	
REMSA						●

(continued)

Table ES-2. Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes Presented in the HCIA Community Resource 2016 Annual Report (continued)

Awardee	Diabetes	Hypertension	Asthma/COPD	Weight Control	Mental Health	Other
South County	●	●				
U-Chicago	●	●		●		
U-Miami	●			●		
W&I						●
Y-USA				●		
Totals	11	10	1	7	3	5

COPD = chronic obstructive pulmonary disease. Data received through June 2015

b. Analysis

We generated descriptive statistics showing the percentage of participants with diabetes or hypertension who were in control of that condition. For a subset of awardees (BAHC, Curators, ECCHC, MPHI, and South County) we used multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time. Regressions for each awardee and each health outcome measure were conducted independently.

4. Qualitative Data

a. Data Collection

In Year 3 of the HCIA Community Resource evaluation, we collected and analyzed qualitative data on workforce development, implementation context, and implementation effectiveness from three annual rounds of key informant interviews and reports requested by CMMI and delivered to RTI on a quarterly basis:

- **Quarterly Awardee Performance Reports** (QAPRs) contained mostly structured qualitative and quantitative data describing the organizational characteristics, expenditures, staffing, training, and program participant characteristics of awardees, as submitted by awardee staff.
- **Narrative Progress Reports** (NPRs) provided a descriptive account of the project's accomplishments, lessons learned to date, planned activities, and self-monitoring findings. Innovation leaders typically prepared the NPR.
- **Sustainability Plans** explained how the awardee intends to continue offering innovation services after the HCIA grant funding period.

The Year 3 qualitative evaluation data presented in this report also include **closeout interviews** with innovation leaders during the final quarter of implementation. The interviews explored changes in the innovation, implementation process, and supporting staff and resources since our last interviews; implementation effectiveness; sustainability efforts; and lessons learned from the implementation experience.

b. Analysis

A team of RTI coders analyzed textual data from the QAPRs, NPRs, sustainability plans, and closeout interview notes using NVivo qualitative analysis software. We developed a coding scheme in the first year of the evaluation to capture key themes related to: implementation processes, organizational capacity, workforce development, workflow and integration, implementation effectiveness and sustainability. For this report, evaluation team members trained in using the coding scheme analyzed documents and interviews to assess these themes for each awardee and across awardees, where relevant. Multiple analysts completed the coding analysis, and areas of disagreements and ambiguities were flagged for discussion and adjudication.

Key Findings

1. Smarter Spending

a. Five Awardees Showed Significant Reductions in Spending

We analyzed claims data from the 15 Medicare awardees and 15 Medicaid awardees that enrolled enough patients for difference-in-differences analyses (see ***Table ES-3*** for awardees with sufficient data). To assess the extent to which the awardees achieved the goal of smarter spending, we present changes in the awardees' total health care spending per patient in ***Table ES-3***. Based on our analyses thus far, the majority of the awardees did not show statistically significant health care savings (p-value < 0.10); however, the five awardees identified below showed significant reductions in spending.

Table ES-3. Summary of Statistically Significant Savings

Awardee	Weighted Quarterly Impact				
	Sample Size	Total	90% CI		P-Value
Medicare					
Bronx RHIO	6,623	−$531	−$804	−$258	<.01
REMSA-Community Paramedic (CP)	182	−$2,394	−$4,553	−$235	.07
Y-USA (Full Sample)	3,319	−$303	−$430	−$176	<.01
Y-USA (No diabetes dx)	2,302	−$278	−$396	−$159	<.01
Medicaid					
MPHI	170	−$1,658	−$2,709	−$606	.01
IA	3,088	−$462	−$910	−$14	.09

Definitions and Notes

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group compared with the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- Medicaid periods may vary, but we received claims no later than December 2015.
- Medicare period covered through December 2015.
- CI = confidence interval; CP = community paramedic.

2. Better Care

a. Thirteen Awardees Had Significant Improvements in One or More Utilization Outcomes

To assess health care utilization, we analyzed claims data on emergency department (ED) visits, inpatient admissions to the hospital, and unplanned readmissions from the 15 Medicare awardees and 15 Medicaid awardees that enrolled enough patients for difference-in-differences analyses. The findings in ***Table ES-4*** show that nine awardees significantly decreased the likelihood of inpatient admissions. Nine awardees had statistically significant reductions in ED visits (p-value < 0.10)—the focus and goal of many awardees. However, successful delivery of the innovation varied among these awardees and across disease conditions. There is less evidence that the innovations decreased unplanned readmissions, with the exception of four awardees: Children's Hospital, SEMHS, U-Chicago, and W&I.

Table ES-4. Summary of Statistically Significant Improvements in Utilization through December 2015

Awardee	Sample Size	Weighted Quarterly Impact per 1,000 Participants											
		Inpatient Admissions				Unplanned Readmissions				ED Visits			
		Total	90% CI		P-Value	Total	90% CI		P-Value	Total	90% CI		P-Value
Medicare													
Altarum,	45,007	−4	−7	−1	.02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BAHC	180	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	−31	−49	−13	<.01
Bronx RHIO	6,623	−18	−24	−12	<.01	N/A	N/A	N/A	N/A	−18	−25	−12	<.01
Curators	6,474	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	−16	−21	−12	<.01
IA	3,799	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	−71	−85	−56	<.01
REMSA(CP)	182	−543	−648	−438	<.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SEMHS	106	N/A	N/A	N/A	N/A	−345	−579	−111	.02	N/A	N/A	N/A	N/A
U-Chicago	8,381	−18	−23	−14	<.01	−19	−35	−3	.06	N/A	N/A	N/A	N/A
Y-USA	3,319	−9	−12	−6	<.01	N/A	N/A	N/A	N/A	−9	−14	−5	<.01
Y-USA (No diabetes dx)	2,302	−8	−12	−4	<.01	N/A	N/A	N/A	N/A	−9	−14	−4	<.01
Medicaid													
ECCHC	274	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	−106	−179	−33	.02
Children's Hospital	518	N/A	N/A	N/A	N/A	−78	−148	−8	.07	N/A	N/A	N/A	N/A
IA	3,088	−43	−67	−20	.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NEU-CHA (Cambridge Health Alliance)	771	−27	−48	−7	.03	N/A	N/A	N/A	N/A	−45	−74	−16	.01
U-Chicago	3,042	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	−51	−67	−35	<.01
W&I	322	−23	−43	−3	.06	−74	−137	−10	.06	−328	−388	−269	<.01

Definitions and Notes

- **Acute care inpatient admissions (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- Medicaid periods may vary, but we received claims no later than December 2015.
- Medicare period covered through December 2015.
- CI = confidence interval; ED = emergency department; N/A= did not significantly decrease.

Table ES-5 provides an overview for Medicare awardees and their spending and utilization outcomes. ***Table ES-6*** gives an overview for each Medicaid awardee. Just under half of awardees (11) had positive, nonsignificant trends toward savings; nine had nonsignificant reductions in inpatient admissions. There were few signficant findings for unplanned readmissions, but half of the awardees (13) trended toward reductions. Five awardees had nonsignificant reductions in ED visits.

Table ES-5. Overview of Medicare Awardee Spending and Utilization Outcomes through December 2015

Medicare Awardee	Sample Size	Spending	Inpatient Admissions	Unplanned Readmissions	ED Visits
AACI	603	⇩	⇧	⇩	⬆
Altarum	45,007	⇧	⬇	▭	⬆
BAHC	180	⇧	⬆	⇩	⬇
Bronx RHIO	6,623	⬇	⬇	⇧	⬇
Curators	6,474	⬆	⬆	⇧	⬇
IA	3,799	⬆	⬆	⇩	⬇
Intermountain-C1	192	⇧	⇧	⇧	⇩
Intermountain-C2	434	⇩	⇩	⇧	▭
Intermountain-C3	28,783	⬆	⬆	⇩	⬆
Mineral Regional	13,822	⇧	⇩	⇧	⬆
MPHI	2,116	⬆	⇧	⇧	⇩
NEU-CHA	950	⬆	⇧	⇩	⇩
NEU-Lahey	188	⇧	⬆	⇩	⬆
Prosser	268	⇧	⬆	⬆	⇧
REMSA-CP	182	⬇	⬇	⇧	⇧
REMSA-NHL	1,157	⇩	⇩	⇩	⬆
SEMHS	106	⇧	⇧	⬇	⬆
U-Chicago	8,381	⇩	⬇	⬇	⇧
Y-USA	3,319	⬇	⬇	▭	⬇
Y-USA (no diabetes dx)	2,302	⬇	⬇	⇩	⬇

ED = emergency department;
Key
⬇ Statistically significant decrease ($p < 0.10$)
⬆ Statistically significant increase ($p < 0.10$)
⇩⇧ Not statistically significant, but trending in a particular direction
▭ Not statistically significant and no change
Medicare period covered through December 2015

Table ES-6. Overview of Medicaid Awardee Spending and Utilization Outcomes through December 2015

Medicaid Awardee	Sample Size	Spending	Inpatient Admissions	Unplanned Readmissions	ED Visits
BAHC	98	⇩	NA	NA	NA
Bronx RHIO	1,606	⇩	⇩	⇩	⬆
Children's Hospital	518	⇩	⇩	⬇	⇩
Curators	2,397	⇧	⬆	⇧	⬆
Delta Dental	4,446	⇩	⇩	⇩	⬆
ECCHC	274	⇧	⇩	NA	⬇
Finity-BP: Babies	4,620	⇧	⬆	⇧	⇧
Finity-BP: Mothers	4,620	⬆	⇧	⇩	⇧
Finity-Diabetes	418	⬆	⇩	⇧	⇧
Finity-Heart Health	419	⇧	⇧	⇧	⇧
IA	3,088	⬇	⬇	⇩	⬆
Mineral Regional	6,591	⇧	⬆	⇩	⇧
MPHI	170	⬇	⇩	⇩	⇩
NEU-CHA	771	⇩	⬇	⇩	⬇
Prosser	130	⇩	⬆	NA	⇩
SEMHS	128	⇩	⇧	NA	⇧
U-Chicago	3,042	⇧	⇧	⇩	⬇
W&I	322	⇧	⬇	⬇	⬇

ED = emergency department; NA= Not applicable due to small sample.
Key:

⬇ Statistically significant decrease ($p < 0.10$)

⬆ Statistically significant increase ($p < 0.10$)

⇩⇧ Not statistically significant, but trending in a particular direction

▭ Not statistically significant and no change

Medicaid periods may vary, but we received claims no later than December 2015.

b. Eight Awardees Provided Recommended Care to Majority of Patients with Chronic Disease

We assessed whether awardees delivered the recommended services to patients with diabetes, hypertension, or coronary artery disease. In particular we assessed the percentage of patients receiving the recommended care and treatment for a specific disease using patient-level data from the electronic health records and administrative databases of 10 awardees. Because of variations in the awardees' interventions, we present key findings from subsets of awardees with similar measures. These findings are entirely descriptive—because a comparison group was not available, we could not determine whether the innovation improved these measures.

Care Provided to Patients with Chronic Disease

Diabetes care:

- More than 60 percent of patients with diabetes received recommended care from **BAHC, Curators, ECCHC, Intermountain,** and **South County**. Recommended services included lab work to assess hemoglobin and lipids, a foot exam, and an eye exam.

Hypertension care:

- More than 70 percent of patients with hypertension received recommended care from **BAHC, Curators, ECCHC, Mary's Center, NHCHC, South County,** and **U-Chicago**. The recommended services included a blood pressure screening and body mass index assessment.

3. Healthier People

a. Five Awardees Demonstrated Improvements in Health Outcomes

We analyzed patient-level data from the awardees' electronic health records and administrative databases on clinical results to assess the extent to which awardee innovations affected the goal of healthier people. Because awardees targeted a range of populations and health conditions, we present key findings from subsets of awardees with similar health outcome measures. These findings are descriptive; without a comparison group we cannot determine whether improvements of these outcomes were due to the innovation.

Health Outcomes

Diabetes outcomes:

- Patients with diabetes in **BAHC, ECCHC, and U-Chicago** had improved hemoglobin A1c control.

- Patients with diabetes in **BAHC, Curators, and South County** had improved low-density lipoprotein cholesterol (LDL-C) control.

Hypertension outcomes:

- Enrollees with hypertension in **ECCHC and U-Chicago** had improved blood pressure control.

4. Reach and Dose of the Innovation

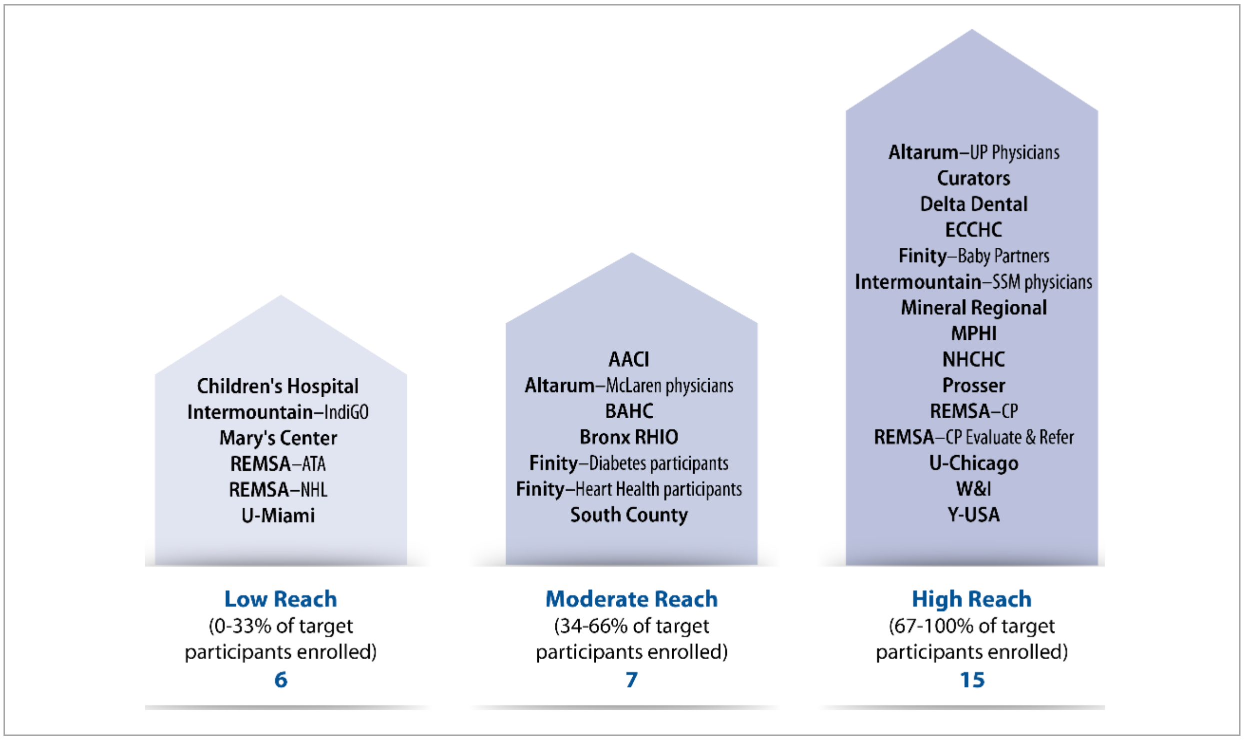
Effective implementation depends on how well awardees reached the target population, as well as the intensity and frequency of the services or treatments provided. As such, we examined secondary data on the *reach* and *dose* (i.e., intensity and frequency) of the awardees' innovations to assess their implementation effectiveness. We also examined the role of organizational factors in achieving overall implementation effectiveness.

a. Over Two-Thirds of Awardees Achieved High Reach

Figure ES-3 shows the cumulative reach for all 24 awardees, which we classified as low, moderate, or high. These classifications are descriptive and based on relative comparisons among the awardees. The measure of "percent reached" was calculated from enrollment data provided by awardees.

Over two-thirds of the awardees achieved a high-level reach (67% or more) of targeted participants for one or more components of the innovation. Not all targeted participants were patients: two awardees (IA and Altarum) included physicians, and one awardee (Mineral Regional) included critical access hospitals. We found that identifying a specific and stable target population based on innovation components helped awardees achieve their reach targets.

Figure ES-3. Cumulative Reach for All Awardees



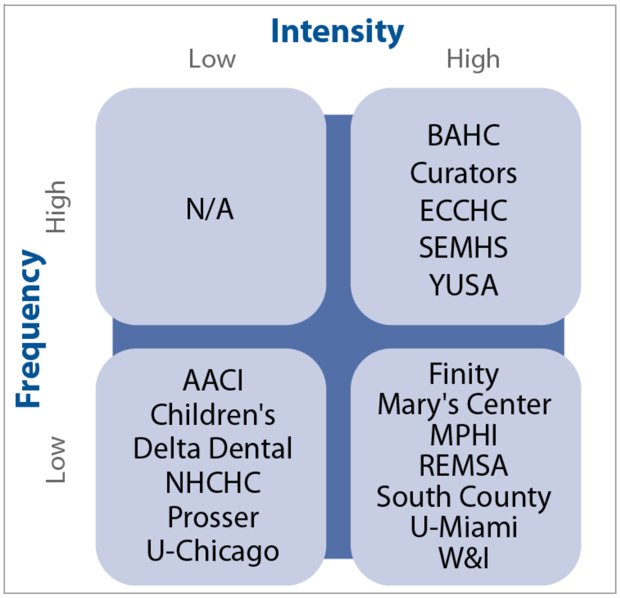
b. Half of Awardees Provided High-Intensity Dose of Services

Awardee innovations included a range of services that varied widely in the degree of interactions with the participant (i.e., intensity), from a referral to a social service to home visits. The intensity of the innovation and how frequently it was delivered can affect whether the innovation impacts outcomes. The combination of these two dimensions is known as dose. We assessed dose for 18 awardees for which data were available. Twelve of 18 awardees provided a high-intensity dose to participants. These awardees were split between high and low frequency. None of the awardees provided services that were low intensity, but high frequency (see ***Figure ES-4***).

5. Workforce Development

Workforce development is an integral component in testing and disseminating service delivery models in the HCIA program. We analyzed qualitative interview and awardee report data in addition to provider survey data to examine barriers and facilitators to staffing, hiring, and retention; training; integration of community health workers; and provider satisfaction.

Figure ES-4. Levels of Dose



a. *New Work Policies and Conditions Improved Hiring and Retention*

Staff responsible for direct service delivery frequently experienced burnout due to their interactions with high-need patients. These patients often required more frequent, intense services than awardees initially expected. Staff stress and exhaustion resulted from (1) lack of time to deliver the level of care required, and (2) the struggle to provide the wide range of resources and services that patients required. For both community health workers and nurses, burnout was linked to navigating health and related systems, each with varying resources and unique administrative and bureaucratic challenges. Awardees that had to integrate and engage new staff also suggested that burnout occurred because of mismatches between the demands of specific positions and the skills and characteristics of the people hired to fill them, especially for community health workers.

In contrast to burnout, awardees experienced turnover for reasons that had nothing to do with the innovation. Some awardees noted that many vacated positions required exceptional traits and complex duties, so these staff and roles were the most difficult to identify and replace. Examples of these critical positions included analytical staff (e.g., health IT analysts, skilled programmers, *"industrial engineers that know about health care"*), support staff, and community health workers.

To build staff numbers and availability and to reduce burnout and turnover, awardees developed new models for staffing policies, interview procedures, and working conditions:

Staffing Policies:

- After facing turnover that slowed program implementation, some awardees identified a need for redundancy in key roles, including community health workers and health promoters (especially with relevant language skills), analysts, supervisors, and nurse practitioners.

Interview Procedures:

- To fill key roles with the right people, awardees realized they needed more rigorous interview processes. By fully disclosing to candidates all the positive and negative aspects of the position, both in the job descriptions and in the interviews, awardees envision being able to find and better retain appropriate candidates.

Working Conditions:

- To protect against burnout, awardees concentrated on improving working conditions and opportunities. Awardees argued that positions should be marketed as careers and offer opportunities for advancement and competitive salaries. They also had to be mindful of staff needs for self-care and peer support during stressful periods.

b. Strategically Integrate Community Health Workers into Health Care Organizations

Despite the significant promise that community health workers hold for increasing health care access, inclusiveness, continuity, and cultural competency, the nonclinical role can create much confusion when new community health workers are integrated into an organization. Based on our qualitative data, we identified three strategies that helped integrate community health workers into health care organizations:

Organizations must prepare for community health workers.

- Awardees that effectively integrated community health workers adopted thoughtful recruitment and training practices; offered information and education to providers; and aligned work processes, tools, and technology with community health workers' responsibilities..

All staff roles must be defined and valued.

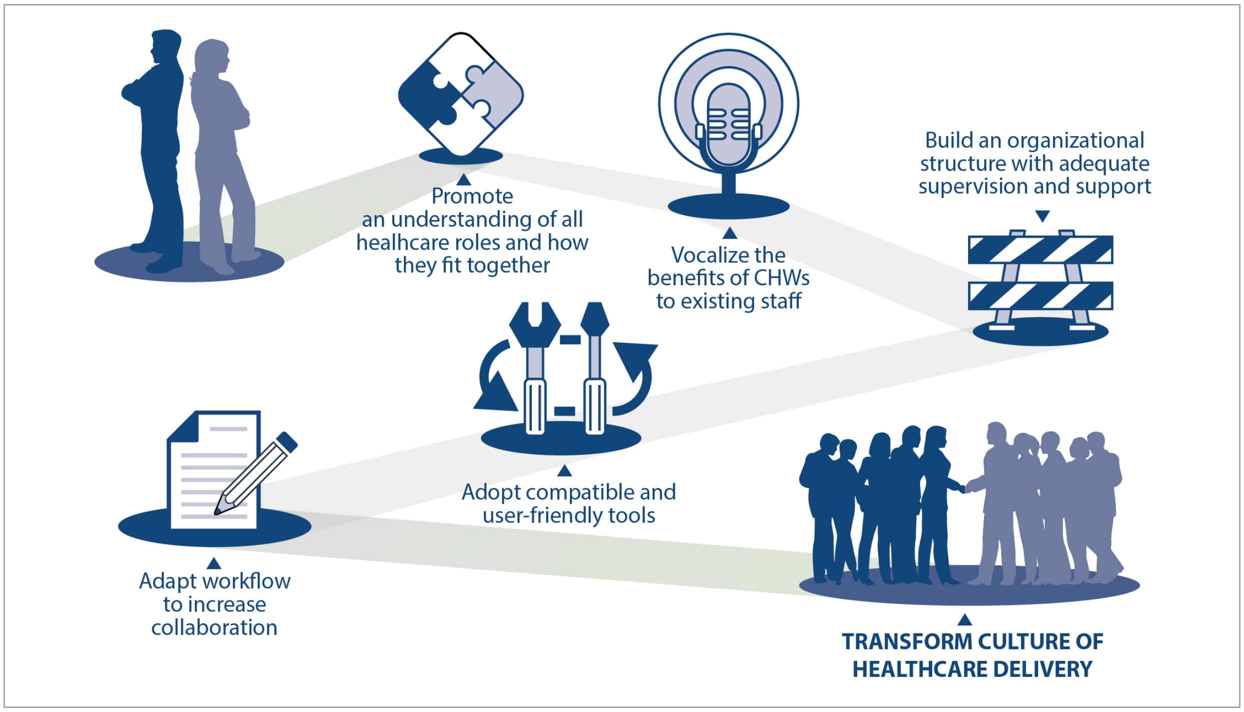
- Targeted communications and education, clear job descriptions and protocols, formal divisions of labor, and liaisons between clinical and nonclinical staff reduced the ambiguity of community health workers' contributions to patient care.

When properly supported, community health workers reduce clinician burden.

- By doing non-medical tasks, community health workers gave other staff the time to focus on clinical care and other productive activities.

Figure ES-5 identifies steps that health care organizations can take to effectively integrate community health workers and thereby transform health care delivery. These steps can be taken sequentially, as shown, or occur simultaneously depending on organizational capacity.

Figure ES-5. Strategies for Facilitating Community Health Worker Integration



c. *Engage Providers to Increase Satisfaction*

Our analysis of provider survey data showed that four factors, when combined into two pathways, contribute to provider satisfaction with the innovation (see *Figure ES-6*). Moreover, our analysis revealed that no one factor led to provider satisfaction; instead, two combinations of factors produced provider satisfaction. Ensuring that providers were involved in implementation of the innovation, perceived the innovation as beneficial to patients, the innovation was integrated into clinical workflow, and sufficient resources were available to implement the innovation generated greater satisfaction—which ultimately encouraged greater adoption and maintenance of the innovation.

Figure ES-6. Two Pathways for Provider Satisfaction

6. Implementation Context

a. Two Combinations of Organizational Factors Led to Effective Implementation

Our analysis examined the role of numerous organizational factors on implementation effectiveness (i.e., having sufficient reach, dose, and executed the innovation largely as planned) but two combinations of factors appear to be most critical:

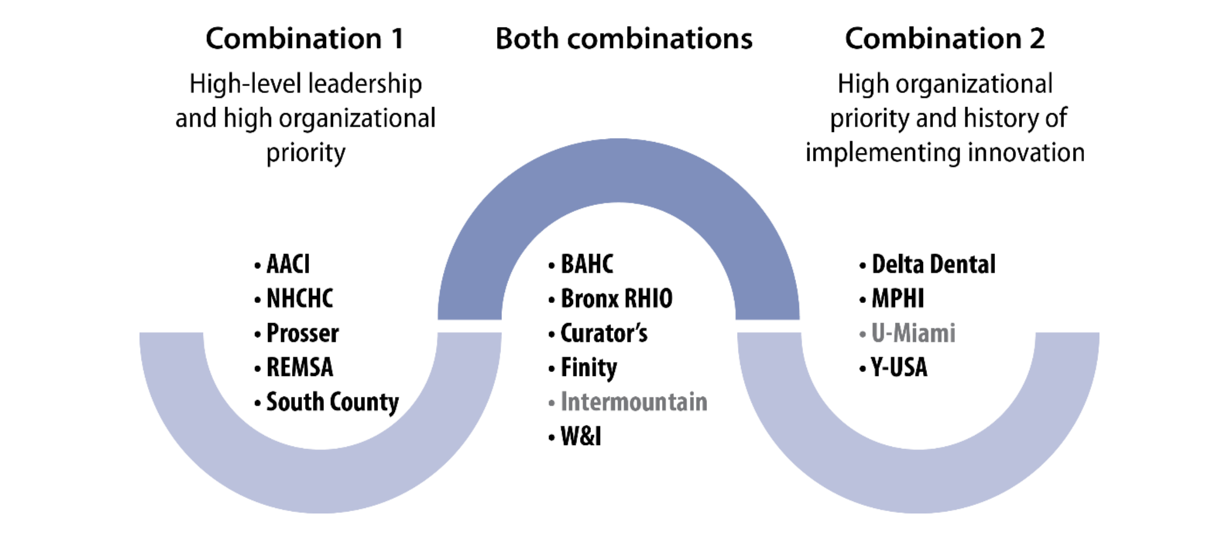
High-level leadership support and high organizational priority. Awardees with this combination of factors tended to have leaders who were directly involved, responded to emerging needs, and had expertise or experience with the innovation. Additionally, these awardees had organizational mandates to support implementation and defined HCIA activities as part of a longer-term change for their organizations.

Our interviews with innovation leaders shed light on how these two factors played out in practice. Most awardees said their supportive leaders helped access and mobilize resources in the organization for startup resources (e.g., technology, office space, equipment) and maintained these resources during the innovation period. Supportive leaders recognized the value in engaging and educating as many potential stakeholders as possible. They communicated the values of the innovation to key stakeholders and ensured that these stakeholders helped to strengthen the innovation's infrastructure. One leader noted, *"She saw her role (as CEO) is to remove barriers and provide resources as needed to get things done."*

High organizational priority and history of implementing the innovation. Aligning innovation activities with existing organizational priorities, such as a mission or strategic plan, meant that implementation leaders did not need to generate new organizational support or create culture change. Because of historical experience, these awardees could also build on previous work and rely on proven resources and partners to implement the innovation.

Figure ES-7 displays the awardees that exhibited the combination of factors associated with implementation effectiveness; grayed-out awardees exhibited the combination but did not achieve the threshold rating for implementation effectiveness.

Figure ES-7. Combination of Organizational Factors that Lead to Implementation Effectiveness



Note: Awardees in grey demonstrated the combination(s) indicated but did not achieve high levels of implementation effectiveness.

b. Inadequate Administrative Structures Undermined Implementation

One-third of the awardees (8) did not have an adequate infrastructure in place at project launch to document, monitor, and ensure the innovation was on course to meet its goals. As a result, these awardees experienced setbacks in implementation. Infrastructure included resources such as information and technology systems, education and training systems, equipment, and physical space needed to implement HCIA innovations. In the absence of such preexisting systems, awardees needed to create new systems for tracking and reporting participant enrollment, processing and managing legal and other nondisclosure agreements with partners, orienting and managing staff, and upgrading IT systems and software applications. One awardee noted the need for more time to develop IT and data access processes than was allocated in the planning phase. Another awardee reflected, *"One of the lessons learned is that we had many infrastructures to set up. We had to build the infrastructure at the same time the innovation was taking place."*

7. Sustainability

a. Majority of the Innovations are Highly Sustainable

The ability to sustain an innovation requires planning, funding, partnerships, workforce development, and other system-level changes. We assessed the presence and absence of these efforts for all awardees to determine their overall sustainability, and our findings are depicted in Table ***ES-7***. On a 5-point scale (not sustainable to highly sustainable), we found that the majority of awardees (two-thirds) were deemed highly sustainable. Most (23) will retain current HCIA-related employees on staff, 16 secured public or private funding to continue efforts related to the innovation, 5 secured insurance reimbursement for innovation services (e.g., community health workers), and 2 expanded their product to new markets. Approximately half of all awardees developed formal sustainability plans, maintained partners, and had system-level changes—including adapting their organizational cultures and changing existing workflows.

Table ES-7. HCIA Awardee Sustainability Factors and Scores

HCIA Awardees	Funding	Partner-ships	Workforce Develop-ment	Integration/ Adoption	Sustain-ability Score	Notes
AACI	●	●	●	●	4	Innovation programs have been integrated and institutionalized at community colleges
NHCHC	●	●	●	●	4	10 of 12 sites made arrangements to continue CHW services through supplemental funding and/or partnerships
Prosser	●	●	●	●	4	Budget approved to continue essential elements of the innovation beyond funding period
South County	●	●	●	●	4	Awardee plans to maintain care coordination model beyond funding period
Y-USA	●	●	●	●	4	Strong continuing partnership with community colleges
Finity	●	●	●	●	4	Partners valued innovation and continued to fund after HCIA award ended
Intermountain	●	●	●	●	4	Close integration of innovation with organizational strategy
NEU	●	●	●	●	4	Additional funding, new partnerships, and continued programs with partners
Delta Dental	●		●	●	3	Diverse sources of funding to support innovation
ECCHC	●		●	●	3	Continue to modify and develop microclinic model
REMSA	●		●	●	3	Identified additional funding sources for paramedicine services beyond funding period
SEMHS	●	●	●		3	Leadership identified ways to offset costs for service delivery by leveraging other staff to provide services
W&I		●	●	●	3	Strong organizational commitment and integration of program; additional funding uncertain as of August 2016
IA	🔒	●	●		3	Commitment from commercial partners to scale innovation to other markets
Curators	🔒		●	●	3	Success integrating LIGHT2 permanently into workflow
Mary's Center	🔒	●	●		3	Lost and could not replace important Medicaid MCO partners
Bronx RHIO	🔒		●	●	3	Strong funding streams and continued workforce support

(continued)

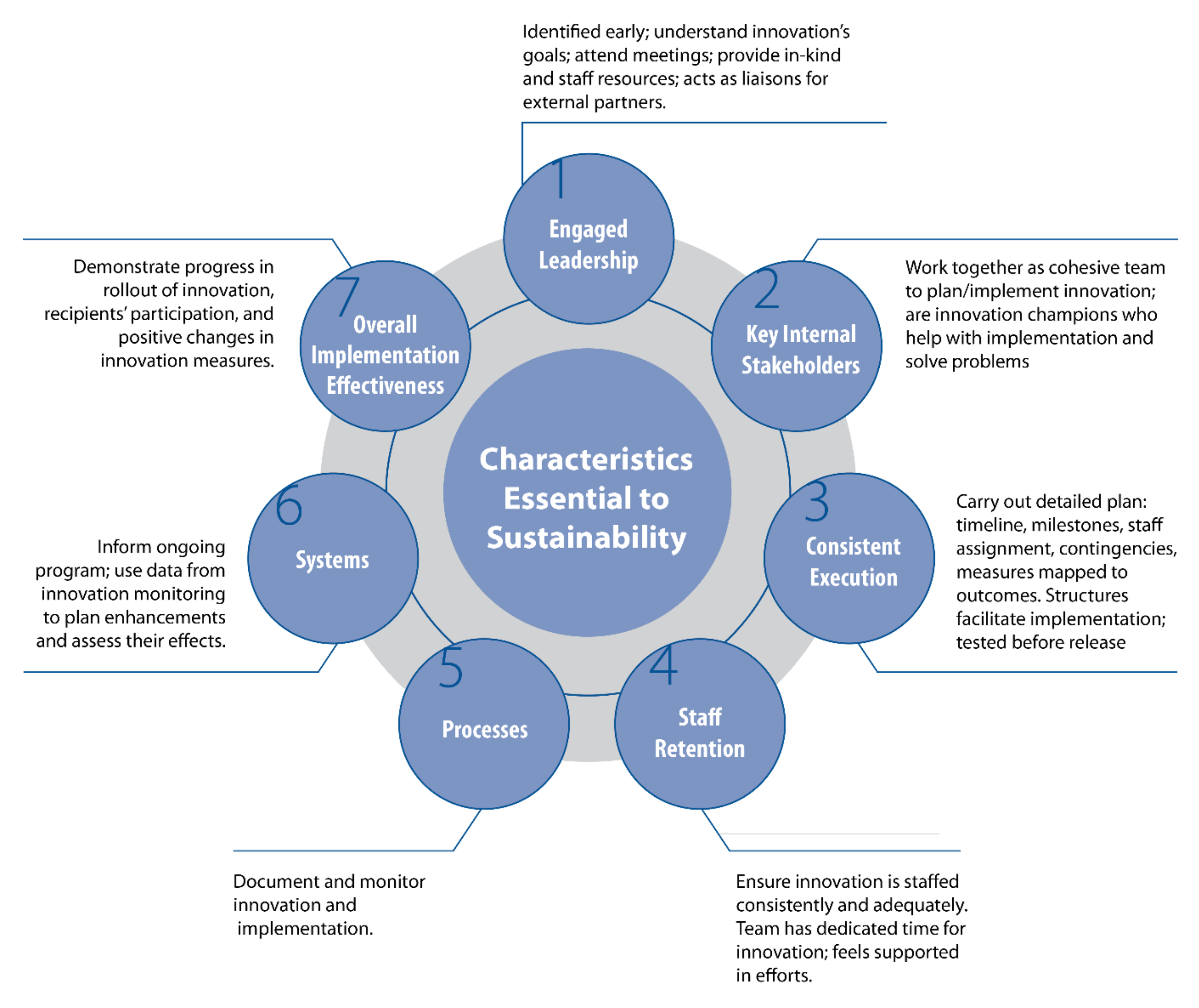
Table ES-7. HCIA Awardee Sustainability Factors and Scores (continued)

HCIA Awardees	Funding	Partner-ships	Workforce Develop-ment	Integration/ Adoption	Sustain-ability Score	Notes
U-Chicago	•		•		2	Certain elements of CommRX will be sustained, but not in target HCIA population
MPHI		•	•		2	Key innovation components lack continued funding and payment model component was ineffective
Altarum	•		•		2	Workflow integration inconsistent across diverse EHR user base
U-Miami	•		•		2	Unclear which services remained and were supported after the HCIA funding ended
BAHC			•		1	Not able to achieve reimbursement for CHWs under existing payment models
Children's Hospital			•		1	Current staff maintained, but target population likely to change
Mineral Regional					0	No parts of innovation sustained

CHW = community health worker; EHR = electronic health record; MCO = managed care organization.

Our analysis also revealed that awardees with high sustainability scores had a combination of seven characteristics, described in ***Figure ES-8***, which distinguished them from those awardees with lower sustainability scores. Awardees represent diverse innovations across care settings. These innovations focused on testing new approaches to care improvement from coordination of care to staffing and workforce development, to use of health IT, to redesign of workflow and care processes, and to decision support. Thus, the most significant finding from the sustainability analysis is the consistency of these seven characteristics across all awardees, despite their heterogeneity.

Figure ES-8. Seven Characteristics Highly Correlated with Sustainability



Conclusion

Overall, 14 of the 24 HCIA Community Resource awardees met one or more goals related to smarter spending and better care. Most awardees reached two-thirds or more of their target participants, and half provided high-intensity services. The majority of patients in eight innovations (for which data were available) received recommended diabetes care (60% or more) or hypertension care (70% or more). Five awardees showed positive improvements over time in diabetes and hypertension outcomes. However, the overall effect on achieving the goal of healthier people remains inconclusive because minimal health outcomes data were available for most awardees, and we lacked a comparison group to conduct inferential analyses.

The workforce development and implementation experiences of the awardees offer useful lessons and insights for future health care transformation initiatives. Community health workers can drive innovation when combined with careful attention to staffing policies, hiring procedures, and workplace conditions. Engagement of providers is critical to any health care innovation. However, involvement alone is not sufficient to lead to satisfaction with the innovation. Satisfaction results when involved providers possess at least one additional factor: (1) have adequate resources, (2) see a benefit to their patients, or (3) experience minimal disruption to their workflow. A fair number of awardees encountered initial and ongoing difficulties because they had not anticipated the types of administrative infrastructures and the time required to implement the innovation. One lesson learned for future implementation efforts is that the importance of planning early in the implementation process cannot be overstated.

Likewise, the impact of leadership was evident both in the effectiveness of implementation and sustainability of the innovation. Those awardees with strong leadership secured the necessary resources for startup and maintenance of the innovation, engaged key partners and stakeholders, and ensured the innovation was an organizational priority. The majority of innovations were highly sustainable and had secured additional funding or reimbursement for services, or were able to expand a product to a new market.

Section 1 Introduction

The Centers for Medicare & Medicaid Services (CMS), through its Center for Medicare & Medicaid Innovation (CMMI), promotes innovative payment and service delivery models that have the potential to improve health care in accord with three overarching aims: *smarter spending, better care, and healthier people*. To implement this directive, in 2012 CMMI established the Community Resource Planning, Prevention, and Monitoring Models (Community Resource) of the Health Care Innovation Awards (HCIA) (https://innovation.cms.gov/initiatives/Health-Care-Innovation-Awards/). This initiative funded 24 awardees for a 3-year period (2012 to 2015) to test promising new models that could drive system transformation and deliver better outcomes for Medicare, Medicaid, and Children's Health Insurance Program (CHIP) beneficiaries through innovations in health care workforce development and the application of health information technology across multiple care settings.

CMMI contracted with RTI International to conduct an evaluation of the HCIA Community Resource awardees. The purpose of the evaluation was to assess the impact of the innovations on health care spending, utilization, and health outcomes on a quarterly and annual basis, and to identify models that could be expanded on a broader scale. RTI's approach to evaluating this diverse and complex group of innovations was to use multiple sources of data to integrate and synthesize findings within awardee(s) and where possible across awardees. This approach incorporated qualitative and quantitative data to assess outcomes at the system, organizational, program, and participant (or patient) levels and addressed the following evaluation questions.

HCIA Overarching Evaluation Questions

- To what extent have HCIA Community Resource awardee innovations affected each goal of the Affordable Care Act: smarter spending, better care, and healthier people?
- How did each awardee and similar awardees transform the health care workforce, and what factors affected their ability to do so?
- How effective have awardees been at implementing their innovations, and what similarities were there in implementation effectiveness across awardees?

This section presents an overview of the awardees included in the HCIA Community Resource evaluation, the data and methods used to conduct the evaluation, and the evaluation's challenges and limitations.

1.1 Overview of HCIA Community Resource Awardees

1.1.1 HCIA Community Resource Awardee Characteristics and Innovation Components

In the first year of the HCIA Community Resource evaluation, RTI gained an understanding of the components of each awardee's innovation through an extensive review of awardee documents and site visits. Twenty-four awardees received a total of $162,622,080 over a 3-year period (July 2012–June 2015). Awardees included different types of organizations with various levels of funding, innovation components and target populations as shown in ***Figure 1-1***. Awards ranged from $1,270,845 (Ben Archer Health Center) to $14,991,005 (Mary's Center for Maternal and Child Care). The mean award across all 24 awardees was $6,743,861 and the median was $5,919,916. The types of organizations receiving awards varied widely but the most numerous were federally qualified health centers (FQHCs; n=5), integrated health systems and hospitals (n=4), and universities (n=3).

The taxonomy shown in ***Figure 1-1*** was developed for the HCIA evaluation to characterize the components of each innovation. Using this taxonomy we can summarize the components of the innovations as follows:

- **Coordination of care**: More than two-thirds of innovations (18) used community health workers (CHWs) or patient navigators to provide patients with personalized education, coaching, coordination of referrals, and follow-up to achieve health care goals. Two innovations linked patients from vulnerable populations to a medical home to achieve better care coordination.
- **Process of care**: Six innovations changed the workflow and processes of care to increase efficiency, reduce waste and duplication, or improve safety.
- **Health information technology:** Nearly half (10) of innovations used health information technology (HIT) to communicate information among providers and organizations, enhance provider or patient decision making, or support data analytics. Examples of HIT included electronic health records and electronic health information exchange among hospitals and providers within a network or region.
- **Provider payment reform.** Five innovations piloted new payment models to incentivize higher quality health care at a lower cost and make components of the innovation, such as CHWs, self-sustaining.
- **Direct health care/dental care.** Six innovations delivered health care or dental services in combination with care coordination or as a stand-alone intervention.
- **Decision support**: Six awardees used electronic 'decision aids' or computerized alerts to generate patient-specific information, filtered and presented at appropriate times, to enhance health care decision making by patients or providers.
- **Health care workforce**: Seven awardees developed and trained new kinds of health care workers: CHWs, data analysts, quality improvement specialists, and health systems engineers.

Figure 1-1. Summary of HCIA Community Resource Awardees

Awardee	State	Innovation Types	Participants	Organization Type	Funding Amount	Payer Type
Altarum Institute (Altarum)	MI	Coordination of care; Process of care; Health information technology	Providers	Evaluation/research organization	$8,366,178	Medicare; Medicaid
Asian Americans for Community Involvement (AACI)	CA	Coordination of care; Health care workforce	Adult Patients	Federally qualified health center	$2,684,545	Medicare
Ben Archer Health Center (BAHC)	NM	Coordination of care	Adults Patients with chronic condition	Federally qualified health center	$1,270,845	Medicare; Medicaid
Bronx Regional Health Information Organization (Bronx RHIO)	NY	Health information technology; Health care workforce	Patients (all ages)	Health information exchange	$12,689,157	Medicare; Medicaid
Children's Hospital and Health System (Children's Hospital)	WI	Coordination of care	Patients (all ages)	HMO health plan	$2,796,255	Medicaid
Curators of the University of Missouri (Curators)	MO	Coordination of care; Health information technology; Decision support	Adult Patients	Integrated health system	$13,265,444	Medicare; Medicaid
Delta Dental Plan of South Dakota (Delta Dental)	SD	Coordination of care; Direct health care/dental care	Children; Infants	Dental health plan	$3,364,528	Medicaid
Eau Claire Cooperative Health Centers (ECCHC)	SC	Coordination of care; Direct health care/dental care	Adults Patients with chronic condition	Federally qualified health center	$2,330,000	Medicare; Medicaid
Finity Communications (Finity)	PA	Coordination of care; Health information technology; Decision support	Patients (all ages)	Health technology firm	$4,967,962	Medicaid
Imaging Advantage (IA)	IL	Process of care; Health information technology; Decision support	Providers	Health technology firm	$5,977,805	Medicare; Medicaid
Intermountain Health Care Services, Inc. (Intermountain)	UT	Health information technology; Decision support; Provider payment reform	Providers	Integrated health system	$9,724,142	Medicare; Medicaid
Mary's Center for Maternal & Child Care (Mary's Center)	DC	Coordination of care; Health information technology; Provider payment reform	Adult Patients	Integrated health system	$14,991,005	Medicaid
Michigan Public Health Institute (MPHI)	MI	Coordination of care; Provider payment reform; Direct health care/dental care; Health care workforce	Adults Patients with chronic condition	Evaluation/ Research Organization	$14,145,784	Medicare; Medicaid
Mineral Regional Health Center (Mineral Regional)	MT	Process of care; Health information technology; Provider payment reform; Health care workforce	Health systems	Hospital collaborative	$10,499,889	Medicare; Medicaid
National Health Care for the Homeless Council (NHCHC)	Multi	Coordination of care; Direct health care/dental care	Adult Patients	Nonprofit organization	$2,681,877	Medicare; Medicaid
Northeastern University (NEU)	MA	Health information technology; Direct health care/dental care	Health systems	University	$8,000,002	Medicare; Medicaid
Prosser Public Hospital District (Prosser)	WA	Coordination of care	Adults Patients with chronic condition	Critical access hospital	$1,470,017	Medicare; Medicaid
Regional Emergency Medical Services Authority (REMSA)	NV	Coordination of care; Process of care; Decision support	Patients (all ages)	Emergency medical services provider	$10,824,025	Medicare; Medicaid
South County Community Health Center (South County)	CA	Coordination of care; Process of care; Direct health care/dental care; Health care workforce	Patients (all ages)	Federally qualified health center	$7,060,843	Medicare; Medicaid
Southeast Mental Health Services (SEMHS)	CO	Coordination of care; Health care workforce	Patients (all ages)	Mental health provider	$1,405,924	Medicare; Medicaid
University of Chicago (U-Chicago)	IL	Coordination of care; Health information technology; Decision support	Patients (all ages)	University	$5,862,027	Medicare; Medicaid
University of Miami (U Miami)	FL	Coordination of care; Health information technology; Provider payment reform; Direct health care/dental care	Children	University	$4,097,198	Medicaid
Women and Infants Hospital of Rhode Island (W&I)	RI	Coordination of care	Infants	Acute care hospital	$3,261,494	Medicaid
YMCA of the USA (Y USA)	Multi	Coordination of care; Health care workforce	Adult Patients	Nonprofit organization	$11,885,134	Medicare
				Total	**$163,622,080**	

Innovation Types

Coordination of care
Planned organization of patient care activities and exchange of information between two or more individuals responsible for that care, including patients and caregiver(s). Revisions of clinical processes, procedures, protocols, and practices, both formal and informal.

Process of care
Modifications to clinical processes, procedures, protocols, and practices (formal and informal) to improve efficiency, quality, safety, and cost of health care.

Health information technology
Information processing that uses computer hardware and software to support health care delivery. Examples are electronic health records, personal health records, and health information exchange.

Decision support
Person-specific information, intelligently filtered and presented at appropriate times, to enhance health care decision making by patients or providers. Examples include tools, paper or electronic decision aids, and computerized alerts and reminders.

Provider payment reform
Use of payment methods to foster greater, efficiency, and quality while reducing unnecessary spending in health care. Examples include accountable care organizations, bundled care/episodic payment, and value-based purchasing.

Direct health care/dental care
Medical or dental care provided by a licensed health care professional.

Health care workforce
Training and deployment of personnel to work in new or expanded roles in a health care setting. Examples include community health workers, data analysts, and systems engineers.

Participants

Adult Patients
Adults Patients with chronic condition
Patients (all ages)
Children
Infants
Providers
Health systems

Payer Type

Medicare **Medicaid**

Source: 2014 & 2015 Site Visits, *Q12 Narrative Progress Report*.
HMO = health management organization.

Summarizing the innovation components was challenging because the innovations had multiple parts that vary in complexity and may have been embedded in programs or initiatives that predated HCIA or operated concurrently with other funding. Few innovations targeted the same health conditions (e.g., asthma, diabetes) and types of patients (e.g., Medicaid beneficiaries, infants) such that outcomes could be compared across awardees. However, a small subset of awardees had comparable diabetes and hypertension outcomes, and we present cross-awardee analyses for these awardees in Section 3 of this report.

1.1.2 Participant Characteristics

HCIA Community Resource awardees served a broad range of participants. Approximately half of the innovations targeted care and services to patients, and of these, four focused on adults with chronic conditions (BAHC, ECCHC, MPHI, and Prosser). Three innovations focused on children, infants or newborns (Delta Dental, U-Miami, and W&I). Nearly all awardees enrolled participants covered by Medicaid (22) and Medicare (21) along with the uninsured and other payer sources. Five awardees targeted Medicaid beneficiaries exclusively. Although the evaluation captured patient-level data from all awardees to assess the impact on spending and utilization, three innovations targeted providers directly not patients (Altarum, IA, and Intermountain). Two innovations engaged providers, administrators, and other facility staff in broader system-level changes to health care delivery (Mineral Regional and NEU). ***Figure 1-2*** illustrates participant characteristics of the target populations for each awardee.

Figure 1-2. Targeted Participants

Participants	Awardee
Adults	Asian Americans for Community Involvement (ACCI)
	Curators
	Mary's Center for Maternal and Child Health (Mary's Center)
	National Health Care for the Homeless Council (NHCHC)
	YMCA of the USA (Y-USA)
Adults with Chronic Conditions	Ben Archer Health Center (BAHC)
	Eau Claire Cooperative Health Center (ECCHC)
	Michigan Public Health Institute (MPHI)
	Prosser Pubic Hospital District (Prosser
Children and/or Infants	Delta Dental Plan of South Dakota (Delta Dental)
	University of Miami (U-Miami)
	Women and Infants Hospital of Rhode Island (W&I)
Patients (All Ages)	Bronx Regional Health Information Organization (Bronx RHIO)
	Children's Hospital and Health System (Children's Hospital)
	Finity Communications (Finity)
	Regional Emergency Medical Services Authority (REMSA)
	South County Community Health Center (South County)
	Southeast Mental Health Services (SEMHS)
	University of Chicago (U-Chicago)
Providers	Altarum Institute (Altarum)
	Imaging Advantage (IA)
	Intermountain Health Care Services Inc. (Intermountain)
Health System	Mineral Regional Health Center (Mineral)
	Northeastern University (NEU)

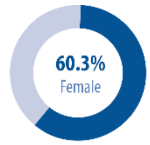
Adult Patients · Patients (all ages) · Infants · Providers

Adults Patients with chronic condition · Children · Homeless persons · Health systems

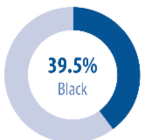
Demographic characteristics shown in ***Figure 1-3*** indicate half of the participants (50.0%) were adults younger than 65 years of age and predominantly female (60.3%); less than half were nonwhite (39.5%). Participant payer categories included Medicaid, (34.6%), Medicare (33.0%), or dually eligible (3.1%).

Figure 1-3. Demographics of Participants in HCIA-Community Resource Innovations

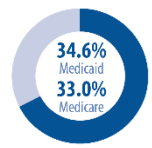
Age	Number of Participants	Percentage of Participants
< 18	96,181	18.7
18-64	**257,584**	**50.0**
65+	154,753	30.0
Missing	6,875	1.3
Total	515,393	



Sex	Number of Participants	Percentage of Participants
Female	**310,917**	**60.3**
Male	182,961	35.5
Transgender	2	0.0
Missing	21,513	4.2
Total	515,593	



Race/ethnicity[1]	Number of Participants	Percentage of Participants
White	76,051	27.1
Black	**110,880**	**39.5**
Hispanic	16,793	6.0
Asian	5,171	1.8
American Indian or Alaska Native	7,377	2.6
Native Hawaiian or Other Pacific Islander	617	0.2
Other	5,703	2.0
Missing/refused	58,117	20.7
Total	280,709	



Payer category[2]	Number of Participants	Percentage of Participants
Dual	10,709	3.1
Medicaid	**118,960**	**34.6**
Medicare	**113,232**	**33.0**
Medicare Advantage	3,920	1.1
Other	46,059	13.4
Uninsured	21,279	6.2
Missing	29,161	8.5
Total	343,320	

[1] IA, Intermountain, and REMSA were unable to provide race/ethnicity data, so are excluded.
[2] IA was unable to provide payer category data, so is excluded.

[1] IA, Intermountain, and REMSA were unable to provide race/ethnicity data, so were excluded.
[2] IA was unable to provide payer category data, so was excluded.

1.2 Data and Methods

1.2.1 Data Sources and Methods

RTI evaluated each awardee's innovation and carried out a cross-cutting analysis and synthesis, to the extent possible, across the 24 awardees. The evaluation combined multiple sources of qualitative and quantitative data sources to determine the impact of the innovation on the final key outcomes of interest—patient spending, hospitalizations, readmissions, emergency department (ED) visits and health status—and the organizational and contextual factors that influenced implementation effectiveness.

An evaluation framework ***(Appendix A)***, described in detail in the 2014 annual report, operationally defined the relationship between innovation activities and HCIA outcomes, accounting for context and implementation effectiveness. This framework served as a tool to identify, prioritize, and refine over time the methods and measures used in the evaluation.

The findings presented in this 2016 annual report draw from a diverse set of key sources described in ***Table 1-1***.

Table 1-1. Data Sources for the HCIA Community Resource Evaluation

Data Source	Brief Description and Use in the Evaluation
Quarterly Awardee Performance Report	An extensive inventory of categorical and numerical data that awardees submitted quarterly; includes organizational characteristics (e.g., services provided, location of innovation, number of clinical sites), direct and indirect expenditures, staffing, training, and program participant characteristics
Awardee Narrative Progress Report	A summary of the past quarter's activities; describes the project's accomplishments, lessons learned to date, and planned activities; and the results of self-monitoring.
Claims Data	Medicare and Medicaid payment information submitted by providers, including payer type, diagnosis and procedure codes, payment amounts, and health care utilization. Accessed via CMS' Chronic Conditions Data Warehouse.
Awardee-Specific Data	Data maintained by the awardee for tracking the client's health care utilization, health status, services received through the innovation, and client characteristics; these may be administrative or case management systems developed by the awardee, and may also include an electronic medical record.
Interview Data	Qualitative data were collected during virtual site visits and closeout interviews with key project leaders in the 11th and 12 quarters of awardee operations. The interviews were follow-ups to site visits conducted a year earlier and covered topics such as: partnerships, organizational capacity, implementation processes and effectiveness, workforce development.
Provider Survey	Survey of physicians from a subset of HCIA awardees affected by the innovation either directly or through a new tool or process. Survey topics measured changes in practice, workflow, and burden resulting from the innovation, and barriers to adoption.

CMMI = Center for Medicare and & Medication Innovation; ED = emergency department; Q = quarter.

1.2.2 Data Availability

RTI secured identifiers for beneficiaries enrolled in 23 of the 24 HCIA Community Resource innovations. Claims-based measures linked to these identifiers are presented in this 2016 annual report. U-Miami was the only awardee that was not able to provide usable identifiers for claims analysis. Currently, complete Medicare claims, with a 6-month runout period, are available through the end of 2015. This report presents descriptive Medicare claims findings for 18 awardees and regression [difference-in-differences (DinD)] findings for 15 awardees. These 15 awardees had patient identifiers RTI could match with existing data in the Chronic Conditions Data Warehouse *and* also provided a sample of at least 20 beneficiaries for descriptive analyses and 100 beneficiaries for regression analyses.

Availability of Medicaid claims varied by the state where awardees were located. The most recent data available were through fourth quarter 2014 in the Alpha-MAX system, although some states had less recent data. In addition to the Alpha-MAX system, four awardees submitted their own Medicaid claims data. In total, we present descriptive Medicaid claims findings for 19 awardees who met the same criteria (patient identifiers and a sample of 20 beneficiaries or more) and 15 who met the criteria for regression analyses (patient identifiers and a sample of 100 beneficiaries or more).

Table 1-2. Claims Data Available for Analyses Presented in the HCIA Community Resource 2016 Annual Report

Awardee	Medicare Descriptive	Medicare Difference-in-Differences	Medicaid Descriptive	Medicaid Difference-in-Differences
AACI	●	●		
Altarum	●	●	●	
BAHC	●	●	●	●
Bronx RHIO	●	●	●	●
Children’s Hospital			●	●
Curators	●	●	●	●
Delta Dental			●	●
ECCHC	●		●	●
Finity			●	●
IA	●	●	●	●
Intermountain	●	●		
Mary's Center			●	
Mineral	●	●	●	●
MPHI	●	●	●	●
NHCHC	●		●	
NEU	●	●	●	●
Prosser	●	●	●	●
REMSA	●	●	●	
SEMHS	●	●	●	●
South County	●		●	
U-Chicago	●	●	●	●
U-Miami	N/A	N/A	N/A	N/A
W&I			●	●
Y-USA	●	●		
Totals	18	15	19	15

N/A = not available.

The evaluation relied on awardee-specific data to identify the demographic characteristics of the patients exposed to the innovation and to assess the clinical effectiveness and health outcomes described above in Section 1.2.1. Where appropriate, awardee-specific data were used to calculate reach—the total number and percentage of persons served by the innovation relative to those targeted; and, where appropriate, dose—the number and frequency of services provided to participants. Obtaining these data was challenging as discussed in the next section, but RTI was able to secure patient–level data for 23 of the innovations.

1.2.3 Evaluation Measures

Collectively, the goals of CMMI programs were to achieve smarter spending, better care and healthier people. The evaluation collected four core measures from Medicare and Medicaid claims so that the impact of the awards can be assessed on these aims. In addition, to assess the impact on the health of participants, RTI collected, constructed, and analyzed innovation-specific measures from other awardee-specific data.

Core Measures from Medicare and Medicaid Claims

The measures calculated through analysis of Medicare and Medicaid fee-for-service claims using definitions specified by CMMI include:

- total health care spending per patient,
- all cause hospital admissions,
- hospital unplanned readmissions, and
- ED visits not leading to a hospitalization.

Detailed specifications for each of these measures are provided in ***Appendix B.1***. As described in the individual awardee sections, some innovations (e.g., dental care for children) may not directly impact these measures. Innovations that addressed specific conditions or procedures (e.g., diabetes, imaging etc.) may have significant impacts on spending, admissions, readmissions, and ED visits for the targeted conditions or procedure. Effects may not be statistically detectable at the aggregate level because the targeted conditions or procedure represent only a small fraction of total spending, inpatient admissions, hospital unplanned readmissions, and ED visits.

Awardee-Specific Health Outcomes

Awardee-specific data reflect the variability of the types of data elements available across awardees and are abstracted from electronic health records or administrative databases. Data include patient-level measures of clinical effectiveness (e.g., adherence to standards of care) and health outcomes related to specific disease conditions. Awardees specified clinical effectiveness (the extent to which patients with receive appropriate clinical care) and/or health outcome measures in their self-monitoring plan as a requirement of their award. RTI reviewed each awardee's self-monitoring measurement plan and identified clinical effectiveness and health outcome measures that would be useful to include as part of the evaluation of awardees' innovations.

As shown in ***Table 1-3,*** this 2016 annual report presents outcomes for 17 awardees with one or more measures related to diabetes, hypertension, asthma, weight control, mental health, or other outcome. The most commonly reported measures were diabetes (11) and hypertension (10). Smaller subsets of awardees had measures related to weight control (7) and mental health (3). One awardee reported asthma and chronic obstructive pulmonary disease (COPD)-related outcomes. Five awardees had outcome measures other than those specified in the table, including items related to radiation exposure, pregnancy, mortality, and health care utilization.

Table 1-3. Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes Presented in the HCIA Community Resource 2016 Annual Report

Awardee	Diabetes	Hypertension	Asthma/COPD	Weight Control	Mental Health	Other
Altarum						●
BAHC	●	●				
Bronx RHIO	●					
Curators	●	●	●			
ECCHC	●	●		●	●	
Finity	●	●		●		●
IA						●
Intermountain	●	●		●	●	
Mary's Center		●				
MPHI	●	●		●		
NHCHC	●	●			●	
REMSA						●
South County	●	●				
U-Chicago	●	●		●		
U-Miami	●			●		
W&I						●
Y-USA				●		
Totals	11	10	1	7	3	5

COPD = chronic obstructive pulmonary disease. Data through June 2015.

1.2.4 Claims Data Methods

Claims data analysis was a multistep process that began with obtaining patient identifiers (e.g., SSN, HIC) from awardees and matching these identifiers to beneficiary claims in the Chronic Conditions Data Warehouse (Medicare and Medicaid). When claims could not be matched, we secured data directly, from the awardee (e.g., Finity, Mary's Center, and SEMHS). Once patient files were created, RTI constructed comparison groups and carried out descriptive and regression analyses as summarized below and detailed in ***Appendix B.2***.

Comparison Groups

For each awardee, where possible, RTI developed a comparison group (CG) to assess what would have happened in the absence of the innovation. The CG methodology aims to select similar CGs and treatment groups (TGs) during the baseline period using information from both the calendar quarter prior to enrollment in the innovation and the four preceding calendar quarters. Using these baseline characteristics, the TG beneficiaries and the potential CG beneficiaries were then included in a logistic regression model to generate a propensity score, which estimated the probability of participation in the innovation. Each TG beneficiary was then matched with up to three CG beneficiaries based on their propensity scores. In order to be matched, the scores must fall within a prespecified distance (20% of the standard deviation of the logit of the propensity score). See Appendix B.2 for additional details.

Descriptive and Regression Analyses

After the CGs were selected, we descriptively plotted the core four outcomes over time for both the CG and the innovation group. This allowed us to examine the trends both before and after the innovation started. In addition, we statistically examined the differences in the growth rates before and after using a DinD analytic approach. DinD was used to identify and quantify innovation effects of the HCIA demonstrations for the four core measures. The DinD regression specification involved both a CG and innovation group along with predemonstration (or innovation) data on both. Quarterly fixed effects models were used to report the performance of the innovation group on a quarterly basis and overall.

1.2.5 Awardee-Specific Data Methods

Data Collection

The goal for clinical effectiveness and health outcomes measurement and analysis was to determine the impact of the innovation on patient health. A second goal was to determine the reach and dose of the innovation by analyzing patient recruitment, enrollment, and service utilization. Beginning in June 2014, RTI began receiving patient-level secondary data on a quarterly basis to assess these impacts. The diversity of the innovations precluded any attempt to define or establish a core set of measures other than those necessary for the claims analysis. Thus, RTI determined in consultation with the awardees which secondary data were appropriate and feasible, given the goals of the innovation and outcomes to be impacted.

RTI met with all awardees individually throughout the evaluation to ensure proper transfer of files, data quality and completeness. Once we received the data, we cleaned the data and provided a file containing patient identifiers (e.g., Medicare HIC number, Medicaid ID, SSN, name, address) to the claims analysis team. We then created new variables or recoded existing variables including patient characteristics, the number of persons enrolled or served (reach), the amount and frequency of the innovation provided (dose), as well as the clinical effectiveness and health outcomes data presented in the individual awardee chapters.

Analyses

We used the health outcome data to generate run charts showing the percentage of participants with diabetes or hypertension who were in control of that condition. For a subset of awardees (BAHC, Curators, ECCHC, MPHI, and South County) for which we received health outcome data, we used multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time, while controlling for repeated measures (i.e., within-subject covariance). We controlled for baseline health outcome, age, sex, race, and insurance type. Regressions for each awardee and each health outcome measure were conducted independently. Additional details of awardee data collection and analyses are provided in ***Appendix C***.

1.2.6 Qualitative Methods

In Year 3 of the HCIA Community Resource evaluation, RTI collected and analyzed qualitative data on workforce development, implementation context, and implementation effectiveness from three annual rounds of key informant interviews and reports requested by CMMI and delivered to RTI on a quarterly basis:

- **Quarterly Awardee Performance Reports** (QAPRs) contain mostly structured qualitative and quantitative data describing the organizational characteristics, expenditures, staffing, training, and program participant characteristics of awardees, as submitted by awardee staff.
- **Narrative Progress Reports** (NPRs) provide a descriptive account of the project's accomplishments, lessons learned to date, planned activities, and self-monitoring findings. Innovation leaders typically prepare the NPR.
- **Sustainability Plans** explain how the awardee intends to continue offering innovation services after the HCIA grant funding period ends.

The Year 3 qualitative evaluation data presented in this report include **closeout interviews** with innovation leaders during the final quarter of implementation. The interviews explored changes in the innovation, implementation process, and supporting staff and resources since our last interviews; implementation effectiveness; sustainability efforts; and lessons learned from the implementation experience. ***Appendix D*** provides additional information on the closeout interviews and all other qualitative data sources.

A team of RTI coders analyzed textual data from the QAPRs, NPRs, sustainability plans, and closeout interview notes using NVivo qualitative analysis software. We developed codes in the first year of the evaluation to capture key elements of implementation processes and effectiveness based on existing implementation science research (e.g., Damschroder et al., 2009; AHRQ, 2013), and expanded those codes to include other patterns and themes that emerged during the evaluation. In Year 3, evaluation team members familiar with and trained to use the codebook independently flagged segments of text representative of the codes. Then we compared the coding across analysts and discussed coding disagreements and ambiguities. Once differences in coding were resolved, a lead coder output reports based on the codes, and awardee-specific teams used the reports and their working knowledge from earlier phases of the evaluation to prepare the findings presented here.[1,2]

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[1] Damschroder, L.J., Aron, D.C., Keith, R.E., et al.: Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. Implementation Science 4:50. 2009. DOI:10.1186/1748-5908-4-50.

[2] Agency for Healthcare Research and Quality. Developing and Assessing Contextual Frameworks for Research on the Implementation of Complex System Interventions Draft Methods Research Report. 2013. Retrieved from http://effectivehealthcare.ahrq.gov/ehc/products/490/1621/interventions-complex-systems-draft-130812.pdf

1.3 Data Challenges and Limitations

The data for this evaluation presented certain challenges that are important to explain. First, awardees varied in their level of experience with evaluation techniques, and in their capacity to submit the data requested. In an effort to reduce the burden to awardees, we accepted data in various file formats including portable document format (PDF) that cannot be directly manipulated or transformed. Even with relatively experienced awardees, we encountered delays in receiving data. Second, awardees sent RTI data files with the following inconsistencies:

- Some awardees submitted only Medicare or Medicaid identifiers (e.g., no names, dates of birth, gender, etc.) and we had no other data with which to link the identifiers.
- Some awardees submitted only patient identification numbers without payer type, so we assumed that the identified matches corresponded with the matched identifiers (e.g., Medicare or Medicaid). However, it is possible that a privately insured individual could have the same identifier as a Medicare ID, though highly unlikely.
- Some awardees sent data that were not readily usable or did not match claims data. Such issues included: identifiers with only 8 digits (9 are expected), data points that correspond to an observation rather than a patient, missing data, or otherwise unusable identifiers. We worked with the awardees to obtain the proper identifiers in these instances.

Third, although we requested that the awardees maintain the same format as in the previous quarters, we often discovered changes (e.g., names, values, calculations, previous patients excluded) over time that made working with the data more challenging. Other challenges included duplicate records, impossible/invalid values, and invalid patient identifiers.

Finally, the number of individuals enrolled and those eligible or targeted for enrollment was often difficult to ascertain. A number of awardees had no defined number of persons they intended to serve (target population) and, therefore, we were unable to calculate a reach measure. Others did not make a distinction between those individuals who were contacted for recruiting purposes and those who were served. For the purposes of assessing reach and dose, we distinguished between those eligible for the innovation from those who actually received it (or exposed to it).

In assessing the evidence for the value and impact of the innovation, RTI considered in the evaluation of each awardee the following:

1. the degree to which the innovation could by design directly impact the measures and outcomes reported;
2. whether the innovation had achieved sufficient reach and dose to achieve an effect;
3. whether the data were sufficiently robust to demonstrate an effect (e.g., sample size); and
4. whether the data were representative of the participants and the services/treatment provided.

Any specific limitations related to these four considerations or any given data source are explained in the individual awardee sections.

1.4 Overview of the Report

The remainder of this report is organized into two chapters. Section 2 includes the individual awardee reports summarizing progress and results to date based on the all key sources of data described above. Section 3 presents a cross-awardee analysis of key measures drawn from claims and awardee-specific data as well as an analyses of qualitative data on selected topics. To ease the readability of the report, highly technical discussions regarding the methods of data collection and analysis are in separate appendices.

Section 2
Awardee-Level Findings

- Altarum Institute (Altarum)
- Asian Americans for Community Involvement (AACI)
- Ben Archer Health Center (BAHC)
- Bronx Regional Health Information Organization (Bronx RHIO)
- Children’s Hospital and Health System (Children’s Hospital)
- Curators of the University of Missouri (Curators)
- Delta Dental Plan of South Dakota (Delta Dental)
- Eau Claire Cooperative Health Centers (ECCHC)
- Finity Communications (Finity)
- Imaging Advantage (IA)
- Intermountain Health Care Services, Inc. (Intermountain)
- Mary’s Center for Maternal & Child Care (Mary’s Center)
- Michigan Public Health Institute (MPHI)
- Mineral Regional Health Center (Mineral Regional)
- National Health Care for the Homeless Council (NHCHC)
- Northeastern University (NEU)
- Prosser Public Hospital District (Prosser)
- Regional Emergency Medical Services Authority (REMSA)
- South County Community Health Center (South County)
- Southeast Mental Health Services (SEMHS)
- University of Chicago (U-Chicago)
- University of Miami (U-Miami)
- Women and Infants Hospital of Rhode Island (W&I)
- YMCA of the USA (Y-USA)

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:
Altarum Institute

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Altarum Institute

2.1 Introduction

Altarum Institute (Altarum), a research organization in southeast Michigan, received an award of $8,366,178 beginning on April 30, 2013. The innovation, which aimed to improve general practice clinicians' selection of appropriate radiologic imaging studies—thereby reducing cost and unnecessary radiation exposure—sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending by 10 percent by eliminating unnecessary, inappropriate image studies, and associated unnecessary care. Altarum expected net savings of $32 million over 3 years.

2. **Better care.** Improve care by providing radiology decision support, access to prior image study reports, patient education, and provider education that promoted use of radiology guidelines and alternative care pathways.

3. **Healthier people**. Improve health by reducing patient radiation exposure, misdiagnosis, and unnecessary treatment and providing patient and provider education.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by Altarum and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Innovation components included web-based and mobile versions of the ImageSmart™ application, an HIT-based radiology tool.
Program Participant Characteristics	
	Emphasis shifted from early focus on nonpediatric PCPs within UP to include UP high-volume specialists, and broadened to include diverse providers in MPP. 99% were Medicare, 91% were white, and 99% were aged 45 and older.
Workforce Development	
Hiring and retention	Fully staffed with a high retention rate (91% in Q12 and 90% in Q11).
Skills, knowledge, and training	Between Q11 and Q12, provided 132 hours of training to 183 community-based clinical and nonclinical personnel. Met 150% of its training target goal (1,509 individuals) for the project.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Award execution	Altarum spent 85.4 percent of total budget, below the projected target.
Leadership	Altarum, UP, and MPP leadership remained engaged and committed to the project. There were no changes in roles or leadership.
Organizational capacity	Altarum's organizational capacity increased over the project; however, throughout the award, processes took much longer than anticipated.
Innovation adoption and workflow integration	Clinicians' use of the tool was consistently low; Altarum had challenges integrating ImageSmart and other HIE tools into provider workflow.
Implementation Effectiveness	
Innovation reach	Two additional UP practices and 4 additional MPP practices used the CDS, for totals of 111 and 44, respectively; 147 UP practices and 69 MPP practices were trained for the CDS.
Innovation dose	Dose was not measured
Sustainability	
	Altarum described plans to continue the intervention (partially) beyond the grant period, focusing on full certification of the ImageSmart™ application within the Allscripts™ EHR.

Sources: *Q11-Q12 Narrative Progress Report*
Q11-Q12 Quarterly Awardee Performance Report
Patient-level data provided to RTI.
Key informant interviews conducted Feb–June 2015.

CDS = clinical decision support; EHR = electronic health record; FTE = full-time equivalent; HIE= health information exchange; HIT = health information technology; MPP = McLaren Physician Partners; PCP = primary care physicians; UP = United Physicians.

Table 3 summarizes Medicare claims-based findings during the innovation period. Spending by the innovation group was not statistically different than spending by the comparison group overall; however, the innovation group's spending was significantly higher in Years 2 and 3 of the innovation. Inpatient stays fell during Year 1, but rose during Years 2 and 3. Overall, inpatient admissions were lower than the comparison group's admissions and the estimate is statistically significant. There was no change in unplanned readmissions. ED visits were higher among the innovation group than the comparison group overall and during Years 2 and 3 of the innovation.

The Altarum innovation was not expected to generate changes in total spending, inpatient stays, unplanned readmissions, or ED visits because it focused on modifying outpatient physician imaging behavior. Outpatient imaging services comprise only a small portion of overall spending and utilization; therefore, results should be interpreted with caution.

Table 3. Summary of Medicare Claims-Based Findings: Altarum

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$3.487	−$83.680, $90.653	−$20.960	−$102.000, $60.091	$15.801	$2.171, $29.430	$8.648	$5.871, $11.425
Acute care inpatient stays	−1,031	−1,769, −293	−2,452	−3,122, −1,783	984	690, 1,279	437	336, 539
Hospital-wide all-cause unplanned readmissions	0	−210, 211	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	1,677	843, 2511	105	−651, 861	1,277	941, 1613	296	190, 401
Average impact per quarter								
Spending per participant	$14	−$347, $376	−$134	−$651, $384	$214	$29, $399	$810	$550, $1,070
Acute care inpatient stays (per 1,000 participants)	−4	−7, −1	−16	−20, −11	13	9, 17	41	31, 50
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	0	−9, 9	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	7	3, 10	1	−4, 5	17	13, 22	28	18, 38

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

We did not have sufficient observations to support regression analysis of the innovation's impact on Medicaid beneficiaries.

2.1.1 Innovation Components

This innovation had two components: web-based and mobile versions of the ImageSmart application—a radiology clinical decision support (CDS) tool that provided specific recommendations about optimal image order selection, and a web-based portal that offered access to ImageSmart, supported electronic exchange of existing study results, and provided educational materials related to radiology exams. The CDS is health information technology that supports clinicians at the point of care with current guidelines on practice relevant to the patient being seen. ImageSmart advised providers about the most appropriate imaging modality for a specific diagnosis. This innovation aimed to change providers' behavior, and did not entail direct service delivery to patients. No changes to these components were made since the 2014 evaluation annual report (Altarum awardee section).

Table 4 displays Altarum's partners for the innovation, which did not change after McLaren Physician Partners (MPP) joined the innovation team in 2014. In total, 147 UP practices and 69 MPP practices received training on use of ImageSmart and were eligible to use the tool.

Table 4. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
United Physicians (UP)	Training, CDS tool users	Bingham Farms, MI
McLaren Physician Partners (MPP)	Training, CDS tool users	Flint, MI

Source: *Q11-Q12 Quarterly Awardee Performance Report*, Jan 2015-June 2015
CDS = clinical decision support; HCIA = Health Care Innovation Award

2.1.2 Program Participant Characteristics

Altarum initially focused on nonpediatric primary care physicians (PCPs) with United Physicians (UP) as recipients of the decision support and health information exchange (HIE) components of the intervention; emphasis in Q9 shifted to high-volume specialty care UP providers. A limited introduction of the intervention was given to MPP providers in Q9. In Q10, Altarum enlarged the intervention target with increased activity at MPP practices. Nurses, physician assistants, and administrative office staff from UP and MPP practices continued to use ImageSmart and were also considered program participants. Patients seen by UP PCPs and specialists, and MPP providers, were indirect targets of the intervention.

Altarum was unable to provide characteristics of patients whose PCP participated in the intervention. However, RTI used information on participating physicians that Altarum provided to link participating physicians to fee-for-service Medicare patients in the Chronic Conditions Data Warehouse (***Table 5***). The distribution of patient characteristics is similar to that in the 2015 evaluation annual report (Altarum awardee section). Overall, the population was composed of mostly adults over the age of 45 (98%) who are predominately white (91%) and insured by Medicare (99%).

Table 5. Characteristics from Quarter Prior to Enrollment for Participants Enrolled in the Altarum Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	37,760	100.0
Age		
< 18	10	0.0
18–24	39	0.1
25–44	467	1.2
45–64	6,361	16.9
65–74	16,247	43.0
75–84	10,306	27.3
85+	4,330	11.5
Missing	—	—
Sex		
Female	22,080	58.5
Male	15,680	41.5
Missing	—	—
Race/ethnicity		
White	34,369	91.0
Black	1,990	5.3
Hispanic	404	1.1
Asian	—	—
American Indian or Alaska Native	—	—
Native Hawaiian or other Pacific Islander	—	—
Other	997	2.6
Missing/refused	—	—
Payer category		
Dual	3	0.0
Medicaid	39	0.1
Medicare	37,718	99.9
Medicare Advantage	—	—
Other	—	—
Uninsured	—	—
Missing	—	—

Source: Chronic Conditions Data Warehouse Medicare and Medicaid claims data.
— Data not yet available.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 6 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 6. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

The Altarum innovation aimed to change physician behavior; therefore, we compared the patients of physicians who participated in the innovation to the patients of physicians who did not participate.

We used propensity score matching (PSM) to select comparison group physicians with similar characteristics as innovation physicians. The innovation group includes physicians who received ImageSmart training. The set of potential comparison group physicians included physicians who were not targeted for training by Altarum. We first limited the pool of innovation and potential comparison physicians to those with overlapping specialties to ensure overlap in the types of physicians in the innovation and comparison groups. Next, innovation and comparison physicians were matched using a logit model predicting the likelihood that a physician was enrolled in the innovation as a function of the number of Medicare patients a physician had, average patient spending, the average number of chronic conditions per patient, the age distribution of patients, patient gender, patient race, end-stage renal disease and disability status of patients, and practice specialty. Physicians were matched 1:1 with replacement using a caliper.

After completing PSM, we selected Medicare fee-for-service patients who saw an innovation or matched comparison physician after the physician received ImageSmart training.[1] The sample contained 45,007 innovation patients and 42,564 comparison patients. The first innovation quarter (I1) for innovation

[1] Comparison group physicians did not receive ImageSmart training. Each comparison physician was assigned the same training date as the matched innovation group physician.

and comparison patients is determined by the first date that the patient saw a physician after that physician/practice received ImageSmart training.

Table 7 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Appendix B.2*** provides technical details on the propensity score methodology. Twenty-eight innovation physicians were dropped from the subsequent analysis because an appropriately matched comparison physician was not available.

Table 7. Mean Values and Standardized Differences of Variables in Propensity Score Model: Altarum

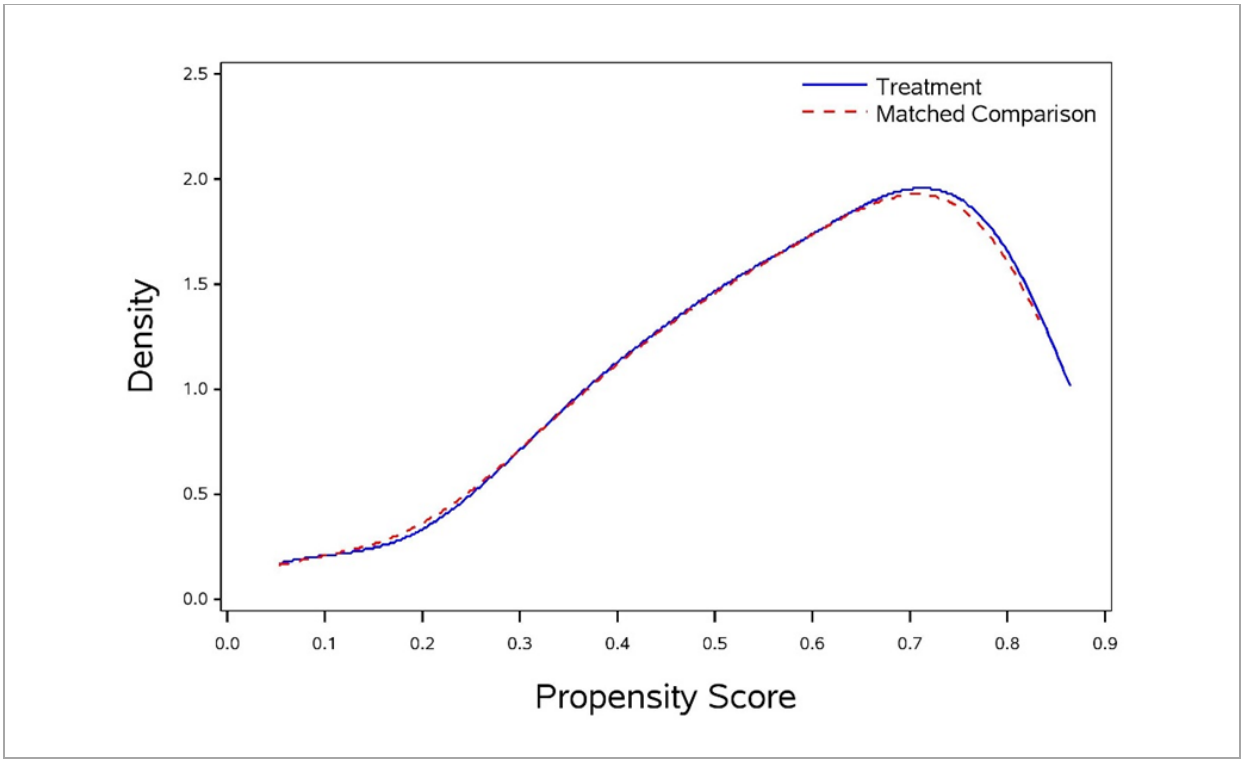
Variable	Before Matching: Innovation Group Mean	Before Matching: Innovation Group SD	Before Matching: Comparison Group Mean	Before Matching: Comparison Group SD	Before Matching: Standardized Difference	After Matching: Innovation Group Mean	After Matching: Innovation Group SD	After Matching: Comparison Group Mean	After Matching: Comparison Group SD	After Matching: Standardized Difference
Average number of patients per physician	341	301	321	202	0.08	339	260	298	196	0.18
Average spending per patient from physician	$913	$1,052	$2,015	$2,163	0.65	$16,892	$9,857	$16,315	$11,031	0.06
Average spending per patient	$16,503	$9,515	$28,327	$21,491	0.71	$965	$1,095	$884	$1,163	0.07
Average number of chronic conditions per patient	7.68	1.40	8.95	1.88	0.77	7.81	1.39	7.70	1.40	0.08
Percentage of patients younger than 65	18.27	38.64	15.66	36.34	0.07	16.19	36.84	15.39	36.09	0.02
Percentage of patients between ages 65 and 74	41.17	49.21	36.97	48.27	0.09	41.67	49.30	43.30	49.55	0.03
Percentage of patients older than age 75	40.86	49.16	47.52	49.94	0.13	42.47	49.43	41.30	49.24	0.02
Percentage of patients that are male	39.30	48.84	38.68	48.70	0.01	39.49	48.88	39.87	48.96	0.01
Percentage of patients that are white	88.69	31.67	80.48	39.64	0.23	88.69	31.68	88.16	32.30	0.02
Percentage of patients that are black/African American	7.12	25.71	14.95	35.66	0.25	7.28	25.99	6.75	25.10	0.02
Percentage of patients that have ESRD	1.16	10.72	2.34	15.12	0.09	1.14	10.62	1.08	10.36	0.01
Percentage of patients that are disabled	26.14	43.94	23.30	42.27	0.07	23.51	42.41	22.73	41.91	0.02
Family practice	50.84	49.99	30.68	46.12	0.42	49.05	49.99	47.14	49.92	0.04
General practice	1.26	11.16	1.59	12.52	0.03	0.95	9.71	0.95	9.71	0.00
Internal medicine	47.06	49.91	66.93	47.05	0.41	49.52	50.00	51.90	49.96	0.05
Other specialty	0.84	9.13	0.80	8.89	0.00	0.48	6.88	0.00	0.00	0.10
Number of Physicians	238	—	251	—	—	210	—	105	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute; ESRD = end-stage renal disease; SD = standard deviation.
— Data not applicable.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and checked whether matching decreased the absolute standardized differences and achieved acceptable balance (Table 7). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 7 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables except average number of Medicare patients per physician. To improve balance on the other variables, balance on the average number of patients per physician was reduced after matching. The average number of patients per physician in the innovation group was 339 compared to 298 in the matched comparison group.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The propensity score distributions for the innovation and matched comparison groups were similar, indicating that matched comparison physicians had similar propensity scores to innovation physicians.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute.

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 8 reports Medicare spending per patient in the eight quarters before and the 11 quarters after a patient visited a physician who received ImageSmart training. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 8 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for pre-innovation quarters.

Spending for the innovation and comparison groups is very similar during the baseline period. The peak in spending during the first quarter of the innovation occurs because beneficiaries were assigned I1 based on their receipt of services. All beneficiaries' I1 are set based on the date that they visited their physician; therefore, every beneficiary utilizes services in I1 and spending peaks during that period. Average spending is lower in other quarters because not all patients generate claims in every quarter. During the first five innovation quarters, spending is very similar between the innovation and comparison groups. Starting in I6, the innovation group's spending rises above the comparison group's spending. As shown in Table 8, the sample size falls dramatically as the innovation progresses because patients who enrolled in the innovation later have fewer post-innovation quarters. These results should be considered preliminary until more beneficiaries have been observed throughout all 12 quarters of the innovation period.

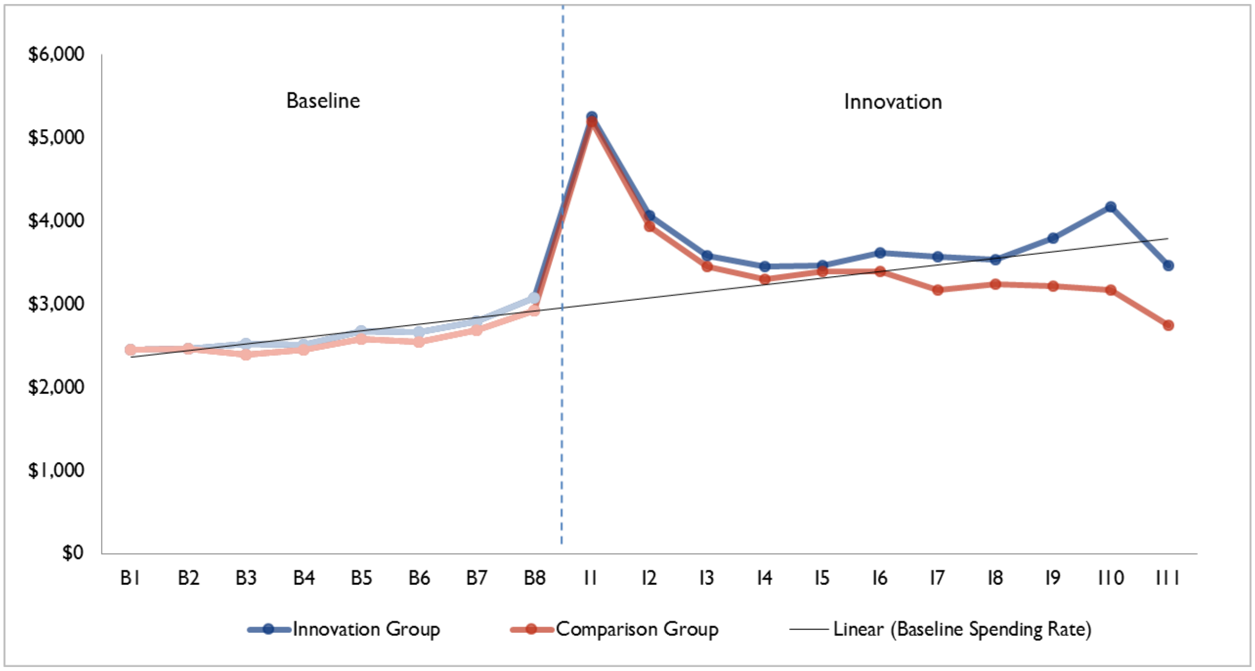
Table 8. Medicare Spending per Participant: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$2,451	$2,463	$2,523	$2,508	$2,677	$2,665	$2,790	$3,080	$5,259	$4,070	$3,586	$3,456	$3,461	$3,620	$3,575	$3,539	$3,797	$4,173	$3,464
Std dev	$7,096	$7,125	$7,121	$7,249	$7,511	$7,544	$8,051	$9,057	$11,849	$10,524	$9,512	$9,000	$9,164	$9,766	$9,524	$9,361	$9,959	$10,374	$7,757
Unique patients	37,678	38,346	38,985	39,715	40,429	41,274	42,243	43,661	45,007	42,186	37,501	31,896	26,127	19,768	16,114	11,728	7,635	2,623	416
Comparison Group																			
Spending rate	$2,458	$2,463	$2,390	$2,453	$2,586	$2,549	$2,685	$2,922	$5,195	$3,939	$3,458	$3,297	$3,395	$3,395	$3,175	$3,243	$3,216	$3,173	$2,743
Std dev	$7,064	$7,304	$6,635	$6,873	$7,700	$7,266	$7,725	$8,361	$11,681	$10,417	$9,438	$9,027	$9,467	$9,857	$8,625	$9,370	$8,743	$7,667	$6,531
Weighted patients	34,933	35,700	36,306	36,989	37,803	38,722	39,768	41,209	42,564	40,383	36,583	32,878	29,345	25,483	21,357	16,070	11,792	5,221	1,170
Savings per Patient																			
	$7	$0	−$133	−$55	−$92	−$117	−$104	−$158	−$64	−$130	−$127	−$159	−$66	−$225	−$400	−$295	−$581	−$999	−$721

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 2. Medicare Spending per Participant: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute

2.4.2 Regression Results

We present the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $14 (90% CI: −$347, $376). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

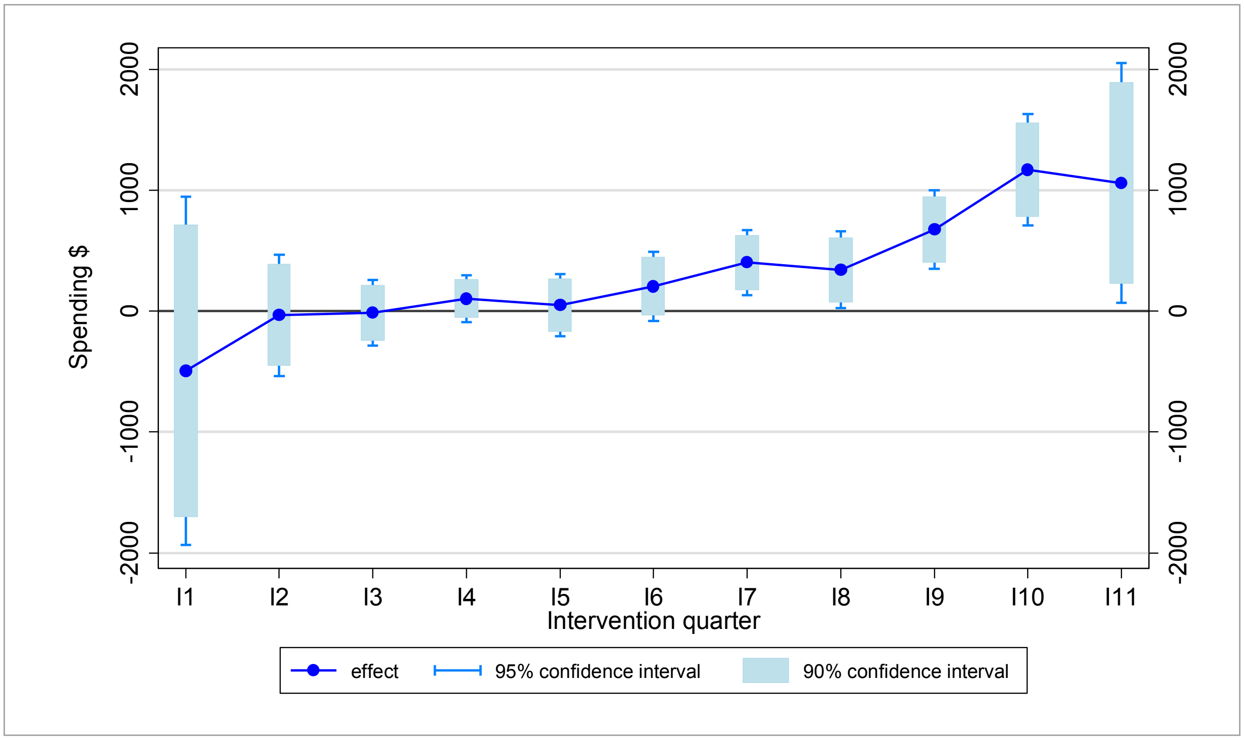
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 9*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. Spending estimates are initially negative, then become positive and large in later innovation quarters. Quarterly spending estimates are statistically significant in I7 through I11. The sample size falls dramatically as the innovation quarters progress, meaning that only a fraction of patients are observed in later innovation quarters. Differences in the set of patients observed early versus late in the innovation could lead to the observed changes in spending. These results should be considered preliminary until more time has elapsed and claims are available for most participants during all quarters of the innovation period.

Table 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−$494	$734	0.501
I2	−$35	$256	0.890
I3	−$13	$139	0.927
I4	$102	$98	0.298
I5	$49	$132	0.707
I6	$204	$146	0.162
I7	$401	$137	0.004
I8	$341	$162	0.037
I9	$674	$165	<.0001
I10	$1,168	$235	<.0001
I11	$1,058	$506	0.037
Overall average	$14	$219	0.947
Overall aggregate	$3,486,731	$52,836,707	0.947
Overall aggregate (IY1)	−$20,960,000	$49,131,127	0.670
Overall aggregate (IY2)	$15,800,564	$8,261,843	0.057
Overall aggregate (IY3)	$8,648,307	$1,683,427	<.0001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups. Standard errors are clustered at the physician level.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
Altarum = Altarum Institute; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

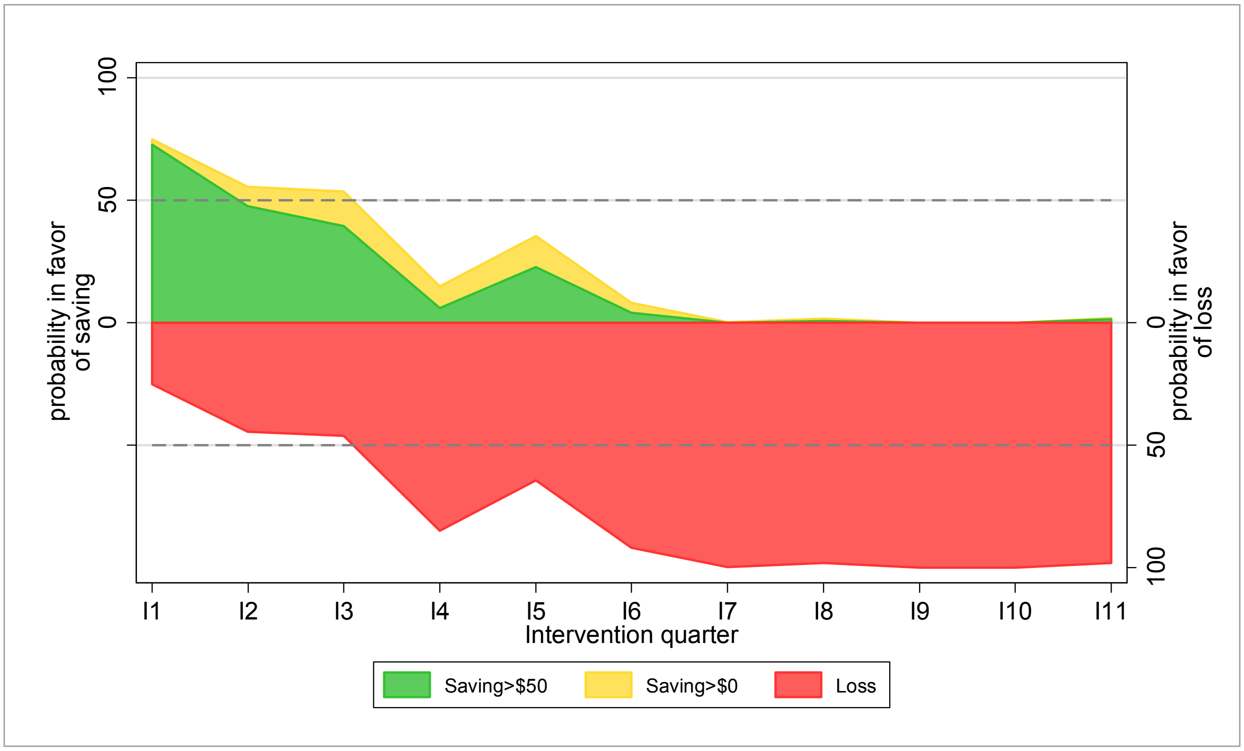
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. During the first three quarters, the evidence favors the innovation generating savings because the innovation group's spending is lower than the comparison group's spending. In subsequent quarters, the evidence favors the innovation generating a loss. These results should be considered preliminary. Additionally, the Altarum innovation was not expected to have a detectable impact on overall patient spending because it focused on imaging services ordered by outpatient physicians, which comprised a small portion of overall spending.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 5***. During the baseline period, innovation and comparison beneficiaries' all-cause inpatient admissions are very similar. All-cause admissions peak during the first quarter of the innovation because I1 is assigned based on the date that the patient saw an innovation or comparison physician. The comparison group's all-cause admissions rate is higher from I1 to I5, then lower than the innovation group's rate from I6 to I10.

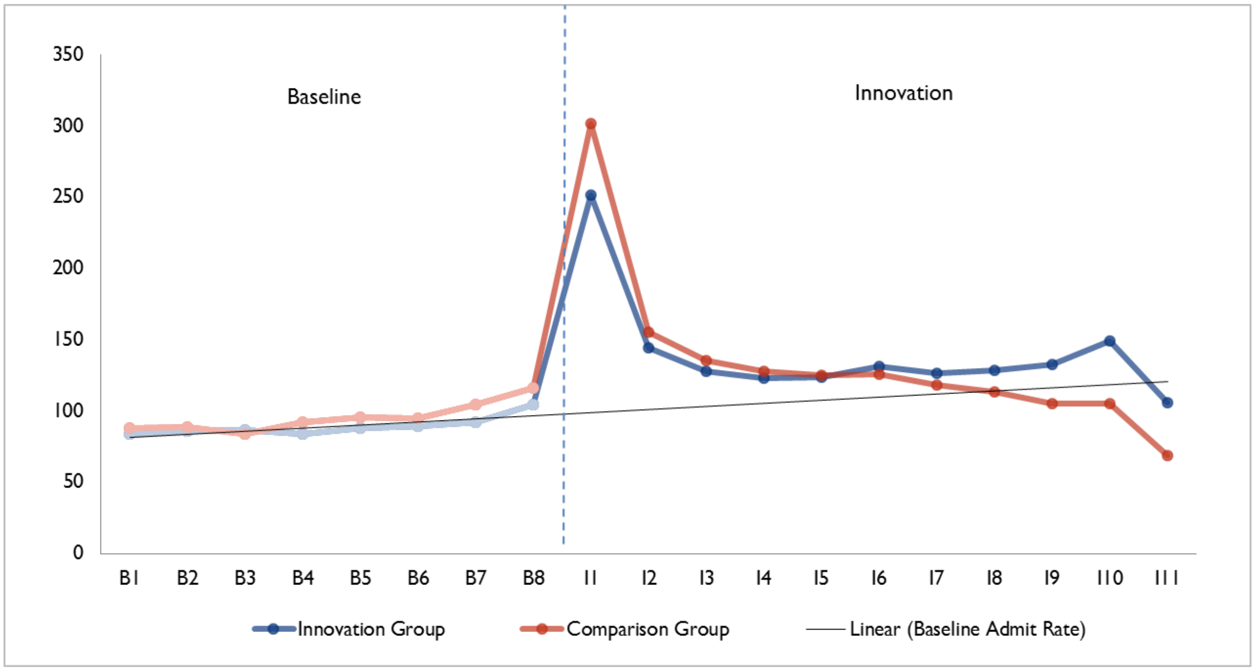
Table 10. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	84	86	87	84	88	89	92	104	251	145	128	123	124	131	126	129	133	149	106
Std dev	354	350	358	349	358	356	375	404	620	478	451	441	443	455	455	455	471	500	390
Unique patients	37,678	38,346	38,985	39,715	40,429	41,274	42,243	43,661	45,007	42,186	37,501	31,896	26,127	19,768	16,114	11,728	7,635	2,623	416
Comparison Group																			
Admit rate	88	89	84	92	96	95	104	116	301	156	136	128	125	126	118	114	105	105	69
Std dev	359	347	332	349	358	363	372	401	632	476	447	447	426	417	420	415	397	382	278
Weighted patients	34,933	35,700	36,306	36,989	37,803	38,722	39,768	41,209	42,564	40,383	36,583	32,878	29,345	25,483	21,357	16,070	11,792	5,221	1,170
Innovation − Comparison Rate																			
	−4	−3	3	−9	−8	−6	−12	−12	−50	−11	−8	−5	−1	5	8	15	27	44	37

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute.

2.5.2 *Regression Results*

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 4 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −7, −1). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 11 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The innovation group's inpatient admissions were significantly lower than the comparison group's during I1. Beginning in I6, inpatient admissions were statistically higher among the comparison group. The innovation group's inpatient admissions were significantly lower overall and in Year 1 of the innovation, but were higher during Years 2 and 3.

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Medicare Participants: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−52	7	0.000
I2	−4	4	0.336
I3	0	4	0.999
I4	2	4	0.559
I5	7	4	0.121
I6	14	5	0.003
I7	18	5	0.000
I8	22	6	0.000
I9	36	7	0.000
I10	54	12	0.000
I11	45	22	0.039
Overall average	−4	2	0.022
Overall aggregate	−1,031	449	0.022
Overall aggregate (IY1)	−2,452	407	0.000
Overall aggregate (IY2)	984	179	0.000
Overall aggregate (IY3)	437	62	0.000

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
Altarum = Altarum Institute; I = Innovation Quarter; IY = Innovation Year.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 12*** and ***Figure 6***. During the baseline period, the readmissions rate for the innovation and comparison groups are very similar. In most quarters after I3, the readmissions rate for the innovation group is higher than the readmissions rate for the comparison group. Altarum's innovation is not expected to affect hospital readmissions because it focuses on imaging services. In the next section, we test for differences in readmissions rates between the innovation and comparison groups.

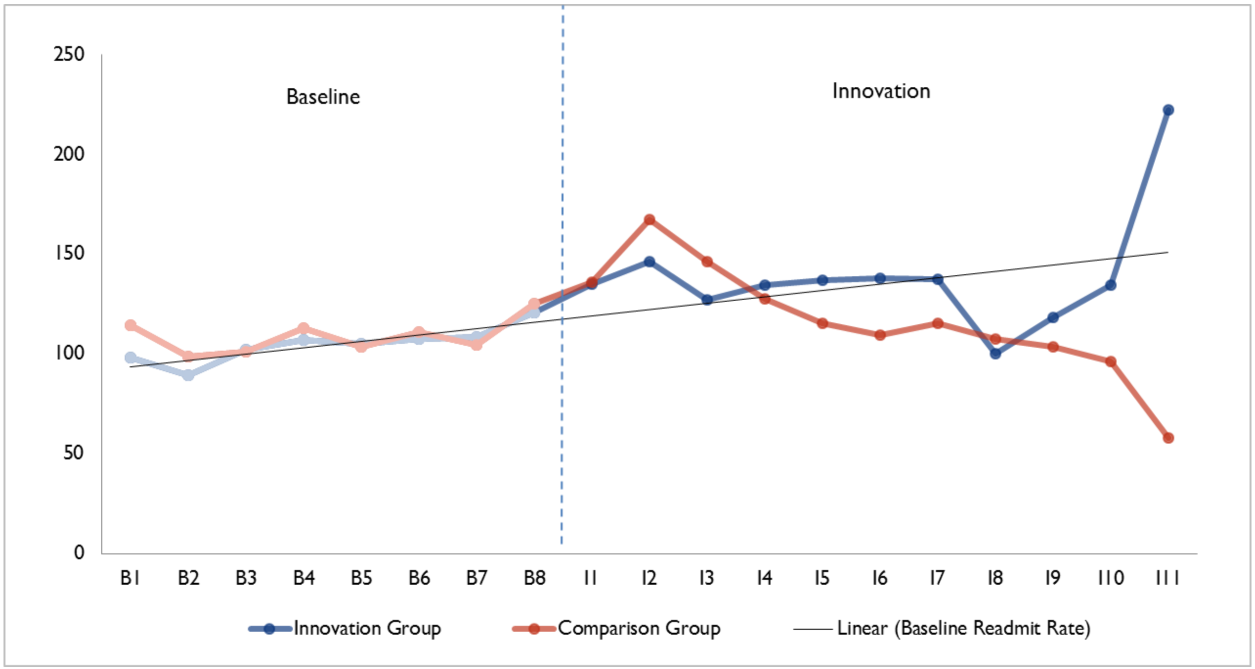
Table 12. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	98	90	102	107	105	107	109	121	135	146	127	135	137	138	138	100	118	134	222
Std dev	298	286	303	309	306	310	311	326	342	353	333	341	344	345	344	300	323	341	416
Total admissions	2,380	2,490	2,552	2,499	2,643	2,747	2,890	3,402	8,395	4,207	3,348	2,712	2,247	1,879	1,425	1,047	626	216	18
Comparison Group																			
Readmit rate	115	99	101	113	103	111	104	125	136	167	146	128	115	109	115	107	103	96	58
Std dev	319	298	301	317	305	314	306	331	343	373	353	334	319	312	320	309	305	295	233
Total admissions	2,322	2,345	2,217	2,475	2,513	2,664	2,912	3,207	8,569	4,168	3,299	2,732	2,493	2,129	1,724	1,268	754	353	52
Innovation − Comparison Rate																			
	−16	−9	1	−6	1	−3	4	−4	−1	−21	−19	7	22	28	22	−7	15	38	165

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute.

2.6.2 Regression Results

Table 13 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 0 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: -9, 9).

Table 13. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Altarum

Quarter	Coefficient	Standard Error	P-Values
Overall average	0	5	0.998
Overall aggregate	0	128	0.998

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Altarum = Altarum Institute.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 14*** and ***Figure 7.*** The ED visit rate is higher for the innovation group, but parallel to the comparison group's ED visit rate during the baseline period. During the innovation period, the two rates converge. The Altarum innovation was not expected to be directly related to ED visits, so care should be taken in making any association between ED visit rates and the innovation.

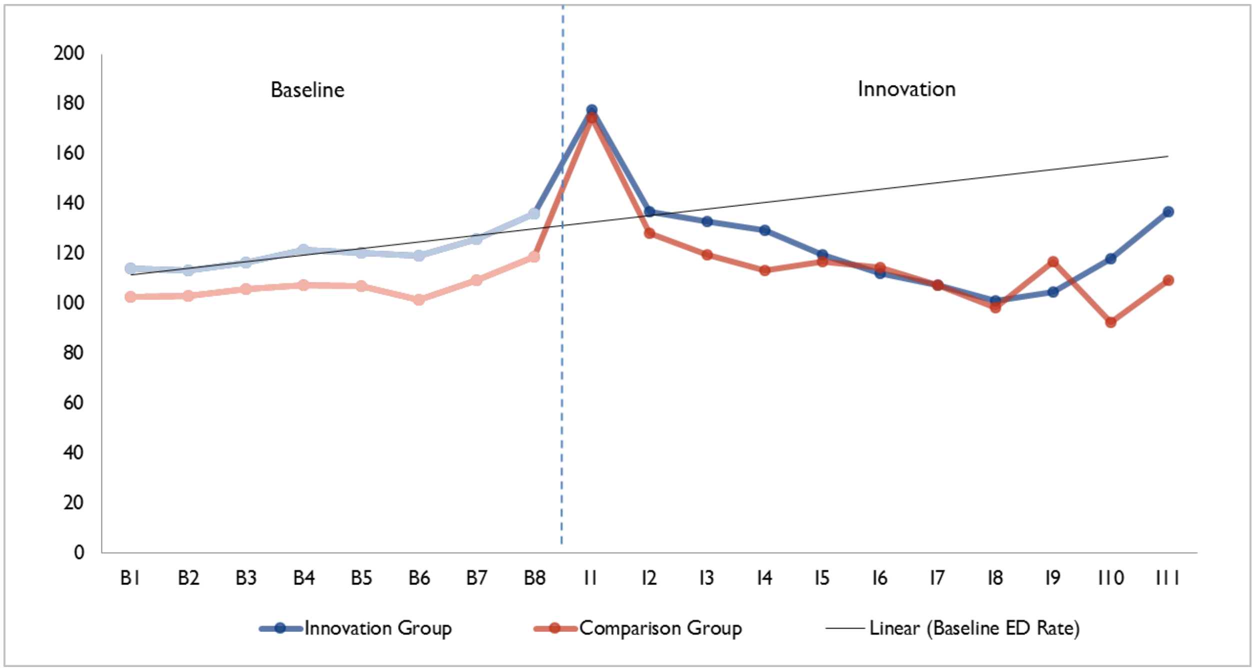
Table 14. ED Visits per 1,000 Medicare Participants: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	114	113	116	122	120	119	126	136	178	137	133	129	119	112	108	101	105	118	137
Std dev	515	523	509	538	518	518	542	583	658	574	640	567	502	482	486	430	445	478	448
Unique patients	37,678	38,346	38,985	39,715	40,429	41,274	42,243	43,661	45,007	42,186	37,501	31,896	26,127	19,768	16,114	11,728	7,635	2,623	416
Comparison Group																			
ED rate	103	103	106	107	107	101	110	119	174	128	120	113	117	114	107	99	117	92	109
Std dev	646	658	631	652	645	630	643	754	1,021	883	814	805	942	969	901	786	1,023	548	558
Weighted patients	34,933	35,700	36,306	36,989	37,803	38,722	39,768	41,209	42,564	40,383	36,583	32,878	29,345	25,483	21,357	16,070	11,792	5,221	1,170
Innovation − Comparison Rate																			
	11	10	11	14	13	18	16	17	3	9	13	16	2	−2	0	2	−12	26	28

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1.

Figure 7. ED Visits per 1,000 Medicare Participants: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute; ED = emergency department.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 7 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 3, 10). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 15 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. Except for I1, the innovation group had more ED visits than the comparison group. Differences between the two were statistically significant in 9 out of 11 innovation quarters. Because the Altarum innovation focused on changing outpatient physician imaging behavior, it was not expected to impact ED visits.

Table 15. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−13	7	0.055
I2	3	5	0.541
I3	1	5	0.794
I4	16	5	0.002
I5	14	5	0.005
I6	16	5	0.004
I7	18	5	0.001
I8	25	6	0.000
I9	18	7	0.012
I10	50	11	0.000
I11	60	30	0.044
Overall average	7	2	0.001
Overall aggregate	1,677	507	0.001
Overall aggregate (IY1)	105	459	0.819
Overall aggregate (IY2)	1,277	204	0.000
Overall aggregate (IY3)	296	64	0.000

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
Altarum = Altarum Institute; I = Innovation Quarter; IY = Innovation Year.

2.8 Medicare Imaging Services

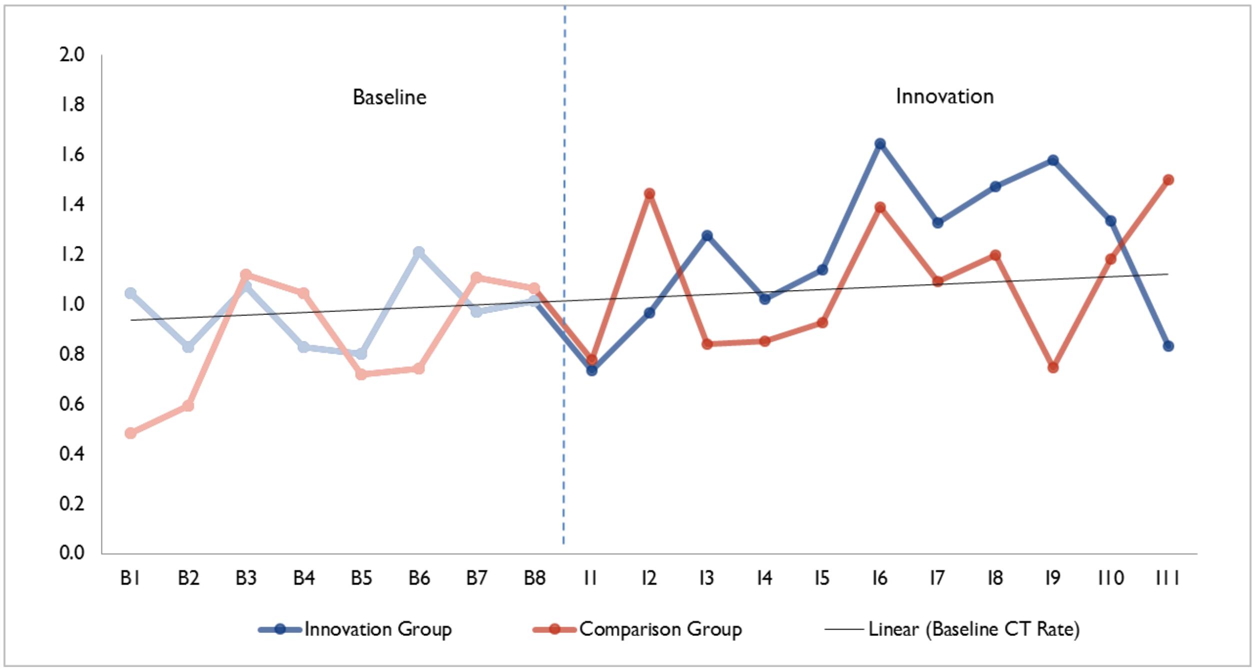
We conducted a descriptive and difference-in-differences analysis of imaging service ordering among physicians participating in the innovation. The sample for this analysis was slightly different than the sample for the Medicare spending, inpatient admissions, unplanned readmissions, and ED visits sample, which followed patients of innovation and comparison physicians over time. To analyze the innovation's impact on imaging ordering among participating physicians, we completed a physician-level analysis on the 210 innovation and 105 comparison physicians matched in Table 7 that calculated the number of imaging services participating and comparison physicians ordered in each quarter. We tested for changes in the following set of focal imaging services, which were targeted by the Altarum innovation:

- Computed tomography (CT) scans
  - Lumbar spine
  - Cervical spine
  - Lower extremity
  - Upper extremity
- Magnetic resonance imaging (MRI) scans
  - Lumbar spine
  - Cervical spine
  - Lower extremity
  - Upper extremity

To account for variation in the number of patients per physician, we calculated imaging services per 1,000 patient visits. ***Figures 8*** and ***9*** present trends in CT and MRI scans per 1,000 patient visits for innovation and comparison physicians separately.

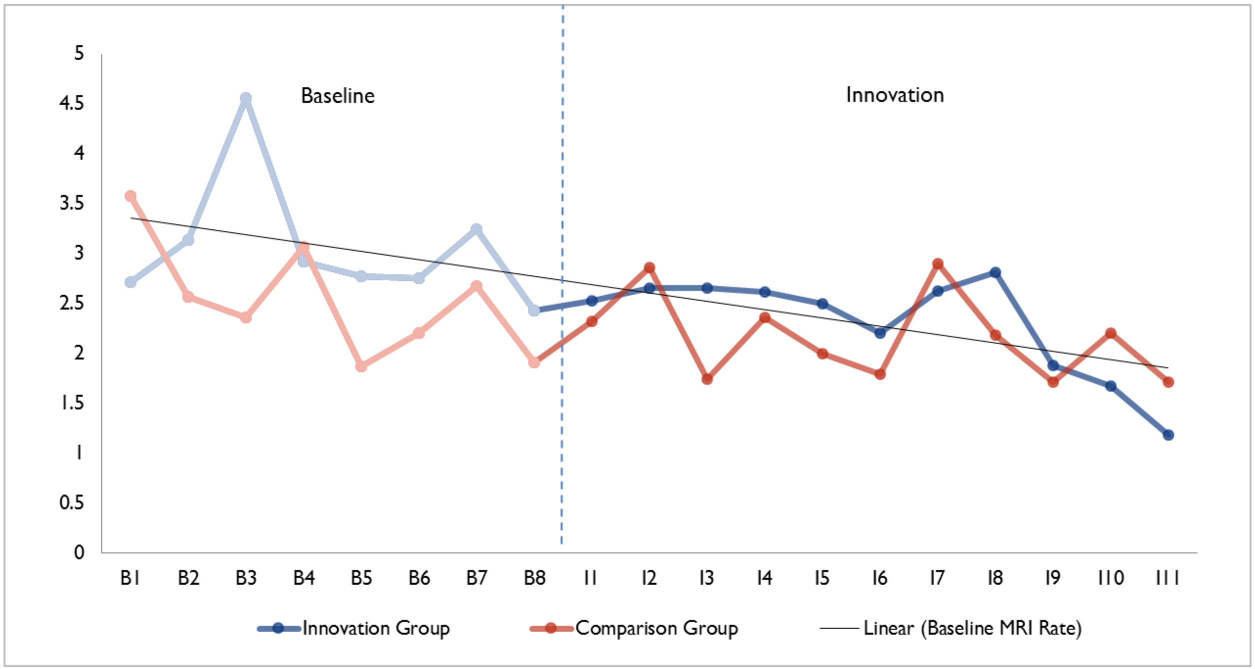
In Figure 8, the baseline level of focal CT scans is similar in the innovation and comparison groups. CT scans are relatively rare, averaging about 1 scan per 1,000 patient visits. Innovation physicians ordered more CT scans than comparison physicians between I3 and I10; however, the data series is highly variable. In Figure 9, MRI scans per 1,000 patient visits are similar between the innovation and comparison groups during the baseline and innovation period. MRI scans are slightly less rare than CT scans, with innovation and comparison physicians ordering approximately 2.5 scans per patient visit during B8.

Figure 8. Focal CT Scans per 1,000 Medicare Patient Visits: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute; CT = computed tomography.

Figure 9. Focal MRI Scans per 1,000 Medicare Patient Visits: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Altarum = Altarum Institute; CT = computed tomography.

We also conducted regression analyses to test for differences in CT and MRI scan ordering between innovation and comparison physicians. Differences in CT and MRIs were not statistically significant. Both Figures 8 and 9 and the regression results support the conclusion that the Altarum innovation did not have an impact on physician imaging ordering of CT and MRIs.

2.9 Discussion: Medicare Results

The Altarum innovation aimed to alter physician imaging behavior and indirectly affected patients; therefore, it was expected to have a minimal impact on total health care spending, inpatient visits, readmissions, and ED visits. Medicare patients who saw physicians participating in the innovation had higher spending during Years 2 and 3 of the innovation; but the effect for the entire innovation period was not statistically significant. However, inpatient stays were lower among the innovation group overall while ED visits were higher among the innovation group overall. Results should be considered preliminary until claims data are available for the majority of patients during all quarters of the innovation period.

We also tested for innovation effects on the imaging service ordering of participating physicians. The innovation did not have a detectable impact on physician ordering behavior, which is consistent with low use of ImageSmart by clinicians due to Altarum's challenges integrating the tool into provider workflow.

2.10 Medicaid Comparison Group

The Altarum innovation aimed to change physician behavior; therefore, we compared the patients of physicians who participated in the innovation to the patients of physicians who did not. We used PSM to select comparison group physicians with similar characteristics as innovation physicians. The innovation group includes physicians who received ImageSmart training. The set of potential comparison group physicians included physicians who were not targeted for training by Altarum. The same set of innovation-comparison physician matches were used for the Medicare and Medicaid analyses. Please see ***Section 2.3 Medicare Comparison Group*** for a complete description of the methodology for selecting comparison physicians and summary statistics for both groups.

After selecting comparison physicians, we selected Medicaid fee-for-service patients who saw an innovation or matched comparison physician after the physician received ImageSmart training.[3] The sample contained 53 innovation patients and 118 comparison patients. The first innovation quarter for innovation and comparison patients is determined by the first date that the patient saw a physician after that physician/practice received ImageSmart training.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 16 reports Medicaid spending per patient in the eight quarters before and the four quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 10*** illustrates the Medicaid spending per beneficiary in Table 16 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baselines quarters.

During the baseline period, spending for the innovation and comparison groups trends upward and is very similar. In both groups, a spike in spending occurs during the last baseline quarter. This spike is driven by an increase in inpatient spending in both groups. During the innovation period, spending for both groups remains similar and trends downward. The small number of innovation participants precludes a formal regression analysis; however, spending is not likely to be statistically different between the two groups due to its high standard deviation resulting from the small sample size and the skewed nature of health care expenditures.

[3] Comparison group physicians did not receive ImageSmart training. Each comparison physician was assigned the same training date as the matched innovation group physician.

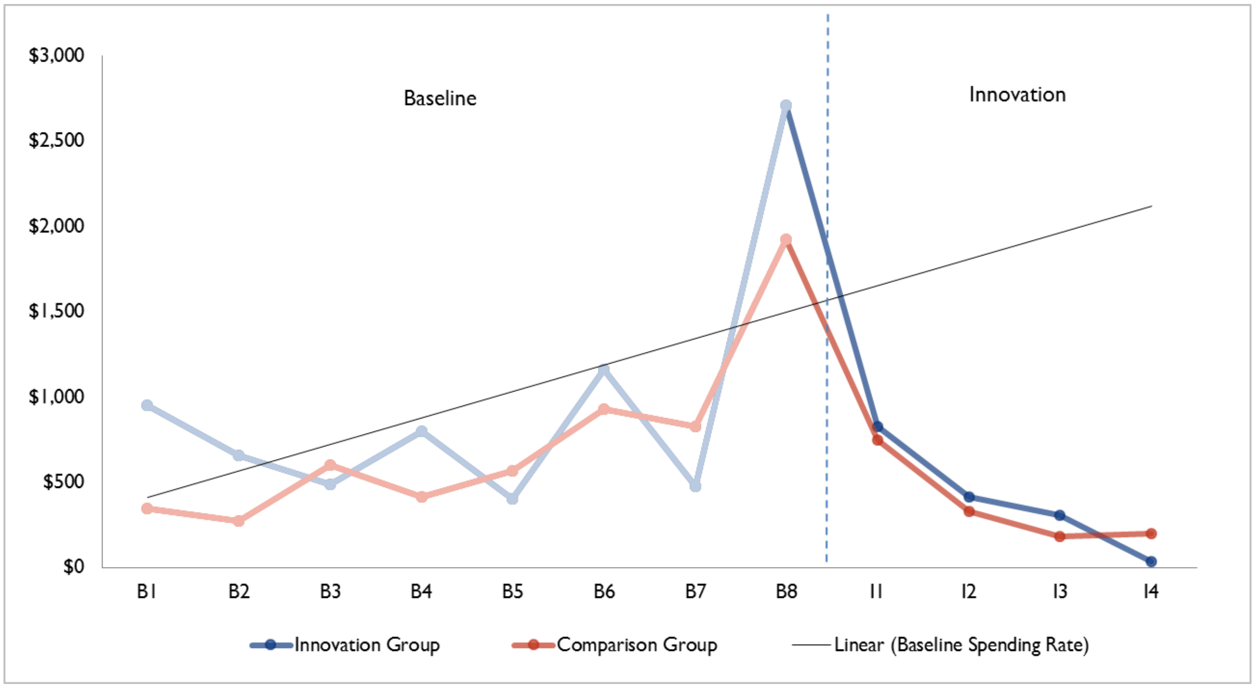
Table 16. Medicaid Spending per Participant: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters			
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4
Innovation Group												
Spending rate	$954	$658	$488	$798	$404	$1,159	$476	$2,711	$825	$413	$307	$35
Std dev	$3,423	$1,481	$1,795	$2,198	$804	$3,224	$1,391	$7,955	$2,558	$1,525	$440	$98
Unique patients	25	30	23	23	16	29	30	42	53	37	35	12
Comparison Group												
Spending rate	$344	$275	$602	$416	$569	$926	$828	$1,926	$746	$330	$185	$197
Std dev	$963	$733	$1,194	$985	$1,185	$2,217	$2,419	$8,232	$2,596	$1,208	$583	$489
Weighted patients	65	61	64	59	43	52	69	91	118	92	107	76
Savings per Patient												
	−$610	−$383	$114	−$382	$165	−$233	$353	−$785	−$79	−$83	−$122	$163

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 10. Medicaid Spending per Participant: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Altarum = Altarum Institute.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 17*** and ***Figure 11***. The all-cause inpatient admissions rate is highly variable during the baseline and innovation period for both groups. During B8, the innovation group experiences a spike in inpatient admissions, generated by 6 inpatient admissions among the 42 innovation beneficiaries in B8. During the innovation period, the comparison group's inpatient admissions rate falls relative to the innovation group's. The innovation was not expected to affect inpatient admissions and with a small sample size, we cannot yet conclude that the innovation had any impact on inpatient admissions.

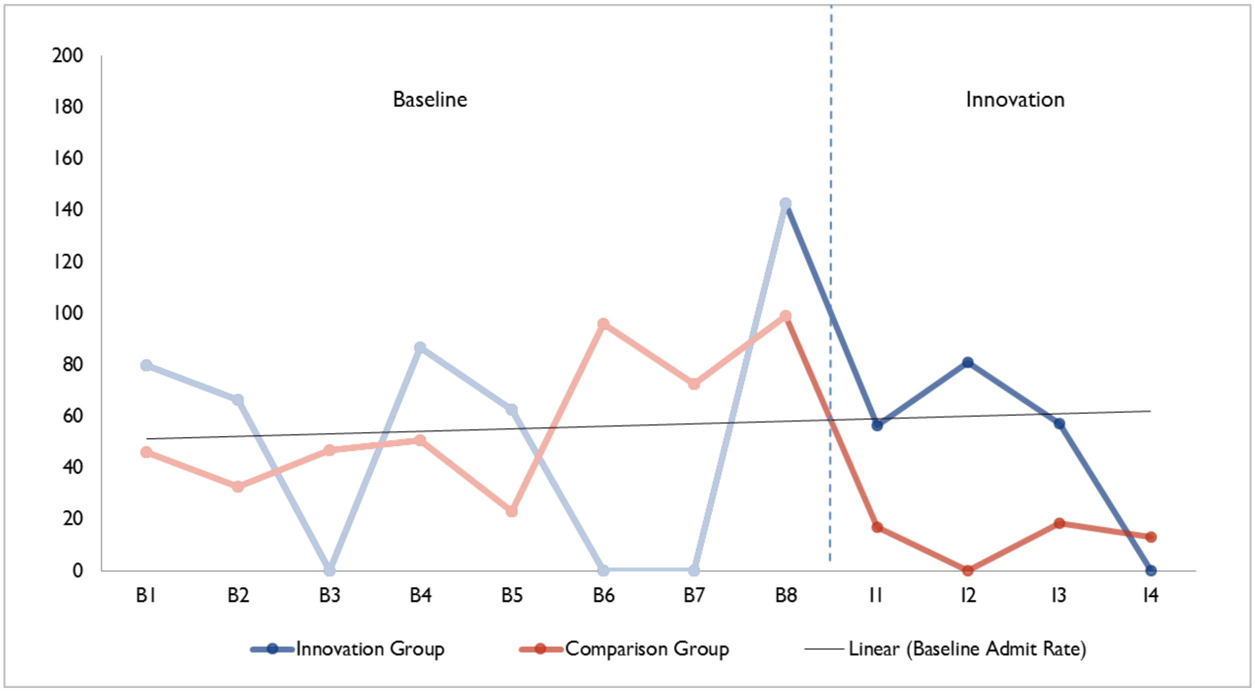
Table 17. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters			
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4
Innovation Group												
Admit rate	80	67	0	87	63	0	0	143	57	81	57	0
Std dev	400	254	0	288	250	0	0	417	233	277	338	0
Unique patients	25	30	23	23	16	29	30	42	53	37	35	12
Comparison Group												
Admit rate	46	33	47	51	23	96	72	99	17	0	19	13
Std dev	276	180	278	222	152	454	312	396	130	0	136	115
Weighted patients	65	61	64	59	43	52	69	91	118	92	107	76
Innovation − Comparison Rate												
	34	34	−47	36	39	−96	−72	44	40	81	38	−13

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 11. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Altarum = Altarum Institute

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 18*** and ***Figure 12***. The small number of hospitalizations in the innovation and comparison groups results in a small number of unplanned readmissions; therefore, no conclusions can be drawn about the innovation's impact on this outcome.

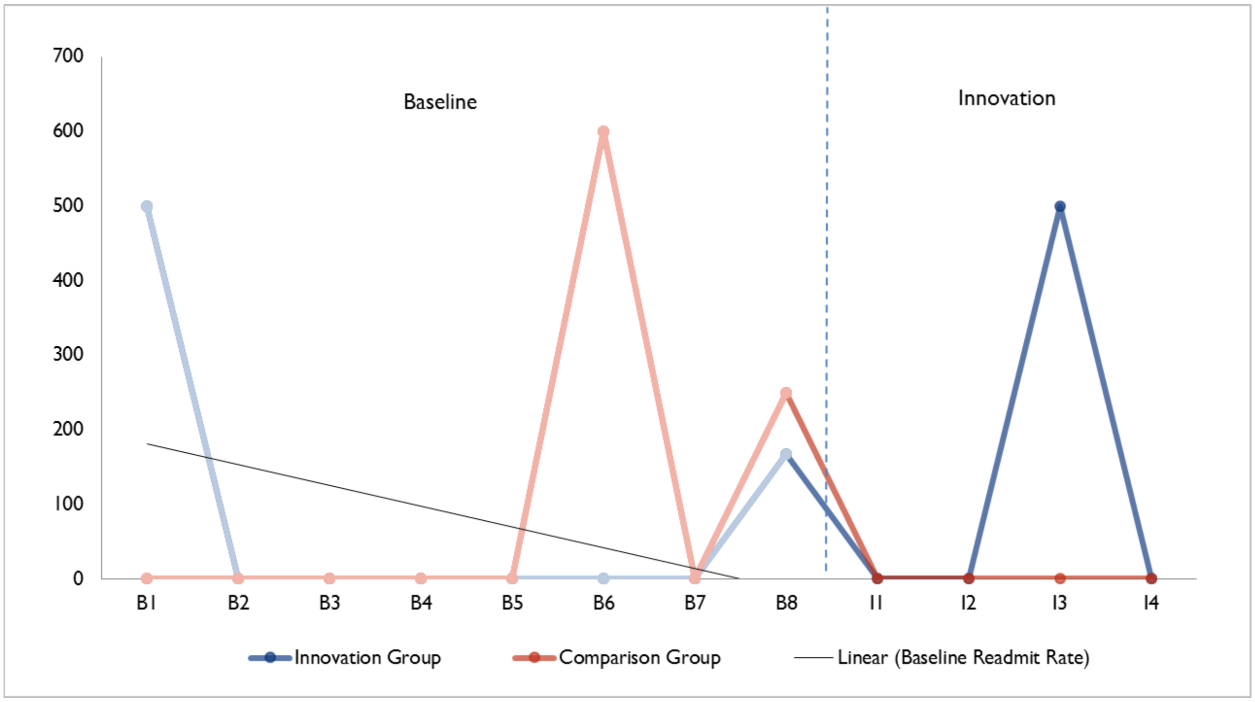
Table 18. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters			
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4
Innovation Group												
Readmit rate	500	0	0	0	0	0	0	167	0	0	500	0
Std dev	500	0	0	0	0	0	0	373	0	0	500	0
Total admissions	2	2	0	1	0	0	0	6	0	3	2	0
Comparison Group												
Readmit rate	0	0	0	0	0	600	0	250	0	0	0	0
Std dev	0	0	0	0	0	490	0	433	0	0	0	0
Total admissions	2	2	2	2	0	5	1	4	1	0	0	0
Innovation − Comparison Rate												
	500	0	0	0	0	−600	0	−83	0	0	500	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 12. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Altarum = Altarum Institute.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 19*** and ***Figure 13.*** During the baseline period, the ED visit rate for the innovation group trends upward and the comparison group's rate is above the innovation group's rate. ED visit rates for both groups trend downward and are virtually the same during the innovation period. In both the baseline and innovation periods, ED visit rates are highly variable.

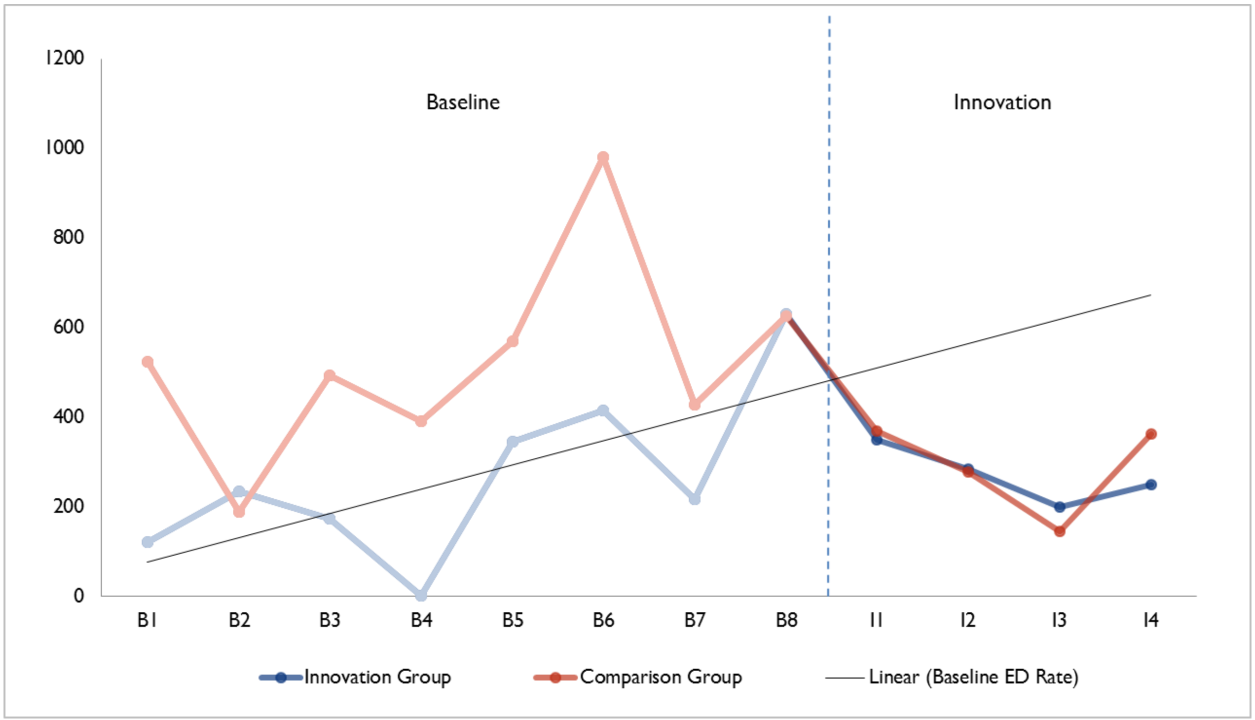
Table 19. ED Visits per 1,000 Medicaid Participants: Altarum

Awardee Number: 1C1CMS330976
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters			
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4
Innovation Group												
ED rate	120	233	174	0	344	414	217	631	349	284	200	250
Std dev	440	626	650	0	831	983	639	1,828	1,246	1,493	621	866
Unique patients	25	30	23	23	16	29	30	42	53	37	35	12
Comparison Group												
ED rate	523	189	492	390	570	981	428	626	369	277	145	362
Std dev	1,687	720	998	938	1,280	3,042	1,255	1,507	919	918	697	889
Weighted patients	65	61	64	59	43	52	69	91	118	92	107	76
Innovation − Comparison Rate												
	−403	45	−318	−390	−226	−567	−211	5	−20	7	55	−112

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
Altarum = Altarum Institute; B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1.

Figure 13. ED Visits per 1,000 Medicaid Participants: Altarum



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Altarum = Altarum Institute; ED = emergency department.

2.15 Discussion: Medicaid Results

The small number of innovation and comparison beneficiaries resulted in highly variable spending, inpatient admissions, readmissions, and ED visits. Differences between the innovation and comparison groups are unlikely to be statistically significant and unlikely to be related to the innovation, which was not expected to have a detectable impact on spending or any impact on inpatient stays, readmissions, or ED visits.

The results do not fully represent the overall population served by the innovation. The results presented here are only for Medicaid and dually-eligible beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent less than 1 percent of the overall population reached by the innovation. In addition, the sample size was small, which can hinder detection of changes in spending.

2.16 Awardee-Specific Measures of Health Outcomes

Altarum submitted data to RTI that are current through June 2015. ***Table 20*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for all of these measures are included in this annual report.

Table 20. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Health outcomes		Reductions in patient exposure to radiation	Data received from Altarum	Yes
		Positive impact rate	Data received from Altarum	Yes
		ImageSmart utilization	Data received from Altarum	Yes

Altarum = Altarum Institute.

2.17 Health Outcomes

We examined ImageSmart utilization and positive impact rate as health outcomes for Altarum, and address the following evaluation questions. The findings are described in the subsections below.

Evaluation Question

- Did patients' levels of radiation exposure relative to imaging change as a result of the Altarum innovation?
- How did radiology utilization change as a result of the Altarum innovation?
- What is the positive impact rate over time?

2.18 Health Outcomes: ImageSmart Utilization

To assess the impact of the ImageSmart tool, we evaluated the outpatient provider's clinical decision making relative to image ordering. When using the tool, the provider could indicate the procedure modality she preliminarily selected (requested procedure). After the CDS presented the recommended procedure, the provider indicated her choice (attested procedure). ***Table 21*** shows the total count of attested sessions[4] based on modality of the requested procedure. Because selection of a requested procedure was optional for the ImageSmart user, the table includes 211 attested sessions for which no procedure was requested. Guidelines for cardiac imaging procedures were included in the ImageSmart application; however, since cardiology use constituted only 2 percent of total utilization, we did not report these results.

[4] Attested sessions/procedure: procedure indicated by the provider after the CDS system recommended a procedure.

Table 21. Distribution of Attested Sessions by Modality Requested through June 2015

Modality Requested	Attested Sessions
CT	729
CTA	16
MR/MRI/MRA	885
No modality requested	211
Total attested sessions	1,841

CT = computed tomography, CTA = computed tomography angiography, MR = magnetic resonance scans, MRI = magnetic resonance imaging, MRA = magnetic resonance angiogram.

Table 22 provides a breakout of the attested procedures by modality of the procedures attested or alternate care (counted as an attested choice).

Table 22. Distribution of Attested Sessions by Procedure Selected through June 2015

Modality	Procedure Selected
CT	757
CTA	19
MR/MRI/MRA	926
XRAY	69
Ultrasound	51
Other	19
Alternate care	113
Unknown	43
Total selected procedure sessions	1,997

CT = computed tomography, CTA = computed tomography angiography, MR = magnetic resonance scans, MRI = magnetic resonance imaging, MRA = magnetic resonance angiogram.

Table 23 shows a detailed breakdown of the requested and attested modalities. Of the 753 requested CT exams attested, 10 percent were diverted to MR/MRI/MRA, other modalities (FLUOR, MAM, NUC, PET-CT, US-XRAY) or alternate care. Of the 950 requested MR/MRI/MRA procedures, 7.7 percent were diverted to other imaging modalities or alternate care.

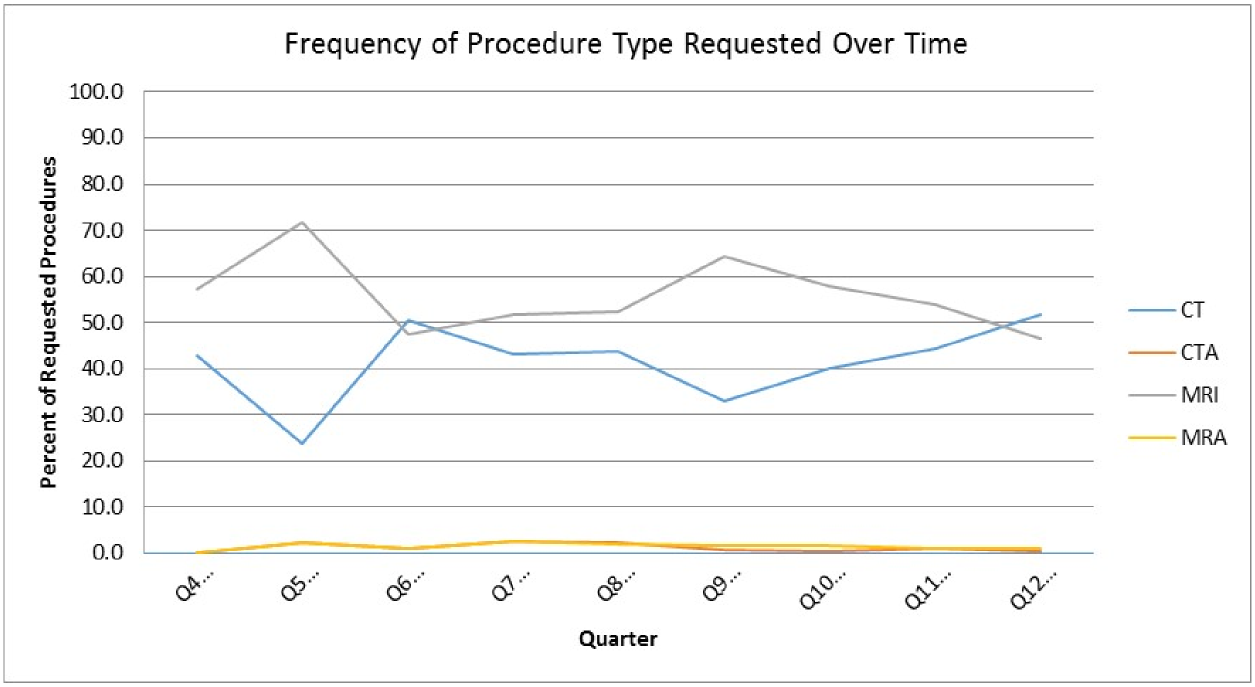
Table 23. Overall Number of Requested and Attested Procedures by Modality through June 2015

Requested Procedure	Total Attested Procedures	Attested Procedure						
		CT	CTA	MR/MRI/ MRA	XRAY	US	Other (incl. FLUOR, MAM, NUC, PET-CT, US-XRAY)	Alternate Care[1]
CT	753	650	5	48	8	14	4	24
CTA	19	6	9	0	0	0	1	3
MR/MRI/MRA	950	35	1	813	19	9	8	65
No procedure requested	232	66	4	65	42	28	6	21
Total attested procedures	1954	757	19	926	69	51	19	113

Source: ImageSmart data provided to RTI by Altarum.
[1] Alternate care was suggested by the ImageSmart application when the use of an imaging study was inappropriate.
CT = computed tomography, CTA computed tomography angiography, MR = magnetic resonance scans, MRI = magnetic resonance imaging, MRA = magnetic resonance angiogram, US = ultrasounds, FLUOR = fluoroscopy, MAM = mammography, NUC = nuclear imaging, PET-CT = positron emission tomography – computed tomography, US-XRAY = ultrasound-x-ray.

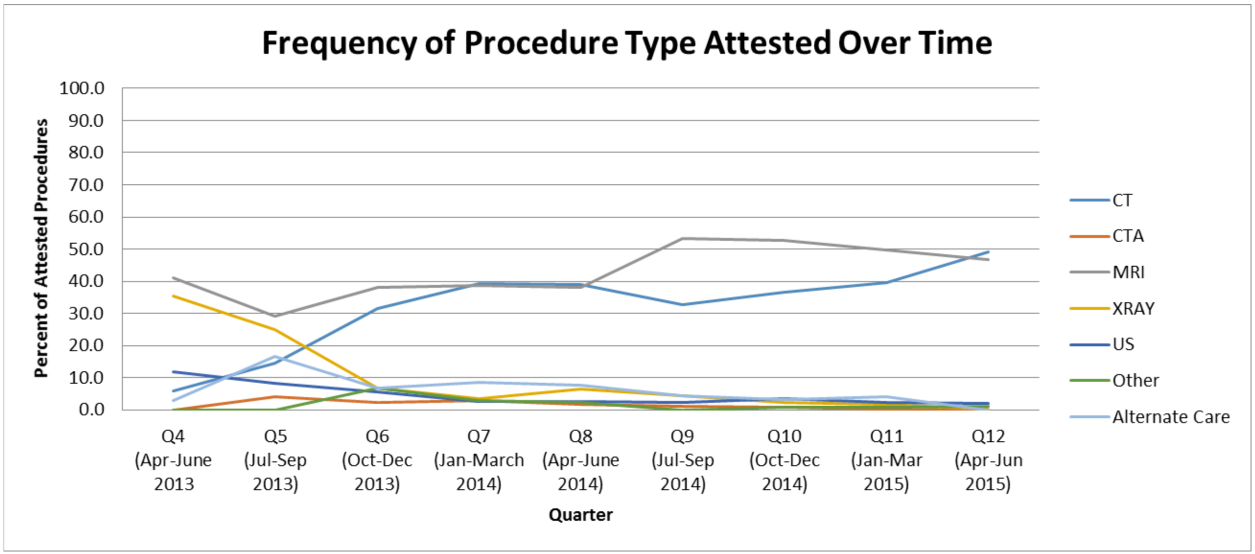
As shown in the following graphs (***Figures 14*** and ***15),*** requested and attested CTs fluctuated since Q6; however, CTs were attested 22.8 percent less than the procedures were requested. This served, to some extent, as a proxy for a change in behavior from what the provider originally intended to select (requested) to what the provider intended to order (attested). By comparison, MRIs, both requested and attested, rose from Q6, peaked in Q9, then steadily declined through Q12. Since the peak quarter, MRIs were attested 17.1 percent less than requested.

Figure 14. Imaging Modality as Requested



Source: ImageSmart data provided to RTI by Altarum.

Figure 15. Imaging Modality as Attested

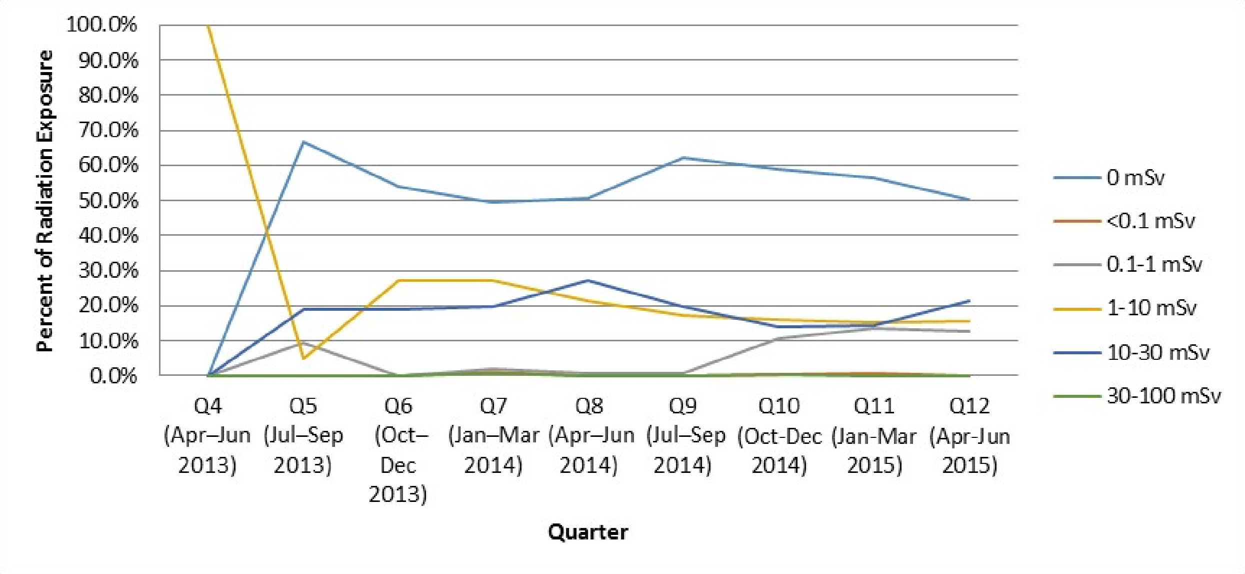


Source: ImageSmart data provided to RTI by Altarum.

Additional content was included in the ImageSmart usage reports of UP and MPP providers and staff activity. For each imaging modality and body area, the imaging record included a standardized range of patient radiation exposure, which enabled RTI to evaluate whether radiation exposure changed during the innovation (***Figures 16*** and ***17***).

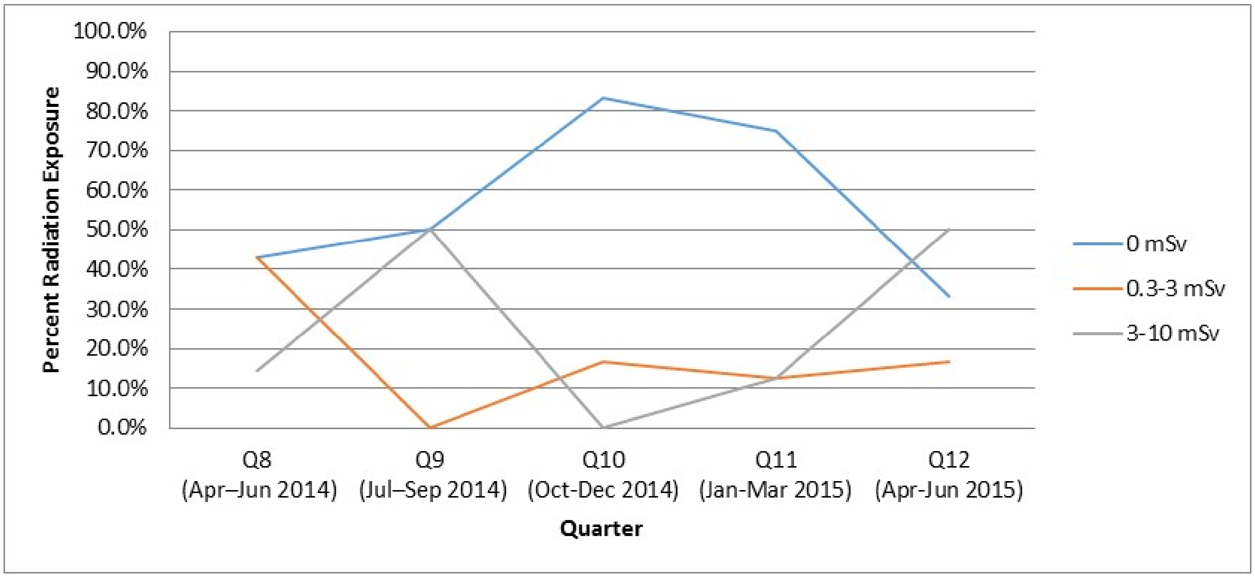
Radiation dosage for medical imaging is measured in milliSieverts (mSv). In the realm of imaging modalities requested and attested to, the CT procedures had the highest levels of radiation exposure, while MRI and ultrasound (US) tests had no (0.0) radiation exposure. Alternate care does not involve radiation, and conventional X-rays fall somewhere in the middle depending on what body area is being studied. For adult patients, the proportion of imaging with 1-10 mSv radiation exposure fell from 23.4 percent in Q5 through Q8 compared to 15.7 percent for the year ending in June 2015. Similarly, the proportion of imaging with 10-30 mSv radiation exposure fell from 23.0 percent in the four quarters ending June 2014 compared to 16.9 percent in the year ending in June 2015. At the same time, the frequency of imaging procedures with zero radiation increased from 51.4 percent in the year ending in June 2014 to 56.2 percent in the four quarters ending in June 2015.

Figure 16. Reduction in Adult Patient Exposure to Radiation



Source: ImageSmart data provided to RTI by Altarum.

Figure 17. Reduction in Pediatric Patient Exposure to Radiation



Source: ImageSmart data provided to RTI by Altarum.

2.19 Health Outcomes: Positive Impact Rate

Table 24 provides an analysis of the positive impact rate. This rate measures the influence on clinical decision making and tabulates instances where providers initially chose a procedure with a low or marginal score but, by using the ImageSmart application, attested a procedure with a high score option (preferred selection). The scoring is geared to the appropriateness criteria devised under American

College of Radiology (ACR) leadership. The numerator for this rate consists of those who requested a procedure with a low or marginal score and attested a procedure with a high score or for whom alternate care was suggested. The denominator for the rate consists of providers who requested and attested a procedure with any score or for whom alternate care was suggested. In essence, the expectation is that low radiation exposure equates to a high score (preferred selection), which is reflected in improvements in the positive impact rate.

The positive trend reflects a small increase in those procedures attested, which have a higher ACR rating than the procedure initially requested, although a decrease occurred in Q12. According to Altarum, the reduction in the impact rate over time occurred because UP specialists and MPP PCPs were less likely to select alternate care. As Figure 16 shows, procedures in Q9 through Q12 using higher radiation (1-100 mSv) made up less than 33 percent of all attested procedures for that period. In the prior four quarters (Q5–Q8) procedures using higher radiation constituted more than 46 percent of all attested procedures.

Table 24. Positive Impact Rate over Time among Providers Using ImageSmart Application

	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Positive impact rate (%)	N/A	5.6	8.2	8.4	10.9	7.1	6.9	8.8	2.3

Source: ImageSmart data provided to RTI by Altarum.

2.20 Discussion: Awardee-Specific Data

Altarum successfully achieved its planned near-term goals. However, as described below, the innovation was not fully integrated into the existing workflow, and use of the tool by intended providers was voluntary, not required, which was an ongoing barrier to adoption and use that was hard to overcome. This finding was supported by data on utilization, Altarum's own usability assessment and the RTI conducted provider survey, completed in 2015.

2.21 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 25*** lists the quantifiable measures of implementation and their status as of June 30, 2015 that RTI obtained from Altarum's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail. The results of analyses for all of these measures are included in this annual report.

The findings presented in the following sections are based on data from Q11 (January–March 2015) and Q12 (April–June 2015) and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 25. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation process	HIT workflow	Rate of ImageSmart uptime (unplanned system downtime/total planned uptime)	Data received from Altarum
Implementation effectiveness	Reach	Number of UP and MPP practices trained on ImageSmart	Data received from Altarum
		Number of UP and MPP practices using ImageSmart	Data received from Altarum

FTE = full-time equivalent; HIT = health information technology; MPP = McLaren Physician Partners; UP = United Physicians.
Q11 = January–March 2015.
Q12 = April–June 2015.

2.22 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.22.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed with 12.09 full-time equivalent (FTE) staff members. Between Q11 (June 2014) and Q12 the innovation was fully staffed and maintained a high retention rate (91% in Q12 and 90% in Q11). Key project staff included the project manager, a data analysis expert, access to a team of internal (to Altarum) developers and, toward the end of the project, an MD who was assisting with data analysis. Project staffing levels remained fairly consistent throughout the innovation period and external collaborators reported strong and consistent working relationships with Altarum staff. Altarum had several staffing changes over the project period, but they did not impact the innovation adversely. One interesting development was that a key Altarum staff member transitioned to a partner organization during the period of performance, perhaps strengthening ties to the partner organization and smoothing the transition for the innovation.

2.22.2 Skills, Knowledge, and Training

Between Q11 and Q12, Altarum provided 132 hours of training to 183 community-based clinical and nonclinical personnel (***Table 26***). During the project, Altarum attained 150 percent of its training target goal (1,509 individuals). The trainings included a train-the-trainer course on ImageSmart for administrative and nonclinical personnel, as well as courses on the HIE and CDS tools for clinical and nonclinical personnel. Early in the innovation (Q5), pilot tests of ImageSmart revealed that physicians did not use the tool frequently; several stated that, *"there are not enough situations where the tool would be useful and there is not added value to decision making."* Altarum responded to the pilot test feedback by enhancing the CDS tool features including EHR integration and the development of mobile applications.

At the site visit, Altarum reported that *who* received the initial training was central to successful adoption. Adoption and level of use increased when the physician received training first, before other clinical staff (i.e., nurse practitioner) or administrative staff, rather than staff getting trained first and then training the physician. This finding may have been the result of self-selection, since a physician who was willing to be trained first was also likely to see the return on investment and be an early adopter. Many of the CDS tool users were clinical and administrative staff, not physicians.

Interview respondents reported that the trainings were brief and effective. One respondent noted that ImageSmart was easy to use: *"If you can order something on Amazon, you can use ImageSmart."*

Table 26. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	132	183
Since inception	913	1,509

Source: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter. Q11-Q12=January-June 2015

2.23 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

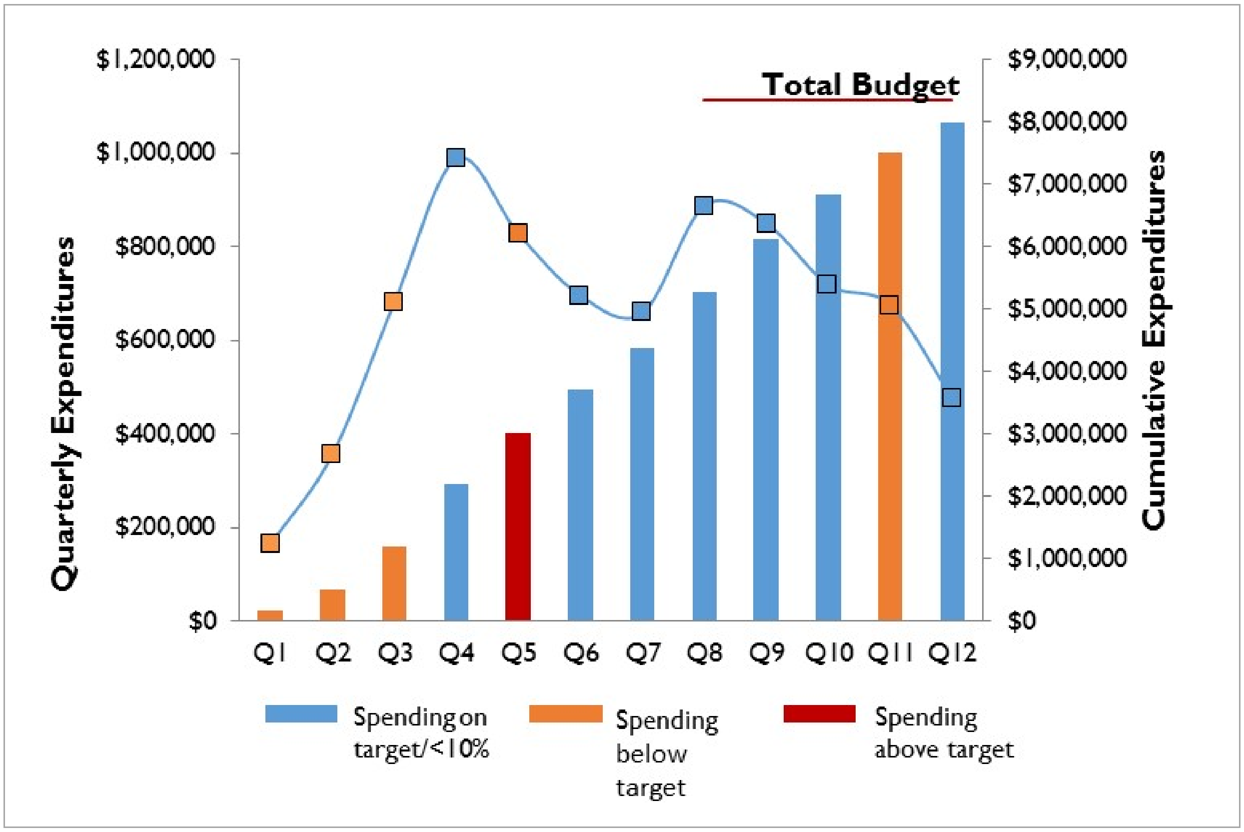
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.23.1 Award Execution

The annual report highlights the significance of Altarum's expenditure rates on implementation. As of June 2015 (Q12), Altarum spent 95.5 percent of its total budget, which is below the projected target (***Figure 18***). Altarum's award period ended in Q12 and project activities likely slowed near the end of funding, which may explain why Altarum's spending was below the projected target.

Figure 18. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015): Altarum



2.23.2 Leadership

Altarum's program leadership and project staff were committed to the innovation's success and sustaining it. The project director was highly engaged throughout the project. For example, a staff member from one of the project partner organizations noted how the project director was a great resource for her staff and stepped in to help with implementation efforts. Altarum's organizational leadership was engaged during the planning phases, but had limited involvement afterward, except for exploring how the Protecting Access to Medicare Act of 2014 (PAMA) might impact the sustainability of the project.

UP's leadership, particularly, clinical leadership, was committed to ensuring that ImageSmart evolved to suit user needs and to support more appropriate radiology utilization. To facilitate implementation, UP provided substantial in-kind contributions, including ImageSmart incentives ($20,000), meetings of the HiTech Steering Committee (HTSC) to discuss image ordering criteria and guidelines, use of internal UP financial analysts and billing systems to understand ImageSmart usage and corresponding changes in image utilization, and other IT-related resources. Additionally, UP upper management helped engage a partner health system to communicate the importance of using ImageSmart.

During the April 2015 site visit, MPP program leadership also noted the importance of using ImageSmart and the desire to continue implementation beyond the funding period. According to one interviewee, MPP organizational leadership used ImageSmart and communicated to clinicians that, *"this is the direction we must go in to sustain and be an important valuable organization."*

2.23.3 Organizational Capacity

Altarum, a research organization, had experience with federal awards, particularly those with HIT. However, this award was its first experience adapting, implementing, and supporting a radiology CDS software tool. Altarum's organizational capacity increased during the project, with the addition of an Allscripts developer, a project manager, a quality improvement analyst, and an internal medicine-trained physician.

Nevertheless, some activities took much longer than anticipated: the extended review process required by electronic health record (EHR) vendors, the termination of UP's portal vendor (Covisint), and the limited robustness of clinical content that the ACR and American College of Cardiology (ACC) provided. The experience Altarum gained in working with its partner organizations to identify and address these challenges provided insights into future implementation strategies. Altarum identified three main strategies for increasing the use of ImageSmart: (1) provide value to users by making it faster to send an order to an imaging center; (2) seamlessly integrate ImageSmart into physician workflow with relevant EHRs; and, (3) to address concerns about return on investment, find a solution to more easily secure authorization for imaging studies through the Radiology Benefit Management organizations. The last strategy would establish a clearer path to provider reimbursement for use of the CDS.

2.23.4 Innovation Adoption and Workflow Integration

Clinician adoption of ImageSmart and workflow integration were major challenges for Altarum. Clinicians' use of the tool was consistently low and Altarum had numerous issues integrating ImageSmart and related HIE tools into provider workflow.

One major challenge to adoption was ImageSmart's usability, particularly via seamless EHR integration. Altarum indicated that community physicians accessing the CDS tool reported that in 20–25 percent of the time, ImageSmart lacked the specific clinical situation selection appropriate to their cases. According to Altarum, providers said the ACR and ACC clinical content did not cover most pertinent reasons for requesting an imaging exam, and content that was provided could be redundant or gave conflicting recommendations to the ordering practitioner. To address this issue, Altarum enhanced the application search functionality to be more dynamic and user-friendly. They also informed professional society partners (ACR and ACC) about several areas where content development was necessary; however, these content areas were not developed during the award period. The Altarum team continued to conduct comparative analyses to understand where gaps in the ACR and ACC guidelines existed and to identify other sources of content to supplement those already in place. In some cases, the HTSC reviewed modified best practice guidelines and approved additional recommendations accordingly.

Altarum implemented several strategies to promote adoption, such as developing a training environment, training an MPP quality improvement team to train providers, establishing an operational oversight committee to gain input from clinical leadership, and granting residents access to ImageSmart (at MPP only). Altarum also developed an Android mobile application for ImageSmart and successfully released it on March 14, 2015 (in Q11). MPP providers received an Android smartphone as an organization standard, and Altarum expected the app to facilitate MPP provider adoption. Altarum improved the tool's user interface significantly (before the Android application was developed) to support many screen sizes with user minimal scrolling. Screenshots of the app and an overview of its features can be reviewed on the Google Play Store at https://play.google.com/store/apps/details?id=org.altarum.cmmi.imagesmart&hl=en.

To strengthen alignment of CDS within the existing physician workflow, Altarum began EHR integration efforts in Q4 to integrate ImageSmart with Beaumont Health System's EHR (EPIC) and with Allscripts. As of September 2014, Beaumont physicians could access ImageSmart from EPIC through a single sign-on. This integration supported the proportion of UP users that the Beaumont Health System employed. Ongoing discussions did not result in further integration of patient data or ordering information into the EHR during the award period, partially due to Beaumont's extensive process to evaluate security risks.

During the last year of the project, Altarum focused on Allscripts integration for users within UP (Professional version) and MPP (TouchWorks version). In Q11, Altarum completed the majority of the integration development, and Allscripts reviewed Altarum's security questionnaire and approved it. In early Q12, Altarum 'passed' the initial test, (preliminary testing of basic functionality) and Allscripts TouchWorks placed the application in the queue for final review and certification. As of June 16, 2015, TouchWorks finished the final testing of the integration and certified the application. Altarum planned to begin the same step-wise review process for the certification of the Allscripts Professional product(s) UP uses.

Altarum successfully integrated ImageSmart into UP's portal, including radiology reports from St. Joseph Hospital-Oakland, which facilitated workflow integration and expanded HIE. UP had concerns with ongoing support the portal vendor (Covisint) provided and believed the best long-term strategy was to develop the infrastructure to support the portal internally. In April 2015, UP decided to terminate the relationship with Covisint, which affected several components of the project including loss of the Master Patient Index (MPI) search for patient data and radiology report integration (HIE). As a result, Altarum cancelled plans to enable the transmission of radiology reports with Crittenton hospital. UP and Altarum worked to replace the previously existing functionality; however, to accommodate the change in the patient search functionality from the MPI, UP providers must manually enter patient information, as providers do at MPP. Similar to UP, to support MPP workflow integration, single-sign-on development was completed for MPP providers allowing them access to ImageSmart once they log into their portal.

2.24 Implementation Effectiveness

A major focus of the evaluation is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach); and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

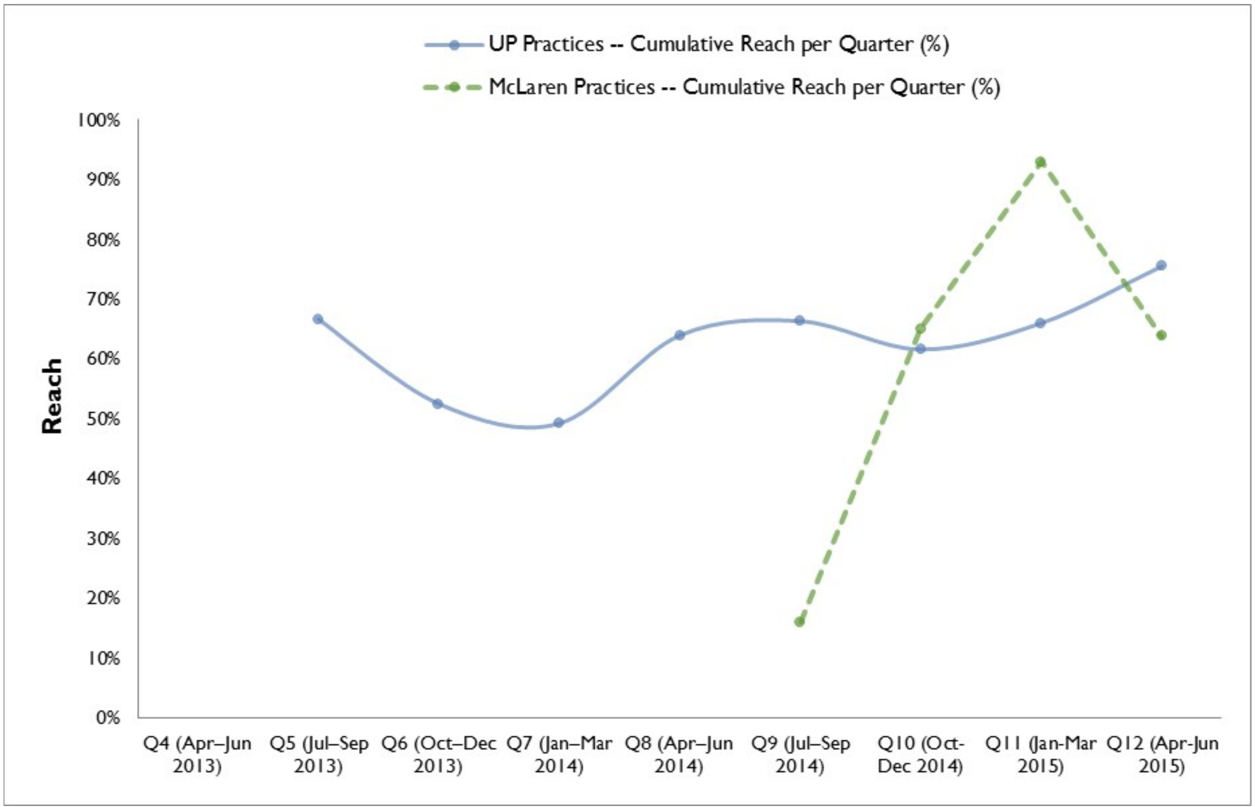
- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.24.1 Innovation Reach

Figure 19 shows reach by quarter since the launch of the innovation. RTI assessed practice training and user reach as the number of trained practices who used the CDS. In the figure, we apply this measure of reach to UP physicians (PCP and specialists) and to MPP physicians. We last reported reach for UP physicians in the 2015 annual report based on data through Q11. Since then, Altarum enrolled an additional two UP practices, increasing reach from 74.1 percent to 75.5 percent. Altarum also enrolled four more MPP practices in the innovation. MPP reach decreased, however, due to the increase in the number of practices trained. Through Q12, 147 UP practices and 69 MPP practices received training.

As noted in ***Section 2.9***, use of the tool had no detectable impact on provider ordering; barriers to physician adoption of ImageSmart and the CDS undermined the program's reach. While training goals were being met, data on utilization remained low. Physicians did not always find the tool useful and reported that it lacked the selections needed for use in all clinical encounters. Though Altarum took steps to increase use of ImageSmart throughout implementation, particularly by adding single sign-on and by modifying the application based on best practices and usability analysis, these steps did not adequately address problems with reach, primarily because ImageSmart was not seamlessly integrated into the EHR.

Figure 19. Participant Reach for Each Quarter since Project Launch



	Quarter	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr–Jun 2015)
●	UP practices—cumulative reach per quarter (%)	66.7	52.5	49.2	64.0	66.3	61.6	66.0	74.1	75.5
	UP physicians—cumulative number enrolled	4	21	32	55	65	77	97	109	111
●	MPP practices—cumulative reach per quarter (%)	0.0	0.0	0.0	0.0	0.0	16.0	65.1	93.0	63.8
	MPP physicians—cumulative number enrolled	0	0	0	0	0	4	28	40	44

Source: ImageSmart data provided to RTI by Altarum.
MPP = McLaren Physician Partners; UP = United Physicians.

2.24.2 Innovation Dose

As the evaluation began, RTI anticipated measuring dose for Altarum providers at the practice level by assessing the number of providers using ImageSmart (actual) relative to applicable visits (potential or visits in which ImageSmart could be used). However, Altarum noted these data were not available at the provider level; therefore, dose was not reported. As reported in ***Section 2.9***, use of the tool had no detectable impact on provider ordering, so even if reporting on dose was possible, it would likely be very low.

2.25 Qualitative Findings: Sustainability

Altarum took steps to sustain the innovation beyond the funding period. They negotiated appropriate use criteria for ACR and ACC beyond the funding period, and they secured licensing agreements to use ImageSmart with UP and MPP through December 2015. Altarum hoped to leverage these agreements to finalize integration efforts with Allscripts. Anticipating full certification of the ImageSmart application in Allscripts, Altarum also planned to staff a booth at the Allscripts annual client conference in August 2015 to facilitate interaction with a broad base of Allscripts users and to assess the viability of ImageSmart as a CDS strategy with Allscripts users. By comparison, in general, integration with the Beaumont Epic system stalled.

Altarum continued to have internal discussions to identify options for funding the project beyond the grant period. Given this activity differs from Altarum's usual business operations, they formed a work group to evaluate their ability to support a commercial product including marketing, distribution methods, pricing, billing, and other backend support.

2.26 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Altarum as well as accomplishments to date. In this section we assess Altarum's progress on achieving HCIA goals to date:

- **Smarter spending.** Medicare patients whose physicians participated in the Altarum innovation had higher spending during Years 2 and 3 of the innovation than patients of comparison physicians. However, the increase in spending was not significant overall or for Year 1 of the innovation. The Altarum innovation focused on changing physicians' imaging behavior, and imaging is a small component of total spending. Therefore, any change in total spending is unlikely to occur because of changes in imaging utilization.

- **Better care.** Medicare patients of physicians participating in the Altarum innovation had significantly fewer inpatient stays and significantly more ED visits during the innovation period than patients of comparison physicians. As previously stated, the Altarum innovation was not expected to impact outpatient ED visits and the difference is likely caused by a factor external to the innovation or changes in the composition of the sample in later innovation quarters.

Physicians participating in the innovation did not change their imaging ordering behavior relative to comparison group physicians.

- **Healthier people**. For the year ending in June 2014, lower radiation procedures (< 1 mSv) made up 53 percent of all attested procedures. For the latest four quarters ending in June 2015 (Q12), lower radiation procedures constituted more than 67 percent of all those attested. This relative increase of 26 percent over 2 years indicates that procedure selection behavior is changing and that use of the CDS may be reducing exposure for patients.

Overall, the Altarum innovation was successfully implemented and tracked. However, usage data were only available at the practice level and utilization was very low, probably because the tool was not required and the application was not integrated into the EHR or the clinical workflow seamlessly.

Altarum and its partners remained committed to sustaining and expanding this innovation. Innovation leaders had clear plans to expand ImageSmart including procuring approved use in the Allscripts EHR. Development and implementation of the Altarum innovation included significant coordination with the ACR and ACC, a process for transforming practice guidelines into usable CDS, and user testing to improve usability. This was the first time Altarum tried to develop a CDS application. Ultimately, the innovation components together were moderately to highly complex and challenging to implement, especially in a complex (multi-EHR) outpatient environment. Altarum's experience with and knowledge of implementation and evaluation were critical to the limited success of the innovation.

ImageSmart represented the core component of the innovation. This electronic CDS tool is a stand-alone application that initially was only peripherally accessible and not directly connected to the ED provider's EHR system. RTI assessed the degree to which the innovation components were used, but given the training method, data were limited to study at the practice level.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Altarum Institute (Altarum)

Altarum Institute (Altarum), a research organization in southeast Michigan, received an award of $8,366,178 beginning on April 30, 2013. The innovation aimed to improve general practice clinicians' selection of appropriate radiologic imaging studies, thereby reducing cost and unnecessary radiation exposure.

Awardee Overview

Innovation dose:	Dose was not measured.	***Innovation reach:***	111 United Physicians (UP) and 44 McLaren Physician Partners (MPP) practices used the CDS; 147 UP practices and 69 MPP practices trained for the CDS.
Components:	(1) Web-based and mobile ImageSmart application—a radiology clinical decision support (CDS) tool for optimal image order selection. (2) Web-based portal with access to electronic exchange of existing study results and related educational materials.	***Participant demographics:***	Emphasis shifted from early focus on nonpediatric PCPs within UP to include UP high-volume specialists, and broadened to include diverse providers in MPP. 99% were Medicare patients, 91% were white, and 99% were aged 45 and older.
Sustainability:	Altarum plans to partially continue the intervention, focusing on full certification of the ImageSmart™ application within the Allscripts™ electronic health record (EHR).		
Innovation Type:	Coordination of care	Process of care	Health IT

Key Findings

Smarter spending. Increases in average quarterly Medicare spending per person were statistically significant in year 2 ($214; 90% CI: $29, $399) and year 3 of the innovation ($810; 90% CI: $550, $1,070). However, among Medicare beneficiaries, the total average quarterly impact on spending per person was not statistically significant ($14; 90% CI: −$347, $376). The Altarum innovation focused on changing physicians' imaging behavior, and imaging is a small component of total spending. Therefore, any change in total spending is unlikely to occur.

Better care. Medicare patients of physicians participating in the Altarum innovation had significantly fewer inpatient stays per 1,000 participants per quarter (−4; 90% CI: −7, −1) and significantly more ED visits per 1,000 participants per quarter (7; 90% CI: 3, 10) during the innovation period than patients of comparison physicians. The Altarum innovation was not expected to impact outpatient ED visits, and the difference is likely caused by a factor external to the innovation or changes in the composition of the sample in later innovation quarters. The innovation did not show a statistically significant effect on readmissions per 1,000 admissions among Medicare patients (0; 90% CI: −9, 9).

Healthier people. For the year ending in June 2014, lower radiation procedures (< 1 mSv) made up 53 percent of all attested procedures. For the latest four quarters ending in June 2015 (Q12), lower radiation procedures constituted more than 67 percent of all those attested. This relative increase of 26 percent over 2 years indicates that procedure selection behavior is changing and that use of the CDS may be reducing exposure for patients.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Asian Americans for Community Involvement

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. **Table 1** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Asian Americans for Community Involvement (AACI)

2.1 Introduction

Asian Americans for Community Involvement (AACI), a federally qualified health center in San Jose, California, received an award of $2,684,545 to implement a patient navigation center (PNC) innovation. AACI began enrolling participants on October 30, 2013. All primary care and behavioral health patients were eligible to receive patient navigator (PN) services, and the innovation was designed to achieve the following HCIA goals:

1. **Smarter spending.** Reduce unnecessary ED visits, saving $3,373,602 in gross medical expenditures.

2. **Better care.** Become a patient-centered medical home and establish a PNC to improve patient access to health and social services for 5,000 unique beneficiaries across nine primary care and mental/behavioral health services.

3. **Healthier people.** Improve cancer and diabetes prevention and early treatment in part by creating 29 nonclinical health worker jobs and training 165 young adults.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter* (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by ACCI and received by June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	No changes to two original components: (1) worked with community college partners to train Asian and Hispanic young adults as nonclinical health workers and (2) provided PN services to AACI patients.
Program Participant Characteristics	Most (84.5%) participants were Asian; 42.7% had Medicaid, 4.8% had Medicare, and 22.7% were eligible for both Medicare and Medicaid.
Workforce Development	
Hiring and retention	Had full staff of PNs (3 FTE, 3 PTE) by June 2015. Three PNs promoted to higher positions, and five PN graduates/interns hired elsewhere.
	Four staff separations occurred in Q12 including patient navigation advice clinician.
Hiring and retention	100 PN graduates at four community colleges: 61% of target to train 165 PNs. Cumulative training hours July 2012–June 2015 totalled 30,300.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Award execution	Spent 71.3% of Year 3 budget and 83.9% of full 3-year award, below the projected target.
Leadership	Retained key staff since inception and received a high level of support from AACI's CEO and COO, who was also the PNC project director.
Organizational capacity	PNC mobile app never implemented. PNC app development continued during Q12; supported by funding from Kaiser Permanente post-award.
	Collaborated to get utilization data for Medicaid/Medicare patients. Data collection and analyses for total cost of care were challenging because AACI lacked direct access to claims data.
Award execution	New integrated front desk positioned PNs to provide first contact with clients and directed them to appropriate front desk staff.
Implementation Effectiveness	
Innovation reach	AACI enrolled 3,113 patients, increasing its reach from 57% to 62%.
Innovation dose	Most participants (71.6%) got help completing forms; 21.7% were assisted in-person. Fewer than 5% received appointment scheduling assistance or reminders, health education, language assistance, or transportation assistance.
Sustainability	Community college partners institutionalized PN certificate programs. AACI obtained state and county funding to retain existing PNs.

Sources: *Q11–Q12 Narrative Progress Report*.
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted from February through June 2015.

AACI = Asian Americans for Community Involvement; CEO = chief executive office; COO = chief operating officer; FTE = full-time equivalent; HCIA = Health Care Innovation Award; PN = patient navigator; PNC = patient navigation center; PTE = part-time equivalent; Q = quarter.

Table 3 summarizes Medicare claims-based findings during the innovation period. The trend in the estimated quarterly spending differences suggests that the innovation might lead to long-term savings. During Years 2 and 3, the innovation group had statistically significant lower spending than the comparison group. The innovation group had, on average, a nonstatistically significant increase in the number of inpatient admissions relative to the comparison group. While the innovation group had a statistically significant higher number of ED visits overall and during the first year, this group had a lower number during the second year. On average, the innovation group had a lower number of unplanned readmissions relative to the comparison group; however, results were not achieve statistically significant.

Table 3. Summary of Medicare Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.668	−$1.917, $0.582	$0.011	−$0.987, $1.010	−$0.613	−$1.150, −$0.075	−$0.066	−$0.133, $0.000
Acute care inpatient stays	15	−3, 33	N/A	N/A	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−1	−7, 6	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	34	6, 62	40	14, 66	−6	−18, 5	2	−3, 7
Average impact per quarter								
Spending per participant	−$210	−$602, $183	$5	−$454, $465	−$634	−$1,191, −$78	−$1,413	−$2,821, −$4
Acute care inpatient stays (per 1,000 participants)	5	−1, 12	N/A	N/A	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−12	−137, 114	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	12	2, 22	19	7, 31	−10	−28, 8	35	−70, 139

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

AACI's PNC innovation worked with community college partners to train Asian and Hispanic young adults as nonclinical health workers, and provided PN services to AACI patients. AACI partnered with the Career Ladders Project and four community colleges to train students as PNs, to develop the PN curriculum, and establish a 1-year certificate program at each school. The PN certificate programs at three of the four community colleges included a paid internship. AACI helped recruit students, provided PN-related workshops with the certificate programs, and established internships for students. AACI hired graduates to provide PN services to primary care and behavioral health patients. PNs helped explain primary care physician changes, assisted clients with insurance applications and verification, and provided a "warm hand-off" to other services within the agency. Additional detail about PN services is provided in the Dose section of this report. The PN training and services components of the innovation did not change during the award.

AACI planned for health information technology (HIT) elements to support the major innovation components. Planned HIT elements included a PNC mobile app that allowed PNs to manage their caseloads, an updated electronic health record (EHR) system, and a call center linked to the EHR system that provided customer service to patients and another format through which PN services could be provided and tracked. AACI began developing the PNC app with partner, Zero Divide, during the award period. However, app development and launch will be completed post-award with funding from Kaiser Permanente. During the award period, AACI updated its EHR system and implemented the call center. The PNC innovation and HIT efforts were part of a larger AACI strategy to obtain Patient-Centered Medical Home accreditation.

Table 4 lists all partners that supported AACI's innovation and maintained their involvement with throughout the award period. During the June 2015 EOY interviews, AACI contracted with a new partner, Zero Divide, to develop the PNC mobile app.

Table 4. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Career Ladders Project	Training, project management/administration	Oakland, CA
San Jose City College	Training	San Jose, CA
Cañada College	Training	Redwood City, CA
Evergreen Valley College	Training	San Jose, CA
Skyline College[1]	Training	San Bruno, CA
Zero Divide	App development	San Francisco, CA

Source: *Q1-Q12 Quarterly Awardee Performance Report.*
[1] Skyline College is not listed as a partner in the Lewin reporting system but was mentioned as a partner in the *Quarter 7 (Q7) Progress Report*.
HCIA = Health Care Innovation Award.

2.1.2 Program Participant Characteristics

Table 5 provides the demographic characteristics of all participants ever enrolled in the innovation. The distributions of age, gender, race/ethnicity, and insurance type were similar to those in the 2015 annual report. More specifically, more than one-third of participants (39.7%) were between 25 and 64 years of age, and more than half (63.5%) were female. Most participants (84.5%) were Asian. More than one-third (42.7%) had Medicaid, less than 5 percent had Medicare only, and almost one-quarter (22.7%) were covered by both Medicare and Medicaid. In the claims section below, Medicare analyses include anyone who was in Medicare fee for service or dually eligible.

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	3,113	100.0
Age		
< 18	90	2.9
18–24	65	2.1
25–64	1,235	39.7
65–74	824	26.5
75–84	826	26.5
85+	65	2.1
Missing	8	0.3
Sex		
Female	1,977	63.5
Male	1,132	36.4
Missing	4	0.1
Race/ethnicity		
White	259	8.3
Black	78	2.5
Hispanic	101	3.2
Asian	2,631	84.5
American Indian or Alaska Native	12	0.4
Native Hawaiian or other Pacific Islander	2	0.1
Other	3	0.1
Missing/refused	27	0.9
Payer category		
Dual	707	22.7
Medicaid	1,329	42.7
Medicare fee-for-service	150	4.8
Medicare Advantage	12	0.4
Other	705	22.7
Uninsured	203	6.5
Missing	7	0.2

Source: Patient-level data provided to RTI by AACI.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that did not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 6 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 6. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	No
		Hospital unplanned readmissions rate	Yes	No
		ED visit rate	Yes	No
	Cost	Spending per patient	Yes	No
		Estimated cost savings	Yes	No

ED = emergency department.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 603 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in Santa Clara County for at least 1 month while the innovation enrolled beneficiaries. Patients who visited AACI after the innovation started enrolling patients in October 2013 were excluded from the comparison group. We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, number of chronic conditions, disability, end-stage renal disease status, dual Medicare-Medicaid status months in the previous calendar year, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 7 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 7. Mean Values and Standardized Differences of Variables in Propensity Score Model: AACI

Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Age	72.39	10.75	71.87	12.34	0.05	72.39	10.75	72.80	11.40	0.04
Percentage white	8.96	28.55	61.70	48.61	1.32	8.96	28.55	8.13	27.32	0.03
Percentage male	40.96	49.18	44.10	49.65	0.06	40.96	49.18	38.23	48.59	0.06
Number of chronic conditions	5.43	2.97	5.82	4.11	0.11	5.43	2.97	5.54	3.22	0.04
Percentage disabled	13.27	33.92	21.85	41.32	0.23	13.27	33.92	11.83	32.30	0.04
Percentage ESRD	0.66	8.12	1.39	11.69	0.07	0.66	8.12	0.61	7.77	0.01
Number of dual eligible months in the previous calendar year	11.06	3.05	3.61	5.43	1.69	11.06	3.05	11.00	3.19	0.02
Payments in calendar quarter prior to enrolment	1,221	4,545	2,614	10,473	0.17	1,221	4,545	1,170	4,229	0.01
Total payments in second, third, fourth, and fifth calendar quarters prior to enrolment	4,671	11,715	7,940	21,525	0.19	4,671	11,715	4,506	12,252	0.01
Number of beneficiaries	603	—	61,199	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	11,106	—	—	603	—	1,363	—	—
Number of weighted beneficiaries	—	—	—	—	—	603	—	603	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

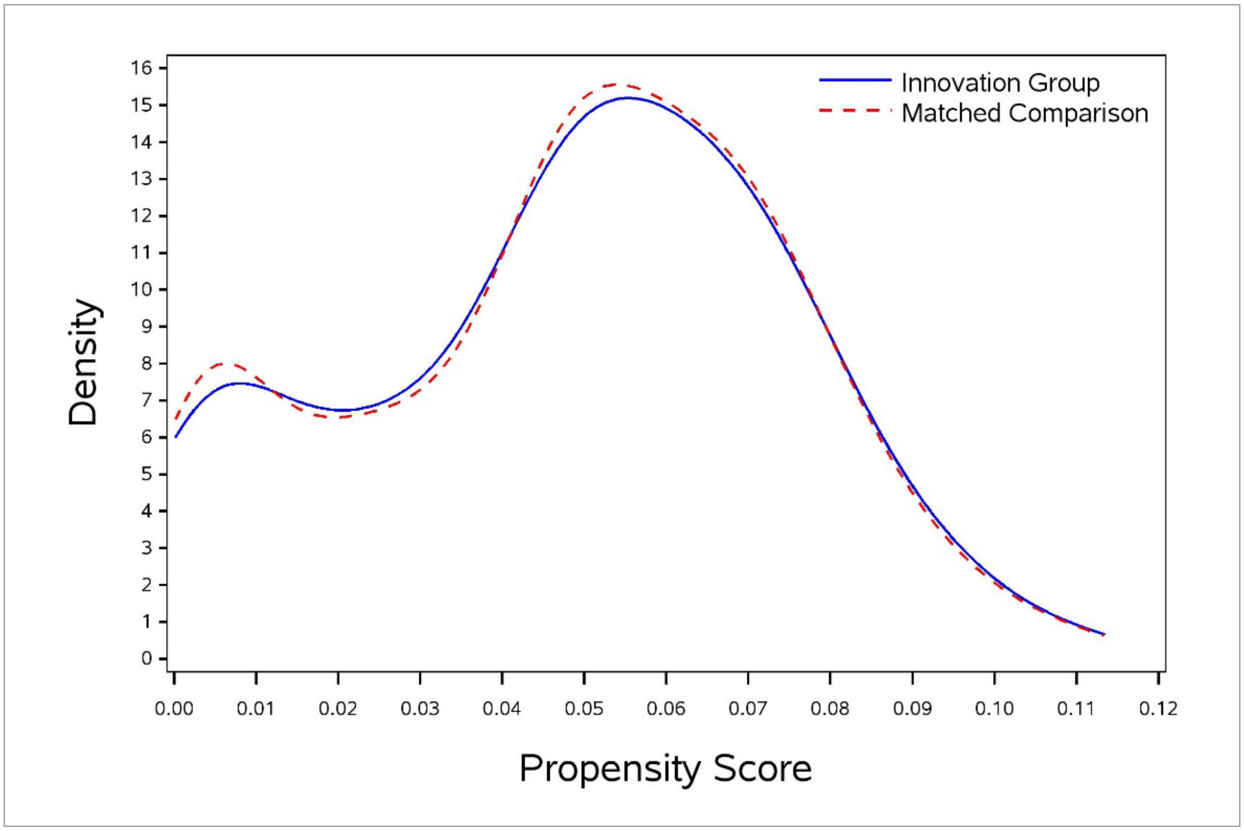
AACI = Asian Americans for Community Involvement; ESRD = end-stage renal disease; SD = standard deviation.

— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 7). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into innovation (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining innovation selection do not require optimal balance. The results in Table 7 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. On the basis of observable characteristics, the two distributions overlap substantially, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: AACI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 8 reports Medicare spending per patient in the eight quarters before and the nine quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 8 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for pre-innovation quarters.

As shown by the baseline trend line for innovation enrollees, spending increases slightly in the baseline quarters. The comparison group spending is greater than the innovation group spending for all innovation periods except I2. With the exception of innovation quarters I7 and I9 for the innovation group, both groups' spending remains above the baseline trend line for all quarters after the innovation. Innovation group spending is generally above the trend line, possibly because patients may have received more services when patient navigators helped them gain better access to those services. However, the standard deviation in spending is high among both groups as shown in Table 8. The regression analysis in the next section assesses the impact of the innovation in the difference in spending between the innovation and comparison groups.

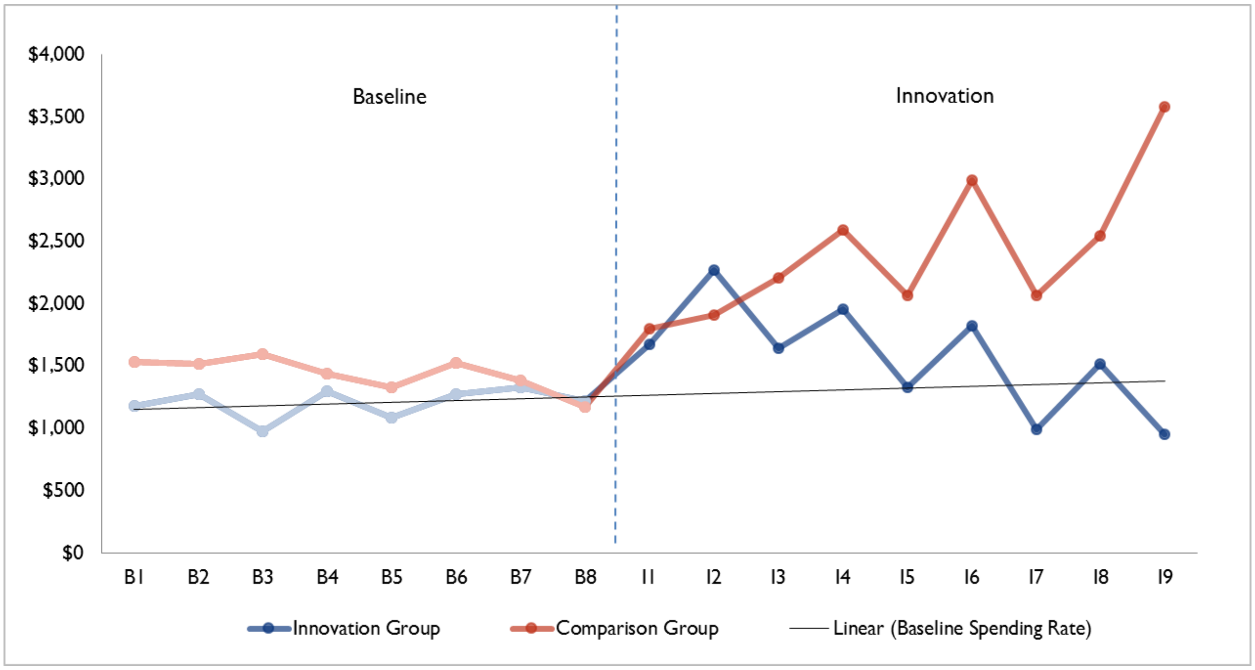
Table 8. Medicare Spending per Participant: AACI

Awardee Number: 1C1CMS331035
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Spending rate	$1,185	$1,273	$979	$1,299	$1,087	$1,273	$1,328	$1,221	$1,672	$2,275	$1,648	$1,960	$1,326	$1,822	$993	$1,520	$949
Std dev	$4,181	$6,905	$2,804	$5,712	$3,396	$6,322	$5,256	$4,545	$6,038	$10,009	$5,562	$10,403	$4,109	$7,695	$1,941	$4,154	$1,954
Unique patients	497	511	522	542	557	572	587	603	603	571	531	468	379	247	205	135	47
Comparison Group																	
Spending rate	$1,534	$1,518	$1,596	$1,441	$1,330	$1,525	$1,386	$1,170	$1,799	$1,912	$2,212	$2,597	$2,065	$2,994	$2,068	$2,550	$3,581
Std dev	$6,643	$6,027	$7,639	$5,540	$5,308	$6,333	$4,619	$4,229	$7,069	$7,903	$9,381	$11,159	$8,910	$14,542	$6,985	$6,755	$9,023
Weighted patients	514	522	533	544	560	583	599	603	603	573	533	456	353	225	188	124	40
Savings per Patient																	
	$349	$244	$616	$143	$243	$252	$58	−$50	$127	−$363	$564	$637	$738	$1,172	$1,076	$1,030	$2,632

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
AACI = Asian Americans for Community Involvement; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 2. Medicare Spending per Participant: AACI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement.

2.4.2 Regression Results

We present the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$210 (90% CI: −$602, 183). This effect is not statistically significant at the 10 percent level. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence. In addition to the average effect over the innovation period, we also present quarterly and aggregate effects. During Years 2 and 3, the innovation group had statistically significant lower spending than the comparison group.

Table 9 presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The innovation quarter coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. Figure 3 shows that the trend in the estimated quarterly spending differences suggests that the innovation might lead to long-term savings. With the exception of I1 and I2, the change in spending among the innovation group is lower than the change in spending for comparison group individuals, and statistically significant lower for I7 and I9. The largest difference occurs in I9, where the change in spending is, on average, $1,413 lower in the innovation group. However, I9 has an even smaller sample size.

Table 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: AACI

Quarter	Coefficient	Standard Error	P-Values
I1	$111	$317	0.727
I2	$609	$488	0.212
I3	−$355	$399	0.373
I4	−$458	$609	0.452
I5	−$544	$369	0.141
I6	−$805	$949	0.396
I7	−$656	$352	0.062
I8	−$545	$525	0.300
I9	−$1,413	$856	0.099
Overall average	−$210	$238	0.379
Overall aggregate	−$667,828	$759,185	0.379
Overall aggregate (IY1)	$11,464	$606,801	0.985
Overall aggregate (IY2)	−$612,895	$326,641	0.061
Overall aggregate (IY3)	−$66,397	$40,228	0.099

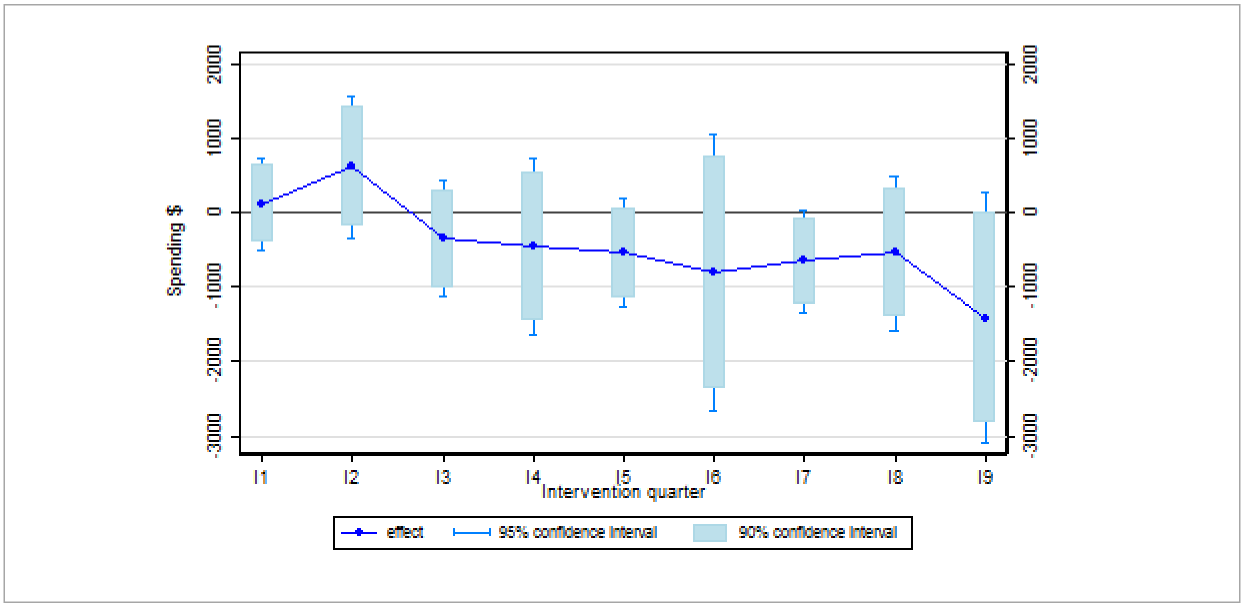
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.

AACI = Asian Americans for Community Involvement; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: AACI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Figure 4 illustrates that, with the exception of I1 and I2, the innovation has a higher probability of generating savings rather than losses.

Figure 4. Quarterly Strength of Evidence in Favor of Savings/Loss: AACI

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 5***. Inpatient admissions rates trend slightly upward during the baseline period. After the innovation began, inpatient admissions rates for both groups are above the baseline trend line up to innovation period I6. After I6 inpatient admission rates for the innovation group are below the trend line The innovation group has a lower number of inpatient admissions than the comparison group for all innovation quarters except I2 and I6. However, as presented in Table 10 below, the standard deviation is high for all periods. The next section describes the regression analysis we conducted to assess the impact of the innovation on inpatient admissions.

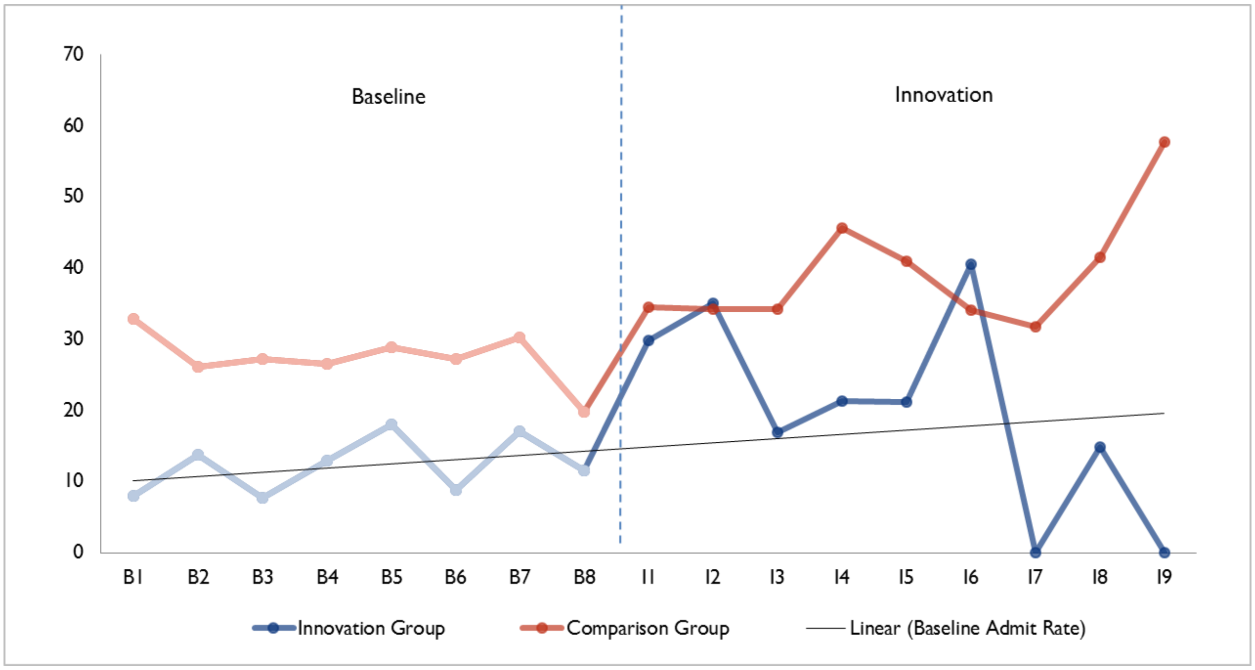
Table 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: AACI

Awardee Number: 1C1CMS331035
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	8	14	8	13	18	9	17	12	30	35	17	21	21	40	0	15	0
Std dev	89	116	87	128	146	93	153	107	189	256	129	172	161	217	0	121	0
Unique patients	497	511	522	542	557	572	587	603	603	571	531	468	379	247	205	135	47
Comparison Group																	
Admit rate	33	26	27	27	29	27	30	20	34	34	34	46	41	34	32	42	58
Std dev	197	163	169	154	173	214	193	142	198	208	220	235	229	208	203	233	298
Weighted patients	514	522	533	544	560	583	599	603	603	573	533	456	353	225	188	124	40
Innovation-Comparison rate																	
	−25	−12	−20	−14	−11	−19	−13	−8	−5	1	−17	−24	−20	6	−32	−27	−58

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; B1 = Baseline Q1.
AACI = Asian Americans for Community Involvement; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Participants: AACI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement.

2.5.2 Regression Results

Table 11 presents the average and aggregate results of a negative binomial count model with the dependent variable equal to the number of hospital visits for each individual during the quarter. The average difference-in-differences estimate for the number of inpatient admissions is an increase of 5 inpatient admissions per 1000 patients in the innovation group relative to the comparison group. This is the average difference in inpatient admissions count for all innovation quarters. The effect is not statistically significant (90% CI: −1, 12).

Table 11. Difference-in-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 participants: AACI

Quarter	Coefficient	Standard Error	P-Values
Overall average	5	4	0.165
Overall aggregate	15	11	0.165

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups.
The overall average is the average innovation effect for all quarters during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
AACI = Asian Americans for Community Involvement.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 12*** and ***Figure 6***. Readmissions rates are highly variable before and after enrollment, reflecting the relatively small number of hospital admissions for both groups during each quarter. With few admissions (the denominator in the readmission rate) and a relatively low underlying percentage of readmissions, the readmissions rate varies widely over time. As more beneficiaries enroll in the innovation and more claims data become available, the sample size will increase and the readmissions measure may be reported with more precision.

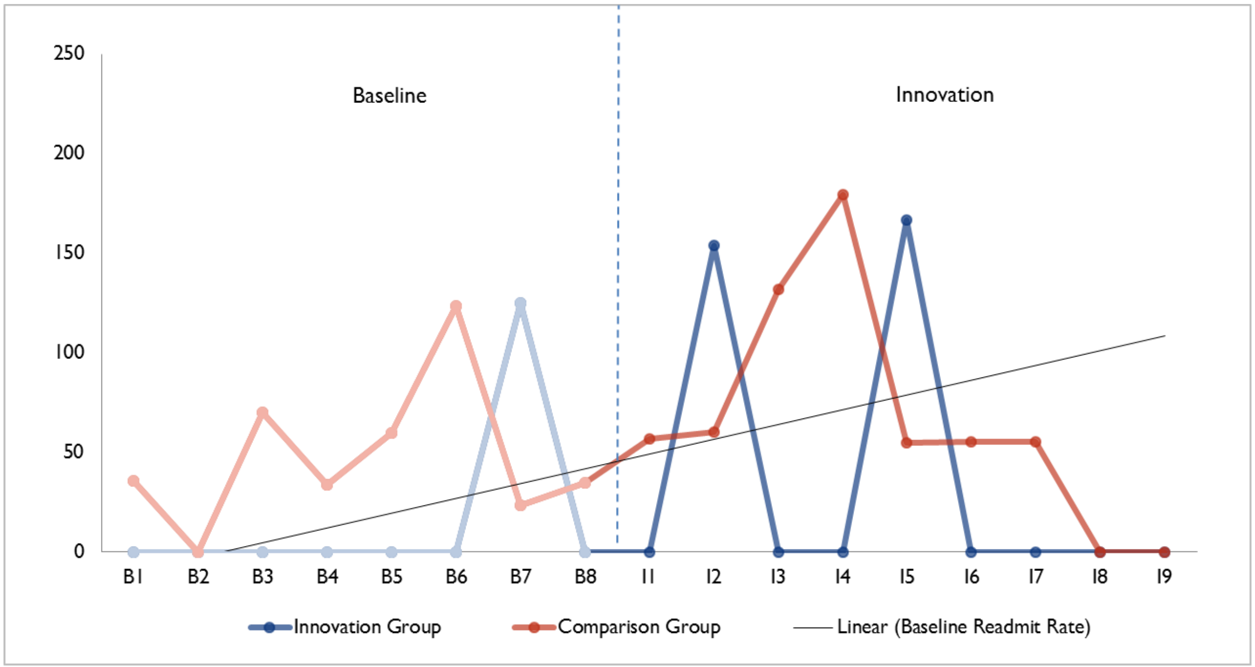
Table 12. Hospital Unplanned Readmissions Rates per 1,000 Admissions: AACI

Awardee Number: 1C1CMS331035
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Readmit rate	0	0	0	0	0	0	125	0	0	154	0	0	167	0	0	0	0
Std dev	0	0	0	0	0	0	331	0	0	361	0	0	373	0	0	0	0
Total admissions	3	7	3	6	7	5	8	6	16	13	9	5	6	4	0	0	0
Comparison Group																	
Readmit rate	36	0	70	34	60	123	23	34	57	60	132	179	55	56	56	0	0
Std dev	186	0	255	181	237	329	151	183	231	238	338	384	228	229	229	0	0
Total admissions	9	10	10	10	11	14	14	10	18	17	15	13	12	6	6	1	1
Innovation-Comparison rate																	
	−36	0	−70	−34	−60	−123	102	−34	−57	94	−132	−179	112	−56	−56	0	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
AACI = Asian Americans for Community Involvement; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Admissions: AACI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement.

2.6.2 *Regression Results*

Table 13 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −12 per 1,000 inpatient admissions (1.2 percentage points, indicating that the innovation-comparison difference is 1.2 percentage points lower during the innovation period). This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −137, 114).

Table 13. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission, per 1,000 Inpatient Admissions: AACI

Quarter	Coefficient	Standard Error	P-Values
Overall average (per 1,000 index admissions)	−12	76	0.880
Overall aggregate	−1	4	0.880

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups.
AACI = Asian Americans for Community Involvement.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 14*** and ***Figure 7.*** Innovation group ED visits trend upward during the baseline period. After the innovation, innovation group ED visits are below comparison group ED visits for all innovation periods except I1, I2, and I9 and below the baseline trend line after I2. The increase in ED visits from I8 to I9 is associated with a steep decrease in the number of patients and, therefore, associated with higher uncertainty. In the next section we examine regression results to assess whether quarterly differences in ED visit rates between the innovation and comparison groups were impacted by the innovation.

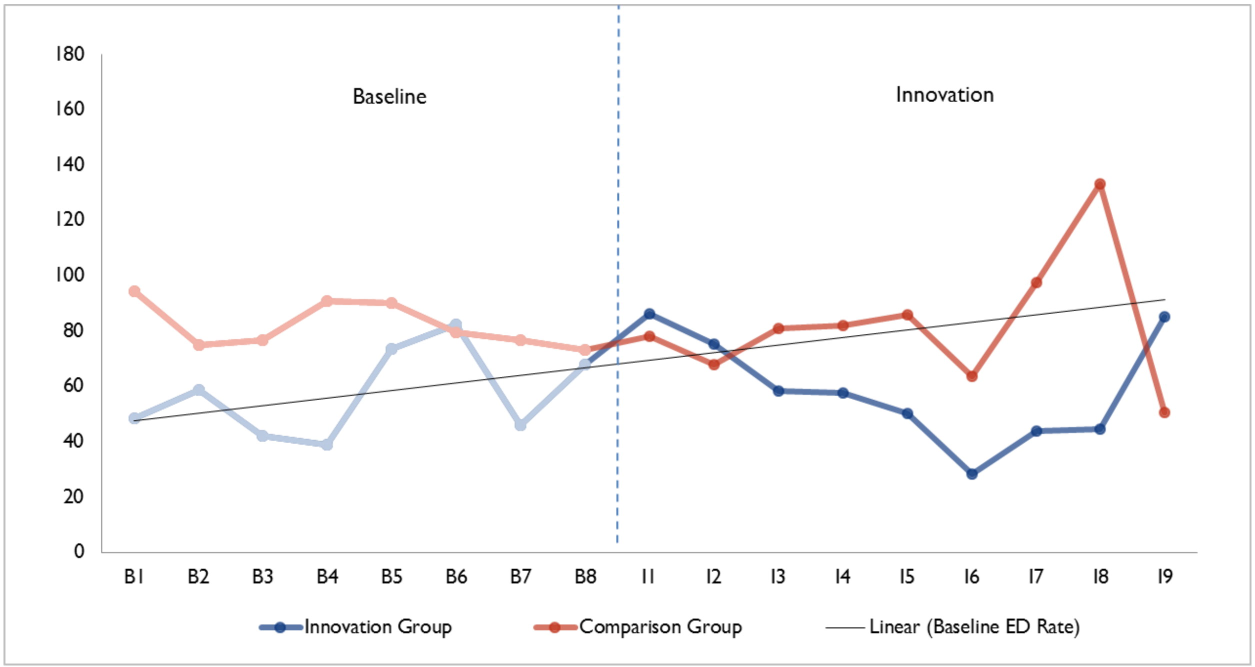
Table 14. ED Visits per 1,000 Participants: AACI

Awardee Number: 1C1CMS331035
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
ED rate	48	59	42	39	74	82	46	68	86	75	58	58	50	28	44	44	85
Std dev	257	251	252	220	480	541	233	306	335	345	250	260	263	189	249	240	282
Unique patients	497	511	522	542	557	572	587	603	603	571	531	468	379	247	205	135	47
Comparison Group																	
ED rate	94	75	77	91	90	79	77	73	78	68	81	82	86	64	98	133	50
Std dev	373	207	215	237	264	216	221	228	223	208	243	227	238	169	249	278	177
Weighted patients	514	522	533	544	560	583	599	603	603	573	533	456	353	225	188	124	40
Innovation-Comparison rate																	
	−46	−16	−35	−52	−17	3	−31	−5	8	8	−22	−24	−36	−35	−54	−89	35

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
AACI = Asian Americans for Community Involvement; B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1.

Figure 7. ED Visits per 1,000 Participants: AACI



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
AACI = Asian Americans for Community Involvement.; ED = emergency department.

2.7.2 Regression Results

Table 15 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants.

The average quarterly difference-in-differences estimate for ED visits is an increase of 12 ED visits per 1,000 participants relative to the comparison group. This is the average difference in the count of ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 2, 22). In addition to the average effect over the innovation period, we also present quarterly and aggregate effects. The overall aggregate estimates show that, throughout the innovation period, the innovation group has 34 more ED visits relative to the comparison group; this result is statistically significant (90% CI: 6, 62). During the first year of the innovation, the innovation group has 40 more ED visits per 1,000 participants than the comparison group, a result that is statistically significant (90% CI: 7, 31). However, this trend is partly reversed in the second year: the innovation group has 6 fewer visits per 1,000 participants, which is not statistically significant (90% CI: −28, 8).

The number of ED visits per quarter fluctuates considerably. For innovation quarters I1, I2, and I3 the number of ED visits is higher for the innovation group, and for the remaining quarters the number is higher for the comparison group. The results are statistically significant for I1 and I2: the innovation group, on average, has 5 to 36 more ED visits per 1,000 participants. There is a statistically significant higher number of aggregate ED visits in the first year of the innovation and a non statistically significant lower number of ED visits in the second year.

Table 15. Difference-in-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Participants: AACI

Quarter	Coefficient	Standard Error	P-Values
I1	36	15	0.017
I2	29	14	0.036
I3	5	14	0.728
I4	−1	15	0.937
I5	−7	15	0.638
I6	−15	15	0.326
Overall average	12	6	0.047
Overall aggregate	34	17	0.047
Overall aggregate (IY1)	40	16	0.010
Overall aggregate (IY2)	−6	7	0.356

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
AACI = Asian Americans for Community Involvement; I = Innovation Quarter; IY = Innovation Year.

2.8 Discussion: Medicare Results

The results may not fully represent the overall population served by the innovation for three reasons. First, the results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 19 percent of the overall population reached by the innovation. Second, for all four measures we found high standard deviations accompanied by a small sample size, particularly for the last quarter for which we have data. Third, longer-term data would better capture the full impact of a patient navigation innovation, and as more claims data become available, the sample size in the later innovation quarters will increase and the precision of the reported estimates will improve.

Even though the overall impact of the innovation on spending among individuals enrolled in the innovation is not statistically significant, the trend in the estimated quarterly spending differences for Medicare is toward savings. For the last two innovation years, the innovation group has statistically significant lower spending than the comparison group. The nonstatistically significant increase in the average and aggregate number of ED visits in the innovation group, relative to the comparison group, is mainly driven by a significant increase in the number of ED visits for the innovation group, relative to the comparison group, during the first year of the innovation. We do not observe any statistically sifnicicant difference in unplanned readmissions or inpatient stays and we were unable to run a quarterly fixed effect model for these outcomes due to convergence issues.

2.9 Medicaid

Currently, Alpha-MAX claims are only available through Q4 2013. Because the AACI innovation was launched on October 1, 2013, and claims for the second quarter after the innovation launch are not yet available, we do not present measures for Medicaid patients in this report. We will provide Alpha-MAX Medicaid analyses in subsequent reports if Alpha-MAX data become available. However, Santa Clara County Medicaid beneficiaries are enrolled in managed care rather than fee-for-service Medicaid, and claims data in the CMS Alpha-MAX files may not be available for all managed care enrollees.

2.10 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Table 16 lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether data are presented in this annual report. AACI was unable to provide data for the requested measures, so no secondary data outcomes are reported.

Table 16. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Patient satisfaction	Experience of patients with physicians and physician office staff	Dropped; data unavailable	No
	Diabetes	Percentage of patients with diabetes who received a hemoglobin A1c and lipid profile assessment	Dropped; data unavailable	No
	Cancer screening	Percentage of members 50–75 years old who had appropriate screening for colorectal cancer	Dropped; data unavailable	No
		Percentage of members 50–75 years old who had appropriate screening for breast cancer	Dropped; data unavailable	No
	Vaccination	Percentage of patients who received pneumovax	Dropped; data unavailable	No
Health outcomes	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c > 9.0%	Dropped; data unavailable	No
	Weight	Percentage of patients who are overweight (BMI 25.0–29.9) or obese (BMI >30)	Dropped; data unavailable	No

BMI = body mass index.

2.11 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 17*** lists the quantifiable measures of implementation and their status as of June 30, 2015 that RTI obtained from AACI's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 17. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Number of young adults trained as patient navigators during the innovation	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of patients receiving navigation services	Data received from AACI
	Dose	Number of PN services provided to each participant	Data received from AACI
		Appointment scheduling assistance or appointment reminders	Data received from AACI
		Language assistance	Data received from AACI
		Assistance finding social services and other community resources	Data received from AACI
		Transportation assistance	Data received from AACI
		Health education (mental/behavioral health PNs)	Data received from AACI

AACI = Asian Americans for Community Involvement; FTE = full-time equivalent; PN = patient navigators; Q = quarter.

2.12 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

> ***Evaluation Question***
> - What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.12.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was staffed with 8.1 full-time equivalent (FTE) staff members, below projection by 2.89 FTE. Between July 2014 and June 2015, AACI hired 4.15 FTEs, for a cumulative total of 11.15 FTEs hired since project inception (115% of projected total).

During Q12, AACI reported a full staff of PNs: three full-time and three part-time PNs. Although AACI reported no problems with hiring PNs, they said,

> ***"The challenge was finding enough folks who speak Chinese or Cambodian (considered an artifact of enrollment [in the PN certificate programs]. We can't hire them if they aren't in the PN certificate program. Most of AACI's patients are Chinese, and there is a growing number of Cambodian patients. We don't have enough PNs to service them completely."***

Additionally, AACI was unable to put a system or standard protocol in place to track students' job or academic placements following graduation. These data were important for tracking their progress on their innovation objective to create 29 nonclinical health worker jobs.

2.12.2 Skills, Knowledge, and Training

Between Q11 and Q12, AACI provided 17,700 hours of training to 59 individuals. Training was provided to students through PN certificate programs at four local community colleges, and 100 students graduated from the PN certificate programs (61% of the training target).

The partnering colleges did not have a PN certificate, so AACI worked closely with Career Ladders Project (CLP) experts and college partners to develop the PN curriculum and establish a 1-year certificate program at each school. To align certificate program rollout with the HCIA timeline, partnering colleges accelerated curriculum development by bundling existing courses relevant to patient navigation (e.g., nursing and community health worker courses). AACI helped recruit students, provided PN-related workshops in tandem with the certificate programs, and established internship opportunities for students.

Students were recruited by AACI and community college partners through internal AACI programs, 10 community agencies, and educational partners, outreach events, classroom presentations, and one-on-one outreach referrals. AACI aimed to recruit students who were proficient in English, had bilingual skills (e.g., Vietnamese, Mandarin Chinese, Spanish), and were 18 to 30 years old. To ensure students were a good fit for the program, AACI created a screening process that included a written application, a short interview, and attendance at a mandatory orientation and introduction meeting. During the site visit, AACI staff explained, *"we work with a lot of at-risk youth and adults—a wide range of students; some have not graduated from high school or college. We want to make sure that students who are new to the college setting have a guide so they don't fail."*

Once students completed the application process and were admitted to the PN certificate program, they completed 1 year of courses. In addition to the required coursework, students completed 75 internship hours to earn a PN certificate. AACI staff and community college partners coordinated the internships for which students earned both work experience and a stipend upon completion.

In AACI's experience, the greatest challenge in developing the PN training program curriculum was defining the role and responsibilities of PNs. No professional standards for PNs exist, and the peer-reviewed literature noted wide variation in PN roles. To develop a training curriculum and coordinate certificate programs across community colleges, innovation partners first had to agree on PNs' roles and responsibilities. In Q11, under CLP's leadership, a Competency to Career work group (community college consultants and health care employers) developed PN workplace competencies and learning outcomes, such as assisting with medical administrative responsibilities including health insurance enrollment.

Table 18. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	17,700	59
Since inception	30,300	101

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Source: *Q11–Q12 Quarterly Awardee Performance Report*.
Q = quarter.

2.13 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

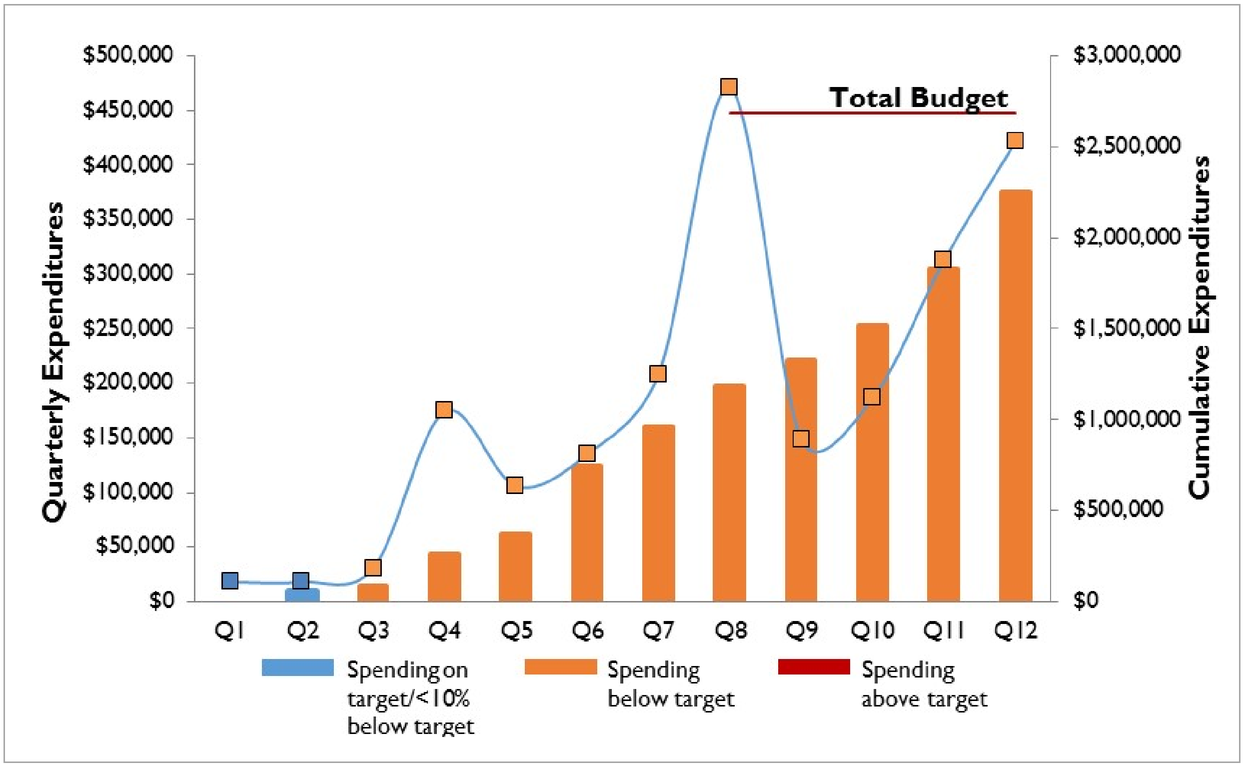
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.13.1 Award Execution

The annual report highlights the significance of AACI's expenditure rates on implementation. As of June 2015 (Q12), AACI spent 83.9 percent of its total budget, which is below the projected target (***Figure 8***). AACI attributed underspending to the time required to obtain carryover approval and the timing of approvals. In Q12, AACI also noted that reported budget data are estimates and may not include all administrative expenses.

Figure 8. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.13.2 Leadership

AACI is the largest community-based organization focused on the Asian community in Santa Clara County. Its mission is to improve the health, mental health and well-being of individuals, families and the Asian community. The PNC innovation was one of many health and human services offered by

AACI. In 2015, 177 AACI staff served approximately 16,760 clients. AACI had a six-member management team and a board of directors of community leaders from the private, public, and nonprofit sectors.

The PNC innovation retained key leadership staff since project inception and received much support from AACI leadership, particularly AACI's chief executive officer (CEO). For example, the CEO featured the PNC innovation in reports to AACI's board of directors and to outside funders. AACI's chief operating officer's (COO) is the PNC project director, and another PNC staff member commented that he was a strong champion for the innovation: *"[the COO] took [the PNC innovation] under his wing and completely supported it and saw it through to the point we're at now. I see 100% support."* The COO incorporated the PNC into AACI's broader practice transformation and improvement efforts and promoted the PNC to local community health agencies.

2.13.3 Organizational Capacity

AACI did not have PNs on staff before the HCIA project. However, ACCI had over 40 years of experience providing health, advocacy, recovery, shelter and youth development services to low-income families in Santa Clara County, over 50 percent of whom are Asian. Through its partnership with CLP, AACI supported the development and implementation of PN certificate programs at four community colleges. AACI experienced setbacks in launching and maintaining the certificate programs because of turnover in leadership at partnering community colleges, but reported that *"bringing funding to the table"* and CLP's technical assistance helped them overcome these challenges. As CLP partners explained during site visit interviews in July 2014, they served as a bridge between AACI and the community college partners; their *"job was to…get the [PNC innovation] concept to work in community colleges"* by helping colleges incorporate PN certificate programs into existing curriculum and career pathways.

At the end of the award period, AACI had not implemented the PNC mobile app, intended to help connect a pool of part-time PNs to patients requesting PN support. Initial efforts to develop an app with a University of California–Berkley volunteer club took longer than expected; a program administrator explained, "*The first couple years, we didn't ask for funding to create the app. The people creating the app are part of a club at Berkeley; they are volunteers. That has its own issues and delays; for example, if they have finals."* AACI used a portion of the award to contract with Zero Divide, a technology consulting company that helped identify an appropriate platform for the PNC app. AACI noted that app development was complicated by the number of insurers the clinic has—because insurers had different restrictions about the types of information that can be included in patient portals. AACI received funding from Kaiser Permanente to continue work on the mobile app post-HCIA funding.

AACI did not have the in-house capacity to assess its innovation based on total cost of care, which may have limited the ability to obtain funding or fulfill funding requirements that included this level of evaluation. AACI recently collaborated with the state Health Services Advisory Group (HSAG) to obtain utilization data for participants with Medicaid and Medicare, but noted that data collection and analyses related to total cost of care were challenging. For example, HSAG data were deidentified and did not include claims details. So, AACI requested additional secondary analysis support from HSAG. In Q12, AACI reported that their costs analyses of the additional data provided by HSAG did not show savings.

2.13.4 Innovation Adoption and Workflow Integration

PNC leadership reported that the PNs' involvement in clinical workflow was critical to reaching patients. AACI created an integrated front desk for PNs, which allowed all patients to receive services from a PN as soon as they entered a clinic. AACI reported that integrating PNs into the workflow increased the number of PN services provided to patients. The new workflow positioned PNs to assist patients with appointment check-ins, intake paperwork, and other services.

> ***"PNs provide the first point of contact with the client and direct them to the appropriate front-desk staff. PNs also provide assistance with primary care physician changes, insurance sign-up and verification, and warm handoffs to other services within the agency. With their welcoming smiles…PNs have led our front-desk integration and patient satisfaction efforts."*** [2]

AACI acknowledged that, initially, primary care and mental health clinic staff did not understand the role of PNs and were concerned that the time patients spent with PNs would cause workflow delays by extending the patients' time in the reception area, for example. However, over time, through learning more about PNs in team meetings and observing PNs in action, clinic staff better understood the ways in which PNs could provide additional supports to patients. A project leader explained, *"Initially folks said, 'what are these young kids doing here?' After a few navigation visits, they had a much better idea [what PNs] can do and to support the patient."* AACI reported that PNs helped patients with insurance sign-ups and primary care physician reassignments, which AACI cited as a key factor in retaining some patients affected by primary care provider turnover.

2.14 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

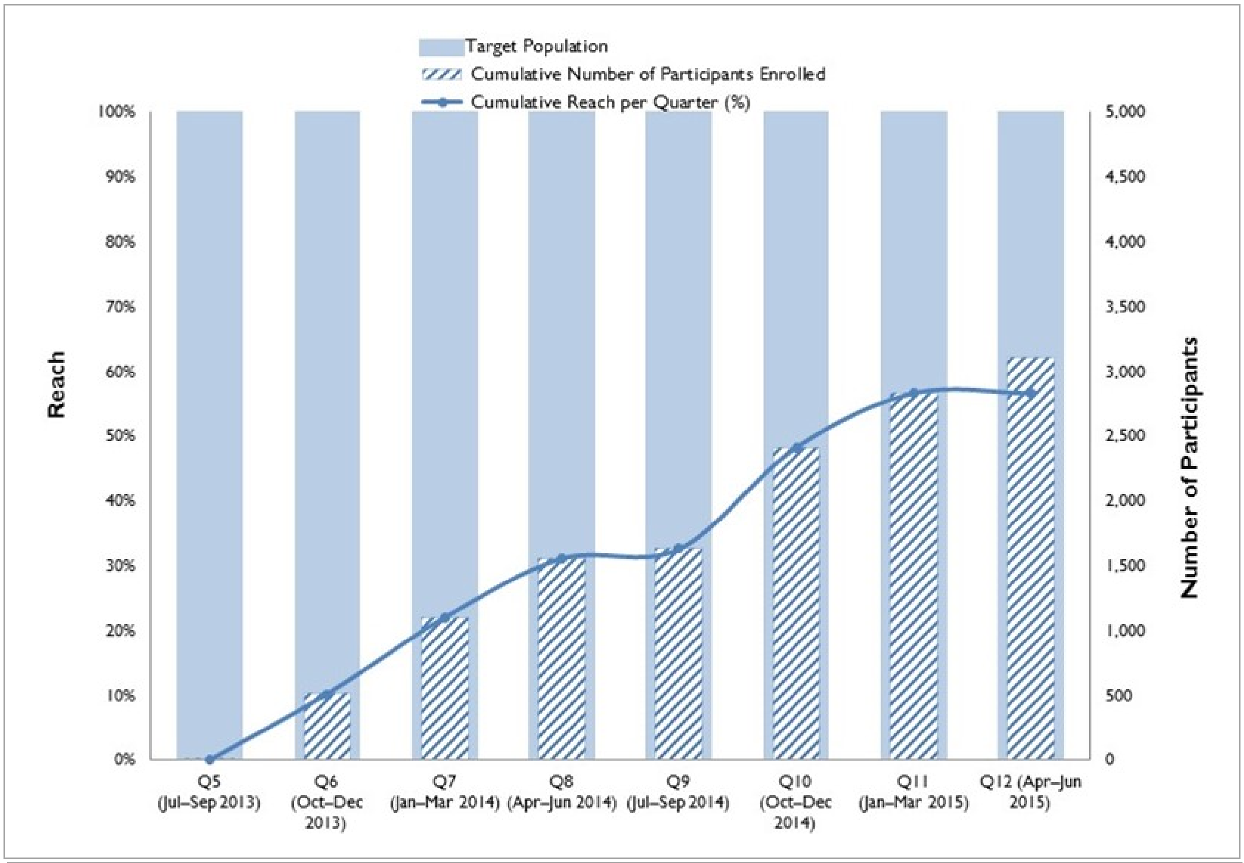
- What is the implementation effectiveness as measured by reach and dose of the innovation?

[2] *Q11* and *Q12 Narrative Progress Reports*.

2.14.1 Innovation Reach

Figure 9 shows reach by quarter for AACI since the launch of the innovation. We last reported reach in the 2015 annual report based on data through Q11. Since then, AACI enrolled an additional 276 patients in the innovation, increasing reach from approximately 57 percent to approximately 62 percent. According to AACI, participants were enrolled before AACI began tracking enrollees in an Excel spreadsheet, and patient information collected prior to formal tracking in Excel was not transferred to the spreadsheet. Thus, these patients were not included in the patient-level data provided to RTI. If the additional patients were included in the data, AACI would have achieved 81 percent of the reach target.

Figure 9. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
●	Cumulative reach per quarter (%)	0.0	10.2	22.0	31.1	32.6	48.3	56.7	62.3
	Target population	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
	Cumulative number of participants enrolled	2	511	1102	1555	1,630	2,415	2,837	3,113

Source: Patient-level data provided to RTI by AACI.

AACI reported that PNC reach was below target because AACI's overall number of patients was lower than expected. AACI's close proximity to other primary care organizations and providers, medical staff vacancies, and a decline in county referrals to AACI's mental health clinic all impacted their patient panel.

AACI leveraged the award to advance quality improvement efforts, which in turn supported enrollment in the innovation. For example, HCIA grant staff led the process to obtain Level 2 Patient-Centered Medical Home (PCMH) accreditation. In Q12, AACI reported enrolling approximately 1,000 new patients. AACI credited recent growth in quality improvement efforts to PCMH accreditation, expanding and redesigning their health care facilities to include an integrated front desk, and PN services.

2.14.2 Innovation Dose

Table 19 provides the number of selected services provided across participants, the number of participants who received services, and the average number of services per participant through Q12. The percentage of participants receiving each type of service was similar to the percentage reported in the 2015 annual report. More specifically, AACI provided patient-level data on the number and types of PN services provided for 2,527 participants (all participants received at least one PN service). Most participants (71.6%) received assistance with filling out forms, and almost one-quarter (21.7%) received assistance during their in-person visits. Fewer than 5 percent of participants received appointment scheduling assistance or reminders, health education, language assistance, or transportation assistance. Although 2,527 patients received services, the types of PN services may not have been enough to achieve AACI's smarter spending goal. In-person visits could have impacted utilization outcomes by encouraging more patients to seek appropriate care. However, only about 20 percent of patients received this type of service.

Table 19. Number and Types of Services Provided to Participants

Services	Number of Services Provided Across Participants	Number (Percentage) of Participants Receiving Service	Average Number of Services per Participant
Appointment scheduling assistance or reminders	32	27 (0.9)	1.2
Assistance with filling out forms	3,837	2,229 (71.6)	1.7
Health education (mental/ behavioral health patient navigation)	23	18 (0.6)	1.3
In-person visit	781	675 (21.7)	1.2
Language assistance	5	5 (0.2)	1.0
Transportation assistance	50	40 (1.3)	1.3
Other service	95	89 (2.9)	1.1
Total	4,823	2,527 (81.2)	1.9

Source: Patient-level data provided to RTI by AACI.

2.15 Qualitative Findings: Sustainability

AACI planned to sustain the PNC innovation and continue to employ PNs and administrative staff to oversee the navigation program. PNs will continue to serve patients in the same capacity and will continue to track the beneficiaries of the services. Additionally, the community colleges with whom AACI partnered have institutionalized their PN programs and will continue to enroll students at all four campuses. Although AACI will no longer fund these programs, the college programs will work with AACI staff to recruit students and place interns.

AACI identified funding for the PN program and administrative staff at AACI through state- and county-level grants. AACI received funding from Kaiser Permanente to develop and implement the PNC mobile app. AACI plans to continue to be an exemplar for patient navigation services in the region, modeling how PNs can be deployed for the benefit of patients and the agency.

2.16 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing AACI as well as accomplishments to date. In this section we assess AACI's progress on achieving HCIA goals to date:

- **Smarter spending.** The trend in the estimated quarterly spending differences suggests long-term savings; results were statistically significant for the last 2 years of the intervention.
- **Better care.** The number of ED visits significantly increased in the innovation group relative to the comparison group. On average, the innovation group had a lower number of unplanned readmissions and a higher number of inpatient admissions relative to the comparison group, but results did not achieve statistical significance.

  A total of 3,113 participants were enrolled; reach was 62 percent. More than 80 percent of participants received at least one PN service. Most participants (71.6%) got help filling out forms, and approximately one-quarter (21.7%) received assistance during their in-person visits. Fewer than 5 percent received appointment scheduling assistance or reminders, health education, language assistance, or transportation assistance.
- **Healthier people**. AACI was unable to provide health outcomes data. Therefore, we are unable to assess health outcomes for those enrolled in the innovation.

Although AACI had positive results for spending and ED visits, we are not confident those results can be ascribed soley to the innovation. AACI's PNC innovation was primarily to partner with community colleges to train young adults as nonclinical health workers who would provide PN services to AACI patients. Engaging patients during in-person visits could have impacted ED visits by encouraging more patients to seek appropriate primary care. However, only about one-fifth of patients received this type of service. Moreover, fewer than 5 percent of participants received services from a PN that would have facilitated primary care access such as appointment scheduling assistance or reminders, health education, language assistance, or transportation assistance. Other practice transformation efforts within AACI that we were unable to assess may have contributed to AACI's lower spending and fewer ED visits.

AACI largely implemented the PNC innovation as planned and retained key leadership and management staff throughout the HCIA period. The PNC innovation received much support from AACI's CEO and COO (the COO was also the PNC project director). With training and management support from CLP, AACI partnered with four community colleges to implement PN certificate programs. AACI maintained these key partnerships during the HCIA award period and planned to continue them post-award. One hundred students graduated from the PN certificate programs (61% of the training target), and CLP leveraged the PNC innovation to facilitate the development of regional PN workplace competencies and learning outcomes.

Since project inception, AACI hired six PNs. In Q11, PNs were placed at AACI's new integrated front desk to provide a welcoming first point of contact with clients and nonclinical support. ACCI reported that an additional five PN graduates/interns were hired at other community health centers in the area. However, no systems were in place to track the employment status of all graduates.

AACI was unable to launch the planned PN mobile app but obtained funding from Kaiser Permanente to execute this component of the innovation in the future. AACI also struggled to assess long-term outcomes for the innovation. Despite collaborating with the state HSAG to obtain utilization data for participants with Medicaid and Medicare, AACI expressed ongoing challenges with data collection and analyses related to total cost of care and was unable to examine HSAG data by insurance coverage or disease condition.

AACI leveraged the HCIA award to advance quality improvement efforts. For example, HCIA grant staff led the process to obtain Level 2 Patient-Centered Medical Home (PCMH) accreditation. In Q12, AACI reported enrolling approximately 1,000 new patients. AACI credits recent growth in quality improvement efforts, including PCMH accreditation, expanding and redesigning their health care facilities to include an integrated front desk, and PN services.

The PNC innovation will be sustained beyond the HCIA funding period. Community college partners institutionalized the PN certificate programs, so they will continue without funding from AACI. AACI will assist the PN certificate programs with recruitment and serve as an internship site for PN students. AACI obtained state and county funding to retain their existing PNs and the administrator who oversees them.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Asian Americans for Community Involvement (AACI)

Asian Americans for Community Involvement (AACI), a federally qualified health center in San Jose, California, received an award of $2,684,545 to implement a patient navigation center (PNC) innovation. AACI began enrolling participants on October 30, 2013. All primary care and behavioral health patients were eligible to receive patient navigator (PN) services.

Awardee Overview

Innovation dose:	Most participants (71.6%) got help completing forms; 21.7% were assisted in-person. Fewer than 5% received appointment scheduling assistance or reminders, health education, language assistance, or transportation assistance.	***Innovation reach:***	AACI enrolled 3,113 patients, increasing its reach from 57% to 62%.
Components:	(1) Working with community college partners to train Asian and Hispanic young adults as nonclinical health workers (2) Providing PN services to AACI patients	***Participant demographics:***	Most (84.5%) participants were Asian; 42.7% had Medicaid, 4.8% had Medicare, and 22.7% were eligible for both Medicare and Medicaid.
Sustainability:	Community college partners institutionalized PN certificate programs. AACI obtained state and county funding to retain existing PNs.		
Innovation type:	Coordination of care		Health care workforce

Key Findings

Smarter spending. The trend in the estimated average quarterly Medicare spending differences suggests that the intervention might lead to long−term savings; results were statistically significant for year 2 (−$634; 90% CI: −$1,191, −$78) and year 3 of the innovation (−$1,413; 90% CI: −$2,821, −$4).

Better care. The average number of ED visits per 1,000 participants significantly increased in the innovation group relative to the comparison group (12; 90% CI 2, 22). On average, the innovation group had a lower number of unplanned readmissions per 1,000 admissions (−12; 90% CI −137, 114) and a higher number of inpatient admissions per 1,000 participants (5; 90% CI −1, 12) relative to the comparison group, but results did not achieve statistical significance.

Healthier people. AACI was unable to provide health outcomes data. Therefore, we are unable to assess health outcomes for those enrolled in the innovation.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:
Ben Archer Health Center

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Ben Archer Health Center

2.1 Introduction

The Ben Archer Health Center (BAHC) is a federally qualified health center (FQHC) in rural New Mexico that received an award of $1,270,845 to implement its innovation, which was launched on September 5, 2012. The innovation targeted the predominantly Hispanic population of northern Doña Ana County, New Mexico, a region designated by the U.S. Department of Health and Human Services as a medically underserved area and a health professional shortage area. BAHC planned to accomplish the following HCIA goals:

1. **Smarter spending.** Reduce total spending in northern Doña Ana County by 10 percent.
2. **Better care.** Improve care for individuals through a home-based health care model that enlists community health workers (CHWs) and nurse health educators (NHEs) to promote healthy lifestyles, provide quality health care education, increase access to health services, and link participants to a primary medical care home.
3. **Healthier people.** Improve health for the population of northern Doña Ana County by increasing HbA1c, low-density lipoprotein cholesterol (LDL-C), and hypertension control.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11-12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received from BAHC through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Components included preventive care services and intensive case management, which did not change since launch.
Program Participant Characteristics	
	Majority of participants (69.7%) were 45 to 74 years of age. More than half were Hispanic (59.7%), and less than half were white (39.6%). More than one-third were covered by Medicare (38.4%), almost one-third were covered by Medicaid (29.0%), and one-quarter were covered by both Medicare and Medicaid (26.0%).
Workforce Development	
Hiring and retention	Total staffing was 7.5 FTE at the end of Q12, with no new hires during the reporting period.
Skills, knowledge, and training	BAHC provided training to 3 HCIA administrators in Q11 and 10 CHWs in Q12, for a total of 84 training hours. Staff also continued to participate in the Southern New Mexico Promotora Committee.
Context	
Award execution	As of Q12, BAHC spent 100% of its Year 3 budget, on target.
Leadership	BAHC's organizational and innovation leadership continued to provide resources and guidance in support of implementation.
Organizational capacity	BAHC largely resolved early challenges with self-monitoring and completed a data review in the last quarter of implementation.
Innovation adoption and workflow integration	Clinical and nonclinical staff continued to work well together.
Implementation Effectiveness	
Innovation reach	601 participants received intensive case management, 41.1% of the target population for the intensive case management component of the innovation. No new participants enrolled in Q11 or Q12. Reach data were not available for the preventive services component.
Innovation dose	Participants received a slightly greater number of primary care and intensive case management visits, on average, in Q12 (5.2 and 10.4, respectively) compared to Q11 (4.7 and 9.8, respectively).
Sustainability	
	BAHC continued to employ innovation staff, but cannot sustain HCIA-supported community- and home-based services without additional funding.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.

BAHC = Ben Archer Health Center; CHW = community health worker; FTE = full-time equivalent; HCIA = Health Care Innovation Award; Q = quarter.

Table 3 summarizes Medicare claims-based findings during the innovation period. Overall, Medicare spending per innovation participant is not significantly higher than for nonparticipants, but spending is significantly higher for participants during Year 1 of the innovation. The innovation group has more inpatient stays overall and the results are statistically significant in Years 1 and 3 of the innovation. The innovation had no impact on unplanned readmissions. Last, ED visits are significantly lower in the innovation group overall and in Years 2 and 3 of the innovation.

Table 3. Summary of Medicare Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$0.678	−$0.387, $1.743	$0.433	$0.012, $0.853	−$0.132	−$0.668, $0.404	$0.375	−$0.136, $0.885
Acute care inpatient stays	83	54, 112	47	28, 66	10	−6, 26	26	11, 41
Hospital-wide all-cause unplanned readmissions	−2	−15, 12	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−47	−74, −20	−6	−23, 12	−27	−44, −11	−14	−26, −2
Average impact per quarter								
Spending per participant	$445	−$254, $1,144	$630	$18, $1,242	−$242	−$1,226, $741	$1,306	−$473, $3,085
Acute care inpatient stays (per 1,000 participants)	54	35, 74	68	41, 96	18	−12, 48	90	37, 144
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−16	−142, 109	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−31	−49, −13	−8	−34, 18	−50	−80, −20	−50	−91, −8

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. We completed a regression analysis to test for changes in spending resulting from the innovation. Spending declined but the estimates are not statistically significant overall in Year 1 or Year 2. The numbers of inpatient admissions, unplanned readmissions, and ED visits were insufficient to allow for count regression analyses of these utilization measures.

Table 4. Summary of Medicaid Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−29,928	−74,871, 15,015	−20,531	−50,299, 9,237	−9,397	−29,907, 11,113	N/A	N/A
Average impact per quarter								
Spending per participant	−82	−206, 41	−62	−153, 28	−268	−854, 318	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.

2.1.1 Innovation Components

BAHC is a community health center that operates 11 facilities serving patients throughout southern New Mexico, particularly those along the Mexican border. According to its HCIA funding application, the organization serves 35,000 patients annually, most of whom are low income, Hispanic, and over 20 miles from the next closest health care provider. BAHC's clinics offer a wide range of services to patients regardless of their ability to pay, including primary medical, dental, and behavioral health care; health education; transportation; referral services to physicians and hospitals; limited laboratory services; x-ray; and eligibility determination for assistance programs. BAHC has used a CHW model in its service area since 1992.

This innovation had two components carried out by CHWs and NHEs: (1) preventive care services and (2) intensive case management. The innovation expanded BAHC's existing services in that HCIA funding provided resources needed to deliver a greater proportion of care in community settings and patients' homes. The innovation was thereby able to link the highest-risk residents of northern Doña Ana County, New Mexico, to primary care medical homes. Pairing CHWs and NHEs in the field allowed BAHC to draw on the strengths of both roles—the culturally sensitive approach of CHWs, who are respected members of the predominantly Hispanic local community, and the medical expertise of nurses. CHWs and NHEs travelled throughout rural service areas to link residents to preventive and primary care. They hosted community events, immunization campaigns, and in-home health education sessions. Patients with complicated medical conditions, including chronic disease, received home visits to help them manage their medications and establish a safe home environment. When CHWs and NHEs identified patients who lacked access to care, they linked them to traditional providers, usually housed in BAHC's existing clinics. No changes to these components were made during the implementation period, except that BAHC adjusted its denominator for calculating reach in light of limited evaluation data on the preventive services component (see ***Implementation Effectiveness*** for more information).

BAHC did not report any formal partners for the innovation, though it actively sought referrals from local organizations to meet patients' complex medical and social needs. For instance, BAHC increased the accessibility of eye exams in cooperation with a local optometrist during Q9. BAHC collaborated with other organizations as appropriate; however, BAHC is the only health care provider in the targeted rural area.

2.1.2 Program Participant Characteristics

Table 5 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report, based on data through Q11. No new patients have been enrolled, so the patient characteristics remain the same. More specifically, a majority of participants (69.7%) were 45 to 74 years of age and more than half (53.6%) were female. More than half of participants (59.7%) were Hispanic, and less than half (39.6%) were white.

More than one-third (38.4%) were covered by Medicare and less than one-third (29.0%) were covered by Medicaid, while approximately one-quarter (26.0%) were eligible for both Medicare and Medicaid.

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	601	100
Age		
< 18	9	1.5
18–24	4	0.7
25–44	36	6.0
45–64	234	38.9
65–74	185	30.8
75–84	104	17.3
85+	29	4.8
Missing	0	0.0
Sex		
Female	322	53.6
Male	279	46.4
Missing	0	0.0
Race/ethnicity		
White	238	39.6
Black	1	0.2
Hispanic	359	59.7
Asian	1	0.2
American Indian or Alaska Native	1	0.2
Native Hawaiian or Other Pacific Islander	0	0.0
Other	1	0.1
Missing/refused	0	0.0
Payer category		
Dual	156	26.0
Medicaid	174	29.0
Medicare	231	38.4
Other	31	5.2
Uninsured	8	1.3
Missing	1	0.1

Source: Patient-level data provided to RTI by BAHC.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 6 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 6. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 180 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in southern Doña Ana County (excluding the city of Las Cruces) and the counties surrounding Doña Ana County (Luna, Sierra, and Otero Counties).

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of dual-eligible months, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 7 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. One innovation beneficiary was dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 7. Mean Values and Standardized Differences of Variables in Propensity Score Model: BAHC

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarter prior to enrolment	2,495	7,794	1,748	6,232	0.106	2,506	7,814	2,419	8,367	0.077
Total payments in second, third, fourth, and fifth calendar quarters prior to enrolment	5,283	15,330	6,100	15,200	0.053	5,132	15,236	4,758	9,421	0.037
Age	69.83	11.39	70.89	11.29	0.094	69.85	11.41	70.74	11.77	0.055
Percentage male	50.83	49.99	49.73	50	0.02	51.11	49.99	49.26	49.99	0.020
Percentage white	32.6	46.87	70.09	45.79	0.809	32.22	46.73	34.81	47.64	0.075
Percentage disabled	32.04	46.66	23.06	42.12	0.203	32.22	46.73	33.15	47.07	0.077
Percentage ESRD	2.76	16.39	0.99	9.9	0.131	2.78	16.43	1.67	12.8	0.037
Number of dual-eligible months in the previous calendar year	5.99	5.76	2.35	4.65	0.695	6.02	5.76	6	5.86	0.003
Number of chronic conditions	6.03	3.75	5.96	4.11	0.017	6.03	3.76	6.39	3.81	0.094
Percentage with hypertension ever	78.45	41.11	67.28	46.92	0.253	78.33	41.2	82.96	37.6	0.117
Percentage with diabetes ever	53.04	49.91	31.34	46.39	0.450	52.78	49.92	54.07	49.83	0.026
Percentage with asthma ever	12.71	33.31	13.68	34.36	0.029	12.78	33.38	15.74	36.42	0.085
Number of ED visits in calendar quarter prior to enrollment	0.12	0.4	0.12	0.46	0.014	0.12	0.4	0.12	0.37	0.014
Number of ED visits in calendar year prior to enrollment	0.44	1.00	0.52	1.28	0.075	0.44	1	0.43	0.87	0.010
Number of inpatient stays in calendar quarter prior to enrollment	0.09	0.44	0.06	0.29	0.103	0.09	0.44	0.12	0.45	0.050
Number of inpatient stays in calendar year prior to enrollment	0.20	0.85	0.2	0.65	0.010	0.19	0.84	0.18	0.55	0.016
Number of beneficiaries	181	—	145,923	—	—	180	—	538	—	—
Number of unique beneficiaries[1]	—	—	17,699	—	—	180	—	534	—	—
Number of weighted beneficiaries	—	—	—	—	—	180	—	180	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

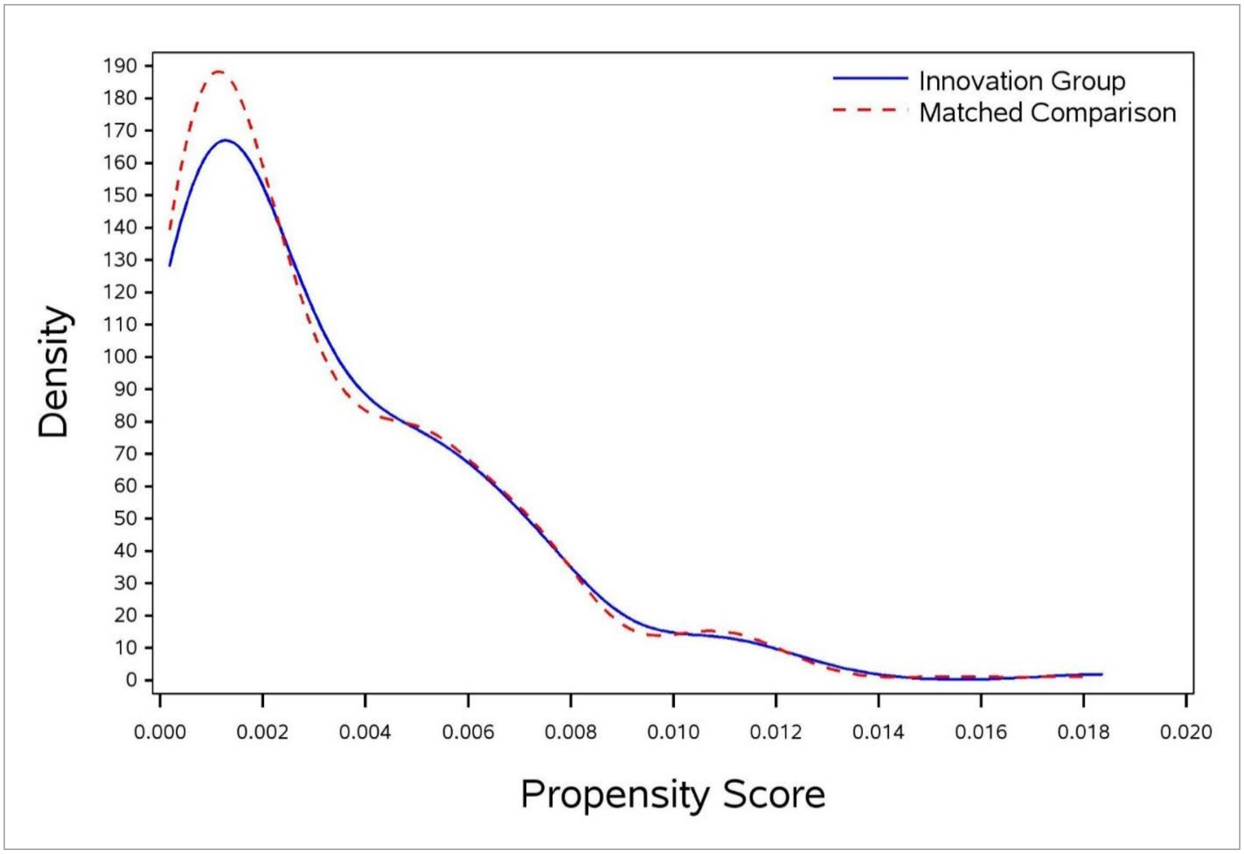
BAHC = Ben Archer Health Center; ED = emergency department; ESRD = end-stage renal disease.

— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 7). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 7 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables except for the percentage of beneficiaries with hypertension, which has a standardized difference of 0.117.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The innovation and comparison group distributions overlap, indicating that the propensity scores are similar across groups.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 8 reports Medicare spending per patient in the eight quarters before and the 12 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 8 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

Spending among innovation beneficiaries trends upward and is similar to comparison group spending during baseline quarters. During the innovation period, the innovation group's spending continues along the baseline trend, while the comparison group's spending falls below the baseline trend. Due to the skewed nature of spending and the small sample size, spending has a high standard deviation. In the next section, we present a regression analysis that tests for differences in spending between the innovation and comparison groups.

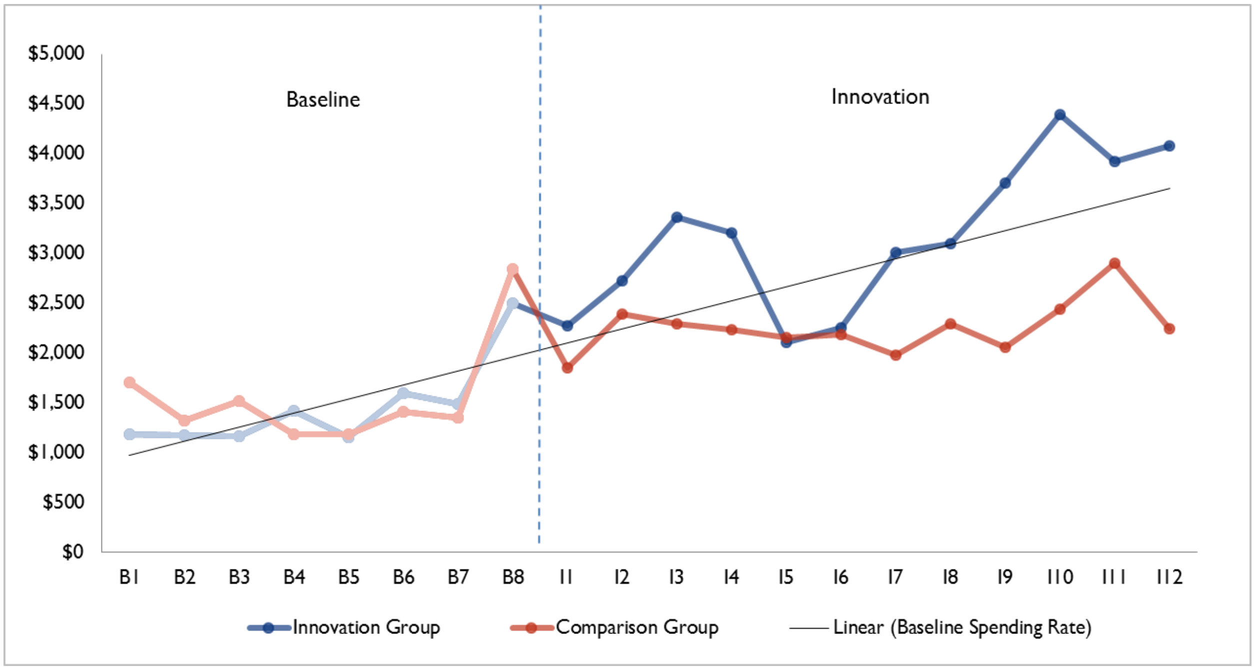
Table 8. Medicare Spending per Participant: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Spending rate	$1,190	$1,175	$1,165	$1,421	$1,160	$1,600	$1,494	$2,506	$2,275	$2,724	$3,362	$3,209	$2,110	$2,260	$3,011	$3,097	$3,711	$4,397	$3,925	$4,080
Std dev	$3,347	$3,895	$3,955	$4,829	$2,576	$7,444	$3,907	$7,814	$5,215	$6,561	$13,329	$7,676	$4,971	$6,237	$14,966	$7,653	$9,276	$16,044	$10,163	$8,724
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	133	120	100	86	65	36
Comparison Group																				
Spending rate	$1,705	$1,323	$1,522	$1,181	$1,185	$1,413	$1,352	$2,840	$1,850	$2,397	$2,299	$2,233	$2,161	$2,191	$1,977	$2,297	$2,064	$2,442	$2,898	$2,247
Std dev	$5,931	$4,132	$5,028	$3,556	$3,318	$4,459	$3,395	$10,221	$5,996	$7,650	$6,940	$6,242	$7,382	$6,035	$6,093	$6,116	$7,065	$6,624	$8,580	$8,031
Weighted patients	155	160	162	167	171	176	179	180	180	179	176	168	161	155	144	132	111	98	82	47
Savings per Patient																				
	$515	$148	$357	−$240	$25	−$187	−$142	$334	−$425	−$326	−$1,063	−$977	$50	−$68	−$1,035	−$800	−$1,647	−$1,955	−$1,027	−$1,833

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; I1 = Innovation Q1.

Figure 2. Medicare Spending per Participant: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center.

2.4.2 *Regression Results*

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, is $445 (90% CI: –$254, $1,144), indicating a loss. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 9*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. In most quarters, the innovation group’s spending is higher than the comparison group’s spending; however, no quarterly differences approach statistical significance. At the annual level, the innovation group’s spending is significantly higher than the comparison group’s spending in Year 1.

Table 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	$484	$399	0.226
I2	$391	$481	0.416
I3	$1,362	$1,015	0.180
I4	$302	$688	0.661
I5	−$849	$569	0.136
I6	−$922	$640	0.151
I7	$286	$1,309	0.827
I8	$734	$771	0.341
I9	$1,175	$964	0.223
I10	$2,170	$1,780	0.223
I11	$1,161	$1,327	0.382
I12	−$132	$1,491	0.929
Overall average	$445	$424	0.295
Overall aggregate	$678,208	$646,604	0.295
Overall aggregate (IY1)	$432,947	$255,297	0.090
Overall aggregate (IY2)	−$132,129	$325,583	0.685
Overall aggregate (IY3)	$374,814	$310,030	0.227

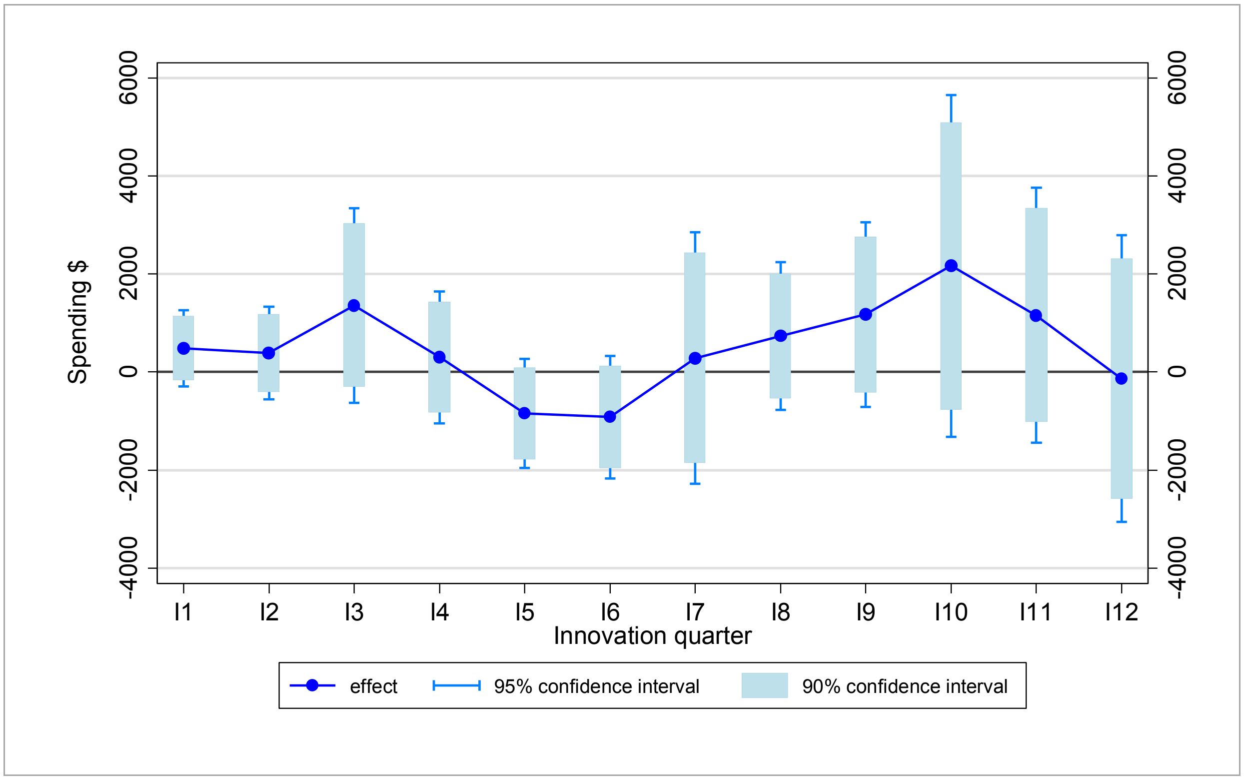
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

BAHC = Ben Archer Health Center; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

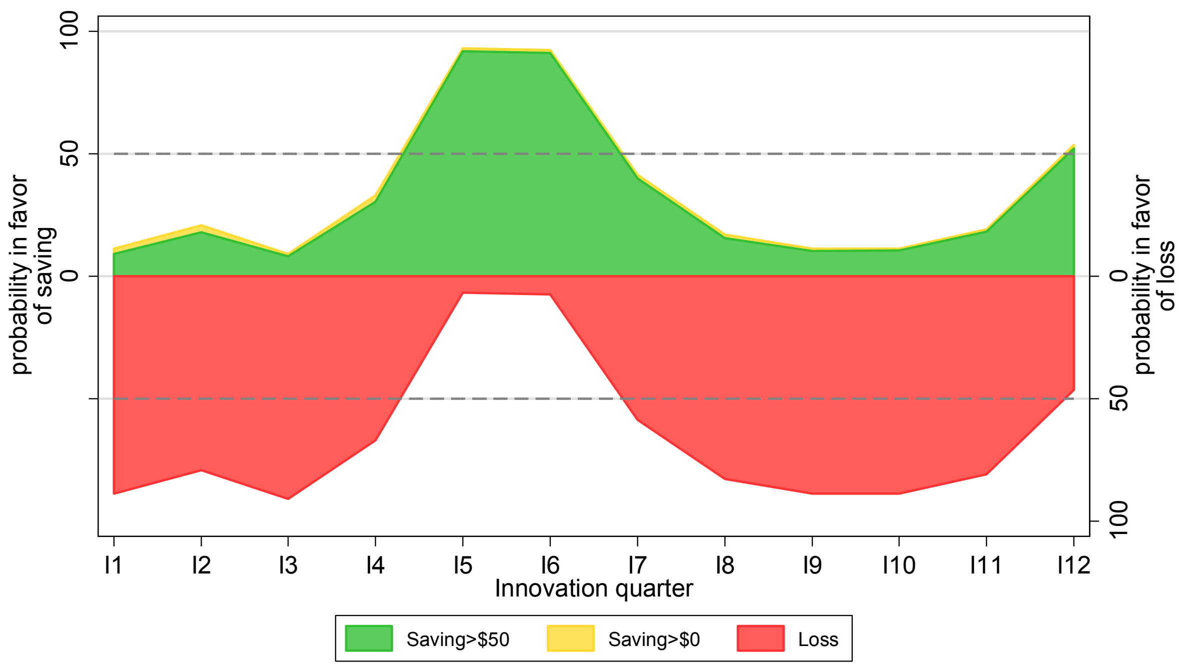
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Spending regression estimates are generally higher for the innovation group; therefore, Figure 4 supports the finding that the innovation generated a loss during most quarters.

Figure 4. Quarterly Strength of Evidence in Favor of Savings/Loss: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 5***. During the baseline period, the innovation group's inpatient admissions rate trends upward and is similar to the comparison group's rate. During the innovation period, the innovation group's rate remains close to the baseline trend, but rises above the comparison group's rate. In the next section, we discuss a regression analysis that tests for differences between the innovation and comparison groups' inpatient admissions.

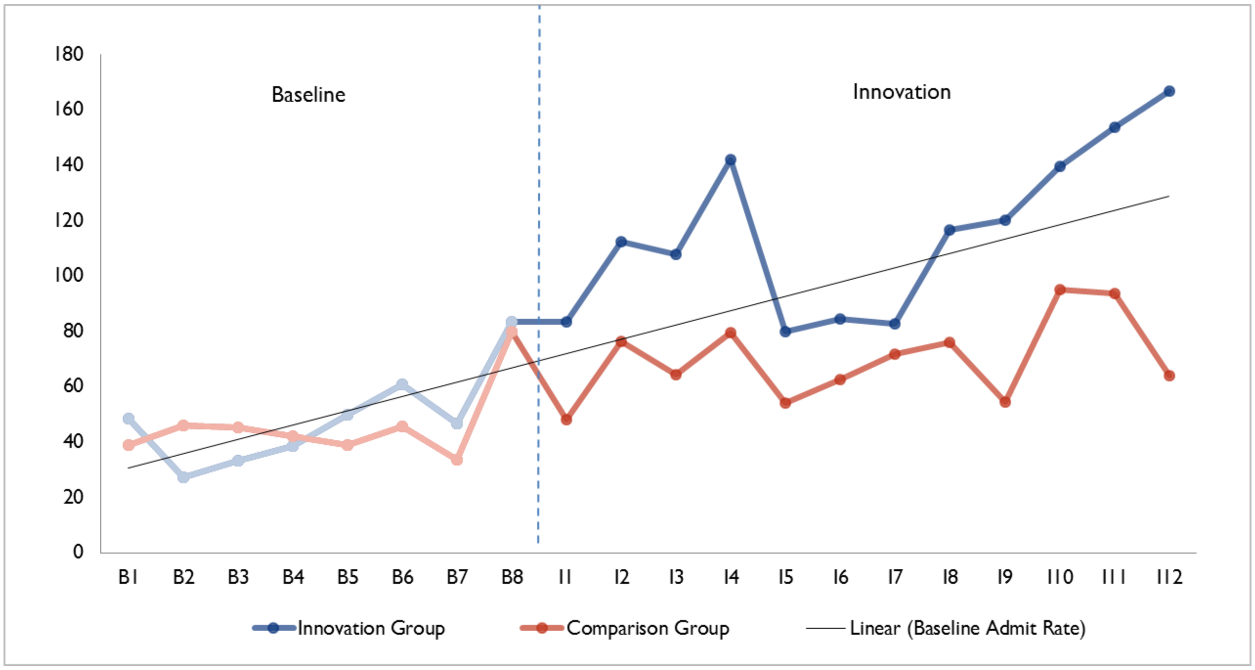
Table 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Admit rate	49	27	33	39	50	61	47	83	83	112	108	142	80	85	83	117	120	140	154	167
Std dev	245	163	180	224	218	465	237	420	331	380	477	414	337	346	369	412	382	486	401	500
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	133	120	100	86	65	36
Comparison Group																				
Admit rate	39	46	45	42	39	46	34	80	48	76	64	80	54	63	72	76	54	95	93	64
Std dev	226	246	254	305	222	250	192	344	239	334	267	325	275	298	382	348	275	336	446	399
Weighted patients	155	160	162	167	171	176	179	180	180	179	176	168	161	155	144	132	111	98	82	47
Innovation − Comparison Rate																				
	10	−19	−12	−3	11	15	13	4	35	36	43	62	26	22	11	41	66	44	60	103

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; I1 = Innovation Q1.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Participants: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 54 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 35, 74). In addition to the average effect over the innovation period, we present quarterly effects.

Table 11 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. In most quarters, the inpatient admissions rate is higher for the innovation group than the comparison group. The estimates reach statistical significance in I1, I2, I3, I4, I8, and I10. The difference is significant overall and during Years 1 and 3 of the innovation.

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Participants: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	61	27	0.025
I2	65	32	0.047
I3	67	32	0.036
I4	81	41	0.049
I5	−10	36	0.778
I6	11	33	0.743
I7	4	36	0.905
I8	77	40	0.055
I9	76	52	0.147
I10	114	55	0.042
I11	83	71	0.244
I12	86	110	0.435
Overall average	54	12	0.000
Overall aggregate	83	18	0.000
Overall aggregate (IY1)	47	11	0.000
Overall aggregate (IY2)	10	10	0.318
Overall aggregate (IY3)	26	9	0.006

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
BAHC = Ben Archer Health Center; I = Innovation Quarter; IY = Innovation Year.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 12*** and ***Figure 6***. Due to the low number of index admissions (the denominator in the readmissions measure), the unplanned readmissions rate is highly variable and the innovation group's unplanned readmission rate spikes in I3 and I10. In the next section, we discuss a regression analysis that tests for differences between the innovation and comparison groups' unplanned readmissions.

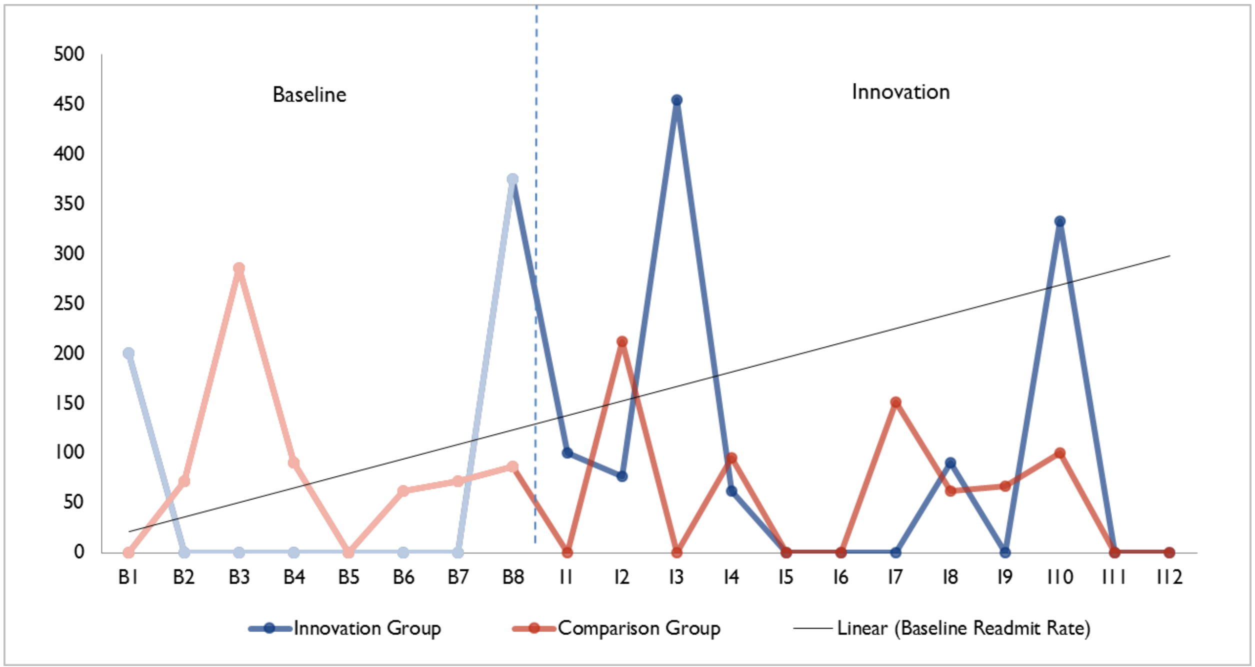
Table 12. Hospital Unplanned Readmissions Rates per 1,000 Admissions: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Readmit rate	200	0	0	0	0	0	0	375	100	77	455	63	0	0	0	91	0	333	0	0
Std dev	400	0	0	0	0	0	0	484	300	267	498	242	0	0	0	288	0	471	0	0
Total admissions	5	1	5	4	7	4	7	8	10	13	11	16	5	8	8	11	10	9	7	1
Comparison Group																				
Readmit rate	0	71	286	91	0	63	71	87	0	212	0	95	0	0	151	63	67	100	0	0
Std dev	0	258	452	288	0	242	258	282	0	409	0	294	0	0	358	242	249	300	0	0
Total admissions	5	5	5	4	4	5	5	12	5	11	7	11	6	7	9	5	5	7	3	0
Innovation − Comparison Rate																				
	200	−71	−286	−91	0	−63	−71	288	100	−135	455	−33	0	0	−151	28	−67	233	0	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; I1 = Innovation Q1.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Admissions: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center.

2.6.2 *Regression Results*

Table 13 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 16 per 1,000 inpatient admissions (1.6 percentage points), indicating that the innovation-comparison difference is 1.6 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: –142, 109).

Table 13. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Inpatient Admissions: BAHC

Quarter	Coefficient	Standard Error	P-Values
Overall average	−16	76	0.831
Overall aggregate	−2	8	0.831

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
BAHC = Ben Archer Health Center.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 14*** and ***Figure 7.*** During the baseline period, the innovation and comparison groups' ED rates are parallel. The difference in rates appears to widen during the innovation period. In the next section, we complete a regression analysis that tests for differences between the innovation and comparison groups' ED visits.

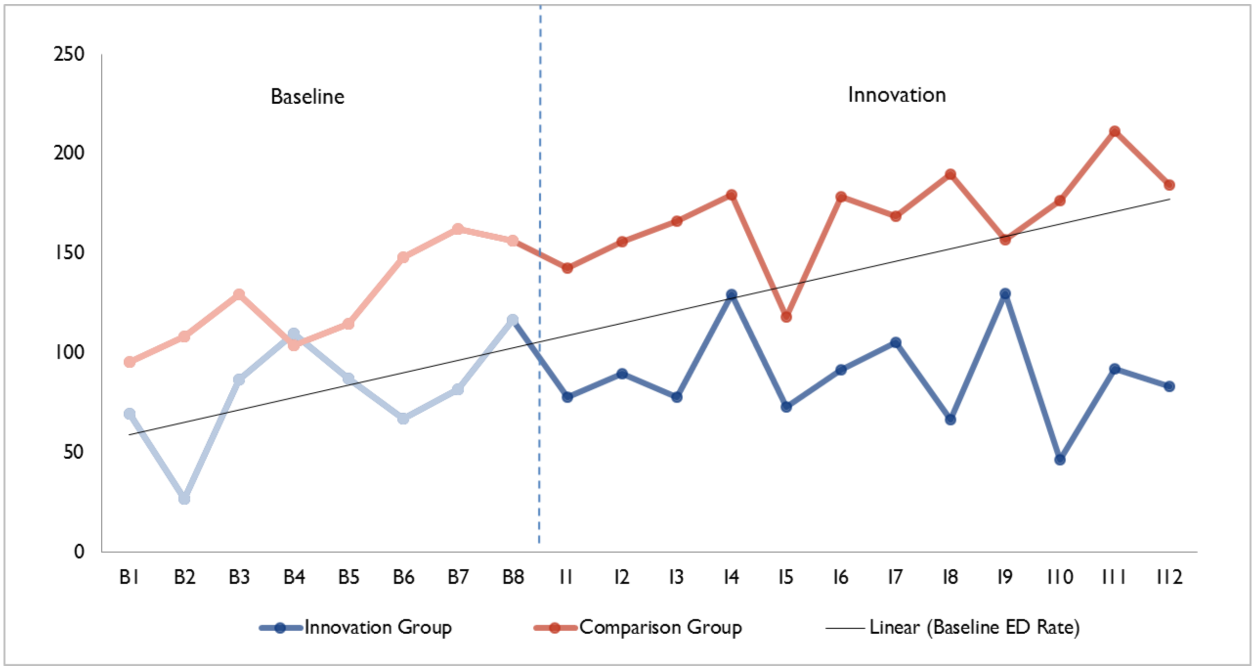
Table 14. ED Visits per 1,000 Participants: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
ED rate	69	27	87	110	88	67	82	117	78	90	78	130	73	92	105	67	130	47	92	83
Std dev	255	163	365	450	344	353	315	399	373	341	290	488	286	335	394	251	418	262	292	280
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	133	120	100	86	65	36
Comparison Group																				
ED rate	96	109	129	104	115	148	162	156	143	156	166	180	118	178	169	190	157	177	211	184
Std dev	194	234	268	270	229	270	290	307	268	290	279	303	239	354	401	304	298	328	336	306
Weighted patients	155	160	162	167	171	176	179	180	180	179	176	168	161	155	144	132	111	98	82	47
Innovation − Comparison Rate																				
	−26	−81	−43	6	−27	−81	−80	−40	−65	−66	−89	−50	−45	−87	−64	−123	−27	−130	−119	−101

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; ED = emergency department. I1 = Innovation Q1.

Figure 7. ED Visits per 1,000 Participants: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
BAHC = Ben Archer Health Center; ED = emergency department.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 31 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: –49, -13).

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 15*** presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. Most quarterly differences between the innovation and comparison groups indicate fewer ED visits among innovation beneficiaries. Quarterly differences are statistically significant in I5, I8, and I10. The overall, Year 2, and Year 3 reductions in ED visits are statistically significant.

Table 15. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Participants: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	−8	27	0.767
I2	−11	30	0.708
I3	−27	30	0.361
I4	15	37	0.684
I5	−70	35	0.050
I6	−39	37	0.294
I7	−30	40	0.462
I8	−62	34	0.073
I9	−5	49	0.915
I10	−66	34	0.058
I11	−76	56	0.178
I12	−86	70	0.223
Overall average	−31	11	0.004
Overall aggregate	−47	16	0.004
Overall aggregate (IY1)	−6	11	0.602
Overall aggregate (IY2)	−27	10	0.007
Overall aggregate (IY3)	−14	7	0.049

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
BAHC = Ben Archer Health Center; ED = emergency department; I = Innovation Quarter; IY = Innovation Year.

2.8 Discussion: Medicare Results

The BAHC innovation generated higher spending and a higher rate of inpatient stays, but fewer ED visits by participants. The goal of the BAHC innovation was to improve patient health via CHWs and NHEs that connect patients to services; therefore, utilization among innovation participants may increase during the short run. In the long run, management of chronic conditions may improve, resulting in a decline in utilization and costs. The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 30 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending.

2.9 Medicaid Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicaid claims data through 2013 Q4. The Medicaid claims analysis focuses on 98 Medicaid beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in southern Doña Ana County (excluding the city of Las Cruces) and the counties surrounding Doña Ana County (Luna, Sierra, and Otero Counties).

We use PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid fee-for-service in the calendar quarter prior to the innovation (n=14) did not have Medicaid claims data for this quarter, and were matched using demographic variables only. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 16 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 16. Mean Values and Standardized Differences of Variables in Propensity Score Model: BAHC

Variable	Before Matching: Treatment Group Mean	Before Matching: Treatment Group SD	Before Matching: Comparison Group Mean	Before Matching: Comparison Group SD	Standardized Difference	After Matching: Treatment Group Mean	After Matching: Treatment Group SD	After Matching: Comparison Group Mean	After Matching: Comparison Group SD	Standardized Difference
Previous Medicaid										
Payments in calendar quarter prior to enrolment	599	2,603	534	3,059	0.023	599	2,587	644	3,810	0.014
Payments in calendar year prior to enrolment	2,076	10,357	1,960	9,757	0.011	2,076	10,296	2,283	14,860	0.016
Age	68.71	10.76	38.49	24.5	1.597	68.71	10.7	68.55	10.61	0.016
Percentage female	54.76	50.07	64.6	47.82	0.202	54.76	49.77	57.14	49.49	0.048
Percentage Hispanic	60.71	49.13	17.13	37.68	0.999	60.71	48.84	60.71	48.84	0.000
Percentage disabled	27.38	44.86	16.98	37.54	0.252	27.38	44.59	28.17	44.99	0.018
Percentage blind, disabled, or aged	98.81	10.91	38.68	48.7	1.704	98.81	10.85	98.81	10.85	0.000
Number of beneficiaries	84	—	30,855	—	—	84	—	252	—	—
Number of unique beneficiaries[1]	—	—	7,226	—	—	84	—	243	—	—
Number of weighted beneficiaries	—	—	—	—	—	84	—	84	—	—
No Medicaid in Previous Quarter										
Age	68.21	5.38	22.60	18.12	3.413	68.21	5.18	66.95	6.29	0.219
Percentage female	35.71	49.72	63.46	48.16	0.578	35.71	47.92	26.19	43.97	0.207
Number of beneficiaries	14	—	5,860	—	—	14	—	41	—	—
Number of unique beneficiaries[1]	—	—	5,474	—	—	14	—	33	—	—
Number of weighted beneficiaries	—	—	—	—	—	14	—	14	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

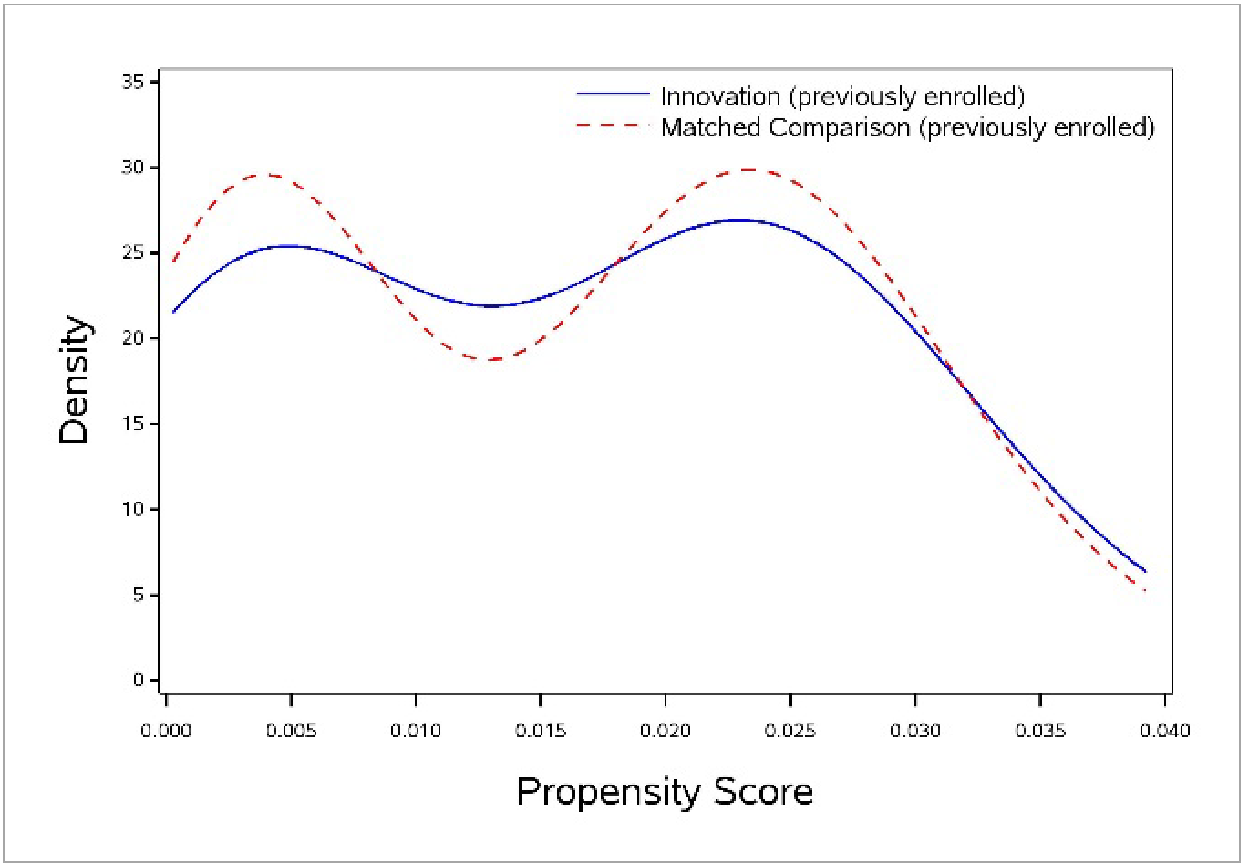
BAHC = Ben Archer Health Center; SD = standard deviation.

— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 16). The results in Table 16 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables in the group with previous Medicaid enrollment. There were only 14 innovation beneficiaries without Medicaid enrollment during the baseline period. These beneficiaries were matched using age and gender, and the standardized differences improved substantially after matching. With such a small sample and so few matching variables, achieving standardized differences ≤ 0.10 is unlikely.

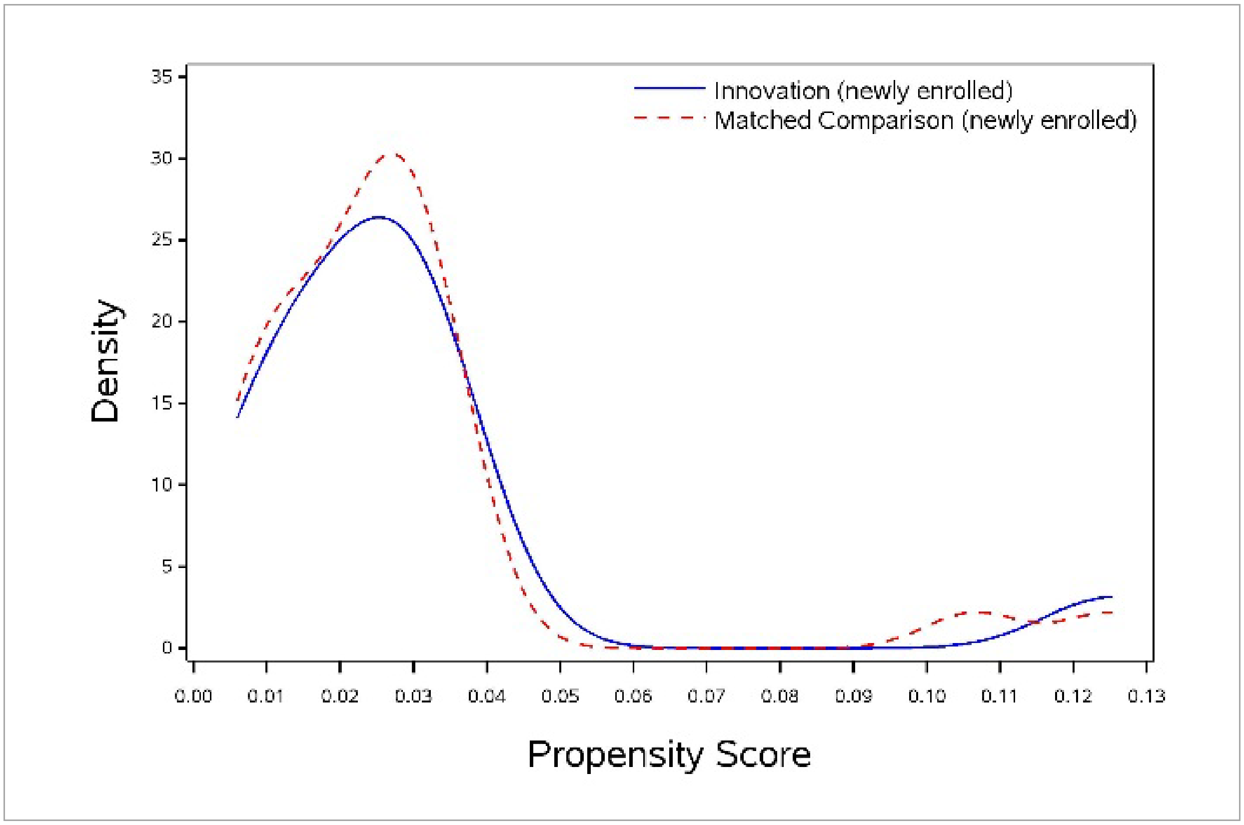
Figure 8 shows the distribution of the propensity scores for both the innovation and comparison groups. Significant overlap is seen in the distributions between the innovation and comparison groups, indicating that the propensity scores are similar across the groups.

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: BAHC



(continued)

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: BAHC (continued)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
BAHC = Ben Archer Health Center.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 17 reports Medicaid spending per patient in the eight quarters before and the five quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 9*** illustrates the Medicaid spending per beneficiary in Table 17 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

During the baseline and innovation periods, spending trends downward for the innovation and comparison groups. During both periods, the level of spending is similar in both groups, and has a high standard deviation due to the skewed spending and the small sample size.

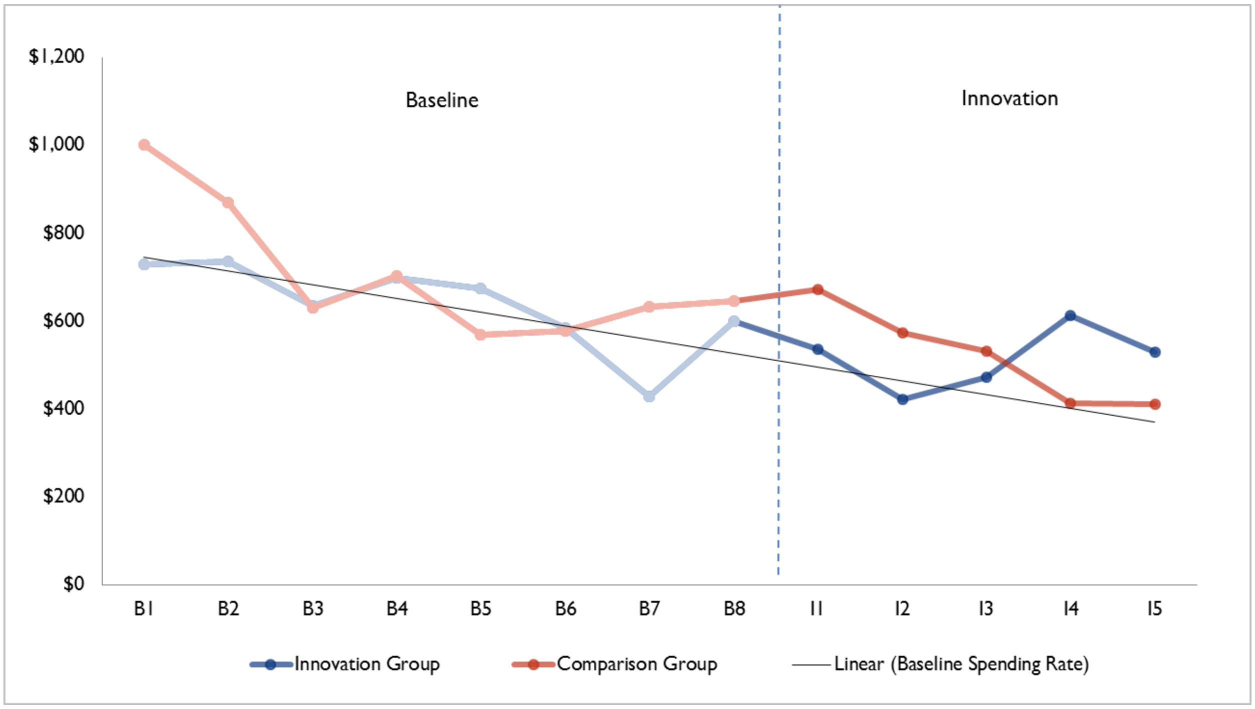
Table 17. Medicaid Spending per Participant: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Spending rate	$729	$736	$635	$698	$674	$583	$429	$599	$536	$421	$473	$613	$528
Std dev	$3,553	$3,590	$2,769	$3,351	$3,012	$2,677	$2,068	$2,603	$2,855	$2,308	$2,092	$2,802	$2,102
Unique patients	64	63	64	67	68	80	83	84	98	94	79	58	35
Comparison Group													
Spending rate	$1,001	$868	$631	$702	$568	$578	$632	$644	$671	$573	$532	$413	$410
Std dev	$3,286	$2,895	$2,044	$2,461	$2,236	$2,232	$2,246	$2,244	$2,196	$1,777	$1,672	$1,497	$1,271
Weighted patients	61	61	67	71	77	82	83	84	98	94	77	58	37
Savings per Patient													
	$272	$132	−$4	$4	−$106	−$6	$204	$45	$135	$151	$59	−$199	−$118

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; I1 = Innovation Q1.
.

Figure 9. Medicaid Spending per Participant: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
BAHC = Ben Archer Health Center.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, is –82 (90% CI: –206, 41), indicating savings. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison groups, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

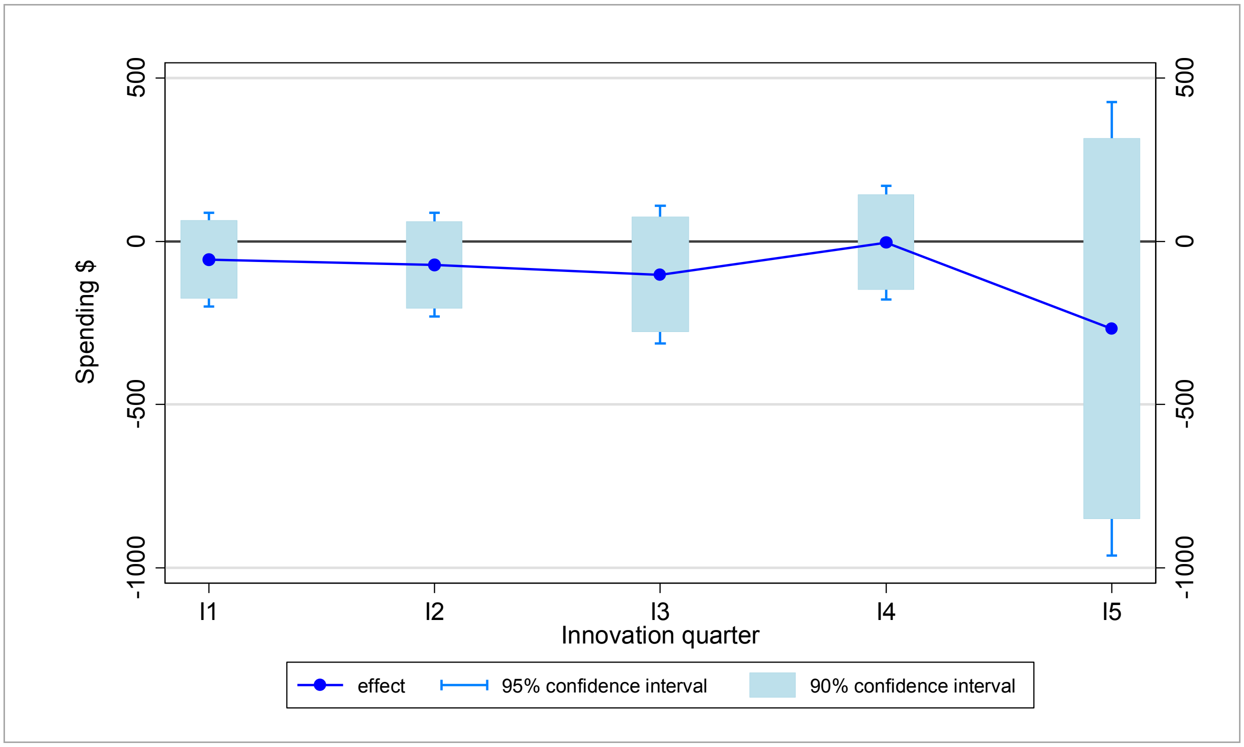
In addition to the average effect, we present quarterly effects. ***Table 18*** shows results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly difference-in-differences estimates. In all periods, the estimates are negative; however, no estimates are statistically significant.

Table 18. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	−56	73	0.440
I2	−72	81	0.378
I3	−102	108	0.344
I4	−4	89	0.968
I5	−268	355	0.450
Overall average	−82	75	0.273
Overall aggregate	−29,928	27,255	0.273
Overall aggregate (IY1)	−20,531	18,052	0.256
Overall aggregate (IY2)	−9,397	12,438	0.450

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, dual eligibility, and spending during the calendar quarter and year prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
BAHC = Ben Archer Health Center; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

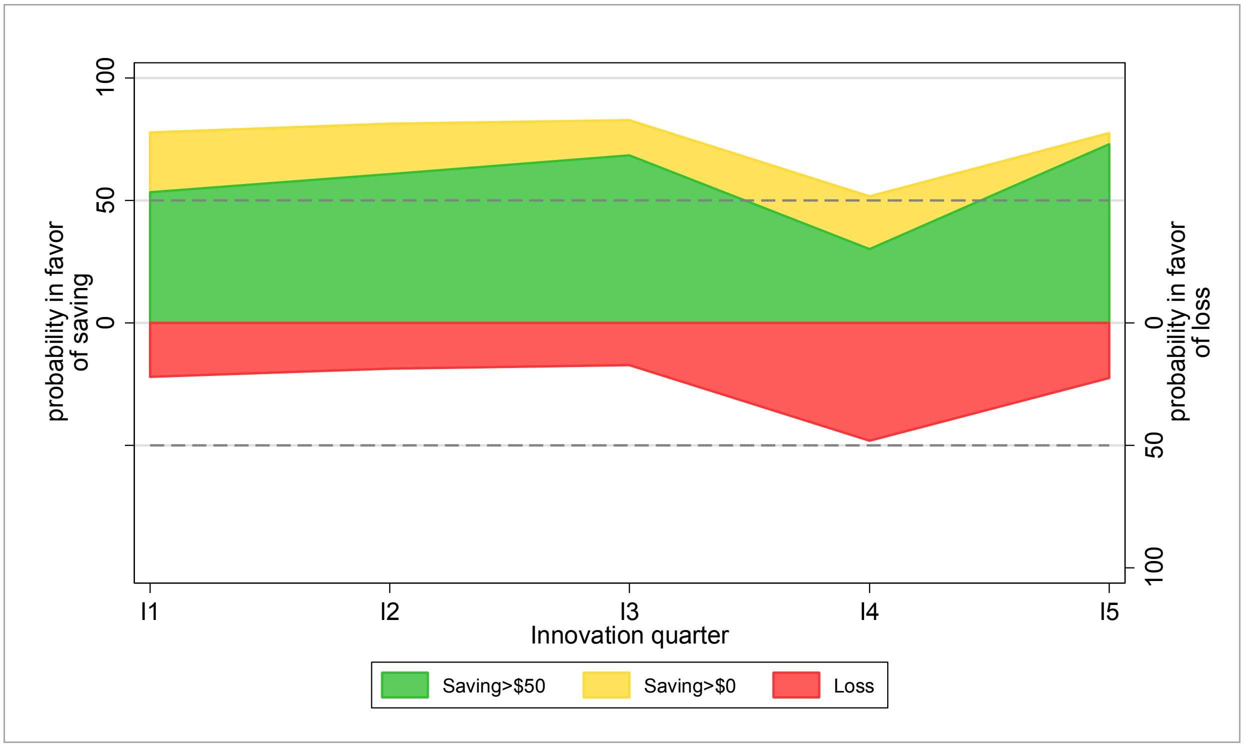
Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
BAHC = Ben Archer Health Center; OLS = ordinary least squares.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The quarterly evidence generally favors the innovation generating savings because the estimated regression coefficients are negative.

Figure 11. Quarterly Strength of Evidence in Favor of Savings/Loss: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
BAHC= Ben Archer Health Center.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 19*** and ***Figure 12***. Due to the small sample size, the inpatient admissions rate is highly variable in the comparison and innovation groups. With a small sample size and few inpatient admissions, no conclusions can be drawn about the innovation's impact on Medicaid beneficiaries. The number of observations was insufficient to support regression analyses of differences between the innovation and comparison groups.

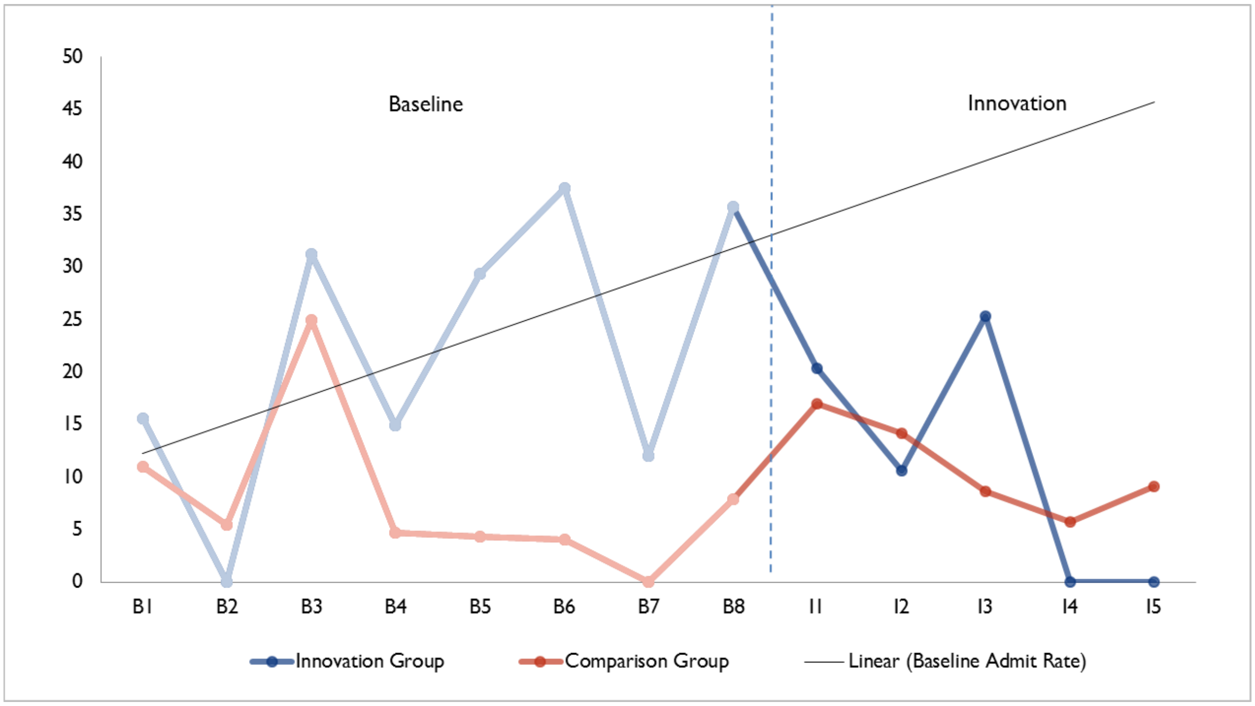
Table 19. All-Cause Inpatient Admissions Rate per 1,000 Participants: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Admit rate	16	0	31	15	29	38	12	36	20	11	25	0	0
Std dev	125	0	175	122	170	191	110	187	142	103	158	0	0
Unique patients	64	63	64	67	68	80	83	84	98	94	79	58	35
Comparison Group													
Admit rate	11	5	25	5	4	4	0	8	17	14	9	6	9
Std dev	61	43	92	40	39	38	0	52	77	71	55	45	57
Weighted patients	61	61	67	71	77	82	83	84	98	94	77	58	37
Innovation − Comparison Rate													
	5	−5	6	10	25	33	12	28	3	−4	17	−6	−9

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
BAHC = Ben Archer Health Center; B1 = Baseline Q1; I1 = Innovation Q1.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Participants: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
BAHC = Ben Archer Health Center.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 20 .*** The readmission rate is zero in every quarter for the innovation and comparison groups.

Table 20. Hospital Unplanned Readmissions Rates per 1,000 Admissions: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Readmit rate	0	0	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	0	0	0	0	0	0	0	0	0	0
Total admissions	1	0	1	0	1	2	1	2	2	0	2	0	0
Comparison Group													
Readmit rate	0	0	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	0	0	0	0	0	0	0	0	0	0
Total admissions	1	0	1	0	0	0	0	1	1	1	0	0	0
Innovation − Comparison Rate													
	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; I1 = Innovation Q1.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 21*** and ***Figure 13.*** During the baseline period, the ED visit rate is similar but highly variable in the innovation and comparison groups. The two groups have similar ED visit rates in I1 and I5, while the comparison group's ED visit rate is larger in I2, I3, and I4. The number of observations was insufficient to support regression analyses of differences between the innovation and comparison groups.

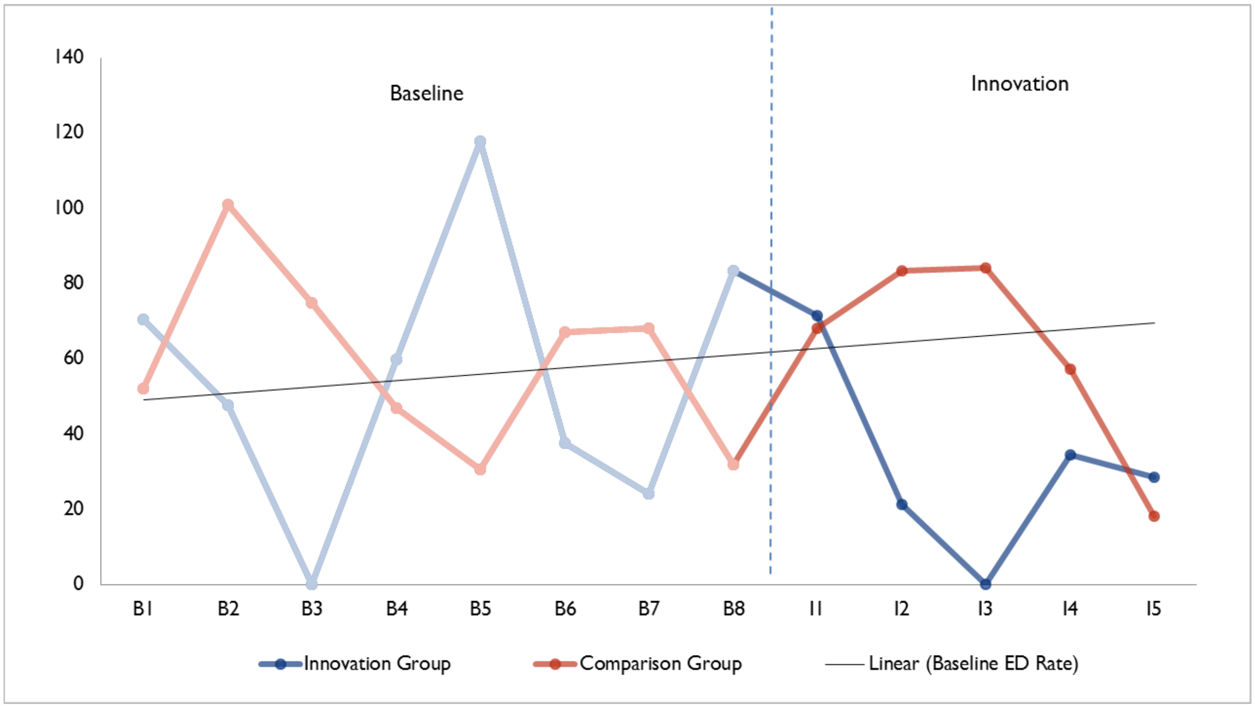
Table 21. ED Visits per 1,000 Participants: BAHC

Awardee Number: 1C1CMS331013
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
ED rate	70	48	0	60	118	38	24	83	71	21	0	34	29
Std dev	280	215	0	239	368	249	154	387	387	145	0	184	169
Unique patients	64	63	64	67	68	80	83	84	98	94	79	58	35
Comparison Group													
ED rate	52	101	75	47	31	67	68	32	68	83	84	57	18
Std dev	180	215	176	169	116	174	197	103	242	220	203	189	81
Weighted patients	61	61	67	71	77	82	83	84	98	94	77	58	37
Innovation − Comparison Rate													
	18	−53	−75	13	87	−29	−44	52	3	−62	−84	−23	10

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; BAHC = Ben Archer Health Center; ED = emergency department; I1 = Innovation Q1.

Figure 13. ED Visits per 1,000 Participants: BAHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
BAHC = Ben Archer Health Center; ED = emergency department.

2.14 Discussion: Medicaid Results

The number of Medicaid enrollees is not large enough to draw firm conclusions about the innovation's impact on the spending, inpatient visits, unplanned readmissions, and ED visits of Medicaid beneficiaries. The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 16 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

BAHC submitted data to RTI that are current through June 2015. ***Table 22*** lists the awardee-specific outcome measures selected for the innovation's evaluation, with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for all of these measures are included in this annual report.

Table 22. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Diabetes	Percentage of patients with diabetes who received an eye screening for diabetic retinal disease	Data received	Yes
		Percentage of patients with diabetes who received a foot exam	Data received	Yes
		Percentage of individuals with diabetes who had an HbA1c test	Data received	Yes
	Vaccination	Percentage of patients who received an influenza immunization	Data received	Yes
		Percentage of patients who received a pneumococcal vaccination	Data received	Yes
Health outcomes	Diabetes	Percentage of patients with diabetes who had HbA1c > 9.0%	Data received	Yes
		Percentage of patients with diabetes with LDL-C < 100 mg/dL	Data received	Yes
	Hypertension	Percentage of patients with a diagnosis of hypertension with last blood pressure reading < 140/90 mm Hg	Data received	Yes

LDL-C = low-density lipoprotein cholesterol.

Clinical effectiveness refers to the extent to which patients with certain health conditions are provided with appropriate clinical care. Clinical effectiveness measures for BAHC include the percentage of patients with diabetes who received an HbA1c test, an LDL-C test, eye exam, and/or foot exam; the percentage of patients with hypertension who received a blood pressure reading; and the percentage of all patients who received an influenza and/or pneumococcal vaccination. The following subsections describe the results of each of these measures.

We examined health outcomes among patients with diabetes and hypertension using run charts that take into account rolling enrollment. The innovation quarters (Is) are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation will have health outcome data in more innovation quarters over time than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tends to drop substantially as the number of quarters enrolled increases. We provide data when at least 20 patients had a test or reading within the innovation quarter.

We also conducted multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time, while controlling for repeated measures (i.e., within-subject covariance). More specifically, HbA1c and LDL-C values among those with diabetes, and systolic and diastolic blood pressure values among those with hypertension, were regressed onto dose (i.e., number of primary care visits and number of intensive case management visits). We controlled for the baseline health outcome being examined in the regression (i.e., HbA1c, LDL-C, or blood pressure at innovation enrollment), age, sex, race, and insurance type. Changes during the innovation for each health outcome measure were examined in separate regression analyses and are presented in the subsections below.

2.16 Diabetes

We received data on whether patients with diabetes received a foot exam, an eye exam, an HbA1c test, or an LDL-C test. This allowed us to examine whether appropriate clinical services were provided to those with diabetes during the innovation.

Evaluation Questions

- What percentage of patients with diabetes received a foot exam during the innovation period?
- What percentage of patients with diabetes received an eye exam during the innovation period?
- What percentage of patients with diabetes received an HbA1c test during the innovation period?
- What percentage of patients with diabetes received an LDL-C test during the innovation period?

We received outcome data for HbA1c and LDL-C among those with diabetes, which allowed us to address whether the percentage of patients with poor HbA1c control decreased and whether the percentage of patients with LDL-C control increased among those with diabetes during the innovation.

Evaluation Questions

- Has the percentage of patients with diabetes with poor HbA1c control decreased over time?
- Has the percentage of patients with diabetes with LDL-C control increased over time?

2.16.1 Descriptive Results

Table 23 shows the percentage of patients who received clinical services. As shown in the table, the majority of patients with diabetes (91.7%) received a foot exam or HbA1c test (95.2%), more than two-thirds (69.3%) received an LDL-C test, and nearly two-thirds (65.5%) received an eye exam.

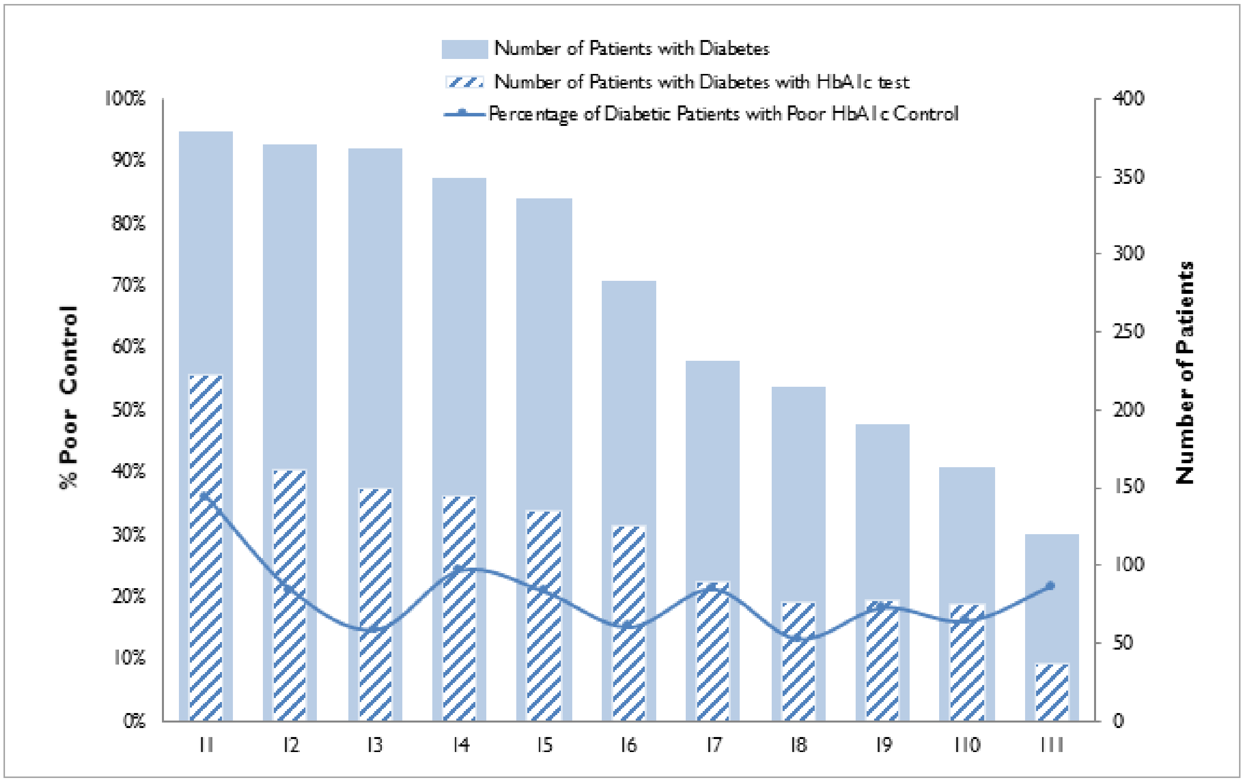
Table 23. Percentage of Patients with Diabetes Who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Diabetes (n=374)	
Percentage of patients with diabetes who received a foot exam	91.7
Percentage of patients with diabetes who received an eye exam	65.5
Percentage of patients with diabetes who received an HbA1c test	95.2
Percentage of patients with diabetes who received an LDL-C test	69.3

Source: Patient-level data provided to RTI by BAHC.
LDL-C = low-density lipoprotein cholesterol.

About 62 percent of patients enrolled in the innovation have diabetes. ***Figure 14*** presents the percentage of patients with diabetes with an HbA1c test indicating poor control (i.e., HbA1c > 9%) over time. The denominator represents the number of diabetes patients who received an HbA1c test for each quarter. The numerator represents the number who received an HbA1c test with a result of > 9.0 percent. As shown, the percentage of patients with poor HbA1c control fluctuated, but in general decreased over time. More specifically, the percentage of patients with poor HbA1c control decreased from 35.9 percent in I1 to 21.6 percent in I11; it is also important to note the sharp decrease from I1 (35.9%) to I3 (14.7%). That is, the percentage of those with poor HbA1c control dropped 21 points among those enrolled in the innovation for at least three quarters. This finding suggests that the innovation may have been effective in reducing the percentage of patients with poor HbA1c control over time. However, the decrease in the denominator over time limits our ability to make strong conclusions.

Figure 14. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



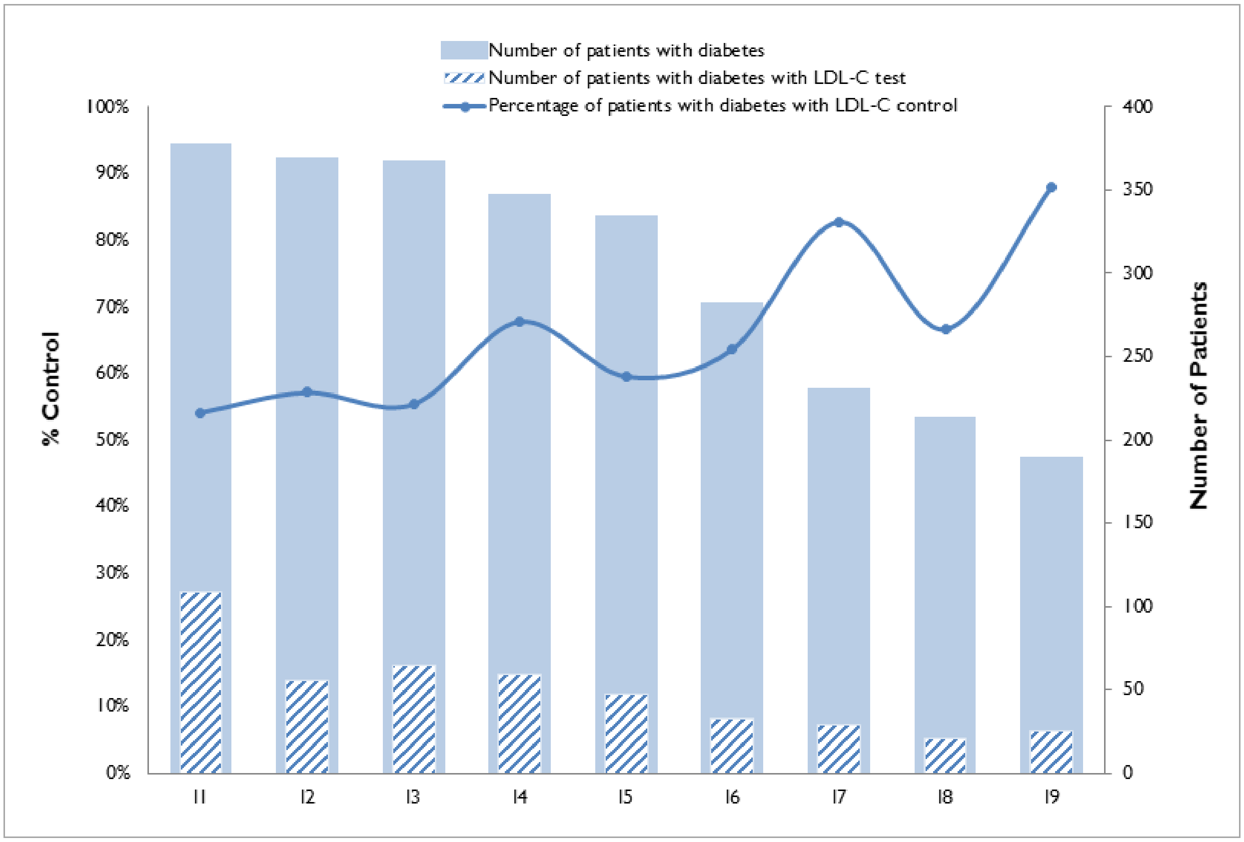
	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
●	Percentage of diabetic patients with poor HbA1c control	35.9	21.0	14.7	24.1	20.7	14.4	21.1	13.2	18.2	16.0	21.6
	Number of patients with diabetes	374	364	362	342	329	277	225	208	184	157	114
	Number of patients with diabetes with HbA1c test	223	162	150	145	135	125	90	76	77	75	37
	Percentage of patients with diabetes with an HbA1c test	59.6	44.5	41.4	42.4	41.0	45.1	40.0	36.5	41.8	47.8	32.5

Source: Patient-level data provided to RTI by BAHC.

Figure 15 presents the percentage of patients with diabetes who had an LDL-C test indicating good control (i.e., < 100 mg/dL) over time. The denominator represents the number of patients with diabetes who received an LDL-C test for each quarter. The numerator represents the number of patients with diabetes who received an LDL-C test with a result of < 100 mg/dL.

As shown, the percentage of patients with LDL-C control fluctuated, but in general increased over time. More specifically, the percentage of patients with good LDL-C control substantially increased from 54.1 percent in I1 to 88 percent in I9. This finding suggests that the innovation may have been effective in increasing the percentage of patients with LDL-C control over time. However, similar to the findings for HbA1c control noted above, the decrease in the denominator over time limits our ability to make strong conclusions.

Figure 15. Percentage of Patients with Diabetes with LDL-C Control over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9
●	Percentage of patients with diabetes with LDL-C control	54.1	57.1	55.4	67.8	59.6	63.6	82.8	66.7	88.0
	Number of patients with diabetes	374	364	362	342	329	277	225	208	184
	Number of patients with diabetes with LDL-C test	109	56	65	59	47	33	29	21	25
	Percentage of patients with diabetes with an LDL-C test	29.1	15.4	18.0	17.3	14.3	11.9	12.9	10.1	13.6

Source: Patient-level data provided to RTI by BAHC.
LDL-C = low-density lipoprotein cholesterol.

2.16.2 Regression Results

GEEs assessing the impact of dose on HbA1c and LDL-C values over time among those with diabetes were also conducted. No statistically significant effects were evident for either of the dose variables and HbA1c or LDL-C values.

2.17 Hypertension

BAHC provided data on whether patients with hypertension received a blood pressure reading, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation. We used the blood pressure values from BAHC to calculate the percentage of patients with hypertension with blood pressure control (i.e., < 140/90 mm Hg).

Evaluation Questions

- What percentage of patients with hypertension received a blood pressure reading during the innovation period?
- Has the percentage of patients with hypertension with blood pressure control increased over time?

2.17.1 Descriptive Results

Nearly all patients with hypertension (99.1%) had blood pressure readings conducted at least once during the innovation period (***Table 24***).

Table 24. Percentage of Patients with Hypertension Who Received Clinical Services

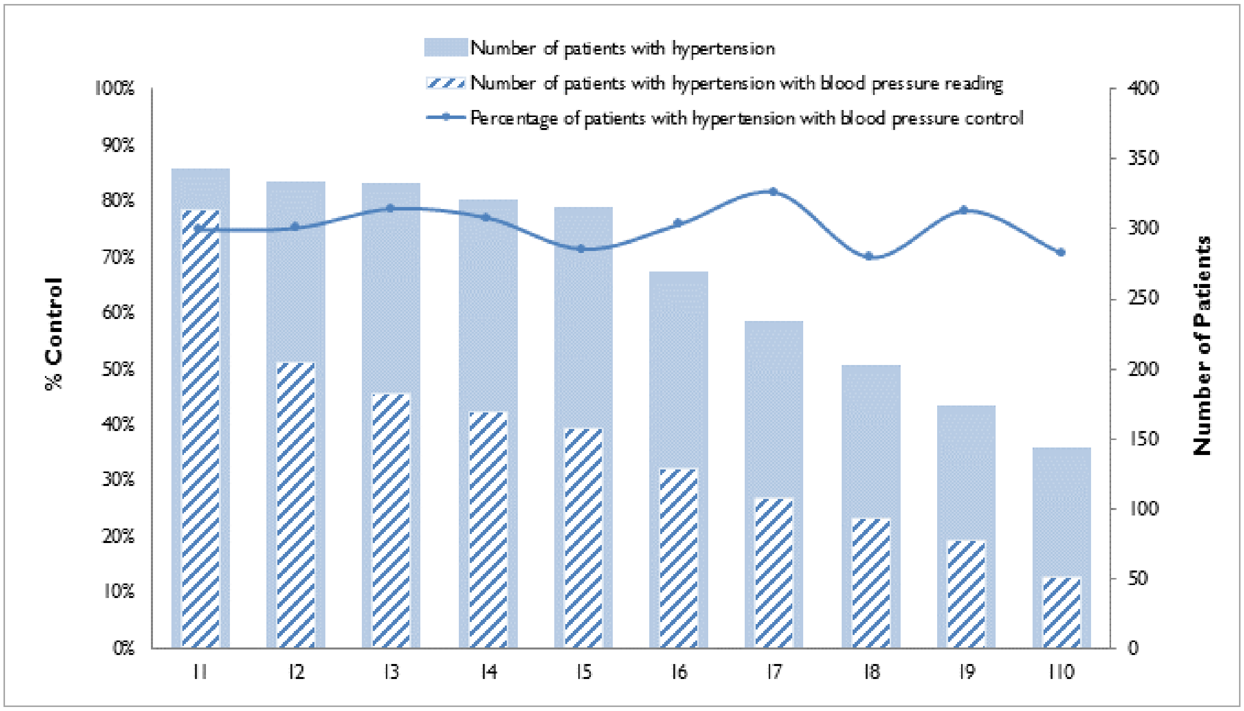
Measure	Percentage of Patients Receiving Clinical Services
Hypertension (n=343)	
Percentage of patients with hypertension who received a blood pressure reading	99.1

Source: Patient-level data provided to RTI by BAHC.

About 57 percent of enrolled patients had hypertension. ***Figure 16*** presents the percentage of patients with hypertension who had a blood pressure reading indicating good control (i.e., < 140/90 mm Hg) over time. The denominator represents the number of hypertension patients who received a blood pressure reading for each quarter. The numerator represents the number of hypertension patients who received a blood pressure reading that was <140/90 mm Hg.

As shown in the figure, 68.9 percent of patients with hypertension had blood pressure control in I11, and the percentage of patients with blood pressure control remained relatively consistent over time.

Figure 16. Percentage of Patients with Hypertension with Blood Pressure Control over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
●	Percentage of patients with hypertension with blood pressure control	74.8	75.1	78.3	77.1	70.4	74.3	82.6	68.6	77.0	69.9	68.9
	Number of patients with hypertension	343	329	328	316	311	264	228	197	168	138	77
	Number of patients with hypertension with blood pressure reading	314	205	184	170	179	140	115	105	87	83	45
	Percentage of patients with hypertension with a blood pressure reading	91.5	62.3	56.1	53.8	57.6	53.0	50.4	53.3	51.8	60.1	58.4

Source: Patient-level data provided to RTI by BAHC.

2.17.2 Regression Results

Table 25 shows results from the GEE assessing the impact of dose on systolic and diastolic blood pressure values over time among those with hypertension. The number of primary care visits for patients with hypertension ranged from 0 to 19, with an average of approximately 1 per quarter. Similar to the findings for those with diabetes, no statistically significant effects were evident for either of the dose variables among those with hypertension for systolic blood pressure. However, there was a significant effect showing a positive relationship between intensive case management visits and diastolic blood pressure values. This finding suggests that a greater number of intensive case management visits was associated with higher diastolic blood pressure values over time.

Table 25. Impact of Dose Quarter on Systolic Blood Pressure Values among Those with Hypertension over Time

Predictor	Coefficient	Standard Error	P-Value
Systolic blood pressure			
Primary care visits	0.49	0.46	0.29
Intensive case management visits	0.24	0.24	0.33
Diastolic blood pressure			
Primary care visits	−0.09	0.28	0.74
Intensive case management visits	0.49	0.15	0.00

Source: Patient-level data provided to RTI by BAHC.

2.18 Immunization and Vaccination

We also received data from BAHC on whether patients received an influenza immunization or pneumococcal vaccination.

Evaluation Questions

- What percentage of patients received an influenza immunization during the innovation period?
- What percentage of patients received a pneumococcal vaccination during the innovation period?

2.18.1 Descriptive Results

As shown in ***Table 26***, most patients (92.3%) received an influenza immunization, and nearly two-thirds (65.1%) of those 65 and older received a pneumococcal vaccination during the innovation.

Table 26. Percentage of Patients Who Received Immunizations and Vaccinations

Measure	Percentage of Patients Receiving Clinical Services
Immunizations and Vaccinations	
Percentage of patients who received an influenza immunization	92.3
Percentage of patients age 65 or older who received a pneumococcal vaccination	65.1

Source: Patient-level data provided to RTI by BAHC.

2.19 Discussion: Awardee-Specific Data

Overall, BAHC provided enrollees who had diabetes and hypertension (approximately 90% of the enrollees) with necessary clinical services. Most patients with diabetes had an eye exam, a foot exam, an HbA1c test, or an LDL-C test. All patients with hypertension received a blood pressure screening. Most patients received a flu or pneumonia vaccination.

Based on the run charts, the percentage of diabetes patients with poor HbA1c control decreased over time, and the percentage with LDL-C control increased over time. Thus, the innovation seems to have been effective in improving HbA1c and LDL-C among patients with diabetes. However, as noted above, conclusions should be drawn with caution, as the denominators decreased substantially over time among those with diabetes who received HbA1c and LDL-C tests. The innovation could indeed have had a positive impact on health outcomes—or less-controlled patients may have dropped out of the innovation or failed to have an Hb1Ac or LDL-C reading in later quarters, leaving a greater proportion of patients with HbA1c and LDL-C control in the sample. The number of primary care visits and intensive case management visits were not related to HbA1c or LDL-C values among those with diabetes.

The findings for blood pressure control among patients with hypertension revealed little change over time. The regression findings show that the increased number of intensive case management visits was related to higher diastolic blood pressure values over time, suggesting that those who had difficulty reducing their blood pressure received a greater number of visits. The number of intensive case management visits was not related to systolic blood pressure values over time.

2.20 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 27*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from BAHC's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12, and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 27. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participants eligible for services	Data received from BAHC
		Number/percentage of participants in the intensive case management component	Data received from BAHC
	Dose	Number of intensive case management home visits completed	Data received from BAHC

BAHC = Ben Archer Health Center; FTE = full-time equivalent; Q = quarter.

2.21 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.21.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed with 7.5 full-time equivalent (FTE) staff members. BAHC onboarded 4.5 FTE staff during Year 1 of implementation, and used HCIA funds to support the remaining 3.0 FTE staff from its existing pool of CHWs and nurses. Between Q11 (June 2014) and Q12, BAHC retained its staff, which included five CHWs, two NHEs, and two managerial/administrative staff.

Project leaders reported that hiring suitable CHWs was key to the innovation's effectiveness. BAHC succeeded in recruiting staff, but sometimes had difficulty in identifying qualified job candidates from the small, rural community that it served. BAHC sought qualified candidates from outside the area, finding it necessary to search beyond the local community to find bilingual nurses; however, problems with patient rapport were introduced. NHEs from outside the community successfully connected with participants only after CHWs vouched for them. Project leaders described how local CHWs were essential for building patient trust and understanding the context of care. Community members knew the local CHWs, and CHWs were embedded in community life.

Throughout the innovation, BAHC helped ensure consistent staffing by filling vacancies with experienced CHWs from within the BAHC organization. As the EOY interviewees explained in June 2015, the innovation had a strong rate of CHW retention because CHWs were part of and committed to the communities they served. In many cases, CHWs were informal caregivers and community leaders before they joined the innovation team.

2.21.2 Skills, Knowledge, and Training

Between Q11 and Q12, BAHC provided 84 hours of training to 13 unduplicated individuals (***Table 28***). During this time, CHWs attended "Stepping Up" training, and administrative staff participated in "Your Heart of Hope" training and the Southern New Mexico Promotora Committee.

Table 28. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	84	13
Since inception	1,576	413

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

BAHC offered 1,520 hours of training throughout implementation; much of this training was delivered to CHWs. Some CHWs began the project with many years of experience, while others were new to care coordination. Project leaders identified training CHWs as essential for preparing newly hired staff to deliver health education and offer case management services in the home. Training may have been less important for staff members who had been CHWs in the target community for many years, especially because CHWs commonly worked alongside NHEs and could turn to the nurses for support. BAHC also offered training beyond its original projections to help ensure that staff were prepared to help patients with chronic conditions.

CHW trainings generally covered information on specific health conditions (e.g., diabetes, asthma), promotion of healthy behaviors, patient safety, project tasks, and behavioral health. A project leader characterized training as need-based and ongoing, although CHWs said that most training occurred annually. CHWs described the trainings as helpful for identifying and solving problems, gathering up-to-date health information, and learning about their role in care. During the first site visit, CHWs suggested the need for additional training on mental health, heart health, smoking, and drinking. Since that time, evaluation data provided by BAHC suggest that CHWs received dedicated training on heart health and smoking, but not on the behavioral health issues that they stressed were a significant challenge in the target population.

Project leaders anticipate that the knowledge and skills that CHWs gained through HCIA-supported training will continue to benefit the community, as CHWs offer ongoing services independent of the innovation.

2.22 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

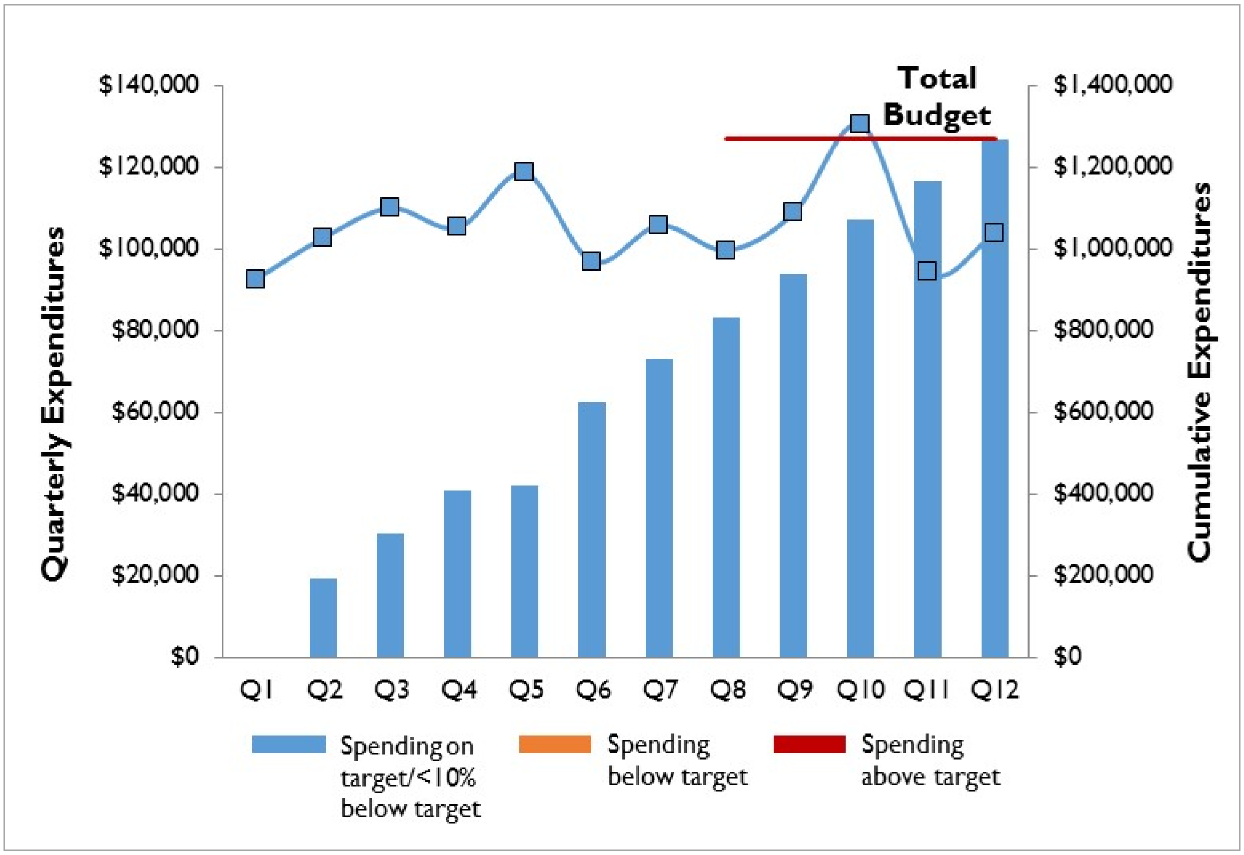
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?
- How has the awardee facilitated innovation adoption and workflow integration?

2.22.1 Award Execution

The annual report highlights the significance of BAHC's expenditure rates on implementation. As of June 2015 (Q12), BAHC spent 100 percent of its total budget. ***Figure 17*** shows that BAHC consistently spent at the projected rate throughout implementation.

Figure 17. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.22.2 Leadership

BAHC maintained leadership involvement in the innovation since program launch, and reported no changes to the core innovation team since beginning implementation. BAHC's leadership reported strong investment in the CHW model that they used and advocated since 1992. BAHC's leadership team is small and members share a common vision for serving the target communities.

Information gathered prior to Q11 suggests that the operations manager participated in monthly project management calls, submitted quarterly invoices, and reviewed financial statements. BAHC leadership provided resources to upgrade an existing database, maintain company cars, and procure computers for CHWs. In Q11 and Q12, BAHC reported that the project director also facilitated performance improvement by monitoring cost, patient safety, and patient wait times, and by promoting evidence-based medical practices.

2.22.3 Organizational Capacity

BAHC has over 20 years of experience employing CHWs and conducting program-related outreach to northern Doña Ana County. As reported in the 2015 annual report, HCIA did not require many new resources, as BAHC already had the necessary personnel and infrastructure—e.g., electronic health record (EHR) system, technical support, and staff (existing CHWs)—in place to implement the innovation. The Centers for Medicare & Medicaid Innovation (CMMI) funding enabled BAHC to expand its community- and home-based services to community members with the highest need for care and augment training opportunities for their CHWs.

Project data collection was one of the most significant challenges that BAHC faced throughout implementation. As reported in the 2014 and 2015 annual reports, BAHC began its innovation with no data collection processes and measures in place. Innovation staff travelling to patients' homes had to collect data on paper, then enter it into a patient registry, and finally transfer it to an EHR. One CHW remarked, *"Documentation can take up your day."* BAHC worked with CMMI and resolved most of the data collection problems during the first 2 years of implementation. During the final quarter of the innovation, staff closely reviewed and addressed remaining gaps in project data. Looking back on the implementation process, project leaders reported that one important lesson learned from their operational experience with HCIA is that organizations should establish plans for capturing and monitoring required data elements prior to offering patient services.

2.22.4 Innovation Adoption and Workflow Integration

BAHC employed CHWs prior to the launch of the innovation; however, CHWs historically had little interaction with clinical staff, except when making a referral. HCIA facilitated the integration of CHWs into the medical team by increasing their involvement in the clinic and creating more opportunities for interaction between CHWs and clinical staff. Clinical training and interaction with clinicians improved the ability of CHWs to understand and address medical concerns, and the integral role of CHWs in the community and their familiarity with patients' contextual circumstances increased clinicians' access to patients and knowledge of potential challenges to care.

Relationships between CHWs and NHEs strengthened as they worked together to address health problems in the field, and each group gained increasing appreciation for the unique contributions of the other group. NHEs reported that they were initially unsure about the contributions of CHWs, but ultimately realized that CHWs were essential for reaching patients. One NHE commented,

> ***"At first, I didn't see their [CHWs] point in coming to home visits, but now I see them as keys coming into the door."***

Likewise, CHWs noted that, through their vital collaboration with NHEs, they increased their capacity to communicate about and serve patients: *"If we don't have answers for patients, we can ask the nurse. I like that open communication. The nice thing is she's aware of all the patients we're working with, knows who we are talking about and we don't have to explain whole situation."*

CHWs also perceived that NHEs helped patients with acute needs to access primary care more quickly. Nurses expedited clinical appointments for patients that the nurses themselves or CHWs identified as having a need for urgent medical care. Because nurses helped patients access care more quickly than otherwise possible, patients were diverted from visiting the ED for nonemergent issues.

BAHC's innovation also improved relationships among physicians, CHWs, and NHEs. At launch of the innovation, CHWs characterized providers as reluctant to work with them, *"One provider doesn't see point of why we are here, why we are doing this, and why we are going to their homes to see their patients?"* The innovation changed this dynamic as providers witnessed how CHWs and NHEs brought new patients into the clinic and effectively managed chronic conditions. A physician explained, *"I'm seeing patients more often. I may be working more, but it's not bad because I stay on top of things… The CHWs help prevent deterioration from becoming an inpatient matter."* A nurse practitioner agreed, elaborating, *"I see a lot of new patients or patients I haven't seen in a couple of years that need help. I see them less in acute states; they [CHWs] prevent them from needing hospitalization."* Project leaders reported that CHWs, NHEs, and providers ended the project with strengthened relationships and mutual respect for one another's contributions to patient care.

2.23 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

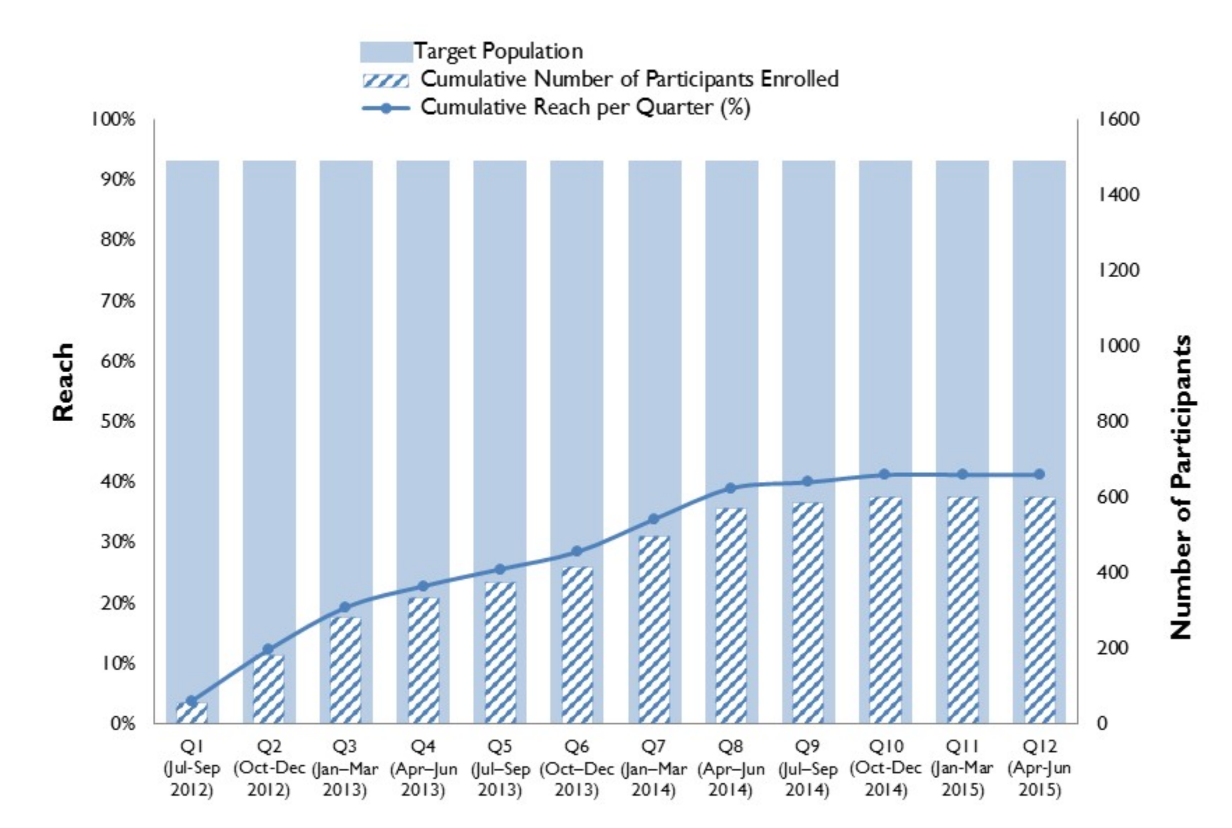
Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.23.1 Innovation Reach

Figure 18 shows reach by quarter since the launch of the innovation. We last reported reach in the 2015 annual report, based on data through Q11. BAHC did not enroll any new patients in the innovation in Q12; thus, reach remains at 41.4 percent.

Figure 18. Participant Enrollment and Reach for Each Quarter since Project Launch



Quarter	Q1 (Jul-Sep 2012)	Q2 (Oct-Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct-Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)
Cumulative reach per quarter	3.8	12.3	19.2	22.7	25.5	28.4	33.8	38.9	39.9	41.1	41.1	41.1
Target population	1,461	1,461	1,461	1,461	1,461	1,461	1,461	1,461	1,461	1,461	1,461	1,461
Cumulative number of participants enrolled	55	179	281	332	373	415	494	569	583	601	601	601

Source: Patient-level data provided to RTI by BAHC.

The number of participants BAHC reported in Q12 (4,735) includes those enrolled in the intensive case management and preventive care services components of the innovation. However, BAHC did not collect data on the preventive services participants. During RTI's June 2014 site visit, we learned that CHWs could not systematically collect data at community events (e.g., large-scale immunization campaigns, health fairs) and load it into BAHC's EHR while also managing their caseloads. Therefore, RTI can only report the number of participants receiving intensive case management. In Q8, RTI worked with BAHC and revised the target population count from 4,656 (both intensive case management and preventive care service) to 1,461 (intensive case management only). Remarks by project leaders in EOY interviews and BAHC's final progress report indicate that BAHC believes it met enrollment targets, despite the difference in target population count.

A June 2014 site visit interviewee said recruitment was challenging for BAHC. Although BAHC used CHWs in the target community for many years, clinics were not uniformly established across the areas targeted for the innovation. For instance, a project leader identified Radium Springs as one of BAHC's newer sites, and said newly hired CHWs went door-to-door to build relationships with local residents. CHWs' presence helped build rapport with community members, but did not always help the innovation team identify suitable candidates for intensive case management services. A project leader said that CHWs gradually learned to target specific community locations that individuals eligible for the innovation frequently visited, such as commodity and food distribution centers. Project leaders perceived that recruitment became easier over time.

BAHC suggested that the innovation may have been more effective if the types of patients enrolled in intensive case management were selected more carefully. For instance, they could have asked interested patients to complete a readiness for change assessment before enrollment to help ensure that participants were willing to make the lifestyle changes necessary for them to effectively manage their health conditions. Both EOY interviewees also suggested that enrolling both high- and moderate-risk patients may have been a better strategy for demonstrating the program's effectiveness than focusing on high-risk patients exclusively. In Q11 and Q12, project leaders added that alternative approaches might have included increasing involvement of licensed medical staff when treating high-risk patients or discontinuing services to patients who failed to demonstrate behavior change.

BAHC ended Q12 with seven total CHWs and NHEs. If they had met their reach target for the intensive case management component of the innovation, each staff member would have had an average of 200 patients. The actual average caseload based on a total of 601 enrollees was closer to 86 patients. Given that outpatient case management caseloads typically vary between 10:1 and 50:1[2], BAHC's goal of enrolling 1,461 patients in the innovation may have been unrealistic (given the amount of staff enlisted).

2.23.2 Innovation Dose

Table 29 provides the number of services provided across participants, the number of participants receiving services, and the average number of services per participant through Q12. We last reported dose in the 2015 annual report, based on data through Q11. As expected, the number of services provided and the percentage of participants receiving those services increased between Q11 and Q12. As shown in the table, 92 percent of participants received an average of approximately 5 primary care visits, and nearly 92 percent received an average of approximately 10 intensive case management home visits (versus 90.5% and 88.4%, respectively, in Q11). The number of intensive case management home visits reported exceeds BAHC's goal of 5,000 visits across the project.

[2] Case Management Society of America (CMSA) and National Association of Social Workers (NASW). Public Version Case Management Caseload Concept Paper: Proceedings of the Caseload Work Group, a Joint Collaboration of CMSA and NASW. 2008. Retrieved from https://www.socialworkers.org/practice/aging/Caseload%20Concept%20Paper%20final.pdf

Table 29. Number and Types of Services Provided to Participants

Services	Number of Services Provided Across Participants	Number (Percentage) of Participants Receiving Services	Average Number of Services per Participant
Case Management Visits			
Primary care visits	2,866	553 (92.0)	5.2
Intensive case management home visits	5,753	552 (91.9)	10.4

Source: Patient-level data provided to RTI by BAHC.

The complex social and medical needs of the rural and elderly populations receiving intensive case management services required significant resources and time to manage appropriately. Targeting the highest-risk patients required that BAHC address fundamental social needs (e.g., running water) before helping patients manage their medical conditions and comorbidities. The complexity of services required lengthy interventions, and many patients may have been at such high risk that their conditions could not be improved during the evaluation period. As a project leader explained, BAHC managed workload by limiting the number of services delivered to any single participant*: "We had to establish boundaries for our staff to not go beyond what we are there to do. We need to say we are not going to work on every socioeconomic factor that affects the patient."*

In Q11, BAHC reported that interactions between staff and patients culminated in strong relationships that both staff; patients said they will miss the project when it ends and home visits can no longer be sustained. During the final quarters of the innovation, project leaders worked to gradually wean patients from the intensive case management and home-based services so that patients left the innovation independent enough to manage their own care.

BAHC reported that one lesson learned from implementing the innovation is that supportive, extended relationships between patients and caregivers enable patients to make lasting changes to their health. Less intensive health education, BAHC contended, rarely motivates patients to initiate change or sustain healthy behavior.

2.24 Qualitative Findings: Sustainability

BAHC ultimately hoped to sustain innovation services using a three-part strategy: (1) continuous performance improvement, including efforts to reduce costs; (2) securing additional funding to support service delivery from private foundations, CMS, and New Mexico's Medicaid program; and (3) further promoting BAHC's vision and mission, which could inspire additional funders to support innovation activities—perhaps through donations. For BAHC, this innovation was part of a larger effort to create self-sustaining patient-centered care systems to help patients access continuous, comprehensive, and coordinated care.

BAHC also intended to continue advocating for CHW services in the policy sphere. For instance, BAHC supported a recent New Mexico bill that creates a process for CHW certification, a step toward reimbursement for CHW services. Given that BAHC intends to continue employing CHWs beyond the project period, reimbursement is key to the sustainability of their model of care.

Currently without additional funding, BAHC reported some short-term strategies for sustaining innovation staff and activities. For example, patient health education will continue, but it will occur in the clinic rather than through home visits, and may be offered in a classroom setting rather than one-on-one. BAHC will also continue to offer CHW services that are reimbursable under existing payment models (e.g., vaccination, diabetes management), while reducing the frequency of nonreimbursable home- and community-based services. All staff hired for this project will be retained within the BAHC clinical system, in the hope that the training and skills they acquired through HCIA will enhance organizational capabilities.

By Q12, staff transitioned all patients out of the intensive case management component and developed individual plans to help patients care for themselves. Patients received a summary of all information provided throughout the innovation, along with the health goals they identified, additional health education materials, and a list of phone numbers to help them access local health care services.

2.25 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing BAHC as well as accomplishments to date. In this section we assess BAHC's progress on achieving HCIA goals to date:

- **Smarter spending.** Medicare beneficiaries who participated in the innovation had higher spending than the comparison group during the first year of the innovation. Spending was no different between the innovation and comparison groups overall and during Years 2 and 3. The increase in spending during Year 1 could be attributed to CHWs connecting beneficiaries to care. In the long run, spending may decrease if innovation participants improve their preventive care and chronic conditions management. The number of Medicaid participants included in the analysis was too small (n=98) to be able to draw conclusions regarding the innovation's impact on Medicaid spending.

- **Better care.** Medicare beneficiaries enrolled in the innovation had higher rates of inpatient stays overall and during the first and third years of the innovation. This result is not unexpected as the innovation served an elderly population with many patients who had not previously been in care for an extended period of time. The increase in inpatient admissions could reflect patients who accessed appropriate care for chronic conditions. ED visits were lower among the innovation group overall and during Years 1 and 3. possibly because the CHWs helped patients address health problems before they became emergencies.The innovation did not have a detectable impact on unplanned readmissions. The number of Medicaid participants included in the analysis was too small to draw conclusions about the innovation's impact on utilization of care among Medicaid beneficiaries.

  A total of 601 patients were enrolled in the intensive case management component through Q12, approximately 41 percent of the target population identified. RTI's evaluation team regards the number of patients targeted for intensive case management as excessively high in light of innovation staffing, suggesting that the reach calculated for this report may misrepresent BAHC's implementation effectiveness.

BAHC provided primary care visits to approximately 92 percent and intensive case management home visits to 91.8 percent of patients enrolled in the innovation. In addition, BAHC provided influenza immunizations to 92.3 percent and pneumococcal immunizations to approximately 62 percent of patients enrolled in the innovation.

Among those with diabetes, approximately 92 percent received an eye exam, approximately 95 percent received an HbA1c test, and more than two-thirds received an LDL-C test or a foot exam.

Among those with hypertension, nearly 100 percent had their blood pressure measured at least once during the innovation period.

- **Healthier people**. Based on the run charts, the innovation seemed to improve HbA1c and LDL-C control among patients with diabetes. However, blood pressure control among patients with hypertension showed no effect. Based on the regressions, participants with hypertension who received a greater number of intensive case management visits had higher diastolic blood pressure values over time.

BAHC has long employed CHWs in northern Doña Ana County to help patients access primary medical, dental, and behavioral health care. Innovation leaders recruited experienced CHWs from the community to deliver patient care and supplemented innovation staff in BAHC's existing staff as needed. The organization had an existing infrastructure for coordinating, directing, and training CHWs. This history, coupled with staff's investment in the Promotora model, facilitated innovation implementation.

Pairing CHWs with traditional clinical staff, including NHEs and providers, emphasized the unique contributions of staff in different roles and facilitated the integration of CHWs into BAHC's clinics. NHEs provided clinical expertise and communicated clinical information to physicians, while CHWs helped BAHC connect with hard-to-reach patients, conducted outreach to onboard new patients, and shared their knowledge about additional community resources. CHWs facilitated trust between clinical providers and members of the local community, benefitting both the care team and patients enrolled in the program.

The blended CHW/NHE medical team delivered the services that patients required to manage their chronic conditions. Over time, patients enrolled in the innovation exhibited improvements in diabetes health outcomes. Fewer ED visits in Year 1 and 3 suggest that innovation staff helped patients manage their health more effectively and steered patients toward appropriate health care utilization. The evaluation team's interviews with providers likewise suggest a positive impact of the innovation, as physicians reported that they saw patients more frequently after the innovation began, and that the health of innovation patients deteriorated more slowly as a result of the extended care they received.

BAHC indicated that the complex high-risk population enrolled in the innovation required more frequent and intense care than initially anticipated, which may have limited the staff's capacity to enroll new patients. Innovation leaders suggested that the project may have demonstrated greater impact if fewer high-risk patients were enrolled, if patients were screened to assess their readiness to change, and/or if staff discontinued services to patients who failed to demonstrate behavior change.

BAHC retained all of the innovation staff within its clinics, but will not be able to offer the same frequency of community- and home-based services without supplemental funding. As BAHC continues to seek funding sources, patients will receive health education within the clinic, potentially in a group classroom setting as opposed to one-on-one. BAHC built the capacity of its health system by integrating innovation staff and their knowledge into new programs. BAHC hopes that policy-level changes will allow them to more easily sustain CHW services in the future.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Ben Archer Health Center (BAHC)

The Ben Archer Health Center (BAHC) is a federally qualified health center (FQHC) in rural New Mexico that received an award of $1,270,845 to implement its innovation, which was launched on September 5, 2012. The innovation targeted the predominantly Hispanic population of northern Doña Ana County, New Mexico, a region designated by the U.S. Department of Health and Human Services as a medically underserved area and a health professional shortage area.

Awardee Overview

Innovation dose:	In the last innovation quarter, participants received an average of 5.2 primary care visits and 10.4 intensive case management visits.	***Innovation reach:***	601 participants received intensive case management, 41.1% of the target population for the intensive case management component of the innovation. Reach data were not available for the preventive services component.
Components:	(1) Preventive care services (2) Intensive case management	***Participant demographics:***	Majority of participants (69.7%) were 45 to 74 years of age, 59.7% were Hispanic, and 39.6% were white. More than one-third were covered by Medicare (38.4%), 29.0% were covered by Medicaid, and 26.0% were covered by both Medicare and Medicaid.
Sustainability:	BAHC continued to employ innovation staff, but cannot sustain HCIA-supported community- and home-based services without additional funding.		
Innovation type:	Coordination of care		

Key Findings

Smarter spending. Medicare beneficiaries who participated in the innovation had higher average quarterly spending than the comparison group during the first year of the innovation only ($630; 90% CI: $18, $1,242). The increase in spending during year 1 could be attributed to CHWs connecting beneficiaries to care. In the long run, spending may decrease if innovation participants improve their preventive care and chronic conditions management. The average quarterly impact on spending per person among the innovation group overall was not statistically significant ($445; 90% CI: −$254, $1,144).

Better care. Medicare beneficiaries enrolled in the innovation had higher rates of inpatient stays per 1,000 participants per quarter overall (54; 90% CI: 35, 74) and during the first (68; 90% CI: 41, 96) and third (90; 90% CI: 37, 144) years of the innovation. ED visits per 1,000 participants per quarter were lower among the innovation group overall (−31; 90% CI: −49, −13) and during years 2 (−50; 90% CI: −80, −20) and 3 (−50; 90% CI: −91, −8), possibly because the innovation connected patients with appropriate, non−emergency health care providers or improvements in health resulting from the innovation.

Healthier people. The innovation exhibited improving trends in HbA1c and LDL-C control among patients with diabetes. However, blood pressure control among patients with hypertension showed no effect. Based on the regressions, participants with hypertension who received an additional intensive case management visit had higher diastolic blood pressure values (0.49 mm Hg) over time.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Bronx Regional Health Information Organization

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q14 (December 2015)
Quarterly Awardee Performance Report	Launch date– Q14 (December 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–December 2015

Q = quarter.

Bronx Regional Health Information Organization

2.1 Introduction

The Bronx Regional Health Information Organization (Bronx RHIO) located in New York City, NY received an award of $12,689,157 beginning on July 1, 2012 and launched the Bronx Regional Informatics Center (BRIC) innovation on February 20, 2014. The innovation aimed to indirectly improve the health of patients who received care at affiliated pilot sites and consented to share their health information through Bronx RHIO exchange. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending by improving clinical quality in the member RHIO sites; Bronx RHIO expected net savings of $15 million over 3 years.

2. **Better care.** Provide countywide data to focus care managers' patient work lists on identified patients. Increase the rates of Bronx residents receiving preventive services at the appropriate times to avoid preventable admissions, 30-day readmissions, and ED visits.

3. **Healthier people**. Use data to pilot interventions targeting distinct patient populations and health outcomes, including asthmatic patients with mental health comorbidities and cohorts with diabetes, asthma, hypertension, and HIV.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11–14 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through December 31, 2015.

Table 2. Summary of Updates as of Quarter 14, December 31, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Data analytics produced aggregate reporting for Bronx RHIO providers, and a trained workforce targeted the care of patients living in the Bronx.
Program Participant Characteristics	
	More than half of participants (58.1%) were 45 to 74 years of age, and approximately half (51.4%) were female. Among participants for whom RTI received data, more than one-third (35.6%) were black, approximately one quarter (26.0%) were Hispanic, and approximately 19 percent were white. Less than one-half had Medicaid or Medicare (40.1% and 43.2%, respectively).

(continued)

Table 2. Summary of Updates as of Quarter 14, December 31, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Workforce Development	
Hiring and retention	19.0 FTEs (fully staffed)
Skills, knowledge, and training	15,128 cumulative training hours for 407 trainees
Context	
Award execution	Cumulative expenditure rate of 86.7% at end of Q14, and forecasted to spend the full award budget value.
Leadership	Leadership initially underestimated the program's complexity, which required a longer planning period. Additional planning resulted in the establishment of realistic goals and achievable milestones.
	Leadership maintained embedded staff at site locations, ensuring strong engagement and communication.
	Leadership focused on increasing the rates at which patients consent to share their data to enable reporting on more local data, and on exchanging data with other local RHIOs.
Organizational capacity	Made significant progress on the development of Spectrum population health tool, which will allow site locations to generate their own analytic reports using Bronx RHIO data.
Innovation adoption and workflow integration	Site locations subscribed to receive alerts on discharged patients about care received at other regional provider sites, and clinicians followed up to assess appropriateness of care.
	Member sites received detailed reports that include patient visit history, lab results, and demographic data. Site staff used this information to design and track interventions for populations of interest.
Implementation Effectiveness	
Innovation reach	28,844 patients, 52.2% of the target population, were enrolled in the innovation, up from 41.7% in Q11.
Innovation dose	More than half of participants (54.7%) were included in only one BRIC report, approximately one-quarter (24.1%) in two BRIC reports, and the remaining 21.2% in three or more BRIC reports.
Sustainability	
	The Bronx RHIO and analytic reporting components will be sustained by a combination of funding sources.

Sources: *Q11-Q14 Narrative Progress Report*.
Q11-Q14 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted February 2016.

BRIC = Bronx Regional Informatics Center; FTE = full-time equivalent; RHIO = regional health information organization.

Table 3 summarizes Medicare claims-based findings during the innovation period. The overall estimate for the difference in quarterly spending is negative and statistically significant, indicating that the innovation group incurred lower spending in the innovation period than the comparison group. Overall, the innovation group had significantly fewer inpatient admissions and ED visits than the comparison group, and the results were statistically significant.

Table 3. Summary of Medicare Claims-Based Findings: Bronx RHIO

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$17.275	−$26.170, −$8.382	−$11.450	−$18.500, −$4.403	−$5.822	−$9.575, −$2.068	N/A	N/A
Acute care inpatient stays	−578	−780, −377	−334	−511, −156	−245	−340, −149	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−3	−55, 61	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−588	−799, −377	−430	−613, −247	−158	−263, −53	N/A	N/A
Average impact per quarter								
Spending per participant	−$531	−$804, −$258	−$480	−$776, −$185	−$669	−$1,100, −$237	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−18	−24, −12	−14	−21, −7	−28	−39, −17	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	1	−17, 19	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−18	−25, −12	−18	−26, −10	−18	−30, −6	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. The innovation group incurred lower spending in the first year after the innovation launch than the comparison group. The overall estimate for the difference in quarterly spending is negative, but not statistically significant, indicating no significant difference between the innovation and comparison groups in Medicaid spending. Overall, the innovation group had significantly more ED visits than the comparison group, whereas the innovation group had similar inpatient stays and unplanned readmissions rates to the comparison group.

Table 4. Summary of Medicaid Claims-Based Findings: Bronx RHIO

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.180	−$1.112, $0.751	−$0.180	−$1.112, $0.751	N/A	N/A	N/A	N/A
Acute care inpatient stays	−10	−69, 49	−10	−69, 49	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−14	−33, 5	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	152	33, 270	152	33, 270	N/A	N/A	N/A	N/A
Average impact per quarter								
Spending per participant	−$46	−$280, $189	−$46	−$280, $189	N/A	N/A	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−3	−17, 12	−3	−17, 12	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−39	−90, 12	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	38	8, 68	38	8, 68	N/A	N/A	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

The Bronx RHIO is a not-for-profit organization established by direct care organizations in the Bronx, NY to build a secure, interoperable health information exchange integrating medical records from across affiliated institutions. This innovation consisted of two components: (1) data analytics to produce aggregate reporting for Bronx RHIO providers (BRIC reports), and (2) a trained workforce to conduct data analytics to identify patients living in the Bronx who might benefit from a provider-initiated intervention. Patients did not receive direct services as part of this innovation; instead, the innovation components aimed to set in place the infrastructure to use data from Bronx RHIO member records to generate information that providers could use to design interventions for specific cohorts to improve patient care and health. To that end, provider end users worked with the analysts to identify the key data elements that were tracked and reported, and informed clinical decision making. Member institutions expected that the innovation would indirectly improve the health of the target population of patients that resided in the Bronx and received care from member institutions, so long as patients consented to share their health information and thus became eligible for inclusion in BRIC reports and associated interventions. For the purposes of this evaluation, RTI considers patients as enrolled in the innovation and as candidates for the claims analysis innovation group if they appeared in at least one BRIC report.

The innovation components described here have not changed over time. While the data analytics and trained workforce will remain in effect after the funding period, the collaboration with Bronx Community College to train students in data analytics and health information technology ended in December 2015.

The partners for this innovation remain unchanged. ***Table 5*** lists the partners involved in the innovation as of Q12.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Research Foundation of the City University of New York/Bronx Community College	Vocational training services	New York City, NY
Weill Cornell Medical College, Center for Healthcare Informatics and Policy	Awardee evaluation and monitoring	New York City, NY
OptumInsight	Health IT expertise	San Jose, CA
Streamline Health	Health IT expertise	New York City, NY
SBH Health System	Health IT expertise	New York City, NY

HCIA = Health Care Innovation Award, IT = information technology.

2.1.2 Program Participant Characteristics

Table 6 provides the characteristics of participants included in at least one BRIC report based on patient-level data that Bronx RHIO provided to RTI. We last reported patient age and sex in the 2015 annual report, based on data through Q11. The distribution of patient characteristics is similar to that in the 2014 Evaluation annual report. More specifically, more than half of participants (58.1%) were between 45 and 74 years of age, and 51.4 percent were female. Approximately one-quarter of the race/ethnicity data and more than one-third of the payer category data were missing. Among participants with race/ethnicity data, more than one-third (35.6%) were black, more than one quarter (26.0%) were Hispanic, and approximately 19 percent were white. Among participants with payer category data, less than one-half had Medicare (43.2%) or Medicaid (40.1%), and less than 5 percent were covered by both Medicare and Medicaid.

Table 6. Characteristics of All Participants Ever Enrolled in the Bronx RHIO Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	28,844	100.0
Age		
< 18	26	0.1
18–24	766	2.7
25–44	3,938	13.7
45–64	10,878	37.7
65–74	5,875	20.4
75–84	3,473	12.0
85+	2,219	7.7
Missing	1,669	5.7
Sex		
Female	14,828	51.4
Male	10,919	37.9
Missing	3,097	10.7
Race/ethnicity		
White	4,011	13.9
Black	7,501	26.0
Hispanic	5,465	18.9
Asian	173	0.6
American Indian or Alaska Native	42	0.2
Native Hawaiian or other Pacific Islander	14	0.1
Other	3,838	13.3
Missing/refused	7,800	27.0
Payer category		
Dual	599	2.1
Medicaid	7,143	24.8
Medicare	7,698	26.7
Other	95	0.3
Uninsured	2,280	7.9
Missing	11,029	38.2

Source: Patient-level data provided to RTI by Bronx RHIO.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We received 582 BRIC reports requested by partners of the RHIO, each of which focused on a specific group of patients requested by the provider from a member site. Because information on enrollment dates was missing, we used the BRIC report extraction date as the innovation enrollment date for patients. For example, the first report on Montefiore Medical Center (MMC) was extracted April 28, 2014, whereas a report on Morris Heights Health Center (MHHC) patients was extracted August 7, 2014. The 582 BRIC report extraction dates ranged from April 18, 2014 to December 31, 2015. Since all dates were very recent, the claims data in the Chronic Conditions Data Warehouse may not be complete for the entire innovation period.

We included patients enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 6,623 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in or near the Bronx, New York City and gave consent for use of their patient information to RHIO.

We used propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter and calendar year before the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 8 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 8. Medicare Mean Values and Standardized Differences of Variables in Propensity Score Model: Bronx RHIO

Variable	Before Matching: Treatment Group Mean	Before Matching: Treatment Group SD	Before Matching: Comparison Group Mean	Before Matching: Comparison Group SD	Standardized Difference	After Matching: Treatment Group Mean	After Matching: Treatment Group SD	After Matching: Comparison Group Mean	After Matching: Comparison Group SD	Standardized Difference
Total payments in calendar quarter prior to enrolment	$7,333	$17,988	$5,011	$13,677	0.15	$7,333	$17,988	$6,911	$15,638	0.03
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$24,027	$41,766	$17,847	$35,962	0.16	$24,027	$41,766	$23,367	$39,791	0.02
Age	70.93	14.01	65.20	15.93	0.38	70.93	14.01	71.08	14.06	0.01
Percentage male	35.71	47.91	40.11	49.01	0.09	35.71	47.91	35.31	47.79	0.01
Percentage white	28.88	45.32	36.97	48.27	0.17	28.88	45.32	31.00	46.25	0.05
Percentage disabled	35.83	47.95	46.14	49.85	0.21	35.83	47.95	35.24	47.77	0.01
Percentage ESRD	7.02	25.55	4.50	20.72	0.11	7.02	25.55	6.36	24.40	0.03
Number of dual eligible months in the previous calendar year	6.16	5.83	6.14	5.77	0.00	6.16	5.83	6.37	5.83	0.04
Number of chronic conditions	9.19	4.01	6.82	4.65	0.55	9.19	4.01	9.29	4.30	0.02
Number of ED visits in calendar quarter prior to enrollment	0.22	1.25	0.22	0.87	0.00	0.22	1.25	0.22	0.90	0.00
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.34	2.97	1.18	3.24	0.05	1.34	2.97	1.33	3.28	0.00
Number of inpatient stays in calendar quarter prior to enrollment	0.21	0.65	0.14	0.50	0.12	0.21	0.65	0.20	0.58	0.02
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.72	1.47	0.53	1.30	0.14	0.72	1.47	0.69	1.40	0.02
Number of beneficiaries	6,623	—	127,858	—	—	6,623	—	19,802	—	—
Number of unique beneficiaries[1]	6,623	—	26,159	—	—	6,623	—	12,771	—	—
Number of weighted beneficiaries	—	—	—	—	—	6,623	—	6,623	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

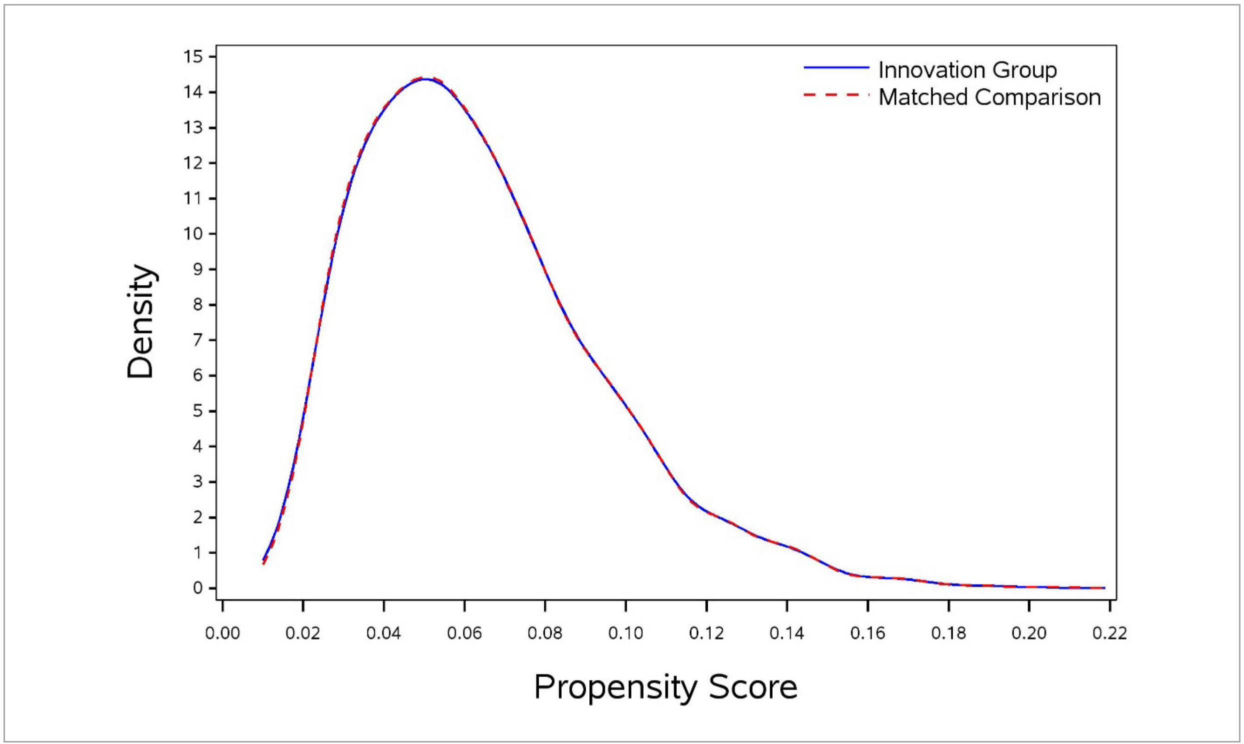
Bronx RHIO = Bronx Regional Health Information Organization; ED = emergency department; ESRD = end-stage renal disease; SD = standard deviation.

— Data not yet available.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and checked whether matching decreased the absolute standardized differences and achieves acceptable balance (Table 8). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 8 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure demonstrates a very close overlap between the innovation and comparison groups' propensity scores. Therefore, we present the Medicare claims analysis using both the innovation group and the matched comparison group.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the 11 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison group beneficiaries and is darker in the innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending trended upward in the baseline quarters for both the innovation and comparison beneficiaries. After the innovation launch, spending decreased for both the innovation and comparison groups. The spending gap between the two groups widened during the innovation quarters. However, it is premature to conclude any impact of the innovation on spending on this basis. As shown in Table 9, the standard deviation for spending was very high, representing the skewed nature of expenditures. We will estimate the statistical impact of the innovation in the difference-in-differences analyses that follow.

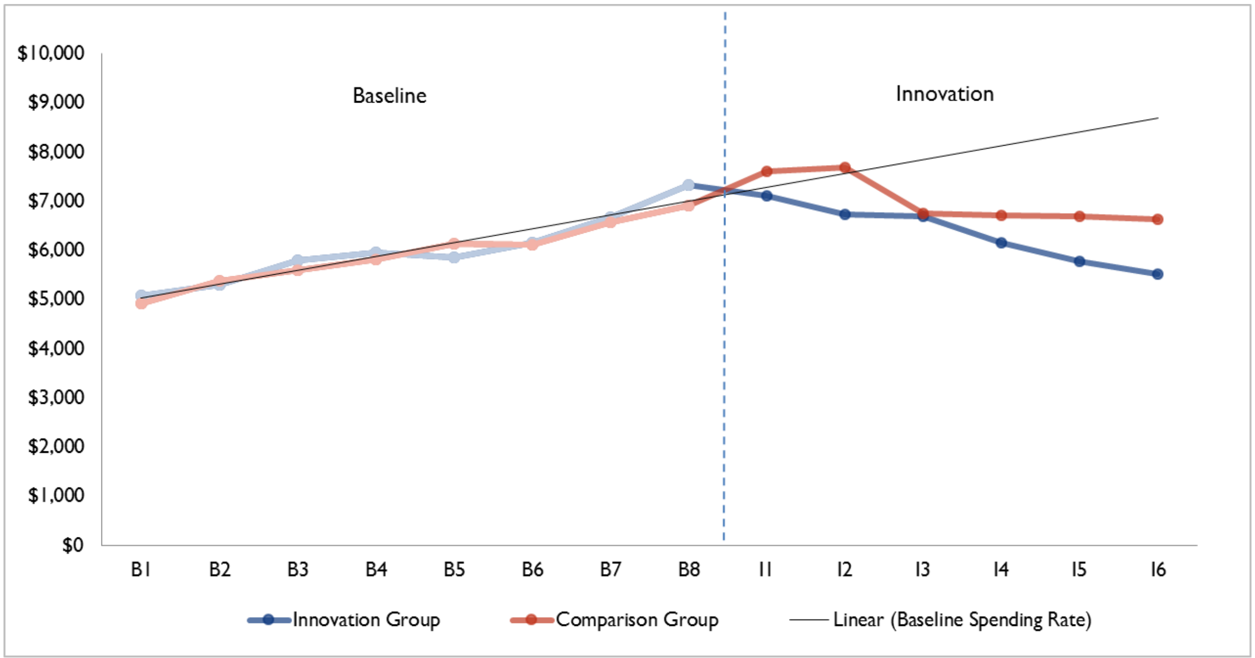
Table 9. Medicare Spending per Participant: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Spending rate	$5,080	$5,309	$5,794	$5,965	$5,859	$6,163	$6,670	$7,333	$7,103	$6,739	$6,703	$6,153	$5,773	$5,512
Std dev	$13,273	$13,437	$16,069	$14,907	$13,854	$14,653	$16,244	$17,988	$17,255	$16,734	$17,928	$15,417	$15,660	$14,596
Unique patients	6,259	6,295	6,327	6,367	6,416	6,475	6,545	6,623	6,623	6,416	6,012	4,791	4,552	4,156
Comparison Group														
Spending rate	$4,930	$5,388	$5,602	$5,829	$6,129	$6,125	$6,571	$6,911	$7,615	$7,686	$6,754	$6,722	$6,693	$6,637
Std dev	$12,436	$13,743	$13,712	$14,265	$14,337	$14,425	$16,379	$15,638	$18,150	$17,919	$17,155	$16,326	$17,654	$16,345
Weighted patients	5,576	5,688	5,855	6,019	6,168	6,341	6,549	6,623	6,623	6,514	5,952	4,554	4,213	3,775
Savings per Patient														
	−$149	$78	−$192	−$135	$270	−$38	−$98	−$423	$512	$948	$51	$569	$919	$1,125

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization; I1 = Innovation Q1.

Figure 2. Medicare Spending per Participant: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.4.2 *Regression Results*

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, was −$531 (90% CI: −$804, −$258). This effect was statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison groups, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

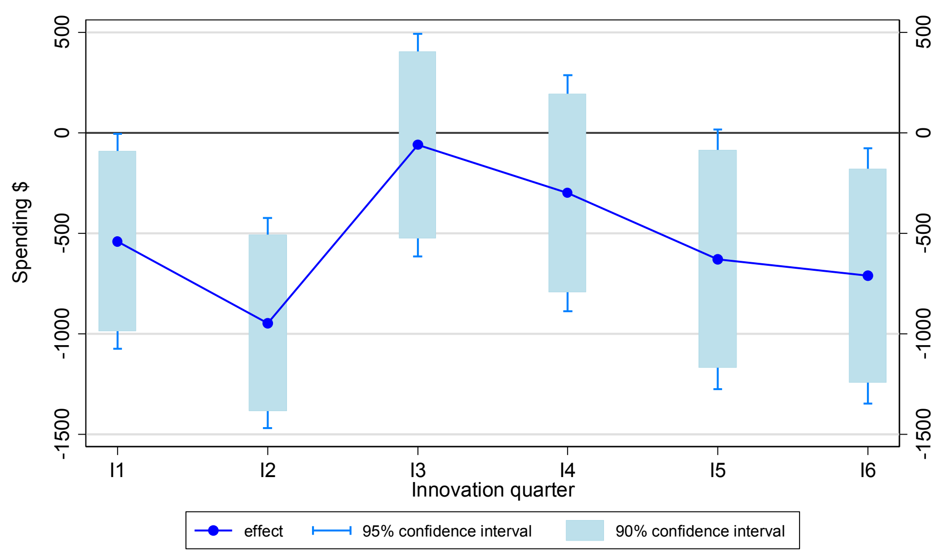
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. All of the quarterly estimates were below zero, and most of them were statistically significant.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	−$540	$273	0.048
I2	−$947	$267	<0.001
I3	−$60	$283	0.832
I4	−$300	$300	0.318
I5	−$629	$330	0.057
I6	−$712	$324	0.028
Overall average	−$531	$166	0.001
Overall aggregate	−$17,275,004	$5,406,138	0.001
Overall aggregate (IY1)	−$11,453,382	$4,286,180	0.008
Overall aggregate (IY2)	−$5,821,622	$2,282,002	0.011

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Bronx RHIO = Bronx Regional Health Information Organization; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

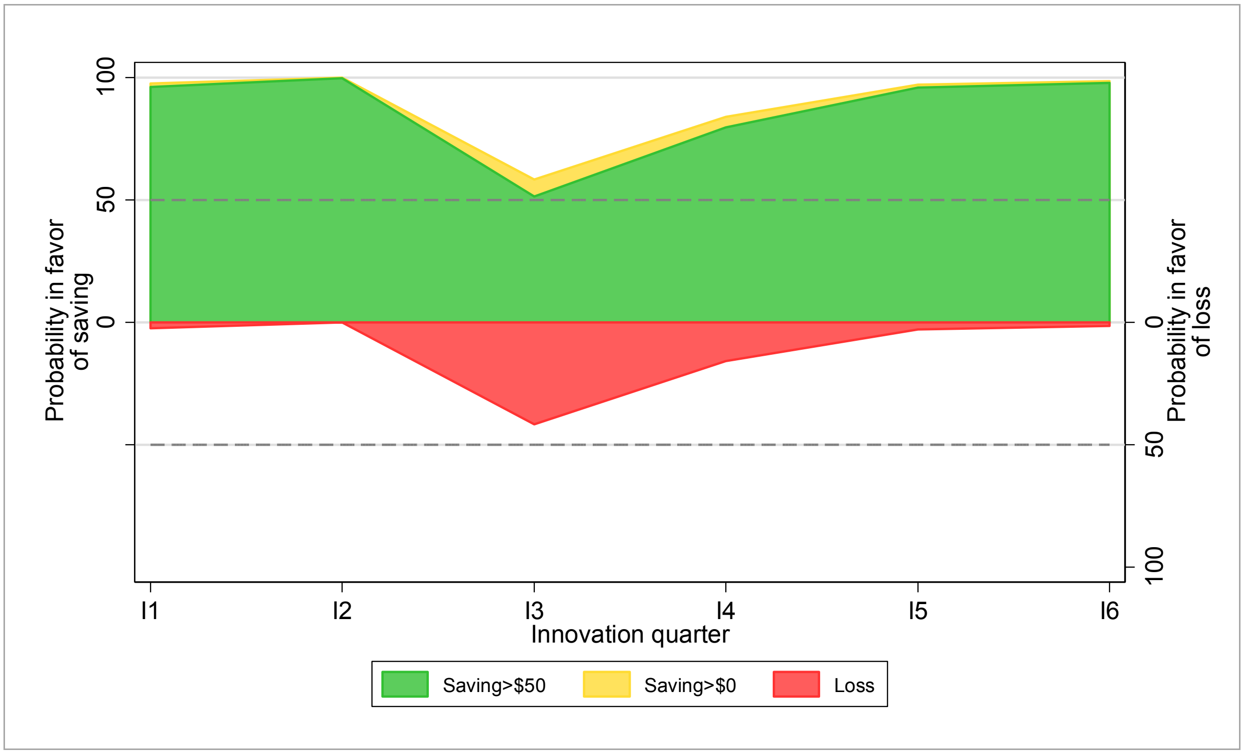
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates were mostly statistically significant in the entire innovation period, we observed a higher probability of savings versus loss for the innovation period.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 5***. Inpatient admissions trend slightly upward and are similar in the baseline period for both the innovation and comparison groups. Inpatient admissions decrease for beneficiaries enrolled in the innovation during the innovation quarters, whereas inpatient admissions for the comparison beneficiaries remain steady. Without statistical testing, it is premature to conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

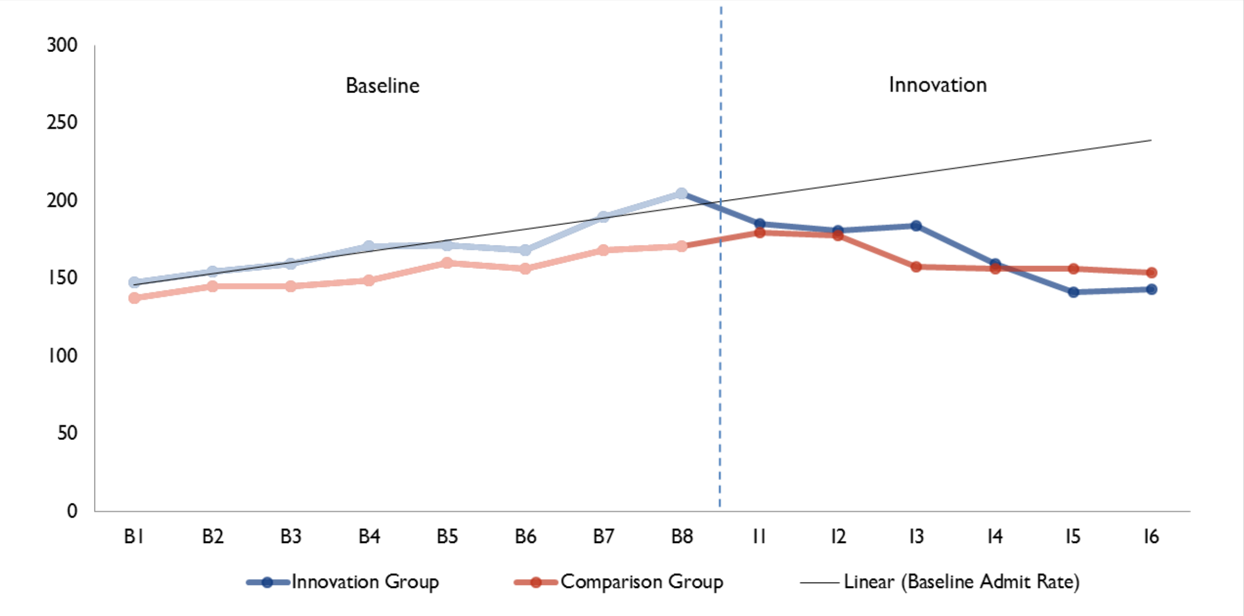
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Admit rate	147	155	160	171	171	168	190	204	186	181	184	159	141	143
Std dev	490	498	500	534	520	514	560	630	586	552	576	503	465	472
Unique patients	6,259	6,295	6,327	6,367	6,416	6,475	6,545	6,623	6,623	6,416	6,012	4,791	4,552	4,156
Comparison Group														
Admit rate	138	145	145	149	160	156	168	171	180	178	158	157	156	154
Std dev	463	479	478	480	520	517	533	560	573	555	520	532	536	537
Weighted patients	5,576	5,688	5,855	6,019	6,168	6,341	6,549	6,623	6,623	6,514	5,952	4,554	4,213	3,775
Innovation − Comparison Rate														
	9	9	14	22	11	12	22	33	6	3	27	3	−15	−10

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization I1 = Innovation Q1.
— Data not yet available.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 18 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: −24, −12). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 12 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Most of the quarterly estimates are negative and statistically significant.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	−25	9	0.005
I2	−23	9	0.009
I3	4	9	0.638
I4	−9	9	0.322
I5	−29	9	0.002
I6	−27	10	0.005
Overall average	−18	4	<0.001
Overall aggregate	−578	123	<0.001
Overall aggregate (IY1)	−334	108	0.002
Overall aggregate (IY2)	−245	58	<0.001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Bronx RHIO = Bronx Regional Health Information Organization; I = Innovation Quarter; IY = Innovation Year.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 6***. Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch, and the trend line is slightly upward. The readmissions rates for the innovation group decrease more than the comparison group during the latter part of the innovation period. Without statistical testing, it is premature to conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

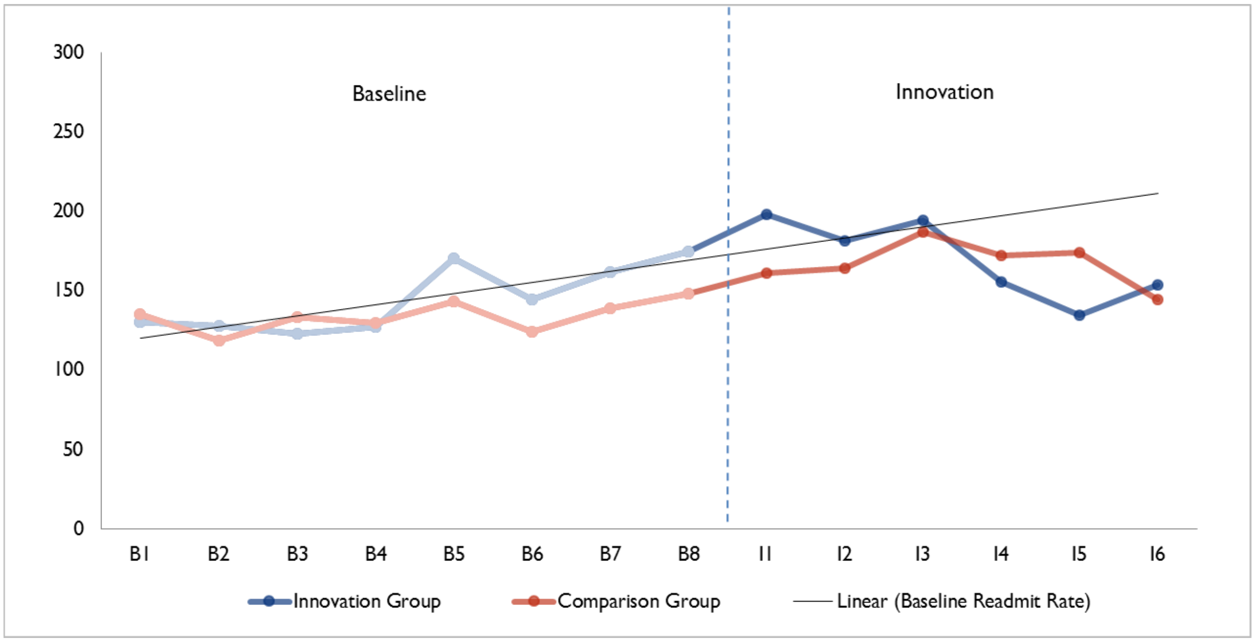
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Readmit rate	130	128	123	127	170	144	162	175	198	182	194	156	135	154
Std dev	337	334	328	333	376	352	368	380	398	386	396	363	341	361
Total admissions	560	603	626	668	717	713	804	864	763	705	617	507	386	280
Comparison Group														
Readmit rate	136	118	134	129	143	124	139	148	161	165	187	172	174	144
Std dev	342	323	340	336	350	330	346	355	368	371	390	378	379	352
Total admissions	514	591	662	650	762	716	796	855	938	831	632	501	449	263
Innovation − Comparison Rate														
	−5	9	−11	−2	27	20	23	27	37	17	8	−16	−39	9

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization; I1 = Innovation Q1.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.6.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 1 per 1,000 inpatient admissions (0.1 percentage points), indicating that the innovation−comparison difference is 0.1 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −17, 19).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
Overall average	1	11	0.932
Overall aggregate	3	35	0.932

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Bronx RHIO = Bronx Regional Health Information Organization.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 7.*** The ED visit rate remains stable before launch and trends slightly upward for both the innovation and comparison groups. During the subsequent innovation quarters, the ED visit rate remains stable for the comparison group, whereas it drops for the innovation group. As with the other variables, we will include statistical tests on the ED visit rate in the following section.

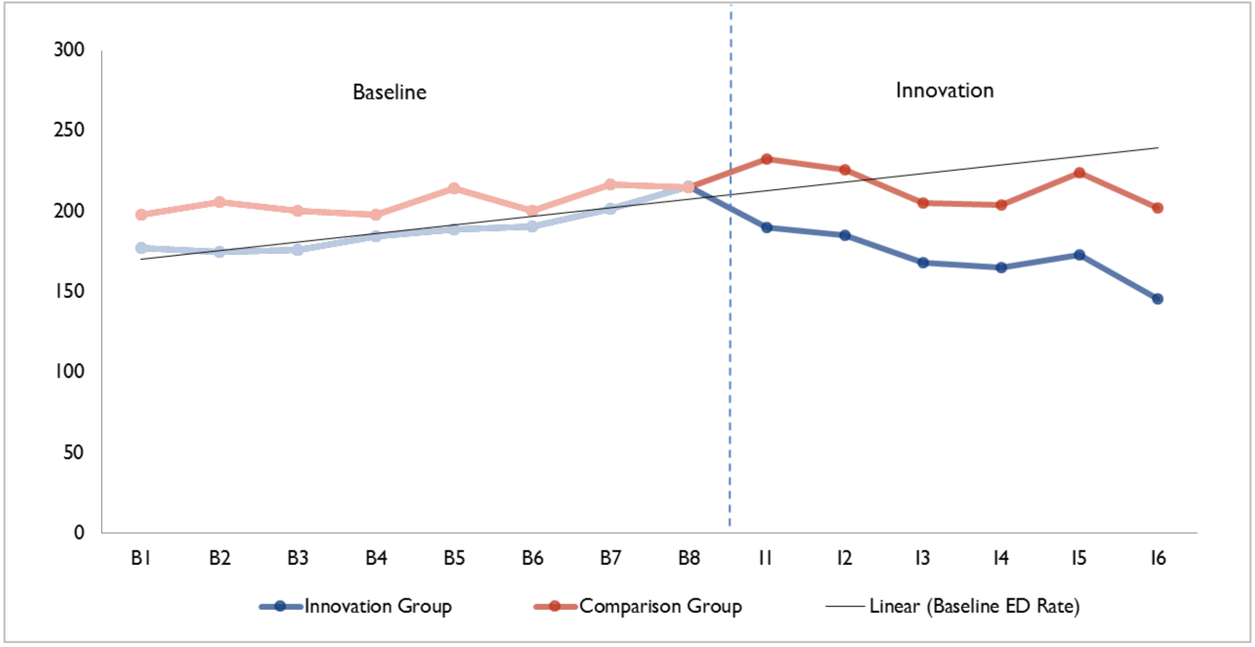
Table 15. ED Visits per 1,000 Medicare Participants: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
ED rate	177	175	176	184	189	191	202	215	190	185	168	165	173	146
Std dev	742	639	846	859	697	723	805	1054	816	798	674	752	758	485
Unique patients	6,259	6,295	6,327	6,367	6,416	6,475	6,545	6,623	6,623	6,416	6,012	4,791	4,552	4,156
Comparison Group														
ED rate	198	206	200	198	215	200	217	215	233	226	205	204	224	202
Std dev	580	634	607	573	603	571	622	642	675	661	599	663	666	654
Weighted patients	5,576	5,688	5,855	6,019	6,168	6,341	6,549	6,623	6,623	6,514	5,952	4,554	4,213	3,775
Innovation − Comparison Rate														
	−21	−31	−24	−14	−26	−10	−15	0	−43	−40	−37	−39	−51	−57

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization; ED = emergency department; I1 = Innovation Q1.

Figure 7. ED Visits per 1,000 Medicare Participants: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization; ED = emergency department.

2.7.2 *Regression Results*

The average quarterly difference-in-differences estimate for ED visits is a decrease of 18 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: −25, −12). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. In all innovation quarters, the number of ED visits among the innovation group is lower than the comparison group, and the estimates are mostly statistically significant.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	−25	9	0.009
I2	−22	9	0.015
I3	−14	9	0.107
I4	−8	10	0.428
I5	−16	11	0.145
I6	−21	10	0.036
Overall average	−18	4	<0.001
Overall aggregate	−588	128	<0.001
Overall aggregate (IY1)	−430	111	<0.001
Overall aggregate (IY2)	−158	64	0.013

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.

Bronx RHIO = Bronx Regional Health Information Organization; I = Innovation Quarter; IY = Innovation Year.

2.8 Discussion: Medicare Results

The four measures provide descriptive data on patients enrolled in the Bronx RHIO innovation before, during, and after the launch of the innovation. These measures may not provide a complete evaluation picture of the Bronx RHIO innovation for several reasons. First, the innovation was only launched on February 20, 2014. The impact of a health IT innovation may not be immediate because providers need time to incorporate new sources of information, and for patient management, time is needed to achieve changes in health care utilization. The regression results so far, however, suggest that the intervention succeeded in reducing total spending, hospital admissions, and ED visits in the early quarters of the innovation. However, the patients identified in the BRIC reports did not necessarily receive subsequent services or treatment. In the data obtained from the awardee, only 60 people (out of 28,964) were marked as followed up by the health system, so we were not able to explore spending and utilization data for those patients who were contacted or treated after the BRIC report. Qualitative interviews with providers/partners suggested that a small number of providers were highly engaged in the innovation and used the alerts and reports to monitor the visit activity of their patient cohort and intervene to suggest alternative medical treatment options.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries whom we were able to match with the identifiers provided by the site. These beneficiaries represent 23 percent of the overall population reached by the innovation.

2.9 Medicaid Comparison Group

We included patients who were enrolled prior to December 31, 2014, and we present Medicaid claims data through Q4 2014. The Medicaid claims analysis focused on 1,606 Medicaid beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in or near the Bronx, New York City and gave consent for use of their patient information to RHIO.

We used PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, enrollee status, number of months of Medicaid eligibility during the calendar year prior to the innovation, number of ED visits, number of inpatient stays, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid fee-for-service in the calendar quarter prior to innovation did not have Medicaid claims data for this quarter, and were matched separately using demographic variables only. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 17 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 8*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Five innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 17. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: Bronx RHIO

	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
Variable	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Previous Medicaid										
Total payments in calendar quarter prior to enrollment	$1,912	$6,781	$2,511	$8,661	0.08	$1,864	$6,638	$2,054	$7,412	0.03
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$6,418	$23,719	$8,282	$26,696	0.07	$6,104	$21,906	$7,334	$26,352	0.05
Age	66.43	15.32	57.42	18.41	0.53	66.43	15.32	65.37	15.48	0.07
Percentage blind, disabled, or aged	62.40	48.45	58.32	49.30	0.08	62.41	48.44	60.14	48.96	0.05
Percentage female	60.74	48.85	58.64	49.25	0.04	60.94	48.79	60.33	48.92	0.01
Percentage black	26.46	44.13	25.69	43.69	0.02	26.48	44.12	27.54	44.67	0.02
Percentage Hispanic	48.81	50.00	46.84	49.90	0.04	48.77	49.98	46.00	49.84	0.06
Percentage dually eligible	95.23	21.33	72.34	44.73	0.65	95.28	21.21	95.68	20.34	0.02
Number of months of Medicaid eligibility in lagged year prior to enrollment	11.13	2.56	11.26	2.07	0.06	11.13	2.55	11.07	2.47	0.02
Number of ED visits in calendar quarter prior to enrollment	0.40	2.08	0.23	0.94	0.11	0.31	1.06	0.30	1.07	0.02
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.08	3.52	0.65	2.28	0.15	0.95	2.44	1.03	4.06	0.02
Number of inpatient stays in calendar quarter prior to enrollment	0.18	0.50	0.11	0.42	0.15	0.17	0.47	0.16	0.54	0.03
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.46	1.38	0.33	1.05	0.11	0.43	1.10	0.46	1.65	0.02
Number of beneficiaries	1,508	—	43,793	—	—	1,503	—	4,506	—	—
Number of unique beneficiaries	1,508	—	18,243	—	—	1,503	—	3,734	—	—
Number of weighted beneficiaries	—	—	—	—	—	1,503	—	1,503	—	—
No Medicaid in Previous Quarter										
Age	60.83	19.78	37.76	15.07	1.31	60.83	19.69	61.92	19.81	0.06
Percentage blind, disabled, or aged	25.24	43.65	7.43	26.23	0.50	25.24	43.44	23.30	42.27	0.05
Percentage female	59.22	49.38	69.60	46.00	0.22	59.22	49.14	62.78	48.34	0.07
Percentage black	25.24	43.65	16.35	36.99	0.22	25.24	43.44	17.15	37.70	0.20
Percentage Hispanic	40.78	49.38	23.56	42.44	0.37	40.78	49.14	52.75	49.92	0.24
Percentage dually eligible	65.05	47.91	7.88	26.95	1.48	65.05	47.68	64.08	47.98	0.02
Number of beneficiaries	103	—	9,337	—	—	103	—	309	—	—
Number of unique beneficiaries[1]	103	—	9,219	—	—	103	—	248	—	—
Number of weighted beneficiaries	—	—	—	—	—	103	—	103	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

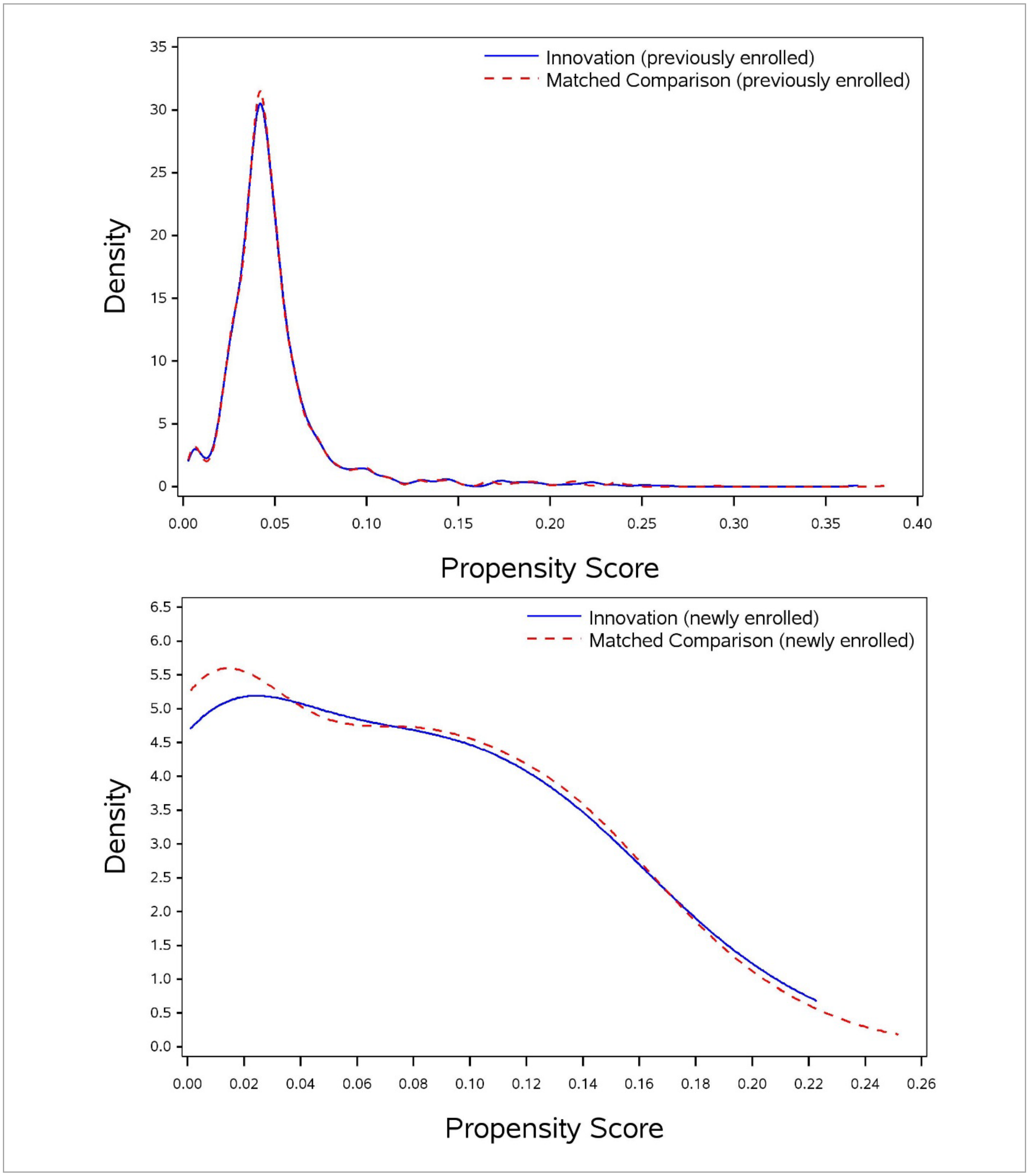
Bronx RHIO = Bronx Regional Health Information Organization; ED = emergency department; SD = standard deviation.

— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 17). The results in Table 17 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables for those who were previously enrolled in Medicaid. Due to the small sample size for those who were newly enrolled in Medicaid, the standardized differences for certain demographic variables such as percentage Black or Hispanic are above the 0.10 threshold.

Figure 8 shows the distribution of the propensity scores for both the innovation and comparison groups. The figures demonstrate a very close overlap between the innovation and comparison groups' propensity scores for those previously enrolled in Medicaid as well as those newly enrolled in Medicaid. Therefore, we present the Medicaid claims analysis using both the innovation group and the matched comparison group.

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 18 reports Medicaid spending per patient in the eight quarters before and the three quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 9*** illustrates the Medicaid spending per beneficiary in Table 18 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending has an upward trend in the baseline quarters for the innovation beneficiaries. Spending in the innovation period decreases in the second and third innovation quarters for the innovation group, and it also falls slightly for the comparison group. It is premature to conclude any impact of the innovation on spending among enrolled beneficiaries. As shown in Table 18, the standard deviation for spending is very high, representing the skewed nature of expenditures.

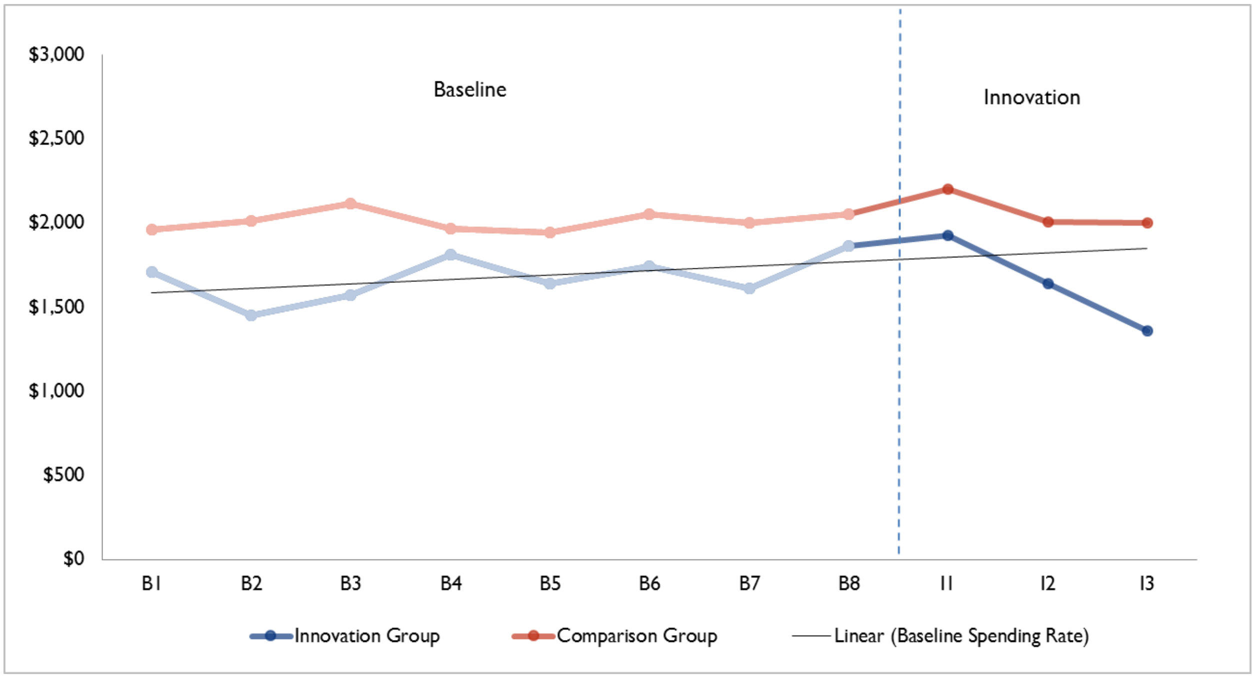
Table 18. Medicaid Spending per Participant: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Spending rate	$1,710	$1,452	$1,573	$1,813	$1,642	$1,744	$1,613	$1,864	$1,930	$1,640	$1,363
Std dev	$6,948	$6,032	$6,093	$7,049	$5,957	$6,428	$6,437	$6,640	$6,827	$6,625	$4,694
Unique patients	1,275	1,274	1,312	1,350	1,385	1,394	1,425	1,503	1,606	1,468	890
Comparison Group											
Spending rate	$1,961	$2,016	$2,115	$1,969	$1,946	$2,052	$2,001	$2,054	$2,204	$2,007	$1,999
Std dev	$4,528	$5,112	$7,039	$4,638	$4,433	$5,519	$4,488	$4,703	$5,666	$4,788	$4,967
Weighted patients	1,421	1,412	1,403	1,401	1,390	1,390	1,422	1,503	1,606	1,448	864
Savings per Patient											
	$251	$563	$542	$156	$304	$308	$387	$191	$274	$368	$637

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization; I1 = Innovation Q1; SD = standard deviation.

Figure 9. Medicaid Spending per Participant: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −46 (90% CI: −$280, $189). This effect is not statistically significant at the 10 percent level. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

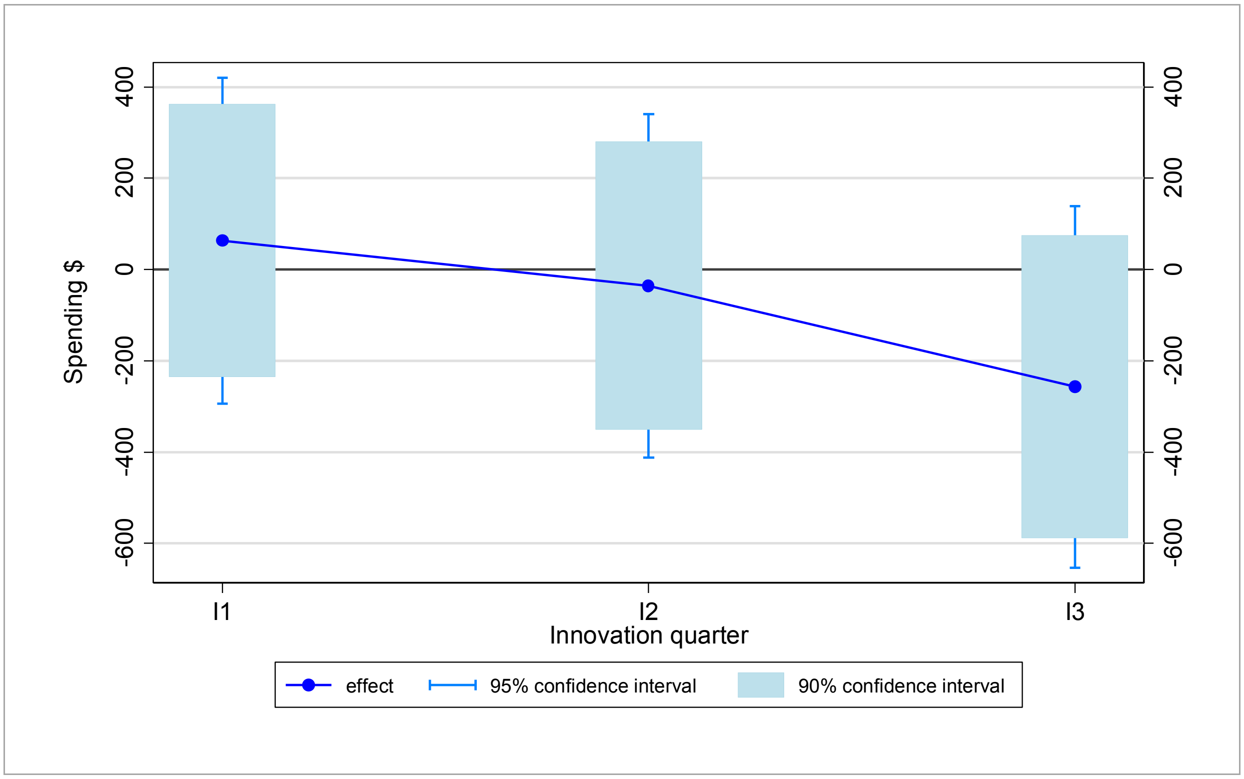
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 19*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly difference-in-differences estimates. Spending among the innovation group is higher than the comparison group in the first innovation quarter, whereas spending is lower in the second and third innovation quarters, although the estimates are not statistically significant.

Table 19. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	\$63	\$182	0.728
I2	−\$36	\$192	0.850
I3	−\$257	\$202	0.203
Overall average	−\$46	\$143	0.750
Overall aggregate	−\$180,414	\$566,066	0.750
Overall aggregate (IY1)	−\$180,414	\$566,066	0.750

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Bronx RHIO = Bronx Regional Health Information Organization; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

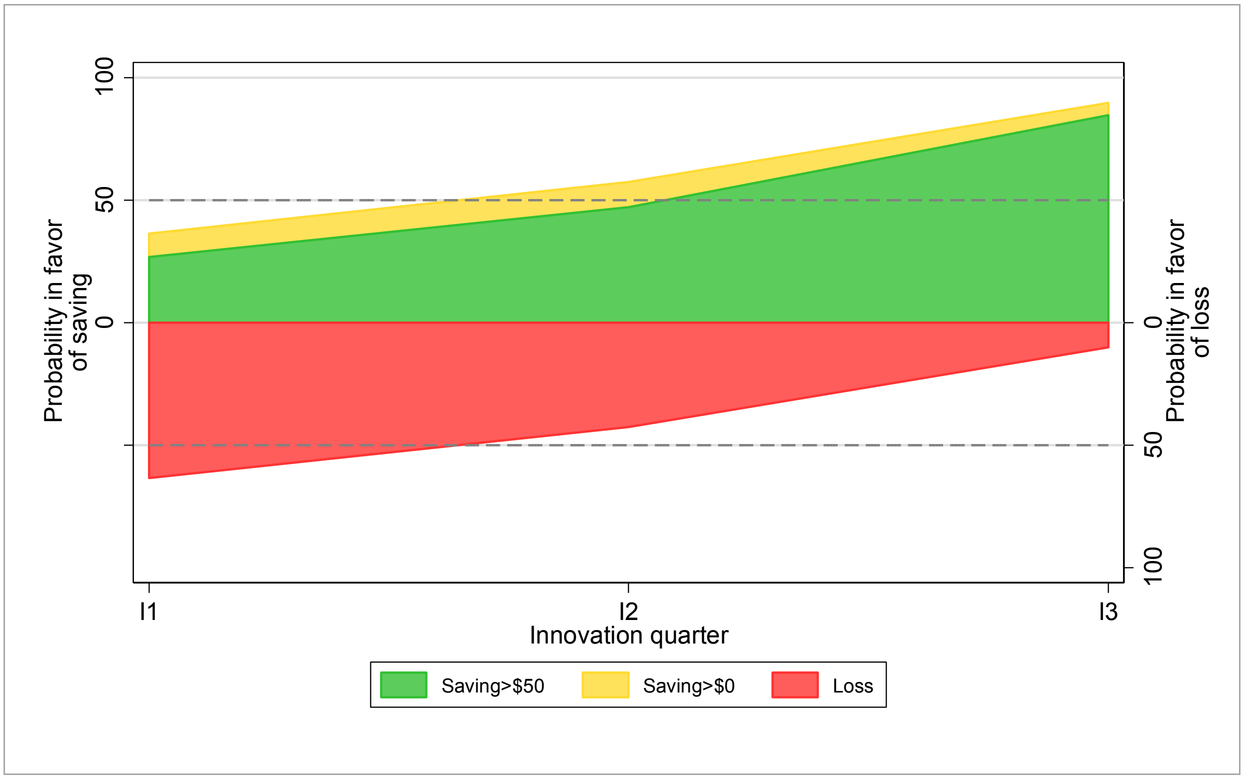
Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization; OLS = ordinary least squares.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates are lower for the innovation group than the comparison group in the second and third innovation quarters, we see a high probability of savings.

Figure 11. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 20*** and ***Figure 12***. Inpatient admissions fluctuate around the baseline trend line and trend upward in the baseline period for the innovation beneficiaries. Inpatient admissions fall during the second and third innovation quarters for the innovation group, whereas they remain steady for the comparison group.

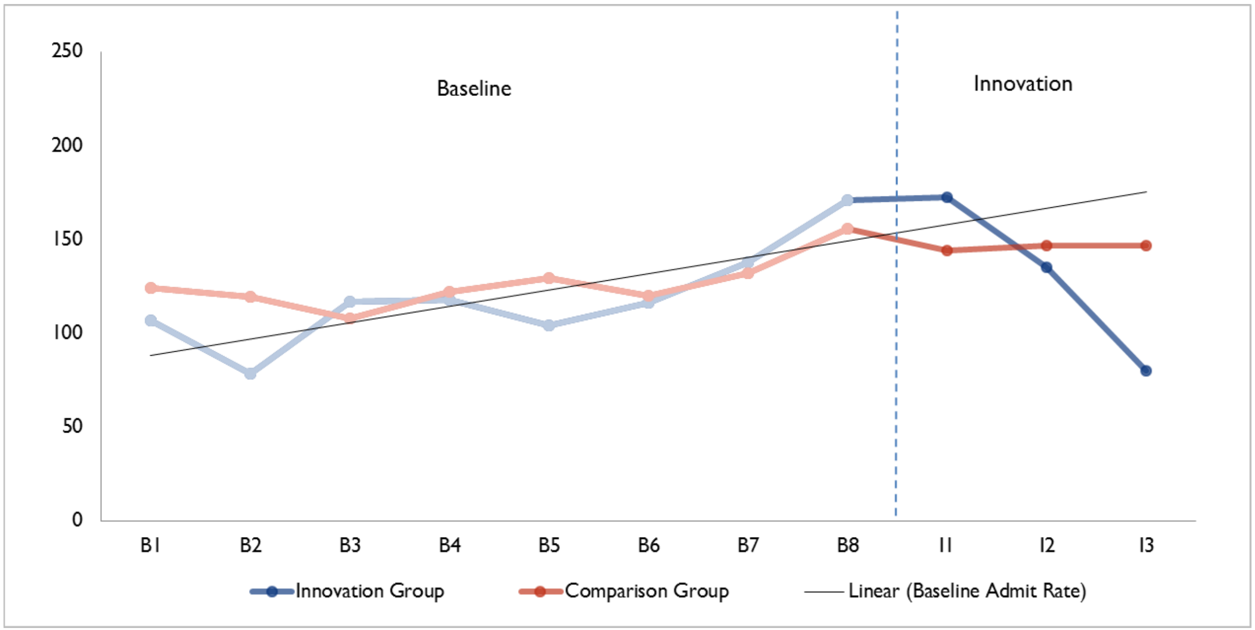
Table 20. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Admit rate	107	78	117	118	104	116	138	171	172	135	80
Std dev	467	346	413	399	396	460	447	471	523	541	279
Unique patients	1,275	1,274	1,312	1,350	1,385	1,394	1,425	1,503	1,606	1,468	890
Comparison Group											
Admit rate	124	119	108	122	130	120	132	156	144	147	147
Std dev	329	335	316	321	337	328	313	345	334	340	341
Weighted patients	1,421	1,412	1,403	1,401	1,390	1,390	1,422	1,503	1,606	1,448	864
Innovation − Comparison Rate											
	−18	−41	9	−4	−26	−3	6	15	29	−12	−67

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization; I1 = Innovation Q1.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.11.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 3 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −17, 12). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 21 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. In the first innovation quarter, the number of inpatient admissions among the innovation group is higher than the comparison group and is statistically significant. The number of inpatient admissions for the innovation group is lower than the comparison group's in the second and third innovation quarters: one estimate is statistically significant, the other is not.

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	32	16	0.040
I2	−11	15	0.461
I3	−52	15	0.001
Overall average	−3	9	0.774
Overall aggregate	−10	36	0.774
Overall aggregate (IY1)	−10	36	0.774

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

Bronx RHIO = Bronx Regional Health Information Organization; I = Innovation Quarter; IY = Innovation Year.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 22*** and ***Figure 13***. Hospital unplanned readmission rates fluctuate around the trend line prior to the innovation's launch, although the trend is going slightly upward. The unplanned readmission rates are below the trend line after innovation launch for the innovation group, and the gap between the innovation and comparison groups widens.

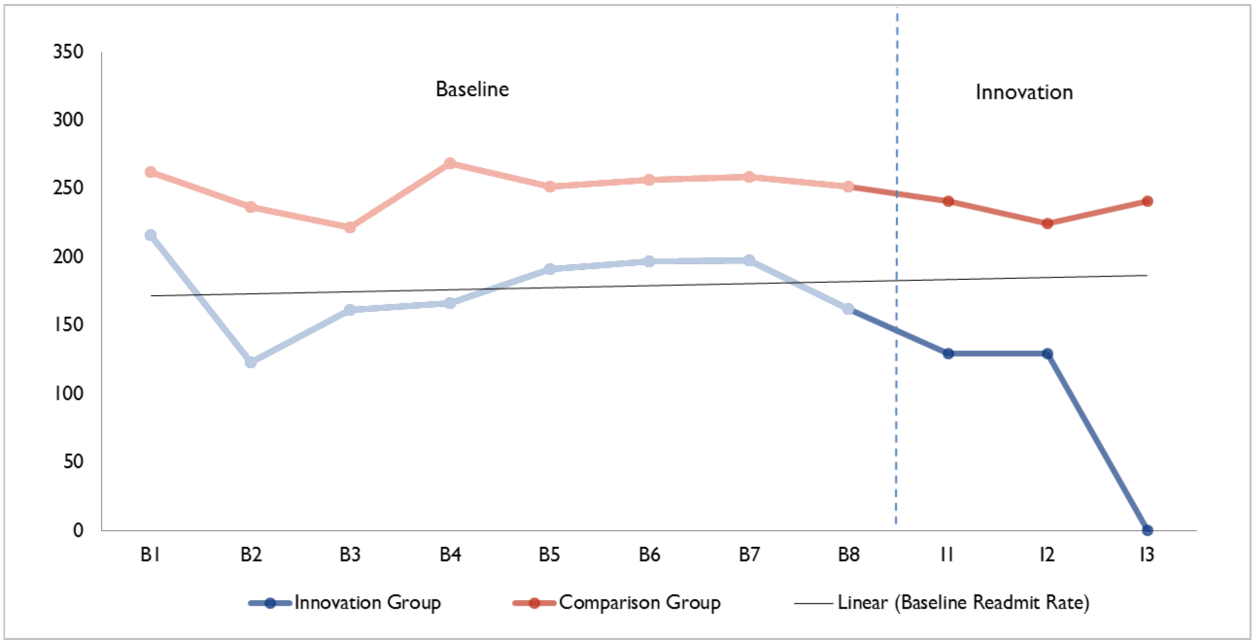
Table 22. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Readmit rate	216	123	162	167	192	197	198	162	130	129	0
Std dev	412	329	368	373	394	398	398	369	336	336	0
Total admissions	111	81	130	126	120	127	162	191	216	116	36
Comparison Group											
Readmit rate	262	237	222	268	252	257	259	252	241	224	241
Std dev	440	425	415	443	434	437	438	434	428	417	428
Total admissions	138	135	123	138	147	132	151	186	179	132	72
Innovation − Comparison Rate											
	−46	−114	−60	−102	−60	−60	−62	−89	−112	−95	−241

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Bronx RHIO = Bronx Regional Health Information Organization; I1 = Innovation Q1.

Figure 13. Hospital Unplanned Readmissions Medicaid Rates per 1,000 Admissions: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization.

2.12.2 Regression Results

Table 23 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −39 per 1,000 inpatient admissions (−3.9 percentage points), indicating that the innovation-comparison difference is 3.9 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant at the 10 percent level (90% CI: −90, 12).

Table 23. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicaid Inpatient Admissions: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
Overall average	−39	31	0.213
Overall aggregate	−14	11	0.213

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Bronx RHIO = Bronx Regional Health Information Organization.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 24*** and ***Figure 14.*** The ED visit rate remains stable before innovation launch and trends upward for the innovation group. During the first innovation quarter, the ED visit rate increases for the innovation group and decreases for the comparison group, although the gap between the two groups diminishes in the subsequent innovation quarters.

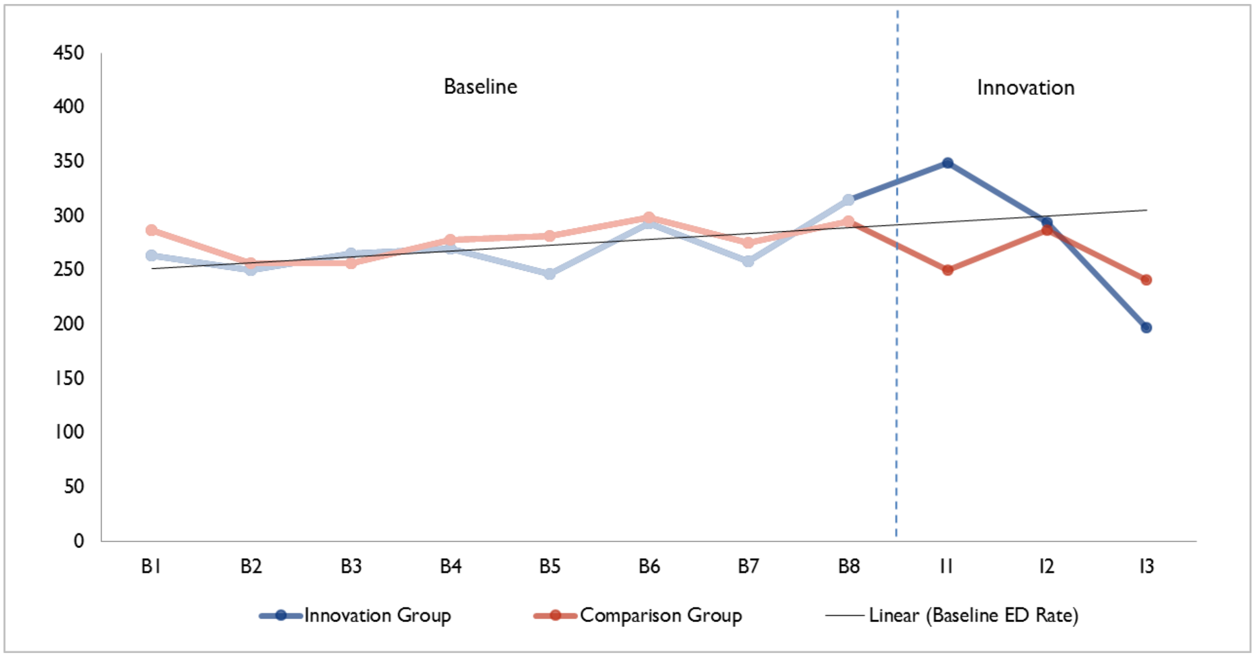
Table 24. ED Visits per 1,000 Medicaid Participants: Bronx RHIO

Awardee Number: 1C1CMS331065
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
ED rate	264	250	266	270	247	293	258	315	349	295	197
Std dev	978	940	1009	806	763	961	941	1063	1319	1177	574
Unique patients	1,275	1,274	1,312	1,350	1,385	1,394	1,425	1,503	1,606	1,468	890
Comparison Group											
ED rate	287	257	257	278	281	299	276	295	250	287	241
Std dev	801	698	662	778	787	852	700	676	571	704	652
Weighted patients	1,421	1,412	1,403	1,401	1,390	1,390	1,422	1,503	1,606	1,448	864
Innovation − Comparison Rate											
	−24	−7	9	−8	−34	−6	−18	20	98	8	−44

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; B1 = Baseline Q1; ED = emergency department.

Figure 14. ED Visits per 1,000 Medicaid Participants: Bronx RHIO



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicaid fee-for-service claims.
Bronx RHIO = Bronx Regional Health Information Organization; ED = emergency department.

2.13.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 38 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: 8, 68). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 25 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. In the first innovation quarter, the number of ED visits among the innovation group is much higher than the comparison group, and the estimate is statistically significant. However, the estimates turn negative in the second and third innovation quarters, although they are not statistically significant.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	110	31	<0.001
I2	−5	31	0.880
I3	−21	30	0.483
Overall average	38	18	0.036
Overall aggregate	152	72	0.036
Overall aggregate (IY1)	152	72	0.036

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

Bronx RHIO = Bronx Regional Health Information Organization; I = Innovation Quarter; IY = Innovation Year.

2.14 Discussion: Medicaid Results

The four measures provide descriptive data on Medicaid patients enrolled in the Bronx RHIO innovation before, during, and after the launch of the innovation. These measures may not provide a complete evaluation picture of the Bronx RHIO innovation. The innovation was only launched on February 20, 2014. The impact of a health IT innovation may not be immediate because providers need time to incorporate new sources of information—and for patient management, time is needed to achieve changes in health care utilization. The four measures listed above are reported at the aggregate level for all Medicaid patients. We found no statistically significant changes in total spending, inpatient admissions or unplanned readmissions, and we saw significantly higher rates of ED visits for Medicaid beneficiaries. The innovation had no overall effect on hospital admissions; however, in I1 the innovation-control difference was positive and significant whereas in I3 the same difference was negative and significant.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represented 5.6 percent of the overall population reached by the innovation.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Bronx RHIO submitted data to RTI that were current through December 2015. ***Table 26*** lists the awardee-specific outcome measures selected for the innovation's evaluation, the status of the data requested, and whether the data are presented in this annual report. The results of analyses for HbA1c poor control are included in this annual report.

Table 26. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status
Health outcomes	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c > 9.0 %	Data received from Bronx RHIO

Bronx RHIO = Bronx Regional Health Information Organization.

We examined the percentage of patients who had a hemoglobin A1c below 9.0 percent for patients with diabetes. The following run chart takes into account rolling enrollment. The innovation quarters (Is) are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation had health outcome data in more innovation quarters over time than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tended to drop substantially as the number of quarters enrolled increased. We provide data when at least 20 patients had a test or reading within the innovation quarter.

2.16 Health Outcomes: Diabetes

We received outcome data for HbA1c allowing us to address the question of whether the percentage of patients with diabetes with poor HbA1c control decreased over the course of the innovation.

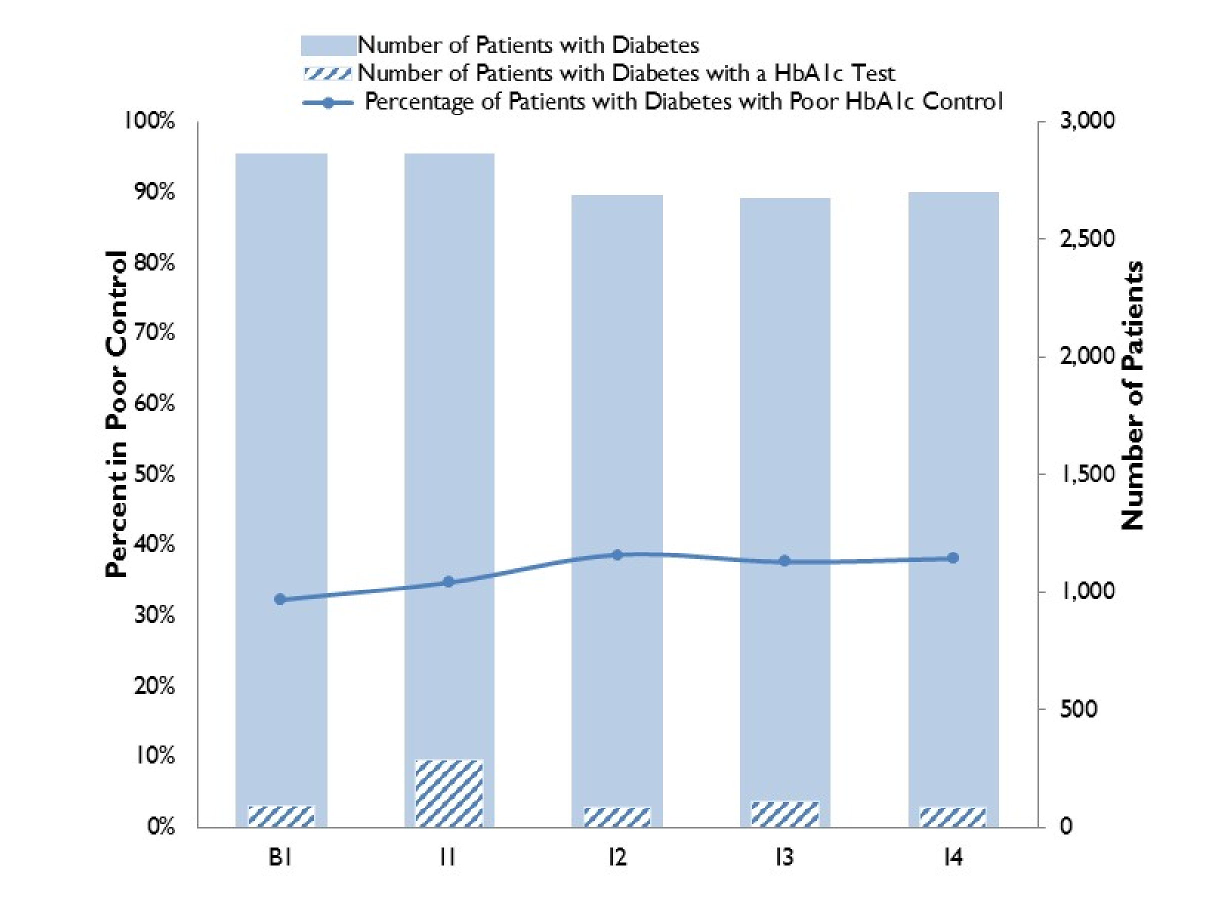
Evaluation Question

- Has the percentage of diabetes patients with poor HbA1c control decreased over time among those enrolled in the innovation?

2.16.1 Descriptive Results

Approximately 10 percent of patients (n=2,815) enrolled in the innovation had diabetes. ***Figure 15*** presents the percentage of patients with diabetes with an HbA1c test indicating poor control (i.e., HbA1c >9%) over time. The denominator represents the number of diabetes patients who received an HbA1c test for each quarter. The numerator represents the number of diabetes patients who received an HbA1c test that was >9.0 percent. As shown in the figure, the percentage of patients with poor HbA1c control increased slightly over time from 34.7 percent in I1 to 38.1 percent in I4.

Figure 15. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



	Quarter	B1	I1	I2	I3	I4
●	Percentage of patients with diabetes with poor HbA1c control	32.2	34.7	38.6	37.6	38.1
	Number of patients with diabetes with a HbA1c test	93	285	88	109	84
	Number of patients with diabetes	2,815	2,815	2,638	2,628	2,651

Source: Patient-level data provided to RTI by Bronx RHIO.

2.17 Discussion: Awardee-Specific Data

We reported findings for HbA1c poor control among patients with diabetes. The percentage of patients included in a diabetes-related BRIC report with HbA1c poor control remained about the same between baseline and I4. This result suggests that the innovation was not effective in improving outcomes for those with diabetes. However, the innovation was not designed to directly impact patient care, and the data reported are for those patients included in at least one BRIC report, regardless of whether the health system that requested the report provided any follow-up care to listed patients. We expect to receive data indicating which patients included in BRIC reports received follow-up care. Patients with diabetes who received follow-up care may have experienced improvement in HbA1c control. We expect to be able to examine this possibility in the annual report addendum.

2.18 Awardee-Specific Measures of Implementation

The evaluation focused on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 27*** lists the quantifiable measures of implementation and their status as of December 31, 2015 that RTI obtained from Bronx RHIO's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* The results of analyses for most of these measures are included in this annual report. Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 through Q14 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context. Bronx RHIO was tracking health system follow-up with patients included in the BRIC reports. We anticipate receiving updated data to include in the annual report addendum.

Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient overall organizational capacity and leadership to implement the innovation effectively?

Table 27. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q14	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 through Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 through Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of unique participants included in at least 1 BRIC report	Data received from Bronx RHIO
	Dose	Number/percentage of participants with which the health system followed up after receiving a BRIC report	Data anticipated from Bronx RHIO

BRIC = Bronx Regional Informatics Center; Bronx RHIO = Bronx Regional Health Information Organization; FTE = full-time equivalent.
Q11–Q14 = January 2015–December 2015.

2.19 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.19.1 Hiring and Retention

The Bronx RHIO did not encounter any challenges with hiring or retention since AR2. As of the end of Q14 (December 2015), the innovation was fully staffed with 19.0 full-time equivalent (FTE) staff members. Between Q10 (December, 2014) and Q14, staffing of the innovation decreased from 24.2 to 19.0 FTEs, mostly due to the reduced scope of work under the no cost extension. Notably, the Bronx Community College (BCC) workforce development program successfully concluded and did not continue during the extension period. In addition, two full-time RHIO staff left the project for positions in other organizations and were not replaced. Near the end of the innovation, Bronx RHIO staff began to transition to other projects within the organization. One site visit interviewee mentioned that, *"Our backup plan was that some staff would come to RHIO and work on project management, and there would be some layoffs, but that's not happening. We have 100% staff retention, and the program will continue intact."* Throughout the project, the Bronx RHIO followed project management best practices, which allowed them to manage staffing effectively. They monitored staffing levels, developed transition plans, and adjusted staffing levels when needed.

2.19.2 Skills, Knowledge, and Training

Prior to the no-cost extension, 391 trainees were trained during the 3-year project period, which was 110 percent of progress toward the projected training target. Additionally, by the end of Q14 (December 2015), the Bronx RHIO provided 15,128 hours of training to 407 individuals, or 111 percent of their training target (***Table 28***). Formal training through BCC ended on December 31, 2015 at the end of the academic term before the end of the extension.

Table 28. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 through Q14 (January–December, 2015)	1,687	38
Since inception	15,128	407

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

The Bronx RHIO offered a variety of trainings on health information technology, analytics for health care workers, and the Clinical Looking Glass (CLG) user interface. Additional training was provided to community health workers (CHWs) on health information exchange (HIE), obtaining patient consent to share data, and population health improvement. Orientation and training of new intervention analysts include RHIO/HIE overview and training, privacy and confidentiality/HIPAA training, orientation to the Bronx Regional Analytic Database (BRAD) data model and its associated analysis and query tools, advanced CLG training, and orientation to participating pilot sites. The Bronx RHIO also established weekly sessions to ensure that all team members reached comparable levels of knowledge and expertise despite their varied backgrounds and experience.

Health IT trainings offered by the BCC workforce development program used a three-tier modular approach, with progressively more advanced subject matter and testing at each level. The modular design allowed the RHIO to use the first module as introductory classes, and then to recruit students for one or more additional modules based on their individual achievement and skill levels. The program ensured a well-trained workforce for the Bronx RHIO and its innovation pilot sites, but also provided new skills to local residents, enabling them to find jobs in the community. As one team member noted,

> ***"The mission of the workforce development program is twofold – the program helps to staff the Bronx RHIO but their need is limited. We also create a local workforce in the Bronx. Some of our students already work in facilities, and the program helps them advance. Some work at RHIO or RHIO participating hospitals/providers. Some go back to their hospitals and train their coworkers."***

The Bronx RHIO overcame several challenges in their training program. Due to the innovation's late start, training lagged behind schedule throughout Year 1. To compensate, the Bronx RHIO increased trainings for Years 2 and 3 until targets were met. Also, the CLG system was originally intended for users with advanced SQL query writing experience and was challenging for students. Bronx RHIO increased training on SQL topics and simplified the CLG application for basic users. In addition, initial student evaluations of health IT modules identified three areas for improvement. First, the classroom computer equipment was inadequate. BCC addressed this by replacing all of the computer stations with new equipment. Second, the course tests were administered in an interactive PDF format, which students found difficult to use. Instructors provided additional information on using the PDF format. Third, the CLG training module was poorly organized and difficult to follow. Significant changes were made to the organization of the material.

The Bronx RHIO's training program was highly successful. The team exceeded the targeted number of trained data analysts. Classes had higher completion rates and much lower dropout rates than other BCC offerings. Graduates were placed in pilot sites where they effectively liaised between sites and the RHIO. The embedded analysts learned site operations, created close ties with key staff at each site, and helped ensure innovation traction at the sites. In addition, BCC and RHIO staff helped ensure that graduates found jobs in the community. As one team member put it, *"The workforce training program is helping young people find employment and giving them a fresh start, which is very rewarding. It's a model for using programs like this to reach out to communities."*

The program did so well that many felt it could be replicated in other organizations and locations. One person related,

> ***"Through my own research, I determined that the curriculum they're using for their students is one of the most diverse work development programs in the nation. I've even talked to them about branding the program and using in other states. Their workforce development plan really prepares their students. They have students from all different walks of life. One of the big problems that we talked about was how to develop new jobs for the new generation. This project developed a whole new job [field] because of the need. It was unique in an area with high unemployment. You are bringing people back to the workforce with a useable skill set."***

2.20 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

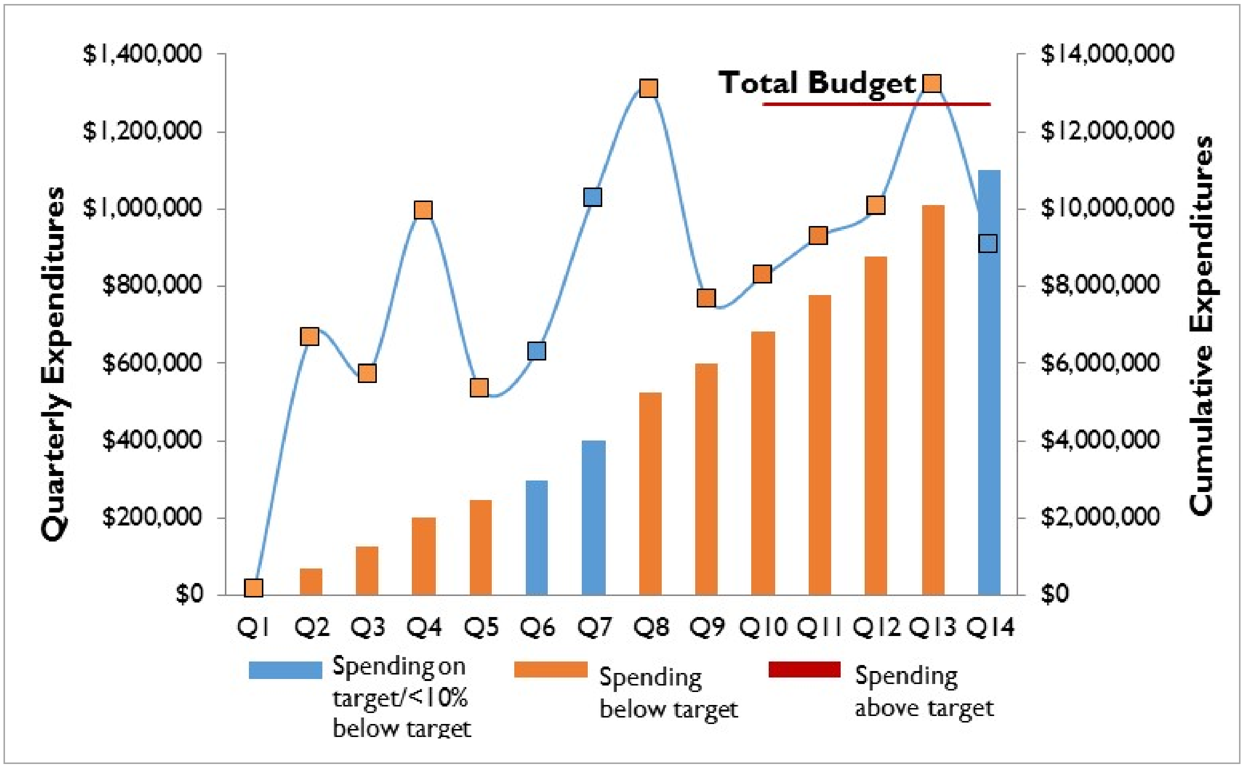
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.20.1 Award Execution

This annual report highlights the significance of the Bronx RHIO's expenditure rates on implementation. As of December 31 (Q14), the Bronx RHIO spent 86.7 percent of its total budget, which was below the projected target (see ***Figure 16***). Spending had been delayed throughout much of implementation as a result of delays in the initial data import. The Bronx RHIO subsequently received a no-cost extension of 9 months to spend the remainder of the budget. Final financial data (through the end of the no-cost extension) are not yet available, but Bronx RHIO expects to spend the full remaining budget. No organizational barriers were encountered in spending the awarded funds.

Figure 16. Cumulative Spend Rate from Q1 (June 1, 2012) to Q14 (December 31, 2015)



2.20.2 Leadership

Project leadership, including the executive director, project director, and clinical director, remained constant since the 2015 annual report. An executive committee, which exercised all functions and powers of the board of directors, oversaw the Bronx RHIO. The committee met monthly to review all aspects of the project including implementation progress, site intervention design, and analytic modeling approaches. Membership was very stable over time, consisting of leaders of organizational partners, patient and member representatives, and physicians. The Bronx RHIO's executive committee was seen as one of the innovation's key strengths. Said one innovation leader, *"We have a strong governance infrastructure. For us, it was making sure we had the right people to be members of our boards and committees. We were fully transparent with [participating pilot sites] as we went through the process."*

In retrospect, leaders acknowledged underestimating the complexity of the innovation, which resulted in a longer than planned start-up period. One leader noted,

> ***"We probably could have embedded the intervention analysts in the sites earlier and not waited as long to start some of the interventions. That might have had a better impact. Then the analysts could have established relationships with medical leadership at the sites to identify the right cohort of patients up front, and these might have been larger cohorts."***

However, leadership felt that this extended planning period ultimately benefitted the project by ensuring that the interventions were well conceived and could achieve the desired results.

The innovation was challenged by incomplete and inconsistently formatted health data. The process of cleaning and standardizing data from each site was time consuming and problematic. Leadership decided to delay innovation go-live with pilot sites rather than risk losing credibility by issuing incomplete and inaccurate reports. Consequently, leadership had to ask innovation partners and participants to be patient and continue to assure them that the Bronx RHIO had rich data, capable staff, and the ability to provide valuable services. As one leader of the innovation put it,

> ***"There was a tremendous amount of skepticism because these stakeholders are accustomed to dealing with large public entities, which the Bronx RHIO is not. We had to go against other large companies such as Allscripts, eClinical Works, and dbMotion. We needed to do a lot of work to properly position ourselves, and those discussions took a year and a half. We had to convince our stakeholders that we were the right partner to meet their needs."***

Ultimately, the decision to delay proved effective when accurate reports were seen as useful and accepted by pilot site clinical staff.

As the award period neared completion, leadership focused on increasing the usable local data held by the Bronx RHIO and the scale on which it was shared. To increase the data that could be included in reports, leadership successfully focused on increasing patient consent rates. One leader said,

> ***"Consent rates are going up consistently 5 percent per month at each pilot site. Our [CHWs] have had a lot to do with that increase—they have taken on a larger role than we originally anticipated. They are improving site workflows in ways that allow the site staff to obtain more patient consents, which leads to more data, and ultimately, getting more patients engaged."***

Bronx RHIO leadership also worked to connect and share data with other regional RHIOs. Despite incentives provided by the April 2014 Delivery System Reform Incentive Payment Program (DSRIP)[2] program, only minimal connections were established as of the date of this report. Leadership noted that,

> ***"While cross-RHIO connectivity is in place, it's not implemented across the entire state, and it's not perfect. The current capability only allows users to look up one patient at a time, which is not optimal. We're still working behind the scenes with each data provider to make sure we have data for analytics. That's all right though, because this was always intended to be the first step, to make improvements and ultimately achieve a meaningful connection."***

2.20.3 Organizational Capacity

To increase the Bronx RHIO's organizational capacity, Spectrum, a Web-based analysis and reporting system featuring dashboard reporting and registry management tools, was created. Spectrum gave the Bronx RHIO the flexibility to adapt to anticipated market demands, and was a key component of

[2] New York State Department of Health: DSRIP Overview. 2014, September. Available from: http://www.health.ny.gov/health_care/medicaid/redesign/dsrip/overview.htm

the long-term sustainability plan. Developed with Optum, Spectrum can track the progress of population health projects and site intervention initiatives and generate reports on performance. It featured an array of useful graphics and offered the ability to drill down to patient-level data by filtering on disease condition, facility, and provider. Patient lists could be created by identifying inclusion/exclusion criteria or by upload, and could be exported for provider/care manager use offline. The system included an algorithm for deidentifying protected health information (PHI), which enabled deidentified aggregate reporting on all patients with data in the BRAD. Reports identifying specific patients could be generated to support intervention with patients who consented to sharing their data.

As of February 2016, Spectrum was beta tested and rapid expansion was planned for the future. Early adopters expressed concern that users would be able to use Spectrum to measure the performance of doctors at specific facilities. Bronx RHIO developed appropriate safeguards and additional training on the tool's limitations. During closeout, one interviewee noted, "*We're currently working with the pilot sites to implement Spectrum, and to educate them on what can and can't be done with the tool."* If fully implemented, Spectrum could potentially be used by thousands of physicians, so the Bronx RHIO planned several rounds of testing prior to full-scale implementation. One main benefit of Spectrum was that it would allow the pilot sites to have access to the same data and reports they already were receiving from the Bronx RHIO, but with much less support required. The Bronx RHIO expected that Spectrum's power and ease of use would increase participation with the RHIO.

2.20.4 Innovation Adoption and Workflow Integration

The Bronx RHIO periodically sent analytic BRIC reports to participating sites to identify patients for intervention. Member sites could also subscribe to receive alerts on specific patients. E-mail alerts sent through a secure messaging system contained notifications about ED admissions and discharges and inpatient usage. Alerts informed site staff in a timely manner about patient visits and enabled staff to provide education or alternative care as needed. While they functioned only as notifications because they did not contain clinical information, alerts offered value because they were received within 24 hours of a patient event, enabling timely delivery of preventive services rather than delaying until the next cycle of BRIC reports triggered intervention. Fewer than half of the sites subscribed to alerts.

Member sites typically received reports from the Bronx RHIO indicating which patients were recently seen at a site, such as a hospital, ED, or care center. The reports contained information such as outpatient usage, lab results, and demographic data. Site staff indicated that these reports gave them a better understanding of patients' decisions regarding health care utilization and enabled them to determine how best to engage these patients. The reports allowed sites to identify patient problems, attempt an intervention, and measure outcomes, although missed appointments created "noise" in reports that led to additional work for the site staff who work with them. Site staff reported that while reports were excellent in quality, workflow challenges existed: staff were not always available to review and process the information, and at times information became dated. To manage their limited resources, some sites wanted to reduce the number of reports received and focus instead on specific conditions. The Bronx

RHIO also hired, trained, and placed CHW staff on site at selected pilot site locations to improve workflow for requesting and obtaining patient consent to share their health information.

2.21 Implementation Effectiveness

A major focus of this report is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.21.1 Innovation Reach

The Bronx RHIO produced analytic reports (BRIC reports) and delivered them to participating pilots sites whose staff interpreted and used them to drive interventions such as patient education and outreach. Bronx RHIO did not perform or control the interventions—selecting patients, providing education, and tracking outcomes. As a result, reach was difficult for the Bronx RHIO innovation to define and track. As one staff member noted,

> ***“The big reason this is such a conundrum that we’re an indirect intervention. Our reach is only as large as the partner sites we can engage with, and their ability to interact and scale what they’re doing with us. The limitations of the sites to expand in the pilot model had a huge impact on our ability to effect the reach and that penetration, because we just didn’t control it. We could have a much bigger pipeline.”***

The Bronx RHIO provided RTI with BRIC reports as the only immediately available measure of the scale of the innovation.

The number of BRIC reports generated by quarter increased over time, from 11 BRIC reports in Q8 to 153 BRIC reports in Q14, for a total of 582 BRIC reports. Thirty-one unique providers across 9 facilities requested at least one BRIC report. ***Table 29*** provides a summary of BRIC report topics including the number of patients in each report, and the number of patients as a percentage of the total number of patients appearing in any report. As shown in the table, the largest percentages of patients were in BRIC reports related to Hepatitis C and other (e.g., BRIC report with patient demographic data generated). Approximately 20 percent of patients were included in BRIC reports related to asthma, and approximately 10 percent were in BRIC reports related to diabetes and geriatrics, respectively.

Table 29. BRIC Report Topics by Number and Percentage of Patients

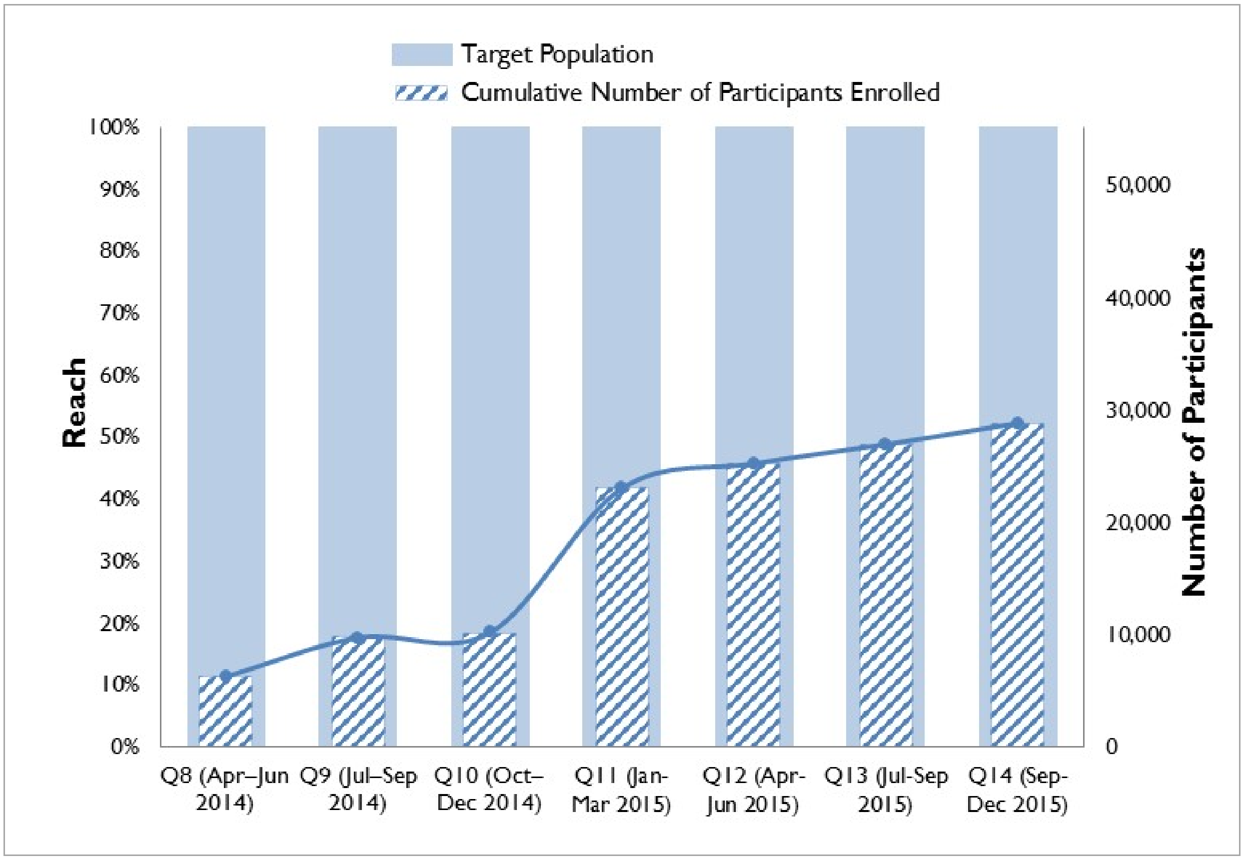
BRIC Report Topic (n=582)	Number of Patients (Percentage) (n=28,844)
Other	9,279 (32.2)
Hepatitis C	7,881 (27.3)
Asthma	5,904 (20.5)
Geriatric	2,978 (10.3)
Diabetes	2,815 (9.8)
Ambulatory intervention	2,020 (7.0)
Four or more diseases	1,593 (5.5)
Nursing/home health	689 (2.4)
Congestive heart failure	37 (0.1)

Source: Patient-level data provided to RTI by Bronx RHIO.

Figure 17 shows reach by quarter since the launch of the innovation based on the 582 BRIC reports with patient-level data that Bronx RHIO provided to RTI through Q14. We worked with Bronx RHIO to determine that 55,215 was an appropriate target population for the patients indirectly served by innovation; it represented the number of patients in BRIC reports through Q5, plus the number of patients they expected to include in BRIC reports following Q5 (estimated as an average of 500 patients per report and 10 reports generated per month). We last reported reach in the 2015 annual report, based on data through Q11. Since that time, Bronx RHIO provided an additional 439 BRIC reports with data, which included an additional 5,845 unique patients in the innovation, increasing reach from 41.7 percent to 52.2 percent.

Cumulative patient enrollment increased slowly over the last several quarters and continued to lag significantly behind innovation goals. The Bronx RHIO did not reach its goal because of implementation delays early in the project timeline and difficulty getting patients' consent to share their data. BRIC reports could potentially include many more patients whose data are held by the RHIO but were excluded from reporting until patient consent was received. At pilot sites that could accommodate additional staff, the Bronx RHIO hired, trained, and placed CHW staff on site to help obtain patient consent to share health information. One leader noted, *"The primary role of the CHWs is to improve consent collection through patient education. We mapped all 12 registration points where a patient could enter the system, tracked each registration area's consent rate, and followed up to improve rates."*

Figure 17. Participant Enrollment and Reach for Each Quarter since Project Launch



Quarter	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)	Q13 (Jul-Sep 2015)	Q14 (Oct-Dec 2015)
Cumulative reach per quarter (%)	11.3	17.6	18.4	41.7	45.7	48.8	52.2
Target population	55,215	55,215	55,215	55,215	55,215	55,215	55,215
Cumulative number of participants enrolled	6,262	9,742	10,153	22,999	25,216	26,931	28,844

Source: Patient-level data provided to RTI by Bronx RHIO

2.21.2 Innovation Dose

Table 30 provides the number of BRIC reports in which participants were included, the number of participants included in that number of reports, and the percentage of enrolled participants represented. This annual report is the first in which we report dose for Bronx RHIO. As shown in the table, more than half of participants (54.7%) were included in only one BRIC report, approximately one-quarter (24.1%) were include in two BRIC reports, with the remaining 21.2 percent included in 3 or more BRIC reports. It is important to note that patients included in more than one BRIC report are likely the same type of report generated over time. For instance, a provider may request a weekly or monthly report on those with diabetes who had three or more ED visits within the past 6 months. Also, inclusion in a BRIC report does not indicate that a patient received intervention such as additional patient education or treatment. As of this writing, RTI has received very little data from pilot sites on the delivery or impact of interventions provided to patients triggered by information contained in BRIC reports.

Table 30. Number and Percentage of Participants by Number of BRIC Reports

Number of BRIC Reports in Which Participants were Included	Number of Participants	Percentage (%) of Enrolled Participants (N=28,844)
1 report	15,774	54.7
2 reports	6,956	24.1
3-5 reports	4,769	16.5
6-10 reports	1,147	4.0
11+ reports	198	0.7

Source: Patient-level data provided to RTI by Bronx RHIO

2.22 Qualitative Findings: Sustainability

The Bronx RHIO had multiple revenue streams and secured sustainable funding beyond HCIA. In part, sustainability came from providing ongoing services to RHIO member sites, similar to the services provided to innovation pilot sites, supported by dues that member sites paid annually for access to RHIO data. Bronx RHIO could also charge customers per service for joining the RHIO. Bronx RHIO membership steadily increased every quarter since late 2010, and will remain a key component of the long-term sustainability strategy.

The Bronx RHIO also plans to implement a new fee structure for its analytic services. This strategy is aligned with a Medicaid payment reform initiative, DSRIP, implemented by the New York State Department of Health. Under this program, 5-year contracts are being given to both SBH Health System and Bronx Lebanon to create Performing Provider Systems (PPSs) of health care delivery and health-related community-based organizations to implement 10 projects each, aimed at reducing hospitalization and ED utilization, while improving quality and reducing cost. These PPSs will require substantial countywide data and analytic and reporting services which the Bronx RHIO will provide. The Bronx RHIO's work with DSRIP will fall into three categories:

1. Providing access to the Bronx RHIO, the standard HIE infrastructure that members receive, including access to the Master Patient Index, consent data, and the portal.

2. Providing data management support for the PPSs including all staff time, professional staff benefits, project managers, training, reporting, claims integration, consent monitoring, and working with partners to make sure data are received.

3. Infrastructure development, hosting, and customization, and helping the PPSs report on measures.

Staff interviewed indicated that this work was a direct result of the HCIA grant:

> ***"We were successful in convincing two of the larger DSRIP awardees in the Bronx to utilize the Bronx RHIO for analytic services. This is 100 percent the result of the CMS innovation award. It paved the way for us to get these awards. It's a substantial sum of money the awardees have agreed to pay us, and we've already started doing some work for them. Right now we're establishing our credibility with them and working to address their reporting needs."***

This 5-year grant will allow the Bronx RHIO to build and expand to the new state health information exchange, and become the essential data provider for various facilities in New York State.

A third revenue stream that the Bronx RHIO will leverage comes from the New York State Operational Fund. The state allocated funds for project-specific improvements and specifically included analytics as a focus area. The Bronx RHIO will use this fund to build on work performed as part of the HCIA innovation. Although not essential for sustainability, leadership is also considering marketing *a la carte* services to other organizations.

The Bronx RHIO plans to sustain current project activities and transition to Web-based data access. All existing pilot sites will have access to data using the Spectrum population health tool after the project ends. RHIO staffing will remain stable, to support their DSRIP contracts. The workforce development program is unlikely to continue, due to the emphasis in DSRIP on clinical delivery innovation rather than on health IT innovation, but could be resumed if needed.

2.23 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Bronx Regional Health Information Organization as well as accomplishments to date. In this section we assess Bronx RHIO's progress on achieving HCIA goals to date:

- **Smarter spending.** The regression results suggest that Medicare beneficiaries incurred lower levels of spending compared to their respective comparison group in the innovation period, whereas Medicaid spending remained similar between the innovation and comparison groups.

- **Better care.** Medicare beneficiaries had significantly fewer inpatient stays and ED visits during the innovation period, whereas Medicaid beneficiaries had significantly higher ED visits during the innovation period.

  Bronx RHIO generated 582 BRIC reports that included 28,844 patients, which is 52.2 percent of the target population, up from 41.7 percent in Q11. More than half of participants (54.7%) were included in one BRIC report, approximately one-quarter (24.1%) were included in two BRIC reports, with the remaining 21.2 percent included in three or more BRIC reports.

- **Healthier people**. The ability to assess health outcomes for the Bronx RHIO's innovation is limited because RTI received very little health outcomes data. We report poor HbA1c control over time for those with diabetes. The percentage of those with poor HbA1c control increased slightly over time; therefore, no improvements in HbA1c control were evident for those included in a diabetes-related BRIC report

The Bronx RHIO executed a well-led program, with adept project management, consistent organizational oversight, and strong community interest. Project staff acknowledged the support and guidance from the BRIC Executive Committee and the overall governance of the project as key strengths of the program. The Bronx RHIO expected to spend the full value of the innovation award and achieved a level of sustainability allowing them to continue to operate in the community. Leadership confirmed that the award enabled Bronx RHIO to demonstrate its capabilities and become a trusted partner in the local health care community. Staffing was stable and effectively managed; no staffing changes occurred in any of the key stakeholder or leadership positions during the life of the program, and turnover at other levels was low. When turnover did occur, appropriate replacements were promptly hired. Training was effective throughout the life of the award, creating a workforce of analysts and technologists who could work effectively at the RHIO, at pilot sites as embedded staff, and elsewhere in the community. Embedded staff were critical to the success of the program, bridging the gap between the sites and the RHIO, ensuring clear communication, contributing to innovation effectiveness, and increasing patient participation.

By all available measures, both innovation components were implemented successfully. In the data analytics component, the Bronx RHIO increased the amount of data collected from participating pilot sites, the number of data sources contributing to the RHIO, and, by increasing consent rates, the richness and utility of the analytic reports Bronx RHIO produced. The number of reports produced per month also increased. Reports were integrated into provider workflow as a routine part of patient care. Integrating analytics into provider workflow should improve as providers adopt their web-based Spectrum population health tool, which will allow providers to produce their own analytic reports with minimal effort. In the workforce development component, graduation and placement rates, student and instructor feedback, job performance ratings, and retention rates all indicate that this program achieved its goals and is appropriate for replication elsewhere.

The Bronx RHIO faced several challenges during the innovation. The startup period was longer than planned but allowed leadership to improve the reliability of services, and achieve sustainability. The Bronx RHIO acknowledged the indirectness of its innovation, which limited its inability to measure reach, dose and health outcomes caused by pilot site interventions. While Bronx RHIO quantified BRIC reports and the number of patients represented in each report, the awardee did not systematically track what providers did with innovation reports or alerts, or what types of services patients received as a result. Interviews suggest that at least some providers were highly engaged in the innovation and used BRIC reports and alerts to monitor and intervene on behalf of their highest risk patients. RTI cannot definitively conclude, however, that the innovation caused reductions in spending, admissions, and ED visits within the Medicare sample, nor explain increases in ED visits among Medicaid patients.

Key lessons learned as a result of the Bronx RHIO innovation were to plan for sustainability in the design of the project, and to gain the support of key stakeholders early in the process. As one project leader noted,

> ***“Building trust from the beginning is a big lesson learned. Now that we know that we’ve been successful in transitioning this innovation and achieving sustainability, we understand that involving key stakeholders from the beginning is very important. If you want to sustain this, you have to get the buy-in early.”***

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Bronx Regional Health Information Organization (Bronx RHIO)

The Bronx Regional Health Information Organization (Bronx RHIO) located in New York City, New York, received an award of $12,689,157 beginning on July 1, 2012 and launched the Bronx Regional Informatics Center (BRIC) innovation on February 20, 2014. The innovation aimed to indirectly improve the health of patients who received care at affiliated pilot sites and consented to share their health information through Bronx RHIO exchange.

Awardee Overview

Innovation dose:	More than half of participants (54.7%) were included in only one BRIC report, approximately one-quarter (24.1%) in two BRIC reports, and the remaining 21.2% in three or more BRIC reports.	***Innovation reach:***	28,844 patients, 52.2% of the target population, were enrolled in the innovation, up from 41.7% in Q11.
Components:	(1) Data analytics produced aggregate reporting for Bronx RHIO providers (2) A trained workforce targeted the care of patients living in the Bronx	***Participant demographics:***	More than half of participants (58.1%) were 45 to 74 years of age, and 51.4% were female. Among participants for whom RTI received data, 35.6% were black, 26.0% were Hispanic, and 19% were white. Less than one-half had Medicaid or Medicare (40.1% and 43.2%, respectively).
Sustainability:	The Bronx RHIO and analytic reporting components will be sustained by a combination of funding sources.		
Innovation type:	Health IT		Health care workforce

Key Findings

Smarter spending. Among Medicare beneficiaries, the average quarterly impact on spending per person was statistically significant, indicating a reduction in Medicare spending (−$531; 90% CI: −$804, −$258). Medicaid spending did not change significantly (−46; 90% CI: −280, 189).

Better care. Total changes in inpatient stays and ED visits for Medicare beneficiaries were statistically significant and amounted to 18 (90% CI: −24, −12) fewer inpatient stays per 1,000 participants per quarter and 18 (90% CI: −25, −12) fewer ED visits per 1,000 participants per quarter. Unplanned readmissions did not change significantly (1; 90% CI: −17, 19). Changes in inpatient says (−3; 90% CI: −17, 12) and unplanned readmissions (−39; 90% CI: −90, 12) did not change significantly for Medicaid beneficiaries. However, ED visits for Medicaid beneficiaries increased significantly, amounting to 38 (90% CI: 8, 68) more ED visits per 1,000 participants per quarter.

Healthier people. The ability to assess health outcomes for the Bronx RHIO's innovation was limited because RTI received very little health outcomes data. We reported poor HbA1c control over time for those with diabetes. The percentage of those with poor HbA1c control increased slightly over time; therefore, no improvements in HbA1c control were evident for those included in a diabetes-related BRIC report.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Children's Hospital and Health System

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Children's Hospital and Health System

2.1 Introduction

Children's Hospital and Health System, Inc. (Children's Hospital), a children's health system in Milwaukee, Wisconsin, received an award of $2,796,255 and began enrolling patients in November 2012. Children's Hospital includes a nonprofit health maintenance organization (HMO) called the Children's Community Health Plan (CCHP) which specifically serves BadgerCare Plus (i.e., Medicaid) members. The hospital and health system, however, serve more than just Badger Care Plus members. CCHP created the Care Links innovation (formerly named Advanced Wrap Network[1] Model), which offered support services through community health navigators (CHNs) to CCHP members at high risk for overusing the ED. Although Care Links specifically targeted CCHP members for the innovation, CHNs services were made available to all members of the household. Children's Hospital sought to achieve the following HCIA goals:

1. **Smarter spending.** Decrease annual ED visits by a total of 2,030 for CCHP members (for a savings of $406,000).
2. **Better care.** Educate and empower members to navigate the health care system and use preventative care so that ED visits are avoided when possible.
3. **Healthier people**. Improve management of chronic diseases, including diabetes and asthma.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter* (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	CHNs continued to provide home visits, health education and counseling, and referral to follow-up care with support from NNs.
Program Participant Characteristics	
	Over one-quarter of participants (26.6%) were under 18 years old and 19.5% were 25–44 years old; 100% were covered by Medicaid.

(continued)

[1] In the Q7 report, this name was changed to Care Links.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Workforce Development	
Hiring and retention	Hired 1 new full-time CHN and 2 temporary CHNs (through June 30, 2015) in Q11.
	One staff separation occurred in Q12 and no new staff were hired.
Skills, knowledge, and training	Two training courses were offered totaling 216 hours of training in Q11; no training occurred in Q12.
	A cumulative 1,226 hours of training was provided to 50 staff since project inception.
Context	
Award execution	86.2% of Year 3 budget expended as of June 30, 2015, below the projected target.
Leadership	No change in leadership reported. Care Links program leadership was more involved in implementation than CCHP organizational leadership.
Organizational capacity	Implementation challenges were due to extreme growth of membership, lack of staffing and management capacity, and data management.
Innovation adoption and workflow integration	Innovation adopted into the CCHP.
	Workflow changed slightly during Year 2: the NN supported the CHNs and did not have her own separate caseload.
Implementation Effectiveness	
Innovation reach	10.7% of eligible members attempted to be contacted (1,722/16,029), and 30.4% of those contacted (1,722/5,662) enrolled in the innovation.
Innovation dose	15.1% of participants received 1 visit, 5.7% received 2 visits and 40.4% received all 3 visits. 38.8% of enrollees did not receive a home visit.
Sustainability	
	Finances were adjusted to maintain employment of the CHNs and NN after grant period ended.

Sources: *Q11–Q12 Narrative Progress Report*.
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted Feb-June, 2015.

CCHP = Children's Community Health Plan; CHN = community health navigator; CMS = Centers for Medicare & Medicaid Services; FTE = full-time equivalent; NN = nurse navigator; PO = project officer; Q = quarter.

Table 3 summarizes Medicaid claims-based findings during the innovation period. The average spending differential in the innovation period, indicating savings for the innovation group, is −$109 per participant per quarter. This difference is not statistically significant (90% CI: −$247, $28). Inpatient admissions decreased, on average, by 11 admission per 1,000 participants per quarter relative to the comparison group. The effect is not statistically significant (90% CI: −25, 2). For readmissions, the average quarterly innovation-comparison difference is 7.8 percentage points lower during the innovation period. The effect is statistically significant (90% CI: −148, −8). ED visits decreased by an average of 16 ED visits per 1,000 participants per quarter relative to the comparison group. The effect is not statistically significant (90% CI: −81, 49).

Table 3. Summary of Medicaid Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI
Aggregated results						
Total spending (in millions)	−$0.203	−$0.458, $0.053	−$0.119	−$0.336, $0.098	−$0.084	−$0.170, $0.002
Acute care inpatient stays	−21	−46, 5	−10	−33, 14	−11	−20, −2
Hospital-wide all-cause unplanned readmissions	−9	−16, −1	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−30	−151, 91	12	−98, 122	−42	−92, 9
Average impact per quarter						
Spending per participant	−$109	−$247, $28	−$64	−$181, $53	−$45	−$92, $1
Acute care inpatient stays (per 1,000 participants)	−11	−25, 2	−7	−22, 9	−29	−53, 6
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−78	−148, −8	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−16	−81, 49	8	−66, 82	−113	−249, 23

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model
- **Hospital-wide all-cause readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause readmissions are the product of Hospital-wide all-cause readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

The Children's Hospital innovation, Care Links, initially consisted of two program components: (1) CHNs and (2) nurse navigators (NNs). The innovation provided support services including home visits, health education and counseling, and referral to follow-up care to CCHP members in the seven-county southeastern Wisconsin region who were at high risk for ED use (i.e., used the ED at least twice in the prior 6 months). Although CCHP serves Medicaid eligible adults and children and Care Links specifically targeted CCHP members for enrollment in the innovation, CHN services were available to all members of the household regardless of insurance status. Other household members, however, are not considered formally enrolled in Care Links. The CHNs are lay workers who represent the communities they serve and often have family lives not unlike the members they serve. In this way, they related to the stress that families experienced and knew about community resources that were accessible to families.

Children's Hospital dissolved the NN component in Year 2 as the position became a support role for the CHNs. The Hiring and Retention Section later in this report provides more information on the reason for this change.

Children's Hospital did not involve any organizational partners or subcontractors under the HCIA Community Resource program. Although they attempted to have CHNs colocated at partner agencies (e.g., clinics, EDs), these arrangements were not sustainable.

2.1.2 Program Participant Characteristics

Table 4 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report, based on data through Q11, and in this report we provide updated data through Q12. The distribution of patient age, sex, race, and payer category presented here is similar to the previous report. Data presented in Table 4 presented data for all patients ever enrolled; however, 44.9 percent did not report age, 22.0 percent did not report sex, and 47.2 percent did not report race. More specifically, over one-quarter of participants (26.6%) were under 18 years old and 20 percent (19.5%) were 25–44 years old. Among those with age reported (n=948), however, 48.3 percent were under 18 years old, 12.4 percent were 18–24, 35.3 percent were 25–44, and 3.9 percent were 45–64 years old. More than half of participants (53.7%) were female although among those with data reported for sex (n=1,342), 68.9 percent were female and 31.1 percent were male. At least one-quarter (26.4%) were black, 16 percent were Hispanic, and approximately 10 percent (9.8%) were white. Among those with data reported for race (n=910), half were black (50.0%), 30.2 percent were Hispanic, and 18.5 percent were white. 100 percent of participants were covered by CCHP's BadgerCare Plus Plan (i.e., Medicaid Managed Care).

Table 4. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	1,722	100.0
Age		
<18	458	26.6
18–24	118	6.9
25–44	335	19.5
45–64	37	2.1
65–74	0	0.0
75–84	0	0.0
85+	0	0.0
Missing	774	44.9
Sex		
Female	924	53.7
Male	418	24.3
Missing	380	22.0
Race/ethnicity[2]		
White	168	9.8
Black	455	26.4
Hispanic	275	16.0
Asian	6	0.3
American Indian or Alaska Native	6	0.3
Native Hawaiian or other Pacific Islander	0	0
Other	0	0
Missing/refused	812	47.2
Payer Category		
Dual	0	0
Medicaid	1,722	100
Medicare	0	0
Medicare Advantage	0	0
Other	0	0
Uninsured	0	0
Missing	0	0

Source: Patient-level data provided to RTI by Children's Hospital.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or readmissions?
- Do patients who receive all three homes visits have lower health care spending and utilization than those who receive one or two home visits?

Table 5 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report. The innovation only serves Medicaid patients; therefore, we do not present Medicare claims analyses.

Table 5. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	Yes
		Hospital unplanned readmissions rate	No	Yes
		ED visit rate	No	Yes
	Cost	Spending per patient	No	Yes
		Estimated cost savings	No	Yes

ED = emergency department.

The primary source of Medicaid data for evaluating HCIA awardees is the Centers for Medicare & Medicaid Services Alpha-MAX data files. However, as of December 31 2015, Alpha-MAX data from Wisconsin were available only for the first year of the innovation period. In addition, Children's Hospital includes only CCHP Medicaid managed care recipients, and Medicaid Alpha-MAX data usually do not include claims information for Medicaid managed care enrollees. Therefore, claims analysis reported here use data directly provided by Children's Hospital. The innovation was launched in November 2012, and claims received represent data from first quarter 2011 to first quarter 2015. Children's Hospital provided data on total amount paid, encounter type, national place of service, and date of intake and discharge for each patient. We use those variables to construct the core four measures.

The analysis focuses on patients who had at least 2 ED visits in the 6 months prior to Care Links enrollment, and who were contacted and located as of March 2015 (n=5,103). The other data presented in this report were provided through June 2015. Of those 5,103 patients, 3,581 declined services, and 1,522 initiated the program, i.e., were enrolled in Care Links. However, not all patients enrolled received home visits. The claims analysis defines participants as those who received at least one home visit (n=907), and nonparticipants as those who declined services (n=3,581) or, despite agreeing to participate in Care Links, did not receive any home visit (n=615). Note that we could not link all patient identifiers to the claims files provided. For the claims analysis, 535 patients received at least one home visit, 282 enrolled patients did not receive any home visit, and 1,782 patients declined services. In addition to comparing Children's Hospital's innovation participants before and after implementation of the innovation, the claims analysis compares the four measures between groups of participants (innovation group) and nonparticipants (comparison group).

2.3 Medicaid Comparison Group

The comparison group includes those who did not receive any home visit and those who declined services. The reason for this is fourfold.

First, those who did not receive any visits were similar in observable characteristics (age, gender, race, and spending and health care utilization for the quarter when patients were selected into the 2+ ED list) to those who declined services. In addition, the full comparison group was similar in those observable characteristics to the innovation group. This approach might suffer from selection bias issues that are not controlled for in the analysis if the probability of declining services is correlated with the outcome variables of interest. However, similarly, the probability of not receiving any home visit could also be correlated with the outcome measures.

The second reason the comparison group includes both patients who did not receive home visits and declined services is that those who declined services were also originally selected for the innovation as part of the prioritization process created by Children's. Therefore, it is reassuring that results for those who did not receive any home visits were similar to those that declined services.

The third reason is that although patients who did not receive any home visits initially agreed to participate in Care Links, ultimately they did not participate. Thus, their reasons for declining to participate in Care Links may be similar to those that declined to participate from the start. Members who agreed to participate in Care Links but did not receive any home visits may not have been home at the agreed appointment time or simply did not answer the door. These explanations for why some who agreed to participate but did not receive a home visit is very similar to the reason for declining services from the onset.

Finally, by also including those who declined services, we increased the comparison group sample size considerably (2,064 vs. 282).Therefore, the claims analysis compares those who received at least one home visit to those who declined or accepted but did not receive any visit.

The following sections present descriptive and regression results for the four core measures. Some beneficiaries did not have any claims data for several quarters. Missing claims could occur because patients were not enrolled in Medicaid or no spending occurred for those enrolled. To partially address this issue, we assume that a missing claim has a zero payment if the patient had a non-missing claim before and after the quarter where the claim is missing. For other quarters, we assumed a missing value (e.g., not enrolled). This approach can underestimate spending if patients used services paid through other means, such as out-of-pocket or other insurance. To fully address this point, we would need information on Medicaid enrollment for each quarter from Children's Hospital or the state Medicaid program.

The regression analyses in the sections below determine the impact of the innovation on spending, number of hospital visits, number of ED visits, and probability of hospital readmission. We also estimate the impact of completing the innovation versus partially completing the innovation on those measures. We define innovation completers as those who received all three home visits, and partial completers as those who received one or two home visits. Of the 535 patients in the innovation group, 315 received all three home visits and 220 received one or two home visits. Although the CHN identifies the patient's most critical needs in the first visit, the second and, particularly, the third visits are more targeted at the patient's needs. This analysis assesses whether receiving all three visits had a "dose effect," whereby those who had more support better managed their health conditions, which can then impact spending, readmissions, hospitalization, and ED visits.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 6 reports Medicaid spending per patient in the eight quarters before and the eight quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 1*** illustrates the Medicaid spending per beneficiary in Table 6 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for participants, health care spending increases prior to enrollment. Spending patterns for both groups are similar before the innovation. Both groups' spending spikes at baseline quarter 8 (B8). This spike occurs because, to be eligible for the innovation, patients must have had two ED visits in the prior 6 months. In addition to the ED visit, patients might have had other health care expenses related to the condition that led them to the ED, which contributed to the spike. After innovation quarter 1 (I1), both groups' spending rate decreases to levels below the baseline trend line: the comparison group has lower spending up to I4 and higher spending afterward. However, the standard deviation in spending is high for both groups, as shown in Table 6. The regression analysis that follows assesses the impact of the innovation on the difference in spending between the innovation and comparison groups.

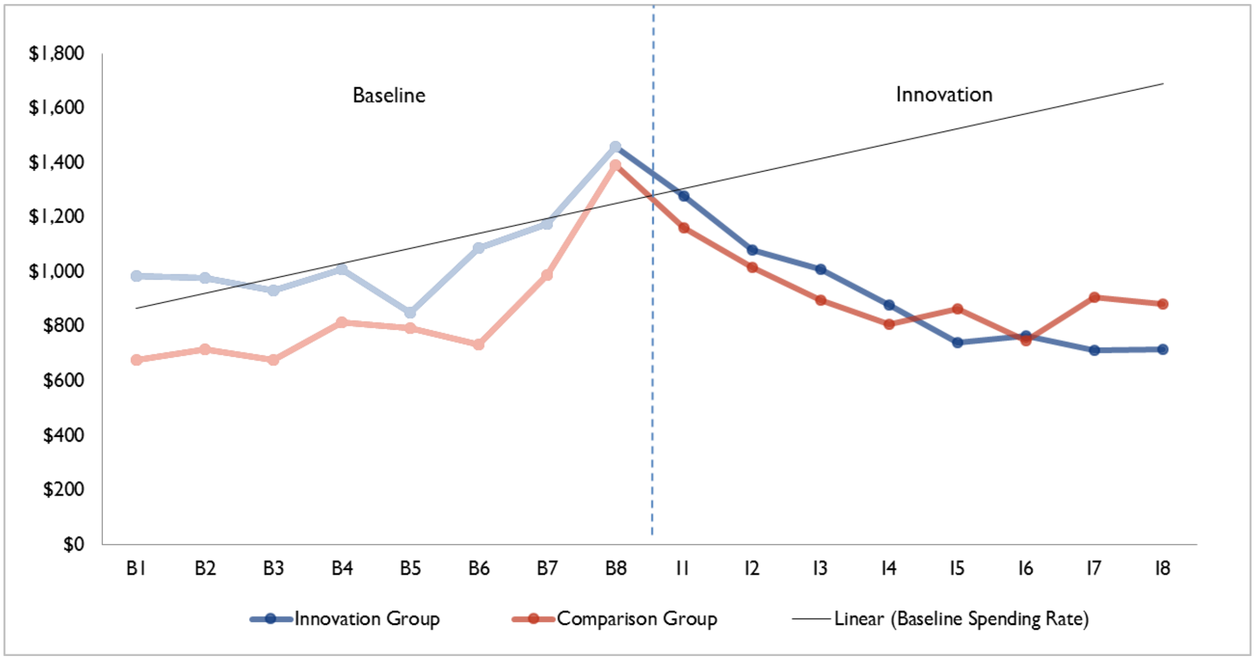
Table 6. Medicaid Spending per Participant: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Spending rate	$985	$977	$932	$1,010	$849	$1,087	$1,176	$1,459	$1,280	$1,082	$1,009	$880	$740	$767	$713	$718
Std dev	$3,250	$1,919	$1,696	$1,966	$1,371	$2,298	$2,644	$3,314	$2,601	$2,066	$2,330	$1,621	$1,415	$1,294	$973	$1,093
Unique patients	196	230	286	353	416	481	538	535	518	439	311	217	149	110	69	40
Comparison Group																
Spending rate	$678	$717	$678	$817	$793	$732	$990	$1,391	$1,161	$1,018	$897	$808	$865	$749	$908	$884
Std dev	$1,445	$1,850	$1,521	$2,619	$1,858	$1,649	$3,372	$4,452	$4,297	$4,339	$3,682	$1,980	$2,583	$2,006	$5,605	$2,443
Weighted patients	623	737	894	1113	1402	1711	1981	2064	1943	1707	1396	1063	622	375	186	73
Savings per Patient																
	−$307	−$260	−$253	−$193	−$56	−$355	−$186	−$68	−$119	−$64	−$111	−$72	$125	−$18	$195	$166

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; Children's Hospital =Children's Hospital and Health System, Inc.; I1 = Innovation Q1.

Figure 1. Medicaid Spending per Participant: Children's Hospital



Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Children's Hospital =Children's Hospital and Health System, Inc.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$109 (90% CI: −$247, $28).This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

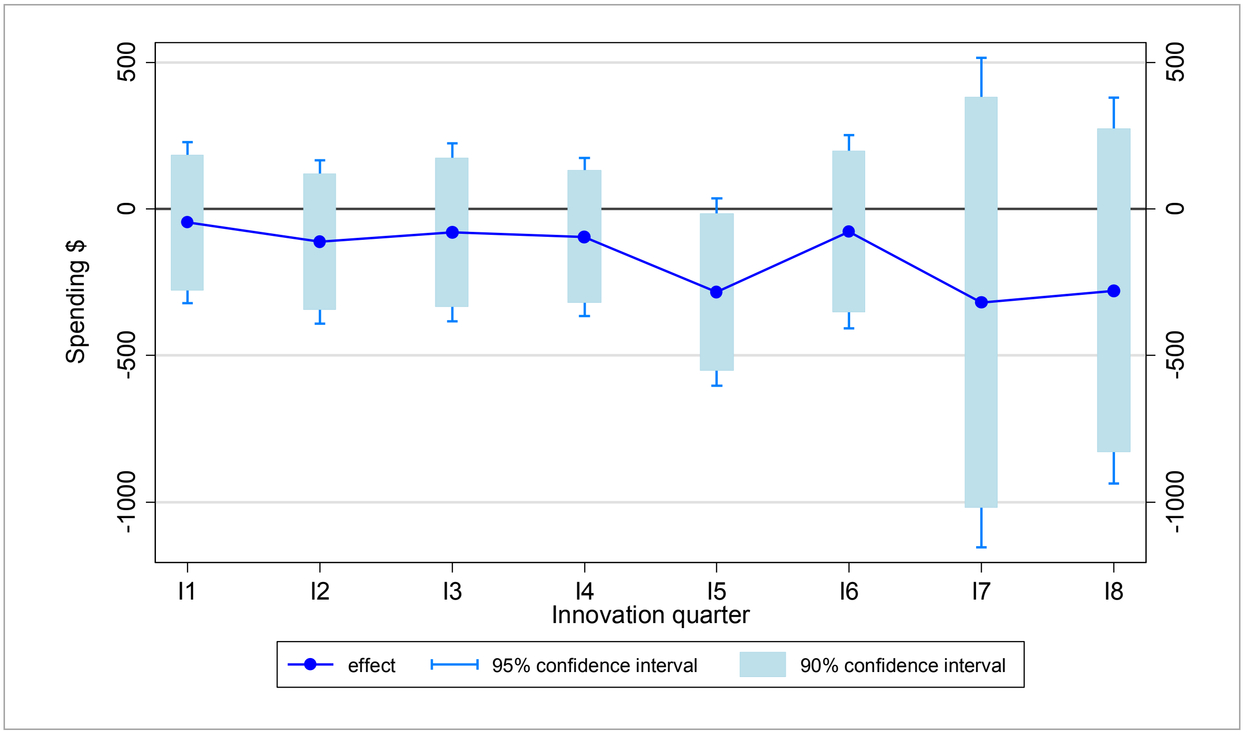
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 7*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 2*** illustrates these quarterly difference-in-differences estimates. The change in spending among the innovation group is lower than the change in spending for comparison group individuals, for all innovation quarters. The largest difference is for innovation periods I5, I7, and I8, where the change in spending was on average almost $300 lower in the innovation group. The differences in spending estimate was statistically significant for I5. Even though the lower spending among innovation group individuals is not statistically significant for most innovation quarters or for any of the aggregate estimates, the trend in the estimated quarterly spending differences suggests that the innovation might lead to long-term savings.

Table 7. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	−46	140	0.740
I2	−112	142	0.430
I3	−80	155	0.604
I4	−95	138	0.490
I5	−283	163	0.082
I6	−77	168	0.644
I7	−319	426	0.455
I8	−278	336	0.409
Overall average	−109	84	0.192
Overall aggregate	−202,532	155,069	0.192
Overall aggregate (IY1)	−118,723	131,959	0.368
Overall aggregate (IY2)	−83,809	52,415	0.110

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for age, gender, and race. The difference-in-differences specification also controls for fixed differences between innovation and comparison groups and for quarterly effects that have same impact on the innovation and comparison groups. Overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Children's Hospital =Children's Hospital and Health System, Inc.; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

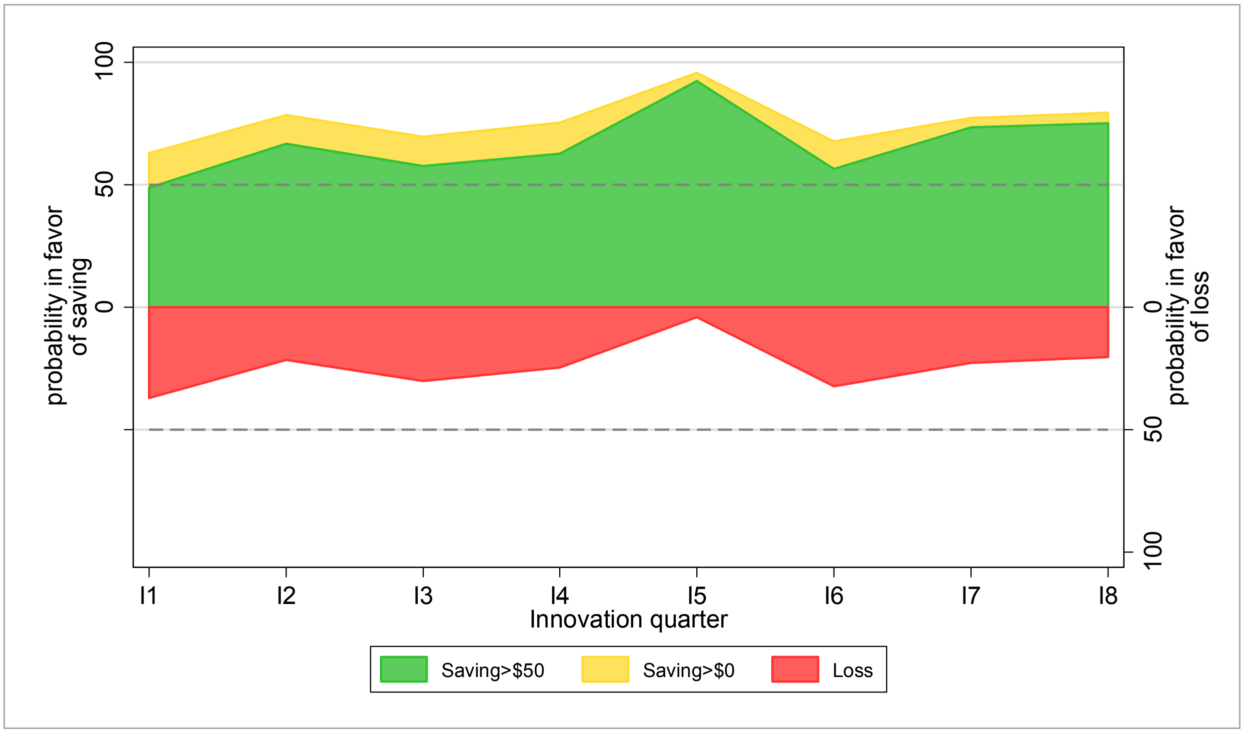
Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Children's Hospital



Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Children's Hospital =Children's Hospital and Health System, Inc.; OLS = ordinary least squares.

Figure 3 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The figure shows that the innovation has a considerably higher probability of generating savings rather than losses throughout all innovation periods.

Figure 3. Quarterly Strength of Evidence in Favor of Savings/Loss: Children's Hospital



Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Children's Hospital =Children's Hospital and Health System, Inc.

Table 8 presents the weighted average treatment effect on spending per participant per quarter during the innovation period for the full innovation group (i.e., both completers and partial completers), completers only, and partial completers only, as compared to the matched comparison group. The table shows the differential spending per quarter in the innovation period between each innovation group and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$109 (90% CI: −$247, $29) and −$209 (90% CI: −$416, −$2) per member for the full innovation and innovation completer groups, respectively. This effect is statistically significant for innovation completers. Partial completers show a non-significant loss of $37 (90% CI: −$208, $282). The lack of savings for those who do not receive all home visits might be related to unobserved characteristics correlated with higher health care expenditures rather than not completing the innovation. Our results show that the innovation generates savings overall (although this effect is not statistically significant), particularly when all three home visits are delivered (and this effect is statistically significant).

Table 8. Average Spending Differential per Participant per Quarter: Full Innovation, Innovation Completers and Partial Completers: Children's Hospital

Innovation group	Average	Standard Error	P-Values
Full innovation	−109	84	0.192
Innovation completers	−209	126	0.097
Partial completers	37	149	0.803

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes: The average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Children's Hospital =Children's Hospital and Health System, Inc.

Table 9 presents the results of an OLS regression with quarterly spending as the dependent variable and innovation completion included as an explanatory variable. The coefficients represent the difference in quarterly spending in innovation quarters between innovation completers and the comparison group (panel A), and partial completers and the comparison group (panel B). The last column tests whether there is a statistically significant difference between the coefficients for each innovation group within each quarter. The results in Table 9 show that the change in spending among those who completed the innovation is much lower than for partial completers except for I8. Although the trend for completers shows consistent savings, that trend does not occur for partial completers. The quarterly changes are not statistically significant for both groups, and the coefficients of the two innovation groups are not significantly different from each other for all quarters. Despite the lack of statistical significance, the results suggest that the downward trend on spending is driven by those who completed the innovation.

Table 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant—Innovation Completers and Partial Completers: Children's Hospital

	A—Three Home Visits (Completers)			B— One or Two Home Visits (Partial Completers)			A vs B
Quarter	Coefficient	Standard Error	P-Values	Coefficient	Standard Error	P-Values	P-Values
I1	−126	204	0.536	69	240	0.772	0.509
I2	−241	218	0.267	78	258	0.763	0.316
I3	−155	256	0.543	26	292	0.930	0.623
I4	−216	295	0.464	82	353	0.815	0.496
I5	−409	354	0.248	−96	427	0.823	0.551
I6	−138	408	0.735	14	511	0.979	0.805
I7	−477	514	0.354	−42	670	0.950	0.578
I8	−245	713	0.731	−342	872	0.695	0.924

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes: The regression coefficients are the quarterly difference-in-differences estimates for each innovation group (completers and partial completers). Besides the innovation quarters, the regression controls for age, gender and race. The difference-in-differences specification also controls for fixed differences between the two innovation groups and control group, and for quarterly effects that have the same impact on innovation completers, partial completers, and control groups.
Children's Hospital =Children's Hospital and Health System, Inc.; OLS = ordinary least squares.

2.5 Medicaid Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 4***. Inpatient admissions trend upward during the baseline period. After the innovation began and up to I3, inpatient admissions decrease in a similar pattern for both groups. After I3, inpatient admissions fluctuate for both groups. However, they always remain below the baseline trend. These results have a high degree of variability. We conducted a regression analysis to assess the impact of the innovation on inpatient admissions, discussed next.

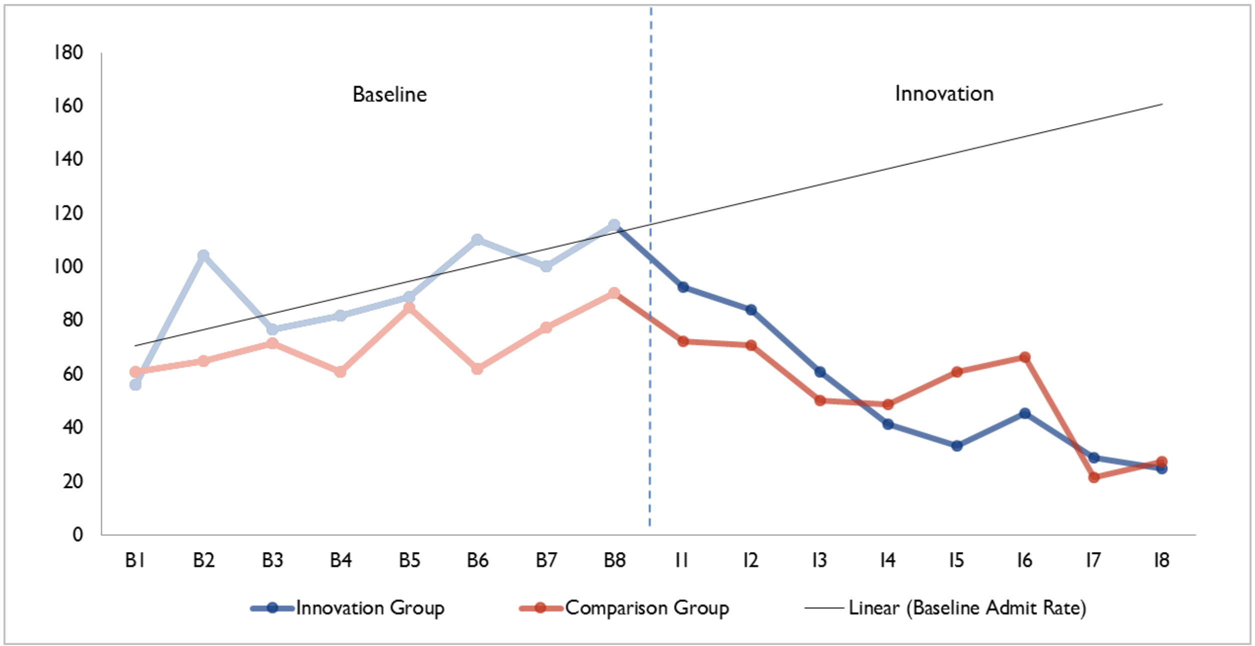
Table 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Admit rate	56	104	77	82	89	110	100	116	93	84	61	41	34	45	29	25
Std dev	272	371	315	304	301	374	402	495	367	294	289	222	181	209	169	158
Unique patients	196	230	286	353	416	481	538	535	518	439	311	217	149	110	69	40
Comparison Group																
Admit rate	61	65	72	61	85	62	78	91	73	71	50	49	61	67	22	27
Std dev	259	278	275	294	313	271	318	407	325	350	296	259	310	378	145	164
Weighted patients	623	737	894	1,113	1,402	1,711	1,981	2,064	1,943	1,707	1,396	1,063	622	375	186	73
Innovation-Comparison rate																
	−5	39	5	21	4	48	23	25	20	13	11	−7	−28	−21	7	−2

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Children's Hospital =Children's Hospital and Health System, Inc.; I1 = Innovation Q1.
.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Participants: Children's Hospital



Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Children's Hospital =Children's Hospital and Health System, Inc.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 11 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in the number of inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −25, 2). In addition to the average effect over the innovation period, we also present aggregate and quarterly effects.

Table 11 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The number of inpatient admissions per quarter for the innovation group, relative to the comparison group, decreases for all innovation quarters, with the exception of I7. The only statistically significant result is for I5, where inpatient admissions decrease by 44 per 1,000 participants. This pattern leads to a lower number of aggregate inpatient admissions for both years of participation in the innovation, a result that is statistically significant for the second year.

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Participants: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	0	18	0.987
I2	−6	19	0.741
I3	−6	19	0.750
I4	−23	19	0.226
I5	−44	23	0.057
I6	−36	31	0.237
I7	2	24	0.939
I8	−11	36	0.751
Overall average	−11	8	0.179
Overall aggregate	−21	15	0.179
Overall aggregate (IY1)	−10	14	0.498
Overall aggregate (IY2)	−11	5	0.040

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for age, gender, and race. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Children's Hospital =Children's Hospital and Health System, Inc.; I = Innovation Quarter; IY = Innovation Year

The dose analysis for the average difference in the number of inpatient admissions for innovation completers and partial completers, relative to the comparison group and for all innovation quarters, shows a statistically significant decrease of 29 inpatient admissions per 1,000 participants for innovation completers (90%CI: −49, −9), and a nonstatistically significant increase of 16 inpatient admissions per 1,000 participants for partial completers (90% CI: −11, 44). This result suggests that completing the innovation results in a lower number of inpatient admissions for the innovation group.

2.6 Medicaid Readmissions

2.6.1 Descriptive Results

Hospital readmissions rates per 1,000 admissions are shown in ***Table 12*** and ***Figure 5***. Readmissions rates are highly variable in the baseline and innovation periods. With few admissions (the denominator in the readmission rate) and a relatively low underlying percentage of readmissions, the readmission rate varies greatly over time. After the innovation, readmissions for the innovation group appear to decrease to values below the comparison group's and always below the baseline trend line. We conducted a regression analysis to assess the impact of the innovation on readmissions, discussed next.

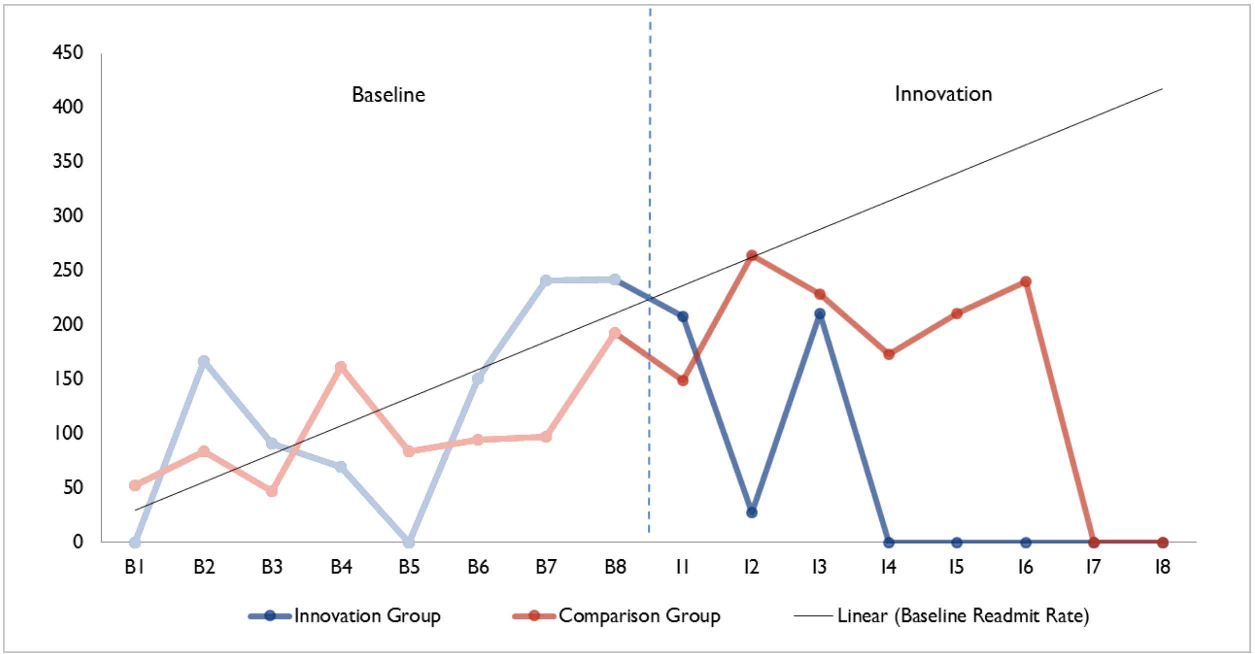
Table 12. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Readmit rate	0	167	91	69	0	151	241	242	208	27	211	0	0	0	0	0
Std dev	0	373	287	253	0	358	428	428	406	162	408	0	0	0	0	0
Total admissions	11	24	22	29	37	53	54	62	48	37	19	9	5	5	2	1
Comparison Group																
Readmit rate	53	83	47	162	84	94	97	193	149	264	229	173	211	240	0	0
Std dev	223	276	211	368	277	292	297	394	356	441	420	378	408	427	0	0
Total admissions	38	48	64	68	119	106	154	187	141	121	70	52	38	25	4	2
Innovation-Comparison rate																
	−53	83	44	−93	−84	57	143	49	59	−237	−18	−173	−211	−240	0	0

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Children's Hospital =Children's Hospital and Health System, Inc.; I1 = Innovation Q1.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Children's Hospital



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Children's Hospital =Children's Hospital and Health System, Inc.

2.6.2 Regression Results

Table 13 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had a readmission within 30 days. The average quarterly difference-in-differences estimate for readmissions is −78 per 1,000 inpatient admissions (7.8 percentage points), indicating that the innovation-comparison difference is 7.8 percentage points lower during the innovation period. This is the average difference in readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −148, −8).

Table 13. Difference-In-Differences Logistic Regression Estimates for Probability of Hospital Readmission per 1,000 Index Admissions: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
Overall average	−78	43	0.0688
Overall aggregate	−9	5	0.0688

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation quarters, the regression controls for age, gender, and race. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Children's Hospital =Children's Hospital and Health System, Inc.

Dose analysis for average difference in the probability of readmissions for innovation completers and partial completers for all innovation quarters shows a reduction in probability of readmissions for each group-comparison difference of 7.8 percentage points. No difference is statistically significant.

2.7 Medicaid Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 14*** and ***Figure 6.*** Outpatient ED visits trend upward during the baseline period mainly due to the high peak of ED visits in B8 for both innovation and comparison groups. To be eligible for the innovation (and thus in the innovation or comparison group), a patient must have had two ED visits in the 6 months before the innovation, which explains the spike in B8. After I1, both innovation and comparison groups show a decrease in the number of ED visits to values below the baseline trend line. The less stable pattern after I6 for the innovation group is related to a reduced sample size. Regression results in the next section assess whether quarterly differences in ED visit rates between the innovation and comparison groups are impacted by the innovation.

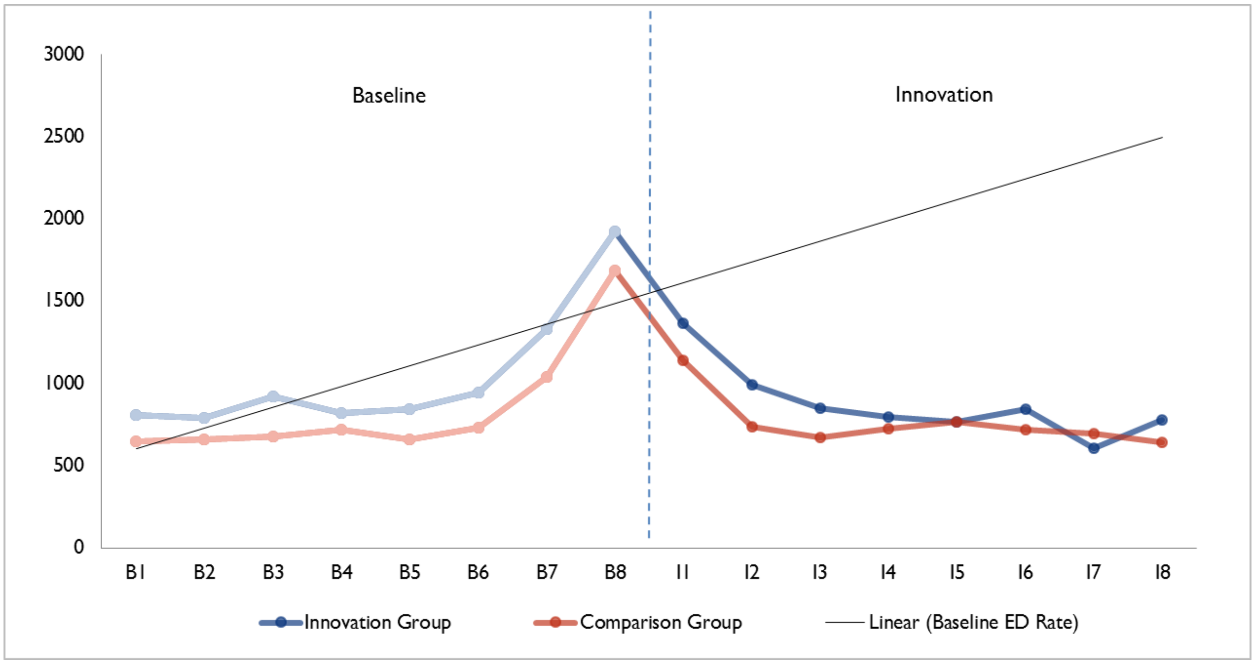
Table 14. ED Visits per 1,000 Participants: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
ED rate	806	791	920	822	841	944	1,331	1,921	1,363	991	852	797	765	845	609	775
Std dev	1,238	1,078	1,368	1,196	1,204	1,316	1,508	1,564	1,798	1,688	1,329	1,157	1,561	1,687	826	1,310
Unique patients	196	230	286	353	416	481	538	535	518	439	311	217	149	110	69	40
Comparison Group																
ED rate	647	657	678	721	660	729	1,040	1,683	1,142	737	669	726	768	720	694	644
Std dev	1,144	1,221	1,253	1,213	1,092	1,107	1,225	1,347	1,429	1,206	1,106	1,233	1,390	1,366	1,049	963
Weighted patients	623	737	894	1,113	1402	1,711	1,981	2,064	1,943	1,707	1,396	1,063	622	375	186	73
Innovation-Comparison rate																
	159	135	242	101	181	215	290	238	221	254	183	71	−3	125	−85	131

Source: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Children's Hospital =Children's Hospital and Health System, Inc.; ED = emergency department; I1 = Innovation Q1.

Figure 6. ED Visits per 1,000 Participants: Children's Hospital



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Children's Hospital =Children's Hospital and Health System, Inc.; ED = emergency department.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 16 ED visits per 1,000 participants relative to the comparison group. This is the average difference in the count of ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −81, 49). In addition to the average effect over the innovation period, we also present quarterly and aggregate effects.

Table 15 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. The number of ED visits per quarter for the innovation group, relative to the comparison group, increases for I2 and I3 and decreases thereafter, up to I8, where it increases again. No result is statistically significant. This pattern leads to a higher number of aggregate ED visits in the first year of participation in the innovation and a lower number of ED visits in the second year of the innovation. However, no result is statistically significant.

Table 15. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	−27	89	0.767
I2	87	83	0.293
I3	26	82	0.750
I4	−96	88	0.273
I5	−168	135	0.214
I6	−14	167	0.933
I7	−221	135	0.102
I8	9	244	0.971
Overall average	−16	40	0.685
Overall aggregate	−30	74	0.685
Overall aggregate (IY1)	12	67	0.862
Overall aggregate (IY2)	−41	30	0.173

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for age, gender, and race. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Children's Hospital =Children's Hospital and Health System, Inc.; I = Innovation Quarter; IY = Innovation Year

The dose analysis for the average difference in the number of ED visits for innovation completers and partial completers, when compared to the comparison group and for all innovation quarters, shows a decrease of 22 ED visits per 1,000 participants for innovation completers and an increase of 88 ED visits per 1,000 participants for partial completers. However, no difference is statistically significant.

2.8 Discussion: Medicaid Results

The trend in the estimated quarterly spending differences for innovation participants suggests that the innovation might lead to long-term savings; however, this result was not statistically significant at conventional significance levels. Our results show that the downward spending trend was driven by those who received all three home visits. We found nonstatistically significant savings of $109 per member per quarter for all members, and statistically significant savings of $209 per member per quarter for those who received all three home visits. Those that received all three home visits (i.e., completers) were slightly younger on average (18 years old) compared to those that did not complete all three home visits (i.e., non-completers) who were 20 years old on average. Part of the explanation may be that participants still living at home with their parents were less likely to leave the program, perhaps because they were easier to find or for other familial reasons.

For health care utilization, our results suggest a pattern of lower inpatient admissions for the innovation group, relative to the comparison group, with statistically significant results for the second year of participation in the innovation. The dose analysis found statistically significant results supporting a decrease in inpatient admissions for those who complete the innovation but not for partial completers. There was a statistically significant reduction in the probability of readmissions for the innovation group compared to the comparison group. ED visits decreased for the innovation group compared to the comparison group, but the difference was not statistically significant. We did not find statistically significant results for dose analysis on the probability of readmission and number of ED visits.

These results may not fully represent the overall population served by the innovation. The results presented here are only for patients whose ID could be matched to the claims file, about 54 percent of the overall population reached by the innovation.

2.9 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Children's Hospital submitted data to RTI that are current through June 2015. ***Table 16*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested. Given the very small number of enrolled participants for which each respective measure was applicable (range n = 3 to n = 29), we decided not to include these data in this report because, based on such a small number, we could not definitively conclude that the innovation affected clinical effectiveness of care provided to participants.

Table 16. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status
Clinical Effectiveness	Timeliness of care	At least one primary care visit completed each year (HEDIS)	Data received from Children's Hospital
		Six well-child visits in the first 15 months of life (HEDIS)	Data received from Children's Hospital
		Well-child visits in the third, fourth, fifth, and sixth years of life (HEDIS)	Data received from Children's Hospital
	Vaccines	Childhood immunization status (HEDIS)	Data received from Children's Hospital
	Asthma	Use of appropriate medications for people with asthma (HEDIS)	Data received from Children's Hospital

HEDIS = Healthcare Effectiveness Data and Information Set; Q = quarter

2.10 Discussion: Awardee-Specific Data

We did not receive any updated clinical effectiveness data from Children's Hospital since the 2015 annual report. In the 2015 annual report, we only received data from Children's Hospital for those enrolled in the innovation, and fewer than 30 participants had any clinical effectiveness data. Given the limited amount of data provided for the clinical effectiveness measures, no data are presented. Therefore, we cannot conclude whether the innovation had an impact on the type of quality of health care services participants received.

2.11 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 17*** lists the quantifiable measures of implementation and their status as of June 30, 2015 that RTI obtained from Children's Hospital's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 17. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of full-time equivalent staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of members on the 2+ list/month contacted to participate in Care Links	Data received from Children's Hospital
		Number/percentage of members who agreed to participate in Care Links	Data received from Children's Hospital
	Dose	Number of completed visits per member	Data received from Children's Hospital

2.12 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.12.1 Hiring and Retention

Children's Hospital maintained a cumulative total of 15 full-time equivalent (FTE) for the duration of the project; most new hires were onboarded in Q2. During Q11, Children's Hospital hired one new full-time permanent CHN and two temporary CHNs (through June 30, 2015). One staff separation occurred in Q12, and no new staff were hired. At the end of Q12 (June 2015), the innovation was almost fully staffed with 14 FTE staff members.

Despite staffing the project according to the original implementation plan, Children's Hospital did not have the capacity to deliver services as intended. The threefold growth in health plan membership and corresponding increase in patients eligible for the innovation could not be effectively managed with the staff allotments available through HCIA funding. Children's Hospital cited many members on the list of targeted patients with at least two ED visits (2+ED list) that could not be located or contacted. In Q12, around half (50.1%) of the 32,149 members on the 2+ED list were not contacted.

Staffing according to the original projections also proved difficult throughout the implementation period. Children's Hospital had difficulty recruiting and retaining CHNs at the salary envisioned because the local labor market offered ample similar positions with better pay. The program manager (PM) identified the low salary as a barrier to CHN recruitment and retention and arranged to increase pay during Year 2, but could not change the positions and fill vacancies quickly enough to keep pace with enrollment goals. Requirements to reach more families than originally planned, coupled with similarities between the CHNs and the patients they served also contributed to burnout and frequent use of leave time. One staff member shared: *"Our experience this third year is that the CHWs might be prone to more mental and physical stress which may result in a higher-than-average rate of absence leading to FMLA."*

Children's Hospital found that the two NN positions were particularly difficult to fill, again as a result of low pay and limited staff capacity to reach the enlarged target population. The first NN left in December 2013 for a higher-paying position providing direct patient care. Her position was filled in June 2014, and her replacement had not begun to make home visits as of our July (2014) site visit. Children's Hospital initially intended for NNs to coordinate care for and provide follow-up care to complex asthma patients. Given how difficult it was to fill the NN position, however, Children's Hospital reworked the NN position into a supporting role for the CHNs. The dissolution of the NN component and asthma management piece was largely due to the inability to hire and retain staff for the role.

In addition to increasing salary and modifying responsibilities, Children's Hospital worked to increase the capacity of staff by creating the Care Management Outreach Coordinator (CMOC) position. Innovation leaders developed the CMOC position after they realized CHNs had to be able to "sell" the program to members on the phone in order to enroll them into the program (they found that several CHNs had consistently higher levels of success on the phone than others). The PM sought approval to create a new, supervisory position: the CMOC would recruit patients into the program while the CHNs continued to conduct the home visits. The PM promoted two existing CHNs to this position, and hired a third in April 2014. Respondents during the site visit spoke positively about this change and felt it helped reach more members.

2.12.2 Skills, Knowledge, and Training

By the end of Q12 (June 2015), Children's Hospital provided 1,266 hours of training to 50 HCIA staff. Between Q11 and Q12, Children's Hospital provided 216 hours of training to 18 staff including administrative and clinical personnel (see ***Table 18***). These courses were provided in online, classroom, discussion, or written text format. CHW training courses included topics such as conducting home visits, environmental triggers of asthma, and breast cancer. A reflective training course was also provided to supervisors.

Table 18. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	216	18
Since inception	1,266	50

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

Although Children's Hospital provided the CHNs with the trainings as described above, CHNs noted that they had no standardized way to offer services or approach members during home visits. The initial CHNs hired at the start of the innovation had a 10-week training that did not prepare them for field experience and conducting home visits. Likewise, CHNs hired since the first and second annual reports (between Q8 and Q12) noted they did not receive standard training to develop the skills and knowledge needed to carry out all of the demands of working with the targeted high-need population. CHNs particularly lacked the skills to serve individuals with chronic mental health conditions and substance abuse histories, adding increased burden to a job that was already demanding.

During a key informant interview, RTI learned that—contrary to the CHNs' perspective that they needed more trainings because they were unprepared to meet this population's needs—innovation staff thought that too much standardized training was incompatible with the innovation. An administrator of the project explained, *"The staff [(i.e., CHNs)] also grew in skill with letting the family lead with their needs* *and priorities. That's not something we can train them on; we lay the groundwork, but they have to learn that the families drive where the program takes them."* CHNs, however, noted that if they were trained to work with this population (who often have issues with drug abuse, domestic violence, food insecurity, and chronic health issues), they might have provided services to clients more effectively while ensuring their own personal safety.

In addition to offering limited training, Children's Hospital did not initially provide the support, supervision, and flexibility required to manage the CHNs' daily activities. CHNs tended to represent the target population of Medicaid recipients and many had never held a position like the CHN role (e.g., working regular work hours, working at desk). Therefore, they required more daily supervision and more feedback than expected from the PM to conduct their work efficiently. As a consequence, the PM moved CHNs from remote work locations to the main office so that she could work with them directly.

Children's Hospital introduced several efforts to improve CHN knowledge and skills at the end of the implementation period. First, the CMOC provided training for new staff hired during Q11. Children's Hospital reported that the CMOC, *"streamlined in-house training so that these two [temporary staff] individuals could begin contacting and working with families as quickly as possible. We don't believe integrity or quality was lost by streamlining the training."* Children's Hospital staff noted that the experience gained in conducting trainings enabled the CMOC to become more efficient and effective. The CMOC held conversations with the new staff to assess what went well and received suggestions for improvement. Second, during Q12, CHP was in the process of incorporating the previously outsourced behavioral health services case management in house to serve their members more efficiently and provide skill development opportunities for CHNs interested in behavioral health.

2.13 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

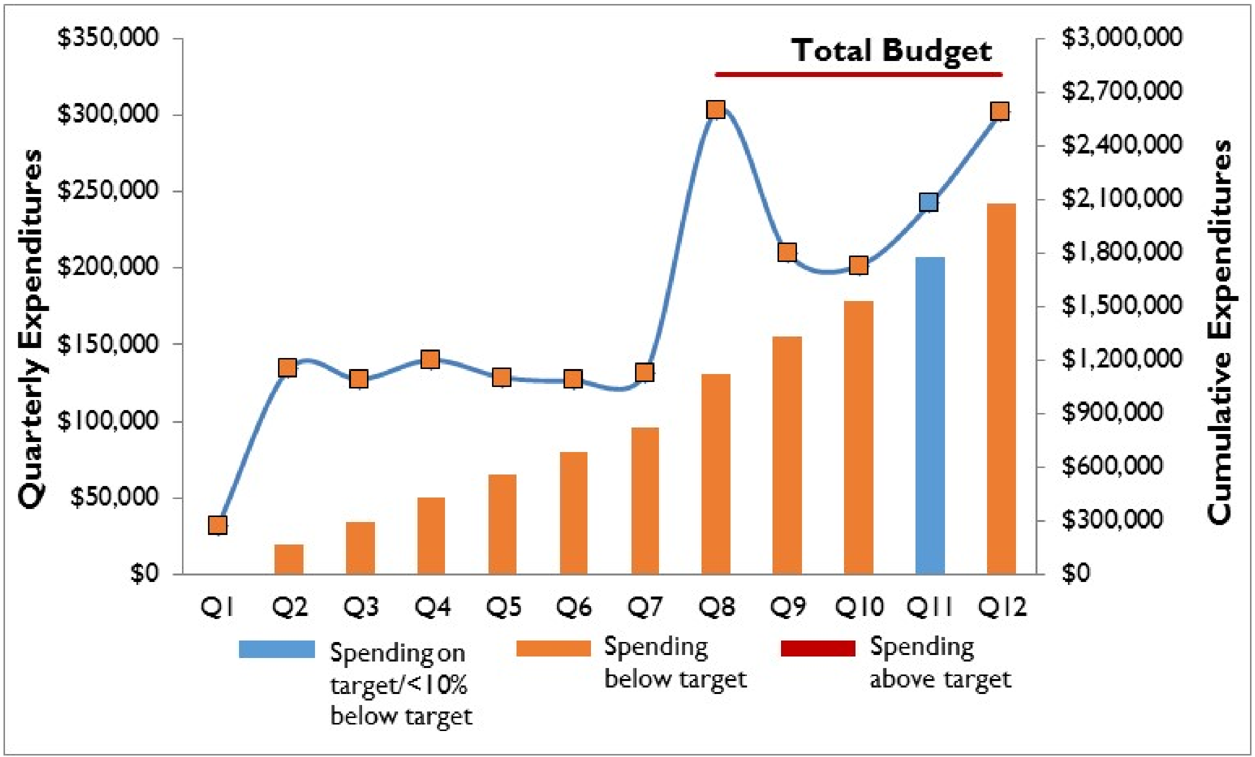
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.13.1 Award Execution

The annual report highlights the significance of Children's Hospital's expenditure rates on implementation. As of June 2015 (Q12), Children's Hospital spent 74.3 percent of its total budget, which is below the projected target (see ***Figure 7***). Children's Hospital received approval for carryover funds in March 2014 to use unspent funds to hire additional CHNs. Since then, Children's Hospital reported that in Q10, two additional staff were hired and in Q11, one full-time CHN and two temporary CHN were hired (through June 2015). The awardee cited understaffing as the primary reason for underspending.

Figure 7. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.13.2 Leadership

The Children's Hospital PM was employed by CCHP before this innovation began, and maintained sole responsibility for all management, implementation, monitoring, and reporting aspects of the innovation for the entire duration of the project. The CCHP vice president technically served as the project director (PD); however, neither he nor other organizational leaders were involved in the day-to-day implementation of the innovation. Organizational leaders did not attend meetings, nor did they provide input on the project. Care Link staff explained *"…leadership hasn't been involved from Day 1. I don't think that has changed, it's just the reality for us."* Children's Hospital did not anticipate the support, supervision, and flexibility required to effectively manage the project and the CHNs' daily activities, especially after the health plan membership grew (see next section). These capacity shortfalls affected Children's Hospital's ability to respond to requests from both CMS and RTI.

The innovation team stated that a lack of provider engagement undermined implementation of the innovation. As representatives of the health plan, staff had existing relationships with patients but not providers. When CHNs attempted to deliver services in the clinical setting, ED staff and providers in the clinics were not receptive because the CHNs worked for CCHP while the providers were not employed by CCHP. Providers also seemed reluctant to serve the target population, which they perceived as bringing little money into their clinics and difficult to treat. One interviewee explained, *"There is animosity between providers and insurance/payers because each points fingers at the other. Providers know they're not going to get paid as much for Medicaid patients who are not as compliant and could be no-shows."* A clinic staff told one CHN that *"they don't take that insurance"* even though it was a CCHP- affiliated practice.

Children's Hospital staff noted that they did not initially think to include provider engagement in the CCHP implementation plan because CHNs were to work in EDs and high-volume clinics where they would interact directly with patients and less dependent on long-term provider relationships. Reflecting on implementation at the end of the project, one interviewee suggested that a provider advisory council may have increased provider support for the project.

2.13.3 Organizational Capacity

Before the HCIA project began, CCHP membership tripled in size after one Medicaid HMO left the local market. The increase in membership resulted in a parallel upsurge in the number of members eligible for the innovation, but no additional organizational or grant-funded resources to deliver the innovation. The impact of the growth of the CCHP membership on all aspects of the organization as a whole and the HCIA project implementation cannot be overstated. The growth affected the allocation of space (because so many new employees had been hired to serve the new members), the number of potential members to serve each month, and the level of attention that leadership could give the program. With the expansion of beneficiaries, Children's Hospital had not planned for the numbers of staff, and extent of management, needed to meet the demands of the influx of new members eligible for the innovation.

Children's Hospital also faced another capacity issue: managing data for the program. The program used an existing data specialist employed by the hospital who did analyses for this innovation in addition to her other responsibilities. Because she was not supported using HCIA funds and had competing responsibilities, she had very limited time to focus on these data and provide them to RTI for the evaluation.

2.13.4 Innovation Adoption and Workflow Integration

Children's Hospital delivered the innovation services primarily by (1) contacting health plan members to identify patients interested in the innovation, (2) sending CHNs to participants' homes for an initial assessment of social needs and linkage to primary care and community resources, and (3) subsequent follow-up home visits by CHNs to provide additional information, resources, and support.

The CHNs did not work in the EDs, although they initially attempted to work directly in clinical settings to reach high ED users, including EDs of surrounding hospitals and high-volume clinics—but they encountered several barriers to working in these locations in addition to those already noted. First, clinics and EDs were reluctant to incorporate the CHNs into their care process because only CCHP members qualify for CHN services, and CCHP members represented a small portion of the clinics' and EDs' overall clientele. As one respondent noted, it is *"hard for any clinic to change their workflow for less than half their patients."* Another lesson learned was that CHNs could more easily recruit families after an ED visit (rather than during it), because members were focused on their acute condition when they were at the ED and were not as interested in follow-up care. Thus, the CHNs experimented with working in other locations before difficulties in managing and their work led the PM to move them into the main office. Although CCHP is owned by the larger health system, it is not the only plan accepted by providers and the CHNs did not typically interact with providers from the hospital. Instead, they referred patients to external primary care clinics and other specialists in an effort to reduce inappropriate use of the ED.

2.14 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

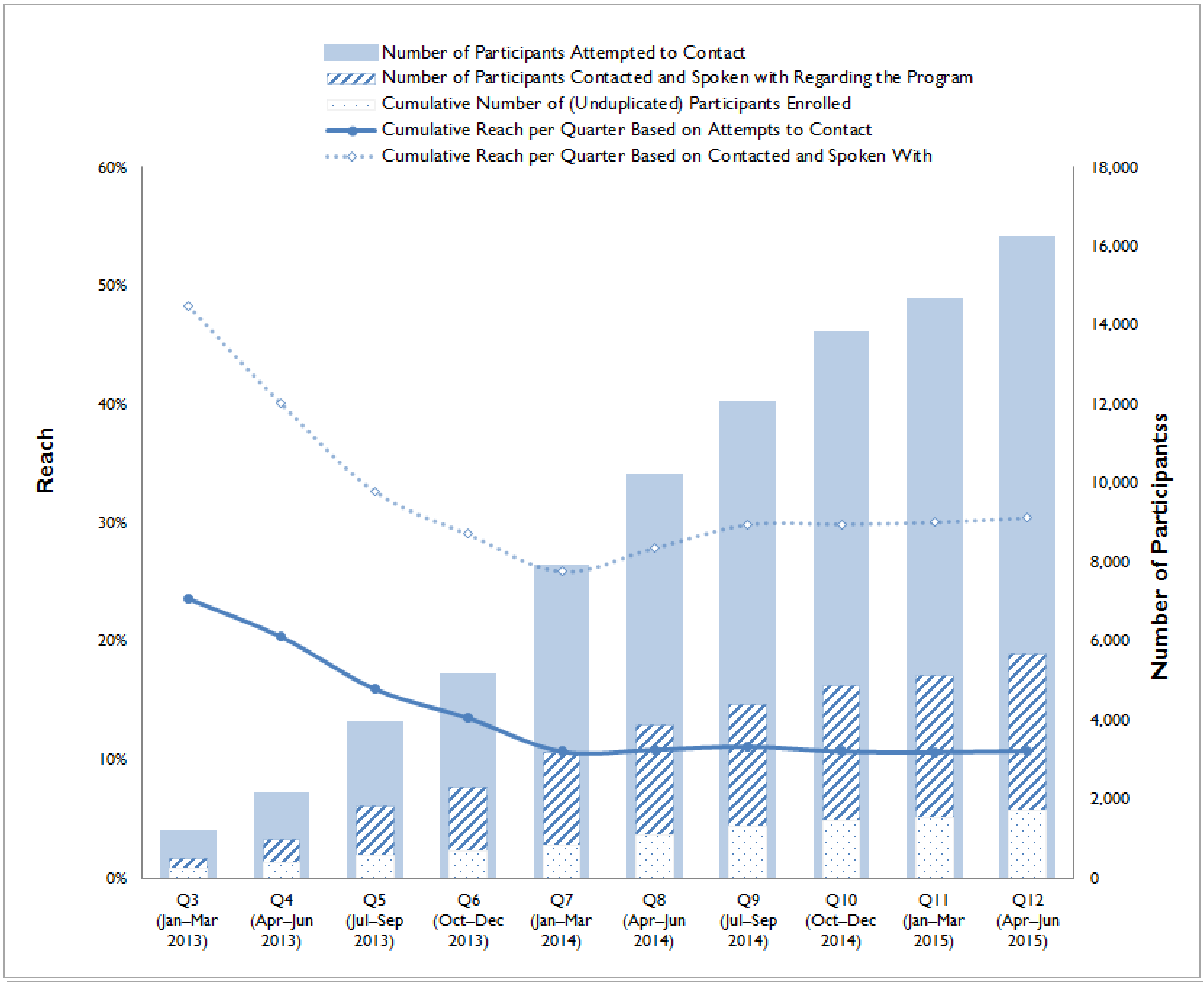
Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.14.1 Innovation Reach

Figure 8 shows reach by quarter since the launch of the innovation: reach is a percentage of the total number of members the CHNs contacted and spoke to about the program (5,662). The target population includes individuals who were located and to whom CHNs spoke about participation in the program. We included all participants who agreed to enroll in the program (1,722). Since the 2015 annual report, Children's Hospital enrolled an additional 200 patients in the innovation, increasing reach (based on participants contacted and spoken with) from 29.8 percent in Q11 to 30.4 percent in Q12. Reach among this target population declined from its highest level in Q3 (48.3%). We also reported reach (based on attempts to contact), which was consistent with 10.6 percent in Q11 and 10.7 percent in Q12. This may be in part due to the creation of the CMOC position in Q8 to increase capacity to engage health plan members and families.

Figure 8. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
●	Cumulative reach per quarter based on attempts to contact	23.6	20.3	16.0	13.5	10.7	10.8	11.1	10.7	10.5	10.7
◊	Cumulative reach per quarter based on contacted and spoken with	48.3	40.1	32.7	29.0	25.9	27.9	29.8	29.9	29.8	30.4
	Number of participants attempted to contact	993	1,946	3,716	4,960	7,690	10,005	11,829	13,591	14,441	16,029
	Number of participants contacted and spoken with regarding the program	484	988	1815	2,308	3,177	3,895	4,398	4,860	5,103	5,662
	Cumulative number of (unduplicated) participants enrolled	234	396	593	670	822	1,085	1,312	1,452	1,522	1,722

Source: Patient-level data provided to RTI by Children's Hospital.
Q = quarter.

Reaching a large proportion of the population was difficult not only because of the staffing capacity issues already noted but also because the Medicaid population is somewhat transient and Care Links staff noted that their phone numbers changed often. Furthermore, once members were contacted, enrolling them in the program was difficult or they were lost to follow-up due to competing priorities. Another persistent internal challenge was that CCHP the implementing arm of the innovation, did not have direct access to patients, which greatly impacted reach and assurance that members were ultimately seen by a health care provider. As noted in a Q10 report,

> ***"One ongoing challenge is our ability to reach our members. Since we are not a health care provider, members don't come to us for care. We reach out to them initially via phone, and mail and drop-ins where we leave basic program information at the address we have on file for them in hopes they will contact us."***

The state's change of vendors for electronic health information exchange across all health care providers was an additional barrier that Children's Hospital was not prepared to address because of limited staffing capacity. Children's Hospital relied on each hospital to provide daily ED reports that staff used to identify eligible participants. The reports came in various formats (faxed, electronic) and had to be manually entered into the CCHP's utilization management software, which took much staff time. In the future Children's Hospital intends to do this through claims records.

To further increase both reach to the members and program completion by enrolled members, in Q11 Children's Hospital offered a $40 gift card to members who completed the entire program instead of a $5 gift card for each home visit. Children's Hospital reported that, as a result of the incentive change, members were eager to complete the program.

2.14.2 Innovation Dose

Table 19 provides the number and percentage of participants enrolled by number of visits received through Q12. Among those initiating the program through Q12, 15.1 percent of participants received one visit, 5.7 percent received two visits, and 40.4 percent received all three visits, as prescribed by the innovation.

The number of participants receiving at least one visit increased from 907 in Q11 to 1,054 in Q12. As shown, 38.8 percent of the respondents who enrolled initially in the program did not receive a home visit, perhaps because, although they agreed to participate in the program, they could not be located or were not present for the scheduled first visit.

To increase innovation exposure and program completion, Children's Hospital revised the method of scheduling the home visits to be on the same day and at the same time for 3 weeks in a row. Previously, the home visits were scheduled in 2-week intervals, but the new scheduling procedure seemed to be easier for the members to remember and helped them keep the appointments.

Table 19. Number and Percentage of Participants by Number of Home Visits Received

Number of Home Visits	Number of Participants	Percentage of Total Enrolled Participants[1] (n=1,722)
0 visit (lost to follow-up)	668	38.8
1 visit	260	15.1
2 visits	98	5.7
3 visits	696	40.4
Total	1,722	100.0

Source: Patient-level data provided to RTI by Children's Hospital.
[1] Enrolled = those contacted who agreed to participate.

2.15 Qualitative Findings: Sustainability

Children's Hospital intends to maintain the current staff of the innovation as employees of the health plan after June 30, 2015, and provide the same services to their members. The health plan adjusted its finances to incorporate the cost for maintaining the staff into its administrative budget (facilitated by changes in the capitation and administration rates calculated in collaboration with DHS). Children's Hospital reported that it will likely increase the current 2+ED visit enrollment criteria for program inclusion after the funding period ends. The current enrollment criteria are no longer feasible because of the unexpected growth in number of health plan members after the start of the HCIA project. *"We are looking at the needs of our health plan and revamping the work that the staff does. Primarily because we have identified the barriers,"* reported a key informant. *"The CHNs' target population may change, but they will still have the same role in patient outreach and education."*

2.16 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Children's Hospital as well as accomplishments to date. In this section we assess Children's Hospital's progress on achieving HCIA goals to date:

- **Smarter spending.** The results showed a downward trend in total health care spending. We found nonstatistically significant savings of $109 per member per quarter for all members, and statistically significant savings of $209 per member per quarter for those who received all three home visits.

- **Better care.** We found a pattern of lower inpatient admissions for the innovation group with statistically significant results in the second year of participation in the innovation. We found a statistically significant decrease in inpatient admissions for those who completed the innovation but not for partial completers. ED visits did not show a significant change for the innovation group and there was a statistically significant reduction in the probability of readmissions for the innovation group. We did not find statistically significant results for dose analysis on the probability of readmission or number of ED visits.

  Reach (based on the number of members contacted and spoken with about the program) was 30.4 percent; a total of 1,722 participants enrolled in the innovation as of Q12. As expected, the number of participants receiving at least one visit increased from 907 in Q11 to 1,054 in Q12. Among those initiating the program, through Q12, 15.1 percent of participants received one visit, 5.7 percent received two visits, and 40.4 percent received the prescribed three visits.

- **Healthier people**. Given the small sample size of enrolled patients with health outcomes measures available, no data are presented.

Children's Hospital faced numerous challenges in implementing its innovation. Initial estimates of reach were calculated on the beneficiary population at the time of the application, which more than tripled within a year of the award because of circumstances outside Children's Hospital's control. The staffing plan was based on serving fewer patients and reaching a larger proportion of eligible patients than was possible with this unprecedented growth. The primary staff involved in the innovation had no experience implementing a patient-navigation program, so they had a steep learning curve in setting up the intervention. Throughout the innovation, Children's Hospital had challenges with hiring and retaining sufficient staff in both the CHN and NN roles. They provided initial training for the CHNs and NNs; however, no established continuing education or systematic method of training was put in place, which likely influenced the extent to which they could provide the best resources to patients. In the future, Children's Hospital plans to work with the National Community Health Worker Training Center at the Center for Community Health Development (within Texas A&M's Health Science Center) to provide a CHW 101 training In addition, Wisconsin is developing a CHW apprenticeship program that may provide additional training opportunities for staff.

The transient Medicaid population, along with ongoing staffing shortages in the organization, hindered Children's Hospital in reaching and serving a large population. Although the claims data are available only through first quarter 2015, initial findings show promising trends for generating savings and reducing admission and readmissions. Analyses also show promising trends among completers of the innovation (i.e., completed all three home visits as prescribed) compared to noncompleters. Children's Hospital did not achieve a significant change in ED visits for their target population of high ED users; however, nearly 40 percent of participants received at least three visits and this level of dose may have been sufficient to prevent an unplanned inpatient visit or readmission. We cannot rule out other health care transformation efforts at Children's Hospital that may have contributed to the decline in these outcomes. The evidence, however, suggests a positive innovation effect despite implementation challenges. As Children's Hospital continues to sustain its efforts in the future after HCIA funding ends, perhaps it will continue to demonstrate impacts on medical spending and utilization based on CHNs' efforts.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Children's Hospital and Health System (Children's Hospital)

Children's Hospital and Health System, Inc. (Children's Hospital), a children's health system in Milwaukee, Wisconsin, received an award of $2,796,255 and began enrolling patients in November 2012. Children's Hospital includes a nonprofit health maintenance organization (HMO) called the Children's Community Health Plan (CCHP) which specifically serves BadgerCare Plus (i.e., Medicaid) members. The hospital and health system, however, serve more than just Badger Care Plus members. CCHP created the Care Links innovation (formerly named Advanced Wrap Network Model), which offered support services through community health navigators (CHNs) to CCHP members at high risk for overusing the emergency department (ED).

Awardee Overview

Innovation dose:	15.1% of participants received 1 visit, 5.7% received 2 visits and 40.4% received all 3 visits. 38.8% of enrollees did not receive a home visit.	***Innovation reach:***	10.7% of eligible members attempted to be contacted (1,722/16,029), and 30.4% of those contacted (1,722/5,662) enrolled in the innovation.
Components:	Community health navigators (CHNs) provided home visits, health education and counseling, and referral to follow-up care with support from nurse navigators (NNs).	***Participant demographics:***	Over one-quarter of participants (26.6%) were under 18 years old and 19.5% were 25–44 years old; 100% were covered by Medicaid.
Sustainability:	Finances were adjusted to maintain employment of the CHNs and NN after the grant period ended.		
Innovation type:	Coordination of care		

Key Findings

Smarter spending. The results showed a downward trend in total health care spending. We found statistically significant average quarterly savings of $209 (90% CI: −$416, −$2) per member per quarter for those who received all three home visits and non-significant findings for the entire cohort of participants (−109; 90%CI: −$247, $28).

Better care. We found a pattern of lower inpatient admissions per 1,000 participants per quarter for the innovation group, with statistically significant results (−29; 90% CI: −53, −6) in the second year of participation in the innovation. We found a statistically significant decrease in inpatient admissions per 1,000 participants per quarter overall only for those who completed the innovation (−29; 90% CI: −49, −9). We also found a statistically significant reduction in the overall probability of readmissions per 1,000 admissions per quarter for the innovation group (−78; 90% CI: −148, −8). Average quarterly changes in ED visits were not significant for the innovation group (−16; 90% CI: −81, 49).

Healthier people. Given the small sample size of patients with health outcomes measures, no data are presented.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

The Curators of the University of Missouri

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q14 (December 2015)
Quarterly Awardee Performance Report	Launch date–Q14 (December 2015)
Medicare	Launch date–Q14 (December 2015)
Medicaid	Launch date–Q14 (December 2015)
Awardee-specific data	Launch date–Q14 (December 2015)

Q = quarter.

The Curators of the University of Missouri

2.1 Introduction

The Curators of the University of Missouri (Curators) is an integrated health system in Columbia, Missouri. Curators was awarded $13,265,444 to support the Leveraging Information Technology to Guide High Tech, High Touch Care (LIGHT^2) innovation. The project was designed to use a combination of advanced information technology and comprehensive health care coordination to improve outcomes for Medicare and Medicaid patients receiving services in a primary care environment. Curators began enrolling patients into its innovation in February 2013. The program was a cohort study with recruitment frozen at 9,932 participants to track progress of the innovation over time for those participants. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Achieve a net savings of $17.7 million over the 3 and a half years of the project by targeting services.

2. **Better care.** Provide better care to patients through improved coordination, preventive care services, and patient engagement.

3. **Healthier people**. Better manage chronic diseases, including asthma, coronary artery disease, chronic obstructive pulmonary disease (COPD), diabetes, and hypertension.

The original 3-year award period for LIGHT^2 ended June 30, 2015 (end of Q12). All active interventions and tracking of identified measures ended then. Curators was awarded a 12-month no-cost extension (NCE) that began July 1, 2015. Work during the NCE focused on continued analyses of the copious data collected during the 3-year award period, and subsequent identification and dissemination of relevant findings.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11–15 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through December 31, 2015.

Table 2. Summary of Updates as of Quarter 14, December 31, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 12/31/2015)
Innovation Components	
	Four components remained unchanged: (1) LIGHT[2] tools to aggregate EHR data for population-based metrics and custom reports; (2) data analytics to support the tools; (3) a patient portal; and (4) care coordination provided by the NCMs.
Program Participant Characteristics	
	Majority (77.7%) of participants aged 45 or older; most (60.1%) were female. Most (85.8%) were white; approximately 11% were black. Majority (79.1%) were covered by Medicare or were dually eligible; 18.1% were covered by Medicaid.
Workforce Development	
Hiring and retention	Between December 2014 and 2015, staffing dropped from 22.27 to 2.39 FTEs. Drop reflected the reduced effort expected during the NCE period and was adequate to complete the remaining tasks.
Skills, knowledge, and training	As of the end of December 2015, Curators provided 4,632.25 hours of training to 1,295 individuals on the LIGHT[2] tools and innovation goals.
Context	
Award execution	Spent 93.6% of its total budget as of Q14.
Leadership	Project leadership remained constant since inception, and addressed challenges with attribution, tiering, and claims data analysis.
Organizational capacity	Project director was supported by clinical co-investigators and Cerner as their EHR vendor and partner. University and Cerner formed the Tiger Institute for Health Innovation, which provided all health IT services for the project.
Innovation adoption and workflow	Providers were satisfied with the innovation, and did not note a workflow change other than delegating tasks to NCMs, which eased their time burden. NCMs were seen as the central role in the innovation.
	Absorption of the NCM role and the population scorecard into the University health system reflects integration of the innovation into ongoing operations.
Implementation Effectiveness	
Innovation reach	No new patients were enrolled in the innovation since Q4 (when a cohort of patients was enrolled); cumulative reach concluded at 100%. However, only 68.2% of those enrolled received at least one of NCM dose services.
	The percentage of patients registered to use the LIGHT[2] patient portal increased from 23.1% in Q11 to 25.0% in Q12.
Innovation dose	Approximately 68% of patients received at least one NCM service through Q12. A greater percentage of patients in Tiers 3 and 4 (89.0%) received services than did patients in Tiers 1 and 2 (64.2%).
Sustainability	
	Innovation components were sustained after HCIA funding ended. NCM role continues under the University Hospital, and LIGHT[2] tools informed development of a permanent Cerner platform. HIAs were incorporated into the University in other roles and continue to work on dissemination.

Sources: *Q11–Q14 Narrative Progress Report*.
Q11–Q14 Quarterly Awardee Performance Report.
Patient-level data provided to RTI by Curators.
Key informant interviews conducted in May 2014, April 2015, and May 2016.

EHR = electronic health record; FTE = full-time equivalent; HIA = health information analyst; IT = information technology; NCE = no-cost extension; NCM = nurse case manager.

Table 3 summarizes Medicare claims-based findings during the innovation period. In all 3 years after the innovation launch, the innovation group incurred higher spending than the comparison group. Spending results were significant overall in Years 1 and 2, and were close to significance in Year 3. The overall estimate for the difference in quarterly spending was positive and statistically significant. Overall, the innovation group had more inpatient admissions, the same level of unplanned readmissions, and fewer ED visits than the comparison group.

Table 3. Summary of Medicare Claims-Based Findings: Curators

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$15.362	$8.824, $21.900	$7.573	$4.505, $10.642	$5.319	$2.104, $8.534	$2.470	−$0.064, $5.003
Acute care inpatient stays	758	590, 927	369	265, 472	295	192, 398	94	11, 178
Hospital-wide all-cause unplanned readmissions	18	−29, 66	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−1,074	−1,366, −782	−439	−621, −257	−360	−535, −185	−275	−422, −127
Average impact per quarter								
Spending per participant	$234	$134, $334	$299	$178, $419	$225	$89, $361	$149	−$4, $301
Acute care inpatient stays (per 1,000 participants)	12	9, 14	15	10, 19	12	8, 17	6	1, 11
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	6	−9, 21	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−16	−21, −12	−17	−24, −10	−15	−23, −8	−17	−25, −8

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. In the first year after the innovation launch, the innovation group incurred higher spending than the comparison group. The overall estimate for the difference in quarterly spending was positive but not statistically significant. Overall, the innovation group had more inpatient stays and ED visits than the comparison group, and the results were statistically significant.

Table 4. Summary of Medicaid Claims-Based Findings: Curators

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$1.993	−$0.525, $4.510	$1.900	$0.253, $3.547	$0.093	−$1.136, $1.322	N/A	N/A
Acute care inpatient stays	186	135, 238	153	109, 196	34	6, 62	N/A	N/A
Hospital-wide all-cause unplanned readmissions	23	−4, 49	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	306	217, 394	306	217, 394	N/A	N/A	N/A	N/A
Average impact per quarter								
Spending per participant	$139	−$37, $315	$218	$29, $407	$17	−$203, $237	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	11	8, 15	18	13, 22	4	1, 8	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	58	−9, 126	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	66	47, 85	66	47, 85	N/A	N/A	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

This innovation had four components: (1) the LIGHT^2 suite of tools to aggregate electronic health record (EHR) data to generate and display population-based metrics and custom reports; (2) data analytics conducted by health information analysts (HIAs) to monitor aggregate metrics and produce custom reports; (3) a patient portal that offers access to educational materials and allows patients to communicate with providers and nurse care managers (NCMs) for prescription refills and other needs; and (4) care coordination provided by the NCMs supported by the LIGHT^2 tools and data analytics. We provided details on these components in the 2014 annual report and reported any changes in the 2015 annual report.[1] Since then (March 2016), the following changes were made:

- The LIGHT^2 suite of tools was replaced by Cerner tools that perform some of the same functions. The physician-facing tools at the point of care will move to the new Cerner platform.
- The NCMs were hired by the hospital within the University of Missouri health system. Their function was similar to their role as part of the innovation, and they will continue using many of the same tools. They will focus on higher-need patients, and their patient population will expand beyond the innovation cohort.

In Year 1 of implementation, the HIAs developed a system to stratify patients into risk tiers based on their complexity, as indicated by social and clinical status. Tiers 1 and 2 included healthy patients without a chronic condition and patients with a stable chronic condition. Tiers 3 and 4 comprised the most complex patients, including those who had at least one hospitalization or multiple outpatient visits to ambulatory care. Patients may change tiers as their health and social status changes.

The partners for this innovation changed: JEN Associates joined the innovation team in early 2015 because of their expertise in conducting claims data analyses. This partnership will end with the NCE. The role of Cerner Corporation, system management, administration, and health IT support, remained unchanged. Cerner was the EHR for the health system with no anticipated changes. ***Table 5*** lists the partners involved in the innovation as of Q15.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Cerner Corporation	Project management/administration, Health IT	North Kansas City, MO
JEN Associates	Data analytics	Cambridge, MA

[1] Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. Prepared for the Centers for Medicare & Medicaid Services, 2015, December.
Holden, D. J., Rojas Smith, L., Hoerger, T., Renaud, J., and Council, M.: (2014, October). Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2014. Prepared for the Centers for Medicare & Medicaid Services, 2014, October. https://downloads.cms.gov/files/cmmi/HCIA-CommunityRPPM-FirstEvalRpt_4_9_15.pdf

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants ever enrolled in the innovation. The program was a cohort study with recruitment frozen at 9,932 participants to track progress of these patients enrolled in the innovation over time. Therefore, the distribution of patient characteristics remains the same as previous reports. As shown in the table, half of participants (50.5%) were 45 to 74 years old, and more than half (60.1%) were female. A majority of participants (85.8%) were white, and 11 percent were black. Most (79.1%) were covered by Medicare or Medicare Advantage or were eligible for both Medicare and Medicaid, and less than 20 percent were covered by Medicaid.

Table 6. Characteristics of All Participants Ever Enrolled in the Curators Innovation through December 2015

Characteristic	Number of Participants	Percentage of Participants
Total	9,932	100.0
Age		
< 18	0	0.0
18–24	467	4.7
25–44	1,749	17.6
45–64	2,119	21.3
65–74	2,903	29.2
75–84	1,759	17.7
85+	934	9.4
Missing	1	0.1
Sex		
Female	5,966	60.1
Male	3,966	39.9
Missing	0	0.0
Race/ethnicity		
White	8,523	85.8
Black	1,092	11.0
Hispanic	35	0.4
Asian	87	0.9
American Indian or Alaska Native	35	0.4
Native Hawaiian or Other Pacific Islander	0	0.0
Other	113	1.0
Missing/refused	47	0.5
Payer Category		
Dual	1,739	17.5
Medicaid	1,798	18.1
Medicare	5,433	54.7
Medicare Advantage	687	6.9
Other	0	0.0
Uninsured	0	0.0
Missing	275	2.8

Source: Patient-level data provided to RTI by Curators.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation was to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?
- Has the innovation reduced spending per patient?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures: Curators

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focused on 6,476 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period, including those dually eligible for Medicare and Medicaid. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in the 23 innovation counties in central Missouri.

We used propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 8 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Two treatment beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 8. Medicare Mean Values and Standardized Differences of Variables in Propensity Score Model: Curators

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Total payments in calendar quarter prior to enrollment	$2,321	$7,363	$1,988	$6,312	0.05	$2,319	$7,363	$2,319	$7,670	0.00
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$8,039	$18,719	$7,542	$15,538	0.03	$8,033	$18,713	$8,269	$19,132	0.01
Age	67.17	15.28	71.04	12.27	0.28	67.18	15.27	67.15	14.66	0.00
Percentage male	42.88	49.49	43.32	49.55	0.01	42.90	49.49	43.37	49.56	0.01
Percentage white	89.30	30.91	95.66	20.38	0.24	89.31	30.89	88.87	31.45	0.01
Percentage disabled	35.00	47.70	26.11	43.92	0.19	34.98	47.69	36.15	48.04	0.02
Percentage ESRD	0.59	7.64	0.68	8.21	0.01	0.59	7.64	0.67	8.15	0.01
Number of dual eligible months in the previous calendar year	2.56	4.75	1.90	4.27	0.15	2.55	4.75	2.67	4.87	0.02
Number of chronic conditions	6.12	3.68	6.85	3.68	0.20	6.12	3.68	6.24	3.72	0.03
Number of ED visits in calendar quarter prior to enrollment	0.19	0.72	0.13	0.48	0.10	0.18	0.61	0.18	0.65	0.00
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	0.93	2.33	0.65	1.62	0.14	0.92	2.08	0.82	2.32	0.04
Number of inpatient stays in calendar quarter prior to enrollment	0.09	0.38	0.08	0.34	0.04	0.09	0.38	0.09	0.40	0.00
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.29	0.84	0.28	0.76	0.02	0.29	0.84	0.31	0.90	0.02
Number of beneficiaries	6,478	—	85,198	—	—	6,476	—	19,428	—	—
Number of unique beneficiaries[1]	6,478	—	85,198	—	—	6,476	—	16,761	—	—
Number of weighted beneficiaries	—	—	—	—	—	6,476	—	6,476	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

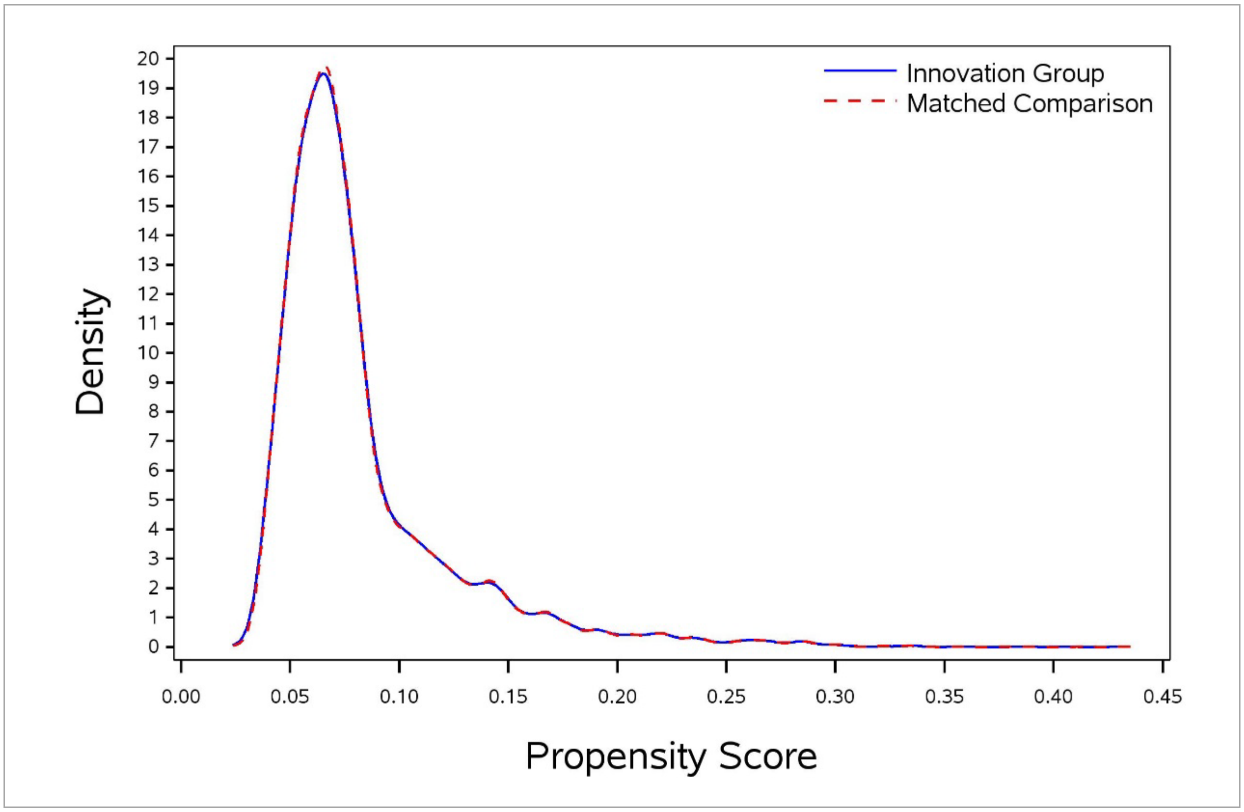
Curators = Curators of the University of Missouri; ED = emergency department; ESRD = end-stage renal disease; SD = standard deviation.

— Not applicable.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and checked whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 8). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 8 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure demonstrates a very close overlap between the innovation and comparison groups' propensity scores. Therefore, we present the Medicare claims analysis using both the innovation group and the matched comparison group.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri.

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the eleven quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison group beneficiaries and is darker in the innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending trended upward in the baseline quarters for both the innovation and comparison beneficiaries. After the innovation launch, spending increased more for the innovation group than the comparison group. The spending gap between the two groups persisted during the innovation quarters. However, it is premature to conclude any impact of the innovation on spending on this basis. As shown in Table 9, the standard deviation for spending was very high, representing the skewed nature of expenditures. We estimate the statistical impact of the innovation in the difference-in-differences analyses that follow.

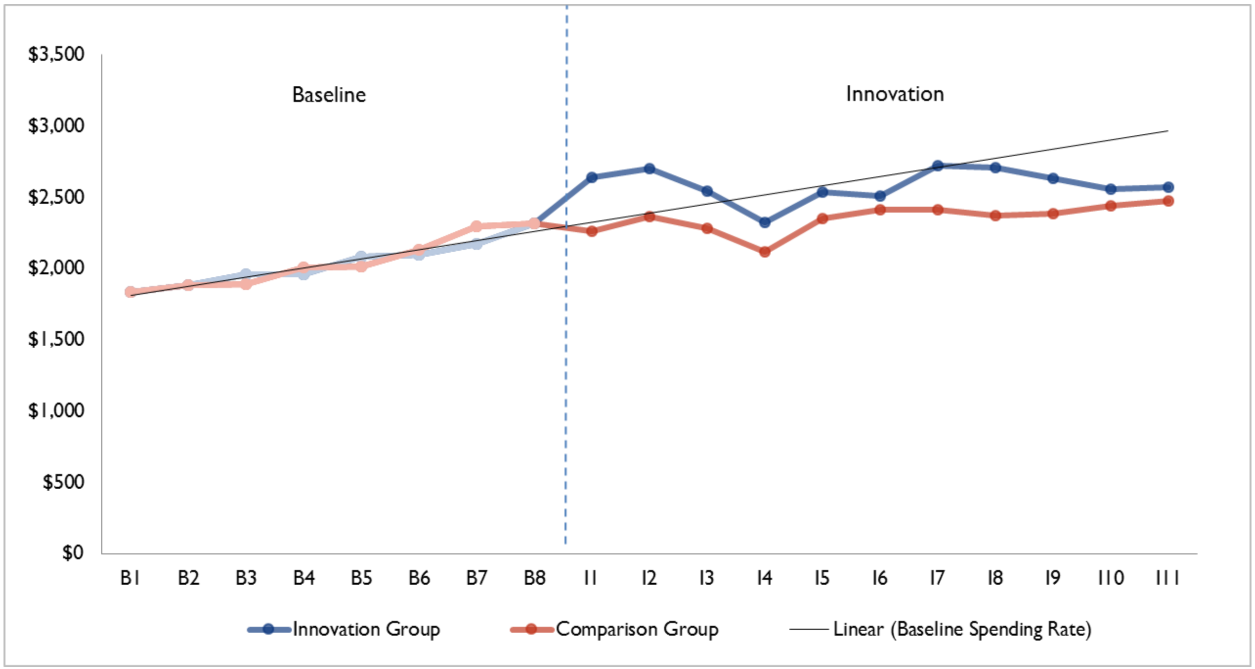
Table 9. Medicare Spending per Participant: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**	**I11**
Innovation Group																			
Spending rate	$1,835	$1,883	$1,960	$1,963	$2,081	$2,095	$2,173	$2,319	$2,638	$2,699	$2,543	$2,322	$2,534	$2,511	$2,720	$2,712	$2,633	$2,557	$2,574
Std dev	$6,565	$6,412	$6,133	$6,813	$7,574	$6,541	$7,007	$7,363	$8,782	$9,340	$8,115	$8,129	$7,765	$7,543	$7,971	$9,091	$7,716	$7,997	$7,188
Unique patients	5,657	5,786	5,927	6,059	6,180	6,336	6,437	6,476	6,476	6,412	6,324	6,157	6,055	5,974	5,910	5,734	5,633	5,530	5,456
Comparison Group																			
Spending rate	$1,834	$1,884	$1,893	$2,011	$2,015	$2,132	$2,299	$2,319	$2,262	$2,368	$2,282	$2,119	$2,350	$2,416	$2,412	$2,370	$2,388	$2,439	$2,474
Std dev	$5,963	$6,516	$6,428	$7,011	$6,508	$6,835	$7,721	$7,670	$6,899	$7,728	$7,315	$7,111	$7,141	$7,468	$7,157	$7,408	$7,474	$7,558	$7,895
Weighted patients	5,734	5,881	5,999	6,156	6,278	6,401	6,471	6,476	6,476	6,470	6,381	6,220	6,123	6,043	5,965	5,805	5,721	5,634	5,550
Savings per Patient																			
	−$1	$1	−$67	$48	−$66	$36	$125	$0	−$376	−$331	−$261	−$203	−$184	−$95	−$309	−$342	−$245	−$118	−$99

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; I1 = Innovation Q1.

Figure 2. Medicare Spending per Participant: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, was $234 (90% CI: $134, $334). This effect was statistically significant at the 10 percent level. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. All of the quarterly estimates were above zero and most were statistically significant.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	$372	$116	0.001
I2	$341	$127	0.007
I3	$270	$115	0.019
I4	$207	$119	0.081
I5	$184	$117	0.117
I6	$90	$118	0.447
I7	$298	$120	0.013
I8	$333	$137	0.015
I9	$241	$126	0.055
I10	$114	$127	0.373
I11	$89	$121	0.462
Overall average	$234	$61	<0.001
Overall aggregate	$15,361,984	$3,974,436	<0.001
Overall aggregate (IY1)	$7,573,316	$1,865,398	<0.001
Overall aggregate (IY2)	$5,319,128	$1,954,586	0.007
Overall aggregate (IY3)	$2,469,540	$1,540,464	0.109

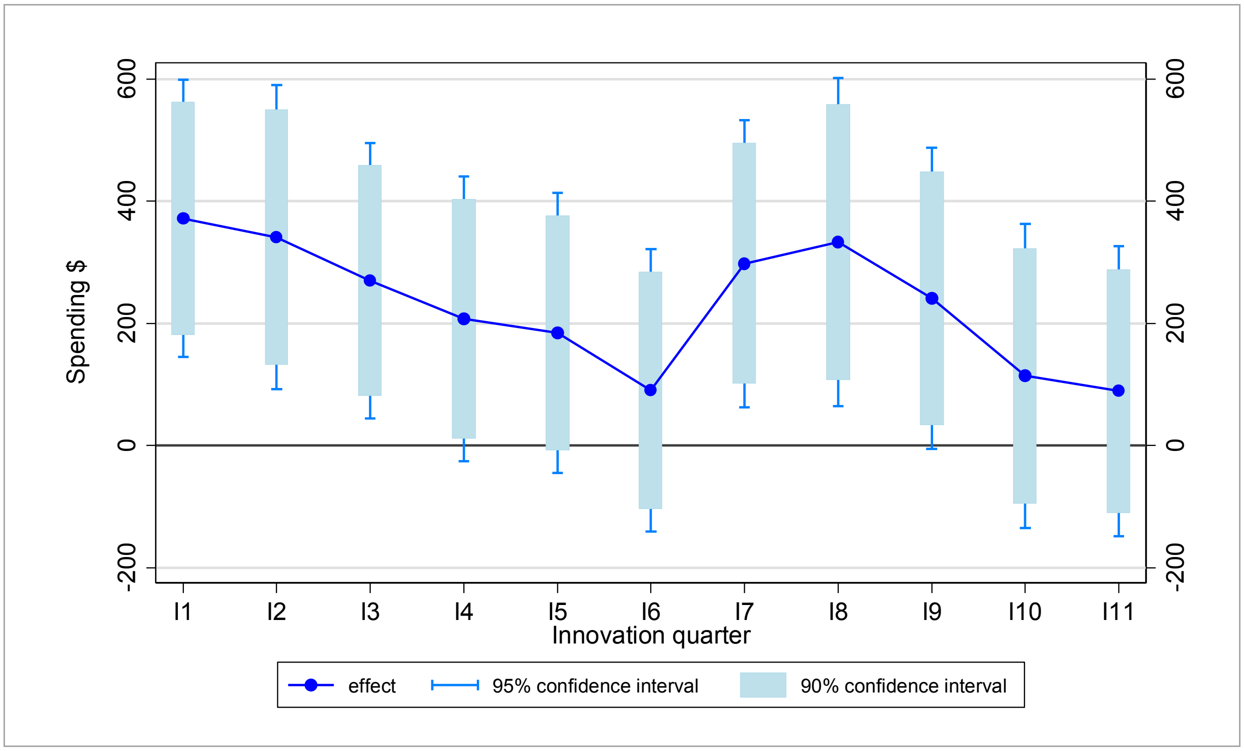
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

Curators = Curators of the University of Missouri; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

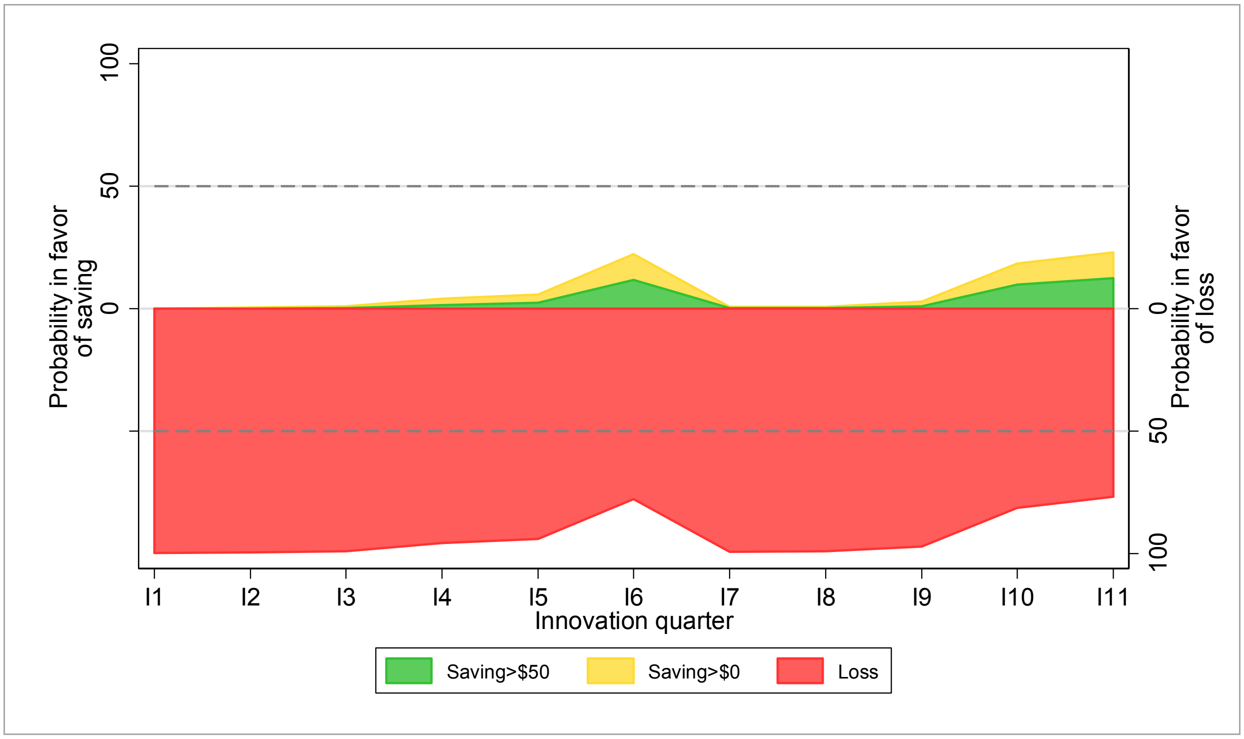
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates were always positive and mostly statistically significant in the entire innovation period, we observed a high probability of loss for the innovation period.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 5***. Inpatient admissions trended slightly upward during the baseline period, and the admissions rates from the comparison group were slightly higher than those from the innovation group. However, after the innovation began, inpatient admissions rose for beneficiaries enrolled in the innovation and were consistently higher than those from the comparison group except for the last innovation quarter. Without statistical testing, cannot conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

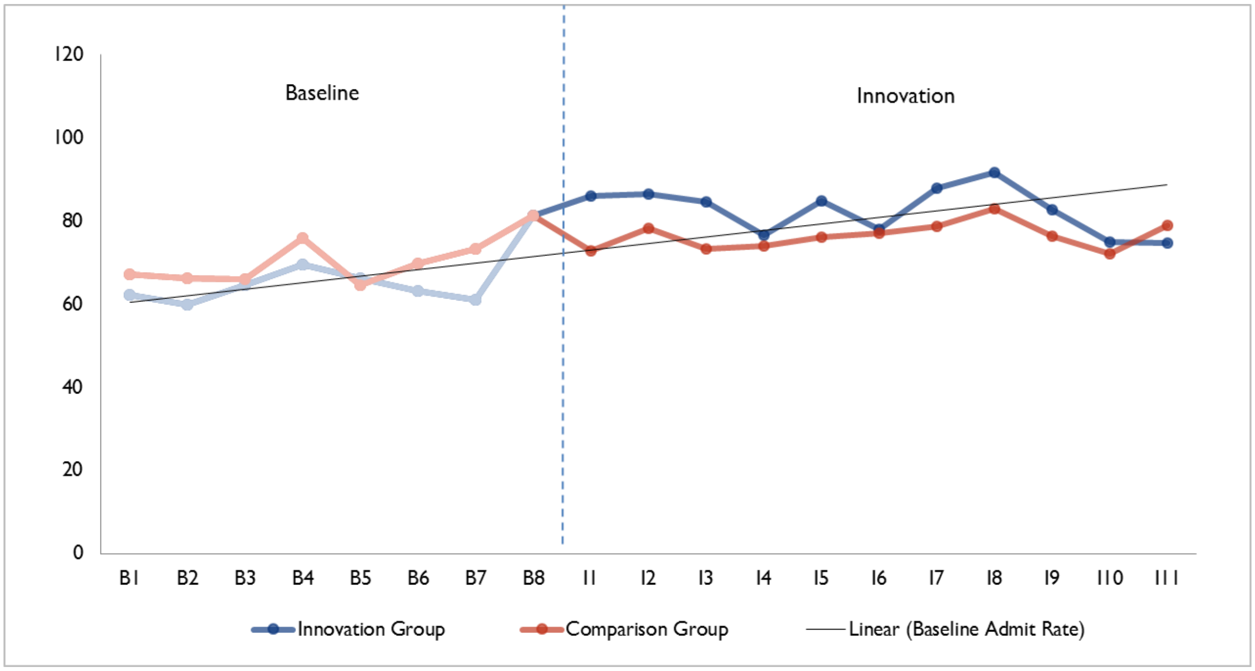
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	62	60	65	69	66	63	61	81	86	87	85	76	85	78	88	92	83	75	75
Std dev	303	306	316	320	307	293	284	345	359	357	360	335	345	350	385	364	346	358	321
Unique patients	5,657	5,786	5,927	6,059	6,180	6,336	6,437	6,476	6,476	6,412	6,324	6,157	6,055	5,974	5,910	5,734	5,633	5,530	5,456
Comparison Group																			
Admit rate	67	66	66	76	65	70	73	81	73	78	73	74	76	77	79	83	76	72	79
Std dev	308	306	306	337	320	327	339	369	325	353	338	331	337	347	345	352	346	336	357
Weighted patients	5,734	5,881	5,999	6,156	6,278	6,401	6,471	6,476	6,476	6,470	6,381	6,220	6,123	6,043	5,965	5,805	5,721	5,634	5,550
Innovation − Comparison Rate																			
	−5	−6	−1	−7	2	−7	−12	0	13	8	11	2	9	1	9	9	6	3	−4

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; I1 = Innovation Q1.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri.

2.5.2 *Regression Results*

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 12 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect was statistically significant at the 10 percent level (90% CI: 9, 14). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 12 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Most of the quarterly estimates show an increase in admissions and are statistically significant.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	18	5	<0.001
I2	14	5	0.006
I3	15	5	0.003
I4	11	5	0.029
I5	14	5	0.007
I6	7	5	0.193
I7	15	5	0.006
I8	15	6	0.008
I9	12	5	0.020
I10	5	5	0.379
I11	0	5	0.976
Overall average	12	2	<0.001
Overall aggregate	758	102	<0.001
Overall aggregate (IY1)	369	63	<0.001
Overall aggregate (IY2)	295	63	<0.001
Overall aggregate (IY3)	94	51	0.063

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Curators = Curators of the University of Missouri; I = Innovation Quarter; IY = Innovation Year.

2.6 Medicare Unplanned Readmissions

2.6.1 *Descriptive Results*

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 6***. Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch, and the trend line slopes down. The unplanned readmissions rates deviate from the trend line during the innovation period for the innovation group, and the rates are similar to the comparison group. Without statistical testing, we cannot conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

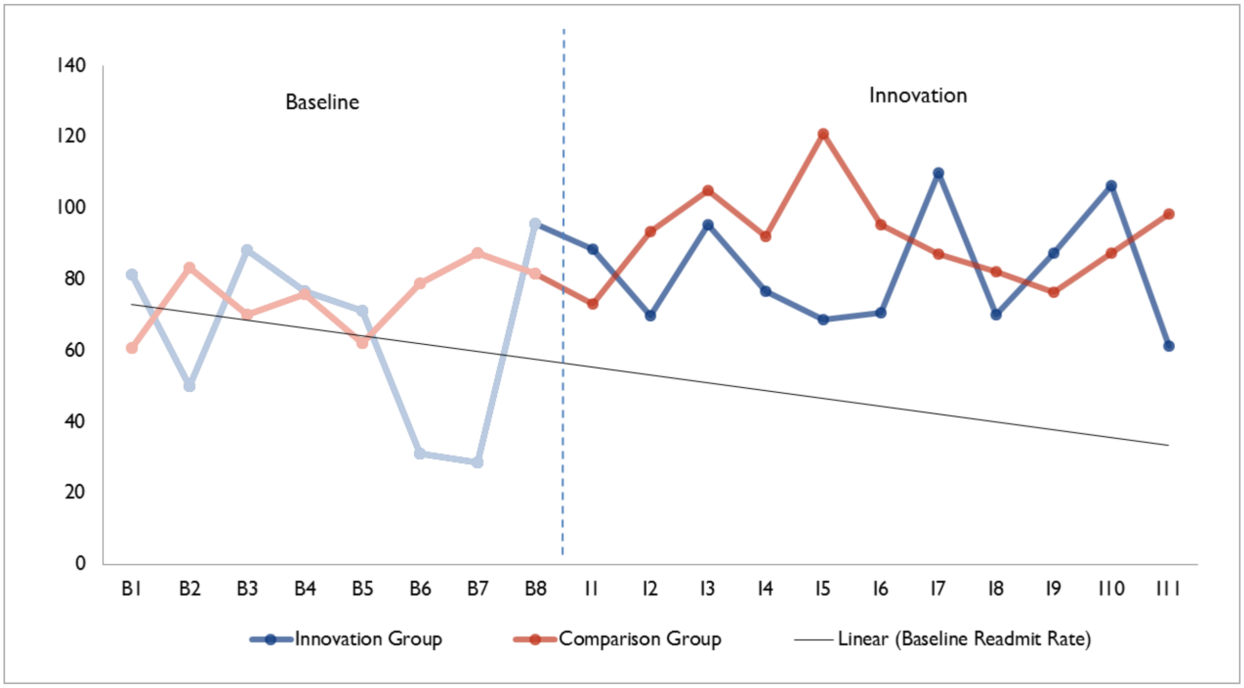
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	81	50	88	77	71	31	29	96	88	70	95	77	69	71	110	70	87	106	61
Std dev	273	218	284	266	257	174	167	294	284	255	294	266	253	256	313	255	282	308	240
Total admissions	209	200	204	248	239	225	245	314	328	315	325	287	320	269	309	300	286	235	147
Comparison Group																			
Readmit rate	61	83	70	76	62	79	87	82	73	94	105	92	121	95	87	82	77	87	98
Std dev	239	276	255	265	241	270	282	274	261	291	306	289	326	294	282	275	266	282	298
Total admissions	241	232	257	290	253	279	305	323	305	303	292	282	301	273	295	304	270	240	173
Innovation − Comparison Rate																			
	20	−33	18	1	9	−48	−59	14	15	−24	−10	−15	−52	−25	23	−12	11	19	−37

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; I1 = Innovation Q1.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri.

2.6.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 6 per 1,000 inpatient admissions (0.6 percentage points), indicating that the innovation-comparison difference was 0.6 percentage points lower during the innovation period. This was the average difference in unplanned readmissions probability for all innovation quarters. The effect was not statistically significant (90% CI: −9, 21).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Curators

Quarter	Coefficient	Standard Error	P-Values
Overall average	6	9	0.526
Overall aggregate	18	29	0.526

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Curators = Curators of the University of Missouri.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 7.*** The ED visit rate follows a fairly stable increasing trend prior to innovation launch for both the innovation and comparison groups. The rate is below the trend line during all innovation quarters for both the innovation and comparison groups, and the gap between the two groups narrows. As with the other variables, we will include statistical tests on the ED visit rate in the following section.

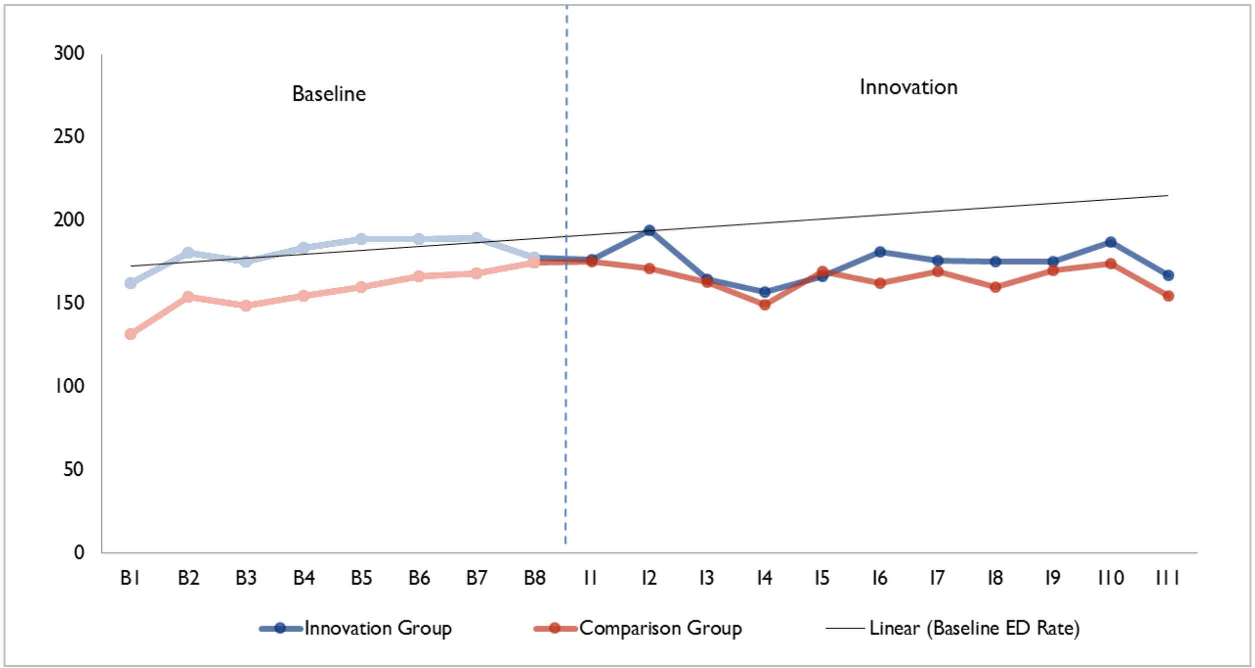
Table 15. ED Visits per 1,000 Medicare Participants: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	162	180	175	184	189	189	189	178	177	194	164	157	166	181	176	175	175	187	167
Std dev	557	584	572	598	619	605	625	606	594	637	618	564	593	651	692	647	630	724	626
Unique patients	5,657	5,786	5,927	6,059	6,180	6,336	6,437	6,476	6,476	6,412	6,324	6,157	6,055	5,974	5,910	5,734	5,633	5,530	5,456
Comparison Group																			
ED rate	132	154	149	155	160	166	168	175	175	171	163	150	169	162	170	160	170	174	155
Std dev	300	375	379	390	405	405	402	391	397	412	402	372	392	386	426	346	403	403	357
Weighted patients	5,734	5,881	5,999	6,156	6,278	6,401	6,471	6,476	6,476	6,470	6,381	6,220	6,123	6,043	5,965	5,805	5,721	5,634	5,550
Innovation − Comparison Rate																			
	30	26	27	29	29	22	21	3	1	23	1	8	−3	19	7	15	5	13	12

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; ED = emergency department; I1 = Innovation Q1.

Figure 7. ED Visits per 1,000 Medicare Participants: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Curators = Curators of the University of Missouri; ED = emergency department.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits was a decrease of 16 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect was statistically significant at the 10 percent level (90% CI: −21, −12). In addition to the average effect over the post-innovation period, we also present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. The average quarterly difference in ED visits between the innovation group and comparison groups were all negative, and most of the estimates were statistically significant.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	−25	9	0.005
I2	−2	9	0.817
I3	−26	9	0.002
I4	−16	8	0.053
I5	−24	9	0.006
I6	−4	9	0.650
I7	−18	9	0.044
I8	−14	9	0.124
I9	−19	9	0.042
I10	−16	10	0.087
I11	−14	9	0.119
Overall average	−16	3	<0.001
Overall aggregate	−1,074	178	<0.001
Overall aggregate (IY1)	−439	111	<0.001
Overall aggregate (IY2)	−360	107	0.001
Overall aggregate (IY3)	−275	89	0.002

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Curators = Curators of the University of Missouri; I = Innovation Quarter; IY = Innovation Year.

2.8 Discussion: Medicare Results

Overall, we found increased spending and inpatient utilization and reduced ED visits among the innovation group compared to the comparison group. The regression results suggest that the innovation group performed similarly to the comparison group in the readmission measure, outperformed in the ED visit measure, but underperformed in Medicare spending and all-cause inpatient admissions rates. Since the innovation focused on care coordination in a primary care setting, the benefits may be more pronounced for measures other than the core four measures we examined. We also conducted a subgroup analysis focusing on high-risk patients (those complex patients with a risk tier rating of 3 or 4, including those who had at least one hospitalization or multiple outpatient visits to ambulatory care, as defined by the awardee), and found similar results.

These results may not have provided a complete evaluation picture of the Curators innovation for several reasons. The innovation was launched on April 1, 2013, with a focus on preventive care and chronic conditions. The impact of health information technology and the NCMs on long-term conditions may not be immediate because smaller, incremental changes take time to develop.

In addition, providers and NCMs had to learn to integrate the role and reporting into their workflow. Although all Curators beneficiaries may potentially benefit from the LIGHT^2 innovation, the benefits may be most pronounced for the more complex patients. Curators shifted its focus to provide more services to more complex patients in the midst of the intervention, so more time may be needed to realize the benefits. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 65 percent of the overall population reached by the innovation.

2.9 Medicaid Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicaid claims data through Q4 2014. The Medicaid claims analysis focused on 2,397 Medicaid beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period, including those dually eligible for Medicare and Medicaid. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in the 23 innovation counties in central Missouri.

We used PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, enrollee status, number of months of Medicaid eligibility during the calendar year prior to the innovation, number of ED visits, number of inpatient stays, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid fee-for-service in the calendar quarter prior to innovation did not have Medicaid claims data for this quarter, and were matched separately using demographic variables only. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 17 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 8*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Seven treatment beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 17. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: Curators

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Previous Medicaid										
Total payments in calendar quarter prior to enrollment	$4,613	$9,178	$3,114	$6,550	0.19	$4,557	$9,078	$4,674	$8,985	0.01
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$16,936	$32,165	$12,957	$25,906	0.14	$16,840	$31,802	$16,511	$30,342	0.01
Age	45.78	16.32	51.73	17.47	0.35	45.79	16.33	44.77	16.24	0.06
Percentage blind, disabled, or aged	89.40	30.80	91.29	28.20	0.06	89.37	30.82	88.95	31.35	0.01
Percentage female	60.74	48.84	65.23	47.63	0.09	60.74	48.83	61.39	48.69	0.01
Percentage black	19.81	39.86	9.29	29.02	0.30	19.72	39.79	18.61	38.92	0.03
Percentage Hispanic	1.45	11.94	1.03	10.11	0.04	1.45	11.95	1.57	12.42	0.01
Percentage dually eligible	56.27	49.62	58.91	49.20	0.05	56.39	49.59	54.88	49.76	0.03
Number of months of Medicaid eligibility in lagged year prior to enrollment	10.77	3.07	11.72	1.30	0.40	10.78	3.05	11.15	2.37	0.14
Number of ED visits in calendar quarter prior to enrollment	0.20	0.83	0.06	0.41	0.21	0.18	0.73	0.40	1.43	0.19
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	0.79	2.69	0.46	1.68	0.15	0.76	2.47	1.22	4.16	0.14
Number of inpatient stays in calendar quarter prior to enrollment	0.05	0.28	0.02	0.18	0.11	0.05	0.24	0.05	0.34	0.03
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.17	0.91	0.10	0.51	0.09	0.16	0.71	0.21	0.93	0.06
Number of beneficiaries	2,282	—	76,183	—	—	2,277	—	6,809	—	—
Number of unique beneficiaries	2,282	—	11,904	—	—	2,277	—	4,270	—	—
Number of weighted beneficiaries	—	—	—	—	—	2,277	—	2,277	—	—

(continued)

Table 17. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: Curators (continued)

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
No Medicaid in Previous Quarter										
Age	41.78	17.54	35.85	15.93	0.35	42.00	17.52	43.98	18.51	0.11
Percentage blind, disabled, or aged	53.28	50.10	38.83	48.75	0.29	54.17	49.83	53.33	49.89	0.02
Percentage female	74.59	43.71	83.07	37.52	0.21	75.00	43.30	79.44	40.41	0.11
Percentage Black	15.57	36.41	12.45	33.03	0.09	15.00	35.71	15.00	35.71	0.00
Percentage Hispanic	0.82	9.05	1.35	11.54	0.05	0.83	9.09	0.00	0.00	0.13
Percentage dually eligible	48.36	50.18	26.20	43.98	0.47	47.50	49.94	46.67	49.89	0.02
Number of beneficiaries	122	—	1,630	—	—	120	—	358	—	—
Number of unique beneficiaries	122	—	1,446	—	—	120	—	160	—	—
Number of weighted beneficiaries	—	—	—	—	—	120	—	120	—	—

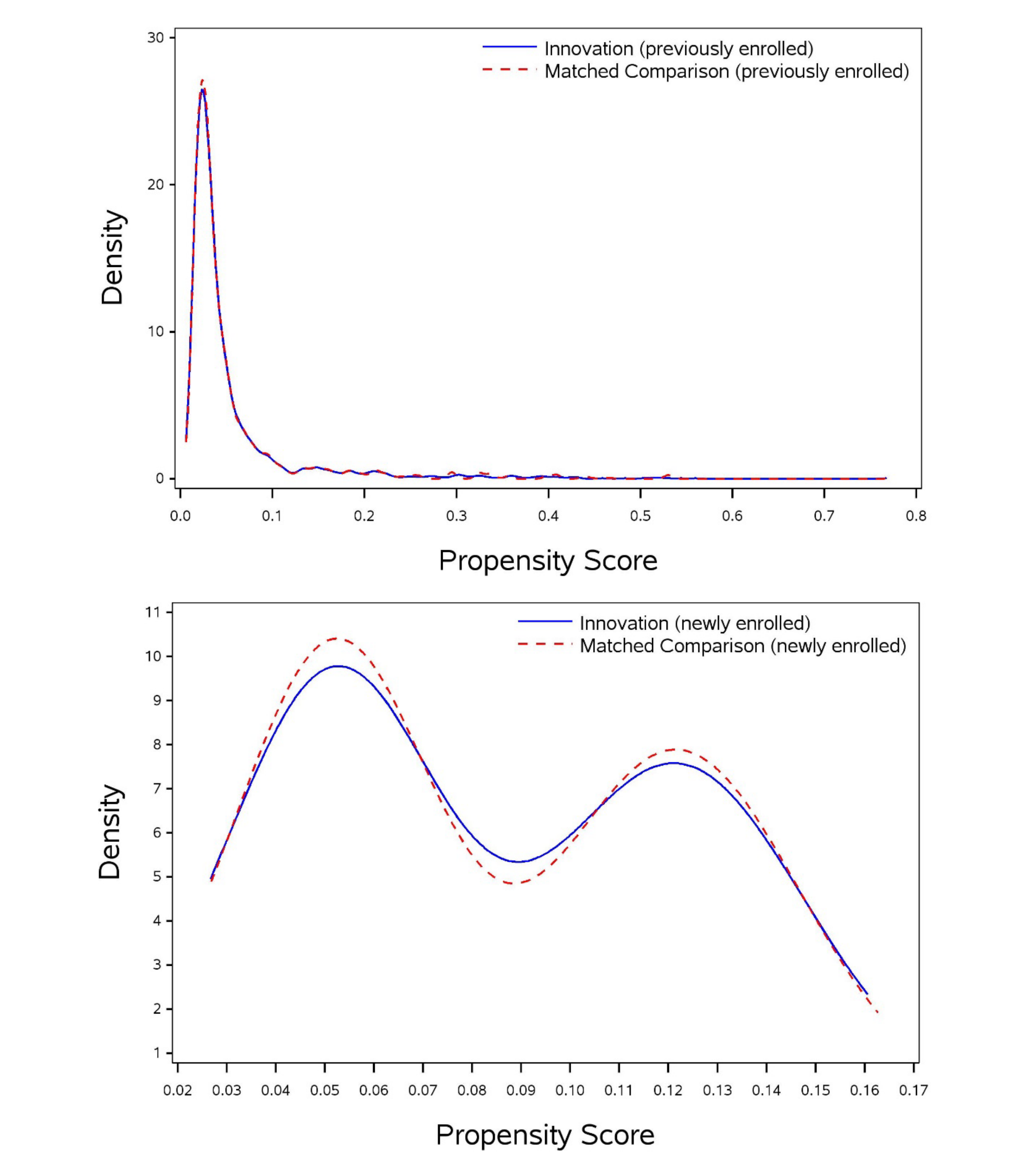
Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).
Curators = Curators of the University of Missouri; ED = emergency department; SD = standard deviation.
— Not applicable.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and checked whether matching decreased the absolute standardized differences and achieved acceptable balance (Table 17). The results in Table 17 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. The exceptions were:

- number of months of Medicaid eligibility in the calendar year prior to enrollment,
- number of ED visits in the calendar quarter and year prior to enrollment for participants who were previously enrolled in Medicaid, and
- certain demographic variables for those who were not previously enrolled in Medicaid.

Figure 8 shows the distribution of the propensity scores for the innovation and comparison groups. The figures demonstrate a very close overlap between the innovation and comparison groups' propensity scores for those previously enrolled in Medicaid as well as those newly enrolled in Medicaid. Therefore, we present the Medicaid claims analysis using both the innovation group and the matched comparison group.

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 18 reports Medicaid spending per patient in the eight quarters before and the three quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 9*** illustrates the Medicaid spending per beneficiary in Table 18 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending trends up in the baseline quarters for the innovation beneficiaries. Innovation spending decreases for both the innovation and comparison groups. It is premature to conclude any impact of the innovation on spending among enrolled beneficiaries. As shown in Table 18, the standard deviation for spending is very high, representing the skewed nature of expenditures.

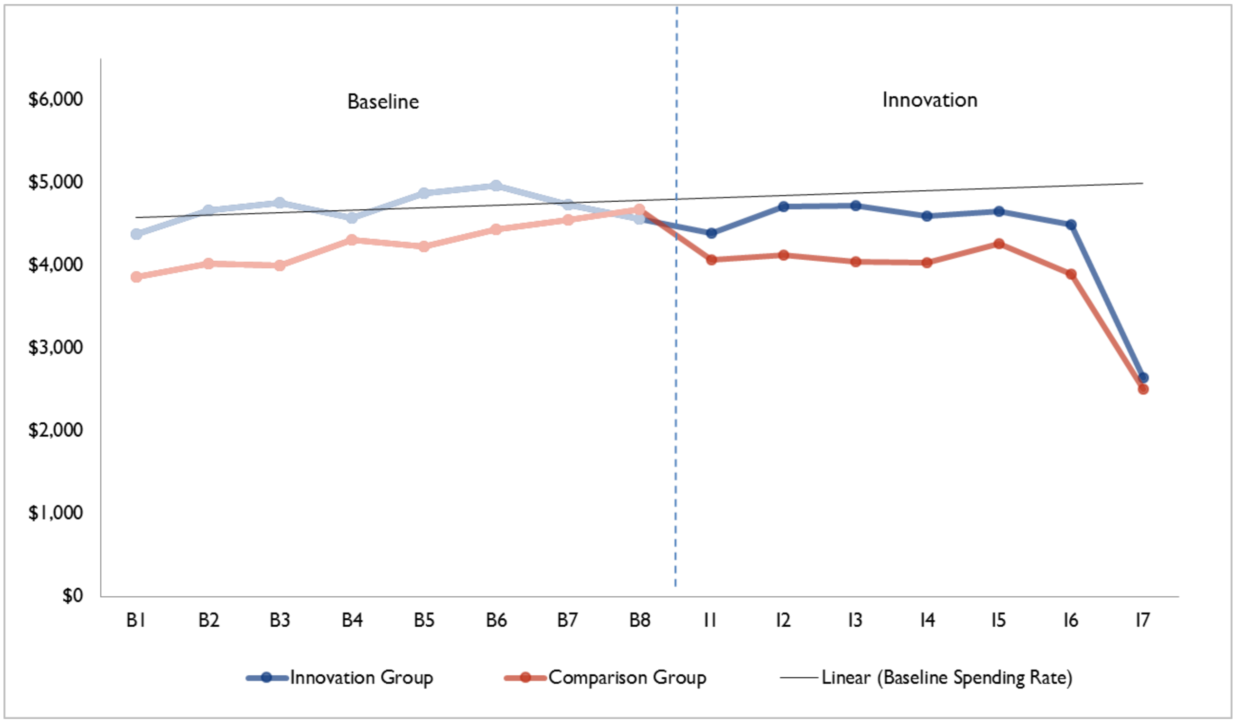
Table 18. Medicaid Spending per Participant: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters						
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7
Innovation Group															
Spending rate	$4,380	$4,668	$4,750	$4,568	$4,865	$4,960	$4,727	$4,557	$4,393	$4,706	$4,725	$4,589	$4,650	$4,490	$2,638
Std dev	$8,028	$9,726	$9,015	$8,468	$9,072	$9,454	$9,286	$9,080	$8,835	$9,490	$9,622	$9,100	$8,896	$8,980	$5,022
Unique patients	1,706	1,740	1,746	1,938	1,987	2,046	2,107	2,277	2,397	2,229	2,116	1,980	1,917	1,866	1,803
Comparison Group															
Spending rate	$3,859	$4,021	$4,002	$4,307	$4,231	$4,432	$4,544	$4,674	$4,064	$4,127	$4,045	$4,031	$4,261	$3,899	$2,505
Std dev	$5,500	$5,812	$5,682	$5,917	$5,533	$6,127	$6,260	$6,562	$5,880	$5,695	$6,071	$5,795	$6,453	$5,461	$3,632
Weighted patients	2,172	2,173	2,164	2,141	2,135	2,149	2,191	2,277	2,397	2,304	2,277	2,253	2,220	2,160	2,084
Savings per Patient															
	−$521	−$647	−$748	−$260	−$633	−$528	−$183	$117	−$329	−$579	−$680	−$558	−$390	−$591	−$133

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; I1 = Innovation Q1.
.

Figure 9. Medicaid Spending per Participant: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $139 (90% CI: -$37, $315). This effect was not statistically significant at the 10 percent level. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the post-innovation period, we also present quarterly effects. ***Table 19*** presents the results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in the innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly difference-in-differences estimates. In almost all innovation quarters, spending among the innovation group is higher than the comparison group. The estimates are statistically significant in I2 and I3, but not other innovation quarters.

Table 19. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	$60	$137	0.663
I2	$286	$154	0.064
I3	$343	$159	0.031
I4	$199	$166	0.231
I5	$46	$191	0.811
I6	$223	$160	0.163
I7	−$228	$158	0.149
Overall average	$139	$107	0.193
Overall aggregate	$1,992,879	$1,530,379	0.193
Overall aggregate (IY1)	$1,899,807	$1,001,163	0.058
Overall aggregate (IY2)	$93,073	$746,845	0.901

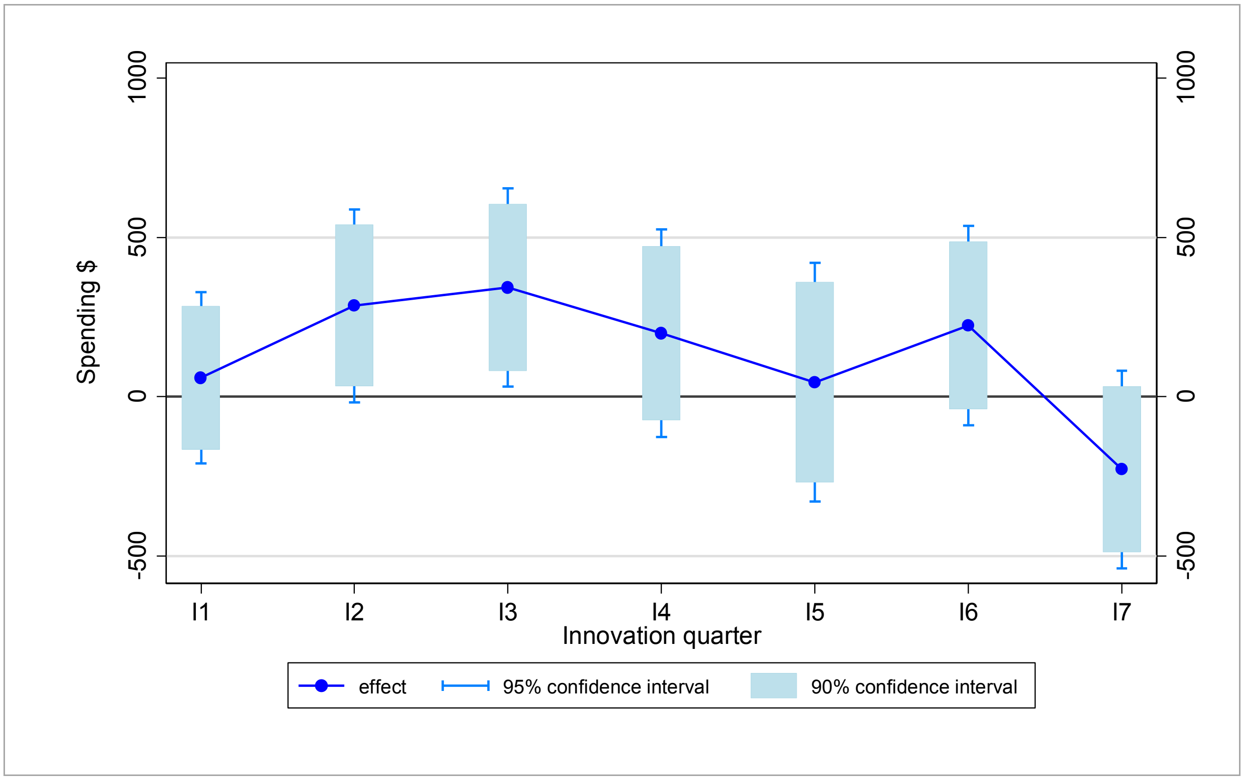
Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

Curators = Curators of the University of Missouri; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

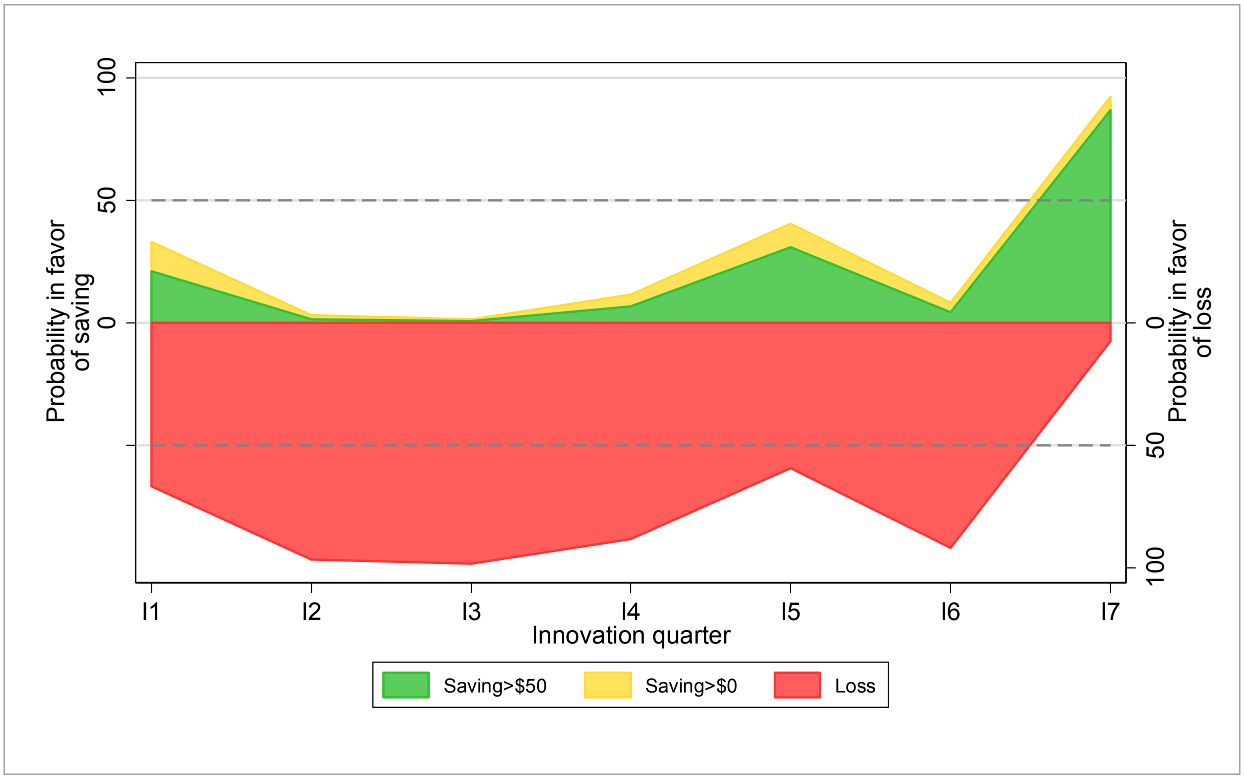
Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri; OLS = ordinary least squares.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates were higher for the innovation group than the comparison group in most of the innovation quarters, we see a high probability of loss.

Figure 11. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 20*** and ***Figure 12***. Inpatient admissions fluctuate around the baseline trend line and trend upward in the baseline period for the innovation beneficiaries. Inpatient admissions fall during the innovation quarters for both the innovation group and the comparison group.

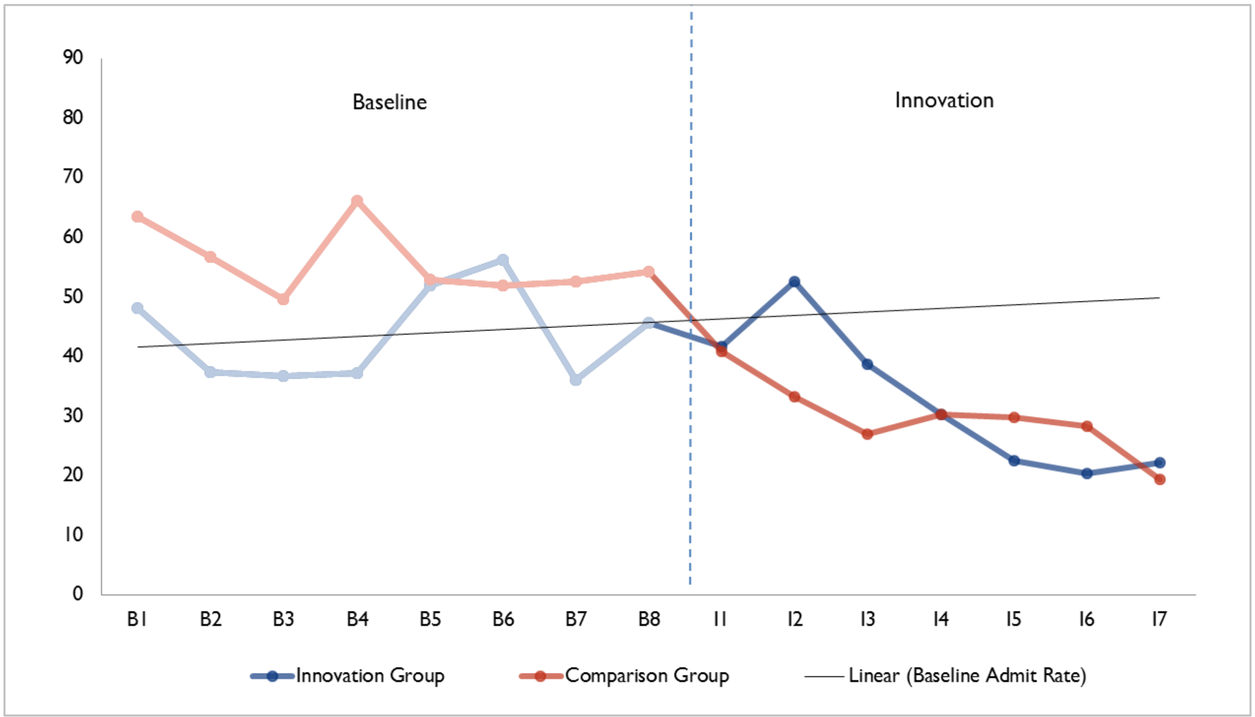
Table 20. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters						
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7
Innovation Group															
Admit rate	48	37	37	37	52	56	36	46	42	52	39	30	22	20	22
Std dev	301	257	237	229	291	370	217	244	242	320	272	225	183	169	172
Unique patients	1,706	1,740	1,746	1,938	1,987	2,046	2,107	2,277	2,397	2,229	2,116	1,980	1,917	1,866	1,803
Comparison Group															
Admit rate	64	57	50	66	53	52	52	54	41	33	27	30	30	28	19
Std dev	254	237	227	291	206	223	255	250	178	158	147	171	156	152	120
Weighted patients	2,172	2,173	2,164	2,141	2,135	2,149	2,191	2,277	2,397	2,304	2,277	2,253	2,220	2,160	2,084
Innovation − Comparison Rate															
	−15	−19	−13	−29	−1	4	−16	−9	1	19	12	0	−7	−8	3

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; I1 = Innovation Q1.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri.

2.11.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions was an increase of 11 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect was statistically significant (90% CI: 8, 15). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 21 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. In all innovation quarters, the number of inpatient admissions among the innovation group was higher than the comparison group, and most of the estimates were statistically significant.

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	11	6	0.097
I2	31	7	<0.001
I3	19	6	0.001
I4	9	5	0.080
I5	4	5	0.416
I6	1	4	0.738
I7	9	4	0.037
Overall average	11	2	<0.001
Overall aggregate	186	31	<0.001
Overall aggregate (IY1)	153	26	<0.001
Overall aggregate (IY2)	34	17	0.046

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Curators = Curators of the University of Missouri; I = Innovation Quarter; IY = Innovation Year.

2.12 Medicaid Unplanned Readmissions

2.12.1 *Descriptive Results*

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 22*** and ***Figure 13***. Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch, although the trend is going downward. The unplanned readmissions rates continue to fluctuate around the trend line in the innovation quarters for both innovation and comparison groups.

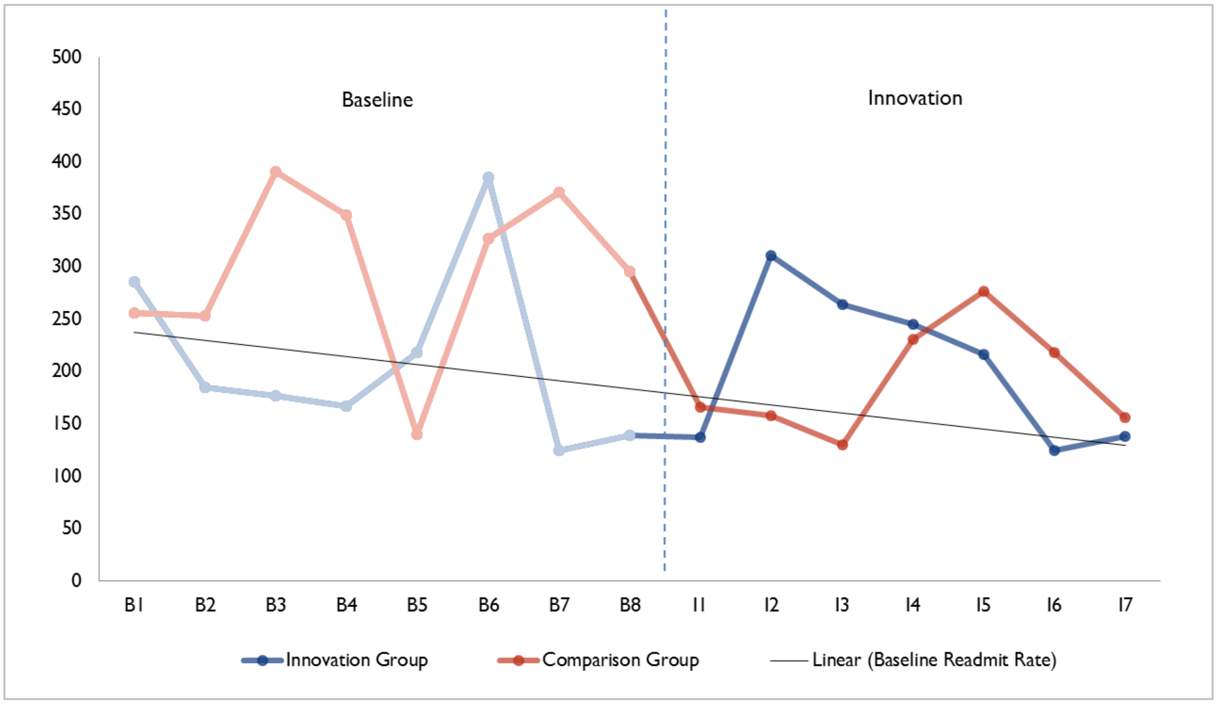
Table 22. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters						
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7
Innovation Group															
Readmit rate	286	185	176	167	218	385	125	140	138	311	264	245	216	125	138
Std dev	452	388	381	373	413	487	331	347	344	463	441	430	412	331	345
Total admissions	70	54	51	60	87	96	64	86	80	90	72	53	37	32	29
Comparison Group															
Readmit rate	256	253	391	350	140	326	371	295	166	158	130	231	276	218	156
Std dev	436	435	488	477	347	469	483	456	372	365	336	421	447	413	363
Total admissions	116	106	93	123	99	89	103	106	80	65	50	56	56	49	32
Innovation − Comparison Rate															
	30	−68	−214	−183	78	59	−246	−156	−29	153	134	15	−60	−93	−18

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; I1 = Innovation Q1.

Figure 13. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri.

2.12.2 Regression Results

Table 23 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions was 58 per 1,000 inpatient admissions (5.8 percentage points), indicating that the innovation-comparison difference was 5.8 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect was not statistically significant at the 10 percent level (90% CI: -9, 126).

Table 23. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Inpatient Admissions: Curators

Quarter	Coefficient	Standard Error	P-Values
Overall average	58	41	0.155
Overall aggregate	23	16	0.155

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Curators = Curators of the University of Missouri.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 24*** and ***Figure 14.*** The ED visit rate remains stable before innovation launch for the innovation group, but drops close to zero starting from the third innovation quarter (not shown). The same pattern can be observed in the comparison group, possibly due to a lack of complete Medicaid claims data. As a result, we only present data and results through the end of the second innovation quarter (I2).

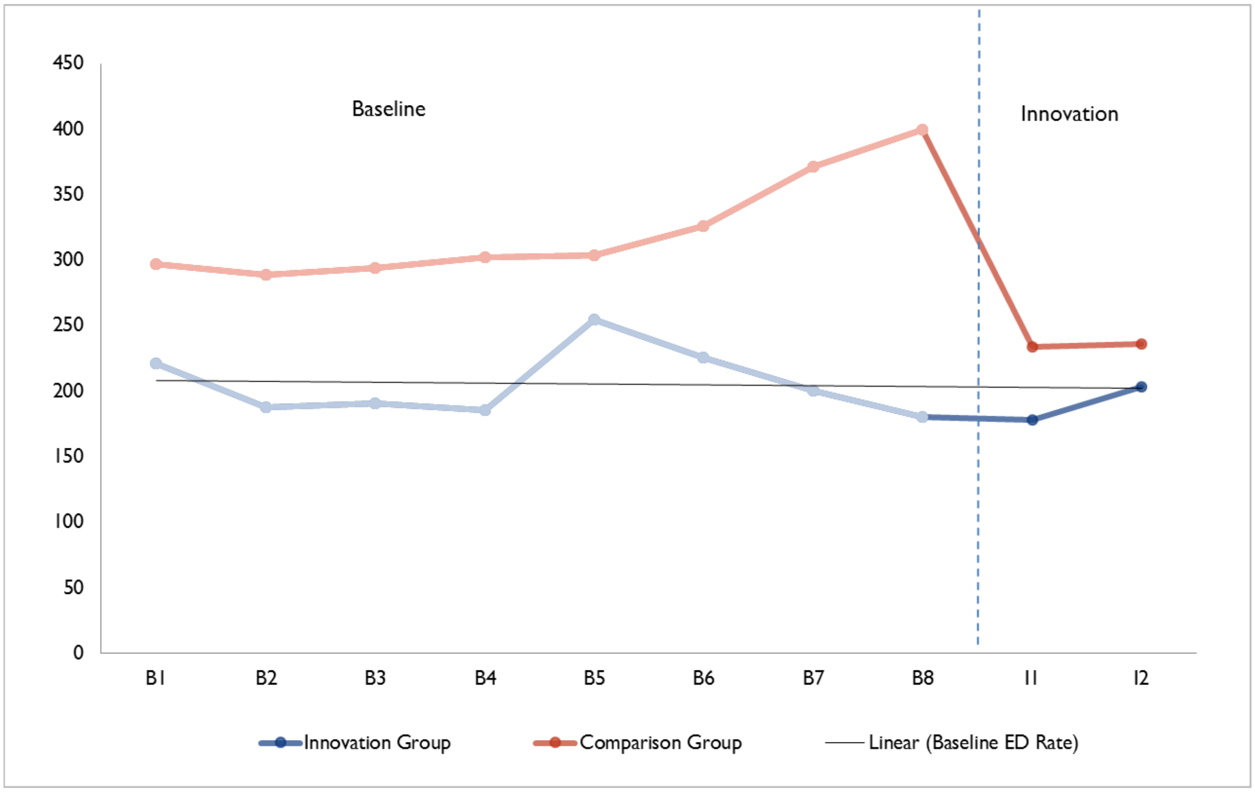
Table 24. ED Visits per 1,000 Medicaid Participants: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters	
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2
Innovation Group										
ED rate	221	188	191	186	254	226	201	180	178	204
Std dev	919	641	717	721	920	885	779	730	683	798
Unique patients	1,706	1,740	1,746	1,938	1,987	2,046	2,107	2,277	2,397	2,229
Comparison Group										
ED rate	297	289	294	303	304	326	371	400	234	236
Std dev	773	732	847	831	746	867	1,034	1,042	638	680
Weighted patients	2,172	2,173	2,164	2,141	2,135	2,149	2,191	2,277	2,397	2,304
Innovation − Comparison Rate										
	−76	−101	−103	−117	−49	−101	−170	−219	−56	−33

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Curators = Curators of the University of Missouri; ED = emergency department; I1 = Innovation Q1.

Figure 14. ED Visits per 1,000 Medicaid Participants: Curators



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Curators = Curators of the University of Missouri; ED = emergency department.

2.13.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits was an increase of 66 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect was statistically significant at the 10 percent level (90% CI: 47, 85). In addition to the average effect over the post-innovation period, we also present quarterly effects.

Table 25 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. In both of the innovation quarters, the number of ED visits among the innovation group was higher than the comparison group, and both estimates were statistically significant.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	59	16	<0.001
I2	74	17	<0.001
Overall average	66	12	<0.001
Overall aggregate	306	54	<0.001
Overall aggregate (IY1)	306	54	<0.001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Curators = Curators of the University of Missouri; I = Innovation Quarter; IY = Innovation Year.

2.14 Discussion: Medicaid Results

The regression results indicate that the innovation group beneficiaries incurred higher spending in the first innovation year and, overall, had more inpatient hospital admissions and ED visits than the comparison group beneficiaries. Since the innovation focused on care coordination in a primary care setting, the benefits may be more pronounced for measures other than the core four measures we examined. One caveat is that we only have data for the first two innovation quarters for ED visits, and more data are needed to make definitive conclusions on changes in ED visits. We also performed a subgroup analysis focusing on high-risk patients (those complex patients with a risk tier rating of 3 or 4, including those who had at least one hospitalization or multiple outpatient visits to ambulatory care, as defined by the awardee) and found similar significant results.

These results may not have provided a complete evaluation picture of the Curators innovation for several reasons. The innovation was launched on April 1, 2013, with a focus on preventive care and chronic conditions. The impact of health information technology and the NCMs on long-term conditions may not be immediate because smaller, incremental changes take time to develop.

In addition, providers and NCMs had to learn to integrate the role and reporting into their workflow. Although all Curators beneficiaries may potentially benefit from the LIGHT^2 innovation, the benefits may be most pronounced for the more complex patients. Curators shifted its focus to provide more services to more complex patients in the midst of the intervention, so more time may be needed to realize the benefits. The results presented here are only for Medicaid beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 24 percent of the overall population reached by the innovation.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

The following sections present awardee-specific, patient-level data on the innovation's impact on clinical effectiveness and health outcomes. After submitting the Q12 data, Curators discovered an issue in how ICD-9 codes were stored in the LIGHT[2] data warehouse. Therefore, more patients were identified as having asthma, coronary artery disease (CAD), and diabetes than reported in the 2015 annual report. In November 2015, Curators submitted new cumulative data files for data through Q12. The data included in this annual report are through December 2015. ***Table 26*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested. Data for all the measures listed in the table were received from Curators and are included in this annual report.

Table 26. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status
Clinical effectiveness	Asthma	Percentage of patients with asthma who received at least one FEV1 test	Data received from Curators
	Coronary artery disease	Percentage of patients with CAD who were prescribed aspirin or clopidogrel	Data received from Curators
		Percentage of patients with CAD who have a LDL-C test	Data received from Curators
	Chronic obstructive pulmonary disease (COPD)	Percentage of patients with COPD who were prescribed an inhaled bronchodilator	Data received from Curators
		Percentage of patients with COPD who had spirometry results documented	Data received from Curators
	Diabetes	Percentage of patients with diabetes who received at least one HbA1c test	Data received from Curators
		Percentage of patients with diabetes who received at least one LDL-C test	Data received from Curators
	Hypertension	Percentage of patients with hypertension who received at least one blood pressure reading	Data received from Curators
Health outcomes	Asthma	Percentage of patients with asthma who have FEV1≥ 80% predicted/personal best	Data received from Curators
	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c>9.0%	Data received from Curators
		Percentage of patients with diabetes with an LDL-C control<100 mg/dL	Data received from Curators
	Hypertension	Percentage of patients with hypertension with blood pressure <140/90 mm Hg	Data received from Curators
	Coronary artery disease	Percentage of patients with CAD who have a LDL-C result <100 mg/dL	Data received from Curators

CAD = coronary artery disease; COPD = chronic obstructive pulmonary disease; Curators = The Curators of the University of Missouri; FEV1 = forced expiratory volume in 1 second; LDL-C = low-density lipoprotein cholesterol.

Clinical effectiveness measures for Curators include the percentage of participants with asthma who received a FEV1 test, the percentage of patients with CAD who were prescribed aspirin or clopidogrel or had a low-density lipoprotein cholesterol (LDL-C) test, the percentage of participants with COPD who were prescribed an inhaled bronchodilator or had spirometry results documented, the percentage of participants with diabetes who received an HbA1c test or LDL-C test, and the percentage of patients with hypertension who received a blood pressure reading.

We examined health outcomes among patients with asthma, coronary artery disease, diabetes, and hypertension. The following run charts take into account rolling enrollment. The innovation quarters are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation had health outcome data in more innovation quarters over time than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tended to drop substantially as the number of quarters enrolled increased. We provide data when at least 20 patients had a test or reading within the innovation quarter. We also conducted multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time, while controlling for repeated measures (i.e., within-subject covariance). More specifically, HbA1c and LDL-C values among those with diabetes, systolic and diastolic blood pressure values among those with hypertension, and LDL-C values among those with CAD, were regressed onto dose (i.e., number of contacts with health coaches). We controlled for the baseline health outcome being examined in the regression (i.e., HbA1c, LDL or blood pressure at innovation enrollment), age, sex, race, and insurance type. Changes over the innovation for each health outcome measure were examined in separate regression analyses and are presented in the subsections below.

The subsections below describe the results of each of the clinical effectiveness and health outcome measures.

2.16 Asthma

Curators provided data on whether patients with asthma received an FEV1 test allowing us to address the question of whether appropriate clinical services were provided to those with asthma during the innovation.

Evaluation Questions

- What percentage of patients with asthma received an FEV1 test during the innovation period?

We received outcome data for FEV1 allowing us to address the question of whether the percentage of patients with asthma with FEV1 control increased over the course of the innovation.

Evaluation Questions

- Has the percentage of patients with asthma with FEV1 control increased over time?

2.16.1 Descriptive Results

Table 27 shows the percentage of patients with asthma who received an FEV1 test during the innovation period. As shown in the table, less than one-quarter of patients with asthma received a FEV1 test.

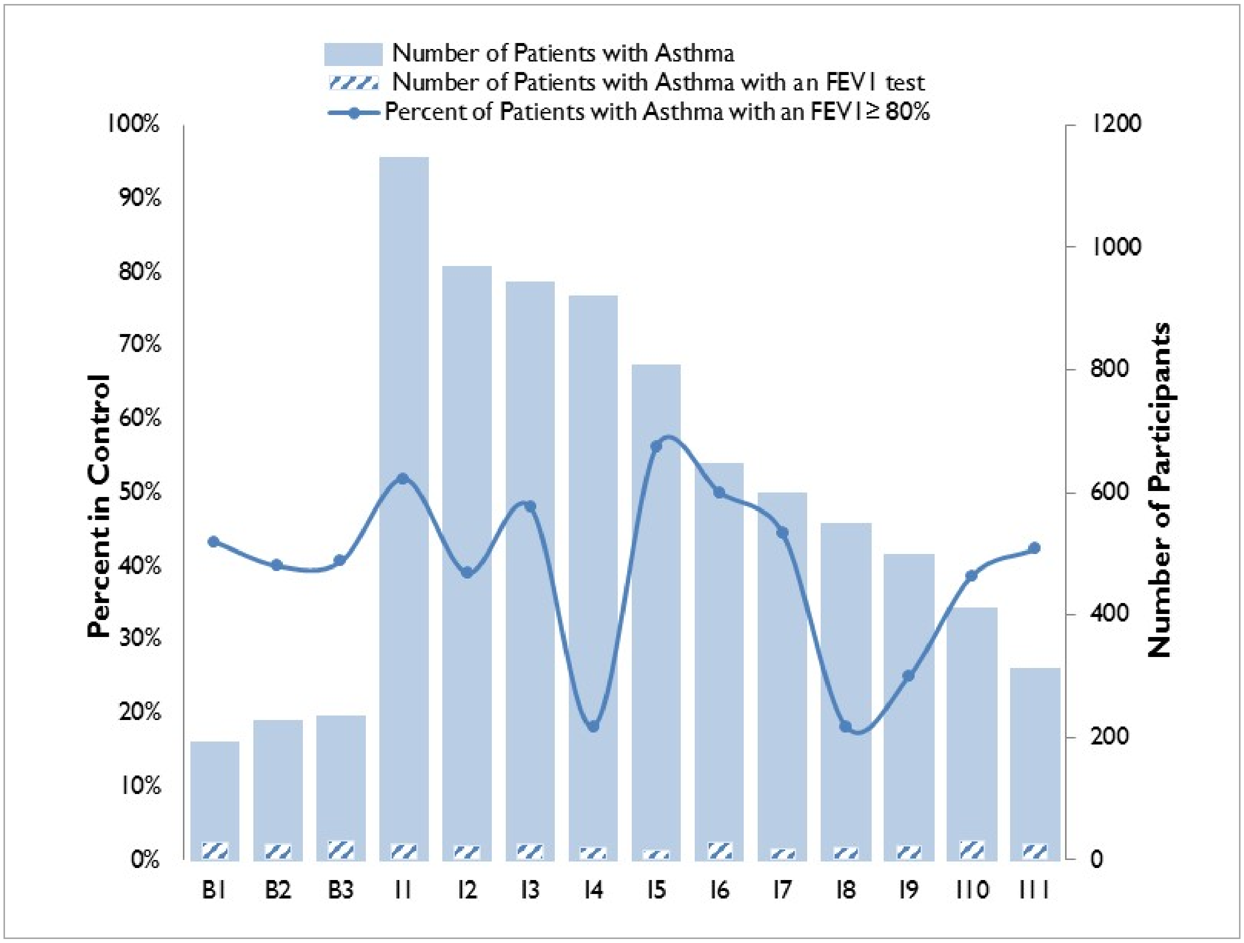
Table 27. Percentage of Patients with Asthma who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
Asthma (n=1,129)	
Percentage of patients with asthma who received an FEV1 test	18.3

Source: Patient-level data provided to RTI by Curators.

Figure 15 presents the percentage of participants with asthma with a FEV1 pre-percentage ≥ 80 over time. The percentage of asthma patients with normal FEV1 was at its peak at approximately 56 percent in I5 and then dropped to approximately 42 percent by I11. These findings suggest that FEV1 among patients with asthma enrolled in the innovation did not improve over time.

Figure 15. Percentage of Patients with Asthma with FEV-1 Control over Time



(continued)

Figure 15. Percentage of Patients with Asthma with FEV-1 Control over Time (continued)

Quarter	B1	B2	B3	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Percentage of patients with asthma with an FEV1≥ 80%	43.3	40.0	40.6	51.9	39.1	48.0	18.2	56.3	50.0	44.4	18.2	25.0	38.7	42.3
Number of patients with asthma	173	208	217	1129	949	924	903	790	628	580	530	480	393	295
Number of patients with asthma with an FEV1 test	30	25	32	27	23	25	22	16	28	18	22	24	31	26

Source: Patient-level data provided to RTI by Curators. FEV1 = forced expiratory volume in 1 second.

2.17 Coronary Artery Disease (CAD)

Curators provided data on whether patients with CAD were prescribed aspirin or clopidogrel and whether they received an LDL-C test, allowing us to address the question of whether appropriate clinical services were provided to those with CAD during the innovation.

Evaluation Questions

- What percentage of patients with CAD were prescribed aspirin or clopidogrel during the innovation period?
- What percentage of patients with CAD were received an LDL-C test during the innovation period?

LDL-C data for those with CAD allowed us to address the question of whether the percentage of patients with CAD with LDL-C control increased over the course of the innovation.

Evaluation Questions

- Has the percentage of patients with CAD with LDL-C control increased over time?

2.17.1 Descriptive Results

Table 28 shows the percentage of patients with CAD who were prescribed aspirin or clopidogrel, or received an LDL-C test, during the innovation period. As shown in the table, approximately 73 percent of patients with CAD were prescribed aspirin or clopidogrel. Ninety percent of patients with CAD received a LDL-C test. Thus, a majority of patients with CAD received appropriate clinical services.

Table 28. Percentage of Patients with CAD who Received Clinical Services

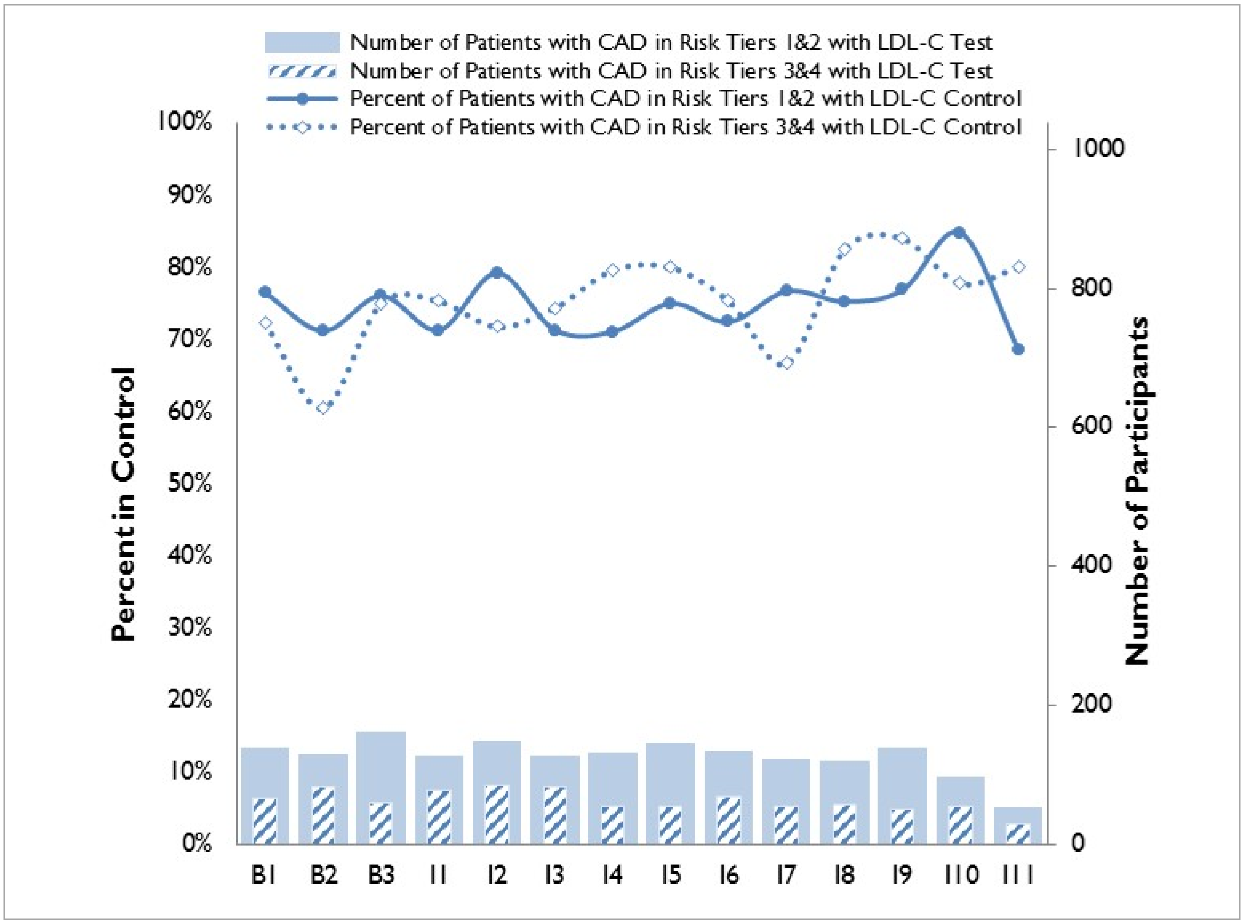
	Percentage of Patients Receiving Clinical Services
CAD (n=824)	
Percentage of patients with CAD who were prescribed aspirin or clopidogrel	72.7
Percentage of patients with CAD who received a LDL-C test	89.7

Source: Patient-level data provided to RTI by Curators. CAD = coronary artery disease

Figure 16 presents the percentage of CAD patients, by baseline risk tier (Tiers 1 and 2 included healthy patients without a chronic condition and patients with a stable chronic condition. Tiers 3 and 4 included the most complex patients, including those who had at least one hospitalization or multiple outpatient visits to ambulatory care), with an LDL-C test indicating good control (i.e., <100 mg/dL). The denominator represents the number of CAD patients who received an LDL-C test for each quarter. The numerator represents the number of CAD patients who received an LDL-C test that was <100 mg/dL.

As shown, the percentage of patients with LDL-C control fluctuates over time for patients in both sets of risk tiers, but more so for those in the higher-risk tiers. Among those in the higher-risk tiers (i.e., Tiers 3 and 4), the percentage with LDL-C control increases when baseline quarters are compared to the last quarter for which data are presented. Approximately 69 percent of higher-risk tier patients had LDL-C control in baseline, but 80 percent did in I11. The increase is less pronounced among those in the lower-risk tiers (i.e., Tiers 1 and 2), where the percentage increased from approximately 75 percent in the baseline quarters to approximately 85 percent in I10. However, the percentage drops to approximately 69 percent in I11. These findings suggest that LDL-C tended to improve over time for CAD patients, especially in the higher-risk tiers, enrolled in the innovation.

Figure 16. Percentage of CAD Patients with LDL-C Control over Time



	Quarter	B1	B2	B3	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
●	Percentage of patients with CAD in risk Tiers 1 & 2 with LDL-C control	76.5	71.2	76.1	71.3	79.2	71.3	71.1	75.0	72.4	76.7	75.2	76.9	84.8	68.6
◊	Percentage of patients with CAD in risk Tiers 3 & 4 with LDL-C control	72.3	60.5	75.0	75.3	71.8	74.4	79.6	80.0	75.4	66.7	82.5	84.0	77.8	80.0
	Number of patients with CAD in risk Tiers 1 & 2 with LDL-C test	119	111	142	108	130	108	114	128	116	103	101	121	79	35
	Number of patients with CAD in risk Tiers 3 & 4 with LDL-C test	65	81	60	77	85	82	54	55	69	54	57	50	54	30

Source: Patient-level data provided to RTI by Curators.
CAD = coronary artery disease; LDL-C = low-density lipoprotein cholesterol.

2.18 COPD

We also received data on whether patients with COPD were prescribed an inhaled bronchodilator or had spirometry results documented during the innovation period. This allowed us to examine whether appropriate clinical services were provided to those with COPD during the innovation.

Evaluation Questions

- What percentage of patients with COPD were prescribed an inhaled bronchodilator during the innovation period?
- What percentage of patients with COPD had spirometry results documented during the innovation?

2.18.1 Descriptive Results

As shown in ***Table 29***, more than three-quarters of patients with COPD were prescribed an inhaled bronchodilator and less than one-third had spirometry results documented.

Table 29. Percentage of Patients with COPD who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
COPD (n=822)	
Percentage of patients with COPD who were prescribed an inhaled bronchodilator	77.9
Percentage of patients with COPD who had spirometry results documented	31.0

Source: Patient-level data provided to RTI by Curators.
COPD = chronic obstructive pulmonary disease.

2.19 Diabetes

We also received data on whether patients with diabetes received an HbA1c test or an LDL-C test during the innovation period. This allowed us to examine whether appropriate clinical services were provided to those with diabetes during the innovation.

Evaluation Questions

- What percentage of patients with diabetes received an HbA1c test during the innovation period?
- What percentage of patients with diabetes received an LDL-C test during the innovation period?

We received outcome data for HbA1c and LDL-C among those with diabetes, which allowed us to address whether the percentage of patients with diabetes with poor HbA1c control decreased and whether the percentage of patients with diabetes with LDL-C control increased among those with diabetes over the course of the innovation.

Evaluation Questions

- Has the percentage of patients with diabetes with poor HbA1c control decreased over time?
- Has the percentage of patients with diabetes with LDL-C control increased over time?

2.19.1 Descriptive Results

Table 30 shows the percentage of patients with diabetes who received an HbA1c test or LDL-C test during the innovation period. Most diabetes patients received an HbA1c test or a LDL-C test (86.0% and 83.1%, respectively).

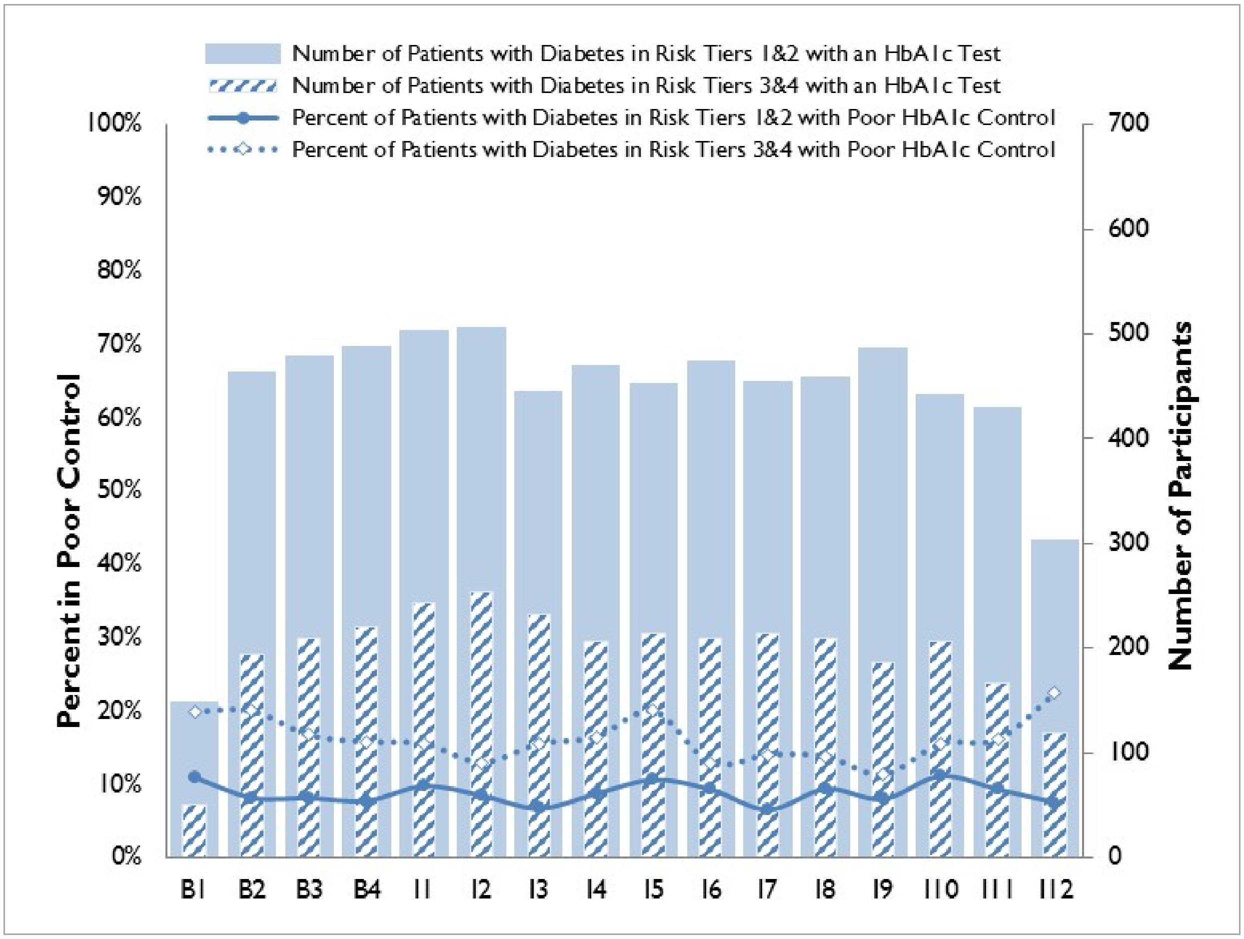
Table 30. Percentage of Patients with Diabetes who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
Diabetes (n=2,005)	
Percentage of patients with diabetes who received an HbA1c test	86.0
Percentage of patients with diabetes who received an LDL-C test	83.1

Source: Patient-level data provided to RTI by Curators.

Figure 17 presents the percentage of patients with diabetes, by baseline risk tier, who had an HbA1c test indicating poor control (i.e., HbA1c > 9%) over time. The denominator represents the number of diabetes patients who received an HbA1c test for each quarter. The numerator represents the number of diabetes patients who received an HbA1c test that was > 9.0 percent. As shown in the figure, the percentage of patients with poor HbA1c control remained relatively consistent over time for patients in both sets of risk tiers. However, as would be expected, there are greater percentages of patients in the higher-risk tiers (Tiers 3 and 4) with poor HbA1c control than in the lower-risk tiers (Tiers 1 and 2). Among those in the higher-risk tiers, the percentage with poor HbA1c control decreases slightly over time, from approximately 18 percent in the baseline quarters, to approximately 11 percent by I9, but then increases in I10 up to approximately 23 percent in I12. For those in the lower-risk tiers, the percentage decreases from approximately 9 percent in the baseline quarters to approximately 8 percent by I12.

Figure 17. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



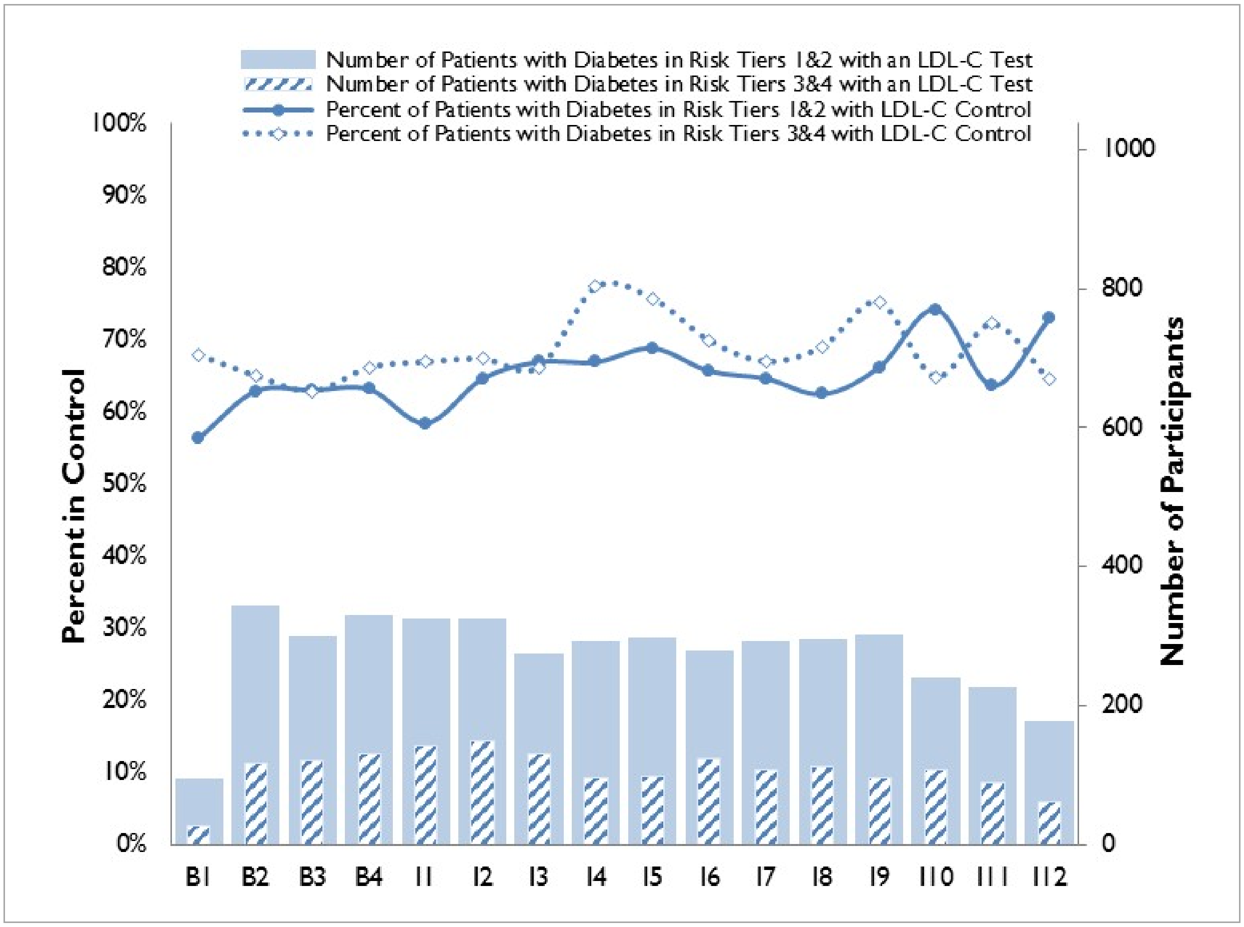
	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
●	Percentage of patients with diabetes in risk Tiers 1 & 2 with poor HbA1c control	10.9	8.2	8.1	7.8	9.8	8.5	6.7	8.7	10.6	9.3	6.5	9.4	8.0	11.1	9.3	7.5
◊	Percentage of patients with diabetes in risk Tiers 3 & 4 with poor HbA1c control	20.0	20.1	16.7	15.8	15.6	13.0	15.5	16.5	20.1	12.9	14.0	13.8	11.3	15.5	16.2	22.5
	Number of patients with diabetes in risk Tiers 1 & 2 with HbA1c test	137	452	467	476	491	494	433	458	442	462	443	447	475	431	418	292
	Number of patients with diabetes in risk Tiers 3 & 4 with HbA1c test	50	194	209	221	244	254	232	206	214	209	214	210	186	206	167	120

Source: Patient-level data provided to RTI by Curators.

Figure 18 presents the percentage of patients with diabetes, by baseline risk tier, who had an LDL-C test indicating good control (i.e., <100 mg/dL) over time. The denominator represents the number of diabetes patients who received an LDL-C test for each quarter. The numerator represents the number of diabetes patients who received an LDL-C test that was <100 mg/dL.

As shown in the figure, the percentage of patients with LDL-C control fluctuates somewhat over time for patients in both sets of risk tiers. Interestingly, however, there are greater percentages of patients in the higher-risk tiers (Tiers 3 and 4) with LDL-C control than in the lower-risk tiers. Although, among those in the higher-risk tiers, the percentage with LDL-C control changes little when comparing the baseline quarters to the last quarter for which data are presented. More specifically, approximately 65 percent of higher-risk tier patients had LDL-C control in the baseline quarters, which was the same as that in I12 (i.e., approximately 65%). The reverse is true for those in the lower-risk tiers, where the percentage increased from 61 percent in the baseline quarters to 73 percent by I12. This suggests that the innovation may have had a greater effect on those in the lower-risk tiers over time than on those in the higher-risk tiers.

Figure 18. Percentage of Diabetes Patients with LDL-C Control over Time



(continued)

Figure 18. Percentage of Diabetes Patients with LDL-C Control over Time (continued)

	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
●	Percentage of patients with diabetes in risk Tiers 1 & 2 with LDL-C control	56.4	62.9	63.0	63.1	58.4	64.6	66.9	66.9	68.8	65.6	64.6	62.5	66.2	74.2	63.6	73.0
◊	Percentage of patients with diabetes in risk Tiers 3 & 4 with LDL-C control	67.9	65.0	62.8	66.2	66.9	67.3	66.2	77.3	75.8	69.9	67.0	69.0	75.3	64.8	72.2	64.5
	Number of Patients with diabetes in risk Tiers 1 & 2 with an LDL-C test	78	326	281	312	308	308	257	275	279	262	274	277	284	221	209	159
	Number of Patients with diabetes in risk Tiers 3 & 4 with an LDL-C test	28	117	121	130	142	150	130	97	99	123	109	113	97	108	90	62

Source: Patient-level data provided to RTI by Curators.
DL-C = low-density lipoprotein cholesterol.

2.20 Hypertension

Curators provided data on whether patients with hypertension received a blood pressure reading, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation.

Evaluation Questions

- What percentage of patients with hypertension received a blood pressure reading during the innovation period?

Blood pressure data for those with hypertension allowed us to address the question of whether the percentage of patients with hypertension with blood pressure control increased over the course of the innovation.

Evaluation Questions

- Has the percentage of patients with hypertension with blood pressure control increased over time?

2.20.1 Descriptive Results

Table 31 shows that nearly all patients with hypertension received a blood pressure reading during the innovation period.

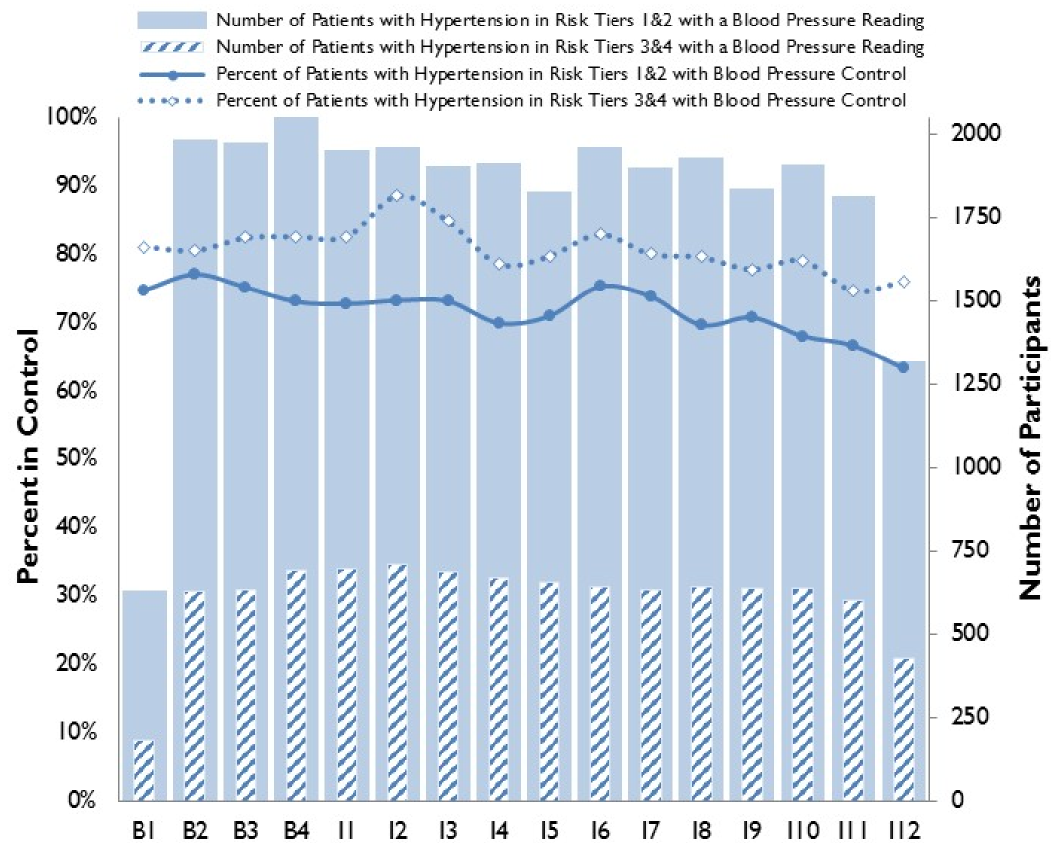
Table 31. Percentage of Patients with Hypertension who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
Hypertension (n=3,936)	
Percentage of patients with hypertension who received a blood pressure reading	93.1

Source: Patient-level data provided to RTI by Curators.

Figure 19 presents the percentage of participants with hypertension, by baseline risk tier, who had a blood pressure reading within the quarter indicating good control (i.e., <140/90 mm Hg) over time. The denominator represents the number of hypertension patients who received a blood pressure reading for each quarter. The numerator represents the number of hypertension patients who received a blood pressure reading that was <140/90 mm Hg. The percentage of patients with blood pressure control fluctuates over time. As shown in the figure, the percentage of hypertension patients with blood pressure control fluctuated somewhat over time for patients in both risk tiers. For both sets of groups, the percentage with blood pressure control decreases over time. More specifically, approximately 82 percent of higher-risk tier (Tiers 3 and 4) patients had blood pressure control in the baseline quarters, but approximately 76 percent did in I12. For lower-risk tier (Tiers 1 and 2) patients, the percent decreases from approximately 75 percent in the baseline quarters to approximately 63 percent by I12. Thus, blood pressure did not improve over time among hypertensive patients enrolled in the innovation, regardless of risk tier.

Figure 19. Percentage of Hypertension Patients with Blood Pressure Control over Time



	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
●	Percentage of patients with hypertension in risk Tiers 1 & 2 with blood pressure control	74.7	77.1	75.2	73.1	72.8	73.2	73.1	69.9	71.0	75.3	73.8	69.7	70.8	68.0	66.6	63.3
◊	Percentage of patients with hypertension in risk Tiers 3 & 4 with blood pressure control	81.1	80.6	82.4	82.6	82.6	88.6	84.9	78.6	79.8	82.9	80.1	79.6	77.8	79.1	74.7	76.1
	Number of patients with hypertension in risk Tiers 1 & 2 with blood pressure reading	597	1,949	1,940	2,036	1,916	1,925	1,869	1,876	1,792	1,926	1,864	1,896	1,802	1,874	1,778	1,283
	Number of patients with hypertension in risk Tiers 3 & 4 with blood pressure reading	180	628	632	689	696	710	687	668	657	644	632	642	636	637	601	426

Source: Patient-level data provided to RTI by Curators.

2.20.2 Regression Results

Results from the GEE assessing the impact of dose (i.e., number of NCM services) on systolic and diastolic blood pressure values over time among those with hypertension are shown in ***Table 32***. The number of NCM services received by patients with hypertension per quarter ranged from 0 to 209, with an average of 6.1. As shown in the table, significant effects were found for dose: a greater number of NCM services was related to lower systolic and diastolic blood pressure over time. More specifically, for each additional NCM service, participants' systolic blood pressure decreased by 0.07 mm Hg and diastolic blood pressure by 0.05 mm Hg.

Table 32. Impact of Dose on Systolic and Diastolic Blood Pressure Values among Those with Hypertension over Time

Predictor	Coefficient	Standard Error	P-Value
Systolic blood pressure			
Number of NCM services	−0.07	0.02	0.00
Diastolic blood pressure			
Number of NCM services	−0.05	0.01	0.00

Source: Patient-level data provided to RTI by Curators.

2.21 Discussion: Awardee-Specific Data

Curators provided patients who had CAD, diabetes, and hypertension with necessary clinical services. Most CAD patients were prescribed aspirin or clopidogrel and received an LDL-C test. Similarly, most diabetes patients received an HbA1c test or an LDL-C test. Nearly all hypertension patients received a blood pressure screening. However, only about one-fourth of patients with asthma received an FEV1 test.

Based on the run charts, the percentages of both diabetes and CAD patients with LDL-C control increased over time. However, the percentage of asthma patients with FEV1 control, the percentage of diabetes patients with HbA1c control, and the percentage of hypertension patients with blood pressure control did not change substantially over time.

The regression findings show that the number of NCM services a patient received was related to improvements in and systolic and diastolic blood pressure values among those with hypertension. However, the number of NCM services was not related to improvements in HbA1c and LDL-C values in diabetes patients or LDL-C values in CAD patients.

2.22 Awardee-Specific Measures of Implementation

The evaluation focused on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 33*** lists the quantifiable measures of implementation and their status as of December 31, 2015 that RTI obtained from Curators *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provided additional detail. Reach and dose measures reflected data through Q12, the end of the implementation phase of the Curators innovation.

The findings presented in the following sections are based on data from Q11–Q14 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 33. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q14	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11–Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11–Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of patients enrolled in the innovation	Data received from Curators
		Number/percentage of patients who enrolled in the patient portal	Data received from Curators
	Dose	Number and type of NCM services provided to patients	Data received from Curators

FTE = full-time equivalent; NCM = nurse case manager.

2.23 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.23.1 Hiring and Retention

By the end of Q14 (December 2015), the innovation was staffed with 2.39 full-time equivalent (FTE) staff members. Between Q10 (December, 2014) and Q14, staffing significantly dropped from 22.27 to 2.39 FTEs. Staffing decreased to reflect the reduced level of effort expected during the NCE and was adequate to complete the remaining tasks. Both NCMs and HIAs were reduced. The HIA term employment ended and some staff moved to full-time permanent positions. Many of the NCMs were hired by the hospital in the University's Health System. This change went smoothly; one team member said, *"That started 7/1/15. All in all, it's gone well. There was a transition for NCMs going from the School of Medicine to the hospital. It's a different mental model, but it's worked out just fine."*

The Curators team struggled with staff retention throughout implementation. One program member noted, *"We've had turnover in the HIA team. There's also been some turnover with NCMs, and some critical turnover on the Tiger Institute side. Every time that happens, we slow down."* Nevertheless, the team did not feel that staffing changes kept the HIAs from analyzing the program data, partially because the HIA manager oversaw staffing transitions and ensured that new hires were properly integrated. The HIA was a term position intended to support LIGHT^2 tools and analytics. Those functions have since been taken on by existing staff in the Tiger Institute. Yet, some team members felt that the gradual attrition of NCMs left remaining NCMs with patient panels that were too large. In addition, NCMs focused on patients with the greatest need versus patients with fewer complications.

One lesson learned was to hire people who were the best fit for the positions. Because the HIA role was new, desired characteristics of hires at the outset did not match desired characteristics once the innovation was in progress. One interview participant described this lesson by saying, "*We should've hired the most uniquely qualified HIAs from the start. The second team of hires had expertise more appropriate to the position, and they excelled, which increased productivity."*

2.23.2 Skills, Knowledge, and Training

By the end of Q14 (December 2015), Curators provided 4,632.25 hours of training to 1,295 individuals. The goal of the training was to orient staff to the innovation and LIGHT^2, and explain the project's goals for providing better health, better care, and reducing health care costs (***Table 34***).

Table 34. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 through Q14	343	70
Since inception	4,632.25	1,295

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter. Q11–Q14 January–December 2015.

As the innovation went on, trainings expanded awareness and adoption of the tools within the various clinics in the University health system. These sessions discussed what clinics could expect with the new Hi-Tech system, and how the Hi-Touch care coordination model might affect primary care physicians, NCMs, and other clinical staff. Routine team meetings, periodic email announcements, and online newsletters supplemented the trainings. Email announcements and newsletters informed staff of any changes at the University or project level, prepared staff for the arrival of new tools, and served as reminders that particular resources existed while highlighting their usefulness.

All innovation staff received some training, but workforce development centered on NCMs and HIAs. Staff pursued training via classroom and online settings, and NCMs used the online platform to share success stories, tips, and resources. Training was structured and focused on documentation, attribution, and the LIGHT^2 web-based tools. Staff from Cerner offered one-on-one training on their tools and products as needed. The Tiger Institute helped determine who needed training in the 10 clinics, and organized the rollout. Follow-up emails and reminders were sent to staff after the trainings were held, and trainers answered questions. Staff also provided feedback and notified trainers when processes did not work as expected. In site visit interviews, team members said they valued this communication.

NCMs received the most training because they needed it in order to be functional. The NCM role in the outpatient setting was new for both NCMs and clinics. NCMs had varying previous experience with care management in the outpatient setting; one team member mentioned, *"It takes 6 to 8 months to get a nurse care manager in, and get them trained and up to speed."* The NCMs from all clinics held monthly meetings (webinars, speakers, networking events) where they conducted training and discussed overall issues. HIA training centered on the ability to perform advanced data analytics, and staff were taught SQL (Structured Query Language), Microsoft Excel, and SAS programming. They also learned how to transition data from Cerner's legacy warehouse, PowerInsight, to newer systems. HIAs thought the most useful training was in SQL because they used it every day, but added, *"The PowerInsight training wasn't specific to LIGHT^2, but we still needed to know how to use it, so that was beneficial."* Overall, the HIAs felt that the training prepared them for their role. Physicians were told what was happening on the project, but did not receive as much direct training as the NCMs and HIAs.

Training for this innovation was adequate. No challenges were encountered when implementing the training; however, project staff suggested some improvements. NCMs were unaccustomed to executing tasks traditionally performed by social workers, financial advisors, or mental health professionals—yet often they were called upon to perform such duties for patients. As one NCM noted, *"I feel like we do a lot of social work tasks. It's frustrating as I am not a social worker or mental health specialist and wasn't trained to do those things. But I fill in."* NCMs felt that the training should have been modified to account for these necessary skillsets, or that new staff with expertise in these areas should have been hired. Some staff felt a disconnect between class training and how quality improvement (QI) work was executed in the field, and that there was no centralized support structure to guide them. One team member clarified,

> ***“The actual improvement experience is another area where we struggle. For instance, we offer some QI training programs here. It’s like learning in the class vs. learning in the field. People are mostly going to be learning in the field, and when they do, they need support and coaching. We need to ensure they’re successful; otherwise the initiative flounders, and the organization doesn’t achieve its goals. It’s all related to how we’re managing our talent. Building a cadre of people who can do the work, and be successful at it—that’s where we’re lacking.”***

Clinic staff and physicians were not trained about the NCMs’ role and how best to use their skills. One NCM indicated that a kickoff or general training for the team would have been helpful. Consequently, NCMs’ services were inconsistently incorporated into clinic workflows.

The HIA training consisted of more on-the-job training rather than structured modules. The HIAs and NCMs did not clearly understand each other’s roles, which participants from both groups sometimes found challenging. It is not clear if the HIAs also took trainings that were delivered to the NCMs, though they occasionally attended NCM meetings.

Curators tried to refine training to adapt to changing circumstances. One person noted, *“You never see complacency. You never see us in the same spot that we were. It’s part of growing the system. It’s not going to start out the best it can be.”* The training program was also popular with other organizations. As other medical centers learned about the training modules through networking events, they requested the training materials for their own use.

2.24 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

Evaluation Questions

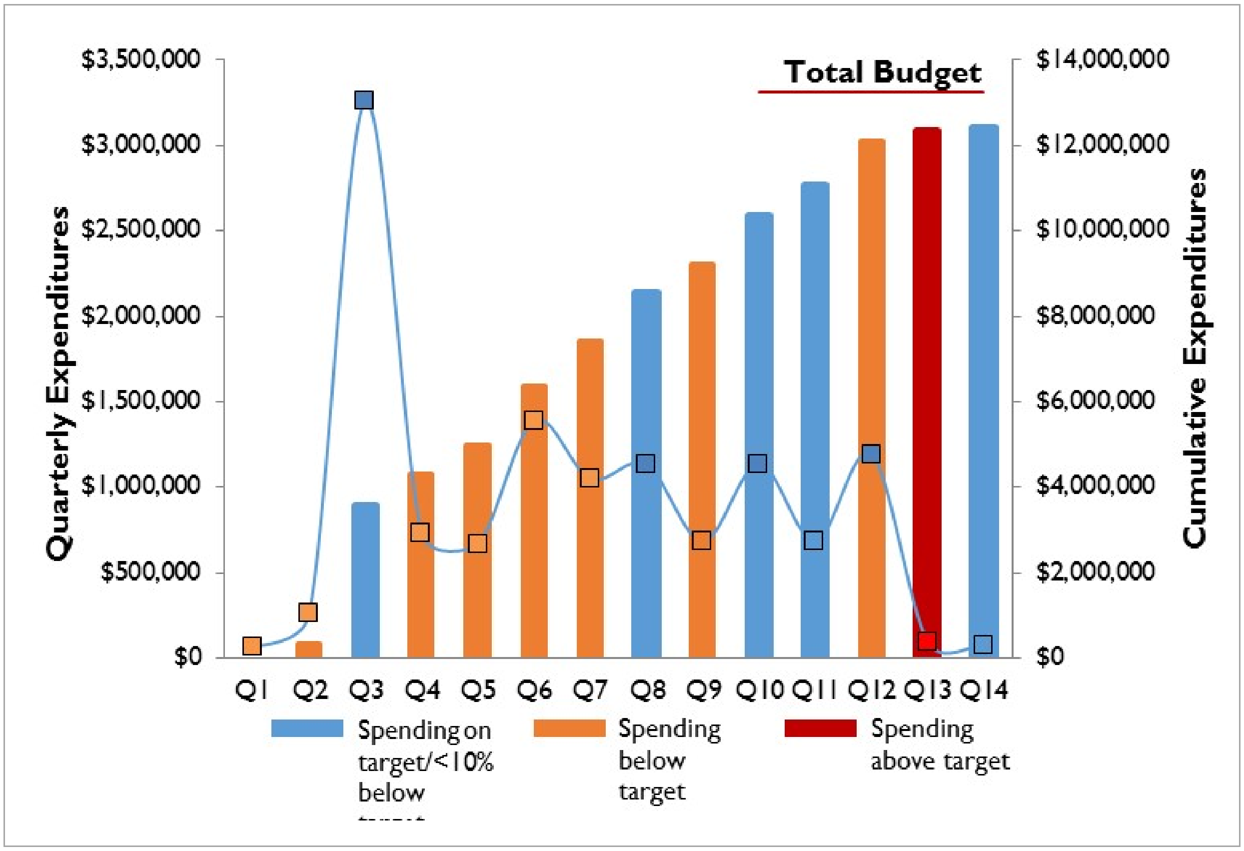
- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.24.1 Award Execution

The annual report highlights the significance of Curators’ expenditure rates on implementation. As of Q14 (December 2015) Curators spent 93.6 percent of its total budget. During the NCE, Curators did not have to adhere to quarterly financial projections, so we cannot assess whether their current spending is at/above/below anticipated levels. However, spending rates decreased significantly from Q12 (Apr–Jun

2015) through Q14 (Oct–Dec 2015), so they likely did not use the full funding, but came very close. Underspending resulted from NCM and HIA staffing decreases and the reduced workload during the NCE. Project leaders and the HIAs intended to spend the remainder of the award conducting data analyses and producing written summaries. See ***Figure 20*** for Curators' quarterly spending from inception to present.

Figure 20. Cumulative Spend Rate from Q1 (June 1, 2012) to Q14 (December 31, 2015)



2.24.2 Leadership

Project leadership remained constant since inception. The project director developed a management structure that incorporated multiple stakeholders within the project team and at the University of Missouri health system. Project leadership indicated that the University of Missouri health system *"was very accommodating and invested in the project,"* as evidenced by the involvement of the chief clinical information officer in project activities. Throughout the project, there was growing organizational emphasis on integrating population health into operations, making LIGHT^2 a very high priority. University of Missouri and project leadership routinely met to develop strategies and identify funding opportunities to continue innovation activities. Both project and University leadership found that LIGHT^2 helped them understand how analytics and NCMs can influence care coordination practices. As the LIGHT^2 project matured, the process of building technical capabilities became less important than the process of improving organizational performance. With the increasing availability of data, leadership focus shifted from implementation to sustainability and data analytics. The University of Missouri's remaining goal was to integrate LIGHT^2 into the structure of their 10 clinics permanently.

LIGHT^2 had clearly designated leadership with the experience, skills, and authority to make decisions. The project director had managed many prior grants, and gained extensive organizational leadership experience during his lengthy tenure at Curators. This institutional knowledge allowed him to garner both organizational and stakeholder support. However, he was not a clinician, so the innovation also had co-investigators with clinical expertise, such as a nurse researcher. This core team of clinical co-investigators and Cerner partners was essential in designing and guiding the project. They collectively considered aspects such as meeting with various stakeholders and incorporating their feedback, planning for the evaluation, and integrating technical and clinical input. Team members were also familiar with federal awards and their oversight.

Throughout the innovation, leadership gained knowledge to share with other organizations conducting similar initiatives. Of particular value were planning for data analytic needs and structuring the project with a more data-centric approach. Early on, the focus was on building out tools and less on building the data infrastructure to support analysis. Staff shared how important it was to account for the format of the data when developing tools, saying, *"Ramp-up was hard on the data side. My team works on the data warehouse for U-Missouri, and we weren't sure what would be needed. I wish we had had a clearer plan of what data needed to be analyzed. But I wish that for every project."* Leadership also emphasized the importance of understanding what could realistically be accomplished within the 3-year timeframe, especially accounting for the lengthy ramp-up period. Knowing what they know now, Curators leaders said they might not have designed such a broad intervention and may have limited themselves to one aspect, such as emergency room admissions.

2.24.3 Organizational Capacity

The Curators of the University of Missouri was the governing body of the university, and this innovation was operationalized through the partnership between the University of Missouri and Cerner. Curators outsourced their health IT functions to Cerner. The only IT functions Curators handled itself were non-health-related IT systems such as human resources systems. In 2009, the University and Cerner formed a public-private partnership called the Tiger Institute for Health Innovation, which remained active after the project concluded, and was dedicated to creating a national model of better health care and reduced costs. The Tiger Institute/Cerner implemented the LIGHT^2 health information technology (HIT) component, and provided all HIT-related services.

An important organizational outcome of the LIGHT^2 innovation was the Health Analytics Library, or HAL. Developed by Tiger, HAL was Curators' clinical data warehouse used for all analytic efforts. HAL was created primarily to pull data from multiple sources into a single database. Prior to HAL, staff had to perform complex queries to get information from different platforms and then bring the data into a third environment. HAL streamlined and organized data management and analytics for the Curators team. As the project went on, the team saw the benefit of HAL and expanded the structure to allow for analyses of other populations outside of LIGHT² such as payer specific, primary care, Cerner health registry populations, and chronic conditions. As one team member described it,

> ***"[In the beginning] I didn't understand all the steps needed to get access to the data. The clinical data warehouse was something I learned immediately, and our institution got working on it right away, really quickly. That is one of the legacies of LIGHT² that's clearly made a difference. We created a place where we could map new data whenever we had a new question. Every time something else was needed, we pulled it in, but in a way that it wasn't only serving LIGHT². Instead, it was mapped in a way that worked for the whole health system. Now HAL is fundamental to our work."***

Staff interviewed in 2016 indicated that the University's health system, the Tiger Institute, and the school of medicine were all firmly committed to maintain HAL.

One key challenge Curators faced early in the project was the attribution and tiering process. After the patient cohort was determined, patients were assigned to individual providers and NCMs. Within each NCM panel, patients were ranked on a four-scale tier indicating their health status and the corresponding level of effort and resources that were anticipated to provide adequate care. The major challenge in attribution was correctly assigning patients to their primary care provider, particularly when a patient saw several providers. The major challenge in tiering was ensuring that HIAs and NCMs had the same understanding of criteria used for tiering and how patients moved between tiers.

Curators transitioned from the LIGHT² tools to a similar platform developed by Cerner. Most of these tools served similar functions to those produced during LIGHT² so the organization could efficiently transition to the new Cerner platform. Project leadership knew of Cerner's technical capabilities and plans to develop these tools. Both the tools and the analytics transitioned to the Tiger Institute. One participant noted the importance of planned incorporation, saying, *"One big lesson is: when you design one-off products tied to a commercial electronic health record vendor, you need a clear idea of the oncoming roadmap. If we had plunged ahead, we would've collided with Cerner development a year from now."*

During the latter period of the project, leadership focus shifted to data analysis, and a series of issues that had to be resolved. For the more comprehensive analyses, claims data were needed, but the LIGHT² HIAs did not have the manpower or the expertise to analyze those in a timely manner. As a result, Curators contracted with JEN Associates, who provided comprehensive claims data analyses, including customized queries. Staff also noted that the lack of a control group with the cohort design was problematic. Leadership ultimately relied on the RTI evaluation team to conduct the comparison group work. As of June 30, 2016, when the NCE ended, the project team lost access to the claims data collected during the project. Curators plans to establish a data use agreement with JEN Associates to continue analysis as needed.

2.24.4 Innovation Adoption and Workflow Integration

Adoption of the innovation varied across the 10 participating clinics in the University health system. These clinics varied by setting (urban vs. rural), access to resources, and patient needs. Clinical specialties also differed: some focused on internal medicine and others on family medicine. Family medicine clinics had resident physicians who maintained their own patient panels, while internal medicine clinics primarily had resident physicians shadowing the attending physicians. Another important difference was that internal medicine physicians and clinic staff had experience with NCMs before the innovation, and family medicine clinics did not. Thus, NCM integration differed by clinic, with some understanding the role and value added more quickly than others.

Because the RTI evaluation team did not have the resources to interview all providers at each HCIA site, a provider survey was conducted in spring 2015 (detailed in the 2015 annual report) to measure providers' perceptions of clinical workflow and satisfaction. Slightly over half of Curators' eligible providers responded (40 providers or 54.8 percent). The majority (95.0%) were doctors of medicine (MD), specializing in family or internal medicine (92.5%). While some of the time spent coordinating services, referrals, and follow-up care was reduced due to the implementation of $LIGHT^2$, most providers did not note a workflow change in the time spent providing patient care or reviewing patient data. These results aligned with site visit reports indicating that physician workflows largely did not change, except to delegate care coordination to the NCMs. One NCM described the situation as follows:

> ***"During the visit, I will go in first and gather information. Sometimes the patient may tell me more than they tell the doctor, especially the ones I know. They might feel like they have more time with me. Then I go fill in the doctor a little bit so she or he will know what's going on with the patient. Then we frequently go in together and the doctor asks me to follow up. 'Can you call and follow up with blood pressure since we started this medication?' 'Can the patient call you in a few days and tell you how their breathing is going?' Things like that. So then I answer those messages or make those follow-ups. That's how my day goes."***

In this way, physicians perceived a positive impact in workflow because they could devote more time to clinical activities.

Almost all providers indicated they were satisfied with the innovation, and approximately half found $LIGHT^2$ either very easy to use (20.0%), or somewhat easy to use (32.5%). Just under a third, or 30.0 percent, of providers indicated that $LIGHT^2$ was neither easy nor hard to use, and 7.5 percent found it somewhat hard to use. A provider survey was not conducted in 2016, but one physician interviewed indicated that physician workflow had not changed significantly: *"I think it's mostly NCMs because the tools are new. All the data isn't there. We are still tweaking things so we can rely on the tools. Trusting that the tools will populate and register with the quality displays is part of the work that's being finalized."*

Physician and nonphysician stakeholders' perceptions were that the physician was not the central player in the innovation: the NCM was. As one provider explained, *"The NCMs or regular nurses use the tools more than physicians. It's a time issue. Physicians are trying to get their work done and it's difficult* *to add another task to the day. That's why we hired extra nurses: to help manage the patient population."* In daily operations, the tools interfaced with the EHR so that NCMs could identify the innovation's patients assigned to the clinic that day and review necessary preventive care and/or required chronic condition care activities. By viewing the metrics of the population as a whole and identifying the most complex patients, NCMs could target preventive services and care coordination. Staff felt that integrating NCMs into the clinic went well, saying that patients often had a better rapport with nurses than physicians:

> ***"We all admit that the patients come to see the physicians because they can diagnose their problems and prescribe medications and treat them. But with these patients, once the NCMs establish long-standing relationships, the patients are more likely to talk with them, not the doctors. When the patients are in the clinic, they want to see the NCMs, and the doctors almost begrudgingly accept that is why the patients keep coming back. It speaks to the relationships that NCMs form with patients, and how much the NCMs have helped both the patient and the physician."***

2.25 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort. The evaluation cannot make conclusive assessments about the innovation's impact without first determining if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

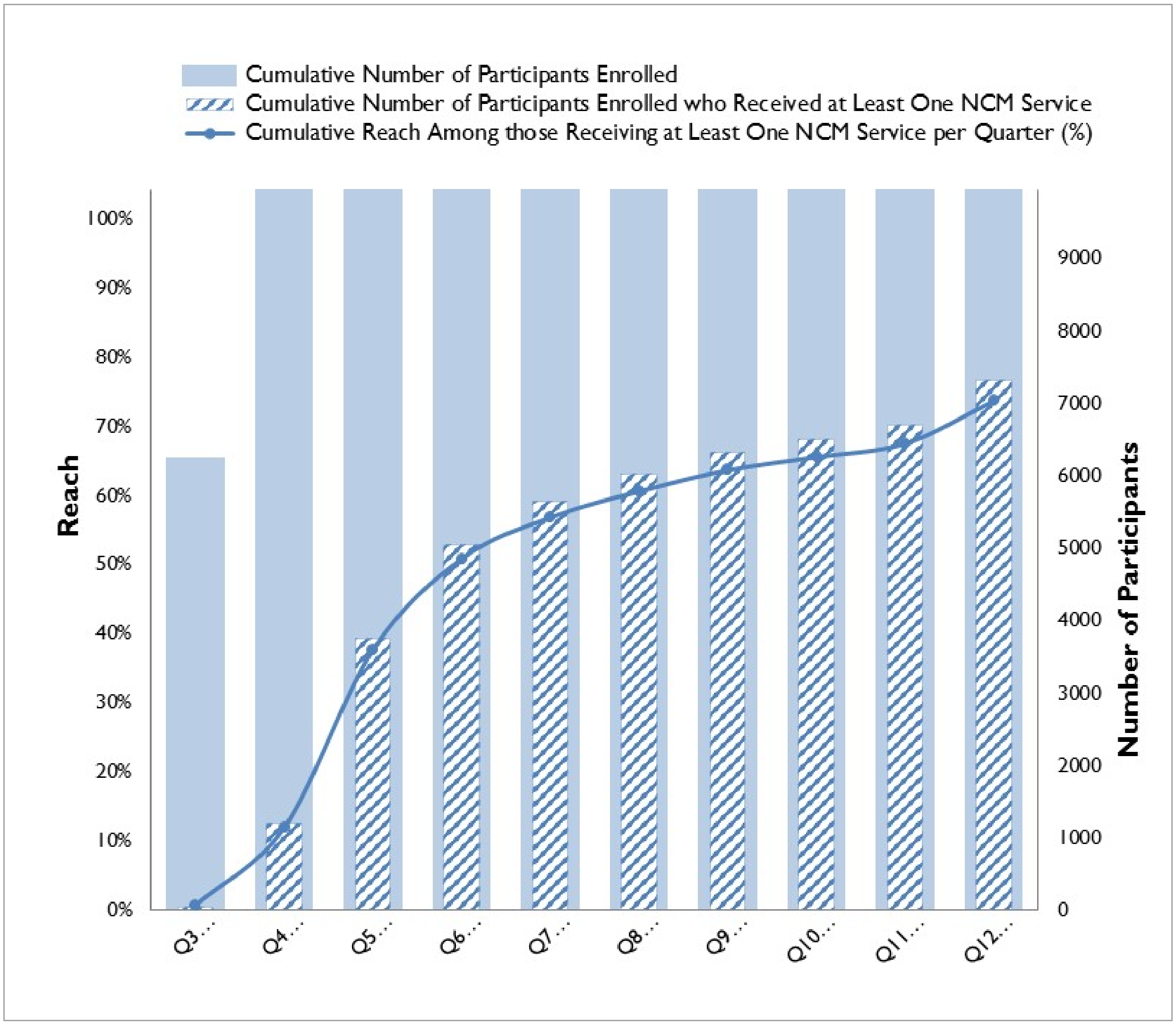
Evaluation Question

- What is the implementation effectiveness, including reach, and dose of the innovation thus far?

2.25.1 Innovation Reach

Curators enrolled a cohort of 9,932 patients by Q4. Among those considered enrolled in the innovation, approximately 68 percent received at least one of the dose services listed in ***Table 35*** (i.e., align resources and needs, assess needs and goals, communicate with NCMs, link to community resources, facilitate transitions, plan of care, and self-management support). Therefore, in this annual report, we report reach as the number of patients through Q14 who received at least one NCM service (***Figure 21***).

Figure 21. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)
•	Cumulative reach among those receiving at least one NCM service per quarter (%)	0.7	11.9	37.6	50.8	56.7	60.5	63.5	65.4	67.4	68.2
	Cumulative number of participants enrolled	6,087	9,932	9,932	9,932	9,932	9,932	9,932	9,932	9,932	9,932
	Cumulative number of participants who received at least one NCM service	43	1,186	3,736	5,042	5,634	6,009	6,311	6,500	6,694	6,769

Source: Patient-level data provided to RTI by Curators.
NCM = nurse case manager; Q = quarter.

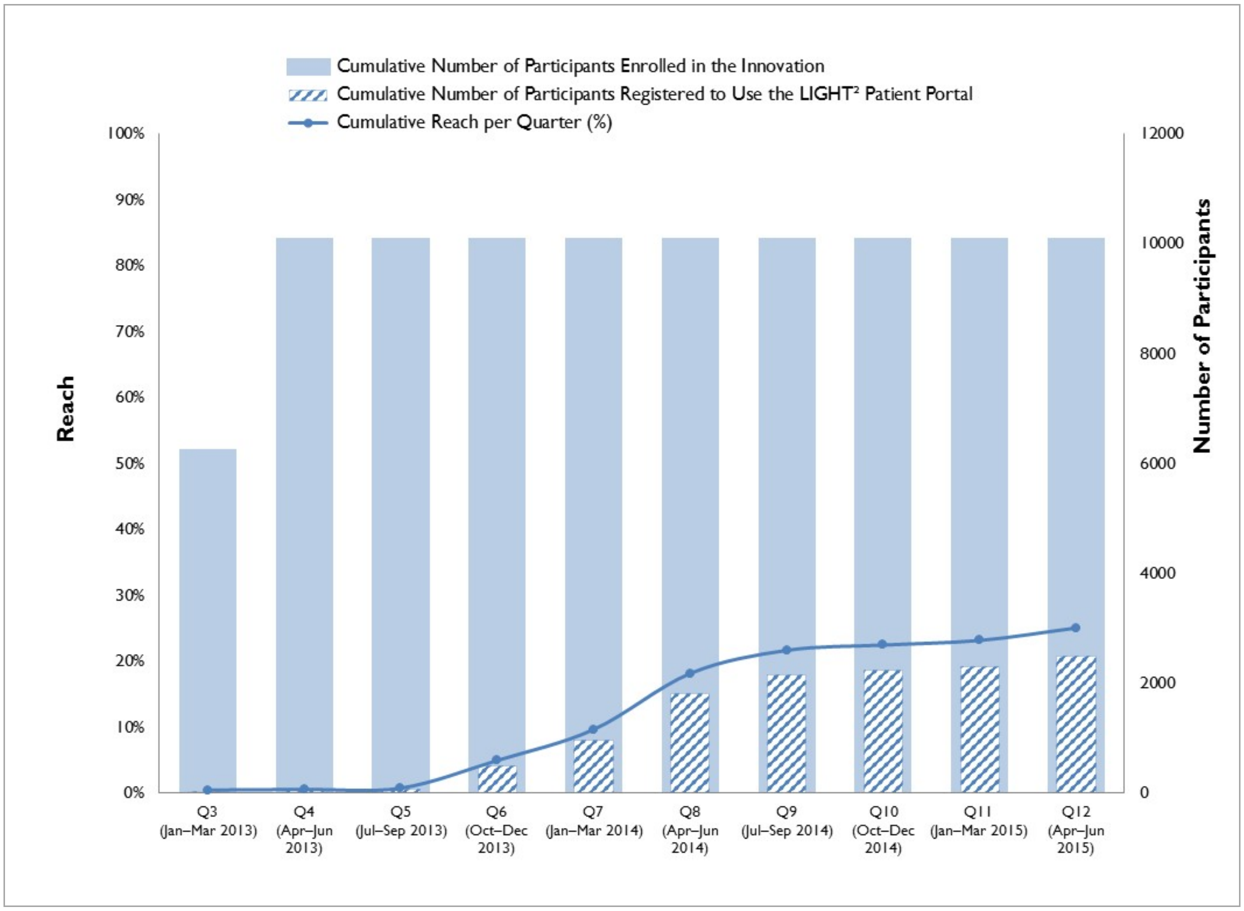
Reach was assessed for the LIGHT[2] patient portal component of the innovation by tracking the number of patients who registered to use the portal since the launch of the innovation and is shown in Figure ***22***. The percentage of portal registration increased slightly from 23.1 percent in Q11 to 25 percent in Q12.

Registration in the portal was still relatively low at the end of the project. During the early phases of the innovation, marketing the portal to patients was less of a focus than building rapport and explaining the NCM function. Later, staff felt that patients gradually understood how useful the portal could be, leading to greater enrollment. As one team leader explained,

> ***"Usage is increasing gradually, and there is greater adoption as the portal becomes more useful to patients. When we began, we were on the cutting edge for what a portal should be. The portal didn't have some core functionalities that drive patients to a portal [(i.e., make online appointments, see physician notes, etc.)], things that are there now. The basic hardware of the portal is so much more advanced now that more people are driven to it. Patients find it interesting to look at their own scorecard. We actually drove our portal usage above the hospital mean, even though overall hospital portal usage is rather low. It's like trying to sell a car on the basis of a nice dashboard when it doesn't have operational wheels and no engine. Putting a dashboard on a really good platform is a lot better than just building a platform."***

RTI previously requested information regarding portal usage such as login information and usage statistics, but were informed that these data were not available. Learning more about usage trends and statistics would provide a richer understanding of Curators' reach.

Figure 22. Participant Enrollment and Reach in Patient Portal Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
•	Cumulative reach per quarter (%)	0.4	0.5	0.7	4.9	9.6	18.1	21.6	22.4	23.1	25.0
	Cumulative number of participants enrolled in the innovation	6,087	9,932	9,932	9,932	9,932	9,932	9,932	9,932	9,932	9,932
	Cumulative number of participants registered to use the LIGHT2 patient portal	23	45	68	486	954	1,797	2,150	2,220	2,298	2,480

Source: Patient-level data provided to RTI by Curators.
Q = quarter.

2.25.2 Innovation Dose

Table 35 provides a list of NCM services and the number and percentage of patients who received each type of service for all patients, as well as for those in baseline risk Tiers 1 and 2 and those in baseline risk Tiers 3 and 4. Although Curators received a 12-month NCE, implementation of the LIGHT² innovation ended in June 2015, so the data included in the table are through Q12. As shown in the table, a greater percentage of patients in Tiers 3 and 4 (89.0%) received services than patients in Tiers 1 and 2 (64.2%). Most patients in Tiers 3 and 4 received an assessment of their needs and goals (86.5%), assistance with transitions (78.9%), and a plan of care (74.7%).

As time passed, more patients in the cohort received services as part of the innovation. Because the NCMs could not devote equal time to all patients in their panels and patients' needs varied, leadership decided to have the NCMs focus on higher-need patients. Services were ultimately prioritized for patients with more serious health care needs. Tiers 3 and 4 have higher numbers of services because they represent the patients with the most serious medical conditions. Services for lower tiers are primarily preventive, which means the outcomes will take longer to demonstrate.

Table 35. Number and Types of Services Provided to Participants

	Number of Services Provided Across Patients					
	All Patients (n=9,932)		Tiers 1 and 2 (n=8,338)		Tiers 3 and 4 (n=1,588)	
Services	Number	Percentage	Number	Percentage	Number	Percentage
Align resources and needs	4,572	46.0	3,436	41.2	1,136	71.5
Assess needs and goals	6,344	63.9	4,969	59.6	1,374	86.5
Communication between patients and NCMs	6,653	66.1	5,160	61.9	1,402	88.3
Community resources link	4,112	41.4	3,017	36.2	1,094	68.9
Facilitate transitions	4,520	45.5	3,266	39.2	1,253	78.9
Plan of care	4,903	49.4	3,716	44.6	1,186	74.7
Self-management support	4,321	43.5	3,181	38.2	1,139	71.7
Total	6,769	68.2	5,355	64.2	1,413	89.0

Source: Patient-level data provided to RTI by Curators.
NCM = nurse case manager.

2.26 Qualitative Findings: Sustainability

Curators started focusing on sustainability midway in the project cycle. No formal sustainability plan or additional funding source was evident, but Curators pursued funding from insurance payers, and the NCM role was permanently incorporated into the University health system. One staff member elaborated, *"We started sustainability planning from Day 1 and had active discussions with the hospital.*

It's a big payroll shift to pick up NCMs and have their salaries suddenly appear. Those new hires cost a lot of money. Before the hospital agreed to the hiring, we had to demonstrate the utility of the NCMs. We succeeded." In addition, leadership worked with Cerner to determine how to maintain the LIGHT^2 analysis tools used to support the NCMs' work. The result was that the University planned to switch from LIGHT^2 tools developed during the innovation to similar Cerner tools. The HIA role did not continue but those analytic functions were incorporated into Cerner and the Tiger Institute to support the similar Cerner tools. .As of the conclusion of the award period, leadership indicated that, *"the program is essentially sustained."*

The claims data analyses were also critically important in informing sustainability plans and evaluating the cost savings of the LIGHT^2 intervention. Curators did not have the in-house expertise to perform these analyses, so they contracted with JEN Associates to perform that function. One member of the project team noted JEN's contributions: *"With JEN we are trying to get good, comprehensive, rolled-up Medicaid and Medicare data, especially for the 2 years we fully ran LIGHT^2."* The relationship with JEN Associates was not expected to continue after the innovation ended because of insufficient funding. Project leadership did not think this would be a problem because Curators was contracted to receive all the intermediate analyses as well as the final rolled-up data. Therefore, the innovation team would be able to use the data on their own, advanced by the final results they received from JEN.

The NCE focused on data analytics performed by HIAs to document project outcomes and development of peer-reviewed papers to disseminate the findings. One analyst noted, *"We're trying to see what kind of evidence we can offer, in hard numbers, on the effect of the program."* Topics for dissemination included the introduction of risk management to the NCM workflow, how patients moved throughout the attribution tiers over the 3-year period, and other data analyses. The team also found evidence that inpatient admissions for Tier 4 patients cost less than other tiers. One challenge was that the HIA team had more ideas for publications than the time or manpower to develop them: "O*f the 25 publication topics identified, most of our energy is being spent on 7 or 8. We're looking at risk stratification and the predictive utility of risk tiers. We're also performing some pretty advanced data mining."*

Leadership was successful in integrating project components into the University health system permanently. Absorption of the NCM "Hi-Touch" component of LIGHT^2 into the broader University of Missouri health system was a significant accomplishment. This happened on July 1, 2015, which was the first day of the LIGHT^2 NCE period. Leadership was pleased with this transition because it maintained continuity of care for LIGHT^2 patients, while retaining the highly skilled NCM workforce and components of the LIGHT^2 care model. The population health scorecard was also integrated into the University health system. The scorecard let patients know if they had met certain gaps in care requirements. It continually pulled in performance data and created a sense of accountability of population management that did not exist before. It also helped to engage the project in direct discussions with hospital leaders about performance, and was one of the most visible components of the innovation.

2.27 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Curators as well as accomplishments to date. In this section we assess Curators' progress on achieving HCIA goals to date:

- **Smarter spending.** Medicare beneficiaries incurred higher spending in all innovation years after the innovation launch than their comparison group had, whereas Medicaid beneficiaries incurred higher spending in the first innovation year.

- **Better care.** Medicare beneficiaries had more inpatient admissions but fewer ED visits than their comparison group, whereas Medicaid beneficiaries had more inpatient admissions and ED visits than their comparison group.

  Curators enrolled 100 percent of its target population by July 2012. Approximately 68 percent of those received at least one NCM dose service as of Q12.

  A majority of patients with CAD were prescribed aspirin or clopidrogel during their enrollment period. Similarly, a majority of patients with COPD were prescribed an inhaled bronchodilator. In addition, most diabetes patients received an HbA1c test or a LDL-C test, and nearly all patients with hypertension received at least one blood pressure reading.

- **Healthier people**. For diabetes health outcomes, the percentage of patients in the higher risk tiers with HbA1c control decreased, but the percentage with LDL-C control did not change. The percentage of patients in the lower-risk tiers with HbA1c control increased, while the percentage with LDL-C control increased over time.

  For hypertension, blood pressure control decreased slightly over time for both the lower- and higher-risk tier groups.

  For CAD, LDL-C control increased over time for both the lower- and higher-risk tier groups and was more pronounced for the lower-risk tier group.

Curators' innovation had strong organizational and leadership support. When issues and challenges arose, they worked together to solve them. The University of Missouri fully implemented, led, and managed this award and successfully executed partnering agreements with Cerner and JEN Associates. The project director had a strong history of leading grants and projects in this field, and his lack of clinical expertise was supplemented by a clinical co-investigator.

Providers were satisfied with the innovation, but did not often use the tools themselves. The primary workflow change for physicians was delegating tasks to NCMs, which eased their time burden. NCMs were the central end user in the innovation, establishing meaningful relationships with patients through their efforts to provide preventive services and care coordination. Staffing was at projected levels for most of the project, but dropped significantly between December 2014 and 2015. This drop reflected the reduced level of effort during the NCE period and the end of the NCM and HIA roles. Training oriented staff to the innovation and LIGHT², and explained the project's goals for providing better health, better care, and reducing health care costs. Routine team meetings, periodic email announcements, and online newsletters supplemented the trainings. The innovation would have benefitted from training about incorporating NCMs into the clinical workflow and specific topical areas identified by the NCMs.

The innovation established a cohort of enrolled patients, which meant that cumulative reach remained at 100 percent throughout the award. Approximately two-thirds of enrolled patients received an NCM-provided service. This may be due to the attribution ranking system, which allowed the innovation to focus limited NCM resources on patients with the greatest need who were most likely to demonstrate outcomes. Not every patient in the cohort received a service because not every patient required a service. Reach was also measured via the patient portal, where enrollment increased over time. Although the enrollment rate was rather low, it was higher than the rate for the rest of the hospital system, and project leadership perceived it as a success.

NCMs' efforts to ensure that patients received appropriate preventive services and care coordination may have contributed to increased spending and inpatient admissions in the short term. It is less clear, however, why Medicaid participants evidenced more ED visits than a matched comparison group, and Medicare participants evidenced fewer visits. NCMs reported that patients needed more social services than they could provide, which could lead to more ED visits for Medicaid beneficiaries. Medicare patients, in contrast, may have been more likely to use NCM services and thus avoid unnecessary ED visits.

The NCE was designed to provide time for analytics and dissemination of findings. During the final months of the award, JEN Associates was contracted to perform advanced claims data analyses, and the HIAs focused on producing peer-reviewed publications highlighting project outcomes. Components of the project will be sustained after the conclusion of HCIA funding. The NCM role will continue under the University Hospital, and LIGHT^2 tools informed the development of a permanent Cerner platform to be used going forward. The HIA role will not continue, but analytics will be supported by Cerner with the permanent tools. Curators plans to continue analysis for publication so more information may emerge about outcomes and the impact of incremental changes.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

The Curators of the University of Missouri (Curators)

The Curators of the University of Missouri (Curators), an integrated health system in Columbia, Missouri, was awarded $13,265,444 to support the Leveraging Information Technology to Guide High Tech, High Touch Care (LIGHT^2) innovation. The project, which began patient enrollment in February 2013, was designed to use a combination of advanced information technology and comprehensive health care coordination to improve outcomes for Medicare and Medicaid patients receiving services in a primary care environment.

Awardee Overview

Innovation dose:	Approximately 68% of patients received at least one nurse care manager (NCM) service. A greater percentage of patients in Tiers 3 and 4 (89.0%) received services than those in Tiers 1 and 2 (64.2%).	***Innovation reach:***	Cumulative reach concluded at 100%; only 68.2% of those enrolled received at least one of NCM dose services. 25% of patients registered to use the LIGHT^2 patient portal.
Components:	(1) LIGHT^2 tools to aggregate electronic health record (EHR) data for population-based metrics and custom reports (2) Data analytics to support the tools (3) A patient portal (4) Care coordination provided by NCMs	***Participant demographics:***	77.7% of participants were 45 or older; 60.1% were female, 85.8% were white, and around 11% were black. 79.1% were covered by Medicare or dually eligible; 18.1% were covered by Medicaid.
Sustainability:	Innovation components were sustained after HCIA funding ended. The NCM role continues under the University Hospital, and LIGHT^2 tools informed development of a permanent Cerner platform. Health information analysts (HIAs) were incorporated into the University in other roles and continue to work on dissemination.		
Innovation type:	Coordination of care	Health IT	Decision support

Key Findings

Smarter spending. Medicare beneficiaries incurred higher average quarterly spending overall after the innovation launch ($234; 90% CI: $134, $334) than their comparison group, whereas Medicaid beneficiaries incurred higher average quarterly spending in the first innovation year ($218; 90% CI: $29, $407), but not overall ($139; 90% CI: −$37, 315).

Better care. Medicare beneficiaries had more inpatient admissions per 1,000 participants per quarter (12; 90% CI: 9, 14) but fewer emergency department (ED) visits per 1,000 participants per quarter (−16; 90% CI: −21, −12) than their comparison group. Medicaid beneficiaries had more inpatient admissions per 1,000 participants per quarter (11; 90% CI: 8, 15) and ED visits per 1,000 participants (66; 90% CI: 47, 85) than their comparison group. There were no significant changes in average readmissions per 1,000 admissions per quarter for Medicare (6; 90% CI: −9, 21) or Medicaid (58; 90% CI: −9, 126) patients.

Healthier people. For diabetes health outcomes, the percentage of patients in the lower-risk tiers with poor HbA1c control decreased from 9.8 to 7.5 percent, while the percentage with LDL-C control increased from 66.9 to 72.2 percent. The percentage of patients in the higher-risk tiers with poor HbA1c control increased from 15.6 to 22.5 percent, but the percentage with LDL-C control did not change. For hypertension, blood pressure control decreased over time for both the lower- and higher-risk tier groups, 9 and 6 percentage points respectively.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Delta Dental Plan of South Dakota

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Delta Dental Plan of South Dakota

2.1 Introduction

Located in Pierre, South Dakota, Delta Dental Plan of South Dakota (Delta Dental) received a total award of $3,364,528 and launched its innovation on January 7, 2013. Its innovation, Circle of Smiles: Improving Oral Health in Indian Country, primarily sought to improve the oral/dental health of American Indian children age 9 and under living on South Dakota reservations. The innovation had the following HCIA goals:

1. **Smarter spending.** Reduce spending by 11 percent by improving oral health care through preventive interventions.

2. **Better care.** Ensure that (1) infants visit a dentist before their first birthday; (2) children aged 0 to 9 receive one annual dental prophylaxis; and (3) children aged 6–8 receive necessary sealants and fluoride varnishes, included as part of the dental prophylaxis once per year.

3. **Healthier people**. Improve infant and child oral health.

To implement its innovation, Delta Dental's original target population for the innovation included children aged 0–9 living on the reservation, patients with diabetes, and pregnant women. Delta Dental, with approval from the Center for Medicare & Medicaid Innovation (CMMI), scaled back the innovation to focus on infants and children aged 0–9 years because of challenges in recruiting patients with diabetes and pregnant women. Delta Dental had planned to recruit patients with diabetes from Indian Health Service (IHS), but clinical staff at most IHS facilities were resistant to having Delta Dental's hygienists working in their clinics. Additionally, Delta Dental staff hoped to recruit pregnant women through WIC offices when women came to pick up their benefits; however, the WIC offices changed policy and began mailing benefits to women (thus, women no longer needed to appear in person). Delta Dental continues to serve patients with diabetes and pregnant women on a more limited basis.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received from Delta Dental through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Expanded ECC Collaborative disease management protocol, an evidence-based method of managing and preventing early childhood tooth decay, to all Pine Ridge Head Start clinics and secured funding to spread ECC statewide.
Program Participant Characteristics	
	Since the 2015 annual report, no significant changes occurred in the distribution of participant characteristics. Most participants (64.4%) were under 9 years old and more than half (52.4%) were female. Most participants (88.1%) were American Indian or Alaska Native, and about 5.0% were white. Most (73.0%) were covered by Medicaid, and one-quarter (25.0%) were uninsured. Since Q11, an additional 462 participants received services through the innovation, for 7,781 total participants through Q12.
Workforce Development	
Hiring and retention	Reduced staff by three FTEs. Currently staffed at 21 FTEs.
Skills, knowledge, and training	Provided 461 hours of training in Q11 and Q12 for four staff persons (oral health coordinator training and orientation, and prevention of dental caries training).
Context	
Award execution	Spending rates are 100%, at projection.
Leadership	Since the 2014 annual report, CEO, project director, and project manager have been involved. Project manager continued to work with external partners.
Organizational capacity	Delta Dental had mobile dental chairs and sufficient transportation to successfully implement the innovation since implementation launch.
Innovation adoption and workflow integration	Delta Dental struggled to gain buy-in from IHS providers and increased coordinating and scheduling among hygienists because of the remote location of many clinics.
Implementation Effectiveness	
Innovation reach	5,796 Medicaid-eligible children, 96.2% of the target population, enrolled through Q12.[1]
Innovation dose	Delta Dental's innovation sought to ensure that: (1) infants visit a dentist; (2) children aged 0 to 9 receive one annual dental prophylaxis; and (3) children aged 6 to 8 receive necessary sealants and fluoride varnishes once per year.
Sustainability	
	Delta Dental intends to integrate the HCIA innovation in an existing mobile dental program and will hire 3 regional OHCs. Delta Dental plans to expand the target innovation age group to early Head Start children up to 8th grade.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
[1]Key informant interviews conducted June 2015.

CEO = chief executive officer; Delta Dental = Delta Dental Plan of South Dakota; ECC = Early Childhood Caries; FTE = full-time equivalent; IHS = Indian Health Service; OHCs = oral health coordinators; Q = quarter.

Table 3 summarizes Medicaid claims-based findings during the innovation period. The number of ED visits increased for the innovation group compared to the comparison group. The Circle of Smiles innovation, however, is not expected to have an impact on ED visits because it focuses on providing one-time dental prophylaxis treatment for children, so the change is likely due to external factors. In Year 2 of the innovation, statistically significant savings occurred as well as lower inpatient admissions for the treatment group compared to the comparison group. The Year 2 results may be due to the preventive care provided by the innovation.

Table 3. Summary of Medicaid Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.065	−$1.039, $0.450	$0.382	−$1.282, $0.515	−$0.515	−$0.951, −$0.079	N/A	N/A
Acute care inpatient stays	−17	−48, 13	6	−22, 33	−23	−36, −9	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−4	−11, 3	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	345	210, 481	282	161, 403	63	2, 124	N/A	N/A
Average impact per quarter								
Spending per participant	−$3	−$57, $51	$30	−$25, $85	−96	−$177, −$15	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−1	−2, 1	0	−1, 2	−4	−7, −2	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−24	−63, 15	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	17	10, 23	19	11, 27	12	0, 23	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

This innovation had two components: direct dental services and oral health care coordination. Delta Dental hygienists travel throughout the reservations in South Dakota, provide prophylaxis dental cleanings to children in schools and day care centers, and refer children who need restorative care to partnering pediatric dentists. Oral health coordinators (OHCs) supported hygienists by facilitating the care transition from the hygienist to the pediatric dentist, following up with children's parents/guardians to ensure the children visit the pediatric dentist, and helping parents/guardians overcome barriers to care (e.g., lack of transportation). Children were typically enrolled through clinics at locations such as schools, Head Start, WIC offices, or other community spaces. In 2015, Delta Dental began implementing the Early Childhood Caries (ECC) Collaborative disease management protocol, a step-by-step tool providers can reference to make clinical decisions to prevent early childhood tooth decay. Delta Dental staff piloted the protocol in one Head Start location and, in Q12, Delta Dental implemented the protocol in all Pine Ridge Head Start locations. The partners for this innovation, listed in ***Table 4***, remained unchanged since the first year of the innovation (2014).

Table 4. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Innovation	Location
Great Plains Tribal Chairmen's Health Board	Training	Rapid City, SD
Maricopa County Community College District (Rio Salado College)	Training	Tempe, AZ
Crow Creek Sioux Tribe	OHCs[1]	Fort Thompson, SD
Cheyenne River Sioux Tribe	OHCs	Eagle Butte, SD
Standing Rock Sioux Tribe	OHCs	Fort Yates, ND
Yankton Sioux Tribe	OHCs	Wagner, SD
Sisseton-Whapeton Oyate	OHCs	Sisseton, SD
Lower Brule Sioux Tribe	OHCs	Lower Brule, SD
Rosebud Sioux Tribe	OHCs	Rosebud, SD
Oglala Sioux Tribe	OHCs	Pine Ridge, SD
Flandreau Santee Sioux Tribe	OHCs	Flandreau, SD
Children's Dental Center	Care coordination	Sioux Falls, SD
Indian Health Service	Advisory board	Aberdeen, SD
South Dakota Dental Association	Advisory board	Pierre, SD
Children's Dental Center	Direct services	Sioux Falls, SD
BPro, Inc.	Health IT	Pierre, SD
Medicaid-CHIP State Dental Association	Project management/ administration, health IT	Sandwich, MA
Black Hills Pediatric Dentistry	Direct services	Rapid City, SD

Source: *Q11-Q12 Narrative Progress Report.*
Q11-Q12 Quarterly Awardee Performance Report.
[1] Through a subcontract with Delta Dental, each tribe hires the OHCs.
HCIA = Health Care Innovation Award; IT = information technology; OHC = oral health coordinator.

Since the project was launched, Delta Dental experienced barriers working with IHS and reaching patients with diabetes and pregnant women. Because of the barriers, Delta Dental changed its target population to focus on children aged 0 to 9. Barriers are described in ***Sections 2.1, 2.12.3***, and ***2.12.4***.

2.1.2 Program Participant Characteristics

Table 5 provides the demographic characteristics of all participants ever enrolled in the innovation through Q12. We last reported patient demographic characteristics in the 2015 annual report, on the basis of data through Q11. The distribution of patient characteristics is similar. More specifically, most participants (64.4%) were under 9 years old and more than half (52.4%) were female. Most participants (88.1%) were American Indian or Alaska Native, and about 5.0% were white. Most (73.0%) were covered by Medicaid, and one-quarter (25.0%) were uninsured.

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	7,781	—
Age		
0–2	579	7.4
3–5	1,936	24.9
6–8	2,497	32.1
9–11	1,568	20.2
12–15	328	4.2
16–18	86	1.1
19–24	97	1.2
25–44	216	2.8
45–64	347	4.5
65–74	77	1.0
75–84	28	0.4
85+	3	0.0
Missing	19	0.2
Sex		
Female	4,078	52.4
Male	3,678	47.3
Missing	25	0.3

(continued)

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015 (continued)

Characteristic	Number of Participants	Percentage of Participants
Race/ethnicity		
White	387	5.0
Black	24	0.3
Hispanic	27	0.3
Asian	9	0.1
American Indian or Alaska Native	6,852	88.1
Native Hawaiian or other Pacific Islander	1	0.0
Other	93	1.2
Missing/refused	388	5.0
Payer category		
Dual	0	0.0
Medicaid	5,679	73.0
Medicare	0	0.0
Medicare Advantage	0	0.0
Other	154	1.9
Uninsured	1,943	25.0
Missing	5	0.1

Source: Patient-level data provided to RTI by Delta Dental.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 6 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report. We do not include analyses of the innovation's impact on Medicare beneficiaries in this report because Delta Dental's innovation did not serve Medicare beneficiaries. We present claims-based measures for Medicaid beneficiaries because the Delta Dental innovation targeted children.

Table 6. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	Yes
		Hospital unplanned readmissions rate	No	Yes
		ED visit rate	No	Yes
	Cost	Spending per patient	No	Yes
		Estimated cost savings	No	Yes

ED = emergency department.

2.3 Medicaid Comparison Group

Alpha-MAX Medicaid claims data for South Dakota are available through December 31, 2014, and we include patients who were enrolled in the innovation prior to October 31, 2014. The Medicaid claims analysis focuses on 4,339 beneficiaries enrolled in fee-for-service Medicaid during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in South Dakota and under the age of 21.

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, a binary indicator for whether the individual is an infant; sex, a binary indicator of whether the individual is Native American/American Indian; disability; and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 7 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 7. Mean Values and Standardized Differences of Variables in Propensity Score Model: Delta Dental

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Medicaid (LQY)										
Payments in calendar quarter prior to enrolment	650	2,022	850	4,889	0.054	650	2,022	655	4,017	0.002
Age	5.60	3.14	8.46	5.72	0.619	5.60	3.14	5.67	3.19	0.022
Percentage infant (age ≤ 1)	8.44	27.79	14.91	35.62	0.203	8.44	27.79	7.91	26.99	0.019
Percentage female	51.58	49.98	50.10	50.00	0.030	51.58	49.98	51.28	49.98	0.006
Percentage disabled	3.23	17.67	4.89	21.56	0.084	3.23	17.67	3.78	19.07	0.030
Percentage American Indian	89.08	31.20	85.29	35.42	0.113	89.08	31.19	89.32	30.89	0.008
Number of months of Medicaid eligibility in second, third, fourth, and fifth calendar quarters prior to enrollment	10.92	2.64	10.74	2.88	0.064	10.92	2.64	10.95	2.53	0.010
Number of beneficiaries	4,339	—	173,956	—	—	4,339	—	12,667	—	—
Number of unique beneficiaries[1]	—	—	25,434	—	—	4,339	—	7,482	—	—
Number of weighted beneficiaries	—	—	—	—	—	4,339	—	4,339	—	—
No Medicaid in previous quarter (LQN)										
Age	5.67	3.66	5.39	7.30	0.048	5.67	3.65	5.65	3.81	0.006
Percentage infant (age ≤ 1)	7.48	26.43	59.16	49.16	1.311	7.48	26.30	7.48	26.30	—
Percentage female	49.53	50.23	52.54	49.94	0.060	49.53	50.00	48.91	49.99	0.012
Percentage American Indian	88.79	31.70	86.92	33.72	0.057	88.79	31.56	88.16	32.31	0.020
Percentage disabled	—	—	0.54	7.35	0.104	—	—	—	—	—
Number of beneficiaries	107	—	5,529	—	—	107	—	321	—	—
Number of unique beneficiaries[1]	—	—	5,303	—	—	107	—	223	—	—
Number of weighted beneficiaries	—	—	—	—	—	107	—	107	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

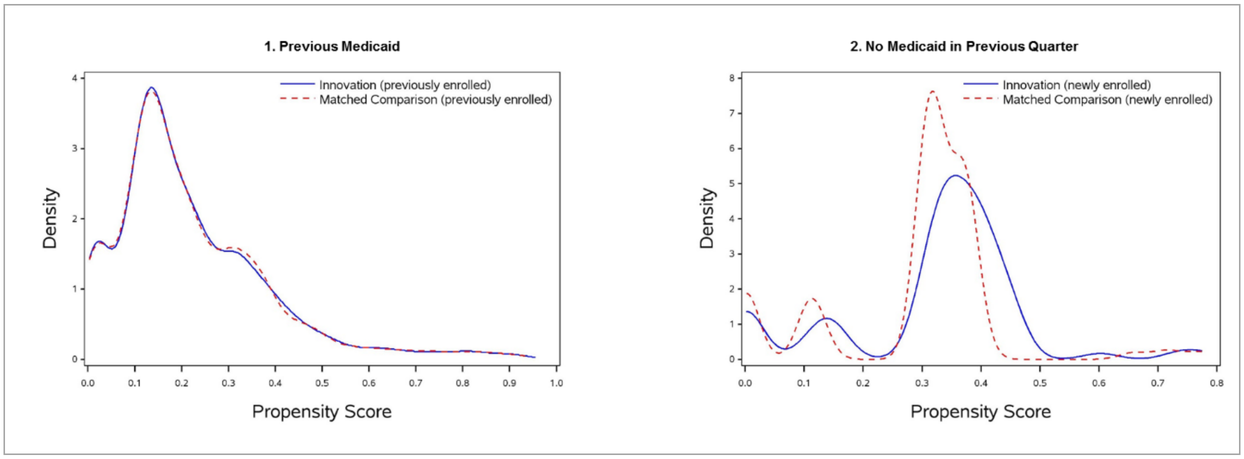
Delta Dental = Delta Dental Plan of South Dakota; SD = standard deviation.

— Not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 7). The results in Table 7 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. Individuals in the innovation and comparison groups who were enrolled in Medicaid in the previous quarter had a close overlap in propensity scores. The overlap in propensity scores is less precise for individuals without Medicaid during the previous quarter; however, some of the increased variation may be due to the smaller sample size in this group because deviations in the score between innovation and comparison groups will carry more weight with fewer observations.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 8 reports Medicaid spending per patient in the eight quarters before and the eight quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicaid spending per beneficiary in Table 8 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

During baseline, spending per person in the innovation and comparison groups follows similar trends, although spending in the innovation group is higher than in the comparison group for almost the entire period. The innovation and comparison groups have similar per-person spending levels in the final quarter of the baseline period, but then diverge again as per-person spending in the innovation group increases. The innovation group has higher spending for the first few quarters of the innovation period; however, in quarters 7 and 8, the innovation group realizes lower spending than the comparison group, possibly benefiting from the gains of the innovation's preventive care. The relatively higher spending in the baseline period may reflect the higher intensity of visits for young children, which declines with age. We will explore the differences between the two groups further in the regression analysis section.

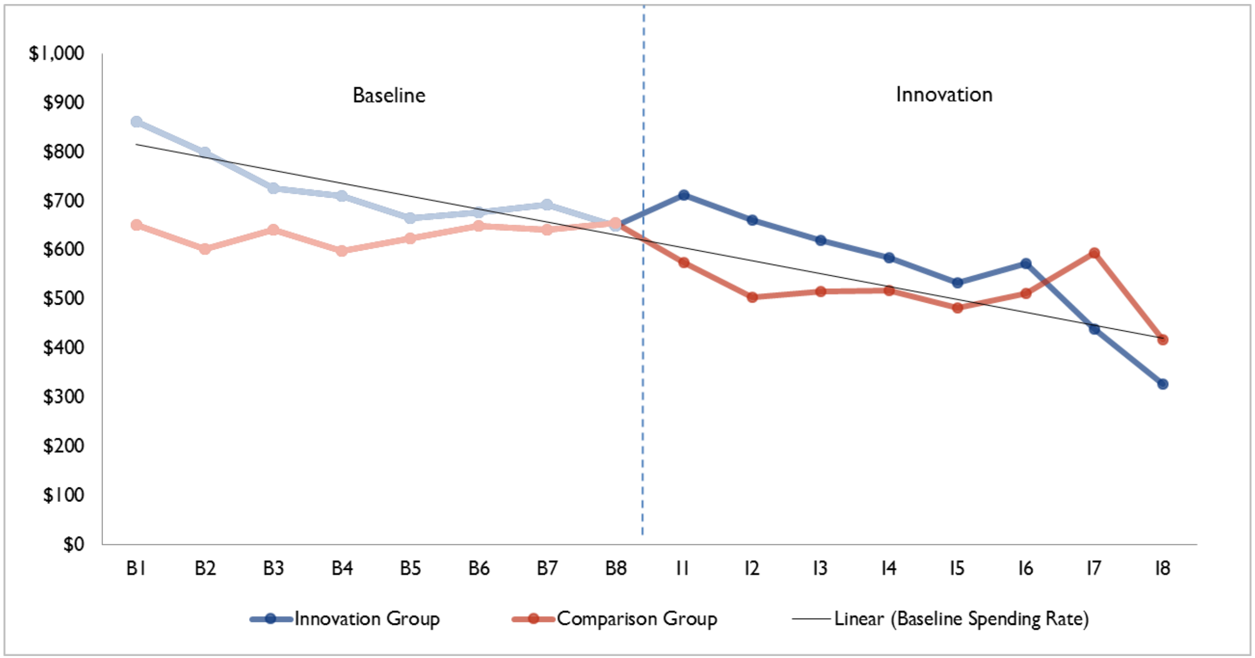
Table 8. Medicaid Spending per Participant: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Spending rate	$861	$800	$726	$710	$666	$676	$694	$650	$712	$662	$621	$585	$534	$573	$440	$326
Std dev	$8,603	$5,877	$2,686	$2,250	$2,115	$1,864	$2,542	$2,022	$1,788	$1,815	$1,655	$1,921	$1,655	$3,523	$771	$585
Unique patients	3,761	3,810	3,887	3,981	4,068	4,164	4,237	4,339	4,446	4,029	3,466	3,153	2,340	1,524	1,002	516
Comparison Group																
Spending rate	$653	$603	$641	$598	$623	$649	$642	$655	$575	$505	$516	$517	$482	$511	$595	$417
Std dev	$2,431	$1,493	$3,507	$1,596	$2,968	$2,446	$2,745	$3,059	$2,516	$2,360	$2,667	$3,669	$1,260	$1,548	$4,637	$2,121
Weighted patients	4,033	4,046	4,065	4,077	4,098	4,136	4,220	4,339	4,446	3,963	3,419	3,125	2,343	1,541	1,020	527
Savings per Patient																
	−$209	−$197	−$85	−$113	−$42	−$27	−$51	$6	−$137	−$157	−$105	−$68	−$52	−$61	$155	$91

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; Delta Dental = Delta Dental Plan of South Dakota; I1 = Innovation Q1.

Figure 2. Medicaid Spending per Participant: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period is -$3 (90% CI: –$57, $51), indicating savings. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison groups, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

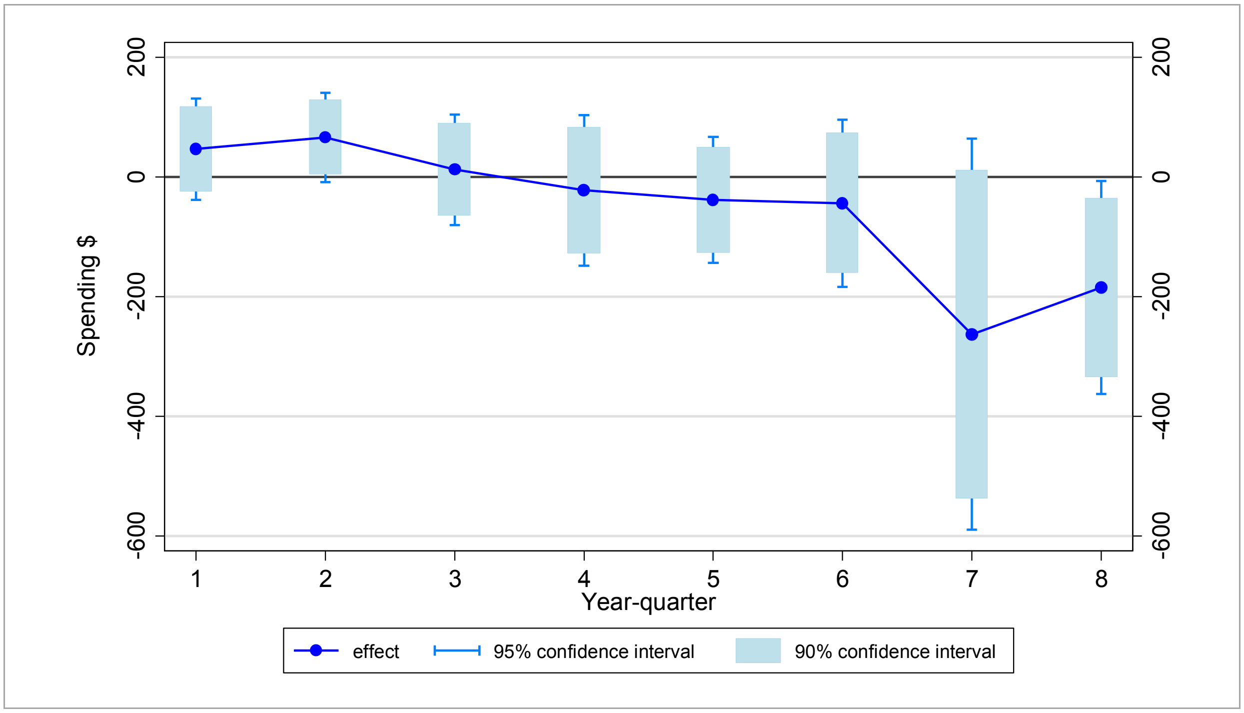
In addition to the average effect over the innovation period, we present quarterly effects. ***Table 9*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. The effect of the innovation on spending is only statistically significant in two quarters: quarter 2, where a slight increase in spending occurs, and in quarter 8, where a decrease in spending occurs for the innovation group in the innovation period, perhaps suggesting that the innovation might generate savings in the long run. The fact that we do not observe many quarters of significant savings in total spending is not surprising, because the Circle of Smiles innovation focuses on dental services for children and, thus, is not expected to have a significant impact on total Medicaid spending.

Table 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant

Quarter	Coefficient	Standard Error	P-Values
I1	$47	43	0.278
I2	$67	38	0.080
I3	$12	47	0.793
I4	−$22	64	0.732
I5	−$38	54	0.478
I6	−$44	71	0.540
I7	−$263	167	0.115
I8	−$185	91	0.042
Overall average	−$3	−$57	0.923
Overall aggregate	−$64,991	−$1,168,877	0.923
Overall aggregate (IY1)	$449,765	−$382,128	0.374
Overall aggregate (IY2)	−$514,757	−$950,755	0.052

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, sex, an indicator for infant (age ≤ 1), an indicator for child (age > 1 and ≤ 8), an indicator for American Indian ethnicity, and an indicator for disability. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Delta Dental = Delta Dental Plan of South Dakota; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

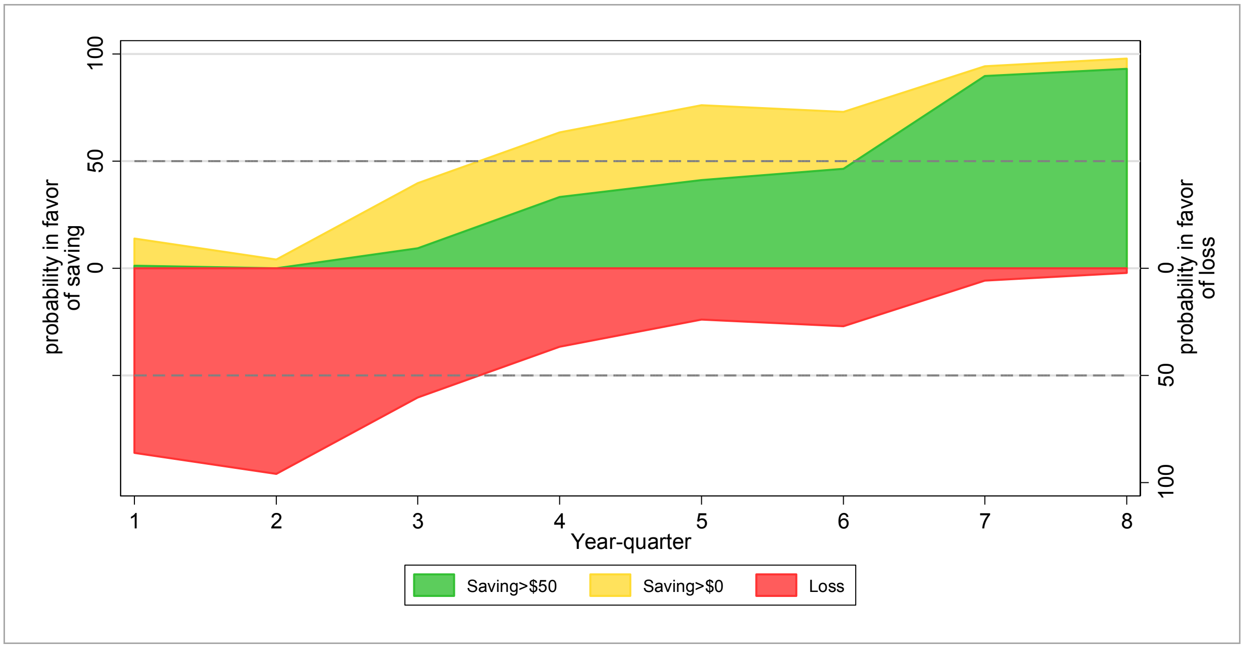
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The higher quarterly spending estimates for the innovation group in the early quarters of the innovation suggest that the innovation may have generated losses; however, we do see evidence of savings from the innovation over time.

Figure 4. Quarterly Strength of Evidence in Favor of Savings/Loss: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota.

2.5 Medicaid Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 5***. The inpatient admissions rate for the innovation group slopes down; the comparison group rate has a similar downward trend, but with slightly lower rates in the first few quarters of the baseline period and a slightly higher rate in the last few quarters of the innovation period. Overall, admissions rates are quite low, which is expected from a healthy population of children. The two groups have similar inpatient admissions rates in the innovation period and do not display significant differences. We will explore the differences between the two groups further in the regression analysis section below.

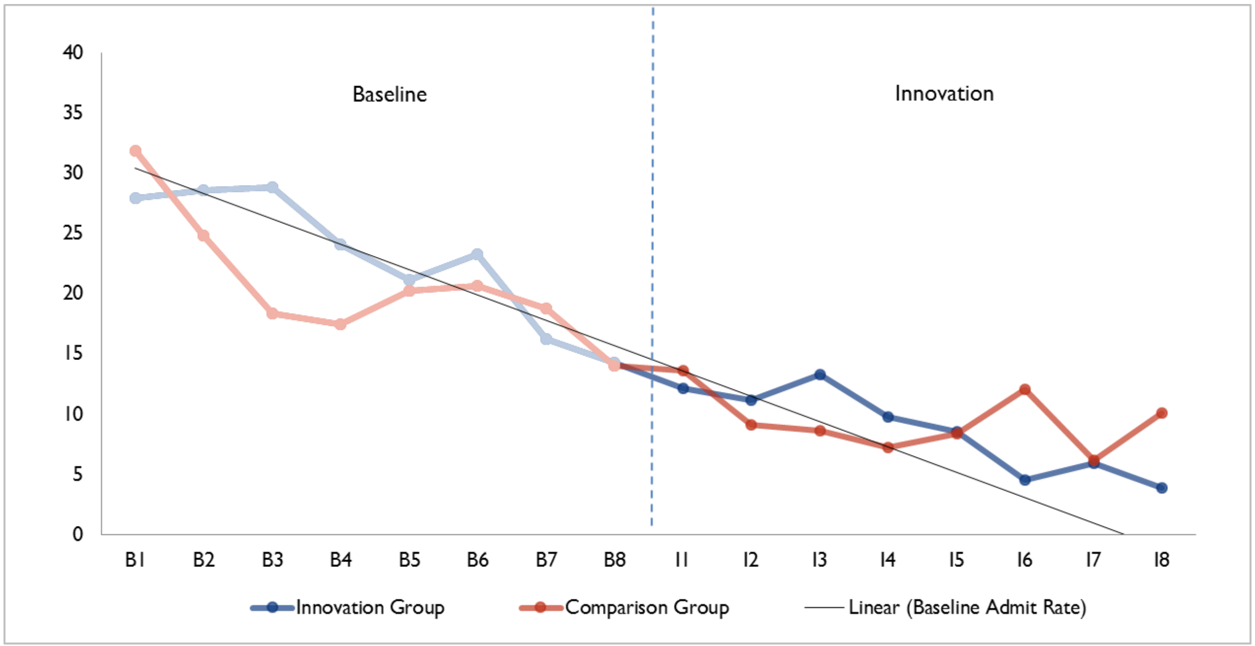
Table 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Admit rate	28	29	29	24	21	23	16	14	12	11	13	10	9	5	6	4
Std dev	189	185	181	168	149	166	137	135	114	107	124	116	97	68	77	62
Unique patients	3,761	3,810	3,887	3,981	4,068	4,164	4,237	4,339	4,446	4,029	3,466	3,153	2,340	1,524	1,002	516
Comparison Group																
Admit rate	32	25	18	17	20	21	19	14	14	9	9	7	8	12	6	10
Std dev	149	126	111	109	122	114	113	109	96	81	76	69	78	84	58	83
Weighted patients	4,033	4,046	4,065	4,077	4,098	4,136	4,220	4,339	4,446	3,963	3,419	3,125	2,343	1,541	1,020	527
Innovation − Comparison Rate																
	−4	4	10	7	1	3	−2	0	−1	2	5	3	0	−8	0	−6

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Delta Dental = Delta Dental Plan of South Dakota; I1 = Innovation Q1.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Participants: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 1 inpatient admission per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: –2.333, 0.669). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 11 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The estimated coefficients in most quarters are not significant, indicating that the likelihood of being hospitalized is not statistically different for the innovation and comparison groups. The exception is in the sixth and eighth innovation quarters, in which the innovation group has, on average, 10 and 8 fewer inpatient admissions per 1,000 beneficiaries, respectively. The results show a significant decrease in the overall aggregate number of hospital visits in the second year of the innovation (−23, P = 0.006).

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions, per 1,000 Participants: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
I1	−3	2	0.151
I2	1	2	0.692
I3	3	2	0.151
I4	1	2	0.487
I5	−1	2	0.666
I6	−10	3	0.001
I7	−1	3	0.653
I8	−8	5	0.099
Overall average	−1	1	0.362
Overall aggregate	−17	19	0.362
Overall aggregate (IY1)	6	17	0.741
Overall aggregate (IY2)	−23	8	0.006

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age; sex; an indicator for American Indian ethnicity, and an indicator for disability. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Delta Dental = Delta Dental Plan of South Dakota; I = Innovation Quarter; IY = Innovation Year.

2.6 Medicaid Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 12*** and ***Figure 6***. There are major fluctuations in the readmissions rate trend line throughout both the baseline and innovation periods for both the control and innovation groups. The fluctuations in the readmission rate are mostly due to the small number of admissions in a given quarter. The frequent fluctuations in the observed readmissions rates among both groups makes comparing and interpreting trends difficult.

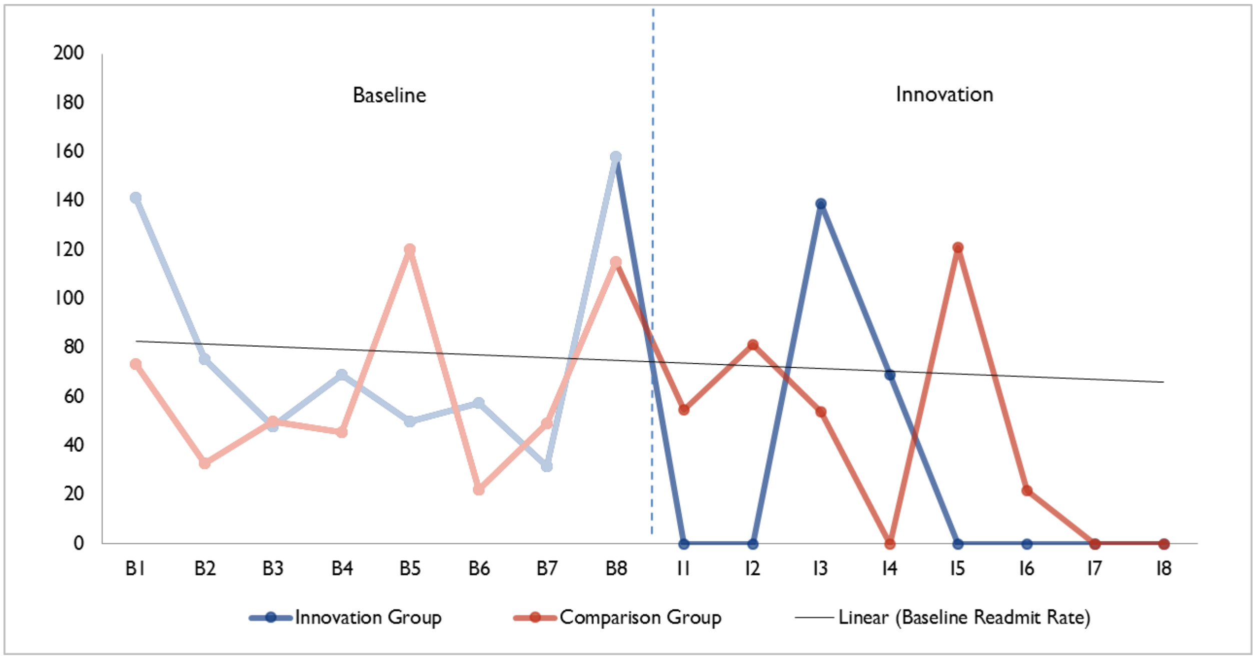
Table 12. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Readmit rate	141	75	48	69	50	57	32	158	0	0	139	69	0	0	0	0
Std dev	348	264	214	253	218	233	175	365	0	0	346	253	0	0	0	0
Total admissions	99	106	104	87	80	87	63	57	46	32	36	29	17	4	5	2
Comparison Group																
Readmit rate	73	33	50	46	120	22	49	115	55	81	54	0	121	22	0	0
Std dev	261	178	218	209	325	147	216	319	227	273	226	0	326	146	0	0
Total admissions	123	91	67	66	74	76	71	51	49	29	25	18	17	15	6	3
Innovation − Comparison Rate																
	68	43	−2	23	−70	35	−17	43	−55	−81	85	69	−121	−22	0	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Delta Dental = Delta Dental Plan of South Dakota; I1 = Innovation Q1.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota.

2.6.2 Regression Results

Table 13 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −24 per 1,000 inpatient admissions (2.4 percentage points), indicating that the innovation group is more than 2 percentage points less likely to have a readmission during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −63, 15).

Table 13. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission, per 1,000 Participants: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
Overall average	−24	24	0.309
Overall aggregate	−4	4	0.309

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age; sex; an indicator for American Indian ethnicity; and an indicator for disability. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Delta Dental = Delta Dental Plan of South Dakota.

2.7 Medicaid Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 14*** and ***Figure 7.*** The ED visit rate per 1,000 participants is relatively flat for the innovation group in the baseline quarters with a slight dip in the innovation periods. Although the comparison group rate follows a similar trend in the baseline period, the comparison group ED visit rate is lower than the innovation group through the first seven quarters of the innovation period. In the final quarter of the innovation period, the innovation group and the comparison group ED rates are approximately the same. We will further analyze whether the innovation had any significant effects on the ED rate in the regression analysis section below.

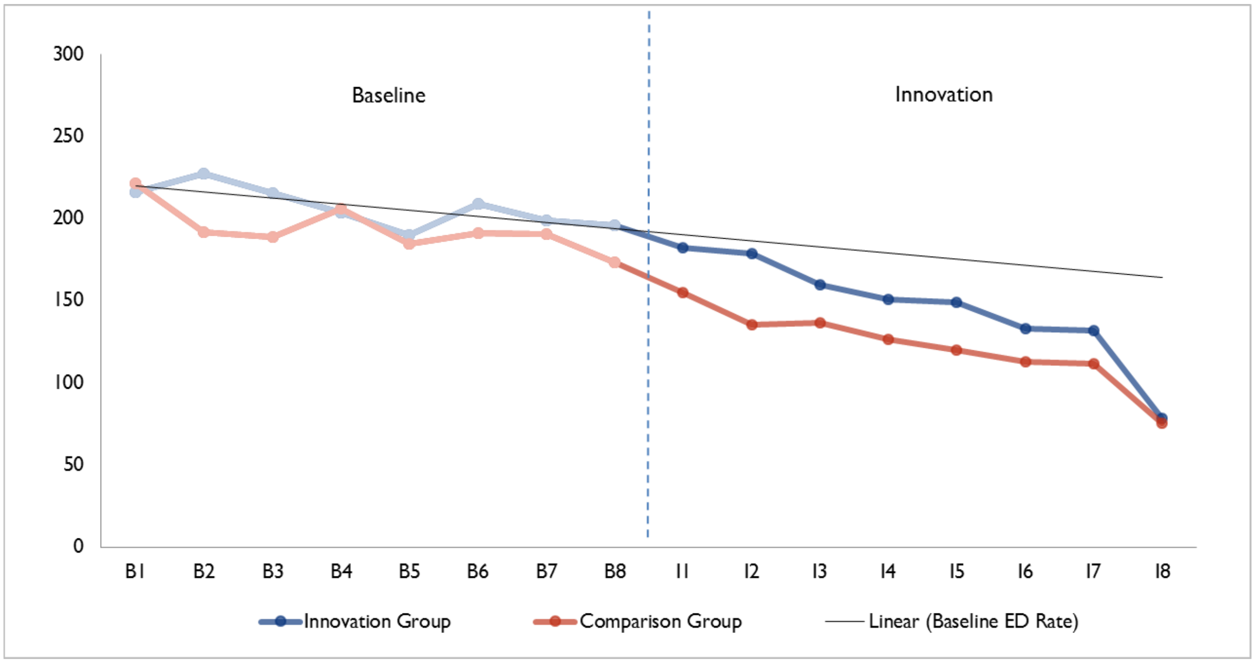
Table 14. ED Visits per 1,000 Participants: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
ED rate	216	227	216	203	190	209	199	196	182	179	160	151	149	133	132	78
Std dev	550	568	550	523	518	551	521	514	501	495	467	462	451	410	435	318
Unique patients	3,761	3,810	3,887	3,981	4,068	4,164	4,237	4,339	4,446	4,029	3,466	3,153	2,340	1,524	1,002	516
Comparison Group																
ED rate	221	192	189	206	185	191	190	173	155	135	136	127	120	113	112	76
Std dev	466	414	405	427	404	412	389	366	372	330	325	313	308	310	284	216
Weighted patients	4,033	4,046	4,065	4,077	4,098	4,136	4,220	4,339	4,446	3,963	3,419	3,125	2,343	1,541	1,020	527
Innovation − Comparison Rate																
	−5	35	27	−3	5	18	8	23	27	43	23	24	29	20	20	3

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Delta Dental = Delta Dental Plan of South Dakota; ED = emergency department; I1 = Innovation Q1.

Figure 7. ED Visits per 1,000 Participants: Delta Dental



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Delta Dental = Delta Dental Plan of South Dakota; ED = emergency department.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 17 visits per 1,000 participants relative to the comparison group. This is the average difference in difference for ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 10, 23). In addition to the average effect over the innovation period, we present quarterly effects.

Table 15 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. The estimated coefficients in over half the quarters of the innovation period are not significant, indicating that the likelihood of an ED visit is not statistically different for the innovation and comparison groups; however, there are significant positive increases in ED visits for the innovation group compared with the comparison group in three quarters after the implementation of the innovation. In the first and second innovation quarters, the innovation group has, on average, 16 and 33 more ED visits per 1,000 participants, respectively, and then again in the fifth quarter the innovation group has 20 more ED visits, on average, per 1,000 participants. Overall, the innovation group has more ED visits cumulatively over the 2 years of the innovation.

Table 15. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits, per 1,000 Participants: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
I1	16	9	0.087
I2	33	10	0.001
I3	12	10	0.240
I4	12	10	0.238
I5	20	11	0.071
I6	8	13	0.557
I7	6	16	0.723
I8	−2	17	0.900
Overall average	17	4	0.000
Overall aggregate	345	82	0.000
Overall aggregate (IY1)	282	73	0.000
Overall aggregate (IY2)	63	37	0.091

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age; sex; an indicator for American Indian ethnicity; and an indicator for disability. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
Delta Dental = Delta Dental Plan of South Dakota; ED = emergency department; I = Innovation Quarter; IY = Innovation Year.

2.8 Discussion: Medicaid Results

The number of ED visits for the innovation group increased compared with the comparison group. The Circle of Smiles innovation, however, is not expected to have an impact on ED visits because it focuses on improving children's oral and dental health, so the change in number of ED visits is likely due to factors other than the innovation. In Year 2 of the innovation, statistically significant savings and lower inpatient admissions occurred for the treatment group compared to the comparison group. The positive results in Year 2 may be due to the preventive care provided by the innovation.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 56 percent of the overall population reached by the innovation.

2.9 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

We did not receive any awardee-specific measures of clinical effectiveness and health outcomes from Delta Dental. As indicated in the 2015 annual report, applicable outcome measures for Delta Dental would need to be extracted from dental claims data and, although Delta Dental provided patient identifiers to RTI, Medicaid claims data available through Alpha-MAX do not include dental claims.

2.10 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 16*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from Delta Dental's *Narrative Progress Reports* and *Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in ***Sections 2.11*** through ***2.14*** are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 16. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number of Medicaid-enrolled AIC aged 0 to 9 living in/on a South Dakota Reservation County who received at least one diagnostic or preventive dental service	Data received from Delta Dental

AIC = American Indian children; Delta Dental = Delta Dental Plan of South Dakota; FTE = full-time equivalent; Q = quarter.

2.11 Qualitative Findings: Workforce Development

The HCIA innovations sought to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill was in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.11.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed with 21 FTE staff members. Between Q11 (June 2014) and Q12, Delta Dental reduced total staff members by three FTEs as part of a gradual process to reduce the size of the team; at Q12, 18 staff remained. Delta Dental recognized that it needed to employ fewer staff as the HCIA funding ended.

Although Delta Dental had minimal staff turnover throughout the entire project period, it recognized that subcontracting the OHC positions through tribes limited its ability to oversee job requirements, supervise OHCs directly, and terminate OHCs whose performance was not adequate. Job requirements, such as level of education, varied across tribes. When a particular OHC's work did not fit well with the innovation, Delta Dental could not change staff; it discussed poor job performance with the underperforming OHC and tribal representatives, although no tribes terminated OHCs. This challenge arose with a very small number of OHCs; because it was not a widespread problem, it likely did not affect the results.

2.11.2 Skills, Knowledge, and Training

Between Q11 and Q12, Delta Dental provided 461 hours of training to four HCIA project-employed administrative personnel. As indicated in the 2015 annual report, a staff member reported that the OHC trainings provided at local community colleges were costly and did not align well with the innovation and OHCs' needs. The certification through a community college required OHCs to complete liberal arts assignments, such as writing essays; OHCs, often adult learners with a high school education or GED, had difficulty adapting to that conventional educational approach. Additionally, OHCs needed to complete modules within specific timeframes, and because many had competing family responsibilities, they could not finish the assignments, which meant that they could not pass the program. Reflecting on past trainings, one EOY interviewee stated that should another opportunity arise, the staff member would conduct OHC training internally.

Throughout the innovation, Delta Dental provided two annual in-person trainings. These trainings included refresher lessons on cultural competency, motivational interviewing, and other topics as identified by program management (e.g., tobacco cessation). Program staff also learned innovation-specific information, such as how to use the Patient Tracker system. In addition to the annual trainings, program management staff led weekly calls with the dental hygienists and OHCs. The calls alternated between regional calls with both hygienists and OHCs from each region and hygienist and OHC calls for all those in each position. These calls not only allowed program management to provide updates, but also served as opportunities for peer-to-peer learning and problem solving. When new staff were hired, they completed an orientation that included: an overview of the innovation, training in Patient Tracker systems, shadowing an experienced hygienist and OHC, and supervision by the OHC liaison (for OHCs only).

Table 17. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	461	4
Since inception	218	5,632

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.12 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

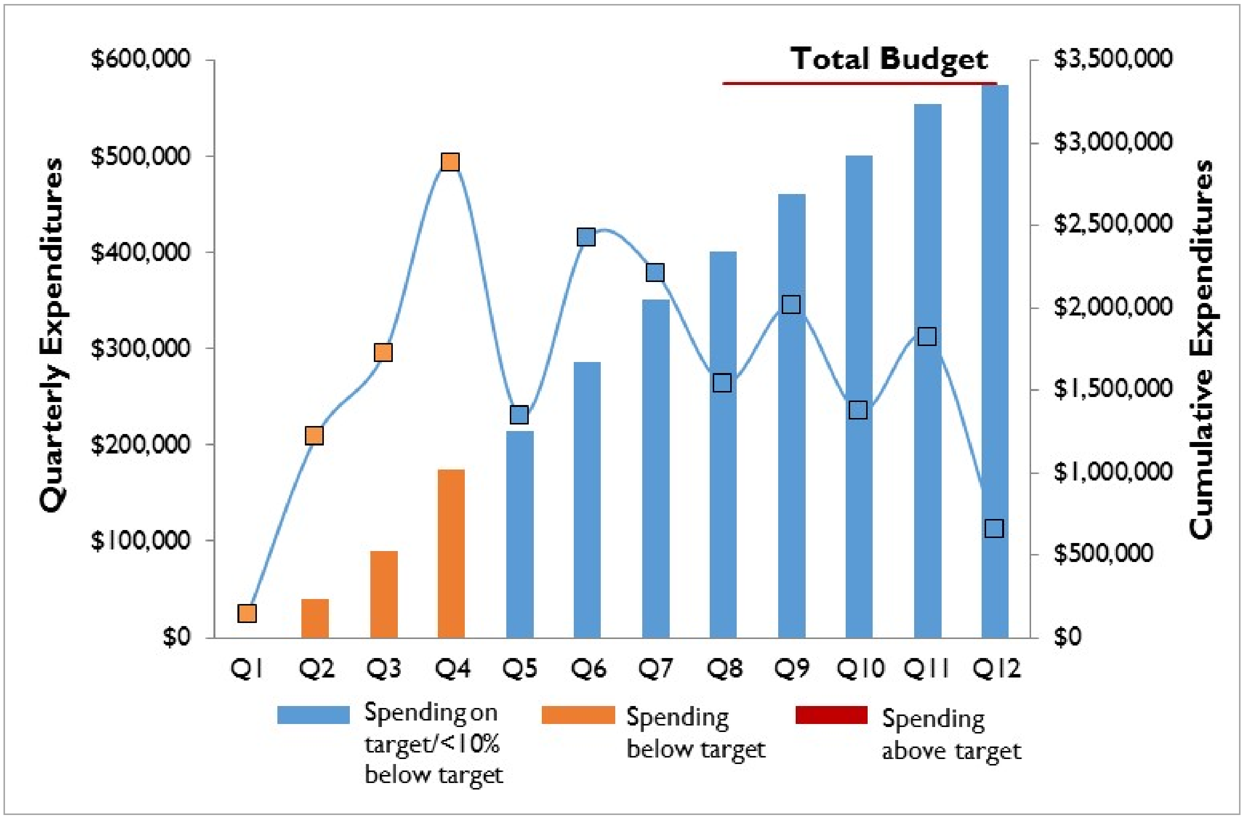
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?
- How has the awardee facilitated innovation adoption and workflow integration?

2.12.1 Award Execution

The annual report highlights the significance of Delta Dental's expenditure rates on implementation. As of June 2015 (Q12), Delta Dental spent 99.6 percent of its total budget, which is at the projected target (***Figure 8***).

Figure 8. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



Despite being fully staffed in Q1 and Q2, Delta Dental's expenditure rate was relatively low during the first year because of challenges in launching the innovation and reaching the original target population. During the first year of the innovation, Delta Dental had difficulty establishing a relationship with IHS because the primary contact left. In addition, Delta Dental originally planned to recruit pregnant women with diabetes at the WIC offices, but during the first year, WIC offices no longer required women to travel to WIC locations to receive resources, reducing Delta Dental's ability to reach and enroll the target population in the HCIA innovation. While Delta Dental likely spent more time and energy identifying the target audience than originally anticipated, they were ultimately unable to service the volume of patients projected for the first year.

2.12.2 Leadership

Since the inception of the innovation, Delta Dental maintained the involvement of the CEO, project director, and project manager. Delta Dental's CEO provided resources, participated in high-level meetings with the Medicaid director, and met with the board of directors to obtain additional funding. In Q11, Delta Dental's project director presented to the Great Plains Tribal Chairmen's Health Board, which represents 18 tribal communities in the states of South Dakota, North Dakota, Nebraska, and Iowa. The presentation focused on the importance of oral health and provided information on the Circle of Smiles program and current services.

2.12.3 Organizational Capacity

During the final quarters of implementation, Delta Dental maintained adequate organizational resources and capacity. Delta Dental had low turnover as well as mobile dental chairs and sufficient transportation to successfully implement the innovation. Each of the seven hygienists received mileage reimbursement for driving her own vehicle and transporting the portable dental chairs to different schools. Each hygienist provided onsite dental services for children in the community. Delta Dental also had an existing mobile oral health care program, which gave its implementation team knowledge of and experience with providing onsite dental services in a range of locations (e.g., schools, churches).

Several barriers to implementation in the first year obliged Delta Dental to change the target population from pregnant women with diabetes and new mothers to children aged 0 to 9. They initially planned to work with two key partners—IHS and WIC—to reach pregnant women with diabetes. At the time of the award, an IHS liaison served as an early partner to reach patients with diabetes. This individual retired, however, and the new interim liaison could not commit time to the innovation, which created a barrier to accessing the target population. In addition, each IHS facility and dental unit had a unique organizational culture; staff in most IHS dental clinics were uncomfortable with external hygienists working in the IHS clinic. The other core partner, WIC, no longer required recipients to travel in person to the WIC office (the primary location for recruiting pregnant women and infants) to receive their benefits. Thus, reaching patients with diabetes, pregnant women, and infants was no longer feasible. Given the external barriers to implementation, Delta Dental opted to drop the outreach to women and focus instead on children aged 0 to 9. Since the last annual report, Delta Dental had no changes in organizational capacity over the course of the innovation.

2.12.4 Innovation Adoption and Workflow Integration

Delta Dental arranged for tribes to hire OHCs directly because, as members of the tribe, they had relationships with individuals in the community. Using their connections and knowledge of their communities, the OHCs could more easily follow up with children's guardians to ensure that the children who needed restorative care were scheduled for an appointment. However, when the OHCs did not provide consistent follow-up and complete administrative requirements, Delta Dental did not have the authority to terminate an OHC's position. Thus, Delta Dental engaged in lengthy discussion with tribal leaders when a few OHCs did not perform as expected. No tribal leaders terminated underperforming OHCs, and after the funding period, Delta Dental will directly hire three OHCs who performed well.

Delta Dental also employs seven hygienists for this innovation, most of whom are members of tribal communities. Hygienists encountered nominal challenges when working with schools (e.g., if a school had a snow day, rescheduling the visit meant juggling schedules). In addition to barriers to OHC patient follow-up, Delta Dental experienced challenges integrating Delta Dental staff into IHS clinics because staff in most clinics did not welcome external hygienists. According to program staff, IHS staff saw the hygienists as competitors rather than as collaborators.

2.13 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine whether the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

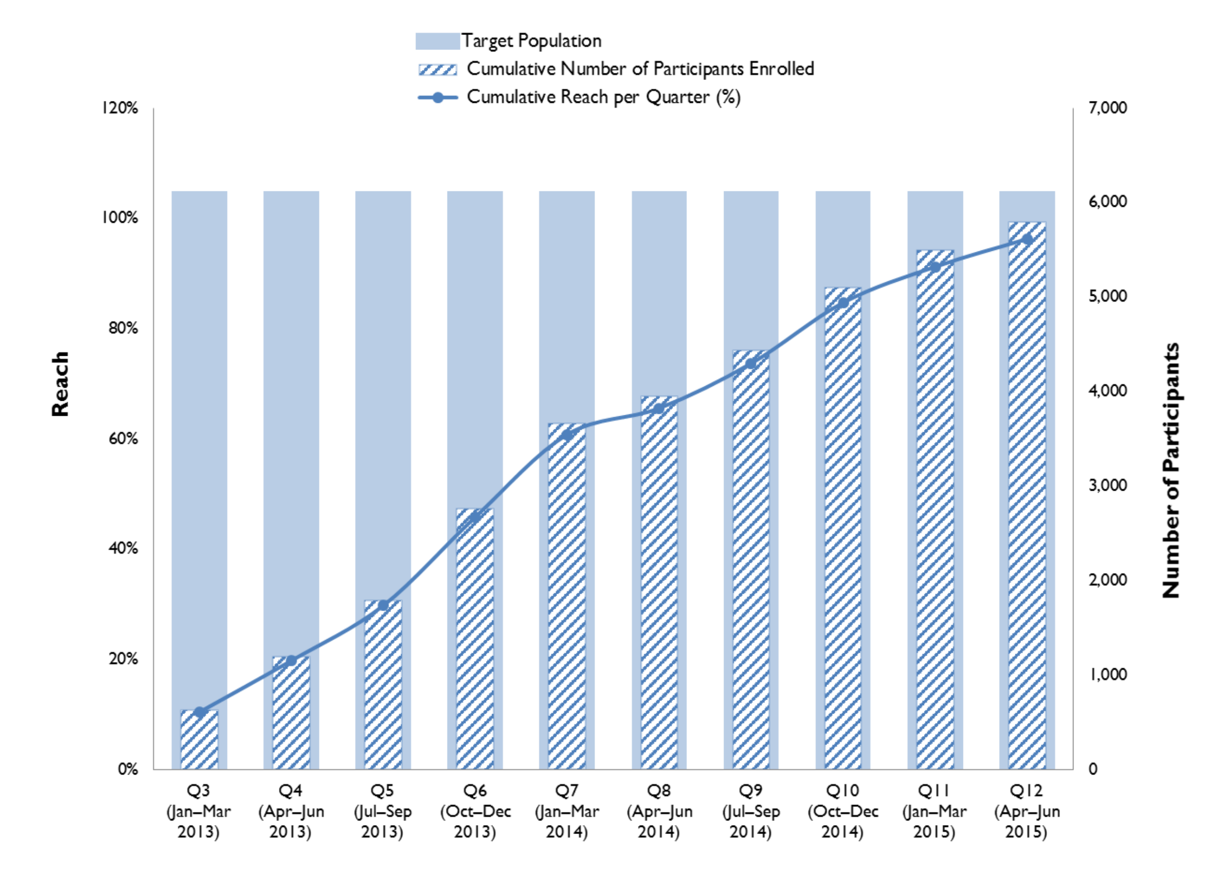
- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.13.1 Innovation Reach

Delta Dental provided cumulative data through Q12 on the target population, which included children aged 0 to 9 from the school sites who were enrolled in the Circle of Smiles program. Delta Dental targeted 6,022 students at Circle of Smiles schools. This population included both Medicaid-eligible and ineligible students. To align with the denominator, the reach calculations were limited to Medicaid-eligible children aged 0 to 9 who received prophylaxis treatment.

Figure 9 shows reach by quarter since the launch of the innovation. We last reported reach in the 2015 annual report, on the basis of data through Q11. Delta Dental enrolled an additional 304 children aged 0 to 9 in the innovation in Q12, increasing reach from 91.2 percent to 96.2 percent. The reasons for Delta Dental's high reach may be that the population was captive (i.e., students in schools) and fairly homogenous, which may have increased accessibility.

Figure 9. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2014)	Q12 (Apr–Jun 2014)
●	Cumulative reach per quarter (%)	10.4	19.7	29.7	45.8	60.8	65.5	73.7	84.7	91.2	96.2
	Target population	6,022	6,022	6,022	6,022	6,022	6,022	6,022	6,022	6,022	6,022
	Cumulative number of participants enrolled	626	1,188	1,790	2,757	3,660	3,947	4,436	5,100	5,492	5,796

Source: Patient-level data provided to RTI by Delta Dental.

2.13.2 Innovation Dose

Delta Dental's innovation seeks to ensure that (1) infants visit a dentist before their first birthday; (2) children aged 0 to 9 receive one annual dental prophylaxis; and (3) children aged 6 to 8 receive necessary sealants and fluoride varnishes once per year, which are included in the dental prophylaxis. Thus, dose, in this case, can be considered synonymous with participant enrollment (presented as Reach).

2.14 Qualitative Findings: Sustainability

During the HCIA implementation period, Delta Dental also participated in an ECC Collaborative pilot program to find a better way to treat children aged 0 to 5 in clinics while they were awaiting surgical care. During the pilot, Delta Dental participated in trainings, conducted a risk assessment to stratify patients into risk categories, and examined patient data to determine patient treatment frequency and type. Delta Dental conducted motivational interviews and self-management goal setting with children's parents. Delta Dental used the ECC Collaborative pilot to apply for Health Resources and Services Administration (HRSA) grant funding, which will enable expansion of this pilot program into seven other Head Start sites.

Using HRSA grant funding and the existing Delta Dental Philanthropic Fund (DDPF), Delta Dental plans to sustain some aspects of the innovation. In Q12, Delta Dental held strategic planning meetings with key staff members to develop a new organizational structure, which will fuse the HCIA project with Delta Dental's existing mobile dental program. The combined programs will share the OHCs' regional travel costs to provide care. All hygienists will continue to serve their regions and will work in the mobile unit alongside dentists and dental assistants when the mobile units are in region. Delta Dental will directly hire 3 of the 14 OHCs, who originally worked directly for the partnering tribes via a subcontract. The OHCs' roles will be adjusted to fit the new combined dental service program, although Delta Dental has not determined which activities will be maintained and which will be altered. The OHCs will serve regions of the state, rather than individual tribes, and will work alongside the mobile unit teams. This approach will allow Delta Dental to ensure consistent job requirements and provide direct oversight of the OHCs' work and progress, while increasing overall staffing capacity in each region. For sustained efforts, Delta Dental plans to expand the target innovation age group to include children from early Head Start ages up to 8th grade.

2.15 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Delta Dental as well as accomplishments to date. In this section, we assess Delta Dental's progress on achieving HCIA goals to date:

- **Smarter spending.** Regression-adjusted differences between the innovation and comparison group showed no statistically significant effect on spending during the first innovation year, but did show a statistically significant decrease in spending among the innovation group during the second innovation year.

- **Better care.** Innovation participants had higher rates of ED visits during Years 1 and 2 of the innovation. Inpatient stays were not statistically different during the first innovation year, but the innovation group experienced lower inpatient admissions rates during the second innovation year. No differences in readmissions were detected between the two groups. The Circle of Smiles innovation was not expected to have an impact on hospital admissions, readmissions, or ED visits because it focused on one-time prophylaxis treatment to children in the relatively short innovation timeframe. The difference in ED and inpatient admissions rates may have been related to factors outside the innovation.

As of Q12, Delta Dental reached 96.2 percent of its target population. Delta Dental's high reach may be because the population is captive (i.e., students in schools) and fairly homogenous.

RTI did not receive clinical effectiveness data from Delta Dental, so those data were not presented in this report.

- **Healthier people.** Delta Dental did not provide health outcome data to RTI; thus, no results on this goal are presented in this report.

Delta Dental removed pregnant women with diabetes and new mothers from its original target population and, instead, focused solely on reaching Medicaid-enrolled American Indian children aged 0 to 9 who lived in a South Dakota Reservation county. By reducing the reach denominator and focusing on a readily available and captive audience (children in school), Delta Dental selected a more attainable target goal, which may have contributed to the overall success of the implementation.

Delta Dental had difficulties working with its primary partner, IHS, to gain access to the tribal community. The new WIC resource distribution mechanism created barriers to reaching pregnant women and infants. Despite these initial setbacks, Delta Dental effectively reached its revised target population (children aged 0 to 9), potentially because of a history of experience providing mobile dental services, employing members of the tribal community as core staff (OHCs), and targeting a captive population (i.e., students in schools).

In the last quarter, Delta Dental worked to integrate its existing mobile dental services with the HCIA project. During Q12, Delta Dental retained the dental hygienist position and hired three OHCs from participating tribes; the OHC and hygienists will operate regionally to serve the population. Delta Dental planned to use funding from its newly obtained HRSA grant and DDPF monies to sustain the hygienists and some OHCs, and expand the target population to children from early Head Start ages up to 8th grade.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Delta Dental Plan of South Dakota (Delta Dental)

Located in Pierre, South Dakota, Delta Dental Plan of South Dakota (Delta Dental) received a total award of $3,364,528 and launched its innovation on January 7, 2013. Its innovation, Circle of Smiles: Improving Oral Health in Indian Country, primarily sought to improve the oral/dental health of American Indian children aged 0 to 9 who live on South Dakota reservations.

Awardee Overview

Innovation dose:	Delta Dental's innovation sought to ensure that: (1) infants visit a dentist; (2) children aged 0 to 9 receive one annual dental prophylaxis; and (3) children aged 6 to 8 receive necessary sealants and fluoride varnishes once per year.	***Innovation reach:***	5,796 Medicaid-eligible children, 96.2% of the target population, enrolled. Delta Dental's high reach may be because the population is captive (i.e., students in schools) and fairly homogenous.
Components:	(1) Direct dental services from traveling Delta Dental hygienists (2) Oral health care coordination to support transition from hygienist to pediatric dentist	***Participant demographics:***	Most participants (64.4%) were under 9 years old, 52.4% were female, 88.1% were American Indian or Alaska Native, and about 5.0% were white. Most (73.0%) were covered by Medicaid, and one-quarter (25.0%) were uninsured.
Sustainability:	Delta Dental intends to integrate the HCIA innovation in an existing mobile dental program and will hire 3 regional oral health coordinators (OHCs). Delta Dental plans to expand the target innovation age group to include early Head Start children up to those in 8th grade.		
Innovation type:	Coordination of care		Direct health care/dental care

Key Findings

Smarter spending. Regression−adjusted differences between the innovation and comparison groups showed no statistically significant effect on average quarterly spending overall (−$3; 90% CI: −$57, $51), but showed a statistically significant decrease in average quarterly spending per participant among the innovation group during the second innovation year (−$96; 90% CI: −$177, −$15).

Better care. Innovation participants had higher rates of emergency department (ED) visits per 1,000 participants per quarter overall (17; 90% CI: 10, 23). Inpatient stays per 1,000 participants were not statistically different overall (−1; 90% CI: −2, 1), but the innovation group experienced lower inpatient admissions rates during the second innovation year (−4; 90% CI: −7, −2). No differences in average readmissions per 1,000 admissions were detected between the two groups (−24; 90% CI: −63, 15). The Circle of Smiles innovation was not expected to have an impact on hospital admissions, readmissions, or ED visits because it focused on one-time prophylaxis treatment to children in the relatively short innovation timeframe. The difference in ED and inpatient admissions rates may have been related to factors outside the innovation.

Healthier people. Delta Dental did not provide health outcome data to RTI; thus, no results on this goal are presented in this report.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Eau Claire Cooperative Health Centers, Inc.

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–June 2014
Awardee-specific data	Launch date–June 2015

Q = quarter.

Eau Claire Cooperative Health Centers, Inc.

2.1 Introduction

Eau Claire Cooperative Health Centers, Inc. (ECCHC), a large federally qualified health center serving four counties in and around Columbia, South Carolina, received an award of $2,330,000 and began enrolling patients into its Innovations Health program on December 1, 2012. Innovations Health established three microclinics in neighborhoods within the targeted 29203 zip code identified as "hot spots" for their high ED utilization, poverty, limited access to primary care, and concentrated health disparities; the program created community health teams and enrolled frequent ED users into the innovation. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending by $3,000 per participant per year, or $14,817,600 over 3 years.

2. **Better care.** Provide comprehensive primary care in microclinics and integrate high-utilizing patients into traditional primary care homes. Offer referrals to specialty care. Reduce inappropriate ED use by 20 percent over 3 years.

3. **Healthier people.** Improve health literacy and outcomes, including management of chronic disease (e.g., asthma, diabetes, and hypertension), family planning, and preventive services and screenings for physical and mental health.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter (Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received from ECCHC through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Shifted care from microclinics to ECCHC's existing practices.
	Concluded project with only two fully operational microclinics.
	Continued partnerships with three Medicaid MCOs for shared savings, New Morning Foundation for pregnancy prevention services, Welvista for mail-order prescription drugs, and Palmetto Health for care for uninsured patients.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Program Participant Characteristics	
	Nearly two-thirds (63.6%) of participants were 25 to 64 years of age; more than half (63.6%) were female. Most (91.5%) were black. Most (74.2%) were uninsured; 19.1% were covered by Medicaid.
Workforce Development	
Hiring and retention	Employed 19.23 FTE staff at end of Q12, below projection by 3.95 FTE due to turnover, ongoing challenges filling CMA, NP, and RN vacancies, and reductions in existing staff hours.
	Clinician credentialing rules associated with ACA contributed to hiring delays for the innovation.
Skills, knowledge, and training	148 hours of asthma education and pregnancy prevention training provided during Q11 and Q12 to project administrative and clinical personnel.
	Lack of experience and fit among staff in NP and CHW roles affected community care team functioning.
Context	
Award execution	Cumulative Year 3 expenditures were 59.8% ($462,638) of target, due in part to ECCHC's decision not to fill NP and RN vacancies.
	Cumulative expenditures since inception were 10% to 20% below projection.
Leadership	ECCHC's organizational leadership was minimally involved in implementation throughout Year 3.
	NPs were not prepared to lead community care teams as originally envisioned.
Organizational capacity	Integrated CHW services into ECCHC's traditional clinics after identifying capacity problems in the health system.
	Operated only two fully functioning microclinics in Year 3, one short of target, due to insufficient staffing.
	RNs and NPs treated more patients in clinical settings than in homes because staffing shortages restricted ability to deliver services in both settings, and more patients could be seen in the clinic.
	Continued to experience problems with data collection and data quality.
Innovation adoption and workflow integration	LISW-AP improved coordination between clinical and nonclinical staff.
	CHWs continued to receive referrals and follow patients in ECCHC's traditional clinics within the targeted zip code.
Implementation Effectiveness	
Innovation reach	ECCHC enrolled 70% of the target population, up from 68.1% in Q11.
	Struggled to identify eligible beneficiaries with Medicaid/Medicare coverage who were not already connected to ECCHC's existing primary care network.
Innovation dose	Nearly all participants (99.6%) received a home or microclinic visit. Nearly half of participants with asthma (46.2%) received asthma-related coaching, and nearly half of participants with CAD/hyperlipidemia (47.8%) received LDL coaching. More than three-quarters of participants with diabetes (81%) received diabetes-related coaching, and nearly three-quarters of participants with hypertension (67.8%) received coaching.
	"Touched" patients less than originally planned, driven by lack of reimbursement and limited staffing.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Sustainability	
	Patients transitioned into existing clinics and other community providers; two microclinics converted to other health practice uses, and some staff were absorbed into traditional clinics.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 2015.

ACA = Affordable Care Act; CAD = coronary artery disease; CHW = community health worker; CMA = certified medical assistant; ECCHC = Eau Claire Cooperative Health Centers, Inc.; FTE = full-time equivalent; LDL = low-density lipoprotein; LISW-AP= licensed independent social worker-advanced practice; MCO = managed care organization; NP = nurse practitioner; RN = registered nurse.

Table 3 summarizes Medicaid claims-based findings during the innovation period. The innovation does not have statistically significant effects on Medicaid spending per patient or inpatient admissions, but is associated with significantly fewer ED visits. The sample size for unplanned readmissions is too small to support regression analysis of innovation effects. We do not summarize Medicare-claims based findings since the sample has too few beneficiaries (less than 100) to perform regression analyses.

Table 3. Summary of Medicaid Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$0.127	−$0.335, $0.590	$0.122	−$0.327, $0.571	$0.005	−$0.047, $0.057	N/D	N/D
Acute care inpatient stays	−7	−18, 3	−7.	−18, 3	N/A	N/A	N/D	N/D
Hospital-wide all-cause unplanned readmissions	N/A	N/A	N/A	N/A	N/A	N/A	N/D	N/D
ED visits not leading to a hospitalization	−97	−164, −30	−97	−163, −31	0	−12, 12	N/D	N/D
Average impact per quarter								
Spending per participant	$132	−$346, $609	$149	−$397, $695	$35	−$320, $390	N/D	N/D
Acute care inpatient stays (per 1,000 participants)	−10	−24, 4	−10	−24, 4	N/A	N/A	N/D	N/D
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	N/A	N/A	N/A	N/A	N/A	N/A	N/D	N/D
ED visits not leading to a hospitalization (per 1,000 participants)	−106	−179, −33	−125	−210, −41	1	−86, 88	N/D	N/D

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size; N/D = no data currently available.

2.1.1 *Innovation Components*

Innovations Health had three components: (1) establishing three new microclinics; (2) forming new five-member community health teams; and (3) enrolling frequent ED users into the program. ECCHC has operated the largest community health care system in South Carolina for over 30 years, and identified three locations within its service area as hot spots for high ED utilization and spending, poverty, limited access to primary care, and concentrated “cradle to grave” health disparities. Using HCIA funds, ECCHC intended to deliver primary care services to community members by opening three small neighborhood-based “microclinics” through which patients would pass before being integrated into primary care homes. Community health teams, consisting of clinical staff including nurse practitioners (NPs), registered nurses (RNs), and certified medical assistants (CMA), along with nonclinical staff including community health workers (CHWs) and patient service representatives (PSRs), staffed the clinics and provided services. Staff arranged an initial comprehensive health assessment to identify patient needs, follow-up health encounters to stabilize medical conditions, referrals for specialty care, medication delivery, and transportation services. ECCHC also intended to reduce health care spending by providing prenatal care, but ultimately shifted its focus to pregnancy prevention.

Table 4 identifies all partners present throughout implementation, who remain unchanged since the 2015 annual report. ECCHC partnered with three Medicaid managed care organizations (MCOs) for shared savings and reimbursement for CHW and RN services, but did not realize the expected savings because of difficulties recruiting Medicaid-covered patients. ECCHC also formed relationships with a variety of community organizations, housing groups, religious leaders, and state agencies, including the South Carolina Department of Health and Human Services (SCDHHS) and the South Carolina Office of Research and Statistics (SCORS).

Table 4. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
BlueChoice Health Plan of South Carolina Medicaid (MCO)	Sharing of ED and hospital utilization data for cost savings	Columbia, SC
Select Health Managed Care Organization (MCO)	Sharing of ED and hospital utilization data for cost savings	Charleston, SC
Palmetto Health Richland and Palmetto Health Baptist Hospitals	Patient referral for specialty care through Palmetto Cares Referral of uninsured patients to Innovations Health	Columbia, SC
Midlands Technical College and the South Carolina Department of Health and Environmental Control	Workforce development (community health workers)	Columbia, SC
Absolute Total Care (MCO)	Sharing of ED and hospital utilization data for cost savings	Columbia, SC
New Morning Foundation	Family planning services	Columbia, SC
Welvista	Provide free mail-order prescription services for uninsured patients	Columbia, SC

ED = emergency department; MCO = managed care organization.

2.1.2 Program Participant Characteristics

Table 5 provides the demographic characteristics of all participants ever enrolled in the innovation. Patient demographic characteristics were last reported in the 2015 annual report, based on data through Q11. The distribution of patient characteristics presented here, based on data through Q12, was similar. Specifically, a majority of participants (63.6%) were 25 to 64 years of age, and more than half (63.6%) were female. Most participants (91.5%) were black, and either uninsured (74.2%) or covered by Medicaid (19.1%).

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	1,653	100.0
Age		
< 18	317	19.2
18–24	129	7.8
25–44	438	26.5
45–64	614	37.1
65–74	104	6.3
75–84	32	1.9
85+	19	1.2
Missing	0	0.0
Sex		
Female	1,051	63.6
Male	600	36.3
Missing	2	0.1
Race/ethnicity		
White	38	2.3
Black	1,513	91.5
Hispanic	65	3.9
Asian	5	0.3
American Indian or Alaska Native	12	0.8
Native Hawaiian or other Pacific Islander	3	0.2
Other	7	0.4
Missing/refused	10	0.6
Payer category		
Dual	0	0.0
Medicaid	316	19.1
Medicare	29	1.8
Medicare Advantage	26	1.6
Other	50	3.0
Uninsured	1,227	74.2
Missing	5	0.3

Source: Patient-level data provided to RTI by ECCHC.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 6 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 6. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	No	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 76 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. Because the majority of patients are uninsured, the Medicare beneficiaries represent only 5 percent of the participants enrolled in the innovation. The total number of Medicare beneficiaries in the claims analysis is higher than the number of Medicare beneficiaries identified using the ECCHC-provided data in Table 5. Medicare beneficiaries for this analysis are based on matching awardee-provided identifiers for program participants with Medicare claims data, without accounting for the payer category listed in the ECCHC-provided data. Therefore, patients incorrectly classified in the ECCHC-provided data (e.g., Medicaid) will be included in the Medicare claims analysis. We present descriptive measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in Richland County, South Carolina, during the innovation launch.

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease (ESRD) status, dual Medicare-Medicaid status, and total Medicare payments in the calendar quarter prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score. The number of matching variables was limited to conform to the rule of 10. The rule of 10 is a statistical rule of thumb for logistic regressions stating that at least 10 events should be in the dependent variable for each independent variable in the regression to avoid biased estimates and unreliable confidence intervals.[1] There are 76 innovation group beneficiaries; therefore, the number of matching variables was limited to 7 in the propensity score model. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 7 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

[1] Concato, J., Peduzzi, P., Holfold, T.R., et al.: Importance of events per independent variable in proportional hazards analysis. I. Background, goals, and general strategy. J Clin Epidemiol. 48:1495-501, 1995.
Peduzzi, P., Concato, J., Feinstein, A.R., et al.: Importance of events per independent variable in proportional hazards regression analysis. II. Accuracy and precision of regression estimates. J Clin Epidemiol. 48:1503-10, 1995.
Peduzzi, P., Concato, J., Kemper, E., et al.: A simulation study of the number of events per variable in logistic regression analysis. J Clin Epidemiol. 49:1373-9, 1996.

Table 7. Mean Values and Standardized Differences of Variables in Propensity Score Model: ECCHC

Variable	Before Matching				Standardized Difference	After Matching				Standardized Difference
	Innovation Group		Comparison Group			Innovation Group		Comparison Group		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarter prior to enrollment	$1,699	$3,290	$2,089	$6,836	0.07	$1,699	$3,290	$1,381	$3,400	0.10
Age	63.41	14.26	70.30	12.05	0.52	63.41	14.26	64.73	14.07	0.09
Percentage male	34.21	47.44	42.12	49.38	0.16	34.21	47.44	32.02	46.65	0.05
Percentage white	7.89	26.97	60.91	48.79	1.34	7.89	26.97	5.26	22.33	0.11
Percentage disabled	61.84	48.58	25.21	43.42	0.79	61.84	48.58	57.46	49.44	0.09
Percentage ESRD	2.63	16.01	1.90	13.64	0.05	2.63	16.01	3.51	18.4	0.05
Number of dual eligible months in the previous calendar year	5.51	5.78	1.76	4.18	0.74	5.51	5.78	5.59	5.82	0.01
Number of beneficiaries	76	—	250,107	—	—	76	—	227	—	—
Number of unique beneficiaries[1]	—	—	40,395	—	—	76	—	227	—	—
Number of weighted beneficiaries	—	—	—	—	—	76	—	76	—	—

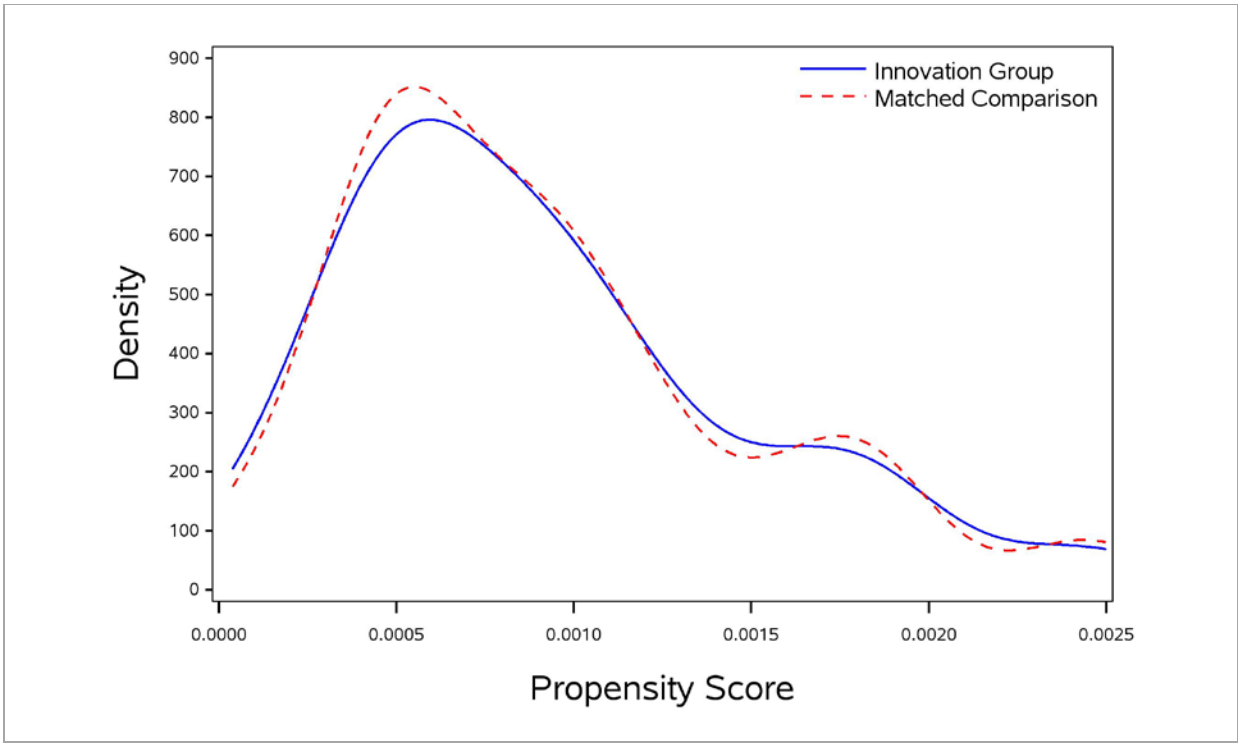
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).
ECCHC = Eau Claire Cooperative Health Centers, Inc.; ESRD = end-stage renal disease; SD = standard deviation.
— Not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 7). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into innovation (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining innovation selection do not require optimal balance. The results in Table 7 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. One variable, Percentage white, did not meet the criteria for acceptable balance (standardized difference ≤ 0.10). The corresponding standardized difference after matching is > 0.10 (0.11). With a small pool of innovation beneficiaries, comparison beneficiaries that match innovation beneficiaries along every dimension may not exist. Lack of balance on a particular variable does not imply lack of overall balance between the innovation and comparison groups. In PSM, innovation and comparison individuals are matched on the basis of the propensity score, which is the individual's predicted probability of innovation using information on all characteristics in the propensity score model.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The propensity scores in Figure 1 are low because the cloning methodology increases the number of comparison beneficiaries in the propensity score model, which mechanically lowers the propensity score. The two distributions overlap substantially, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries.

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 8 reports Medicare spending per patient in the eight quarters before and the 12 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 8 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

Although spending over time varies widely, the baseline trend line for spending increases slowly. In innovation quarters, average spending for the innovation group increases relative to the trend line in innovation quarter 1 (I1) through I4, and then spending is highly variable for both the innovation and comparison groups. A similar trend in spending is observed among comparison group individuals. Although the levels of spending were different between the innovation and comparison groups, the standard deviation in spending is high in both groups, as shown in Table 8.

The sample size was too small to support regression analysis.

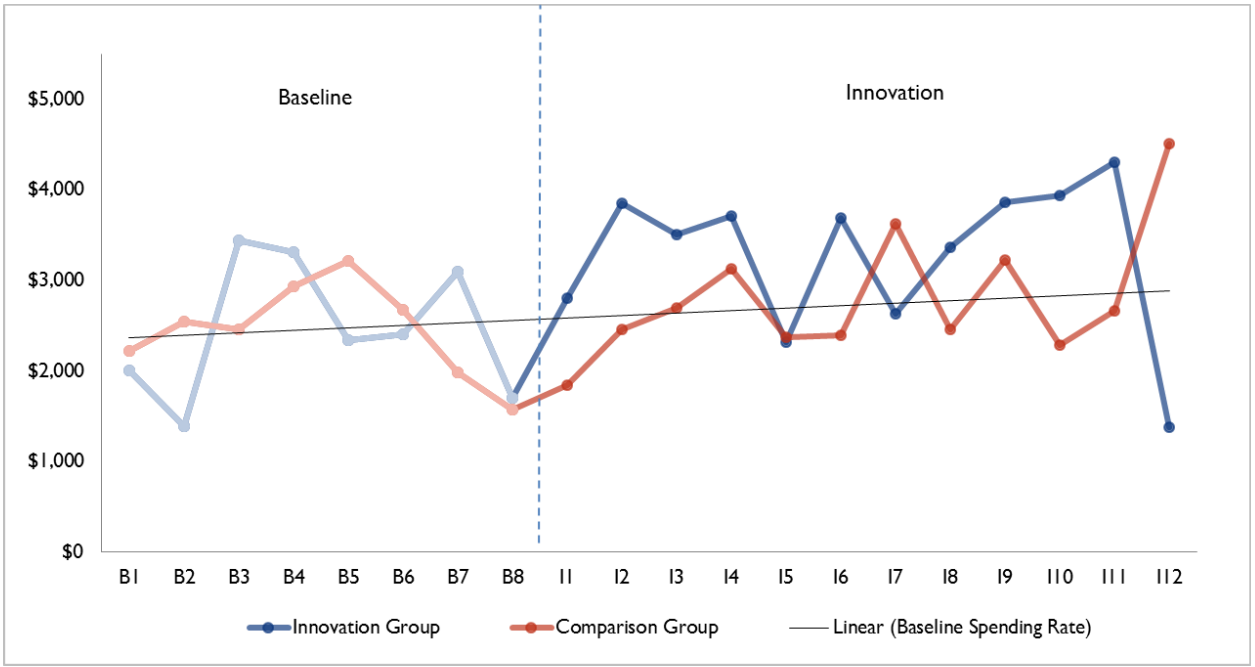
Table 8. Medicare Spending per Participant: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Spending rate	$2,006	$1,392	$3,438	$3,315	$2,340	$2,403	$3,096	$1,699	$2,804	$3,856	$3,505	$3,708	$2,320	$3,685	$2,628	$3,367	$3,865	$3,935	$4,303	$1,374
Std dev	$6,999	$2,612	$9,028	$7,997	$4,842	$5,939	$6,586	$3,290	$6,104	$10,357	$8,472	$7,095	$4,538	$8,092	$6,489	$7,054	$11,959	$7,460	$7,431	$3,729
Unique patients	63	64	66	66	71	72	74	76	76	75	69	67	65	63	62	57	49	45	33	19
Comparison Group																				
Spending rate	$2,226	$2,540	$2,463	$2,939	$3,210	$2,677	$1,983	$1,575	$1,846	$2,463	$2,696	$3,127	$2,372	$2,394	$3,628	$2,463	$3,223	$2,283	$2,667	$4,507
Std dev	$6,419	$7,864	$6,607	$8,250	$11,248	$8,054	$4,730	$5,157	$5,619	$6,927	$6,801	$9,736	$8,643	$6,310	$10,531	$7,566	$9,116	$4,807	$7,488	$9,649
Unique patients	65	66	68	69	72	73	75	76	76	76	75	72	70	69	66	61	55	49	36	23
Savings per Patient																				
	$220	$1,149	−$975	−$377	$870	$274	−$1,112	−$124	−$958	−$1,393	−$809	−$580	$52	−$1,291	$1,000	−$904	−$641	−$1,652	−$1,636	$3,133

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc; I1 = Innovation Q1.

Figure 2. Medicare Spending per Participant: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 9*** and ***Figure 3***. During the baseline period, the inpatient admissions rate is very similar for the innovation and comparison groups. However, the small sample size results in a high degree of variability in inpatient admissions. Inpatient admissions for the innovation group in the innovation quarters are highly variable and similar to the comparison group in most quarters. The sample size is too small to support regression analysis.

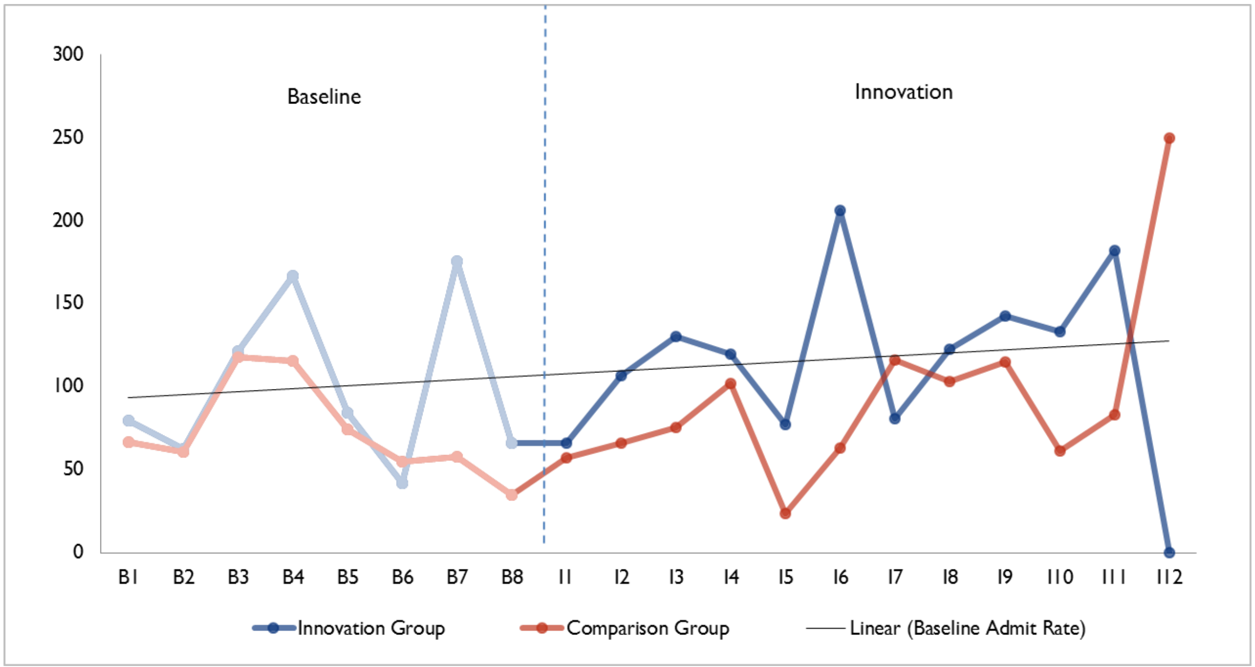
Table 9. All-Cause Inpatient Admissions Rate per 1,000 Participants: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Admit rate	79	63	121	167	85	42	176	66	66	107	130	119	77	206	81	123	143	133	182	0
Std dev	410	242	477	510	366	200	644	248	296	449	414	324	266	539	326	328	404	542	458	0
Unique patients	63	64	66	66	71	72	74	76	76	75	69	67	65	63	62	57	49	45	33	19
Comparison Group																				
Admit rate	67	61	118	115	74	55	58	35	57	66	75	102	24	63	116	103	115	61	83	250
Std dev	321	278	449	477	365	264	285	184	431	325	337	317	181	243	440	354	355	267	388	774
Unique patients	65	66	68	69	72	73	75	76	76	76	75	72	70	69	66	61	55	49	36	23
Innovation − Comparison Rate																				
	13	2	4	51	10	−13	118	31	9	41	55	18	53	143	−36	20	28	72	98	−250

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; I1 = Innovation Q1.

Figure 3. All-Cause Inpatient Admissions Rate per 1,000 Participants: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ECCHC= Eau Claire Cooperative Health Centers, Inc.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 10*** and ***Figure 4***. Readmissions rates are highly variable in the baseline and innovation periods, reflecting the relatively small number of hospital admissions for participants during each quarter. With few admissions (the denominator in the readmission rate) and a relatively low underlying percentage of readmissions, the readmissions rate varies widely over time.

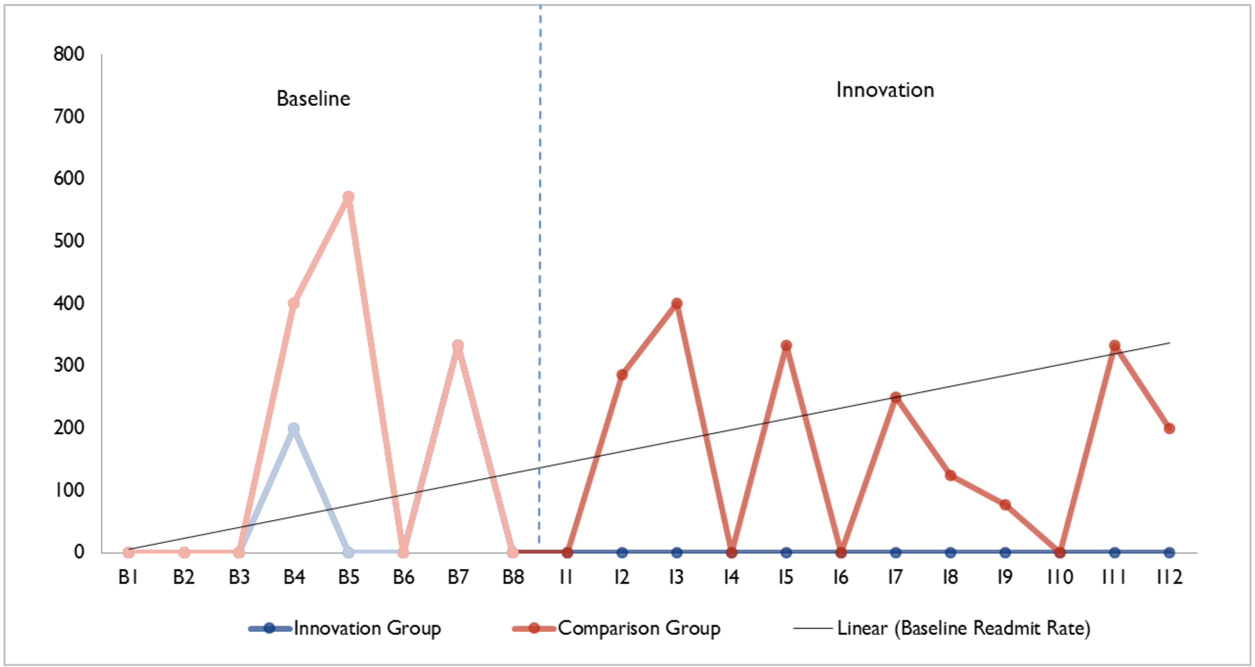
Table 10. Hospital Unplanned Readmissions Rates per 1,000 Admissions: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Readmit rate	0	0	0	200	0	0	333	0	0	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	400	0	0	471	0	0	0	0	0	0	0	0	0	0	0	0	0
Total admissions	0	2	1	5	1	1	6	1	1	3	4	5	0	3	0	4	1	1	1	0
Comparison Group																				
Readmit rate	0	0	0	400	571	0	333	0	0	286	400	0	333	0	250	125	77	0	333	200
Std dev	0	0	0	490	495	0	471	0	0	452	490	0	471	0	433	331	267	0	471	400
Total admissions	1	2	3	3	2	1	2	2	1	2	2	4	1	3	3	3	4	1	1	2
Innovation − Comparison Rate																				
	0	0	0	−200	−571	0	0	0	0	−286	−400	0	−333	0	−250	−125	−77	0	−333	−200

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; I1 = Innovation Q1.

Figure 4. Hospital Unplanned Readmissions Rates per 1,000 Admissions: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ECCHC= Eau Claire Cooperative Health Centers, Inc.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 11*** and ***Figure 5.***

The ED visit rate line reflects a slight downward trend in the baseline and innovation periods for both the innovation and comparison groups. Although the time series continues to follow the trend in the first four innovation quarters, it drops considerably in the fifth quarter but increases in the sixth quarter. On average, the ED visit rate is consistently higher in the innovation group, but further statistical testing with multivariate analyses would be required to determine whether the effect is driven by the innovation. Unfortunately, the sample size is too small to support regression analysis. Note that the ED visit rate in the Calendar quarter prior to enrollment variable was not included in PSM because of the limited sample size.

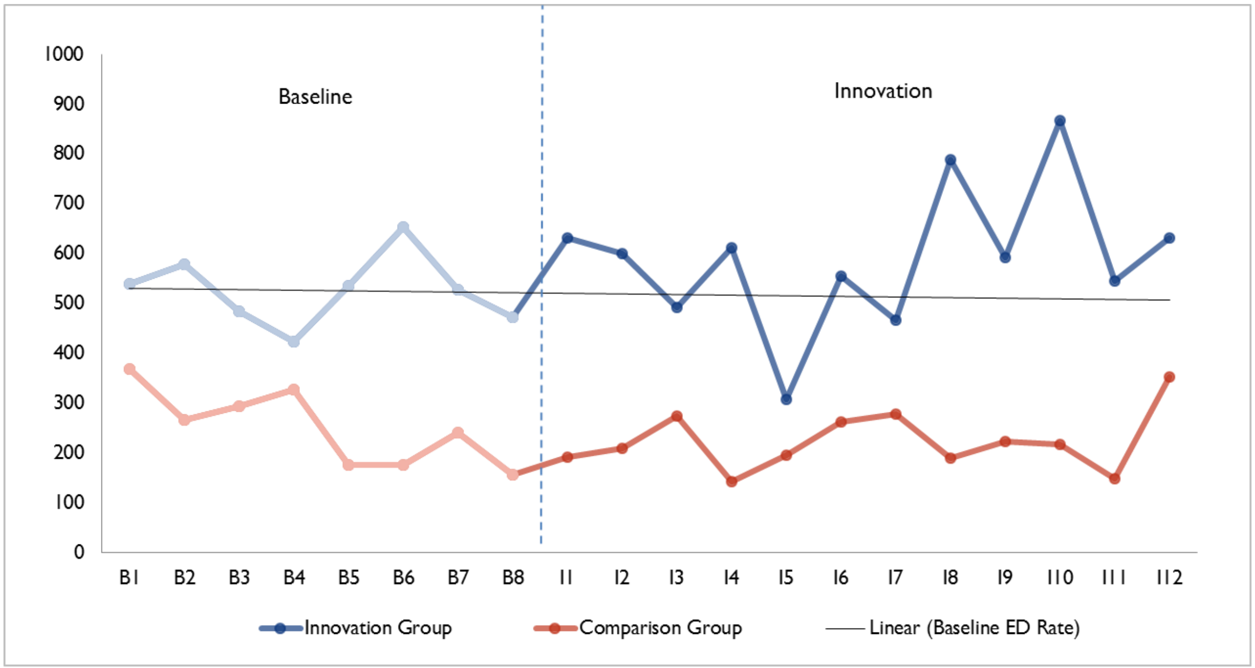
Table 11. ED Visits per 1,000 Participants: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
ED rate	540	578	485	424	535	653	527	474	632	600	493	612	308	556	468	789	592	867	545	632
Std dev	2,161	2,724	1,721	1,746	2,137	2,563	1,932	1,536	2,285	3,045	1,491	1,915	999	1,990	1,544	3,654	1,743	2,581	1,394	1,606
Unique patients	63	64	66	66	71	72	74	76	76	75	69	67	65	63	62	57	49	45	33	19
Comparison Group																				
ED rate	369	268	294	327	176	177	241	158	193	211	274	144	195	262	278	190	224	218	148	353
Std dev	1,392	687	588	608	308	302	456	298	337	359	423	280	307	516	469	373	395	341	247	465
Unique patients	65	66	68	69	72	73	75	76	76	76	75	72	70	69	66	61	55	49	36	23
Innovation − Comparison Rate																				
	170	310	191	97	359	476	286	316	439	389	218	468	112	293	190	599	368	649	397	279

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; ED = emergency department; I1 = Innovation Q1.

Figure 5. ED Visits per 1,000 Participants: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.; ED = emergency department.

2.8 Discussion: Medicare Results

The relatively small number of Medicare beneficiaries enrolled in the ECCHC innovation hinders the ability to obtain statistically significant evidence that the innovation affected spending and health care utilization among enrolled individuals. A larger sample size is required to draw firm conclusions about the impact of the ECCHC innovation.

The results may not fully represent the overall population served by the innovation. The results presented here are for Medicare beneficiaries who we were able to match with the identifiers provided by the site. These beneficiaries represent 5 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending.

2.9 Medicaid Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicaid claims data through June 2014. The Medicaid claims analysis focuses on 274 Medicaid beneficiaries enrolled in fee-for-service Medicaid during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in Richland County, South Carolina, during the innovation launch.

We use PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. We estimate two separate models for beneficiaries with and without Medicaid in the previous calendar quarter. For beneficiaries with Medicaid in the previous calendar quarter, innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, number of ED visits in the calendar quarter prior to the innovation, and total Medicaid payments in the calendar quarter prior to the innovation. For beneficiaries without Medicaid in the previous calendar quarter, innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 12 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 6*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Two innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 12. Mean Values and Standardized Differences of Variables in Propensity Score Model: ECCHC

Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Medicaid in previous quarter										
Payments in calendar quarter prior to enrollment	1,155.65	3,655.49	1,288.11	5,338.16	0.03	956.47	3,038.27	808.98	2,566.38	0.05
Age	39.46	22.34	32.89	26.27	0.27	39.36	22.36	39.37	24.02	0.00
Percentage dual eligible	33.18	47.20	38.04	48.55	0.10	33.49	47.20	32.22	46.73	0.03
Percentage female	67.30	47.02	58.16	49.33	0.19	67.94	46.67	65.39	47.57	0.05
Percentage nonwhite	96.21	19.14	81.05	39.19	0.49	96.17	19.19	96.17	19.19	0.00
Percentage disabled	29.86	45.87	34.33	47.48	0.10	29.19	45.46	34.29	47.47	0.11
Number of ED visits in calendar quarters prior to enrollment	0.72	3.34	0.21	0.85	0.21	0.42	1.28	0.24	0.86	0.16
Number of beneficiaries	211	—	12,0410	—	—	209	—	627	—	—
Number of unique beneficiaries[1]	—	—	25,999	—	—	209	—	602	—	—
Number of weighted beneficiaries	—	—	—	—	—	209	—	209	—	—
No Medicaid in previous quarter										
Age	34.54	19.05	12.78	13.07	1.33	34.54	18.90	34.38	19.44	0.01
Percentage dual eligible	18.46	39.10	1.87	13.53	0.57	18.46	38.80	17.44	37.94	0.03
Percentage female	67.69	47.13	59.57	49.08	0.17	67.69	46.77	72.31	44.75	0.10
Percentage nonwhite	96.92	17.40	86.61	34.06	0.38	96.92	17.27	97.44	15.81	0.03
Percentage disabled	18.46	39.10	4.83	21.43	0.44	18.46	38.80	17.95	38.38	0.01
Number of beneficiaries	65	—	16,346	—	—	65	—	195	—	—
Number of unique beneficiaries[1]	—	—	15,523	—	—	65	—	162	—	—
Number of weighted beneficiaries	—	—	—	—	—	65	—	65	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

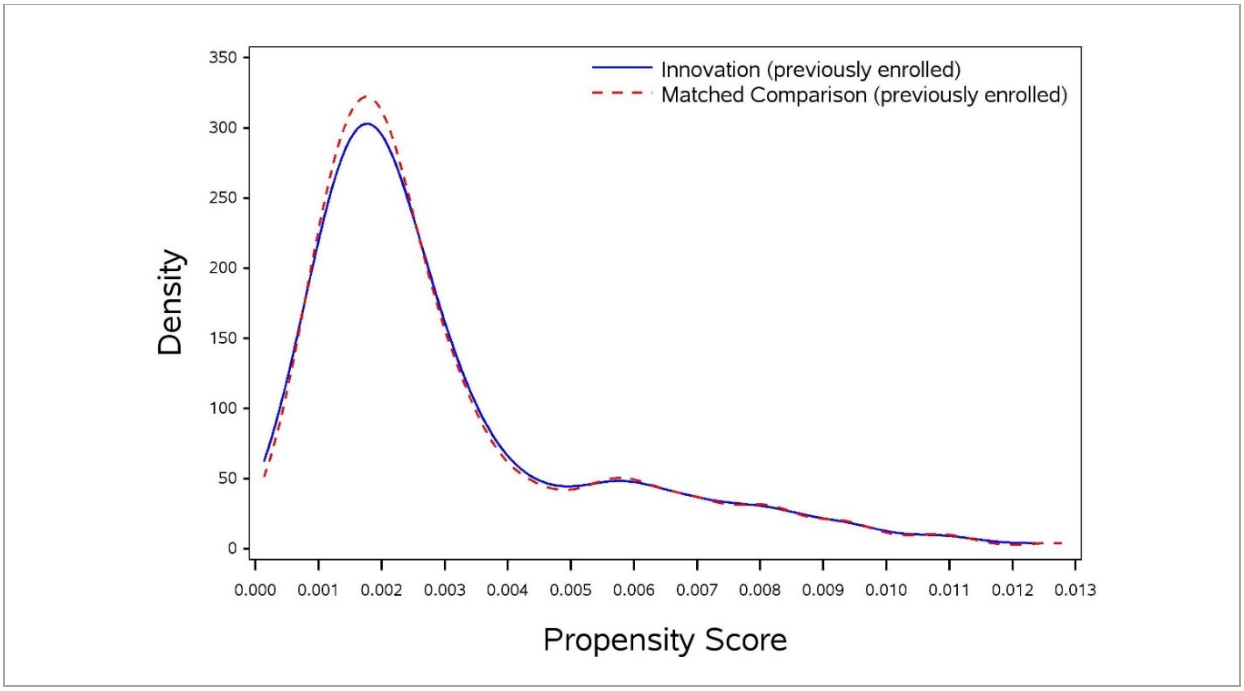
ECCHC = Eau Claire Cooperative Health Centers, Inc.; ED = emergency department; SD = standard deviation.

— Not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 12). The results in Table 12 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. Two variables, percentage disabled and number of ED visits in calendar quarter prior to enrollment, in the model including beneficiaries with Medicaid in the previous quarter, did not meet the criteria for acceptable balance (standardized difference ≤ 0.10). The corresponding standardized differences after matching are > 0.10 (0.11 and 0.16, respectively). With a small pool of innovation beneficiaries, comparison beneficiaries that match innovation beneficiaries along every dimension may not exist. Lack of balance on a particular variable does not imply lack of overall balance between the innovation and comparison groups. In PSM, innovation and comparison individuals are matched on the basis of the propensity score, which is the individual's predicted probability of innovation using information on all characteristics in the propensity score model. The model that only included beneficiaries with no Medicaid in the previous calendar quarter achieved adequate balance for all variables.

Figure 6 shows the distributions of the propensity scores for both the innovation and comparison groups for beneficiaries with and without Medicaid in the previous quarter. The innovation and comparison distributions overlap substantially, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries.

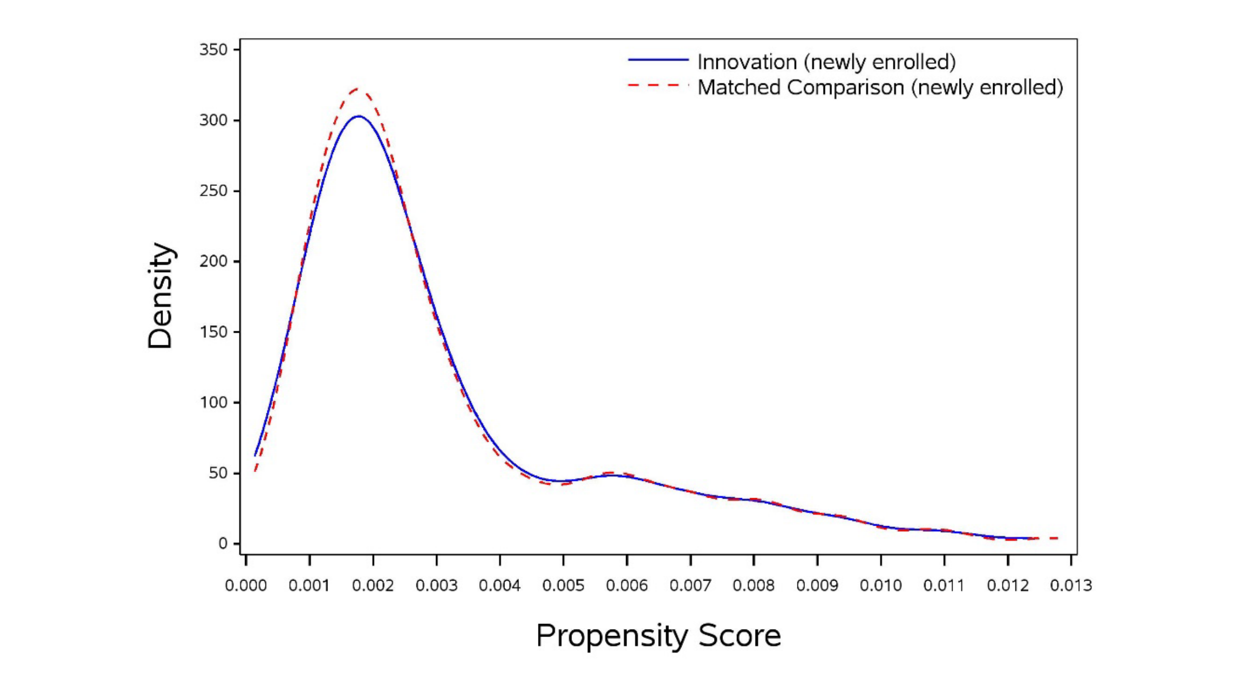
Figure 6. Distribution of Propensity Scores for Comparison and Innovation Groups: ECCHC Medicaid in Previous Quarter



(continued)

Figure 6. Distribution of Propensity Scores for Comparison and Innovation Groups: ECCHC (continued)

No Medicaid in Previous Quarter



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 13 reports Medicaid spending per patient in the eight quarters before and the six quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 7*** illustrates the Medicaid spending per beneficiary in Table 13 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

Spending over time declines for both the innovation and comparison groups in the baseline period, and follows a similar trend for both groups in the innovation period. In innovation quarters, average spending for the innovation group increases relative to the trend line in innovation quarter 2 (I2) returning to the trend line in I3 through I5. As Table 13 shows, the standard deviation for spending is very high. A similar trend in spending is observed among comparison group individuals.

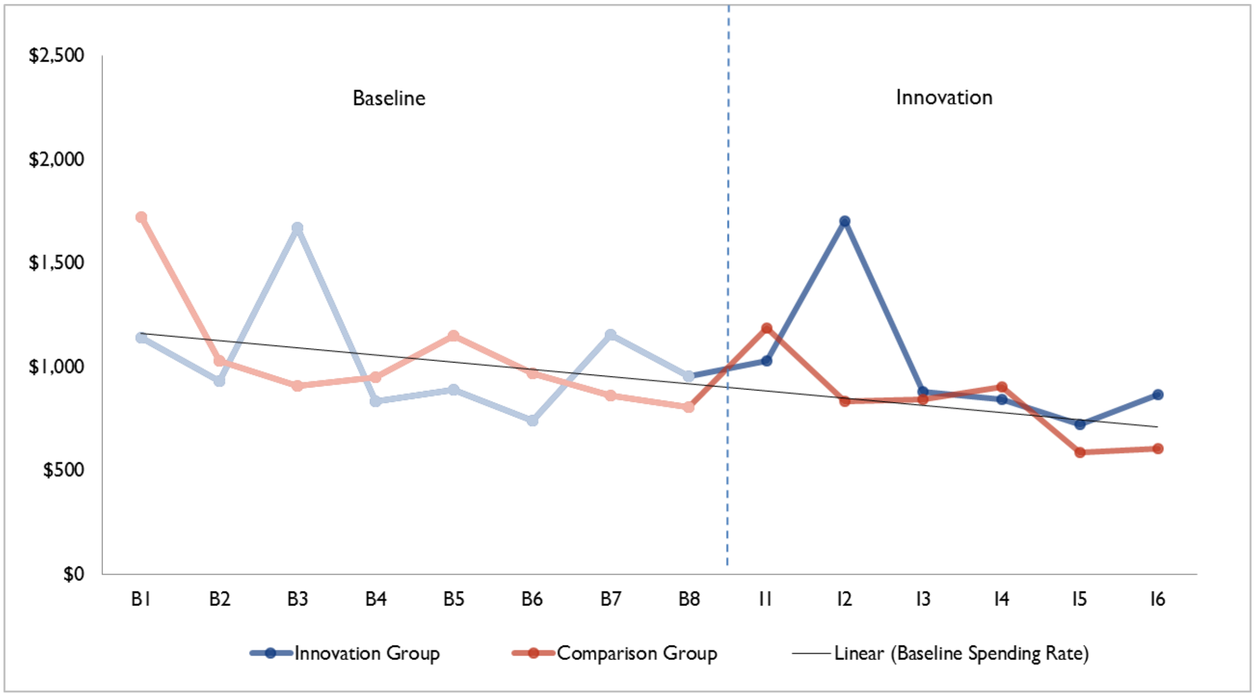
Table 13. Medicaid Spending per Participant: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Spending rate	$1,141	$932	$1,674	$834	$890	$742	$1,158	$956	$1,031	$1,705	$884	$845	$725	$867
Std dev	$2,658	$2,279	$5,734	$2,318	$2,550	$2,415	$6,552	$3,046	$3,538	$15,161	$2,673	$2,457	$2,241	$2,565
Unique patients	114	118	124	142	161	162	178	209	274	224	179	145	97	49
Comparison Group														
Spending rate	$1,721	$1,031	$911	$953	$1,152	$969	$863	$809	$1,190	$834	$844	$905	$589	$608
Std dev	$7,174	$2,309	$1,857	$1,770	$2,611	$1,830	$1,618	$1,513	$4,885	$1,650	$1,619	$1,636	$1,129	$1,129
Unique patients	174	182	181	184	189	191	198	209	274	221	179	150	101	47
Savings per Patient														
	0	$580	$99	−$763	$120	$262	$227	−$295	−$147	$159	−$871	−$40	$59	−$135

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; I1 = Innovation Q1.

Figure 7. Medicaid Spending per Participant: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.

2.10.2 Regression Results

We present the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their matched comparison group in ***Table 14***. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $132 (90% CI: −$345, $609). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence. The overall aggregate spending in the innovation period, also indicating losses, is $127,445 (90% CI: -$334,698, $589,587). This effect is not statistically significant.

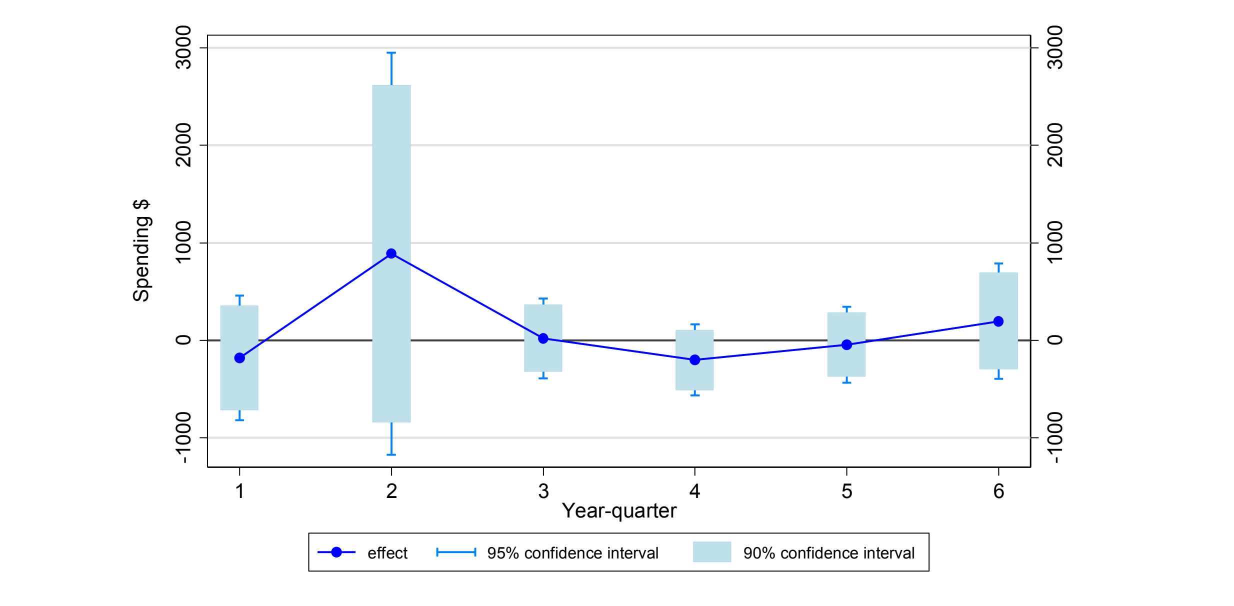
In addition to the average effect over the innovation period, we present quarterly effects. ***Table 14*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 8*** illustrates these quarterly difference-in-differences estimates. None of the quarterly effects are significant.

Table 14. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: ECCHC

Quarter	Coefficient	Standard Error	P-Values
I1	−182	326	0.576
I2	887	1,052	0.399
I3	17	209	0.937
I4	−203	186	0.276
I5	−46	199	0.818
I6	195	301	0.518
Overall average	132	290	0.45
Overall aggregate	127,445	280,705	0.45
Overall aggregate (IY1)	122,326	272,750	0.45
Overall aggregate (IY2)	5,118	31,488	0.16

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and persons without spending data in the quarter before enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; ECCHC = Eau Claire Cooperative Health Centers, Inc.; OLS = ordinary least squares.

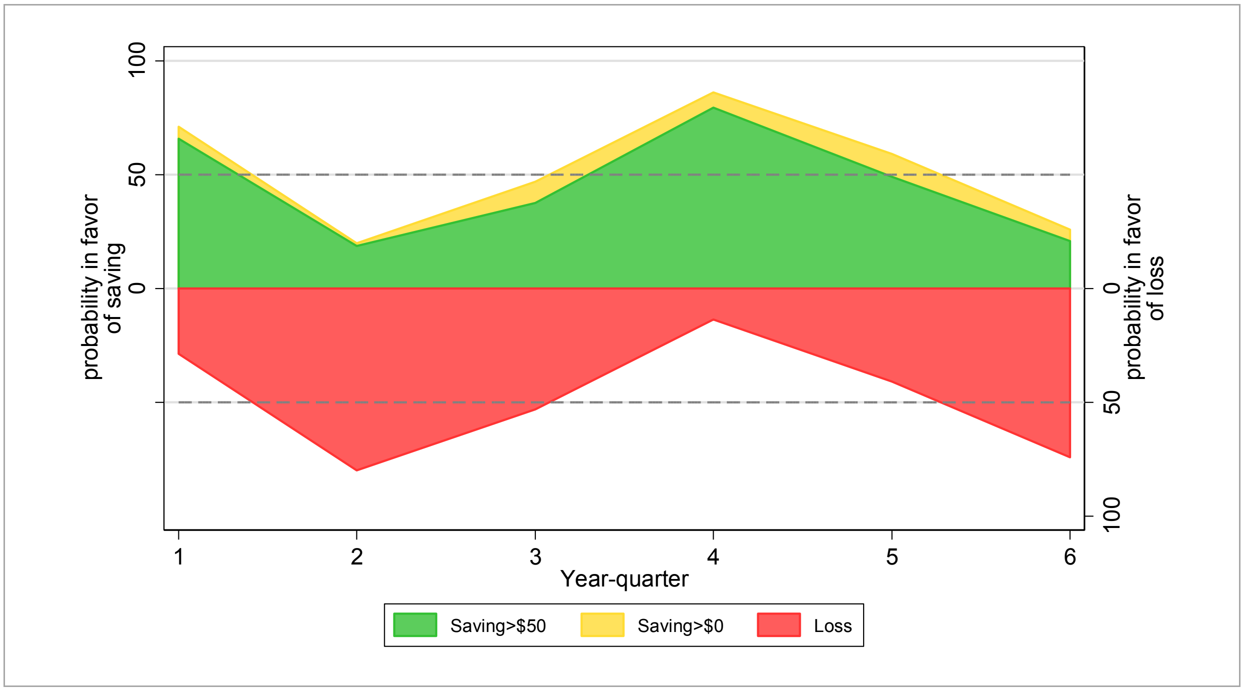
Figure 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.; OLS = ordinary least squares.

Figure 9 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The evidence in Figure 9 supports the conclusion that the intervention generated a small loss.

Figure 9. Quarterly Strength of Evidence in Favor of Savings/Loss: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC= Eau Claire Cooperative Health Centers, Inc.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 15*** and ***Figure 10***. During the baseline period, the inpatient admissions rate is similar for the innovation and comparison groups and follows a downward trend. The inpatient admissions rate falls below the baseline trend line beginning in I3 through I6. A similar trend is observed for the comparison group in the innovation period.

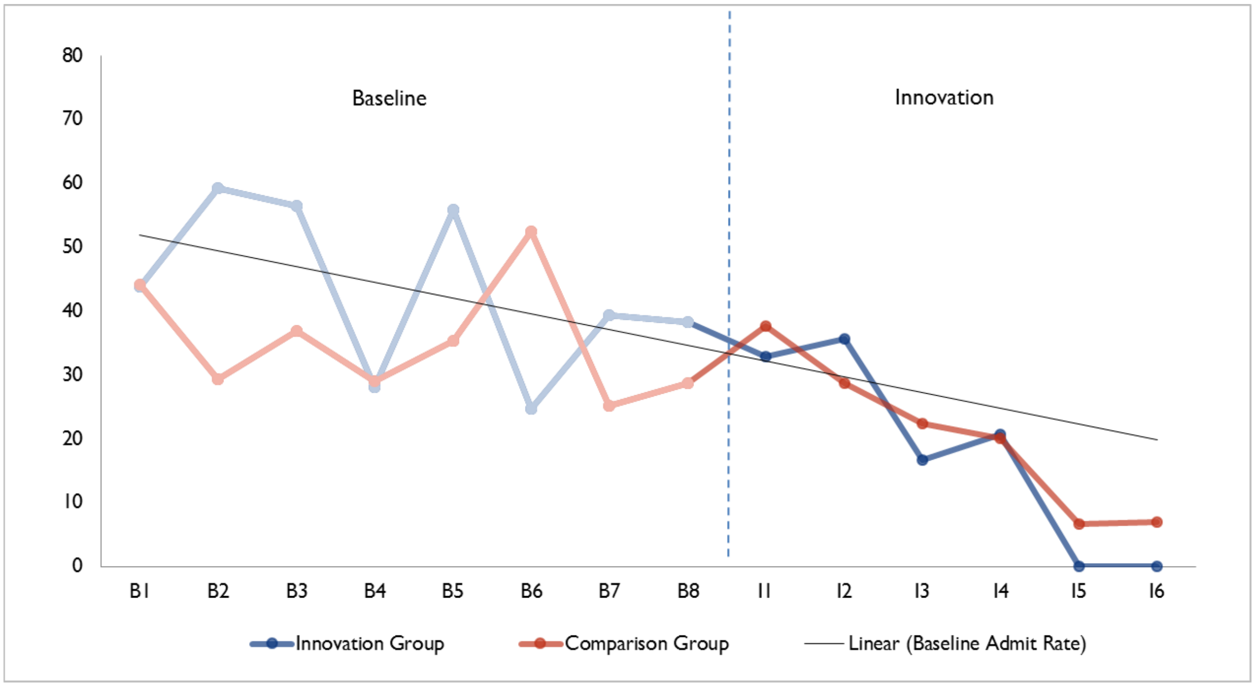
Table 15. All-Cause Inpatient Admissions Rate per 1,000 Participants: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Admit rate	44	59	56	28	56	25	39	38	33	36	17	21	0	0
Std dev	206	271	232	166	279	156	195	192	198	209	129	143	0	0
Unique patients	114	118	124	142	161	162	178	209	274	224	179	145	97	49
Comparison Group														
Admit rate	44	29	37	29	35	52	25	29	38	29	22	20	7	7
Std dev	127	139	118	100	110	141	93	104	135	110	88	83	48	50
Unique patients	174	182	181	184	189	191	198	209	274	221	179	150	101	47
Innovation − Comparison Rate														
	0	30	20	−1	21	−28	14	10	−5	7	−6	1	−7	−7

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; I1 = Innovation Q1.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.

2.11.2 Regression Results

Because of a limited number of observations, we were only able to estimate the count regression with four quarters of innovation data. The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 10 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −24, 4). In addition to the average effect over the innovation period, we present quarterly effects.

Table 16 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The quarterly effects show mostly decreases in inpatient hospital admissions and are not significant in any innovation quarter.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Participants: ECCHC

Quarter	Coefficient	Standard Error	P-Values
I1	−15	17	0.406
I2	0	17	0.997
I3	−12	15	0.407
I4	−12	15	0.415
Overall average	−10	9	0.259
Overall aggregate	−7	7	0.259
Overall aggregate (IY1)	−7	7	0.259

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and persons without spending data in the quarter before enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

ECCHC = Eau Claire Cooperative Health Centers, Inc.; I = Innovation Quarter; IY = Innovation Year.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 17*** and ***Figure 11***. Readmissions rates are highly variable in the baseline and innovation periods, reflecting the relatively small number of hospital admissions for participants during each quarter. With few admissions (the denominator in the readmission rate) and a relatively low underlying percentage of readmissions, the readmissions rate varies widely over time.

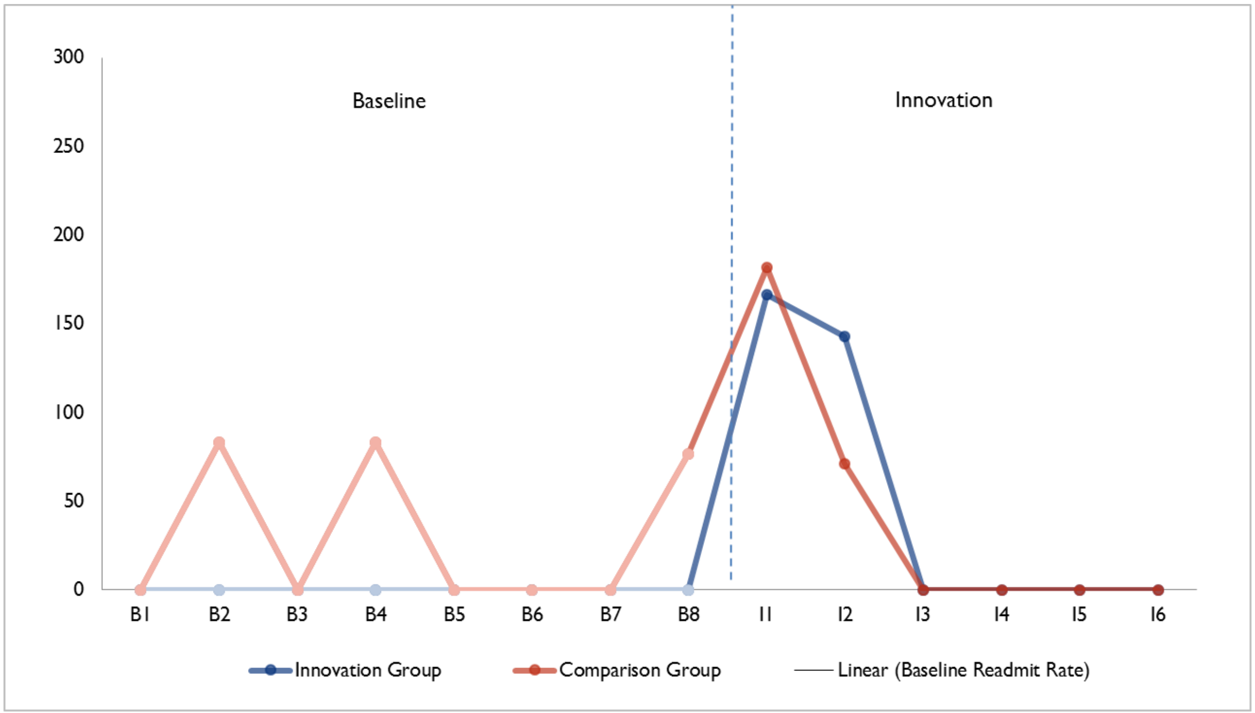
Table 17. Hospital Unplanned Readmissions Rates per 1,000 Admissions: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Readmit rate	0	0	0	0	0	0	0	0	167	143	0	0	0	0
Std dev	0	0	0	0	0	0	0	0	373	350	0	0	0	0
Total admissions	4	7	5	3	6	3	6	3	6	7	0	1	0	0
Comparison Group														
Readmit rate	0	83	0	83	0	0	0	77	182	71	0	0	0	0
Std dev	0	276	0	276	0	0	0	266	386	258	0	0	0	0
Total admissions	5	4	5	4	5	8	4	4	7	5	3	2	1	0
Innovation − Comparison Rate														
	0	−83	0	−83	0	0	0	−77	−15	71	0	0	0	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; I1 = Innovation Q1.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Admissions: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.

2.12.2 Regression Results

We do not present regression results on unplanned readmissions due to the few observed readmissions in the data (10 total over the time period for the innovation and comparison groups), resulting in a lack of variation necessary for multivariate regression.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 18*** and ***Figure 12.*** ED visits follow a downward baseline trend. The trend is similar between the innovation and comparison groups. In all baseline and innovation periods the number of ED visits are higher for the innovation group than the comparison group. ED visits drop below the baseline trend line beginning in I5 through I6 for both the innovation and comparison groups.

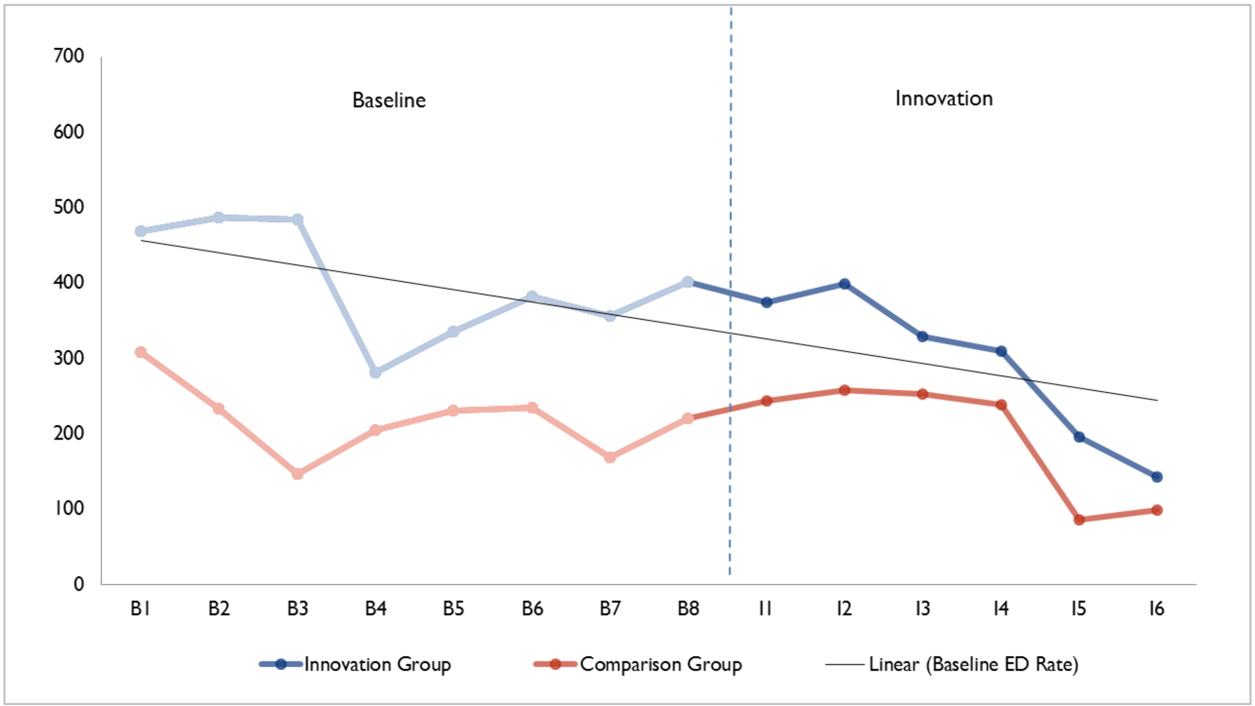
Table 18. ED Visits per 1,000 Participants: ECCHC

Awardee Number: 1C1CMS331045
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
ED rate	469	487	484	282	335	383	357	402	374	400	330	310	196	143
Std dev	1,793	1,690	1,584	1,006	960	1,709	1,288	1,270	1,335	2,009	904	1,109	687	500
Unique patients	114	118	124	142	161	162	178	209	274	224	179	145	97	49
Comparison Group														
ED rate	309	234	147	205	231	234	168	220	243	258	253	238	86	99
Std dev	1,066	482	339	445	401	490	377	484	502	572	495	620	260	285
Unique patients	174	182	181	184	189	191	198	209	274	221	179	150	101	47
Innovation−Comparison Rate														
	160	253	337	77	104	148	189	182	131	142	77	72	110	44

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.; ED = emergency department; I1 = Innovation Q1.

Figure 12. ED Visits per 1,000 Participants: ECCHC



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ECCHC = Eau Claire Cooperative Health Centers, Inc.; ED = emergency department.

2.13.2 Regression Results

As shown in ***Table 19***, the average quarterly difference-in-differences estimate for ED visits is −106 per 1,000 participants, indicating that the ED visit rate is lower during the innovation period. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −179, −33). The overall aggregate ED visit rate in the innovation period is −97 (90% CI: −163, −32). This effect is also statistically significant.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 19*** presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. All but one of the quarterly estimates are negative, and I3 is statistically significant.

Table 19. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Participants: ECCHC

Quarter	Coefficient	Standard Error	P-Values
I1	−90	89	0.312
I2	−88	106	0.407
I3	−224	115	0.053
I4	−128	100	0.201
I5	32	66	0.627
I6	−57	87	0.513
Overall average	−106	44	0.017
Overall aggregate	−97	41	0.017
Overall aggregate (IY1)	−97	40	0.015
Overall aggregate (IY2)	0	8	0.980

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and persons without spending data in the quarter before enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
ECCHC = Eau Claire Cooperative Health Centers, Inc.; ED = emergency department; I = Innovation Quarter; IY = Innovation Year.

2.14 Discussion: Medicaid Results

The innovation does not have statistically significant effects on Medicaid spending per patient or inpatient admissions, but it is associated with significantly fewer ED visits. The results may not fully represent the overall population served by the innovation. The results presented here are only for fee-for-service Medicare beneficiaries who we were able to match with the identifiers provided by the site. These beneficiaries represent 17 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

ECCHC submitted data to RTI that are current through June 2015. ***Table 20*** lists the awardee-specific outcome measures selected for the innovation's evaluation, with an indication of the status of the data requested and whether the data are presented in this annual report. This annual report includes the results of the analyses of all of these measures.

Table 20. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Diabetes	Percentage of patients with diabetes who received a foot exam	Data received from ECCHC	Yes
		Percentage of patients with diabetes who received a hemoglobin A1c test	Data received from ECCHC	Yes
	Hypertension	Percentage of patients with hypertension who received BMI assessment	Data received from ECCHC	Yes
		Percentage of patients with hypertension who received a blood pressure screening	Data received from ECCHC	Yes
	Vaccination	Percentage of patients who received an influenza vaccination	Data received from ECCHC	Yes
		Percentage of patients who received a pneumococcal vaccination	Data received from ECCHC	Yes
	Mental health	Percentage of patients screened for clinical depression using PQ9	Data received from ECCHC	Yes
Health outcomes	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c > 9.0%	Data received from ECCHC	Yes
	Hypertension	Percentage of patients who had a diagnosis of hypertension with blood pressure < 140/90 mm Hg	Data received from ECCHC	Yes
		Percentage of patients who were overweight (BMI 25.0–29.9) or obese (BMI > 30)	Data received from ECCHC	Yes
	Cardiovascular disease	Percentage of patients with CAD/hyperlipidemia who had an LDL-C result < 100 mg/dL	Data received from ECCHC	Yes

BMI = body mass index; CAD = coronary artery disease; ECCHC = Eau Claire Cooperative Health Centers, Inc.; LDL-C = low-density lipoprotein cholesterol; PQ9 = patient questionnaire.

We examined clinical effectiveness and health outcomes among patients with coronary artery disease (CAD)/hyperlipidemia, diabetes, and hypertension. The following run charts take into account rolling enrollment. The baseline quarters (Bs) represent data prior to enrollment. The innovation quarters (Is) are based on individual enrollment date. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation are more likely to have health outcome data in more innovation quarters than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tends to drop substantially as the number of quarters enrolled increases. We provide B and I data when at least 20 patients had a test or reading within the innovation quarter. When possible, we also present the linear trend line based on the pre-intervention or baseline data.

We also conducted multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time, while controlling for repeated measures (i.e., within-subject covariance). More specifically, HbA1c values among those with diabetes, LDL-C values among those with CAD/hyperlipidemia, and systolic and diastolic blood pressure values among those with hypertension were regressed onto dose (i.e., number of coaching sessions and number of home or clinic visits). We controlled for the baseline health outcome being examined in the regression (i.e., HbA1c, LDL, or blood pressure at innovation enrollment), age, sex, race, and insurance type. Changes over the innovation for each health outcome measure were examined in separate regression analyses.

2.16 Diabetes

We received data on whether patients with diabetes received an HbA1c test or a foot exam during the innovation period. This allowed us to examine whether appropriate clinical services were provided to those with diabetes during the innovation. HbA1c test result values from ECCHC were used to calculate the percentage of diabetes patients with poor HbA1c (i.e., HbA1c > 9%) over time. We also assessed the relationship between dose and HbA1c values over time.

Evaluation Questions

- What percentage of patients with diabetes received an HbA1c test during the innovation period?
- What percentage of patients with diabetes received a foot exam during the innovation period?
- Has the percentage of patients with diabetes with poor HbA1c control decreased over time?
- Is there a relationship between dose (i.e., diabetes coaching and home or clinic visits) and HbA1c values over time?

2.16.1 Descriptive Results

About 17 percent of patients enrolled in the innovation had diabetes. ***Table 21*** shows the percentage of patients with diabetes who received an HbA1c test or LDL-C test during the innovation period. More than 70 percent of patients with diabetes received an HbA1c test or a foot exam (78.8% and 70.3%, respectively).

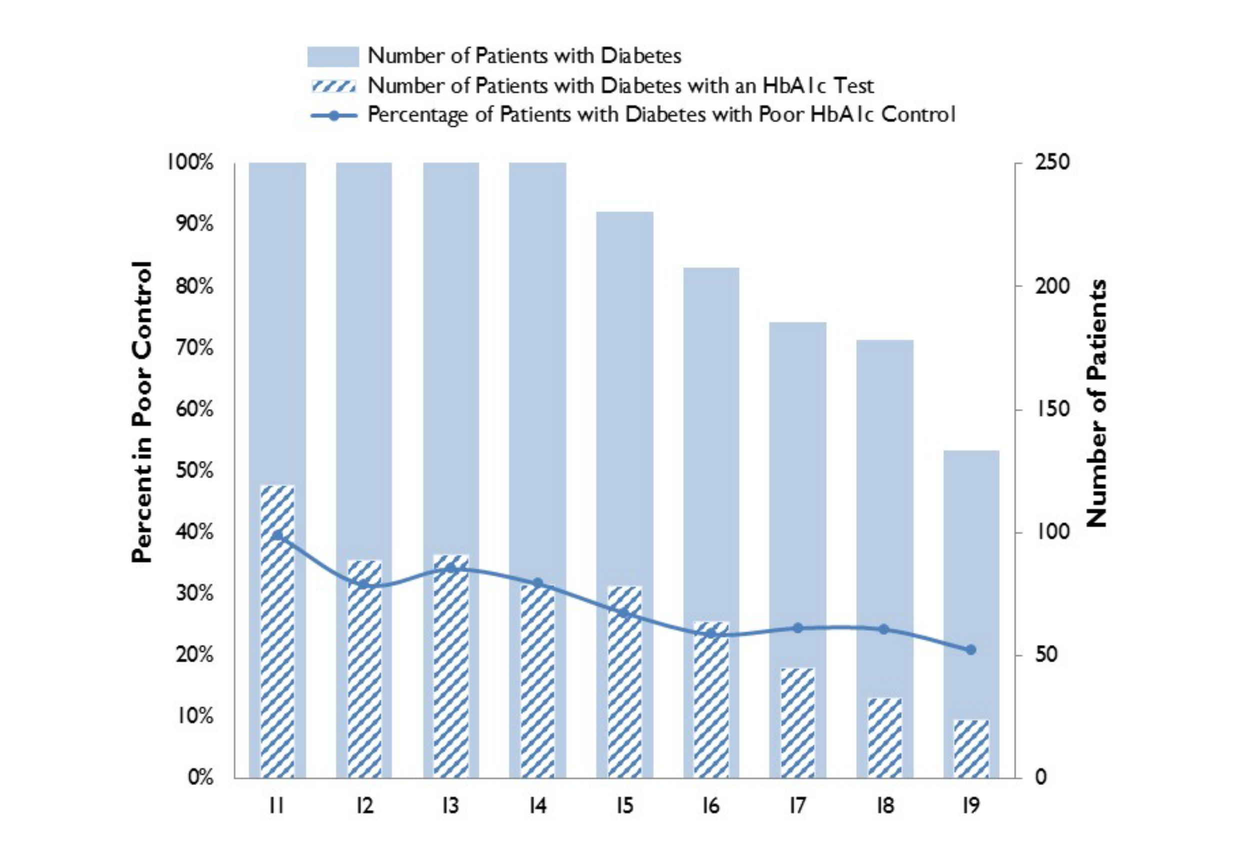
Table 21. Percentage of Patients with Diabetes who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Diabetes (n = 273)	
Percentage of patients with diabetes who received an HbA1c test	78.8
Percentage of patients with diabetes who received a foot exam	70.3

Source: Patient-level data provided to RTI by ECCHC.

Figure 13 presents the percentage of patients with diabetes who had an HbA1c test indicating poor control (HbA1c > 9%) over time. The denominator represents the number of diabetes patients who received an HbA1c test for each quarter. The numerator represents the number of diabetes patients who received an HbA1c test that was > 9.0 percent. As shown in the figure, the percentage of patients with poor HbA1c control decreased from approximately 40 percent in I1 to 21 percent by I9. This drop suggests that the innovation may be helping to reduce poor HbA1c control among its enrollees. However, the decrease in the denominator for calculating percentages over time limits our ability to make strong conclusions.

Figure 13. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9
●	Percentage of patients with diabetes with poor HbA1c control	39.5	31.5	34.1	30.8	26.0	23.4	24.4	24.2	20.8
	Number of patients with diabetes	273	260	253	249	226	203	181	174	129
	Number of patients with diabetes with an HbA1c test	119	89	91	78	77	64	45	33	24

Source: Patient-level data provided to RTI by ECCHC.

2.16.2 Regression Results

Table 22 presents the results from the GEE assessing the impact of dose (i.e., number of diabetes coaching sessions and number of home or clinic visits) on HbA1c values over time among those with diabetes. We found a statistically significant relationship between number of diabetes coaching sessions and HbA1c values over time, which suggests that a larger number of diabetes coaching sessions was related to higher (worse) HbA1c values over time. Thus, those patients who had more difficulty with their HbA1c values received more coaching sessions over the course of the innovation.

Table 22. Impact of Dose on HbA1c Values among Those with Diabetes over Time

Predictor	Coefficient	Standard Error	P-Value
Diabetes coaching sessions	0.03	0.01	0.00
Home or clinic visits	0.01	0.02	0.45

Source: Patient-level data provided to RTI by ECCHC.

2.17 Hypertension

ECCHC provided data on whether patients with hypertension received a blood pressure reading or a body mass index (BMI) assessment, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation. We used the blood pressure values from ECCHC to calculate the percentage of patients with hypertension with blood pressure control (i.e., < 140/90 mm Hg). ***Figure 14*** provides these percentages over time by quarter. We also assessed the relationship between dose and blood pressure values over time.

Evaluation Questions

- What percentage of patients with hypertension received a blood pressure reading during the innovation period?
- What percentage of patients with hypertension received a BMI assessment during the innovation period?
- Has the percentage of hypertension patients with blood pressure control increased over time among those enrolled in the innovation?
- Is there a relationship between dose (i.e., hypertension coaching and home or clinic visits) and systolic and diastolic blood pressure values over time?

2.17.1 Descriptive Results

One-third of enrolled patients had hypertension. ***Table 23*** shows that nearly all patients with hypertension received a blood pressure reading or BMI assessment during the innovation period.

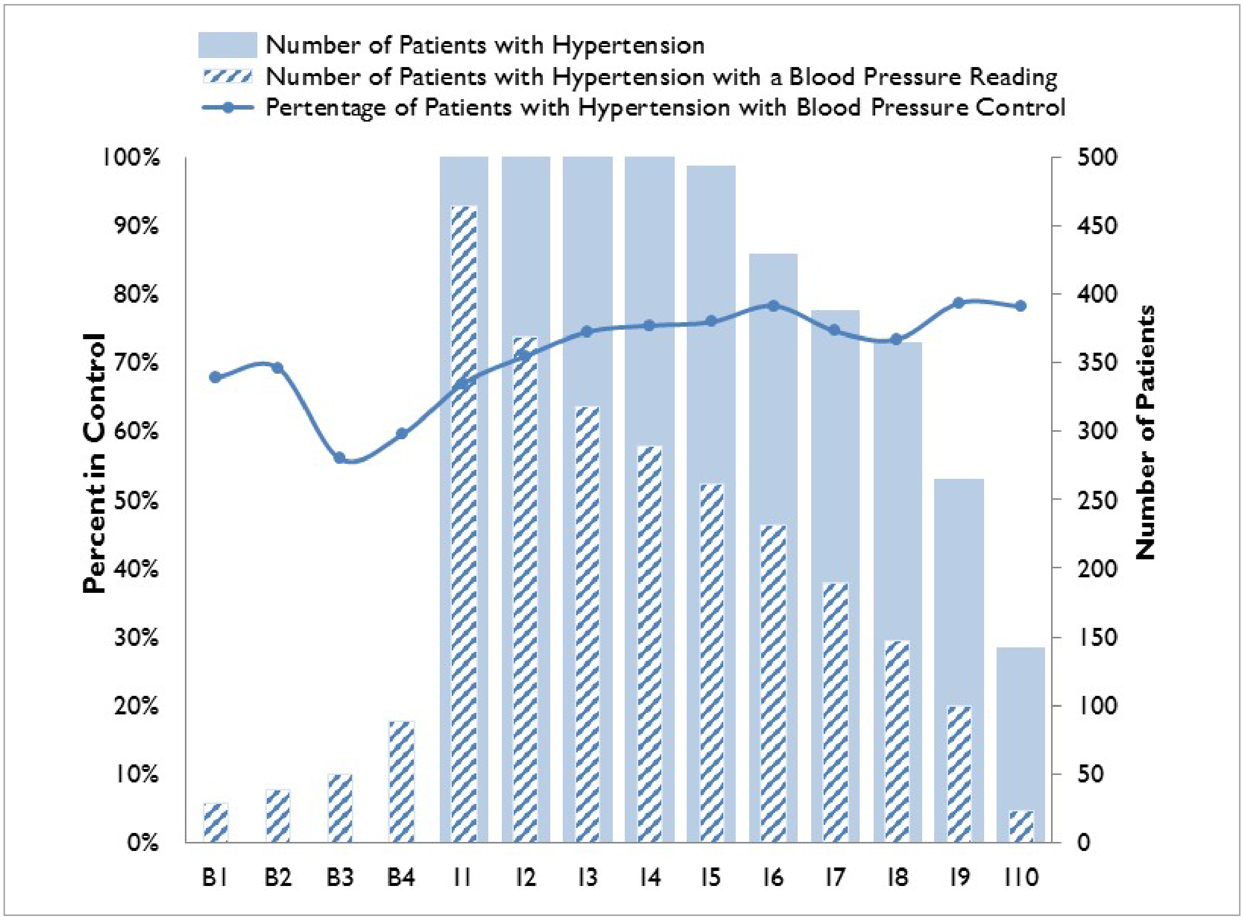
Table 23. Percentage of Patients with Hypertension who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Hypertension (n = 553)	
Percentage of patients with hypertension who received a blood pressure reading	97.8
Percentage of patients with hypertension who received BMI assessment	95.5

Source: Patient-level data provided to RTI by ECCHC.
BMI = body mass index.

Figure 14 presents the percentage of participants with hypertension who had a blood pressure reading within the quarter indicating good control (< 140/90 mm Hg) over time. The denominator represents the number of hypertension patients who received a blood pressure reading for each quarter. The numerator represents the number of hypertension patients who received a blood pressure reading that was < 140/90 mm Hg. As shown in the figure, the percentage of hypertension patients with blood pressure control fluctuated over time, but increased overall between baseline and I10. More specifically, the percentage of patients with blood pressure control was approximately 63 percent in the baseline quarters, and rose to nearly 80 percent in I10. Thus, the percentage of patients with hypertension with blood pressure control increased during the innovation period. Note, however, that the denominator decreased across the innovation quarters, making any interpretation of the findings tentative.

Figure 14. Percentage of Patients with Hypertension with Blood Pressure Control over Time



	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
•	Percentage of patients with hypertension with blood pressure control	67.9	69.2	56.0	59.6	67.2	71.5	74.5	75.6	76.1	78.8	74.6	73.5	79.0	79.2
	Number of patients with hypertension	—	—	—	—	553	544	535	532	485	421	380	356	256	133
	Number of patients with hypertension with a blood pressure reading	28	39	50	89	464	369	318	290	263	231	189	147	100	24

Source: Patient-level data provided to RTI by ECCHC.
— Data not available.

2.17.2 Regression Results

Results from the GEE assessing the impact of dose (i.e., number of hypertension coaching sessions and number of home or clinic visits) on systolic and diastolic blood pressure values over time among those with hypertension are shown in ***Table 24***. The number of hypertension coaching sessions ranged from 1 to 13, with an average of 2.1 sessions, per quarter. The number of home or clinic visits for those with hypertension ranged from 1 to 23, with an average of 4.1 visits, per quarter. There was a significant effect for home or clinic visits among those with hypertension and systolic (but not diastolic) blood pressure values. That is, a greater number of home or clinic visits was related to lower (better) systolic blood pressure values over time.

Table 24. Impact of Dose on Systolic and Diastolic Blood Pressure Values among Those with Hypertension over Time

Predictor	Coefficient	Standard Error	P-Value
Systolic Blood Pressure			
Hypertension coaching sessions	0.37	0.35	0.30
Home or clinic visits	–0.32	0.17	0.06
Diastolic Blood Pressure			
Hypertension coaching sessions	–0.05	0.23	0.82
Home or clinic visits	–0.01	0.11	0.92

Source: Patient-level data provided to RTI by ECCHC.

2.18 CAD/Hyperlipidemia

Only about 1 percent of patients had CAD/hyperlipidemia. We used the low-density lipoprotein cholesterol (LDL-C) values from ECCHC to calculate the percentage of patients with CAD/hyperlipidemia with LDL-C control (< 100). We also assessed the relationship between dose and LDL-C values over time.

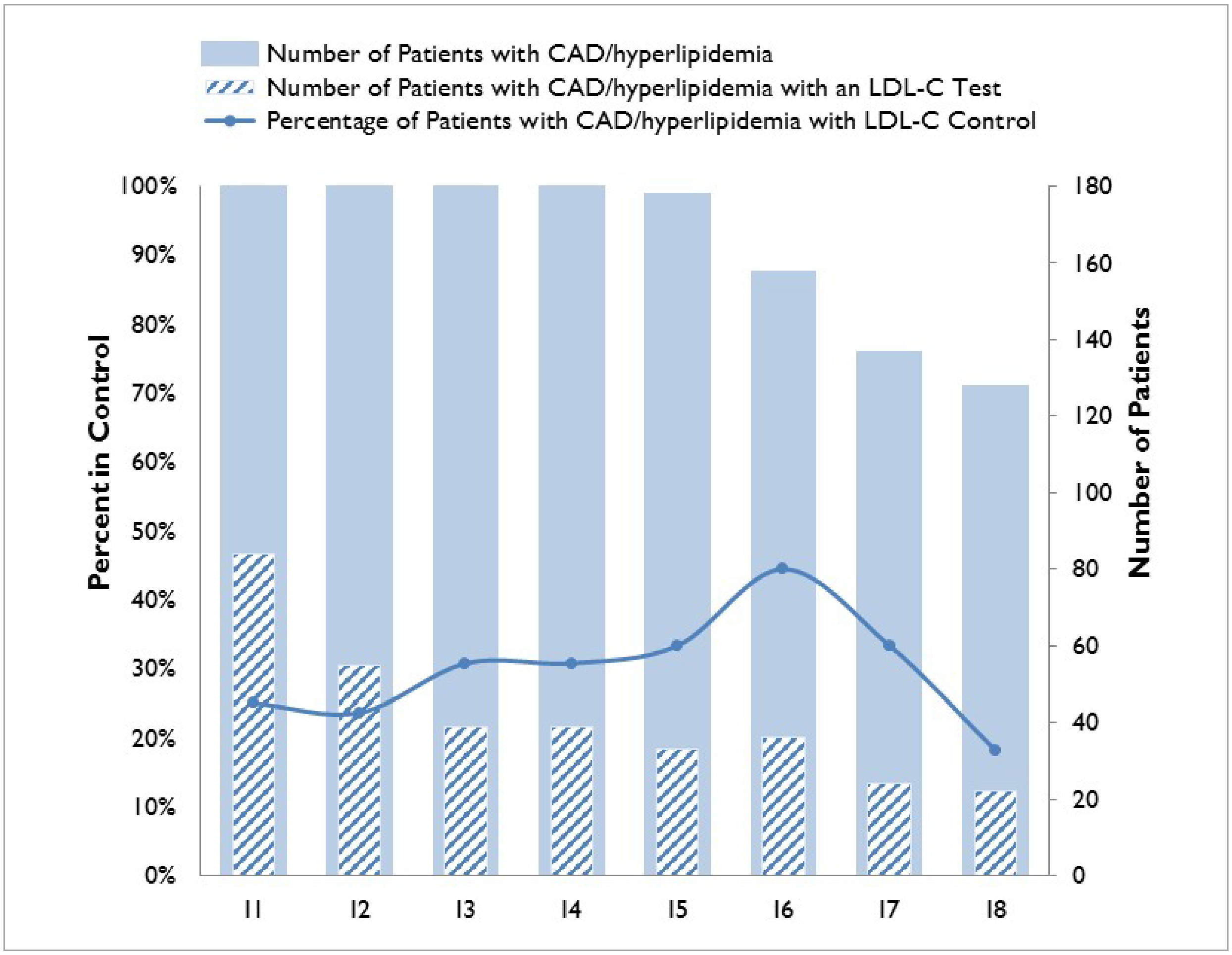
Evaluation Questions:

- Has the percentage of CAD/hyperlipidemia patients with LDL-C control increased over time among those enrolled in the innovation?
- Is there a relationship between dose (i.e., hypertension coaching and home or clinic visits) and LDL-C values over time?

2.18.1 Descriptive Results

Approximately 13 percent of patients had CAD/hyperlipidemia. Of those, less than one-half (40.6%) received at least one LDL-C test during the innovation period. ***Figure 15*** presents the percentage of patients with CAD/hyperlipidemia who had an LDL-C test indicating good control (< 100) over time. The denominator represents the number of CAD/hyperlipidemia patients who received an LDL-C test for each quarter. The numerator represents the number of CAD/hyperlipidemia patients who received an LDL-C test that was < 100. As shown in the figure, the percentage of patients with LDL-C control increased slowly over time between I1 and I6, from approximately 25 percent in I1 to approximately 44 percent by I6, before decreasing in I7 and I8 (33.3% and 18.2%, respectively). This suggests that LDL-C control did not improve over time for CAD/hyperlipidemia patients enrolled in the innovation. It is important to note that the denominator changes dramatically over time, making any interpretation of the findings tentative.

Figure 15. Percentage of Patients with CAD/Hyperlipidemia with LDL-C Control over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8
●	Percentage of patients with CAD/hyperlipidemia with LDL-C control	25.0	23.6	30.8	30.8	33.3	44.4	33.3	18.2
	Number of patients with CAD/hyperlipidemia	207	203	197	196	175	155	134	125
	Number of patients with CAD/hyperlipidemia with an LDL-C test	84	55	39	39	33	36	24	22

Source: Patient-level data provided to RTI by ECCHC.
CAD = coronary artery disease; LDL-C = low-density lipoprotein cholesterol.

2.18.2 Regression Results

Table 25 presents the results from the GEE assessing the impact of dose (i.e., number of diabetes coaching sessions and number of home or clinic visits) on LDL-C values over time among those with CAD/hyperlipidemia. We found a statistically significant relationship between number of home or clinic visits and LDL-C values, suggesting that a greater number of home or clinic visits was associated with higher (worse) LDL-C values over time (Table 25). There was also a significant effect for innovation quarter, showing improvement in LDL-C values among patients with CAD/hyperlipidemia over the innovation period, regardless of dose.

Table 25. Impact of Dose on LDL-C Values among Those with CAD/Hyperlipidemia over Time

Predictor	Coefficient	Standard Error	P-Value
LDL-C coaching sessions	–1.08	1.55	0.49
Home or clinic visits	1.87	0.88	0.03

Source: Patient-level data provided to RTI by ECCHC.
CAD = coronary artery disease; LDL-C = low-density lipoprotein cholesterol.

2.19 Mental Health

We also received data from ECCHC on whether patients enrolled in the innovation were screened for depression. The project team added depression screening for all new innovation enrollees early in the implementation period, after they determined that many patients presenting with chronic conditions had mental health comorbidities.

Evaluation Question

- What percentage of patients were screened for depression during the innovation period?

2.19.1 Descriptive Results

As shown in ***Table 26,*** approximately 30 percent of all patients were screened for clinical depression during the innovation period. ECCHC reported that depression screenings were typically completed only among new innovation enrollees, and some staff neglected to conduct screenings or record depression scores for participants enrolled during the first year of implementation.

Table 26. Percentage of Patients with Depression who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Mental Health	
Percentage of all patients screened for clinical depression	29.1

Source: Patient-level data provided to RTI by ECCHC.

2.20 Immunization and Vaccination

We received data from ECCHC on whether patients received an influenza immunization or pneumococcal vaccination.

Evaluation Questions

- What percentage of patients received an influenza immunization during the innovation period?
- What percentage of patients received a pneumococcal vaccination during the innovation period?

2.20.1 Descriptive Results

As shown in ***Table 27,*** approximately 12 percent of all patients enrolled in the innovation received an influenza immunization, and about 14 percent of patients 65 or older received a pneumococcal vaccination during the innovation period. Innovation staff reported that data from electronic health records (EHR) did not include when patients may have had pneumococcal vaccinations prior to the innovation, which reduced the likelihood that the community health team would offer this service to their patients. Staff likewise reported that uninsured patients were unwilling to pay for influenza immunization, that many patients refused immunization, and that immunization efforts were concentrated during the flu season.

Table 27. Percentage of Patients who Received Immunizations and Vaccinations

Measure	Percentage of Patients Receiving Clinical Services
Immunizations and Vaccinations	
Percentage of all patients who received an influenza immunization	12.2
Percentage of patients 65+ (n=155) who received a pneumococcal vaccination	14.2

Source: Patient-level data provided to RTI by ECCHC.

2.21 Discussion: Awardee-Specific Data

Overall, it appears that ECCHC provided the necessary clinical services to enrollees with diabetes and hypertension. Most patients with diabetes had a foot exam and an HbA1c test. Almost all patients with hypertension received a blood pressure screening and a BMI assessment. Few patients enrolled in the innovation received an influenza immunization, and few of those 65 and older received a pneumonia vaccination. Reports suggest that patients frequently refused vaccinations when they were offered. Approximately 30 percent all patients enrolled were screened for depression.

Based on the run charts, the percentage of patients with improved diabetes and hypertension outcomes increased over time. The percentage of patients with diabetes with HbA1c control and the percentage of patients with hypertension with blood pressure control increased. However, the percentage of patients with CAD/hyperlipidemia with LDL-C control decreased over time. This finding suggests that those enrolled in ECCHC's innovation are achieving better diabetes and hypertension outcomes.

However, findings must be interpreted with caution, because the number of patients decreases over the innovation quarters. It is possible that patients who were lost to attrition might have had different health outcomes than those who remained in the innovation.

The regression findings suggest that enrollment in the innovation is related to improvements, over time, in HbA1c among those with diabetes, LDL-C among those with CAD/hypertension, and systolic and diastolic blood pressure values among those with hypertension. With regard to dose, among patients with hypertension, the number of home or clinic visits was related to lower (better) systolic blood pressure over time. However, among patients with CAD/hyperlipidemia, the number of home or clinic visits was related to higher (worse) LDL-C values over time. Among patients with diabetes, the number of diabetes coaching sessions was related to lower (worse) HbA1c values over time. LDL-C and hypertension coaching sessions were not related to health outcome values over time. Thus, diabetes patients who had greater difficulty with their HbA1c levels likely received a greater number of diabetes coaching sessions to provide more support. Similarly, those with CAD/hyperlipidemia who had difficulty with their LDL-C levels likely received a greater number of home or clinic visits to provide greater support over time.

2.22 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 28*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from ECCHC's *Narrative Progress Reports and Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12, and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 28. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participants eligible for services	Data received from ECCHC
	Dose	Number of home and microclinic visits	Data received from ECCHC
		Number of disease-specific (i.e., asthma, diabetes, hypertension) coaching sessions with CHWs per patient	Data received from ECCHC

CHW = community health worker; ECCHC = Eau Claire Cooperative Health Centers, Inc.; FTE = full-time equivalent.

2.23 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.23.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was staffed with 19.23 FTE staff members, below projection by 3.95 FTEs. No new hires were reported during Year 3. As reported in the Execution of Implementation section of this report, ECCHC decided not to fill vacancies in budgeted positions for an NP and RN, because even if the positions were filled, ECCHC was unlikely to reach the number of patients anticipated. In addition to these vacancies, ECCHC experienced turnover in the CMA position, had difficulty recruiting a qualified referral specialist, and reduced the hours of existing NPs and CHWs during Year 3.

During the June 2015 EOY interviews, innovation leaders reported that clinician credentialing rules associated with the ACA contributed to hiring delays for the innovation. New guidelines required that organizations more carefully document relationships among providers, insurance companies, and patients, which hindered ECCHC from onboarding new staff or moving existing staff within the organization. Under ACA, ECCHC had to distinguish among its clinical sites and could no longer provide records that represented ECCHC as a single organization. The interviewee explained that in a health system as large as ECCHC, with 26 sites, 50 providers, and 20 insurance companies, thousands of reportable linkages are possible. The unintended consequence of the reporting change was a tremendous increase in the burden of hiring or moving providers. This change in policy affected the organization as a whole and the Innovations Health program specifically.

Turnover in the NP position undermined the success of Innovations Health. As the designated leader of the community health team, NPs should have been responsible for outpatient assessment and care. Innovation leaders determined that many NPs lacked the clinical expertise to conduct assessments in the field, and were not organized and adaptable enough to cope with the realities of community-based care, particularly social barriers to health. NPs also resisted RNs doing front-end work their patients, which undermined the intended flow of patients among care team staff members. ECCHC's original project coordinator raised concerns about NP performance, which led two of the original staff members to leave the project. Project leaders could not easily replace the lost NPs because the leaders determined that existing nurses, including nurses employed elsewhere in the ECCHC system, rarely had the training necessary to effectively deliver health care in the home. Project leaders identified a few NPs that embraced their role in the community-based care model, though one leader felt that hiring staff with more experience and providing additional supervision for the NP role could have been beneficial.

Interviews with care team members suggest that staff in all roles lacked adequate support throughout implementation. Turnover in key leadership positions, including the project coordinator, medical director, and nursing director, reduced ECCHC's capacity to provide adequate supervision to care team members. Staff reported that they had problems connecting with their supervisors and felt that the intense needs of the target population—particularly with respect to mental health—were difficult to cope with and exceeded their professional expertise. At least one CHW was described as being "maxed out."

2.23.2 Skills, Knowledge, and Training

Table 29 provides a summary of training provided to staff. Between Q11 and Q12, ECCHC provided 148 hours of training to 12 unduplicated project administrative and clinical personnel. In Q11, 10 CHWs attended classes in asthma education through the Association of Asthma Educators, which were led by a certified asthma educator. In Q12, one NP and one CHW attended a 14-hour training on pregnancy prevention for health care workers and professionals, provided by the South Carolina

Campaign to Prevent Teen Pregnancy. Training modalities included classroom, discussion, text, role play, and demonstration.

Across the entire implementation period, ECCHC trained 130 unduplicated trainees for a total of 4,500 hours. ECCHC offered more training than originally planned to meet needs resulting from new hires and turnover. CHWs received training based on the Minnesota Model and Better Choices Better Health; they generally described both as valuable but insufficient for their professional development. Many staff began training before patients enrolled in the program, leaving no immediate opportunities for them to apply course content. Most training occurred at the beginning of the implementation, and staff expressed a preference for ongoing professional development as the project continued. Training appeared particularly weak for CHWs, who were largely new to the organization and CHW role, and received limited guidance on how to be a CHW. Because some CHWs were hired late and missed the initial round of training, they had varying approaches to the same task.

The LISW-AP hired during Q8 provided ongoing informal training in areas necessary for program improvement and reporting, including: enrolling patients, verifying insurance, coding procedures, scheduling patients, creating care plans, tracking medication, handling prescription assistance programs, transitioning patients to a medical home, and other project tasks. The CHWs received training in areas necessary for transitioning patients from Innovations Health to traditional medical practices. During Q8, ECCHC developed workflow and EHR templates for care plans, CHW workflow checklists, and other data tracking tools. The templates were reviewed and modified to separate nonclinical data from clinical data and designed to optimize staff productivity.

In reviewing Year 3, one innovation leader said he would have preferred to bring more experienced NPs and CHWs into the innovation. The NPs that ECCHC selected had not worked in the community and felt uncomfortable delivering care in nonclinical settings. He also questioned the quality of the CHWs that were recruited. He explained, *"The [CHWs] were always a challenge in terms of their role and what they can and can't do. We never quite had the right people on the team in a way that we would have liked."* Because ECCHC had not previously used CHWs, new hires seemed to lack the appropriate skill set, and personalities did not mesh. Hiring and training for this new role thus represented a significant challenge.

Table 29. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	148	12
Since inception	4,500	130

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.24 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. In this annual report, RTI examines three contextual factors—award execution, leadership, and organizational capacity—to address the following evaluation questions.

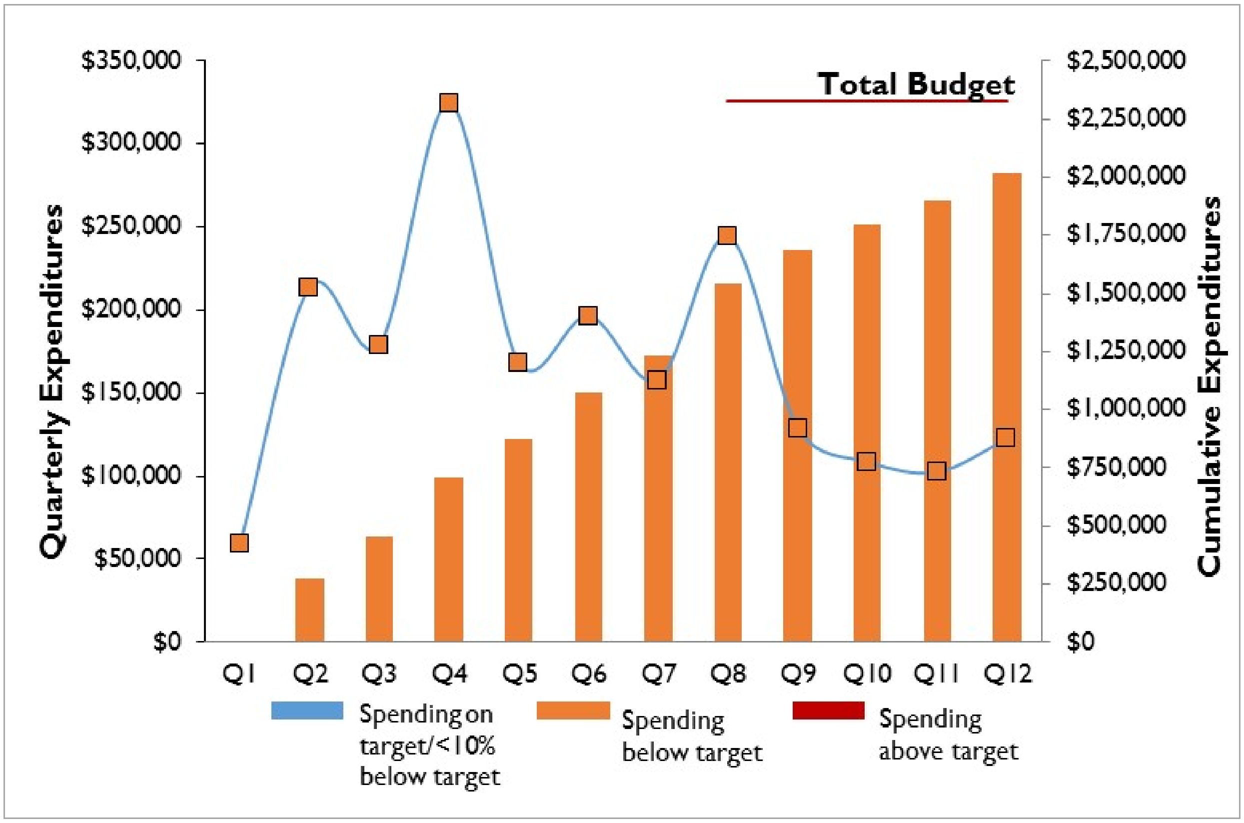
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.24.1 Award Execution

The annual report highlights the significance of ECCHC's expenditure rates on implementation. As of June 2015 (Q12), ECCHC spent 59.8 percent of its Year 3 budget. Cumulative expenditures since inception were at 88.7 percent, 10–20 percent below the projected target of $2,330,000 (see ***Figure 16***). Throughout implementation, Health Innovations struggled to recruit and retain staff for its community health teams, and consequently lacked the capacity to operate microclinics as planned. Working with its project officer from the Center for Medicare & Medicaid Innovation (CMMI), ECCHC decided not to fill vacancies in budgeted positions for an NP and RN, because even if the positions were filled, ECCHC was unlikely to reach the number of patients anticipated. The Reach section provides more information on ECCHC's enrollment challenges.

Figure 16. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.24.2 Leadership

The Innovations Health program was led by a project manager (PM) with support from ECCHC's chief medical officer (CMO) and other clinical staff. The CEO of ECCHC originally applied for grant funding, and asked the PM to assume responsibility for leading the innovation 2–3 months into the funding period. The PM initially worked with a project coordinator (PC) and anticipated that the PC would be responsible for day-to-day management of the grant while the PM would provide oversight. Ultimately, the PC was not a good fit and left during the first year. The PM assumed primary responsibility for grant activities throughout the remainder of implementation, with occasional guidance on clinical issues from the CMO. The LISW-AP ultimately took on the PC role after being hired in June 2014. One interviewee reflected on the role of ECCHC's organizational leaders in Innovations Health and commented, *"it really kind of stopped with him [the PM]."* The limited engagement from organizational leaders reflects a departure from the implementation plan outlined in ECCHC's application for funding, which suggested that the CEO, chief operating officer (COO), chief financial officer (CFO), and especially CMO would directly support the PM (e.g., by overseeing the NPs).

Despite limited involvement from the executive board, interviewees suggested that they had the necessary staff support and resources from ECCHC throughout implementation. In addition to the CMO, the PC worked with a nursing administrator and ECCHC's information technology and human resources departments. Over 40 providers in ECCHC's network in many specialties saw Innovations Health patients during the implementation period. A June 2015 EOY interviewee reported that the goals of the innovation were widely understood, and that staff joined monthly meetings when relevant topics arose.

Throughout implementation, leadership within the community health teams continued to be an obstacle. ECCHC originally envisioned that NPs would lead the community health teams and coordinate nonclinical staff activities. However, project leaders ultimately found that new NPs did not want to manage community health teams and frequently lacked the skills necessary to assume leadership roles. NP professionalization focuses on care delivery in a traditional clinic, and the innovation required NPs to guide care in the relatively unfamiliar contexts of the community and patients' homes. In Q8, ECCHC hired a LISW-AP to supervise CHWs and bridge the gap between clinical and nonclinical staff, which seems to have improved leadership in the community health teams. We provide more information below, in the Innovation Adoption and Workflow Integration section.

2.24.3 Organizational Capacity

ECCHC designed Innovations Health to help high-risk patients access permanent primary care medical homes, thereby reducing inappropriate hospital use. ECCHC ultimately experienced several capacity-related challenges that prevented it from implementing the innovation as designed. First, ECCHC assumed that South Carolina would expand Medicaid, which would have dramatically increased the number of services eligible for reimbursement within its target community. Instead, South Carolina implemented the Healthy Outcomes Plan (HOP), which encouraged hospitals to reduce ED utilization and readmissions or else risk losing up to 5 percent of funding for Medicaid patients. As a result of HOP, hospitals became less willing to refer their Medicaid-insured patients to Innovations Health. The loss of these referrals and failure of South Carolina to expand Medicaid left ECCHC with a large proportion of uninsured patients enrolled in the innovation, and reduced the total savings associated with the innovation, which partnering MCOs had agreed to share with ECCHC.

Second, capacity issues in the ECCHC system undermined the innovation team's efforts to adapt to HOP and place patients in permanent medical homes. When ECCHC did not receive the expected number of patient referrals from partnering hospitals, it began its own outreach efforts targeting frequent ED users with Medicaid or Medicare who lacked access to primary care medical homes. After initiating the outreach plan, staff discovered that the patients they had been targeting were already affiliated with ECCHC's traditional (i.e., non-innovation) clinics and sought medical care through the ED when they could not been seen quickly enough by providers in ECCHC's network. In fact, some of ECCHC's traditional clinics had been sending their patients to the innovation microclinics to alleviate burden elsewhere in the health system. When project leaders realized that their patient population was affiliated with the health system but was underserved, they moved staff from the Innovations Health microclinics to ECCHC's traditional primary care network. Reflecting on the project, ECCHC leaders said the separation of the microclinics from the traditional practices created barriers to integration and communication in their health system. Even if the innovation team had been able to transition patients with Medicaid coverage to a medical home, ECCHC's traditional clinics likely would have struggled to provide services promptly.

ECCHC ended the cooperative period with two fully functioning microclinics (Greenview and Ridgewood) and one partially functioning microclinic (Eau Claire). ECCHC was unable to provide a full range of services at the Eau Claire clinic because of problems recruiting NPs. To help improve patient access to care, ECCHC offered expanded clinic hours 1 day per week starting in Q10, and partnered with the local bus system to obtain free day passes to improve patients' transportation to the microclinics, starting in Q8.

In response to staffing shortages and a lack of organizational capacity in the larger ECCHC network, ECCHC changed its method of deploying members of the community health team. First, to increase the number of patients who could be seen, NPs and RNs delivered more care in clinical settings than originally planned. We previously reported that RNs assumed responsibility for NPs' community-based services, but recent turnover in the CMA position required RNs to remain in the clinics to support NPs. RNs stopped offering home visits by Q12. CHWs also continued to transition from community-based service delivery to working at ECCHC's traditional sites to increase enrollment in the innovation and facilitate linkages with primary care.

ECCHC struggled to collect and report data on Innovations Health throughout the implementation period, and identified data collection and monitoring as significant barriers that affected the program's implementation and operation. Program leaders reported that the EHR system, shared by all clinics affiliated with the health system, *"is not user friendly, is difficult to maneuver, and has not proved to be a good tool for measuring CHW effectiveness and documentation."* Staff had difficulty accessing the EHR due to poor connectivity in the microclinics and to integrate CHW services into the EHR. Data collection challenges may have been mitigated if the staff who applied for HCIA funding had consulted the staff responsible for managing and reporting project data. As one interviewee noted,

> ***""…hospital administrators or project directors should work with implementers when writing the proposal. Everyone plays an integral part of the project and they need to discuss what is realistic and what is not. The administrators don't understand how the clinical and IT processes work, so they need to consult with people who are experts in the real world."***

ECCHC identified a number of problems in its project data during implementation. In June 2015, we reported that ECCHC could not distinguish between CHW home visits and office visits and was missing data elements associated with pneumococcal immunizations. In Q11 and Q12, ECCHC reported that a patient identifier was missing from 348 EHRs. The identifier could not be recovered in time for Q12 reporting, but was not essential, given multiple identifiers in use.

ECCHC took steps to improve the collection and quality of project data over time, including hiring the LISW-AP, carefully reviewing data with the project officer and data specialists during Q10, and organizing routine staff meetings to examine data and discuss process improvements.

2.24.4 Innovation Adoption and Workflow Integration

Community care team functioning continued to represent a significant challenge throughout ECCHC's final year of funding. ECCHC reported that clinical staff did not always want to be involved in community-based care, and sometimes failed to recognize the value of nonclinical interventions for improving patient health outcomes. In Q12, ECCHC reported, *"it was difficult for CHWs to sometimes get their voice heard."*

An LISW-AP was hired in June 2014 to improve coordination between the clinical (NP, RN, and CMA) and nonclinical (CHW and PSR) staff. The LISW-AP assumed responsibility for supervising the CHWs and developed templates, protocols, and other materials to help clarify team members' roles and improve workflow. The LISW-AP's efforts to supervise the CHWs allowed time for clinical staff to provide patient care. The LISW-AP helped address disagreement between CHWs and providers on how to standardize care with respect to case management and care plan development. The LISW-AP also helped clarify reporting lines, facilitated relationship building, and fostered communication and understanding among team members.

EOY interviews and ECCHC's reports suggest that although the LISW-AP improved community care team functioning, she came to the project too late and only partially addressed underlying problems in the care team. One interviewee reported,

> ***"…We didn't have any expertise and we didn't bring in anyone who came in with a lot of experience integrating medical staff. I'm not sure if we ever arrived at having a strong program. If we came in with a clearer understanding of what everyone's role was and a clearer understanding of how everyone was supposed to work together, that would have made a big difference from the very beginning."***

During the final reporting quarters, ECCHC indicated that providers in ECCHC's traditional clinics specializing in internal medicine, behavioral medicine, and pediatrics had accepted Innovations Health CHWs into their practices, were receptive to CHWs, and valued CHWs' home-based services.

2.25 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

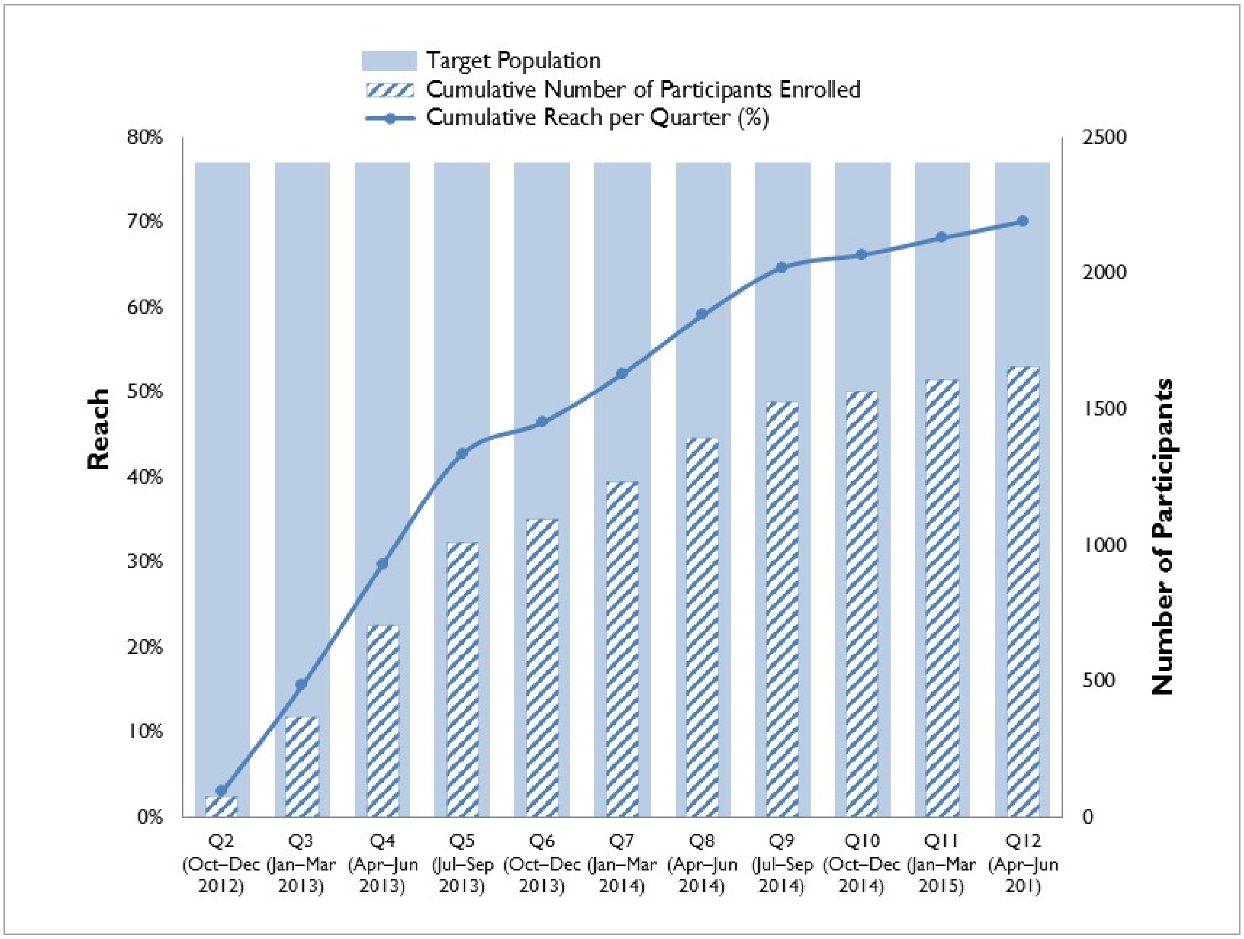
2.25.1 Innovation Reach

Figure 17 shows reach by quarter since the launch of the innovation. Reach is defined as the number of patients who completed the Innovations Health enrollment process. We last reported reach in the 2015 annual report, based on data through Q11. Since that time, ECCHC provided data for an additional 185 patients, increasing reach to 70 percent.

ECCHC did not fully meet its reach targets for several reasons. First, ECCHC was unable to provide consistent staffing for the innovation—particularly at the Eau Claire microclinic—which undermined its ability to enroll patients in the innovation. In light of limited staffing, ECCHC suggested that an enrollment goal of 1,100 patients per year was more realistic than the original goal of 1,600 patients. Second, South Carolina's passage of HOP disincentivized the referrals for patients with Medicaid coverage, resulting in a significant proportion of innovation participants that lacked health coverage and were difficult and expensive to treat. Third, when ECCHC attempted to recruit participants unaffiliated with the hospitals, they found that many patients in need of services already had a medical home at ECCHC's traditional clinical sites, but used the ED when they could not be treated quickly.

In Year 3, ECCHC pursued a new strategy of enrolling patients in the innovation directly from its primary care clinics. CHWs began providing services at ECCHC's behavioral medicine, adult medicine, and pediatrics clinics during Q10, but enrollment did not pick up as quickly as originally anticipated, and ECCHC failed to reach projections. Considering the wind-down stage of the project and ECCHC's difficulties with recruitment throughout implementation, the total reach achieved seems relatively high.

Figure 17. Participant Enrollment and Reach for Each Quarter since Project Launch



Quarter	Q2 (Oct–Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
Cumulative reach per quarter (%)	3.0	15.5	29.7	42.7	46.4	52.1	59.0	64.6	66.1	68.1	70.0
Target population	2,361	2,361	2,361	2,361	2,361	2,361	2,361	2,361	2,361	2,361	2,361
Cumulative number of participants	71	367	702	1,008	1,095	1,230	1,392	1,526	1,561	1,608	1,653

Source: Patient-level data provided to RTI by ECCHC.

A subset of Innovations Health patients included in the reach totals above accessed unique services through partnerships that ECCHC maintained. Through ECCHC's partnership with Palmetto Health's HOP, 110 uninsured Innovations Health patients with high numbers of ED visits accessed a wide variety of free health care services. ECCHC provided family planning/pregnancy prevention, STD/STI screening and treatment, and health education services to 150 students from a local high school through an ongoing partnership with the New Morning Foundation.

2.25.2 Innovation Dose

Table 30 shows the number of services provided to participants, the number of participants receiving services, and the average number of services per participant through Q12. We last reported dose in the 2015 annual report based on data through Q11. As would be expected, the number of services provided and the number of participants receiving those services increased from Q11 to Q12. As shown in the table, almost all participants (99.6%) received an average of approximately nine home and/or microclinic visits. Almost half of participants with asthma (46.2%) received an average of three asthma coaching sessions, and almost half of participants with CAD/hyperlipidemia (47.8%) received an average of three LDL-C coaching sessions. More than three-quarters of participants with diabetes (81%) received an average of 14 diabetes coaching sessions, and approximately three-quarters of participants with hypertension (67.8%) received an average of approximately five hypertension coaching sessions.

ECCHC's own analyses showed no improvement in the number of home visits by CHWs, NPs, or RNs during Q11 and Q12. Project leadership reported that staff began to focus efforts on transitioning Innovations Health patients into ECCHC's traditional clinics for sustained care.

Table 30. Number and Types of Services Provided to Participants

Services	Number of Services Provided to Patients	Number (Percentage) of Participants Receiving Service	Average Number of Services per Participant
Visits	14,678	1,646 (99.6)	8.9
Coaching			
Asthma (n = 119)	171	55 (46.2)	3.1
CAD/Hyperlipidemia (n = 207)	313	99 (47.8)	3.2
Diabetes (n = 273)	3,047	221 (81.0)	13.8
Hypertension (n = 553)	1,947	375 (67.8)	5.2

Source: Patient-level data provided to RTI.
CAD = coronary artery disease.

ECCHC initially intended to provide five to seven encounters with patients for the initial assessment phase of the innovation, and then follow up with patients on an as-needed basis to help manage chronic diseases and offer referrals for specialty care—minimally, one touch per quarter. Staff ultimately delivered fewer services than originally planned, given understaffing and changing project roles. Despite these capacity challenges, ECCHC's dose is high relative to other awardees, particularly among patients with diabetes and hypertension.

2.26 Qualitative Findings: Sustainability

RTI did not receive a formal sustainability plan from ECCHC. However, in Q11 and Q12, ECCHC reported that it worked to transition existing Innovations Health patients into existing clinics and other community providers, and established plans for two of three microclinics. The Ridgewood microclinic will become a teen/young adult health practice offering comprehensive health care targeted to patients 13- to 26 years of age. The Greenview microclinic will become part of ECCHC's local adult medicine site.

ECCHC planned to absorb some members of the community care teams into its traditional clinics. Two NPs, one RN, two CMAs, two PSRs, and two CHWs will continue to work for ECCHC, while six CHWs, the program coordinator, and the grant manager will not. Among the staff remaining, four employees will expand a pregnancy prevention initiative. Two CHWs will offer care coordination services, as recommended by primary care providers, through ECCHC's Patient-Centered Medical Home initiative. Innovations Health project leadership suggested that CHW services would be difficult for the organization to sustain without policy-level changes to reimbursement models.

ECCHC secured funding from the SCDHHS to continue providing services to uninsured Innovations Health patients who have chronic diseases. Funding comes from a limited-benefit Medicaid program called Healthy Connections Checkup. ECCHC will establish a baseline medical assessment for eligible patients and then link them to a medical home.

2.27 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing ECCHC as well as accomplishments to date. In this section, we assess ECCHC's progress on achieving HCIA goals to date:

- **Smarter spending.** Trends in Medicare and Medicaid spending per patient for innovation beneficiaries are highly variable and similar to comparison beneficiaries.
- **Better care.** The Medicare and Medicaid inpatient admissions rates are very similar for the innovation and comparison groups. The small sample size results in high variability in the inpatient admissions and readmissions rates. Medicaid ED visit rates are decreasing over time and are lower on average for the innovation group than the comparison group.

  ECCHC enrolled 70 percent of its target population as of Q12. Almost all participants received a home or microclinic visit. Nearly half of all participants with asthma and CAD/hyperlipidemia, 81 percent of diabetics, and about 70 percent of hypertensive participants received disease-related coaching.

  The majority of patients with diabetes and hypertension received clinical services. Most patients with diabetes had a foot exam and an HbA1c test. Almost all patients with hypertension received a blood pressure screening and a BMI assessment. However, few patients received an influenza or pneumonia vaccination. Approximately 30 percent were screened for depression.

- **Healthier people**. Over time, the percentage of patients with diabetes with HbA1c control increased, as did the percentage of patients with hypertension with blood pressure control. This finding suggests that those enrolled in ECCHC's innovation are achieving better diabetes and hypertension outcomes. Findings should be interpreted with caution, however, given that the differential attrition of sick patients could also explain these results.

  In addition, those with diabetes enrolled in the innovation had improvements in HbA1c, those with CAD/hyperlipidemia had improvements in LDL-C, and those with hypertension had improvements in systolic and diastolic blood pressure values over time. With regard to dose, it seems that those who had difficulty improving their test results received a greater number of home or clinic visits or coaching sessions but, ultimately, the additional services were not enough to address the needs of some patients.

ECCHC's Innovations Health program team faced many challenges, partly because the assumptions made by project leaders going into the implementation later proved incorrect. First, South Carolina failed to pass Medicaid expansion as staff had anticipated, which dramatically reduced the number of patients in the targeted 29203 zip code for whom services could be reimbursed. South Carolina's alternative to Medicaid expansion, HOP, incentivized hospitals to limit referrals to uninsured patients. Second, ECCHC designed Innovations Health assuming that Columbia residents used the ED for medical care because they lacked relationships with primary care providers. Instead, project leaders learned that many frequent ED users were patients of ECCHC's health system and sought primary care treatment from hospitals because ECCHC's clinics lacked the capacity to provide timely care.

ECCHC also encountered difficulties implementing community care teams. Clinical staff, including NPs and RNs, reportedly failed to see the value of the blended clinical/nonclinical model, and lacked the experience and skill to effectively supervise community-based service delivery. Staff turnover and recruitment problems forced project leaders to change plans for deploying staff, shifting services from the community back into the clinic, and reducing the number of fully functioning microclinics from three to two.

ECCHC took several steps to address implementation challenges. ECCHC modified its recruitment strategy to focus on Medicaid and Medicare beneficiaries within its network during Year 3, which increased enrollment, but came too late for Innovations Health to meet its enrollment goals. ECCHC also worked to improve care team functioning by hiring an LISW-AP to more clearly define staff roles, standardize care, and supervise nonclinical staff. By the conclusion of the project, the team collaborated more effectively and delivered services at a high dose. Preliminary evidence suggests that, despite the difficult implementation process, ECCHC's staff may have provided enough services to reduce inappropriate use of the ED among Medicaid beneficiaries and help patients better manage their chronic conditions.

After ECCHC's award ended in June 2015, the organization dissolved the community health team structure and microclinics as implemented for Innovations Health, but will sustain nine project staff members and continue offering services out of two microclinic sites. Most HCIA-supported staff will be integrated into ECCHC's existing clinics or assigned to a pregnancy prevention initiative. Project leadership suggested that policy-level changes supporting reimbursement for CHW services could help ECCHC and other organizations continue to provide valuable care coordination services.

Despite implementation and sustainability challenges, ECCHC reached the majority of high ED users targeted for the innovation, and provided them recommended clinical services. Home and office visits could have helped patients address health concerns without relying on the ED.Thus, the positive trends in health outcomes and reductions in ED visits among Medicaid beneficiaries may have been attributable to the innovation although, we cannot rule out other factors.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Eau Claire Cooperative Health Centers, Inc. (ECCHC)

Eau Claire Cooperative Health Centers, Inc. (ECCHC), a large federally qualified health center serving four counties in Columbia, South Carolina, received $2,330,000; it began enrolling patients in its Innovations Health program on December 1, 2012. Innovations Health established three microclinics in neighborhoods identified as “hot spots” for their high emergency department (ED) utilization, poverty, limited access to primary care, and concentrated health disparities.

Awardee Overview

Innovation dose:	Nearly all participants (99.6%) received a home or microclinic visit. 46.2% of participants with asthma received asthma-related coaching, and 47.8% of participants with coronary artery disease (CAD)/ hyperlipidemia received low-density lipoproteins (LDL) coaching. 81% of diabetic participants received diabetes-related coaching, and 67.8% of participants with hypertension received coaching.	***Innovation reach:***	ECCHC enrolled 70% of the target population, but struggled to identify eligible Medicaid/Medicare beneficiaries not already connected to ECCHC’s existing primary care network.
Components:	(1) Establishing 3 new microclinics (2) Forming new 5-member community health teams (3) Enrolling frequent ED users in the program	***Participant demographics:***	Nearly two-thirds (63.6%) of participants were 25–64 years old, 63.6% were female, 91.5% were black, 74.2% were uninsured, and 19.1% covered by Medicaid.
Sustainability:	Patients transitioned into existing clinics and other community providers; two microclinics converted to other health practice uses, and some staff were absorbed into traditional clinics.		
Innovation type:	Coordination of care		Direct health care/dental care

Key Findings

Smarter spending. Trends in Medicaid spending per patient for innovation beneficiaries were highly variable and similar to comparison beneficiaries. Average quarterly Medicaid spending per participant was not significant ($132; 90% CI: −$346, $609).

Better care. For Medicaid beneficiaries, inpatient stays per 1,000 participants did not change significantly (−10; 90% CI: −24, 4). Medicaid ED visit rates per 1,000 participants decreased over time and were significantly lower on average for the innovation group (−106; 90% CI: −179, −33). Approximately 70 percent of patients with diabetes had a foot exam and 79 percent had an HbA1c test, and 98 percent of patients with hypertension received a blood pressure screening and 96 percent received a BMI assessment. Few patients received an influenza (12%) or pneumonia vaccination (14%). Approximately 30 percent were screened for depression.

Healthier people. Over time, the percentage of patients with diabetes with HbA1c control increased from 60 to 79 percent, as did the percentage of patients with hypertension with blood pressure control (72% to 79%). This finding suggests that those enrolled in ECCHC’s innovation are achieving better diabetes and hypertension outcomes. Findings should be interpreted with caution, however, given that the differential attrition of sick patients could also explain these results. For dose, those who had difficulty improving their test results received a greater number of home or clinic visits or coaching sessions but, ultimately, the additional services were not enough to address the needs of some patients.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Finity Communications, Inc.

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Finity Communications, Inc.

2.1 Introduction

Finity Communications, Inc. (Finity), a technology vendor in Portland, OR, received an award of $4,967,962 to implement an innovation that launched on November 15, 2012. Finity partnered with a Medicaid managed care organization (MCO), Health Partners Plans (HPP), located in Philadelphia, Pennsylvania, and SCIO Health Analytics to provide condition management and wellness programs to HPP beneficiaries. Finity also partnered with Duke University to develop and implement a customized training course for peer health mentors (PHMs). The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce total cost of care by $8,744,407.

2. **Better care.** Improve care by implementing a condition management program that will result in reduction of inpatient admissions by an average of 0.1 percent from the baseline for program participants. Finity's original goal at the onset of the innovation was to reduce ED services by an average of 0.1 percent from the baseline for program participants, and this goal was updated to reflect a reduction in inpatient admissions in 2013.

3. **Healthier people**. Improve targeted health outcomes by an average of 0.1 percent from the baseline for program participants.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter* (*Q)11–Q12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by Finity and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	No changes occurred in innovations components: Baby Partners, Diabetes Management, and Heart Health and EveryBODY Get Healthy patient portal and health alerts.
Program Participant Characteristics	
	84.2% of Baby Partners participants were aged 18 to 44 years. 82.3% and 80.2%, respectively, of Diabetes Management and Heart Health participants were aged 45 to 64 years old.
Workforce Development	
Hiring and retention	Staffing remained at 11.5 FTEs.
Skills, knowledge, and training	According to *Quarterly Awardee Performance Reports*, no training occurred in Q11–Q12.
Context	
Award execution	As of June 2015 (Q12), Finity spent 100% of its total budget.
Leadership	Leadership at Finity remained strong throughout the innovation, even amidst changes in selected leaders at HPP and SCIO Health Analytics.
Organizational capacity	Finity used its own call center employees to expand capacity of the innovation's PHMs and help engage members.
	At HPP, innovation competed for resources needed to support Medicaid expansion and change in selected leadership.
Innovation adoption and workflow integration	Payer and provider portals with comparative performance data were key to provider adoption.
Implementation Effectiveness	
Innovation reach	Between Q11-Q12, Finity increased Baby Partners reach from 106.5% to 114.9%. Diabetes Management increased reach from 33.3% to 39.7%, and Heart Health reach also increased from 54.3% to 62.4%.
Innovation dose	16.3 % of Baby Partners participants completed all three activities and earned bonus payments. Diabetes Management and Heart Health participants received at least one incentive.
Sustainability	
	Finity and HPP reported plans to continue the innovation after funding ended.

Sources: *Q11–Q12 Narrative Progress Report*.
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted February–June 2015.

Finity = Finity Communications, Inc.; FTE = full-time equivalent; HPP = Health Partners Plans; PHM = peer health mentor; Q = quarter

Tables 3, 4, and 5 summarize Medicaid claims-based findings during the innovation period for Baby Partners, Diabetes Management, and Heart Health incentive programs.

Table 3. Summary of Medicaid Claims-Based Findings: Baby Partners

	Mothers		Babies		Mothers and Babies	
Outcome	**Effect**	**90% CI**	**Effect**	**90% CI**	**Effect**	**90% CI**
Aggregated results						
Total spending (in millions)	$1.305	$0.026, $2.609	$2.362	−$3.650, $8.375	$2.698	−$1.806, $7.203
Inpatient admissions	86	−201.39, 373.94	361	99.28, 623.28	399	−29.94, 827.30
Hospital readmissions	−13	−26.48, 1.33	12	−5.82, 28.68	−4	−26.27, 18.00
ED visits	444	−84.59, 973.20	258	−27.95, 543.73	704	53.82, 1,354.58
Average impact per member						
Spending per member per month	$20	$0.4, $40	$88	−$136, $312	$584	−$391, $1,559
Inpatient admissions (per 1,000 members)	19	−43.59, 80.94	78	21.49, 134.91	86	−6.48, 179.07
Hospital readmissions (per 1,000 members)	−3	−6.18, 0.31	3	−1.28, 6.31	−1	−5.78, 3.96
ED visits (per 1,000 members)	96	−18.31, 210.65	56	−6.05, 117.69	152	11.65, 293.20

Table 4. Summary of Medicaid Claims-Based Findings: Diabetes Management

Outcome	Effect	90% CI
Aggregated results		
Total spending (in millions)	$0.909	$0.311, $1.513
Inpatient admissions	−20	−98.66, 58.48
Hospital readmissions	3	−4.18, 9.27
ED visits	20	−75.05, 114.18
Average impact per member		
Spending per member per month	$184	$63, $306
Inpatient admissions (per 1,000 members)	−48	−236.04, 139.91
Hospital readmissions (per 1,000 members)	27	−44.05, 97.57
ED visits (per 1,000 members)	47	−179.53, 273,15

Table 5. Summary of Medicaid Claims-Based Findings: Heart Health

Outcome	Effect	90% CI
Aggregated results		
Total spending (in millions)	$0.437	−$0.002, $0.875
Inpatient admissions	5	−9.23, 13.44
Hospital readmissions	1	−20.26, 40.88
ED visits	39	−64.73, 142.31
Average impact per member		
Spending per member per month	89	−$0.5, $178
Inpatient admissions (per 1,000 members)	12	−22.03, 32.07
Hospital readmissions (per 1,000 members)	24	−48.35, 97.57
ED visits (per 1,000 members)	93	−154.49, 339.64

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department.

None of the innovation components reduced costs significantly. For Baby Partners, total spending was higher for mothers and babies per member per month (PMPM) and for the mother and baby combined during the entire pregnancy and postnatal period, a result that was only statistically significant for mothers alone. For Diabetes Management, the innovation participants had significantly higher overall spending than nonparticipants (loss of $184 PMPM, *p*-value=0.012); however, the innovation achieved its intended increase in primary care visits. On average, each participant had 2.3 more primary care visits. We found that spending, inpatient admissions, hospital readmissions, and ED visits were higher for Heart Health participants than nonparticipants; however, the differences were not statistically significant. The innovation achieved its intended increase in primary care visits for Heart Health. On average, each participant had 2.6 more primary care visits.

2.1.1 Innovation Components

The Finity innovation consisted of three components that target Medicaid patients through their managed care partner, Health Partners Plans (HPP): (1) condition management LifeTracks, (2) the EveryBODY Get Healthy member portal and (3) health alerts. The central innovation component, LifeTracks, consists of condition management innovations designed to improve the health of specific populations, including separate treatment plans for pregnant Medicaid beneficiaries (Baby Partners); those with diabetes (Diabetes Management) and heart conditions (Heart Health); and members with needs relating to weight loss, tobacco cessation, and asthma management. LifeTracks uses Finity's closed-loop tracking technology to deliver, assess, and adapt these innovations according to participant behaviors. The integrated technology tracks program outreach, and beneficiary participation in incentive activities. These data are then linked to other data sources—beneficiary claims and risk profiles—to determine which program components are influencing health behaviors and costs. LifeTracks also offers beneficiaries education, financial incentives for completing specific healthy behaviors, and access to PHMs to support and encourage participants to better manage their conditions.

The second component, the online Web-based portal, EveryBODY Get Healthy, provides general health and wellness education (https://www.everybodygethealthy.com/hpp/login/) for HPP members. Finally, the third innovation component sends health alerts via text messages, the LifeTracks portal and print. The health alert messages consist of reminders to members for activities such as obtaining preventive screenings, visiting their providers, and taking their medications. They are available for both LifeTracks and general wellness participants using the EveryBODY Get Healthy portal.

To meet payer requirements for improved quality measure compliance, Finity developed payer portals with Healthcare Effectiveness Data and Information Set (HEDIS) performance data and analytics. Additionally, Finity created provider portals with comparative performance data, analytics, and claims data to increase claims transparency for providers.

The partners for this innovation—HPP, SCIO Health Analytics, and Duke University—remain unchanged since the 2014 annual report (see ***Table 6***). HPP is Finity's Medicaid MCO partner. SCIO is Finity's analytic partner who helps analyze the claims data provided by HPP, and Duke University helped to develop Finity's PHM training.

Table 6. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Health Partners Plans	Provides participants, enrollment or outreach, project management and administration, and payer expertise and oversees peer health mentors	Philadelphia, PA
SCIO Health Analytics	Conducts health analytics	Farmington, CT
Duke Integrative Medicine	Develops peer health mentor training	Durham, NC

Source: Site Visit May 21–22, 2014.
HCIA = Health Care Innovation Award.

2.1.2 Program Participant Characteristics

Table 7 provides the demographic characteristics for all members who indicated that they had ever enrolled in Baby Partners, for Diabetes Management, and for Heart Health. Participants in the innovation overall were defined for this evaluation as those members with the targeted condition who enrolled in the innovation regardless of whether they received an incentive. Participants enrolled in Diabetes Management and Heart Health all earned at least one incentive. However, not all Baby Partners participants received an incentive (see Dose, Section 2.31.2).

The distribution of member characteristics is similar to that in the 2015 annual report. More specifically, most Baby Partners participants (84.2%) were aged 18 to 44 years. For Diabetes Management and Heart Health, most participants were aged 45 to 64 years (82.3% and 80.2%, respectively) and most participants were also female (63.6% and 65.8%, respectively). Many participants across all three programs (42.2% for Baby Partners; 49.0% for Diabetes Management; and 56.5% for Heart Health) were black. All participants were members of HPP's Medicaid or CHIP plans.

Table 7. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Baby Partners Number of Participants	Baby Partners Percentage of Baby Partners Participants	Diabetes Management Number of Participants	Diabetes Management Percentage of Diabetes Participants	Heart Health Number of Participants	Heart Health Percentage of Heart Health Participants
Total	11,999	100	769	100	749	100
Age						
<18	413	3.4	0	0.0	0	0.0
18–24	4,775	39.8	8	1.1	6	0.9
25–44	5,324	44.4	117	15.2	135	18.0
45–64	7	0.1	633	82.3	601	80.2
65–74	0	0.0	6	0.8	3	0.4
75–84	0	0.0	1	0.1	1	0.1
85+	0	0.0	0	0.0	1	0.1
Missing	1,480	12.3	4	0.5	2	0.3
Sex						
Female	11,999	100.0	489	63.6	493	65.8
Male	0	0.0	217	28.2	195	26.1
Missing	0	0.0	63	8.2	61	8.1
Race/ethnicity						
White	2,379	19.8	189	24.6	181	24.2
Black	5,059	42.2	377	49.0	423	56.5
Hispanic	655	5.5	11	1.4	8	1.1
Asian	307	2.6	4	0.5	3	0.4
American Indian or Alaska Native	149	1.2	42	5.5	27	3.6
Native Hawaiian or Other Pacific Islander	166	1.4	42	5.5	40	5.3
Other	0	0.0	0	0.0	0	0.0
Missing/ Refused	3,284	27.4	104	13.5	67	8.9
Payer category						
Dual	0	0	0	0	0	0.00
Medicaid	11,999	100	769	100	749	100.00
Medicare	0	0	0	0	0	0.00
Medicare Advantage	0	0	0	0	0	0.00
Other	0	0	0	0	0	0.00
Uninsured	0	0	0	0	0	0.00
Missing	0	0	0	0	0	0.00

Source: Patient-level data provided to RTI by Finity.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 8 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 8. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	Yes
		Hospital unplanned readmissions rate	No	Yes
		ED visit rate	No	Yes
	Cost	Spending per patient	No	Yes
		Estimated cost savings	No	Yes

ED = emergency department.

RTI uses claims-based quantitative data to assess the impact of Finity's innovation on key outcomes. This report includes claims data for Medicaid beneficiaries that capture both health spending and utilization. The claims analysis focuses on the three LifeTracks where incentives are offered: Baby Partners, Diabetes Management, and Heart Health. RTI received the most-recent claims data for Baby Partners in August 2015 and for Diabetes Management and Heart Health in November 2015. Finity provided information on total expenditures, inpatient and ED spending, number of hospital admissions and readmissions, and number of ED visits for participants and nonparticipants of the three programs.

Baby Partners

The managed care data on Baby Partners covers members who delivered a baby between July 2012 and December 2014 and includes both participants and nonparticipants. For the Baby Partners claims analysis we restricted the definition of participants to eligible mothers who agreed to participate and earned incentives from the Baby Partners program. Nonparticipants include eligible mothers who did not receive incentives from the program. This definition varies from the one used for the overall evaluation (e.g., any member who enrolled in Baby Partners regardless of receipt of incentive) but is in line with the awardee's definition for claims analyses,

Finity provided data on 14,662 babies and 13,605 mothers. Of these, 8,409 babies and 7,936 mothers were eligible for Baby Partners and were included in this analysis. Following Finity's criteria, to be eligible for the analysis, babies had to be enrolled in the HPP Medicaid managed care plan after delivery and their mothers must have been enrollees of the same plan for a minimum of 6 months before delivery and 3 months after delivery. Participants were also excluded if they had any of the following comorbidities: HIV, end-stage renal disease, transplant, or non-skin cancer. If a mother had two births within the 12-month period, only the first birth was eligible for inclusion in the analysis.

2.3 Medicaid Comparison Group

For each claims outcome measure, we compared eligible participants to eligible nonparticipants in the Baby Partners LifeTracks program. Of the 8,409 babies eligible, 3,789 were nonparticipants and 4,620 were participants. Of the 7,936 mothers eligible for analysis, 3,507 were nonparticipants and 4,429 were participants.

We used propensity score matching (PSM) to select comparison group beneficiaries (i.e., nonparticipants) with similar characteristics as innovation group beneficiaries (i.e., participants). Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of mother's age; number of children; mothers' preexisting conditions (e.g., cerebrovascular or cardiovascular disease; central nervous system–related or gastrological disease; genital, infectious, metabolic, psychiatric, pulmonary, skeletal, or skin-related disease); substance abuse; number of months enrolled; mothers' risk score; and existence of mother complications. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 9 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. No innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 9. Mean Values and Standardized Differences of Variables in Propensity Score Model: Baby Partners

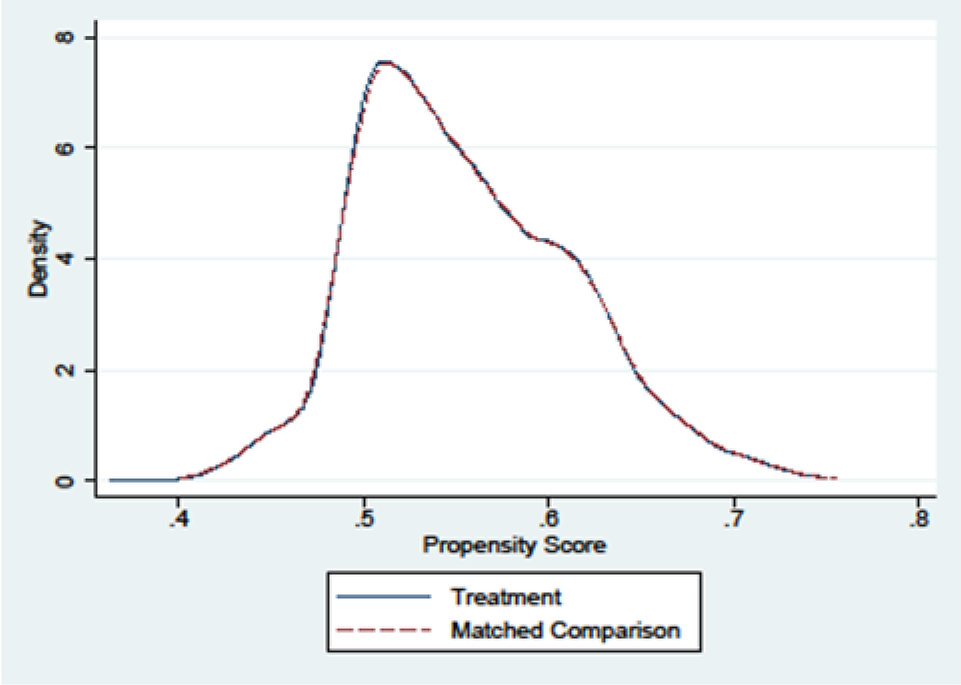
Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Mother's age	26.19	5.52	25.67	5.52	0.09	26.19	5.52	26.14	5.60	0.01
Number of children	1.03	0.17	1.02	0.15	0.05	1.03	0.17	1.02	0.15	0.03
Percentage of mothers with cerebrovascular disease	0.45	6.73	0.34	5.85	0.02	0.45	6.73	0.28	5.30	0.03
Percentage of mothers with genital disease	7.23	25.90	6.10	23.93	0.05	7.23	25.90	7.03	25.58	0.01
Percentage of mothers with cardiovascular disease	18.94	39.19	17.71	38.18	0.03	18.94	39.19	17.02	37.59	0.05
Percentage of mothers with CNS-related disease	11.06	31.37	9.32	29.07	0.06	11.06	31.37	10.56	30.73	0.02
Percentage of mothers with gastrological disease	16.19	36.84	14.49	35.20	0.05	16.19	36.84	15.04	35.76	0.03
Percentage of mothers with infectious disease	2.68	16.16	2.90	16.80	0.01	2.68	16.16	2.14	14.48	0.04
Percentage of mothers with metabolic disease	5.39	22.58	4.67	21.10	0.03	5.39	22.58	5.06	21.92	0.01
Percentage of mothers with psychiatric disease	15.91	36.58	14.99	35.70	0.03	15.91	36.58	14.88	35.59	0.03
Percentage of mothers with pulmonary disease	25.09	43.36	24.23	42.85	0.02	25.09	43.36	22.53	41.78	0.06
Percentage of mothers with skeletal disease	8.35	27.67	6.68	24.97	0.06	8.35	27.67	7.13	25.73	0.05
Percentage of mothers with skin-related disease	6.99	25.50	7.73	26.71	0.03	6.99	25.50	6.71	25.02	0.01
Percentage of mothers with substance abuse	2.55	15.78	3.46	18.27	0.05	2.55	15.78	2.08	14.27	0.03
Mother's risk score	3.79	4.32	3.70	3.36	0.02	3.79	4.32	3.65	3.71	0.04
Number of member months	14.12	1.35	14.33	1.21	0.2	14.12	1.35	14.04	1.37	0.04
Percentage of mothers with complications	94.03	23.70	92.58	26.21	0.06	94.03	23.70	94.29	23.22	0.01
Number of beneficiaries	4,620	—	3,789	—	—	4,620	—	2,604	—	—

Source: RTI analysis of managed care data provided by Finity.
CNS = central nervous system; Finity = Finity Communications, Inc.; SD = standard deviation.
— Data not applicable.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and checked whether matching decreased the absolute standardized differences and achieved acceptable balance (Table 9). The results in Table 9 show that matching reduced the absolute standardized differences for most variables and achieved adequate balance for all variables. On the basis of observable characteristics, the comparison group selected is a good match to patients who participated in Finity's Baby Partners LifeTracks program.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The innovation and matched comparison groups' propensity scores have an extremely close overlap, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries. Therefore, we present the Medicaid claims analysis using both the innovation group and the matched comparison group.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Baby Partners



Source: RTI analysis of managed care data provided by Finity.
Finity = Finity Communications, Inc.

In the following sections, we present health care spending per member, followed by utilization rates for all-cause inpatient admissions, readmissions, and ED visits. Because we only received aggregate data for beneficiaries enrolled in the innovation from the time of enrollment, we are not able to present quarterly trends based on time of enrollment, and we are also not able to compare the innovation period with the baseline period on spending and utilization. For mothers and babies separately, descriptive and regression spending analyses are presented as per member per month (PMPM), and utilization measures are presented for the full enrollment period as per 1,000 members. Regression analyses for mothers and babies combined are presented for the full enrollment period. Mothers in the comparison and innovation groups were, on average, enrolled for 14 months, and babies in the comparison and innovation groups were, on average, enrolled for 6 months. Descriptive and regression analyses compare innovation and statistically matched comparison groups.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 10 reports Medicaid spending PMPM. Savings PMPM reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. Mothers in the innovation group had higher ED and total health care spending and lower inpatient spending than the matched comparison group (***Table 10***). Babies in the innovation group had higher ED, inpatient, and total spending than the matched comparison group. Participating mothers received more preventive and prenatal care, and babies received more care in their first 6 months of life, which might have contributed to an increase in total spending.

Table 10. Total, Inpatient, and ED Spending PMPM: Baby Partners

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=2,604 (Mothers)		Innovation Group N=4,620 (Mothers)		Savings PMPM
	Mean	SD	Mean	SD	
Total costs	$829	$646	$868	$520	−$39
Inpatient costs	$451	$422	$449	$307	$2
ED costs	$25	$36	$27	$38	−$2
	Comparison Group N=2,604 (Babies)		**Innovation Group N=4,620 (Babies)**		**Savings PMPM**
	Mean	**SD**	**Mean**	**SD**	
Total costs	$1,124	$3,016	$1,291	$7,812	−$168
Inpatient costs	$813	$2,358	$928	$7,030	−$115
ED costs	$20	$38	$22	$42	−$2

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; PMPM = per member per month; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.4.2 Regression Results

Table 11 presents the results of an ordinary least squares (OLS) regression with spending as the dependent variable. We present the average and aggregate treatment effect during the innovation period for mothers and babies enrolled in the innovation compared to their matched comparison group. Differences in total, inpatient, and ED spending are presented PMPM for mothers and babies separately, and over the whole innovation period for mothers and babies combined. Amongst other variables, the regression specification controls for the number of months that mothers and babies were observed in the sample.

For mothers only, the average PMPM total spending differential in the innovation period, indicating a loss, is $20 (90% CI: 0.4, 40). This effect is statistically significant. The average PMPM inpatient spending differential, indicating savings, is -$10 (90% CI: −23, 3). This effect is not statistically significant. The average PMPM ED spending differential, indicating a loss, is $1 (90% CI: −0.4, 2). This effect is not statistically significant.

For babies only, the average PMPM total spending differential in the innovation period, indicating a loss, is $88 (90% CI: −136, 312). This effect is not statistically significant. The average PMPM inpatient spending differential, indicating a loss, is $116 (90% CI: -656, 887). This effect is not statistically significant. The average PMPM ED spending differential, indicating a loss, is $2 (90% CI: 0.1, 3). This effect is statistically significant.

For mothers and babies combined, the average total spending differential in the innovation period, indicating a loss, is $584 (90% CI: −391, 1,559). This effect is not statistically significant. The average inpatient spending differential, indicating savings, is -$25 (90% CI: −821, 770). This effect is not statistically significant. The average ED spending differential, indicating a loss, is $21 (90% CI: −1, 43). This effect is not statistically significant. The estimates represent the average differential spending in the innovation period between individuals enrolled in the innovation and comparison group individuals. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

Table 11. OLS Regression Estimates for Medicaid Spending per Member: Baby Partners

N=7,224	Difference in Spending PMPM (Mothers) (SE; P-values)	Difference in Spending PMPM (Babies) (SE; P-values)	Difference in Spending for Mothers and Babies over Enrollment Period (SE; P-values)
Average total costs	$20 (12; 0.094)	$88 (136; 0.518)	$584 (592; 0.324)
Average inpatient costs	$−10 (7; 0.199)	$52 (121; 0.668)	−$25 (484; 0.958)
Average ED costs	$1 (1; 0.276)	$2 (1; 0.075)	$21 (13; 0.117)
Aggregate total costs	$1,304,688 (782,813; 0.094)	$2,362,114 (3,650,539; 0.518)	$2,698,080 (2,735,040; 0.324)
Aggregate inpatient costs	$−652,344 (456,641; 0.199)	$1,395,794 (2,165,952; 0.668)	−$115,500 (2,236,080; 0.958)
Aggregate ED costs	$65,234 (65,234; 0.276)	$53,684 (26,842; 0.075)	$97,020 (60,060; 0.117)

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; OLS = ordinary least squares; PMPM= per member per month; SE = standard error.
Notes: The regression coefficients are the average difference in spending for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: treatment indicator, mother's age, number of children, cerebrovascular disease, genital disease, cardiovascular disease, CNS-related disease, gastrological disease, infectious disease, metabolic disease, psychiatric disease, pulmonary disease, skeletal disease, skin-related disease, substance abuse, and number of months that mothers and babies were observed in the sample. On average, mothers in the comparison and innovation groups were observed for 14 months, and babies in the comparison and innovation groups were observed for 6 months. Aggregate estimates represent the change in spending for the 4,620 observations of mothers, babies and mothers, and babies combined in the innovation group.

2.5 Medicaid Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 members are shown in ***Table 12***. Inpatient admissions were higher for mothers and babies in the innovation group than the matched comparison group.

Table 12. All-Cause Inpatient Admissions Rate per 1,000 Members for the Full Enrollment Period: Baby Partners

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=2,604 (Mothers)		Innovation Group N=4,620 (Mothers)		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
All-cause inpatient admissions per 1,000	1,375	1,348	1,408	1,034	33
	Comparison Group N=2,604 (Babies)		**Innovation Group N=4,620 (Babies)**		**Innovation-Comparison Rate**
	Mean	**SD**	**Mean**	**SD**	
All-cause inpatient admissions per 1,000	1,245	1,243	1,332	1,298	88

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.5.2 Regression Results

Table 13 presents the results of a negative binomial count model with the dependent variable set to the number of inpatient visits for each individual during the innovation period. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in inpatient admissions for the innovation and comparison groups for the full innovation period.

For mothers only, the average difference in inpatient admissions is an increase of 19 inpatient admissions per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −43, 81). For babies only, the average difference in inpatient admissions is an increase of 78 inpatient admissions per 1,000 members in the innovation group relative to the comparison group. The effect is statistically significant (90% CI: 21, 135). For mothers and babies combined, the average difference in inpatient admissions is an increase of 86 inpatient admissions per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −6, 179).

Table 13. Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission over Enrollment Period: Baby Partners

N=7,224	Difference in Inpatient Admissions (Mothers) (SE; P-value)	Difference in Inpatient Admissions (Babies) (SE; P-value)	Difference in Inpatient Admissions for Mothers and Babies (SE; P-value)
Average all-cause inpatient admissions per 1,000 members	19 (38; 0.622)	78 (34; 0.023)	86 (56; 0.126)
Aggregate all-cause inpatient admissions	86 (174, 0.622)	361 (159, 0.023)	399 (261, 0.126)

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number; SE= standard error.
Note: The negative binomial coefficients are the average difference in inpatient admissions for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared with their matched comparison group. Aggregate estimates represent the change in all-cause inpatient admissions for the 4,620 observations in the innovation group. The regression controls for the following variables: treatment indicator, mother's age, number of children, cerebrovascular disease, genital disease, cardiovascular disease, CNS-related disease, gastrological disease, infectious disease, metabolic disease, psychiatric disease, pulmonary disease, skeletal disease, skin-related disease, substance abuse, and number of months that mothers and babies were observed in the sample. On average, mothers in the comparison and innovation groups were observed for 14 months, and babies in the comparison and innovation groups were observed for 6 months. For mothers only, all binary variables were dropped from the analysis because of complete prediction.

2.6 Medicaid Readmissions

2.6.1 Descriptive Results

Hospital readmission rates per 1,000 admissions are shown in ***Table 14***. Hospital readmissions add to the costs of a prior hospitalization, and they often reflect a problem in the care provided during the first admission. We report the number of readmissions per 1,000 members for babies and mothers separately. However, Finity did not provide data on dates of claims; hence, an index hospital admission cannot be defined to determine whether readmissions occurred within 30 days of the index admission. Therefore, we present readmissions per 1,000 members who had an inpatient admission. We found lower rates of readmissions for participating mothers, and higher rates of readmission for participating babies.

Table 14. Hospital Readmissions Rates per 1,000 Members: Baby Partners

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=2,553 (Mothers)		Innovation Group N=4,545 (Mothers)		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
Hospital readmissions per 1,000	9.97	136.66	4.40	118.60	−5.97
	Comparison Group N=2,477 (Babies)		**Innovation Group N=4,471 (Babies)**		**Innovation-Comparison Rate**
	Mean	**SD**	**Mean**	**SD**	
Hospital readmissions per 1,000	11.83	148.06	12.75	121.76	0.92

Source: RTI analysis of managed care claims data.
Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.6.2 Regression Results

Table 15 presents the results of a logistic regression model with the dependent variable set to one for members who had at least one hospital readmission during the innovation period, constrained to those who had an inpatient admission. The coefficients are the average difference in the probability of a hospital readmission per 1,000 members for the innovation and comparison groups for the full innovation period.

For mothers only, the average difference for unplanned readmissions is −3 per 1,000 inpatient admissions (0.3 percentage points), indicating that the innovation–comparison difference is 0.3 percentage points lower during the innovation period. The effect is not statistically significant (90% CI: −6, .0). For babies only, the average difference for unplanned readmissions is 3 per 1,000 inpatient admissions (0.3 percentage points), indicating that the innovation−comparison difference is 0.3 percentage points higher during the innovation period. The effect is not statistically significant (90% CI: −1, .6). For mothers and babies combined, the average difference for unplanned readmissions is −1 per 1,000 inpatient admissions (0.1 percentage points), indicating that the innovation−comparison difference is 0.1 percentage points lower during the innovation period. The effect is not statistically significant (90% CI: −6, 4).

Table 15. Logistic Model Regression Estimates for Probability that Members Had Hospital Readmission: Baby Partners

	Difference in Hospital Readmissions (Mothers) N=6,636 (SE; P-value)	Difference in Hospital Readmissions (Babies) N= 7,098 (SE; P-value)	Difference in Hospital Readmissions for Mothers and Babies N=7,098 (SE; P-value)
Average hospital readmissions per 1,000 members	−3 (2;0.137)	3 (2; 0.276)	−1 (3; 0.758)
Aggregate hospital readmissions	−13 (8, 0.137)	12 (10, 0.276)	−4 (13, 0.758)

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number; SE= standard error.
Notes: The logistic regression coefficient is the average difference in the probability of a hospital readmission for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. Aggregate estimates represent the change in unplanned readmissions for the number of observations in the innovation group (4,284 for mothers only regression, 4,545 for babies only regression, and 4,545 for combined mothers and babies regression). The regression controls for the following variables: treatment indicator, mother's age, number of children, cerebrovascular disease, genital disease, cardiovascular disease, CNS-related disease, gastrological disease, infectious disease, metabolic disease, psychiatric disease, pulmonary disease, skeletal disease, skin-related disease, substance abuse, and number of months that mothers and babies were observed in the sample. On average, mothers in the comparison and innovation groups were observed for 14 months, and babies in the comparison and innovation groups were observed for 6 months.

2.7 Medicaid Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 members are shown in ***Table 16.*** ED visits are sometimes viewed as a symptom of the inability of the community's health care system to provide adequate preventive and ambulatory care visits. Although reducing ED visits was not a goal, the innovation might reduce ED visits by reinforcing the use of prenatal and postnatal care to decrease pregnancy-related complications and promote babies' health. When compared with the matched comparison group, mothers and babies in the innovation group have higher rates of ED utilization.

Table 16. ED Visits per 1,000 Members: Baby Partners

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N= 2,604 (Mothers)		Innovation Group N=4,620 (Mothers)		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
All-cause ED visits per 1,000	2,016	2,591	2,143	2,485	128
	Comparison Group N= 2,604 (Babies)		**Innovation Group N=4,620 (Babies)**		**Innovation-Comparison Rate**
	Mean	**SD**	**Mean**	**SD**	
All-cause ED visits per 1,000	685	1,115	745	1,196	60

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; SD=standard deviation.
Note: Numbers might not add up because of rounding.

2.7.2 Regression Results

Table 17 presents the results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the innovation period. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in ED visits for the innovation and comparison groups for the full innovation period.

For mothers only, the average difference in ED visits is an increase of 96 ED visits per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −18, 211). For babies only, the average difference in ED visits is an increase of 56 ED visits per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −6, 118). For mothers and babies combined, the average difference in ED visits is an increase of 152 ED visit per 1,000 members in the innovation group relative to the comparison group. The effect is statistically significant (90% CI: 12, 293).

Table 17. Negative Binomial Count Model Regression Estimates for ED Visits: Baby Partners

N=7,224	Difference in ED Utilization (Mothers) (SE; P-value)	Difference in ED Utilization (Babies) (SE; P-value)	Difference in ED Utilization for Mothers and Babies (SE; P-value)
Average all-cause ED visits per 1,000 members	96 (70; 0.1670)	56 (38; 0.138)	152 (86; 0.075)
Aggregate all-cause ED visits	444 (322, 0.1670)	258 (174, 0.138)	704 (395, 0.075)

Source: RTI analysis of managed care claims data provided by Finity.

ED = emergency department; Finity = Finity Communications, Inc.; N = number; SE= standard error. Aggregate estimates represent the change in ED visits for the 4,620 observations in the innovation group.

Notes: The negative binomial coefficients are the average difference in ED visits for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. Aggregate estimates represent the change in ED visits for the 4,620 observations in the innovation group. The regression controls for the following variables: treatment indicator, mother's age, number of children, cerebrovascular disease, genital disease, cardiovascular disease, CNS-related disease, gastrological disease, infectious disease, metabolic disease, psychiatric disease, pulmonary disease, skeletal disease, skin-related disease, substance abuse, and number of months that mothers and babies were observed in the sample. On average, mothers in the comparison and innovation groups were observed for 14 months, and babies in the comparison and innovation groups were observed for 6 months.

2.8 Discussion: Baby Partners Medicaid Results

The current results do not appear to support cost savings or positive effects in other key measures, though additional results (Section 2.24.2) point to improved compliance with recommended care that may drive some of the spending results. We found that total spending was higher for mothers PMPM, babies PMPM, and the mother and baby combined during the entire pregnancy and postnatal period. However, only the difference for mothers was statistically significant ($20 loss PMPM, *p*-value= 0.094). Perhaps participants in the innovation may be more prone to higher expenditures due to unmeasured health and socioeconomic characteristics. Or perhaps the innovation is—as intended—creating a higher demand for health services because incentives are provided when participants attend prenatal and postnatal visits—and this increase in preventive care is not fully offset by reductions in complications. When we focused on mothers and babies over the entire period, the only statistically significant result that the count regression analyses found was a higher number of ED visits (increase of 152 per 1,000 members, *p*-value= 0.075). For the analyses focusing on babies only, we found that babies in the innovation group had statistically significant higher ED spending ($2 loss PMPM, *p*-value= 0.075) and a statistically significant higher number of inpatient admissions (increase of 78 per 1,000 members, *p*-value=0.023). A possible reason for the high rate of ED visits is that most participants and nonparticipants resided in urban areas (ZIP codes) where the only health care facilities were three hospitals. No walk-in clinics were available in the areas. Most participants were among the poorest Medicaid members in the country and did not have means to travel to any other health care facilities outside of the inner city.

Because this analysis focuses on pregnancies during the prenatal and postnatal periods, it better captures the impact of the innovation on the period around each pregnancy. In the long run, however, the innovation may be associated with lower spending and health care utilization if its impact lasts beyond the postnatal period.

Diabetes Management

The managed care data on the Diabetes Management incentive program covers the period of claims incurred from January 2014 to December 2014 and includes both participants and nonparticipants. All Diabetes Management participants earned at least one incentive. For this claims analysis, then, participants are HPP members who agreed to participate and earned at least one incentive from the program. Nonparticipants include diabetic members who did not earn incentives from the program. Finity provided data on 15,105 members. Of these, 13,712 were eligible for the Diabetes Management program and were included in this analysis. Following Finity's criteria, members were excluded from the analysis if they had HIV/AIDS, end-stage renal disease, or cancer.

2.9 Medicaid Comparison Group

For each claims outcome measure, we compared eligible participants to eligible nonparticipants in the Diabetes Management program. Of the 13,712 eligible members, 13,294 were nonparticipants and 418 were participants. We used PSM to select comparison group beneficiaries (i.e., nonparticipants) with similar characteristics as innovation group beneficiaries (i.e., participants). Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, number of months the patient is a member of the HPP plan, risk score, number of chronic conditions and gender. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 18 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 2*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. No innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 18. Mean Values and Standardized Differences of Variables in Propensity Score Model: Finity Diabetes Management

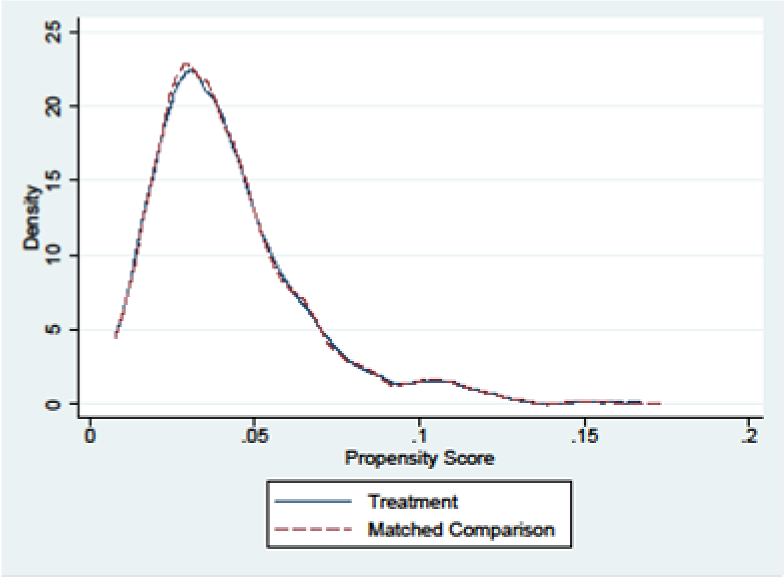
Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Age	52.72	8.77	49.11	13.09	0.32	52.72	8.77	53.16	10.72	0.04
Female	0.73	0.44	0.61	0.49	0.24	0.73	0.44	0.73	0.45	0.01
Number of member months	11.83	0.89	11.43	1.92	0.27	11.83	0.89	11.84	0.90	0.01
Risk score	4.76	3.41	3.71	3.66	0.30	4.76	3.41	4.77	3.71	0.00
Number of chronic conditions	5.93	2.75	4.47	2.58	0.55	5.93	2.75	5.89	2.75	0.01
Number of beneficiaries	418	—	13,294	—	—	418	—	1,161	—	—

Source: RTI analysis of managed care data provided by Finity.
Finity = Finity Communications, Inc.; SD = standard deviation.
— Data not applicable.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and checked whether matching decreased the absolute standardized differences and achieved acceptable balance (Table 18). The results in Table 18 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables. On the basis of observable characteristics, the comparison group selected is a good match to patients who participated in the Diabetes Management program.

Figure 2 shows the distribution of the propensity scores for both the innovation and comparison groups. The innovation and matched comparison groups' propensity scores have an extremely close overlap, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries. Therefore, we present the Medicaid claims analysis using both the innovation group and the matched comparison group.

Figure 2. Distribution of Propensity Scores for Comparison and Innovation Groups: Finity Diabetes Management



Source: RTI analysis of managed care data provided by Finity.

In the following sections, we present health care spending per member, followed by utilization rates for all-cause inpatient admissions, readmissions, ED visits, and primary care visits. Because we only received aggregate data for beneficiaries enrolled in the innovation from the time of enrollment, we are not able to present quarterly trends based on time of enrollment, and we are also not able to compare the innovation period with the baseline period on spending and utilization. Descriptive and regression spending analyses are presented as PMPM, and utilization measures are presented for the full enrollment period as per 1,000 members. Descriptive and regression analyses compare innovation and statistically matched comparison groups.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 19 reports Medicaid spending PMPM. Savings PMPM reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. Participants in the Diabetes Management program have higher ED, inpatient, and total health care spending than the matched comparison group (***Table 19***).

Table 19. Total, Inpatient, and ED Spending PMPM: Finity Diabetes Management

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=1,161		Innovation Group N=418		Savings PMPM
	Mean	SD	Mean	SD	
Total costs	$1,185	$1,727	$1,371	$2,023	−$186
Inpatient costs	$298	$926	$302	$1,016	−$4
ED costs	$25	$48	$27	$54	−$2

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; SD = standard deviation; PMPM = per member per month.
Note: Numbers might not add up because of rounding.

2.10.2 Regression Results

Table 20 presents the results of an OLS regression with spending as the dependent variable. We present the average and aggregate treatment effect during the innovation period for participants in the Diabetes Management program compared to their matched comparison group. The average PMPM total spending differential in the innovation period, indicating a loss, is $184 (90% CI: 63, 306). This effect is statistically significant. The average PMPM inpatient spending differential, indicating a loss, is $4 (90% CI: −67, 76). This effect is not statistically significant. The average PMPM ED spending differential, indicating a loss, is $1 (90% CI: −3, 5). This effect is not statistically significant. The estimates represent the average differential spending in the innovation period between individuals enrolled in the innovation and comparison group individuals. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

Table 20. OLS Regression Estimates for Medicaid Spending: Finity Diabetes Management

N=1,579	Coefficient	Standard Error	P-Values
Average Total costs PMPM	184	74	0.012
Average Inpatient costs PMPM	4	2	0.920
Average ED costs PMPM	1	2	0.790
Aggregate Total costs	909,869	365,926	0.012
Aggregate Inpatient costs	197,80	9,890	0.920
Aggregate ED costs	4,945	9,890	0.790

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; OLS = ordinary least squares; PMPM= per member per month.
Notes: The regression coefficients are the average difference in spending for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared with their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the change in spending for the 418 members in the innovation group for the total number of months members were enrolled in the innovation. On average, innovation group participants were enrolled for 11.83 months.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 members are shown in ***Table 21***. Inpatient admissions are lower for participants in the Diabetes Management program than the matched comparison group.

Table 21. All-Cause Inpatient Admissions Rate per 1,000 Members: Finity Diabetes Management

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=1,161		Innovation Group N=418		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
All-cause inpatient admissions per 1,000	411	917	385	983	−26

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.11.2 Regression Results

Table 22 presents the results of a negative binomial count model with the dependent variable set to the number of inpatient visits for each individual during the innovation period. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in inpatient admissions for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in inpatient admissions for the 418 members in the innovation group. The average difference in inpatient admissions is a decrease of 48 inpatient admissions per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −236, 140).

Table 22. Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions: Finity Diabetes Management

N=1,579	Coefficient	Standard Error	P-Values
Average all-cause inpatient admissions per 1,000 members	−48	114	0.674
Aggregate all-cause inpatient admissions	−20	48	0.674

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number.
Note: The negative binomial coefficients are the average difference in inpatient admissions for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in inpatient admissions for the 418 members in the innovation group.

2.12 Medicaid Readmissions

2.12.1 Descriptive Results

Hospital readmission rates per 1,000 members who had an inpatient admissions are shown in ***Table 23***. Participants in the Diabetes Management program have higher rates of readmissions when compared to the matched comparison group.

Table 23. Hospital Readmissions Rates per 1,000 Members: Finity Diabetes Management

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=278		Innovation Group N=95		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
Hospital readmissions per 1,000	233	730	253	743	20

Source: RTI analysis of managed care claims data.
Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.12.2 Regression Results

Table 24 presents the results of a logistic regression model with the dependent variable set to one for members who had at least one hospital readmission during the innovation period, constrained to those who had an inpatient admission. The coefficients are the average difference in the probability of a hospital readmission per 1000 members for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in readmissions for the 95 members in the innovation group.

The average difference for readmissions is 27 per 1,000 inpatient admissions (2.7 percentage points), indicating that the innovation–comparison difference is 2.7 percentage points higher during the innovation period. The effect is not statistically significant (90% CI: −44, 98).

Table 24. Logistic Model Regression Estimates for Probability that Members Had Hospital Readmission: Finity Diabetes Management

N=373	Coefficient	Standard Error	P-Values
Average hospital readmissions per 1,000 members	27	43	0.534
Aggregate hospital readmissions	3	4	0.534

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number.
Notes: The logistic regression coefficient is the average difference in the probability of a hospital readmission for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in readmissions for the 95 members in the innovation group.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 members are shown in ***Table 25.*** When compared to the matched comparison group, members in the innovation group have higher rates of ED utilization.

Table 25. ED Visits per 1,000 Members: Finity Diabetes Management

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N= 1,161		Innovation Group N=418		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
All-cause ED visits per 1,000	1,391	2,555	1,440	2,901	49

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; SD=standard deviation.
Note: Numbers might not add up because of rounding.

2.13.2 Regression Results

Table 26 presents the results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the innovation period. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in ED visits for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in ED visits for the 418 members in the innovation group.

The average difference in ED visits is an increase of 47 ED visits per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −180, 273).

Table 26. Negative Binomial Count Model Regression Estimates for ED Visits: Finity Diabetes Management

N=1,579	Coefficient	Standard Error	P-Values
Average ED visits per 1,000 members	47	138	0.734
Aggregate ED visits	20	58	0.734

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number
Notes: The negative binomial coefficients are the average difference in ED visits for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in ED visits for the 418 members in the innovation group.

2.14 Medicaid Primary Care Visits

2.14.1 Descriptive Results

The Diabetes Management LifeTracks program has four incentives: one is that the participant receives $25 for a checkup with the provider, and primary care visits can increase for participants in the program. Primary care visits per 1,000 members are shown in ***Table 27.*** When compared to the matched comparison group, members in the innovation group have higher rates of primary care visits.

Table 27. Primary Care Visits: Finity Diabetes Management

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N= 1,161		Innovation Group N=418		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
Primary care visits per 1,000	9,642	7,536	12,029	8,442	2,387

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.14.2 Regression Results

Table 28 presents the results of a negative binomial count model with the dependent variable set to the number of primary care visits for each individual during the innovation period. We estimated the equations using data on individual members. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in primary care visits for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in primary care visits for the 418 members in the innovation group.

The average difference in primary care visits is an increase of 2,273 primary care visits per 1,000 members in the innovation group relative to the comparison group. The effect is statistically significant (90% CI: 1,627, 2,919).

Table 28. Negative Binomial Count Model Regression Estimates for Primary Care Visits: Finity Diabetes Management

N=1,579	Coefficient	Standard Error	P-Values
Average primary care visits per 1,000 members	2,273	393	0.000
Aggregate primary care visits	950	164	0.000

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number.
Notes: The negative binomial coefficients are the average difference in primary care visits for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in primary care visits for the 418 members in the innovation group.

2.15 Discussion: Diabetes Management Results

The current results do not support cost savings. Participants had statistically significant higher overall spending than nonparticipants (loss of $184 PMPM, *p*-value=0.012). The innovation, by supporting and encouraging better management of diabetes, is possibly leading to higher costs related to higher demand for health services that manage the disease. Inpatient and ED spending was higher for Diabetes Management participants than nonparticipants; however, the differences were not statistically significant. Participants had fewer inpatient admissions and more ED visits and hospital readmissions; however, no difference was statistically significant. The innovation achieved the intended increase in primary care visits, where on average, each participant had 2.3 more primary care visits, which might also be related to the higher overall spending in the innovation group.

Because we did not have baseline and innovation data, we could not perform a difference-in-differences analysis to account for baseline factors. Even though our analyses controlled for observable characteristics, it did not control for unobservable factors, such as motivation to participate in the incentive program and previous health care utilization and spending, that might have affected selection into participation in the innovation and also impact outcomes. Additionally, Finity only started enrolling patients in the Diabetes Management program in July 2013, and the impact of the innovation on total spending may be more evident in the long term, particularly because diabetes is a chronic disease.

Heart Health

The managed care data on the Diabetes Management incentive program covers the period of claims incurred from January 2014 to December 2014 and includes both participants and nonparticipants. For the claims analysis, participants are HPP members who agreed to participate and earned incentives from the Diabetes Management program. Nonparticipants include eligible members who did not earn at least one incentive from the program. Finity provided data on 9,394 members. Of these, 8,647 were eligible for the Heart Health program and were included in this analysis. Following Finity's criteria, members were excluded from the analysis if they had HIV/AIDS, end-stage renal disease, or cancer.

2.16 Medicaid Comparison Group

For each claims outcome measure, we compared eligible participants to eligible nonparticipants in the Heart Health program. Of the 8,647 eligible members, 8,228 were nonparticipants and 419 were participants. We used PSM to select comparison group beneficiaries (i.e., nonparticipants) with similar characteristics as innovation group beneficiaries (i.e., participants). Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, number of months the patient is a member of the HPP plan, risk score, number of chronic conditions, and gender. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 29 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 3*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. No innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 29. Mean Values and Standardized Differences of Variables in Propensity Score Model: Finity Heart Health

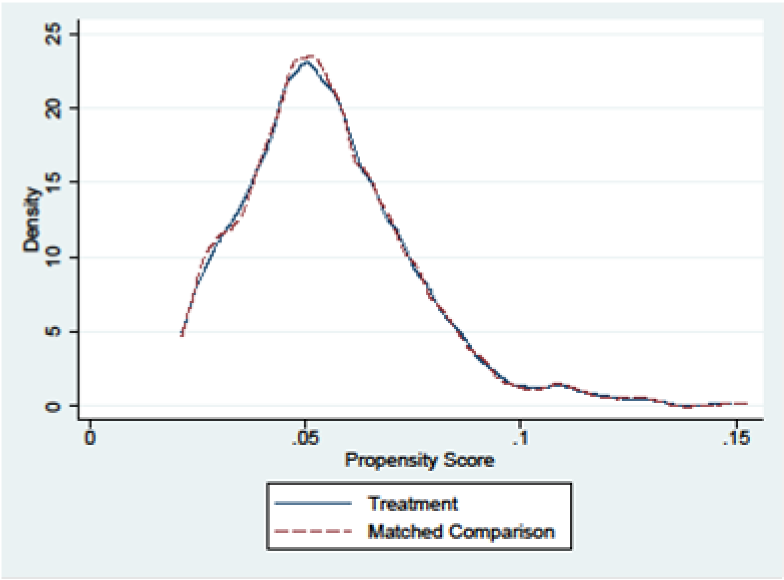
Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Age	51.29	8.41	50.18	12.01	0.11	51.29	8.41	51.44	11.36	0.02
Female	0.76	0.43	0.63	0.48	0.04	0.76	0.43	0.77	0.42	0.02
Number of member months	11.74	1.03	11.70	1.46	0.15	11.74	1.03	11.77	1.20	0.01
Risk score	3.17	2.71	2.74	2.94	0.28	3.17	2.71	3.14	3.42	0.03
Number of chronic conditions	4.27	2.53	3.61	2.30	0.29	4.27	2.53	4.18	2.52	0.04
Number of beneficiaries	419	—	8,228	—	—	419	—	1,133	—	—

Source: RTI analysis of managed care data provided by Finity.
Finity = Finity Communications, Inc.; SD = standard deviation.
— = Data not available.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and checked whether matching decreased the absolute standardized differences and achieved acceptable balance (Table 29). The results in Table 29 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables. On the basis of observable characteristics, the comparison group selected is a good match to patients who participated in the Diabetes Management program.

Figure 3 shows the distribution of the propensity scores for both the innovation and comparison groups. The innovation and matched comparison groups' propensity scores have an extremely close overlap, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries. Therefore, we present the Medicaid claims analysis using both the innovation group and the matched comparison group.

Figure 3. Distribution of Propensity Scores for Comparison and Innovation Groups: Finity Heart Health



Source: RTI analysis of managed care data provided by Finity.

In the following sections, we present health care spending per member, followed by utilization rates for all-cause inpatient admissions, readmissions, ED visits, and primary care visits. Because we only received aggregate data for beneficiaries enrolled in the innovation from the time of enrollment, we are not able to present quarterly trends based on time of enrollment, and we are also not able to compare the innovation period with the baseline period on spending and utilization. Descriptive and regression spending analyses are presented as PMPM, and utilization measures are presented for the full enrollment period as per 1,000 members. Descriptive and regression analyses compare innovation and statistically matched comparison groups.

2.17 Medicaid Spending

2.17.1 Descriptive Results

Table 30 reports Medicaid spending PMPM. Savings PMPM reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. Participants in the Heart Health program have higher total and inpatient spending and about the same ED spending when compared with the matched comparison group.

Table 30. Total, Inpatient, and ED Spending PMPM: Finity Heart Health

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=1,133		Innovation Group N=419		Savings PMPM
	Mean	SD	Mean	SD	
Total costs	$653	$1,372	$755	$1,225	−$102
Inpatient costs	$168	$698	$156	$649	−$12
ED costs	$22	$56	$22	$41	$0

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; PMPM = per member per month; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.17.2 Regression Results

Table 31 presents the results of an OLS regression with spending as the dependent variable. We present the average and aggregate treatment effect during the innovation period for participants in the Heart Health program compared to their matched comparison group. The average PMPM total spending differential in the innovation period, indicating a loss, is $89 (90% CI: −0.5, 178). This effect is not statistically significant. The average PMPM inpatient spending differential, indicating savings, is −$17 (90% CI: −65, 32). This effect is not statistically significant. The average PMPM ED spending differential, indicating savings, is −$1 (90% CI: −5, 3). This effect is not statistically significant. Average estimates represent the PMPM average differential spending in the innovation period between individuals enrolled in the innovation and comparison group individuals. Aggregate estimates represent the difference in spending for the 419 members in the innovation group through the innovation period. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

Table 31. OLS Regression Estimates for Medicaid Spending: Finity Heart Health

N=1,552	Coefficient	Standard Error	P−Value
Average Total costs PMPM	89	54	0.102
Average Inpatient costs PMPM	−17	30	0.576
Average ED costs PMPM	−1	2	0.776
Aggregate Total costs	437,796	265,629	0.102
Aggregate Inpatient costs	−83,624	147,571	0.576
Aggregate ED costs	−4,919	9,838	0.776

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; OLS = ordinary least squares; PMPM= per member per month.
Notes: The regression coefficients are the average difference in spending for the innovation and comparison groups, representing the PMPM average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the change in spending for the 419 members in the innovation group for the total number of months members were enrolled in the innovation. On average, innovation group participants were enrolled for 11.74 months.

2.18 Medicaid Inpatient Admissions

2.18.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 members are shown in ***Table 32***. Inpatient admissions are higher for participants in the Heart Health program than the matched comparison group.

Table 32. All-Cause Inpatient Admissions Rate per 1,000 Members: Finity Heart Health

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=1,133		Innovation Group N=419		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
All-cause inpatient admissions per 1,000	215	662	227	691	12

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.18.2 Regression Results

Table 33 presents the results of a negative binomial count model with the dependent variable set to the number of inpatient visits for each individual during the innovation period. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in inpatient admissions for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in inpatient admissions for the 419 members in the innovation group. The average difference in inpatient admissions is an increase of 12 inpatient admissions per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −22, 32).

Table 33. Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions: Finity Heart Health

N=1,552	Coefficient	Standard Error	P-Values
Average all-cause inpatient admissions per 1,000 members	12	39	0.760
Aggregate all-cause inpatient admissions	5	16	0.760

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number.
Note: The negative binomial coefficients are the average difference in inpatient admissions for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared with their matched comparison group. The regression controls for age only. Other covariates had to be dropped due to perfect prediction. Aggregate estimates represent the difference in inpatient admissions for the 419 members in the innovation group.

2.19 Medicaid Readmissions

2.19.1 Descriptive Results

Hospital readmissions rates per 1,000 members who had an inpatient admissions are shown in ***Table 34***. Participants in the Heart Health program have higher rates of readmissions when compared to the matched comparison group.

Table 34. Hospital Readmissions Rates per 1,000 Members: Finity Heart Health

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N=162		Innovation Group N=62		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
Hospital readmissions per 1,000	152	572	194	596	41

Source: RTI analysis of managed care claims data.
Finity = Finity Communications, Inc.; N = number; SD = standard deviation.
Note: Numbers might not add up because of rounding.

2.19.2 Regression Results

Table 35 presents the results of a logistic regression model with the dependent variable set to one for members who had at least one hospital readmission during the innovation period, constrained to those who had an inpatient admission. The coefficients are the average difference in the probability of a hospital readmission per 1,000 members for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in readmissions for the 62 members in the innovation group with at least one inpatient admission.

The average difference for readmissions is 24 per 1,000 inpatient admissions (2.4 percentage points), indicating that the innovation–comparison difference is 2.4 percentage points higher during the innovation period. The effect is not statistically significant (90% CI: −48, 98).

Table 35. Logistic Model Regression Estimates for Probability that Members Had Hospital Readmission: Finity Heart Health

N=224	Coefficient	Standard Error	P-Values
Average hospital readmissions per 1,000 members	24	44	0.584
Aggregate hospital readmissions	1	3	0.584

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; N = number.
Notes: The logistic regression coefficient is the average difference in the probability of a hospital readmission for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in readmissions for the 62 members in the innovation group.

2.20 Medicaid Emergency Department Visits

2.20.1 Descriptive Results

ED visits per 1,000 members are shown in ***Table 36.*** When compared to the matched comparison group, members in the innovation group have lower rates of ED utilization.

Table 36. ED Visits per 1,000 Members: Finity Heart Health

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N= 1,133		Innovation Group N=419		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
All-cause ED visits per 1,000	1,150	2,808	1,143	1,881	−6

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; SD=standard deviation.
Note: Numbers might not add up because of rounding.

2.20.2 Regression Results

Table 37 presents the results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the innovation period. We estimated the equations using data on individual members. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in ED visits for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in ED visits for the 419 members in the innovation group.

The average difference in ED visits is an increase of 93 ED visits per 1,000 members in the innovation group relative to the comparison group. The effect is not statistically significant (90% CI: −154, 340).

Table 37. Negative Binomial Count Model Regression Estimates for ED Visits: Finity Heart Health

N=1,552	Coefficient	Standard Error	P-Values
Average ED visits per 1,000 members	93	150	0.538
Aggregate ED visits	39	63	0.538

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number.
Notes: The negative binomial coefficients are the average difference in ED visits for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in ED visits for the 419 members in the innovation group.

2.21 Medicaid Primary Care Visits

2.21.1 Descriptive Results

The Heart Health LifeTracks program has four incentives, one of which pays participants $20 for a checkup with their provider. As a result, Heart Health participants may increase primary care visits. ***Table 38*** shows primary care visits per 1,000 members. When compared to the matched comparison group, members in the innovation group have higher rates of primary care visits.

Table 38. Primary Care Visits: Finity Heart Health

Awardee Number: 1C1CMS331034
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Comparison Group N= 1,133		Innovation Group N=419		Innovation-Comparison Rate
	Mean	SD	Mean	SD	
Primary care visits per 1,000	7,239	6,600	9,819	7,718	2,579

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number; SD=standard deviation.
Note: Numbers might not add up because of rounding.

2.21.2 Regression Results

Table 39 presents the results of a negative binomial count model with the dependent variable set to the number of primary care visits for each individual during the innovation period. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. The coefficients are the average difference in primary care visits for the innovation and comparison groups for the full innovation period. Aggregate estimates represent the difference in primary care visits for the 419 members in the innovation group.

The average difference in primary care visits is an increase of 2,594 primary care visits per 1,000 members in the innovation group relative to the comparison group. The effect is statistically significant (90% CI: 2,010, 3,179).

Table 39. Negative Binomial Count Model Regression Estimates for Primary Care Visits: Finity Heart Health

N=1,552	Coefficient	Standard Error	P-Values
Average primary care visits per 1,000 members	2,594	356	0.000
Aggregate primary care visits	1,087	149	0.000

Source: RTI analysis of managed care claims data provided by Finity.
ED = emergency department; Finity = Finity Communications, Inc.; N = number.
Notes: The negative binomial coefficients are the average difference in primary care visits for the innovation and comparison groups, representing the average treatment effect during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The regression controls for the following variables: age, gender, months in the sample, risk score, and number of chronic conditions. Aggregate estimates represent the difference in primary care visits for the 419 members in the innovation group.

2.22 Discussion: Heart Health Medicaid Results

The current results do not support cost savings. We found that total spending was higher for Heart Health participants than nonparticipants; however, the difference was not statistically significant. Inpatient and ED spending were lower for participants than nonparticipants, but no difference was statistically significant. When compared to nonparticipants, participants had more inpatient admissions, readmissions, and ED visits; however, no difference was statistically significant. The innovation achieved the intended increase in primary care visits, where each participant had, on average, 2.6 more primary care visits than nonparticipants.

Because we did not have baseline and innovation data, we could not perform a difference-in-difference analysis to account for baseline factors. Even though our analyses controlled for observable characteristics, it did not control for unobservable factors, such as motivation to participate in the incentive program and previous health care utilization and spending, that might have affected selection into participation in the innovation and also impact outcomes. Additionally, Finity only started enrolling patients in the Heart Health program in July 2013, and the impact of the innovation on total spending may be more evident in the long term, particularly because hypertension is a chronic disease.

2.23 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Finity submitted data to RTI that are current through June 2015. ***Table 40*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. These measures have been revised slightly since the 2015 annual report to reflect the actual data received from Finity for Diabetes Management and Heart Health.

Table 40. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measures	Status
Clinical effectiveness	Pregnancy	Ultrasounds received	Data received from Finity
		Percentage who received an influenza immunization	Data received from Finity
		Office visits (during pregnancy and postpartum)	Data received from Finity
		Patients who received a glucose test (if applicable)	Data received from Finity
	Diabetes	Percentage of targeted members with diabetes who received a HbA1c test	Data received from Finity
		Percentage of targeted members with diabetes who received LDL-C screening	Data received from Finity
		Percentage of targeted members with diabetes who received a nephropathy screening	Data received from Finity
		Percentage of targeted members with diabetes who received an eye screening	Data received from Finity
	Cardiovascular Disease	Percentage of targeted members with diabetes who received LDL-C screening	Data received from Finity
Health outcomes	Pregnancy	Birth weight	Data received from Finity

LDL-C = low-density lipoprotein cholesterol.

Clinical effectiveness refers to the extent to which patients with certain health conditions are provided with appropriate clinical care. We used the same sample of participants from the claims analysis. Therefore, it is a matched subsample of the overall Baby Partners, Diabetes Management, or Heart Health participants. The same control group was also used in the regression analyses. We examined health outcomes among Baby Partners participants. Similar to the clinical effectiveness analyses, we used the same sample of participants from the claims analysis. Therefore, it is a matched subsample of the overall Baby Partners participants. The same control group was also used in the regression analyses.

2.24 Baby Partners

Finity provided data on whether Baby Partners participants received prenatal and postpartum care services, as well as birth weight data, allowing us to address the following questions:

Evaluation Questions

- What percentage of Baby Partners participants are receiving prenatal and postpartum care?
- Do Baby Partners participants receive more prenatal and postpartum care services than nonparticipants?
- How did the birth weights of Baby Partners participants compare with those of nonparticipants?

2.24.1 Descriptive Results

Table 41 demonstrates that the vast majority of Baby Partners participants for whom we had additional clinical effectiveness data completed at least one office visit during pregnancy (98.9%) and obtained at least one ultrasound (98.5%). Only slightly more than one-third, however, completed a postpartum visit (39.2%), and about one-fourth obtained a flu vaccine (27.1%). On average, participants completed 11.2 office visits during pregnancy and received more than 10 ultrasounds. Office visits may specifically include prenatal visits, but may be for other clinical reasons as well. These data are consistent with the data presented in the dose section below; although, we only have clinical effectiveness data for significantly less than the almost 12,000 Baby Partners participants enrolled, as this data was provided by HPP as part of the claims data.

Table 41. Clinical Effectiveness Measures Among Baby Partners Participants with Claims Data Available

	Number of Participants with Any Visits/ Services	Percent of Participants with Any Visits/ Services	Mean Number	Median Number	Range
Baby Partners Participants N=4,620					
Office visit during pregnancy[1]	4,555	98.9	11.2	11	0 to 40
Ultrasounds received	4,552	98.5	10.6	8	0 to 66
Glucose test received	87	1.9	0.0	0	0 to 4
Flu vaccine received	1,250	27.1	0.3	0	0 to 3
Postpartum office visit[2]	1,810	39.2	0.4	0	0 to 4

Source: Pregnancy-level data provided to RTI by Finity.
[1] Office visit during pregnancy defined by CPT codes 99201–99205 and 99211–99215.
[2] Postpartum office visit defined by CPT code 59430.

Table 42 shows the average birth weight among Baby Partners participants and nonparticipants. Overall, the mean weight among participants was 3,145 grams compared to 3,116 grams for nonparticipants.

Table 42. Birth Weight: Baby Partners

	(1) Nonparticipant N=3,722		(2) Participant N=4,531	
	Mean	SD	Mean	SD
Birth weight (grams)	3,116	592	3,145	601

Source: RTI analysis of managed care data provided by awardee.
Finity = Finity Communications, Inc.; N = number of unique pregnancies; SD = standard deviation.

2.24.2 Regression Results

Table 43 shows the difference-in-differences estimates for the Baby Partners participants compared to the control group of Baby Partners nonparticipants as described above. Overall, Baby Partners participants had significantly more office visits during pregnancy and postpartum, received more ultrasounds, and were more likely to receive a flu vaccine compared to matched nonparticipants. Baby Partner participants were not more likely to receive a glucose test, which makes sense, as glucose tests are not as commonly prescribed during pregnancy.

Table 43. OLS Regression Estimates for Clinical Effectiveness Measures: Baby Partners

Clinical Effectiveness Outcome (n=7,224)	Coefficient	Standard Error	P-Values
Office visit during pregnancy[1]	2.105	0.116	0.00
Ultrasounds received	1.596	0.168	0.00
Glucose test received	0.00596	0.00482	0.216
Flu vaccine received	0.0640	0.0105	0.00
Postpartum office visit[2]	0.139	0.0118	0.00

Source: RTI analysis of managed care claims data provided by Finity.
[1] Office visit during pregnancy defined by CPT codes 99201–99205 and 99211–99215.
[2] Postpartum office visit defined by CPT code 59430.
Finity = Finity Communications, Inc.; OLS = ordinary least squares.
Notes: The regression coefficients are OLS regression estimates. Covariates used: treatment indicator (reported), mother's age, number of children, cerebrovascular disease, genital disease, cardiovascular disease, CNS-related disease, gastrological disease, infectious disease, metabolic disease, psychiatric disease, pulmonary disease, skeletal disease, skin-related disease, substance abuse, and months in the sample.

Table 44 demonstrates the results are significant at the 10% level, indicating that babies of participating mothers are on average 24.49 grams heavier than babies of nonparticipating mothers (P-value=0.08). This positive health outcome might be due to the impact of prenatal care on the health of mothers and their babies.

Table 44. OLS Regression Estimates for Baby Birth Weight: Baby Partners

N=7,087	Coefficient	Standard Error	P-Values
Birth weight (grams)	24.49	13.88	0.078

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; OLS = ordinary least squares.
Notes: The regression coefficients are OLS regression estimates. Covariates used: treatment indicator (reported), mother's age, number of children, cerebrovascular disease, genital disease, cardiovascular disease, CNS-related disease, gastrological disease, infectious disease, metabolic disease, psychiatric disease, pulmonary disease, skeletal disease, skin-related disease, substance abuse, and months in the sample.

2.25 Diabetes

We also received data on whether Diabetes Management participants received an HbA1c test, an eye exam, a low-density lipoprotein cholesterol (LDL-C) test, or a nephropathy screening during the innovation period. This allowed us to examine whether appropriate clinical services were provided to those with diabetes during the innovation.

Evaluation Questions

- What percentage of Diabetes Management participants received an HbA1c test during the innovation period?
- What percentage of Diabetes Management participants received an eye exam during the innovation period?
- What percentage of Diabetes Management participants received an LDL-C test during the innovation period?
- What percentage of Diabetes Management participants received a nephropathy screening during the innovation period?
- Did Diabetes Management participants receive more diabetes care services than nonparticipants?

2.25.1 Descriptive Results

Table 45 demonstrates that the vast majority of Diabetes Management participants for whom we had additional clinical effectiveness data completed an HbA1c test (95.9%) and an LDL-C test (90.9%). The high percentage of completed HbA1c and LDL-C tests may be because these tests were included as part of the incentives for Diabetes Management. Less than one-third of Diabetes Management participants for whom we had data received an eye exam (28%) and nephropathy screening (17.7%). These data are consistent with the data presented in dose; although, we only have clinical effectiveness data for slightly more than half of all Diabetes Management participants.

Table 45. Clinical Effectiveness Measures Among Diabetes Management Participants with Claims Data Available

	Number of Participants with Any Visits/ Services	Percent of Participants with Any Visits/ Services	Mean Number
Diabetes Participants (n=418)			
HbA1c test	401	95.9	1.0
Eye exam	117	28.0	0.3
LDL-C test	380	90.9	0.9
Nephropathy screening	74	17.7	0.2

Source: Patient-level data provided to RTI by Finity.
LDL-C = low-density lipoprotein cholesterol.

2.25.2 Regression Results

Table 46 shows the estimates for the Diabetes Management participants compared to the control group of nonparticipants as described above. Overall Diabetes Management participants had significantly more HbA1c and LDL-C tests compared to matched nonparticipants. Diabetes Management participants were not more likely to receive an eye exam or nephropathy screening compared to nonparticipants.

Table 46. OLS Regression Estimates for Clinical Effectiveness Measures: Finity Diabetes Management

Clinical Effectiveness Outcome N=1,579	Coefficient	Standard Error	P-Values
HbA1c test	0.142	0.0151	0.00
Eye exam	0.0389	0.0217	0.074
LDL-C test	0.142	0.0177	0.00
Nephropathy screening	0.0284	0.0184	0.122

Source: RTI analysis of managed care claims data provided by Finity.
Finity = Finity Communications, Inc.; LDL-C = low-density lipoprotein cholesterol; OLS = ordinary least squares.
Notes: The regression coefficients are OLS regression estimates. Covariates used: treatment indicator (reported), age, gender, risk score, and count of comorbidities

2.26 Heart Health

Finity provided data on whether Heart Health participants received an LDL-C test, allowing us to address the question: were appropriate clinical services provided to participants during the innovation?

Evaluation Questions

- What percentage of Heart Health patients received an LDL-C test during the innovation period?

2.26.1 Descriptive Results

Table 47 demonstrates that the vast majority of Heart Health participants for whom we had additional clinical effectiveness data for completed a LDL-C test (76.4%). An incentive was provided for the Heart Health participants to complete a LDL-C test

Table 47. Clinical Effectiveness Measures Among Heart Health Participants with Claims Data Available

	Number of Participants with Any Visits/ Services	Percent of Participants with Any Visits/ Services	Mean Number
Heart Health Participants (n=419)			
LDL-C test	320	76.4	0.76

Source: Patient-level data provided to RTI by Finity.
LDL-C = low-density lipoprotein cholesterol.

2.27 Discussion: Awardee-Specific Data

Overall, Baby Partners participants had significantly more prenatal and postpartum services compared to nonparticipants for both services that were and were not specifically incentivized by the program (e.g., flu vaccines, ultrasounds, office visits for pregnancy and postpartum). Baby weight is higher at the 10 percent level, which is likely due to the increase in health care services received by participants during pregnancy. These results are also likely attributable to HPP's prior experience with Baby Partners and the high levels of participation among HPP members.

For Diabetes Management, the only significant differences between participants and nonparticipants were in HbA1c and LDL-C tests, which were included as part of the incentive program. This results reiterate that incentives do, in fact, encourage members to obtain care related to their chronic conditions. The number of members included in Diabetes Management and Heart Health was much lower, however, as compared to Baby Partners, so as additional members enroll in these programs, we may see additional differences between participants and nonparticipants for services not specifically included as part of the incentive program (e.g., eye exam, nephropathy screening).

2.28 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 48*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from Finity's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in Sections 2.30 through 2.34 are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 48. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Members enrolled in Baby Partners incentive component	Data received from Finity
		Members enrolled in Diabetes Management incentive component	Data received from Finity
		Members enrolled in Heart Health incentive component	Data received from Finity
	Dose	Baby Partners: incentive received by specific activity completed (e.g., prenatal visit, postnatal visit, dental visit)	Data received from Finity
		Diabetes Management: incentive received by specific activity completed (e.g., LDL-C test, hemoglobin A1c test, peer mentor contact)	Data received from Finity
		Heart Health: incentive received by specific activity completed (e.g., LDL-C test, PCP visit, improve blood pressure)	Data received from Finity

Finity = Finity Communications, Inc.; FTE = full-time equivalent; HbA1c = hemoglobin A1c test; LDL-C = low-density lipoprotein cholesterol; PCP = primary care provider.

2.29 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their roles in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.29.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed with 11.5 full-time equivalent (FTE) staff members. Between January – June, 2015 (Q11 and Q12, FTEs remained at 11.5, and no new hires were made. Finity did not report any issues with hiring, but they did need additional PHMs to handle the call volume. Finity supplemented the PHM staff with three of its own call center employees to conduct outbound calls to members and increase engagement in LifeTracks. Finity cited having dedicated FTE staff members to conduct member outreach facilitated implementation, and it was an important lesson learned.

2.29.2 Skills, Knowledge, and Training

According to data provided in the Q11–Q12 *Quarterly Awardee Performance Report,* Finity provided 0 hours of training between Q11 and Q12. A representative from Finity later indicated that 152 hours were provided but not reflected in Q11–Q12 *Quarterly Awardee Performance Report* data. A Year 2 site visit interviewee also noted the following:

> *"At first, Finity used the three peers with the grant to make outbound calls. They were getting a backlog with voice mails and didn't have the bandwidth to handle it. Finity decided to use their call center reps (three additional reps). They trained their reps using Duke's training program and some additional trainings."*

The additional call center staff and training were resources provided in-kind by Finity in support of innovation implementation.

Initial innovation training consisted of Health Insurance Portability and Accountability Act (HIPAA) compliance and PHM certification. In earlier quarters, Finity facilitated the training of the three original customer service representatives as PHMs, who then conducted outreach to HPP members. Because staff served as PHMs and were responsible for recruiting and enrolling HPP members, HIPAA training taught staff to access and use members' health information appropriately. The PHM certification trained mentors on how to conduct the outbound calls and outreach to members and also ensured consistent processes across all mentors. Finity worked with Duke to create distance-learning content and software for the PHM certification based on Duke's integrative health coaching program. Topics covered during the training included how to speak with participants, sympathy versus empathy, types of listening, and how to be an active listener.

Table 49. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12 (January–June 2015)	0	0
Since inception	616	26

Note: Trainees are counted more than once if they participated in more than one HCIA training course. Hours reported come from the Q11–Q12 *Quarterly Awardee Performance Reports*.
Q = quarter. Q11–Q12 = January–June 2015.

2.30 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions:

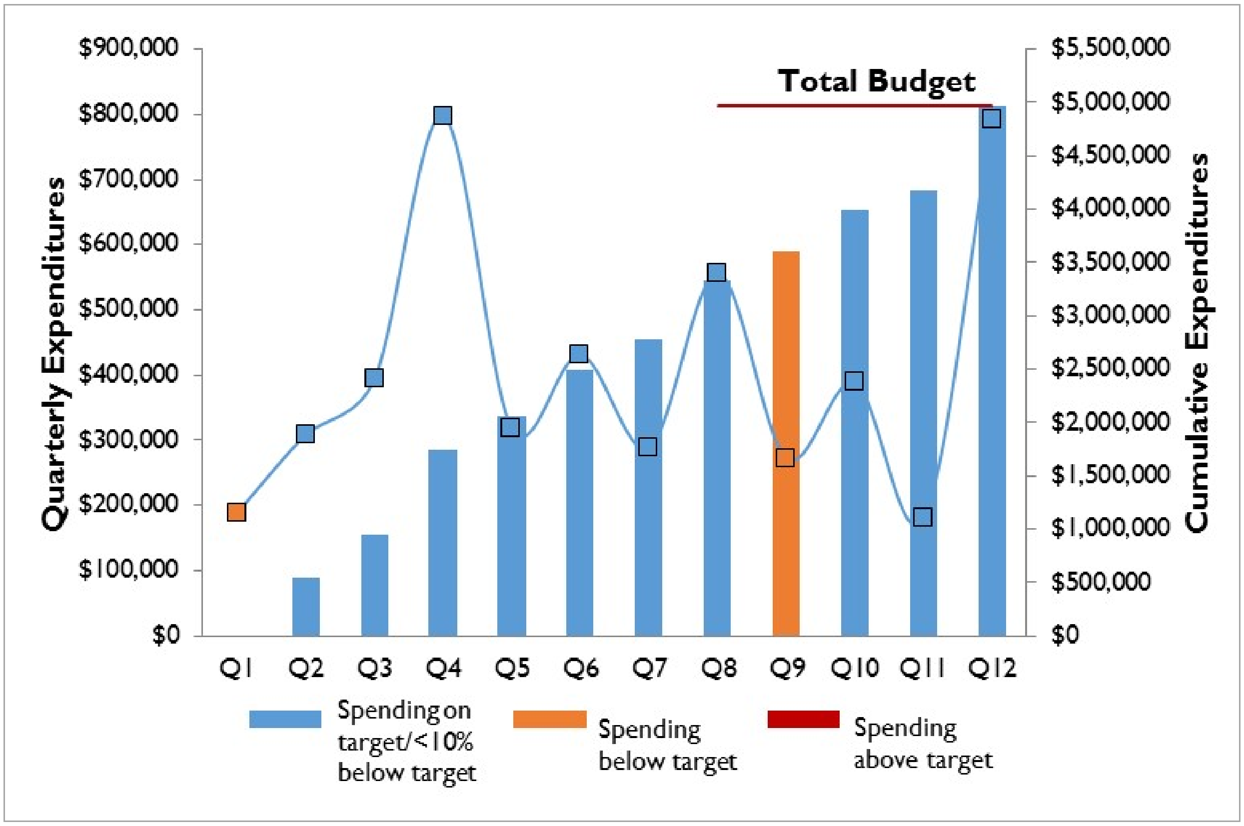
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.30.1 Award Execution

The annual report highlights the significance of Finity's expenditure rates on implementation. As of June 2015 (Q12), Finity spent 100 percent of its total budget, which is at the projected target. ***Figure 4*** demonstrates that significant spending occurred in earlier quarters in project startup. Spending remained on target throughout the innovation despite some challenges with PHM capacity and leadership at the partner organizations. These challenges will be discussed in later sections.

Figure 4. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.30.2 Leadership

Finity's leadership support remained strong and engaged throughout the award. This strong support was complemented by partner organizations. Project champions from Finity and all partners attended weekly meetings to review milestones and challenges. Finity also led quarterly governance meetings with key leadership from its partners. Furthermore, Finity conducted annual strategic meetings with project leadership to discuss progress, align goals, and obtain support as the program evolved. The Finity project director remained with the innovation throughout the award, providing continuity and consistency despite some turnover in senior management and analytics staff at the partner organizations.

Finity reported some challenges related to turnover in leadership at HPP and in analytics at SCIO. This turnover resulted in a lengthy reassessment of the incentive programs, consequently causing a delay in expanding the Heart Health and Diabetes Management programs. This turnover pushed Finity to educate and ensure the cooperation of new leadership at the partner organizations. In Q11, Finity reported that training new health plan leadership caused delays in implementation. Moving forward, beyond HCIA, Finity notes that it will hire an additional project manager, who will train new leadership on Finity's tracking technology.

2.30.3 Organizational Capacity

In the final two quarters of their award, Finity expanded capacity to enhance the Baby Partners component and increase membership for the Diabetes Management and Heart Health programs. Additionally, Finity's partner, SCIO Health Analytics, noted that they underestimated the resources needed for innovation analytics and reporting. HPP and SCIO took longer to negotiate data measures and analysis strategies than originally envisioned. In Q11, Finity cited moving the milestone of developing the analytics plan to the beginning of the project lifecycle for future implementations. A SCIO Health Analytics staff member noted the following:

> *"We went in under the assumption of the amount and types of resources we would need, and we underestimated how much it would take. Building the data, validating the information with HPP took longer than we thought. Building the methodology for the maternity (program) post launch was tricky. When you are building these types of outputs, it is best to build it upfront, prelaunch, and get everyone to agree upfront. Communicating the data management and methodology with the key players that may not have the research experience took more time than we had expected."*

Finally, HPP suggested that changes within the state's health care climate strained resources available to support the innovation. "*Pennsylvania undertook a quasi-Medicaid expansion…now we have had a new governor and he is reversing the whole thing. Frankly, this (innovation) is not one of my top 10 projects and so I've had other people on my team able to step up and do what needed to be done. But, we haven't put in additional effort that might have been able to push this even further.* " Combined with state requirements to review all messages sent to Medicaid beneficiaries as part of LifeTracks implementation, these external factors slowed innovation implementation.

2.30.4 Innovation Adoption and Workflow Integration

Finity built the main innovation component, LifeTracks, around existing HPP condition management programs, which meant that the initial groundwork and integration had already occurred. For example, Baby Partners—the component of the innovation that offered prenatal care and support services for pregnant Medicaid beneficiaries—operated at HPP before the award. Finity enhanced this program with multiple forms of communication (e.g., mail, phone, e-mail, text) from the PHMs to participants; financial incentives; and a tracking platform to better analyze and engage this population.

HPP cited challenges in engaging the Medicaid population, including limitations in access to certain types of technology (more smartphones, fewer personal computers). PHMs struggled to locate participants for whom they had incorrect contact information. Finity also reported that gaining approval from the Department of Public Welfare for their messaging and outreach to Medicaid participants was challenging. Finity overcame these challenges with leadership support from HPP and partner organizations, frequent communication among partner organizations, and a flexible approach to staffing supported innovation adoption.

In Q12, Finity reported several lessons learned about adoption of the innovation at the member (patient) levels. Finity found that payers were motivated by measure compliance, while providers were motivated by performance incentives. As a result, Finity developed both payer and provider portals with comparative performance data. For example, for payers, these portals contained comparative data on the Healthcare Effectiveness Data and Information Set (HEDIS) and risk analytics. Additionally, Finity reported that incentives were key motivators for members to participate in the condition management LifeTracks. However, timely payment of incentives proved challenging at times. One Year 2 site visit interviewee noted the following:

> *"The member may see a primary care physician, but money may not be loaded on their card for 6 weeks. So some members don't like to have to wait. Everything is explained when they enroll, but the member wants their money."*

Extensive testing and studies of the habits of HPP members and other state populations determined which incentive structures and amounts yielded the greatest participant engagement. Finity learned the importance of matching rewards with outcomes that individuals feel they can control. Finity also found that incentives need to be communicated using a robust engagement campaign, and that, in a payer-based program, PHMs are a cost-effective and successful outreach method for members.

2.31 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine whether the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which (1) the innovation reached the number of targeted members or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question:

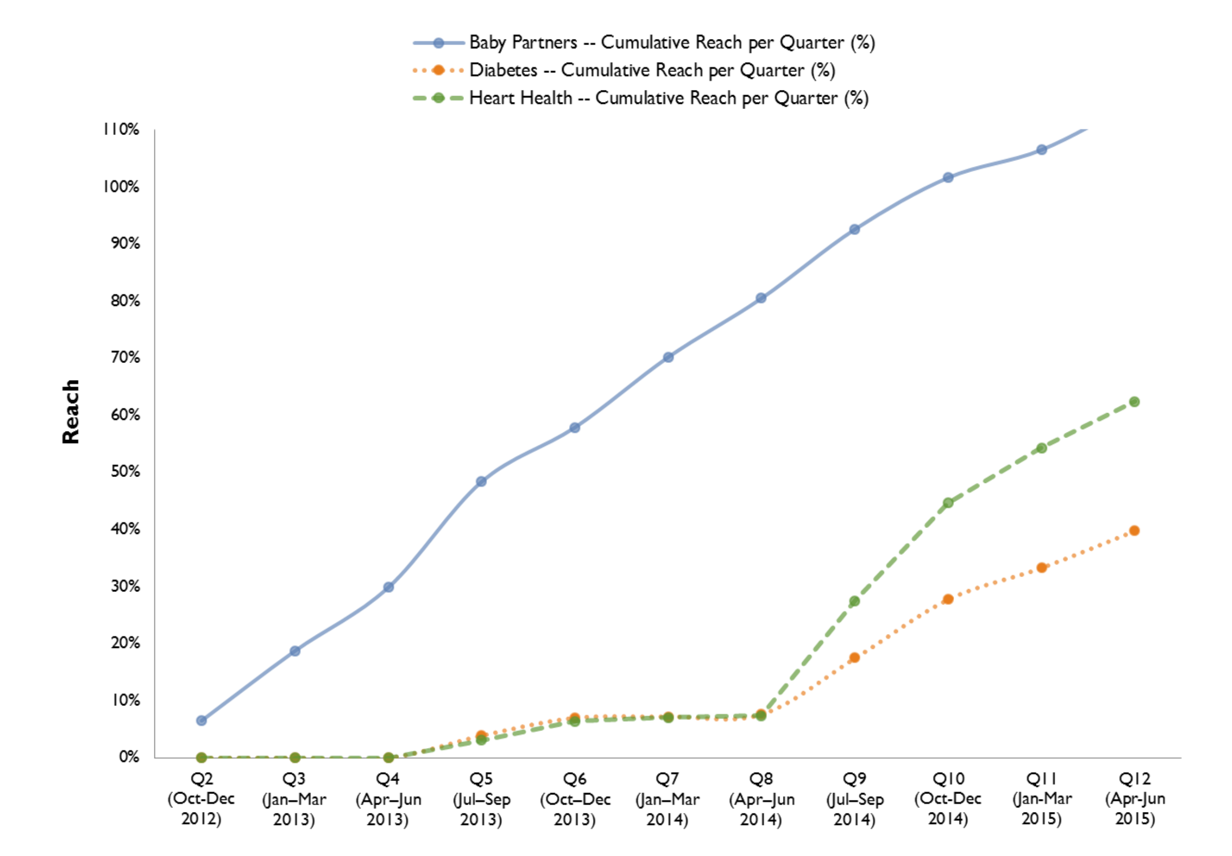
Evaluation Question
• What is the implementation effectiveness as measured by reach and dose of the innovation?

2.31.1 Innovation Reach

Figure 5 shows reach by quarter since the launch of Finity's innovation through Q12 and is based on target population and enrollment data for each of the three LifeTracks. Since the last annual report (2015), Finity enrolled an additional 224 Baby Partners participants, increasing reach to 11,999 participants. This total also includes 654 participants with missing enrollment dates. Given that the target population was 10,445 HPP members, the percent reach for Baby Partners increased to 114.9 percent through Q12. For Diabetes Management, Finity enrolled an additional 125 participants in the last quarter, increasing reach from 33.3 percent to 39.7 percent (target population 1,935 HPP members); and for Heart Health, an additional 97 participants enrolled since Q11, increasing reach from 54.3 percent to 62.4 percent (target population 1,201 HPP members).

After Q8, Finity began to increase its engagement and outreach. Before Q8, the PHMs funded by HCIA had already reached capacity with inbound call volume. Finity began using their call center representatives to expand staffing capacity and conduct outreach to more participants. Additionally, Finity deployed health alerts that they described as targeted Web and text alerts providing relevant health information and resources to LifeTracks participants at the right time. As reported in prior annual reports, the Pennsylvania Department of Public Welfare's approval time for the content of the health alerts delayed deployment. We infer this delay initially resulted in lower reach for the Diabetes Management and Heart Health LifeTracks. HPP had already piloted Baby Partners; therefore, the LifeTracks program required less startup time. As demonstrated in Figure 5, once Finity added their call center staff and received approval for their health alerts, reach increased in the Diabetes Management and Heart Health LifeTracks. These results are also consistent with Finity's positive feedback on how effective PHMs were in reaching participants.

Figure 5. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q2 (Oct–Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
•	Baby Partners—Cumulative reach per quarter (%)	6.5	18.7	29.8	48.3	57.9	70.2	80.5	92.6	101.6	106.5	114.9
	Baby Partners—Cumulative number enrolled[1]	677	1,953	3,113	5,047	6,043	7,328	8,405	9,667	10,613	11,121	11,999
•	Diabetes Management—Cumulative reach per quarter (%)	0.0	0.0	0.0	3.9	7.0	7.2	7.6	17.5	27.8	33.3	39.7
	Diabetes Management—Cumulative number enrolled	0	0	0	76	136	140	148	338	537	644	769
•	Heart Health—Cumulative reach per quarter (%)	0.0	0.0	0.0	3.1	6.4	7.0	7.3	27.5	44.6	54.3	62.4
	Heart Health—Cumulative number enrolled	0	0	0	37	77	84	88	330	536	652	749

Source: Patient-level data provided to RTI by Finity.
[1] Includes 654 Baby Partners participants with missing enrollment dates.
Q = quarter.

2.31.2 Innovation Dose

We capture dose in the condition-specific LifeTracks incentive programs as the number and type of incentives received for specific activities. Baby Partners enrollees received incentive payments for completing prenatal, postnatal, and dental visits and a bonus payment for completing all three of these activities. The Diabetes Management program participants received an incentive for completing an LDL-C) test, an HbA1c test, monthly contact with a peer health mentor, and a visit with their provider. The Heart Health participants received an incentive for completing an LDL-C test, a primary care visit, improved blood pressure as reported by providers, medication adherence for refilling prescriptions), and monthly contact with a peer health mentor.

We last reported dose in the 2015 annual report on the basis of data through Q12 for Baby Partners, Diabetes Management, and Heart Health. As expected, the number of services provided and the percentage of participants who received those services have increased since Q11. ***Tables 50***, ***51***, and ***52*** provide the number of incentives rewarded for each of the condition management programs from Q2 through Q12 of the innovation.

For Baby Partners, more than one-third of participants completed just one activity and received an incentive payment for either a prenatal visit (11.8%), a dental visit (7.9%), or a postpartum visit (17.6%), and approximately 30 percent completed two of the three required activities, such as a prenatal visit and a dental visit (8.7%), a prenatal visit and a postpartum visit (10.5%), or a dental visit and a postpartum visit (12.7%). In addition, only 16.3 percent received a bonus payment for completing all three activities. Lastly, 14.5 percent of those enrolled did not complete any of the required activities and, thus, did not earn an incentive.

Table 50. Number and Types of Incentives Provided to Baby Partners Participants

Incentive Activities	Number of Incentives Provided	Percentage of Total Enrolled Participants (N=11,999)
Prenatal visit only	1,418	11.8
Dental visit only	952	7.9
Postpartum visit only	2,107	17.6
Prenatal visit and dental visit	1,045	8.7
Prenatal visit and postpartum visit	1,261	10.5
Dental visit and postpartum visit	1,520	12.7
Bonus received for all three activities completed	1,955	16.3
Enrolled but no incentives received	1,741	14.5
Total	11,999	100.0

Source: Patient-level data provided to RTI by Finity.

For the Diabetes Management program, the vast majority of participants completed an HbA1c assessment (80.9%), a provider visit (87.3%), and an LDL-C test (69.8%), and fewer than 10 percent had monthly interactions with their peer health mentors. This result was expected, because completing an HbA1c assessment or LDL-C test was a one-time activity, and contact with the peer health mentor required an ongoing monthly commitment. Every Diabetes Management participant, however, received at least one incentive.

Table 51. Number and Types of Incentives Provided to Diabetes Management Participants

Incentive Activities	Number of Incentives Provided	Percentage of Total Enrolled Participants (N=769)
LDL-C test	537	69.8
HbA1c assessment	622	80.9
Provider visit	671	87.3
Monthly contact with peer health mentor	69	9.0

Source: Patient-level data provided to RTI by Finity.
HbA1c = hemoglobin A1c test; LDL-C = low-density lipoprotein cholesterol.

Lastly, for the Heart Health program, most participants received a primary care visit (87.7%) and an LDL-C test (58.1%). These activities can be assessed via claims data and, thus, may be easier for HPP and Finity to track and report. The remaining activities such as improved blood pressure (completed by 14.7% of participants), medication adherence (completed by 39.0%), and monthly contact with their PHMs (completed by 6.8%) require health care providers to share additional information to HPP and Finity. Like the Diabetes Management program, all Healthy Heart participants received at least one incentive.

Table 52. Number and Types of Incentives Provided to Heart Health Participants

Incentive Activities	Number of Incentives Provided	Percentage of Total Enrolled Participants (N=749)
LDL-C test	435	58.1
Primary care visit	657	87.7
Improved blood pressure	110	14.7
Medication adherence	292	39.0
Monthly contact with peer health mentor	51	6.8

Source: Patient-level data provided to RTI by Finity.
LDL-C = low-density lipoprotein cholesterol

2.32 Qualitative Findings: Sustainability

Finity plans to work with additional payers to sustain their innovation. As of Q12, Finity had contracted with HPP to continue the innovation beyond the Centers for Medicare and Medicaid Innovation (CMMI) funding period. Finity also added New Mexico and its four Medicaid MCOs as clients. Finity is actively selling their closed-loop platform and incentive programs to additional states and health plans that will serve Medicaid and Medicare members. To aid in its sustainability efforts, Finity hired additional employees, including project managers, consultants, administrative staff, and call center representatives.

Moreover, HPP leadership reported continuing support for the innovation past the CMMI funding period—*"we are planning on going forward after the grant period ends with Finity to use the closed loop platform and member forum…"*—and applying the innovation methods to newer programs: weight loss, tobacco cessation, and asthma management.

Finity intends to apply several key lessons learned that will help its sustainability efforts. These lessons include building robust analytics and reporting at the start of each new implementation, streamlining processes for efficiency, and maintaining stakeholder engagement. HPP did note changes in the state's political environment (changes in Medicaid expansion) impacted organizational support for the initiative. Finity will need to continue navigating this issue while spreading their innovation to other states.

2.33 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Finity as well as accomplishments to date. In this section, we assess Finity's progress on achieving HCIA goals.

- **Smarter spending.** None of the innovation components evaluated significantly reduced spending. Finity and partners were unable to achieve their proposed savings target of $8,744,407. Finity reported that it had exceeded this cost savings goal by achieving combined cost-savings of $11,835,691 from the Baby Partners, Diabetes Management, and Heart Health Incentive programs. Our findings differ from the Finity estimate. Finity's saving estimates were based on a different propensity score matching approach. Although we used the same group of participants in our analysis, the comparison group differed because we used a different matching method. We also conducted regression analysis that adjusted for covariates and reported the level of confidence in our results. Finity did not conduct regression analyses and did not report whether the estimates were statistically significant. In addition, Finity's analysis extrapolated their savings estimate for participants to all persons eligible for each innovation program.

  Many LifeTracks programs increased spending; however, only Diabetes Management participants had statistically significant higher overall spending than nonparticipants. Higher spending may reflect, in part, higher visit rates due to incentives in each of the three LifeTracks evaluated. The spending increases may also be partially attributable to increases in utilization—hospitalizations, rehospitalizations, ED visits—during the evaluation timeframe. Moreover, the evaluation timeframe may not have been long enough to produce expected savings. As one HPP staff person remarked in Year 2 site visit interviews, *"We really are impacting costs 3-5 years down the road. We can say in 3 years that our diabetes hospitalization is down."* Short-term increases in spending may, therefore, reflect appropriate care and the potential for savings that manifest in the long term.

- **Better care.** None of the innovation components evaluated significantly decreased hospital admissions, readmissions, or ED visits. Overall, utilization increased across many claims analysis measures. For Baby Partners, participant mothers and babies combined had a statistically significant higher number of ED visits, and babies only had statistically significant higher numbers of inpatient admissions. For Diabetes Management, participants had more ED visits and hospital readmissions, though neither were statistically significant. Similarly, Heart Health participants had more inpatient admissions, readmissions, and ED visits than controls, but these were not statistically significant either. As none of these measures were related to LifeTracks incentives, it is unlikely that program incentives led to increased hospitalizations, readmissions, and ED visits. Participants may have sought and used more health services simply because they were enrolled in a condition management program and, arguably, more engaged in their own care. Perhaps other secular trends or even seasonal fluctuations in demand increased utilization of these services over the evaluation timeframe.

Some participants received increased care appropriate to their conditions. Participants in the Diabetes Management and Heart Health programs visited their primary care providers significantly more often than nonparticipants. The vast majority of Heart Health participants for whom we had additional clinical effectiveness data for completed an LDL-C test (76.4%) while almost 96% of Diabetes Management participants completed an LDL-C test. These are positive trends that, if maintained, could result in improved health outcomes for participants and potentially lower costs for HPP.

- **Healthier people**. We had limited data to assess innovation component's effects on health outcomes, and, therefore, are unable to determine whether Finity achieved their goal of changes in health outcomes by an average of 0.1 percent from the baseline for program participants. For our only health outcomes measure, birth weights were higher for babies whose mothers participated in Baby Partners, which could have resulted from more frequent and appropriate care.

Finity and partners continued to implement the innovation effectively, improving reach for Baby Partners, Diabetes, and Heart Health LifeTracks programs. Finity achieved its reach goal for Baby Partners, but did not attain the reach goal for the remaining LifeTracks programs. Over the course of the evaluation, several lessons emerged that are important for other organizations attempting similar innovations to consider.

- **Build upon existing programs**. Condition management programs related to pregnancy and chronic conditions had already been implemented at HPP before Finity's innovation award. Leadership cited this prior experience as important to the successful launch of the innovation, which represented more of an evolution in condition management—the addition of closed-loop tracking, tiered communication, monetary incentives, and a member education portal—than an entirely new approach. Finity was therefore able to build upon the existing Baby Partners program and add additional LifeTracks as part of implementing its innovation.

- **PHMs are effective in engaging beneficiaries in condition management program.** Innovation reach accelerated once Finity added three additional call center staff to serve as PHMs. Site visit interviewees consistently cited the importance of PHMs in enrolling and supporting participants with accessing needed services. Finity attributed much of its success to reaching patients via the PHMs, reporting that PHMs are a cost-effective outreach method for payers compared with using disease management staff. Moreover, high touch—meaning outbound phone calls to participants from PHS—was the most effective means of engaging with this population compared with other forms of communication (letters, emails, or texts).

- **Incentives help motivate participants to obtain appropriate care.** Lastly, incentives were valuable in driving patients to obtain appropriate care. Positive differences in the number of office visits by Baby Partners participants compared with the control group and by the percentage of participants who received appropriate tests, such as LDL and HbA1c, are likely attributable to incentives. The incentivized visits could have led to more frequent touches and, consequently, slightly higher baby weights for Baby Partners participants.

Finity is applying these lessons in their sustainability efforts as they engage and contract with new states and health plans.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Finity Communications, Inc. (Finity)

Finity Communications, Inc. (Finity), a technology vendor in Portland, Oregon received an award of $4,967,962 to implement an innovation that launched on November 15, 2012. Finity provided disease management and wellness programs to Health Partners Plans (HPP) and implemented a customized training course for peer health mentors (PHMs).

Awardee Overview

Innovation dose:	16.3 % of Baby Partners participants completed all three activities and earned bonus payments. Diabetes Management and Heart Health participants received at least one incentive.	***Innovation reach:***	Between Q11-Q12, Finity increased Baby Partners reach from 106.5% to 114.9%. Diabetes Management increased reach from 33.3% to 39.7%, and Heart Health reach increased from 54.3% to 62.4%.
Components:	(1) Condition management LifeTracks (2) The EveryBODY Get Healthy patient portal (3) Health alerts	***Participant demographics:***	84.2% of Baby Partners participants were aged 18 to 44 years old. 82.3% and 80.2%, respectively, of Diabetes Management and Heart Health participants were aged 45 to 64 years old.
Sustainability:	Finity and HPP reported plans to continue the innovation after funding ended.		
Innovation type:	Coordination of care	Health IT	Decision support

Key Findings

Smarter spending. No innovation component evaluated significantly reduced spending. Many LifeTracks programs increased spending; however, only Diabetes Management participants had statistically significant higher overall spending per member than nonparticipants ($184; 90% CI: $63, $306). Higher spending may reflect, in part, higher visit rates due to incentives in the three LifeTracks evaluated. The spending increases may also be partially attributed to increases in utilization. Moreover, the evaluation timeframe may not have been long enough to produce expected savings. Spending per member did not significantly change for mothers and babies in Baby Partners ($584; 90% CI: −$391, $1,559) or for Medicaid beneficiaries in the Heart Health component ($89; 90% CI: −$0.5, $178).

Better care. No innovation component evaluated significantly decreased hospital admissions, readmissions, or ED visits. Baby Partners participant mothers and babies combined had a statistically significant higher number of ED visits per 1,000 members (152; 90% CI: 11.65, 293.20), and babies only had statistically significant higher numbers of inpatient admissions per 1,000 members (78; 90% CI: 21.49, 134.91). Diabetes Management participants had more ED visits per 1,000 members (47; 90% CI: −179.53, 273.15) and hospital readmissions per 1,000 admissions (27; 90% CI: −44.05, 97.57), though neither were statistically significant. Similarly, Heart Health participants had more inpatient admissions (12; 90% CI: −22.03, 32.07), readmissions (24; 90% CI: −48.35, 97.57), and ED visits (93; 90% CI: −154.49, 339.64) than controls, but these were not statistically significant. Participants may have sought and used more health services simply because they were enrolled in a LifeTracks program and, arguably, more engaged in their own care.

The vast majority of Heart Health participants for whom we had additional clinical effectiveness data for completed an LDL-C test (76.4%); almost 96 percent of Diabetes Management participants completed an LDL-C test. These are positive trends that, if maintained, could result in improved health outcomes for participants and potentially lower costs for HPP.

Healthier people. Birth weights were higher (3,145 grams) for babies whose mothers participated in Baby Partners than those who didn't participate (3,116 grams), which could have resulted from more frequent and appropriate care.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:
Imaging Advantage

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Imaging Advantage

2.1 Introduction

Imaging Advantage (IA), a for-profit provider of hospital-based and telemedicine solutions for medical imaging located in Phoenix, Arizona, received an award of $5,977,805 and began rollout in partner hospitals in Chicago, IL, in October 2012. The IA innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending by reducing or eliminating duplicative or clinically unnecessary radiology exams and decreasing final report turnaround time.

2. **Better care.** Improve care by implementing a comprehensive total quality management program that applies a double-blind reading of high-difficulty radiology exams.

3. **Healthier people**. Improve health by reducing patient exposure to radiation.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter *(Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by IA and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Modified RA to highlight prompted areas of patient charts.
	Developed the Better Tech program, a QA program for radiology technologists. IA conducted CME seminars for radiology technicians and standardized QA measures for technicians.
Program Participant Characteristics	
	Most patients (59.3%) were 25 to 64 years old and more than half (63.4%) were female. Race/ethnicity and payer category data are not available from IA.
Workforce Development	
Hiring and retention	24 FTE in Q12, with no changes in hiring or retention since Q10.
Skills, knowledge, and training	Provided 120 hours of training to 7 trainees during Q11 and Q12, and 3,722 hours of training to 413 trainees since inception.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Award execution	Expended 100% of total project budget, on target.
	Eliminated preliminary reads for the Tenet system.
	Implemented RA in four Tenet hospitals.
	Discontinued RealTime QA after beta testing failures.
Leadership	Project management leadership remained consistent and brought teams together at each of the Tenet hospitals.
Organizational capacity	Capacity remained stable for the reporting period.
Innovation adoption and workflow integration	IA provided all radiology services to all four Tenet hospitals. RA was used at all four Tenet hospitals and had a limited impact on provider workflow. The Better Tech program and the RealTime QA program were not successfully adopted and were discontinued.
Implementation Effectiveness	
Innovation reach	172,073 patients received an imaging study through Q12.
Sustainability	
	IA described plans to continue all components of the intervention beyond the grant period, having already extended some components to other markets.

Sources: *Q11–Q12 Narrative Progress Report*.
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted February–June 2015.

CME = continuing medication education; FTE = full-time equivalent; IA = Imaging Advantage; Q = quarter; QA = quality assurance; RA = Radiology Advisor.

Table 3 summarizes Medicare claims-based findings during the innovation period. Patients that participated in the IA innovation had higher costs, more inpatient stays, fewer readmissions, and fewer ED visits overall than the comparison group. These differences were statistically significant. The innovation was not expected to impact total spending, inpatient stays, or ED visits. In three of the four measures, statistically significant results are likely artifacts of the ability to detect small changes due to large sample sizes rather than attributable to any or all of the innovation components.

Table 3. Summary of Medicare Claims-Based Findings: Imaging Advantage

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI	Year 4	90% CI
Aggregated results										
Total spending (in millions)	$35.077	$4.140, $66.013	$2.997	−$5.682, $11.677	$14.974	$3.611, $26.337	$16.191	$1.920, $30.461	$0.914	−$0.441, $2,270
Acute care inpatient stays	2,955	2,544, 3,365	431	177, 684	1,238	1,002, 1,474	1,156	945, 1,368	129	67, 191
Hospital-wide all-cause unplanned readmissions	−349	−681, −17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−2,992	−3,605, −2,378	−71	−450, 309	−1,384	−1,734, −1,033	−1,427	−1,744, −1,109	−110	−205, −16
Average impact per quarter										
Spending per participant	$827	$98, $1,555	$192	−$365, $750	$1,059	$255, $1,863	$1,401	$166, $2,636	$780	−$377, $1,937
Acute care inpatient stays (per 1,000 participants)	70	60, 79	28	11, 44	88	71, 104	100	82, 118	110	57, 163
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−5	−10, 0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−71	−85, −56	−5	−29, 20	−98	−123, −73	−124	−151, −96	−94	−175, −14

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. Total spending and inpatient stays were significantly lower among the innovation group than the comparison group. There was no difference in unplanned readmissions between the two groups. ED visits were significantly higher among the innovation group relative to the comparison group.

Table 4. Summary of Medicaid Claims-Based Findings: Imaging Advantage

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$4.705	−$9.265, −$0.145	−$4.354	−$8.718, $0.009	−$0.351	−$1.162, $0.461	N/A	N/A
Acute care inpatient stays	−442	−683, −200	−388	−616, −160	−54	−134, 26	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−12	−39, 15	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	646	216, 1,075	589	176, 1,002	57	−59, 172	N/A	N/A
Average impact per quarter								
Spending per participant	−$462	−$910, −$14	−$455	−$912, $1	−$563	−$1,866, $739	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−43	−67, −20	−41	−64, −17	−86	−215, 42	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−29	−94, 37	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	63	21, 106	62	18, 105	91	−94, 277	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

This innovation consisted of four components: (1) radiology outsourcing and workflow reengineering and teleradiology services (RO); (2) IA's Radiology Advisor (RA); (3) radiology dashboards/reports (RD); and (4) IA's RealTime™ imaging quality assurance (QA), which applied double-blind readings to high-difficulty radiology exams before the patient is treated. RA is a proprietary radiology clinical decision support tool integrated into the EHR for referring physicians to reduce or eliminate duplicative or clinically unnecessary radiology exams. IA added a new component developed in late 2014 and rolled out in 2015, Better Tech, which provided continuing medical education, standardized protocols, and implemented a QA scorecard for radiology technologists. Additionally, in 2015 IA piloted its RealTime QA service aimed at providing near real time double-blind reads. These components used different means—changes in provider workflow, optimization of radiology staff availability and access, radiology decision support, and access to radiology utilization data—to:

- facilitate appropriate use of radiology services and reviews of image studies;
- reduce final imaging report turnaround time, regarded as a significant factor in hospital efficiency and cost control, at Vanguard Health Chicago (now Tenet Health); and
- eliminate suboptimal wet or preliminary readings in Tenet Health EDs, including readings by nonradiologists.

Table 5 displays IA's innovation partners. IA worked with two organizational partners, Tenet Health (Chicago) and medCPU (Israel); an advisory board; and consultants to develop and implement the innovation. Tenet Health, a for-profit hospital system, operates the four hospitals where IA implemented the innovation: West Suburban Medical Center, Westlake Hospital, Weiss Memorial Hospital, and MacNeal Hospital. IA's technology partner, medCPU, developed RA. The advisory board of stakeholders from multiple organizations included providers and radiologists from IA and medCPU and a consultant, Dr. Steve Smith, a radiologist in Chicago. The partners for this innovation remained unchanged since RTI's 2014 annual report.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
medCPU	Decision support tool (Radiology Advisor) development and implementation	Israel
Tenet Health (formerly Vanguard Health Chicago)	Clinical sites for development and implementation	Chicago, IL
Advisory board of stakeholders from multiple organizations	Advisory board and consultant involved in the development and refinement of clinical algorithms for use in Radiology Advisor	Varies

Sources: Q_ Quarterly Awardee Performance Report, 2012–2014, May 7–8 site visit.
HCIA = Health Care Innovation Award.

2.1.2 Program Participant Characteristics

As reported in Q6, IA planned to expand RA's primary target beyond EDs to include any ordering physician in the four Chicago-area Tenet Health hospitals, but according to reports at the end of the grant period, this had still not happened. Through the end of Q11, 172,073 secondary participants (patients) received imaging studies in one of the Tenet facilities.

Table 6 provides the demographic characteristics of all patients who received an imaging study at one of the four Chicago-area Tenet Health hospitals. We last reported patient characteristics in the 2015 annual report based on data through Q11. The distribution of patient characteristics is similar to that in the 2015 annual report. More specifically, most patients (59.3%) were 25 to 64 years old, and more than half (63.4%) were female. Race/ethnicity and payer category data are not available from IA.

Table 6. Characteristics of All Participants Ever Enrolled in IA Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	172,073	100.0
Age		
< 18	20,520	11.9
18–24	11,784	6.8
25–44	44,587	25.9
45–64	57,471	33.5
65–74	20,658	12.0
75–84	11,420	6.6
85+	5,633	3.3
Missing	0	0.0
Sex		
Female	109,031	63.4
Male	63,038	36.6
Missing	4	0.0
Race/ethnicity		
White	—	—
Black	—	—
Hispanic	—	—
Asian	—	—
American Indian or Alaska Native	—	—
Other	—	—
Missing/refused	—	—
Payer category		
Dual	—	—
Medicaid	—	—
Medicare	—	—
Medicare Advantage	—	—
Other	—	—
Uninsured	—	—
Missing	—	—

Source: Patient-level data provided to RTI by Imaging Advantage.
— Data not available.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We include patients who were enrolled before December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. The sample for the claims analysis includes all fee-for-service Medicare patients who entered the ED at one of the four Chicago-area Tenet Health hospitals or four comparison hospitals. For each treatment and comparison hospital, we generated a list of all patients who entered the ED during the quarter. In each quarter, the sample size is the number of unique patients who visited a treatment or comparison hospital ED. Costs and utilization for patients visiting the comparison hospital EDs were then compared with the corresponding variables for patients who visited the ED in the treatment hospitals.

We used propensity score matching (PSM) to select Chicago-area comparison hospitals with characteristics similar to hospitals enrolled in the innovation. Treatment and comparison hospitals were matched using a logit model predicting the likelihood that a hospital participated in the innovation as a function of number of beds, race composition of patients, total patient days, the fraction of hospital revenue from Medicaid, the fraction of hospital revenue from Medicare, and the resident-to-bed ratio. Each treatment hospital was matched to the comparison hospital with the nearest propensity score. Since the last report, Norwegian-American Hospital replaced Skokie Hospital as the comparison for MacNeal

Hospital because Skokie merged with another hospital during the innovation period. The merge affected the claims reporting for Skokie hospital; therefore, it was no longer an appropriate counterfactual. Norwegian-American was the next best match for MacNeal Hospital. ***Table 8*** describes the mean values of the variables of interest included in the propensity score model before and after matching.

Table 8. Mean Values of Variables in Propensity Score Model: IA

Variable	Treatment Hospitals		Full Comparison Group Hospitals		Matched Comparison Hospitals	
	Mean	SD	Mean	SD	Mean	SD
Patient beds	267	71	414	222	256	102
Percentage of patient days, white patients	46	23	39	28	42	41
Percentage of patient days, black patients	39	23	42	29	43	39
Percentage of patient days, Hispanic patients	13	7	11	10	16	16
Number of patient days	48,541	21,725	91,962	61,492	45,682	18,584
Percentage of payments from Medicaid	26	5	25	14	34	25
Percentage of payments from Medicare	24	11	24	9	21	12
Resident-to-bed ratio	32	7	38	35	22	34
N	4	—	19	—	4	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ESRD = end-stage renal disease; SD = standard deviation.
— Data not applicable.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the 13 quarters after the start of the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 1*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

During the baseline period, quarterly Medicare spending trends upward and is slightly lower among the innovation group than the comparison group. During the initial quarters of the innovation period, the innovation and comparison groups' spending is very similar. Beginning in innovation quarter 3, spending among the innovation group becomes larger than the comparison group's spending.

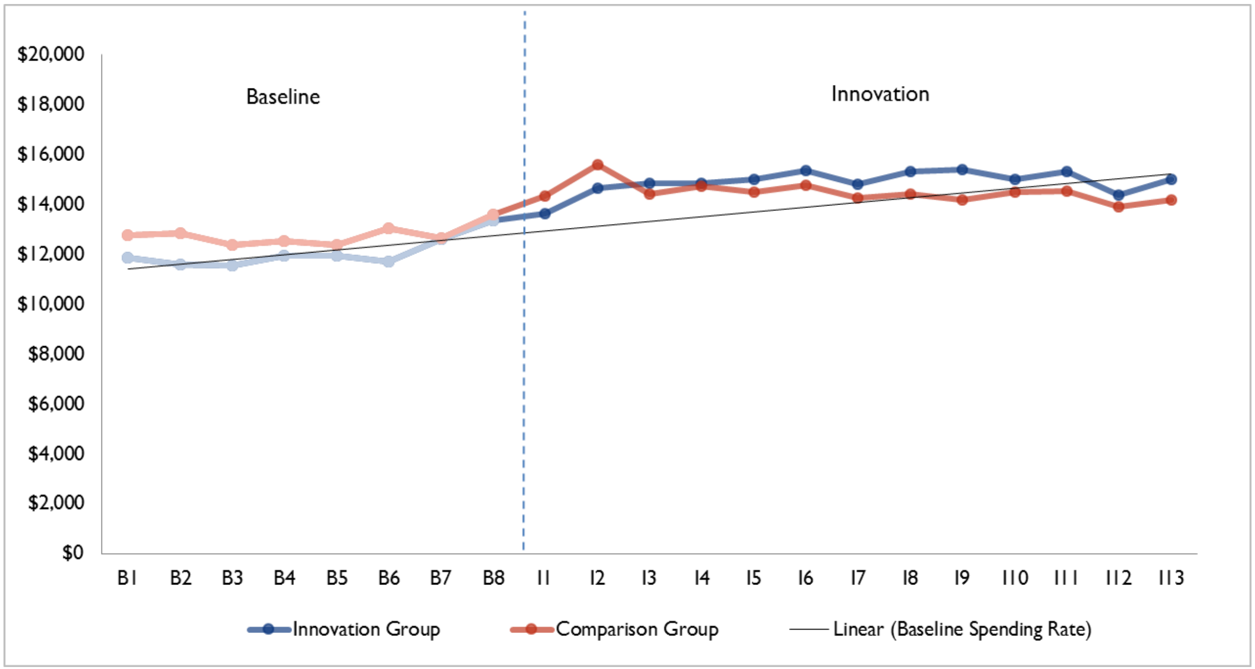
Table 9. Medicare Spending per Participant: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Spending rate	$11,861	$11,596	$11,556	$11,947	$11,929	$11,703	$12,610	$13,364	$13,648	$14,634	$14,859	$14,836	$15,025	$15,374	$14,828	$15,328	$15,395	$15,013	$15,319	$14,373	$15,022
Std dev	$17,298	$18,036	$18,747	$19,129	$18,294	$17,572	$17,830	$20,105	$19,709	$22,134	$21,628	$22,047	$22,069	$22,184	$21,646	$21,614	$21,054	$21,604	$21,735	$19,840	$21,346
Unique patients	2,928	3,115	3,060	3,246	3,370	3,513	3,551	3,650	3,799	3,952	3,938	3,885	3,789	3,680	3,459	3,211	3,082	3,088	3,022	2,362	1,172
Comparison Group																					
Spending rate	$12,764	$12,864	$12,386	$12,530	$12,358	$13,062	$12,641	$13,584	$14,346	$15,578	$14,413	$14,744	$14,497	$14,775	$14,256	$14,402	$14,183	$14,481	$14,540	$13,922	$14,194
Std dev	$17,573	$18,606	$17,165	$16,474	$17,952	$18,366	$18,183	$19,800	$20,570	$21,830	$20,556	$20,060	$19,942	$19,842	$19,852	$20,161	$19,396	$18,989	$20,918	$19,636	$19,139
Weighted patients	2,816	2,917	2,999	3,159	3,189	3,415	3,574	3,769	3,812	3,874	3,918	3,780	3,877	3,581	3,693	3,461	3,263	3,107	3,218	2,659	2,183
Savings per Patient																					
	$902	$1,269	$830	$583	$429	$1,360	$31	$221	$697	$944	−$445	−$92	−$528	−$598	−$572	−$926	−$1,212	−$532	−$779	−$451	−$828

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage; Std dev = standard deviation.

Figure 1. Medicare Spending per Participant: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
IA = Imaging Advantage.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $827 (90% CI: $98, $1,555). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 2*** illustrates these quarterly difference-in-differences estimates. In most innovation quarters, spending is higher among the innovation group than the comparison group. The innovation group's spending is significantly higher than the comparison group's spending in I4, I6, I8, I11, and I12. Although spending among the innovation group is higher, the innovation's focus on imaging workflow was not expected to have a detectable impact on total patient spending, and results should be interpreted with caution.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: IA

Quarter	Coefficient	Standard Error	P-Values
I1	-$231	$670	0.741
I2	-$511	$422	0.265
I3	$771	$651	0.275
I4	$735	$311	0.050
I5	$888	$637	0.206
I6	$1,030	$540	0.098
I7	$952	$665	0.195
I8	$1,409	$604	0.052
I9	$1,679	$931	0.114
I10	$1,178	$888	0.226
I11	$1,296	$542	0.048
I12	$1,465	$698	0.074
I13	$780	$611	0.242
Overall average	$827	$385	0.069
Overall aggregate	$35,076,510	$16,328,994	0.069
Overall aggregate (IY1)	$2,997,286	$4,581,297	0.534
Overall aggregate (IY2)	$14,974,008	$5,997,731	0.041
Overall aggregate (IY3)	$16,190,833	$7,532,358	0.069
Overall aggregate (IY4)	$914,382	$715,632	0.242

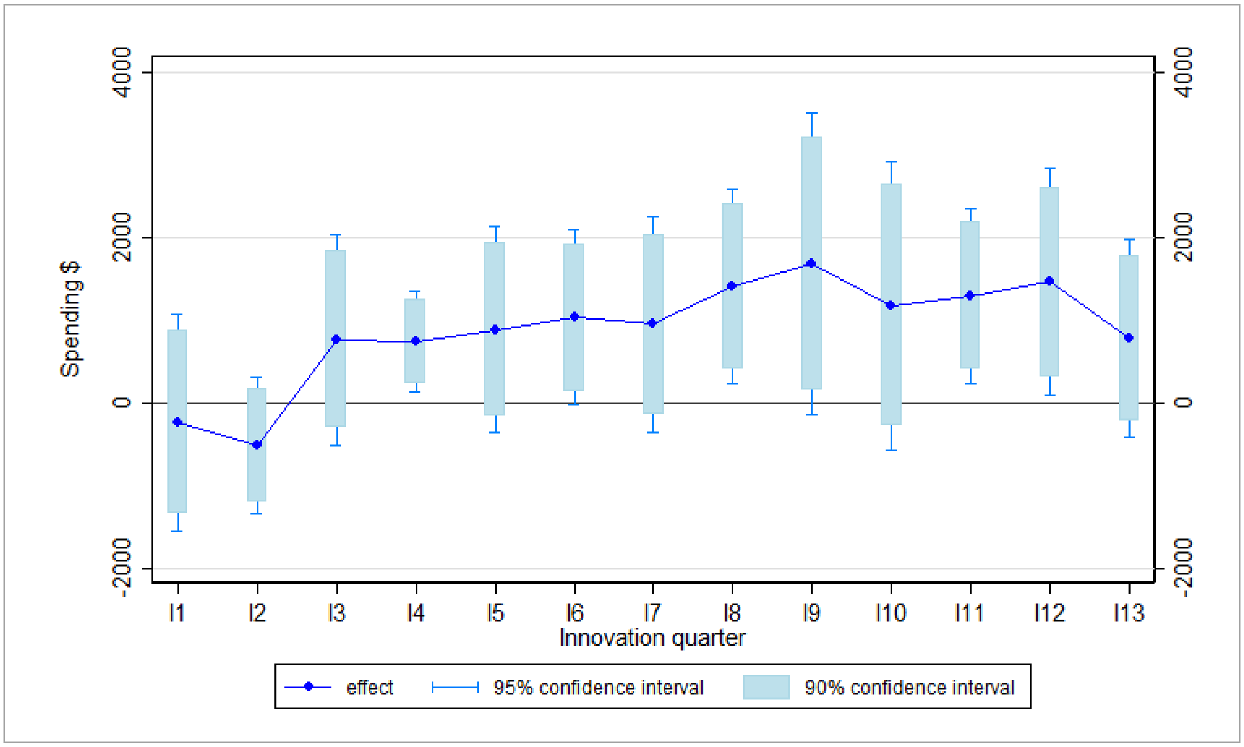
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, the number of chronic conditions, and hospital fixed effects. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; IA = Imaging Advantage; OLS = ordinary least squares.

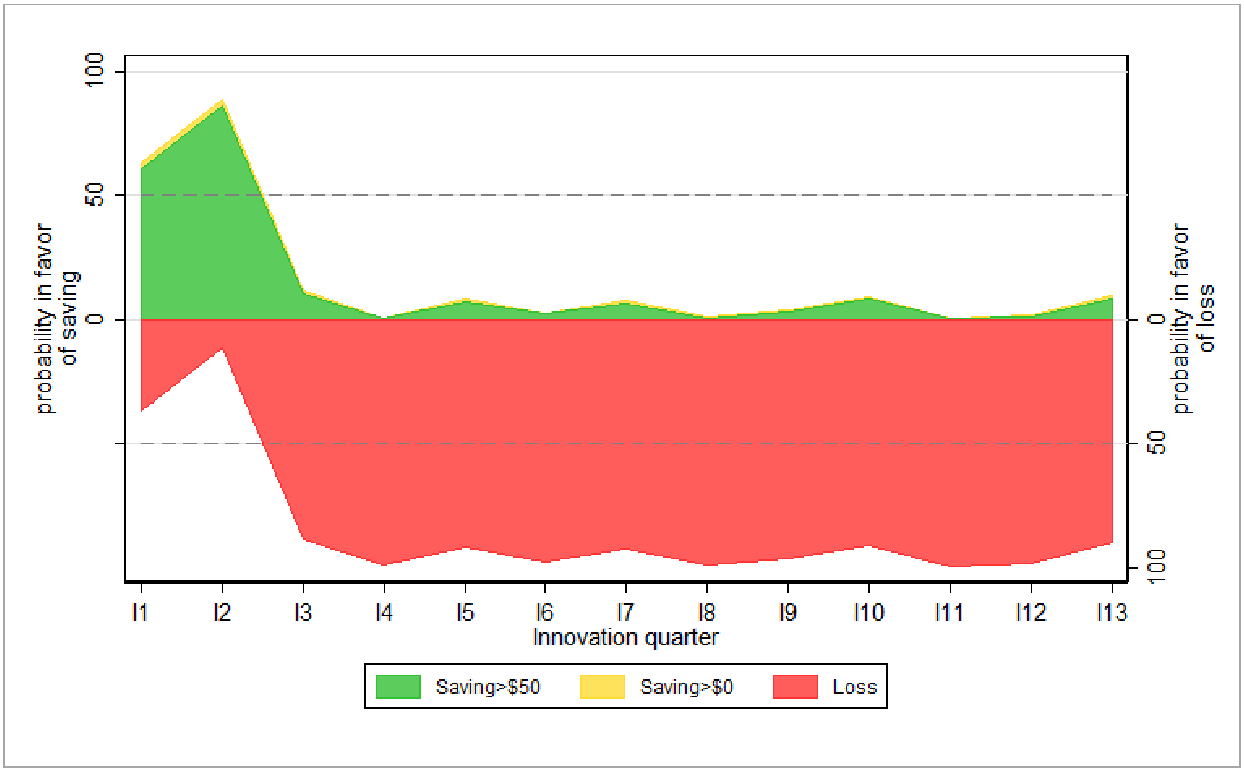
Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
IA - Imaging Advantage; OLS = ordinary least squares.

Figure 3 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because spending among the innovation group is higher than the comparison group, the evidence favors the innovation generating a loss. However, it is important to note that the innovation affected imaging workflow within the hospital and was not expected to have a detectable impact on total spending. Thus, readers should not conclude that the innovation generated a loss.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
IA = Imaging Advantage.

2.5 Medicare Inpatient Admissions

2.5.1 *Descriptive Results*

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 4***. During the baseline period, the innovation and comparison groups' trends in inpatient admissions are parallel and trend slightly downward. During the innovation period, the innovation group's admissions rate turns slightly upward and converges with the comparison group's rate.

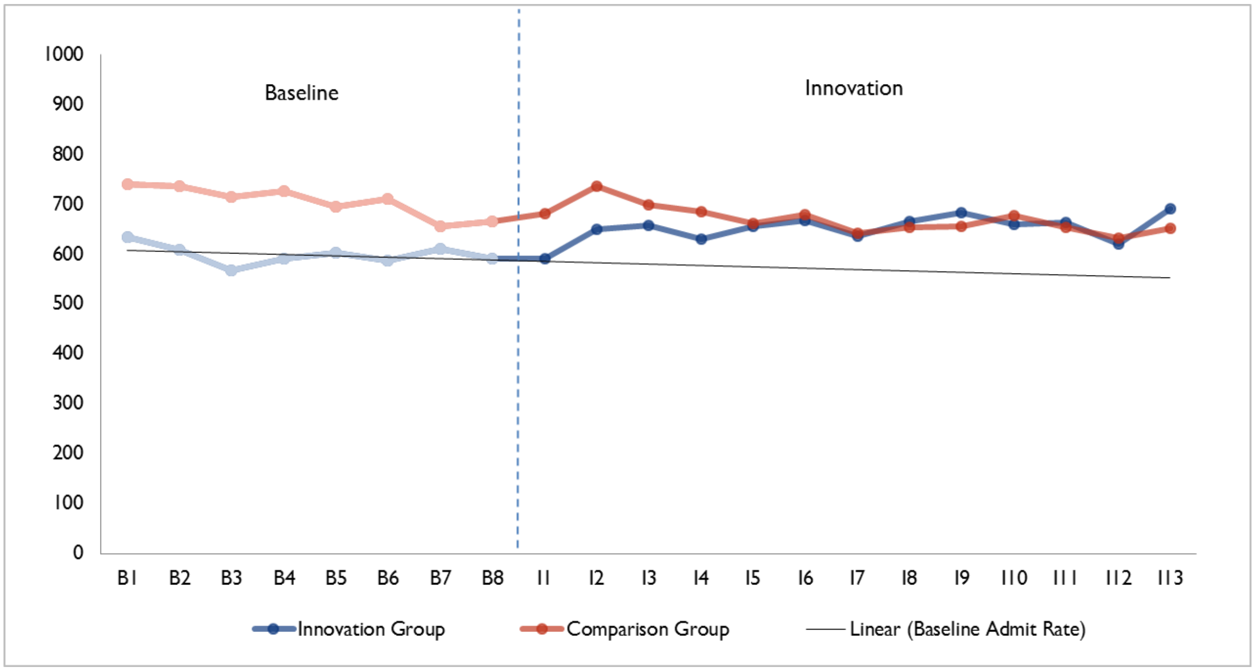
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Admit rate	635	609	567	591	602	586	610	591	590	650	657	631	656	667	636	666	683	660	664	621	690
Std dev	916	894	894	969	920	907	917	863	880	948	923	904	944	959	963	928	936	888	959	901	966
Unique patients	2,928	3,115	3,060	3,246	3,370	3,513	3,551	3,650	3,799	3,952	3,938	3,885	3,789	3,680	3,459	3,211	3,082	3,088	3,022	2,362	1,172
Comparison Group																					
Admit rate	741	736	715	726	695	711	656	665	681	737	699	685	661	679	641	653	656	677	653	633	652
Std dev	1002	994	1026	982	1017	944	985	903	915	950	1004	974	975	928	939	905	890	910	901	893	868
Weighted patients	2,816	2,917	2,999	3,159	3,189	3,415	3,574	3,769	3,812	3,874	3,918	3,780	3,877	3,581	3,693	3,461	3,263	3,107	3,218	2,659	2,183
Innovation − Comparison Rate																					
	−107	−127	−149	−135	−93	−125	−46	−74	−91	−87	−42	−54	−5	−12	−5	12	27	−17	11	−12	38

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
IA = Imaging Advantage.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 70 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 60, 79). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 12 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show inpatient admissions per 1,000 participants. Inpatient admissions are higher among the innovation group than the comparison group during all innovation quarters. In most quarters, the difference is statistically significant.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: IA

Quarter	Coefficient	Standard Error	P-Values
I1	4	19	0.852
I2	13	20	0.532
I3	50	20	0.013
I4	44	20	0.024
I5	82	20	0.000
I6	82	20	0.000
I7	80	20	0.000
I8	109	21	0.000
I9	118	22	0.000
I10	84	22	0.000
I11	107	22	0.000
I12	90	23	0.000
I13	110	32	0.001
Overall average	70	6	0.000
Overall aggregate	2,955	249	0.000
Overall aggregate (IY1)	431	154	0.005
Overall aggregate (IY2)	1,238	143	0.000
Overall aggregate (IY3)	1,156	128	0.000
Overall aggregate (IY4)	129	38	0.001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, the number of chronic conditions, and hospital fixed effects. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; IA = Imaging Advantage.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 5***. During the baseline period, the unplanned readmissions rate was higher among the comparison group than the innovation group, and both groups had a nearly flat trend in unplanned readmissions. The comparison group’s rate remains above the innovation group’s during the initial quarters of the innovation period, after which the two rates converge. In the next section, we use a difference-in-differences regression to test the impact of the innovation on unplanned readmissions.

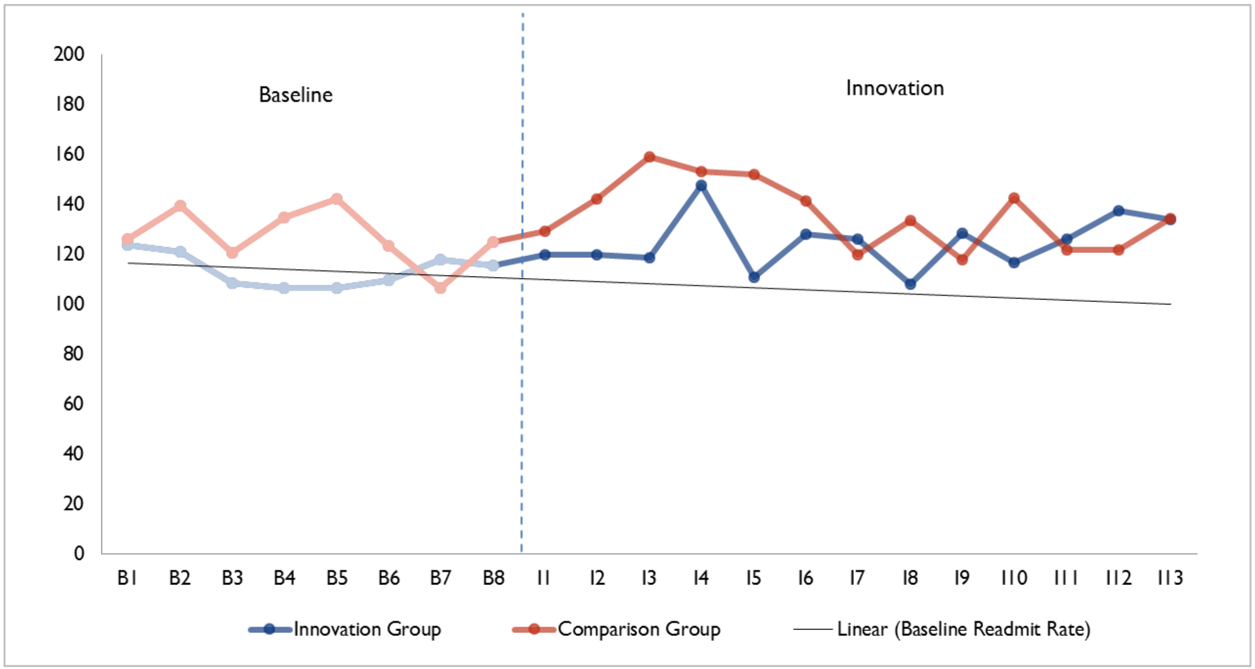
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Readmit rate	124	121	108	107	107	110	118	116	120	120	119	148	111	128	126	108	129	117	126	138	134
Std dev	330	326	311	309	309	313	323	320	325	325	323	355	314	334	332	311	335	321	332	345	341
Total admissions	1,146	1,191	1,015	1,115	1,181	1,203	1,398	1,376	1,411	1,542	1,559	1,409	1,435	1,437	1,308	1,341	1,306	1,309	1,127	799	328
Comparison Group																					
Readmit rate	126	139	120	135	142	123	106	125	129	142	159	153	152	141	120	133	118	143	122	122	135
Std dev	332	346	326	342	349	329	308	331	336	349	366	360	359	349	325	340	323	350	327	327	341
Total admissions	1,213	1,299	1,245	1,378	1,378	1,475	1,438	1,663	1,724	1,773	1,702	1,585	1,521	1,456	1,494	1,409	1,423	1,373	1,296	1,008	654
Innovation − Comparison Rate																					
	−2	−18	−12	−28	−36	−14	12	−10	−10	−22	−41	−6	−41	−13	6	−25	11	−26	4	16	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
IA = Imaging Advantage.

2.6.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −5 per 1,000 inpatient admissions (0.5 percentage points), indicating that the innovation−comparison difference is 0.5 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −10, 0).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: IA

Quarter	Coefficient	Standard Error	P-Values
Overall average	−5	3	0.084
Overall aggregate	−349	202	0.084

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, the number of chronic conditions, and hospital fixed effects. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
IA = Imaging Advantage.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 6.*** During the baseline period, the ED visit rates for the innovation and comparison groups overlap and both trend slightly upward. During the innovation period, the ED visit rates move below the baseline trend but remain similar for the innovation and comparison groups.

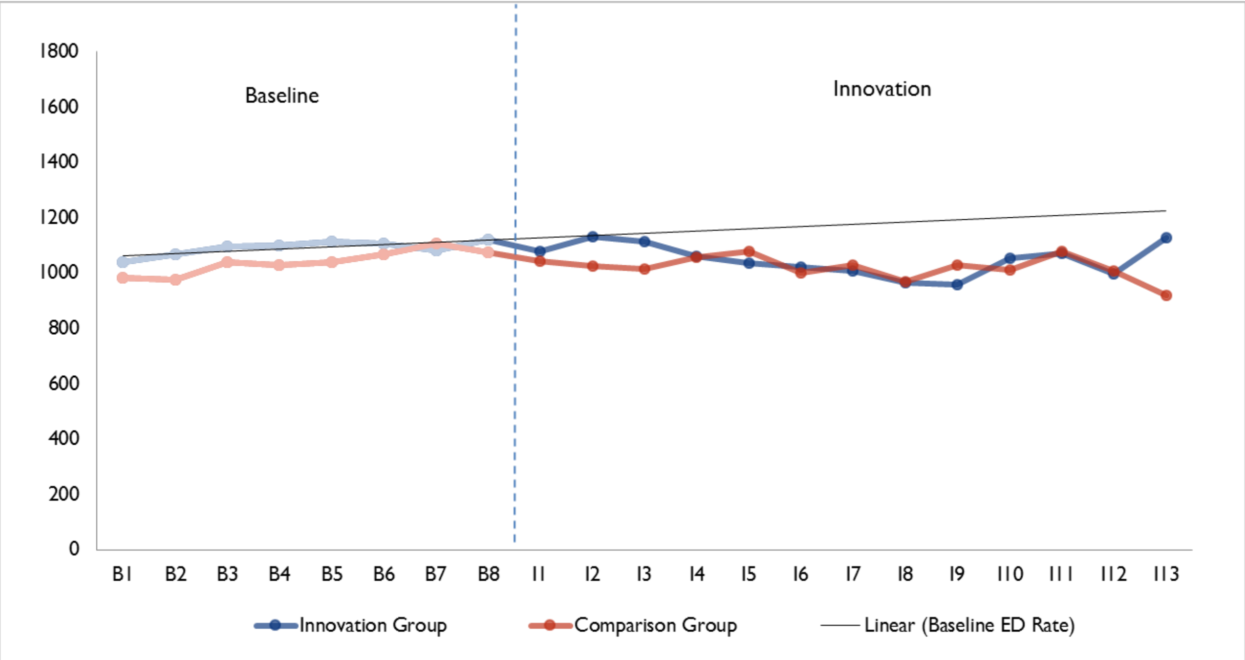
Table 15. ED Visits per 1,000 Medicare Participants: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
ED rate	1,039	1,067	1,096	1,099	1,112	1,106	1,083	1,120	1,078	1,130	1,113	1,061	1,036	1,023	1,009	964	959	1,053	1,071	998	1,127
Std dev	1,484	1,454	1,442	1,374	1,538	1,631	1,448	1,931	1,612	2,055	2,067	1,586	1,507	1,451	1,344	1,491	1,499	1,785	1,607	1,213	1,958
Unique patients	2,928	3,115	3,060	3,246	3,370	3,513	3,551	3,650	3,799	3,952	3,938	3,885	3,789	3,680	3,459	3,211	3,082	3,088	3,022	2,362	1,172
Comparison Group																					
ED rate	984	977	1,041	1,029	1,040	1,067	1,107	1,075	1,045	1,026	1,014	1,057	1,077	1,001	1,030	970	1,031	1,011	1,077	1,007	919
Std dev	1,708	1,461	1,751	1,862	1,917	1,774	1,789	1,795	1,614	1,801	1,658	1,481	1,528	1,345	1,360	1,170	1,806	1,616	1,639	1,311	1,109
Weighted patients	2,816	2,917	2,999	3,159	3,189	3,415	3,574	3,769	3,812	3,874	3,918	3,780	3,877	3,581	3,693	3,461	3,263	3,107	3,218	2,659	2,183
Innovation − Comparison Rate																					
	55	90	55	70	73	40	−24	45	34	104	99	4	−41	21	−21	−6	−72	42	−6	−9	208

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 6. ED Visits per 1,000 Medicare Participants: IA



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; IA = Imaging Advantage.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 71 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: -85, -56). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. In most innovation quarters, the number of ED visits is lower among the innovation group than the comparison group. Initially, differences in ED visits are not statistically significant; however, as the innovation quarters progress, the differences become mostly statistically significant. Because the IA innovation was not expected to impact patient ED visits, results should be interpreted with caution.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: IA

Quarter	Coefficient	Standard Error	P−Values
I1	−21	30	0.479
I2	42	29	0.150
I3	35	29	0.231
I4	−76	30	0.011
I5	−103	30	0.001
I6	−57	30	0.058
I7	−129	31	0.000
I8	−106	30	0.001
I9	−167	32	0.000
I10	−53	32	0.102
I11	−108	33	0.001
I12	−178	37	0.000
I13	−94	49	0.054
Overall average	−71	9	0.000
Overall aggregate	−2,992	373	0.000
Overall aggregate (IY1)	−71	230	0.759
Overall aggregate (IY2)	−1,384	213	0.000
Overall aggregate (IY3)	−1,427	193	0.000
Overall aggregate (IY4)	−110	57	0.0543

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, the number of chronic conditions, and hospital fixed effects. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; IA - Imaging Advantage.

2.8 Medicare Outpatient Imaging in the ED

We conducted an analysis to test for changes in the volume and spending on imaging services in the ED for participating hospitals. IA’s innovation focused on reducing unnecessary and duplicate imaging across the hospital. In the ED setting, IA’s goal was to eliminate after-hours, sub-par “wet” or preliminary readings of imaging orders and to reduce turnaround time on imaging readings. By reducing sub-par readings in the ED, fewer imaging services may need to be replicated.

Our analysis focuses on payments for outpatient imaging services ordered in the ED because inpatient ED service payments are subsumed under DRG payments. Using a difference-in-differences framework, we estimated quarterly differences between innovation and comparison hospitals’ imaging service spending for outpatient ED visits. We completed separate regression analyses for computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance angiography (MRA), X-ray, ultrasound, other types of imaging, and total imaging payments. The results of regression analyses for the three most commonly ordered imaging procedures in the ED (X-ray, CT, and MRI) are presented in ***Table 17***. In general, payments for X-rays and CT scans are higher in innovation hospitals, but the majority of quarterly effects are not statistically significant. There is no evidence that the innovation generated savings for X-rays and CT payments in the outpatient ED setting. In contrast, the coefficients on MRI payments are predominantly negative and are statistically significant at the 10 percent level in I1, I4, I5 and on the margin of significance in I11 and I13, indicating that there may be some savings in MRI payments generated. For the remaining services analyzed (MRA, ultrasound, other imaging services, and total imaging services overall), results were not statistically significant.

Table 17. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Imaging Spending Per Outpatient ED Visit: IA

	X-Ray Payments			CT Payments			MRI Payments		
Quarter	Coefficient	Standard Error	P−Values	Coefficient	Standard Error	P−Values	Coefficient	Standard Error	P−Values
I1	−1.63	1.04	0.162	0.51	8.36	0.953	−4.02	1.77	0.057
I2	0.09	1.08	0.934	−8.68	4.38	0.088	−1.14	1.24	0.390
I3	−0.30	1.54	0.850	9.41	11.54	0.442	−2.16	2.21	0.359
I4	1.79	3.61	0.634	11.89	11.57	0.338	−2.16	0.97	0.062
I5	2.23	2.79	0.450	5.78	13.07	0.672	−4.56	2.36	0.095
I6	2.97	1.89	0.161	4.92	4.23	0.283	−1.34	1.76	0.473
I7	0.79	1.53	0.621	6.10	2.08	0.022	−0.18	1.45	0.905
I8	0.69	6.31	0.916	7.71	6.22	0.255	0.05	1.92	0.978
I9	−0.07	5.80	0.991	11.23	8.41	0.224	−1.67	2.91	0.583
I10	4.20	3.40	0.257	7.90	8.11	0.362	−0.64	3.19	0.846
I11	0.98	2.02	0.644	12.88	6.02	0.070	−2.99	1.70	0.123
I12	5.74	3.05	0.102	23.01	9.74	0.050	−0.35	2.32	0.886
I13	5.79	1.62	0.009	−3.59	5.73	0.551	−4.91	2.59	0.100

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: patient age, patient race, disability status, dual eligibility status, and number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

CT = computed tomography; I = Innovation Quarter; IA = Imaging Advantage; MRI = magnetic resonance imaging; OLS = ordinary least squares.

The limitation of this analysis is that the claims included are outpatient imaging services in the ED, and do not reflect potential changes in imaging services utilization elsewhere in the hospital. Therefore, these conclusions should not be generalized to the IA innovation overall.

2.9 Discussion: Medicare Results

Patients admitted to EDs participating in the IA innovation had significantly higher spending, more inpatient hospitalizations, and fewer ED visits than patients admitted to EDs in comparison hospitals. Although differences between the innovation and comparison groups are statistically significant, the IA innovation was not expected to have a detectable impact on spending or affect inpatient stays and readmissions. Because of the large number of patients visiting each hospital per quarter, the regression models were able to detect relatively small differences between the innovation and comparison groups due to the large sample size. Outpatient imaging service payments in the ED did not show large changes, although some evidence of decreased outpatient MRI spending was found.

2.10 Medicaid Comparison Group

We included patients who were enrolled before October 31, 2013, and we present Medicaid claims data through December 31, 2013. Because IA's innovation focused on the ED, the Medicaid claims analysis focuses on ED patients at the four participating hospitals and four comparison hospitals. For each treatment and comparison hospital, we generated a list of all patients who entered the ED during the quarter. In each quarter, the sample size is the number of unique patients who had an inpatient or outpatient ED visit at a treatment or comparison hospital. Costs and utilization for patients visiting the comparison hospital EDs were then compared with the corresponding variables for patients who visited the treatment hospital EDs. We present results for quarterly spending per patient, inpatient admissions, hospital unplanned readmissions, and outpatient ED visits.

We used PSM to select Chicago-area comparison hospitals with characteristics similar to hospitals enrolled in the innovation. Treatment and comparison hospitals were matched using a logit model predicting the likelihood that a hospital participated in the innovation as a function of number of beds, race composition of patients, total patient days, the fraction of hospital revenue from Medicaid, the fraction of hospital revenue from Medicare, and the resident-to-bed ratio. Each treatment hospital was matched with the comparison hospital with the nearest propensity score. We have the same set of comparison hospitals for the Medicaid analysis as for the Medicare analysis.

Refer to Table 8 for the mean values of the variables of interest included in the propensity score model before and after matching. ***Appendix B.2*** provides technical details on the propensity score methodology.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 18 reports Medicaid spending per patient in the eight quarters before and the five quarters after the start of the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 7*** illustrates the Medicaid spending per beneficiary in Table 18 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

During the baseline period, spending trends downward in innovation and comparison hospitals. Total Medicaid spending among individuals who enter comparison hospitals is higher than spending by individuals who enter innovation hospitals, but the trends are parallel. The gap in the spending level during the baseline period between the two groups will be accounted for in the difference-in-difference regression analysis that follows. During I1 through I4, the comparison-innovation group difference in spending widens, indicating lower spending among the innovation group. In I5, the innovation group's spending is higher than the comparison group's spending; however, the data from I5 represents one innovation hospital (the one that began participation earliest) and one comparison hospital and is not representative of the full set of hospitals participating in the innovation.

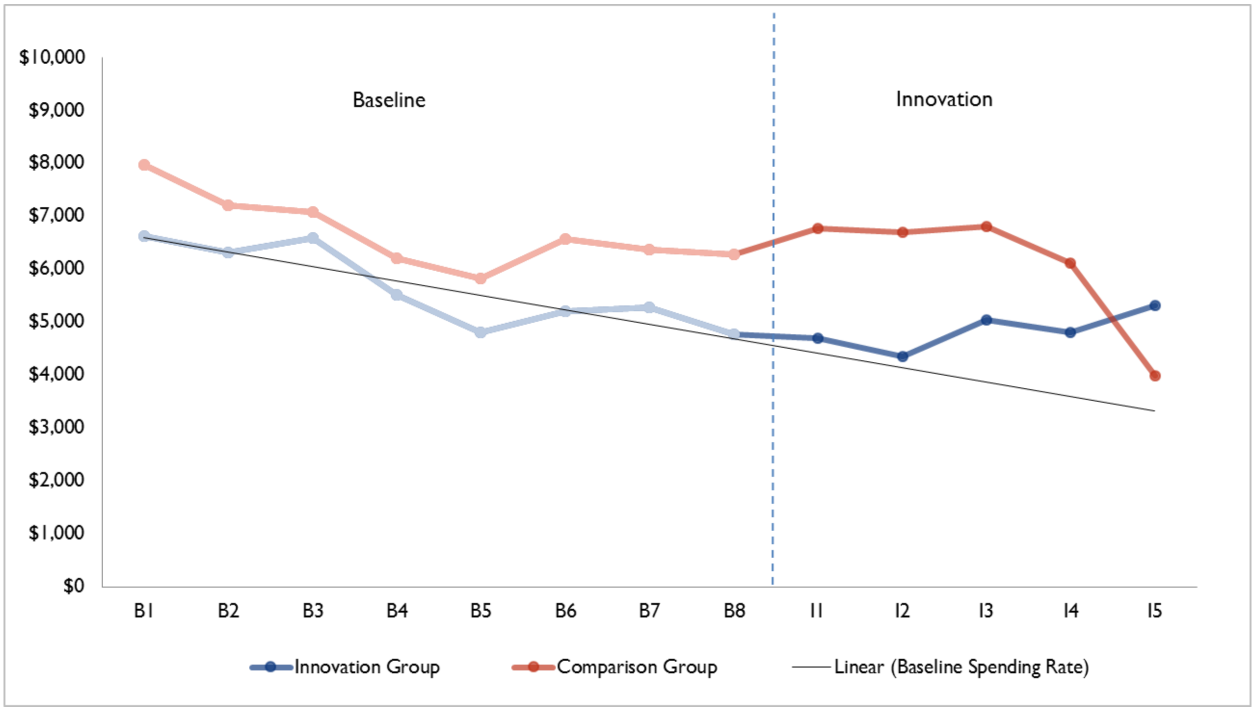
Table 18. Medicaid Spending per Participant: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Spending rate	$6,617	$6,314	$6,597	$5,522	$4,804	$5,206	$5,284	$4,777	$4,703	$4,358	$5,040	$4,815	$5,318
Std dev	$17,687	$17,198	$21,437	$15,013	$13,779	$14,981	$16,310	$15,198	$16,910	$10,779	$14,005	$16,202	$13,249
Unique patients	3,562	3,525	3,528	3,244	3,302	3,702	3,536	3,481	3,088	2,537	2,299	1,636	623
Comparison Group													
Spending rate	$7,965	$7,202	$7,081	$6,211	$5,821	$6,578	$6,376	$6,284	$6,768	$6,703	$6,809	$6,113	$3,996
Std dev	$25,833	$16,159	$21,490	$14,330	$13,734	$17,471	$15,071	$17,150	$15,755	$15,019	$16,155	$14,128	$11,061
Weighted patients	2,308	2,317	2,284	2,613	2,606	2,710	2,703	2,473	2,259	2,167	1,621	1,006	329
Savings per Patient													
	$1,348	$888	$485	$689	$1,016	$1,373	$1,092	$1,507	$2,064	$2,345	$1,768	$1,299	−$1,323

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 7. Medicaid Spending per Participant: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
IA = Imaging Advantage.

2.11.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is -$462 (90% CI: -$910, -$14). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

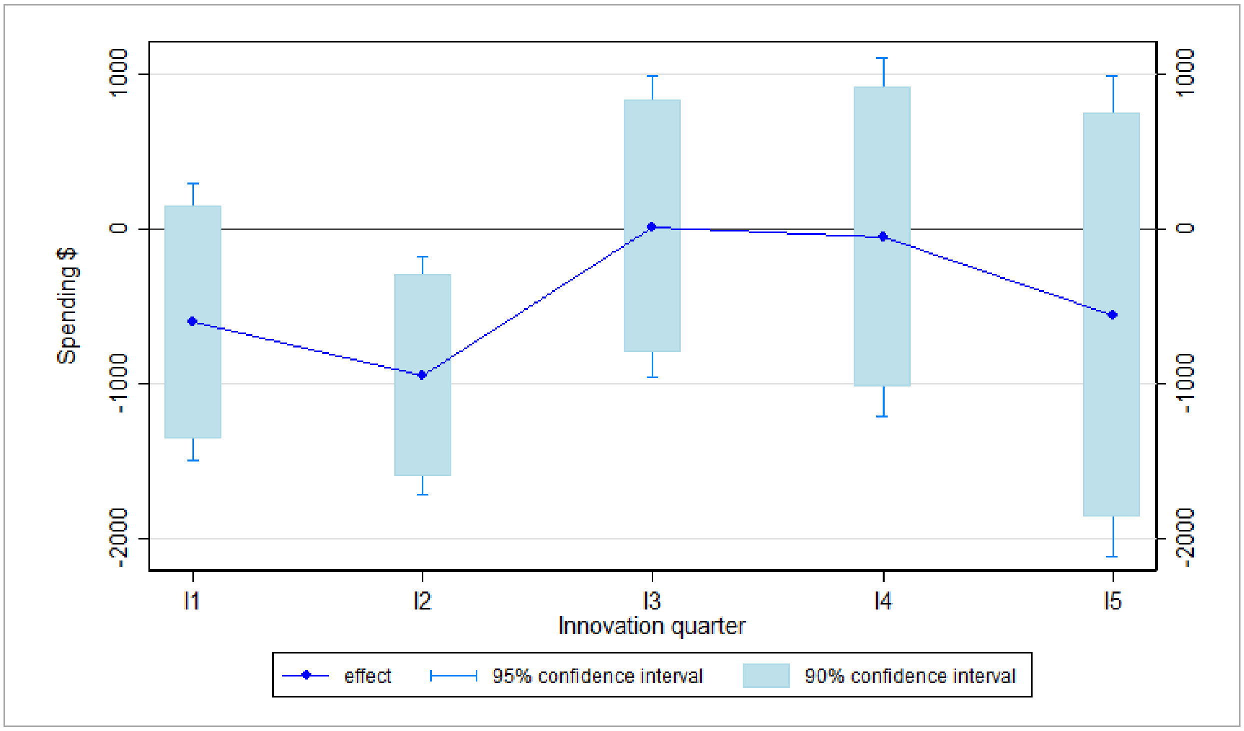
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 19*** presents the results of an OLS regression with quarterly spending per quarter as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 8*** illustrates these quarterly difference-in-differences estimates. During four out of five innovation quarters, the estimated coefficients are negative indicating lower spending among the innovation group. The quarterly estimates are not statistically significant, with the exception of I2.

Table 19. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant

Quarter	Coefficient	Standard Error	P-Values
I1	−$607	$457	0.184
I2	−$950	$394	0.016
I3	$9	$495	0.985
I4	−$56	$590	0.924
I5	−$563	$792	0.477
Overall average	−$462	$272	0.090
Overall aggregate	−$4,705,262	$2,772,133	0.090
Overall aggregate (IY1)	−$4,354,405	$2,652,877	0.101
Overall aggregate (IY2)	−$350,857	$493,342	0.477

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, and dual eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; IA = Imaging Advantage; OLS = ordinary least squares.

Figure 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
IA = Imaging Advantage; OLS = ordinary least squares.

Figure 9 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. In early innovation quarters, the evidence supports the innovation generating savings. Starting in I3, the probability of savings roughly equals the probability of losses.

Figure 9. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: IA

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
IA = Imaging Advantage.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 20*** and ***Figure 10***. All-cause inpatient admissions trend downward during the baseline period for both the innovation and comparison groups. The trends for inpatient admissions are parallel during the baseline period, and the gap between the innovation and comparison hospitals widens during the innovation period, indicating fewer inpatient admissions among the innovation group. In the next section, we use regression analysis to test for differences between the innovation and comparison groups' inpatient admission rates during the innovation period.

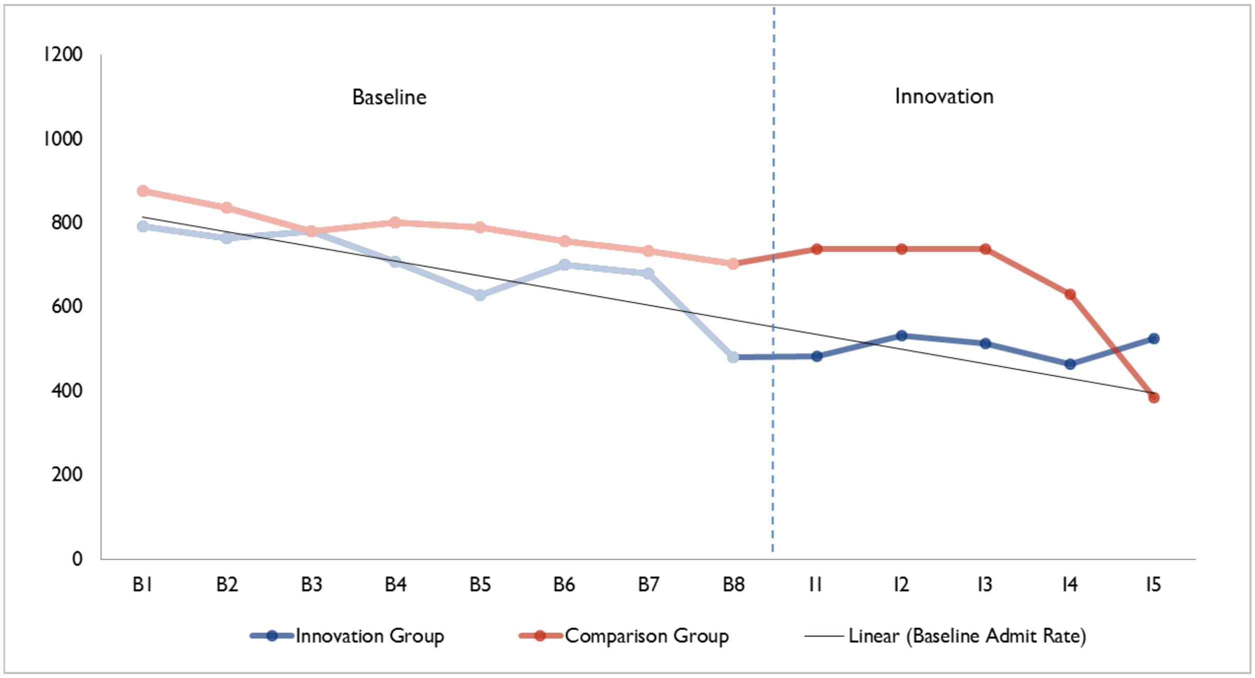
Table 20. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Admit rate	794	765	782	709	629	702	680	481	483	533	515	466	525
Std dev	1,963	1,972	2,120	1,936	1,738	1,906	1,912	1,018	1,051	1,209	1,066	1,078	1,083
Unique patients	3,562	3,525	3,528	3,244	3,302	3,702	3,536	3,481	3,088	2,537	2,299	1,636	623
Comparison Group													
Admit rate	877	836	782	802	790	759	734	704	738	738	739	630	386
Std dev	1,517	1,422	1,402	1,342	1,386	1,231	1,240	1,234	1,199	1,200	1,268	1,069	800
Weighted patients	2,308	2,317	2,284	2,613	2,606	2,710	2,703	2,473	2,259	2,167	1,621	1,006	329
Innovation − Comparison Rate													
	−83	−71	0	−93	−161	−57	−54	−223	−255	−205	−224	−164	139

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
IA = Imaging Advantage

2.12.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 43 per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The estimate is statistically significant (90% CI: −67, −20). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 21 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Quarterly estimates are negative, indicating a lower inpatient visit rate among the innovation group. The effect is statistically significant in I1.

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: IA

Quarter	Coefficient	Standard Error	P-Values
I1	−63	26	0.014
I2	−16	27	0.553
I3	−29	30	0.338
I4	−52	36	0.142
I5	−86	78	0.269
Overall average	−43	14	0.003
Overall aggregate	−442	147	0.003
Overall aggregate (IY1)	−388	139	0.005
Overall aggregate (IY2)	−54	49	0.269

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, and dual eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; IA = Imaging Advantage.

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 22*** and ***Figure 11***. The unplanned readmissions rate is higher among the innovation group than the comparison group during the baseline period; however, the two groups’ trends are parallel. In the last baseline quarter, the innovation group’s unplanned readmissions rate falls to the level of the comparison group’s. During the innovation period, unplanned readmission rates for the two groups are similar.

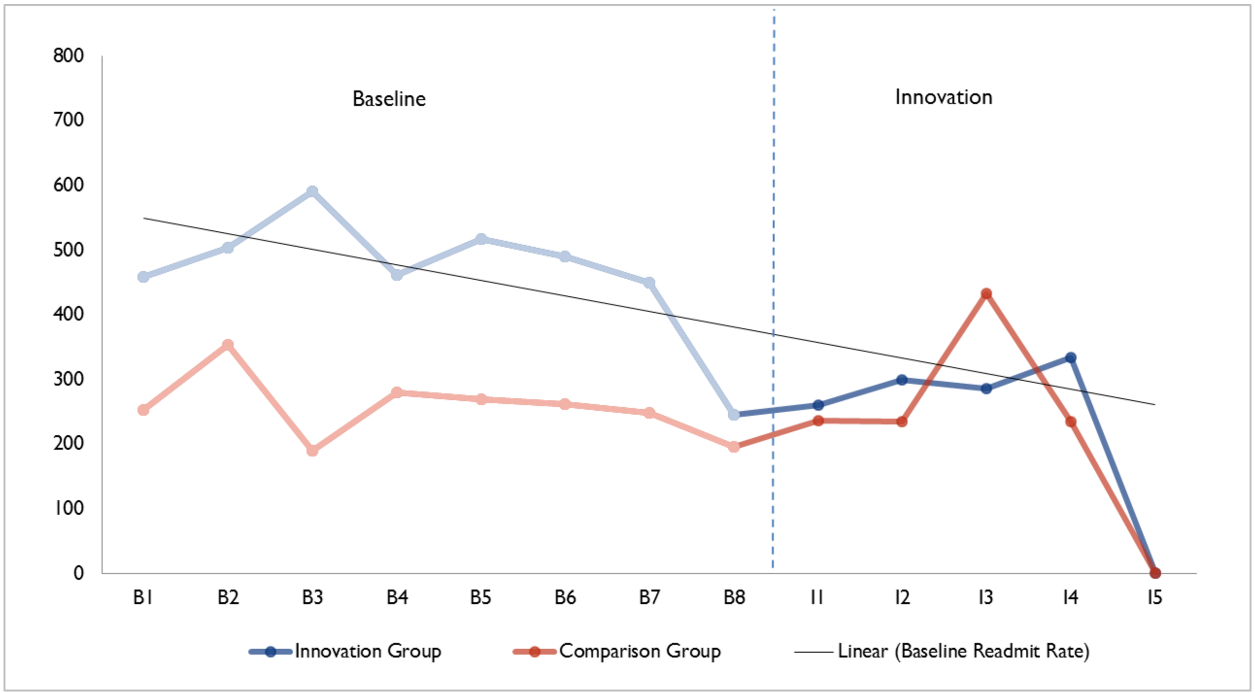
Table 22. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Readmit rate	459	504	591	462	517	490	450	245	261	299	286	333	0
Std dev	498	500	492	499	500	500	498	430	439	458	452	471	0
Total admissions	342	341	291	223	232	302	191	106	115	107	77	39	4
Comparison Group													
Readmit rate	252	353	190	280	270	261	248	196	236	235	432	235	0
Std dev	434	478	393	449	444	439	432	397	425	424	495	424	0
Total admissions	107	133	105	125	115	134	137	107	106	102	74	17	2
Innovation − Comparison Rate													
	207	151	401	182	248	229	202	49	25	64	−147	98	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1IA = Imaging Advantage.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: IA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
IA = Imaging Advantage.

2.13.2 Regression Results

Table 23 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is -29 per 1,000 inpatient admissions, (2.9 percentage points), indicating that the innovation-comparison difference is 2.9 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: -94, 37).

Table 23. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Inpatient Admissions: IA

Quarter	Coefficient	Standard Error	P-Values
Overall average	−29	40	0.473
Overall aggregate	−12	17	0.473

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, and dual eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
IA = Imaging Advantage.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 24*** and ***Figure 12.*** During both the baseline and innovation periods, the trend ED visits are flat for the innovation and comparison groups. In the next section, we conduct a regression analysis to statistically test for differences between the two groups due to the innovation.

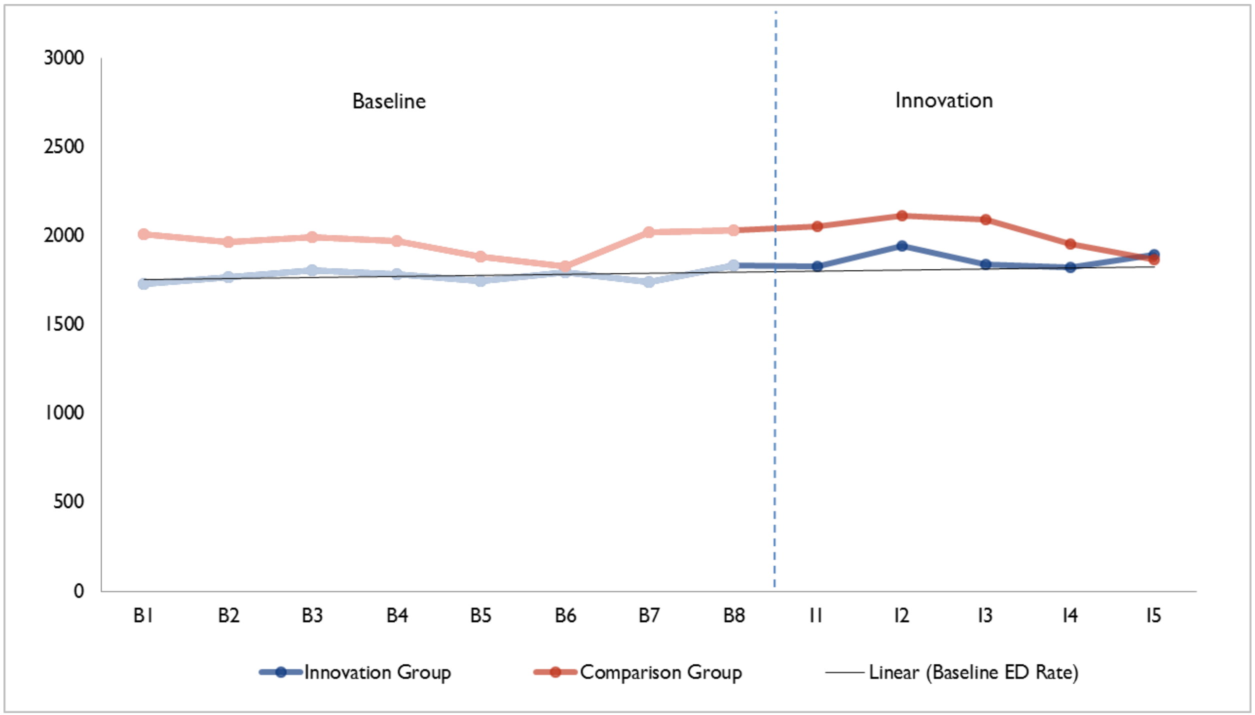
Table 24. ED Visits per 1,000 Medicaid Participants: IA

Awardee Number: 1C1CMS331066
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
ED rate	1,731	1,770	1,810	1,784	1,749	1,797	1,741	1,834	1,828	1,942	1,841	1,821	1,893
Std dev	2,170	2,173	2,258	2,154	2,186	2,212	2,140	1,905	2,241	2,648	2,160	2,471	2,033
Unique patients	3,562	3,525	3,528	3,244	3,302	3,702	3,536	3,481	3,088	2,537	2,299	1,636	623
Comparison Group													
ED rate	2,013	1,966	1,995	1,974	1,886	1,831	2,020	2,034	2,054	2,117	2,091	1,955	1,865
Std dev	2,946	2,297	2,484	2,738	2,619	2,537	2,993	2,868	2,885	3,002	3,176	2,947	2,680
Weighted patients	2,308	2,317	2,284	2,613	2,606	2,710	2,703	2,473	2,259	2,167	1,621	1,006	329
Innovation − Comparison Rate													
	−282	−196	−186	−190	−137	−34	−279	−200	−226	−175	−250	−134	29

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 12. ED Visits per 1,000 Medicaid Participants: IA



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicaid fee-for-service claims.
IA = Imaging Advantage; ED = emergency department.

2.14.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is 63 ED visits per 1,000 participants, indicating that the innovation-comparison difference is larger during the innovation period. This is the average difference in ED visit probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 21, 106). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 25 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show ED visits per 1,000 participants. All quarterly coefficients are positive and the estimate is statistically significant at the 10 percent level in I4. The remaining quarters are not significant at the 10 percent level.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: IA

Quarter	Coefficient	Standard Error	P-Values
I1	47	46	0.313
I2	81	50	0.106
I3	20	54	0.718
I4	118	64	0.064
I5	91	113	0.420
Overall average	63	26	0.013
Overall aggregate	646	261	0.013
Overall aggregate (IY1)	589	251	0.019
Overall aggregate (IY2)	57	70	0.420

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, and dual eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; IA = Imaging Advantage.

2.15 Discussion: Medicaid Results

RTI was never granted access to data that would have enabled evaluation of health care outcomes or health outcomes attributable to the use of RA. Reportedly, the data could be made available via a dashboard, but despite monthly requests, no clear plan for providing that data for evaluation purposes was enacted, which left data stewardship a missing element for IA.

Medicaid patients who entered participating EDs had significantly less total spending and significantly fewer inpatient stays than patients who entered nonparticipating EDs. However, innovation patients had significantly higher rates of ED visits than comparison patients. The IA innovation is not expected to directly impact these measures.

2.16 Awardee-Specific Measures of Health Outcomes

IA submitted some compiled data to RTI that were current through June 2015. ***Table 26*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for all of these measures are included in this annual report. We did not receive Q12 data for CT and MRI exams, so we report data received through Q11 for those two measures.

Table 26. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Health outcomes		Patient exposure to radiation	Data received	Yes
Health care outcomes	Utilization	CT exams	Data received	Yes
		MRI exams	Data received	Yes

CT = computed tomography; MRI = magnetic resonance imaging.

2.17 Patient Radiation Exposure

Using the image studies from the Chicago area hospitals, we estimated radiation exposure using an industry standard average radiation range for each procedure. More specifically, radiation dosage for medical imaging is now measured in milliSieverts (mSv; 1 mSv = 100 milliRem). The radiation dose received is a function of the imaging technology being utilized, the body area being imaged, and the duration of the imaging study. Furthermore, imaging for core body areas such as abdomen or pelvic regions expose patients to far more radiation than studies of peripheral areas such as hands, feet, arms, or legs. Thus, the radiation exposure values are only an approximation of the actual radiation received by each patient. This allowed us to address the question of whether exposure to radiation changed over the course of the innovation.

Evaluation Question

- Has patient exposure to radiation changed over the course of the innovation?

2.17.1 Descriptive Results

As shown in ***Figure 13,*** over the course of the innovation, 78–79 percent of the procedures were in the very low or zero radiation dosage categories; this level remained stable. There are several sources of standard radiation exposure such as the *Effective Radiation Dose in Adults* chart accessed on RadiologyInfo.org.[1] As Figure 13 depicts, all life is exposed to a certain amount of radiation due to natural sources, and the annual radiation per person is estimated at 3mSv. Exposure from radiology exams is a function of both the type of radiology exam and of the body area being studied. For example, dental x-rays are considered to be low-radiation exposure, whereas an x-ray of the pelvic area is considered relatively high radiation exposure. Therefore, the net cumulative radiation exposure is of potential concern, and one goal of this innovation was to eliminate duplicative or clinically unnecessary radiation exposure, while using clinical decision support to guide the clinician toward lower radiation alternatives. Comparing Q12 to Q7, the share of 0 mSv studies increased a relative 10 percent (from 22.7% to 25.0%). Over the same period, the higher radiation exposure studies (1-30 mSv) decreased from 21.9 percent to 21.3 percent.

[1] Radiological Society of North America, Inc.: Radiation dose in X-ray and CT exams. 2016. Retrieved from: http://www.radiologyinfo.org/en/info.cfm?pg=safety-xray

Figure 13. Radiation Exposure by Quarter

	Quarter	Q7	Q8	Q9	Q10	Q11	Q12
●	0 mSv	22.7	23.2	23.8	23.0	25.0	25.0
●	0.1-1 mSv	55.4	55.1	54.0	55.1	53.5	53.7
●	1-10 mSv	15.0	14.6	15.0	15.0	14.5	14.5
●	10-30 mSv	6.9	7.1	7.2	6.9	7.0	6.8
	Total imaging studies	68,244	71,846	74,929	68,255	74,116	72,944

Source: Data provided to RTI by IA.

2.18 Utilization

Using the utilization data provided by IA, we sought to gauge the impact of the RA innovation on the proportion of higher radiation imaging modalities that transitioned to lower radiation procedures over the course of the innovation. This allowed us to address the question of whether utilization of imaging modalities changed over the course of the innovation.

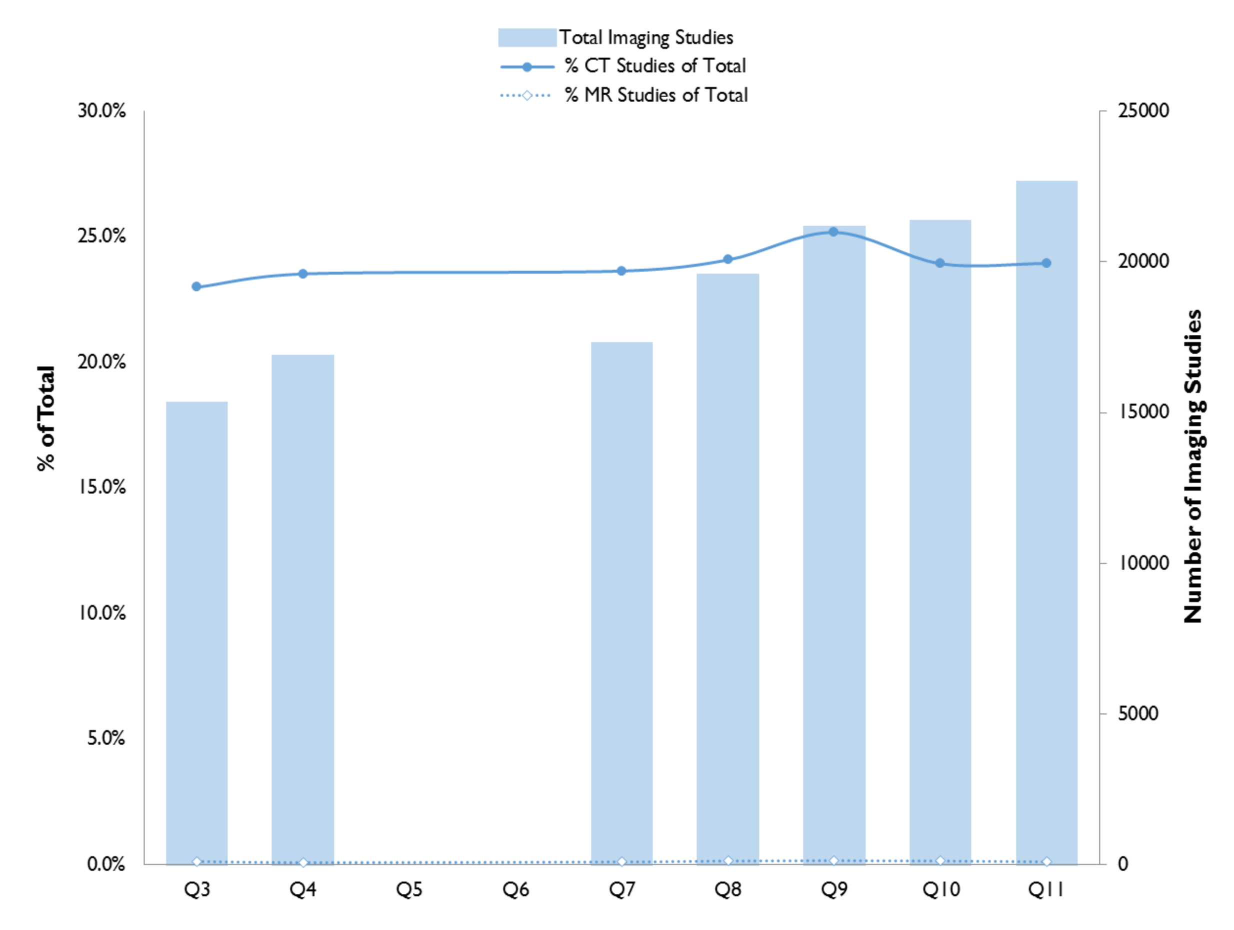
Evaluation Question

- Has utilization of CT and MR imaging modalities changed over the course of the innovation?

2.18.1 Descriptive Results

Figure 14 shows that the percentage of higher radiation CT procedures was essentially unchanged at approximately 24 percent of all imaging over time. Similarly, the proportion of MR procedures remained unchanged at approximately 0.2 percent of all imaging studies across the four Tenet hospitals. On the basis of our understanding of the IA innovation, we planned to report on health outcomes directly associated with the elimination of incorrect and duplicative imaging exams and to provide details on reduction in patient radiation dosage. Lacking access to the radiology dashboards, we do not have the data to report on these outcomes. In the next report, we will estimate the health outcome by using an industry standard average radiation range for each procedure.

Figure 14. Percentage of CT and MR Imaging Studies over Time



(continued)

Figure 14. Percentage of CT and MR Imaging Studies over Time (continued)

	Quarter	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
●	Percentage of CT studies of total	23.0	23.5	0.0	0.0	23.6	24.1	25.2	23.9	23.9
◊	Percentage of MR studies of total	0.1	0.1	0.0	0.0	0.1	0.2	0.2	0.2	0.1
	Total Imaging Studies	15,029	16,580	0	0	17,025	19,288	20,859	21,054	22,367

Source: Data provided to RTI by IA.
CT = computed tomography; MRI = magnetic resonance imaging.

2.19 Discussion: Awardee-Specific Data

From an evaluation standpoint, the IA innovation was a complex component from which to capture accurate information and data. The dashboard application that IA uses to capture data on use in real time was under development, contained erroneous information when tested, or was not accessible (due to privacy concerns) to RTI. IA provided data suggesting that multiple innovation components were reducing turnaround time and affecting more appropriate radiologic imaging selection. However, this suggestion was not confirmed in the data RTI examined. From this assessment, it is unclear whether the innovation components had the impact that IA anticipated. From claims review, both cost in the form of total imaging studies (which increased over the innovation period) and imaging type (higher versus lower cost image orders remained unchanged) were unaffected by the innovation. Review of the outpatient ED claims data on MRI ordering showed a possible, very slight indication of a change to the latter, imaging type—so this is an indicator to watch.

2.20 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 27*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from IA's *Narrative Progress Reports, Quarterly Awardee Performance Reports*. Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 27. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number of patients who received an imaging study	Data received from Imaging Advantage

FTE = full-time equivalent; Q = quarter.

2.21 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.21.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation remained fully staffed with 24 full-time equivalent (FTE) staff members. Staff included physicians, clinical support personnel, practice managers, project managers, software developers, network engineers, and physician licensure and credentialing personnel. Between Q6 (December 2013) and Q12, no changes were made in the number of FTEs.

Toward the end of the project period, IA reported issues with credentialing for reengineering and teleradiology services, causing delays that affected turnaround time. In the Chicago market, IA mentioned difficulty maintaining credentialed radiologists at the Tenet hospitals because of unanticipated problems with local credentialing departments. This weak retention reduced the number of radiologists available to complete timely imaging reads.

2.21.2 Skills, Knowledge, and Training

Between Q11 and Q12, IA provided 120 hours of training to seven individuals. Three continuing medical education seminars for Tenet radiology technicians were delivered, additional radiation and MRI safety training modules were completed, and a standardized bone fracture training presentation was awaiting review and approval from medical staff. Some training was provided for each intervention component, and some ongoing support was provided by medCPU for RA. The feedback loop was generally perceived as quick and responsive to changes when needed. Some staff indicated involvement early in the process, others indicated getting involved only in an ad hoc fashion after implementation.

Table 28. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12 (January–June 2015)	120	7
Since inception	3,722	413

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.22 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, the sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

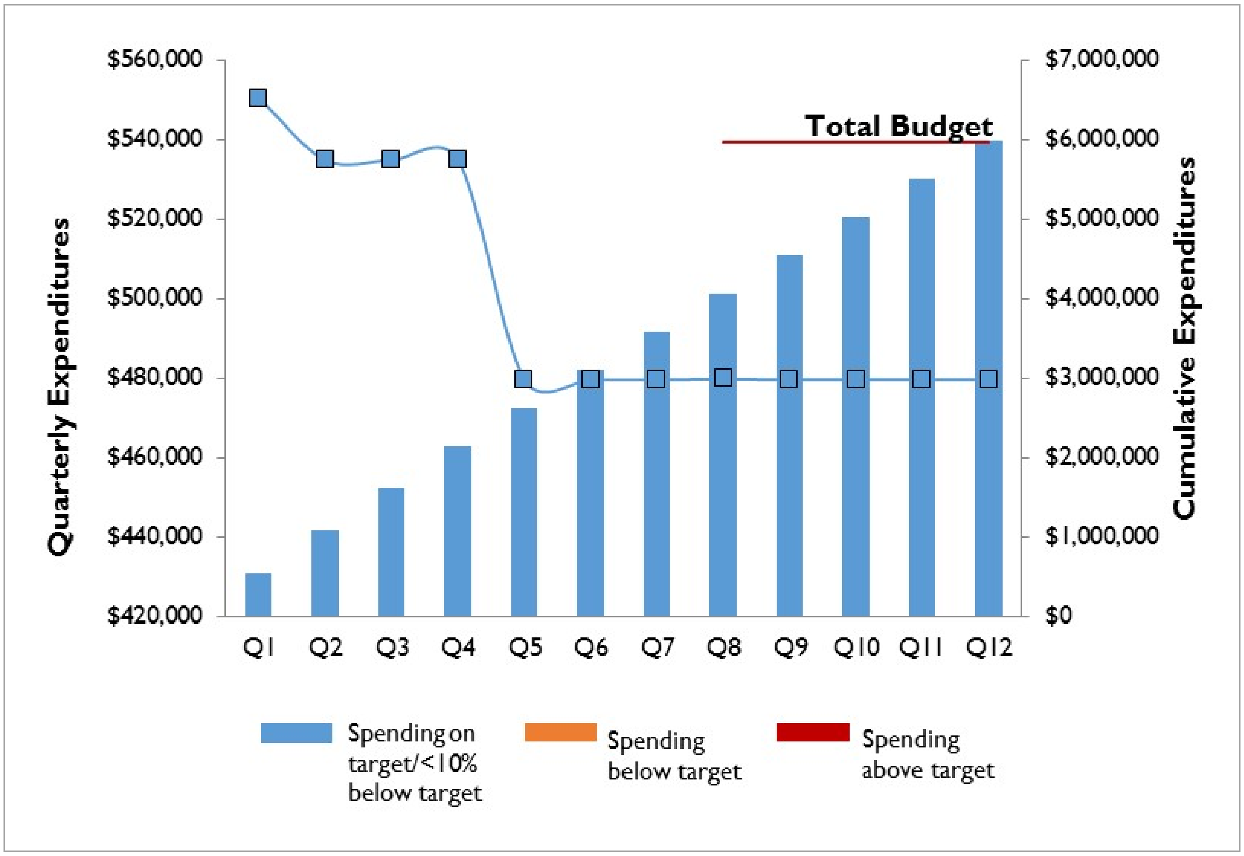
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.22.1 Award Execution

The annual report highlights the significance of IA's expenditure rates on implementation. As of June 2015 (Q12), IA spent 100 percent of its total budget, which is at the projected target. IA was consistently on target with spending from Q10 through Q12 (***Figure 15***).

Figure 15. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.22.2 Leadership

Throughout the project, the IA project director was recognized by members of the team as a champion and strong innovation leader. Interviewees and survey respondents indicated that they felt supported, and the project director initiated meetings and provided important information sharing opportunities at each of the Tenet hospitals. In addition, staff from partner medCPU made themselves available in person to address software and usability concerns and to provide information on any changes that had been implemented (including changes to the back-end algorithm). Tenet hospitals leadership and staff were supportive but involved in the intervention to varying degrees. Medical directors in the ED also played an important role in garnering adoption and effective use of the RA tool with variable success and addressing some issues related to staff transition. In one case where a new ED director had been added, the IA project manager worked closely with the new director to introduce the innovation components and respond, along with partner medCPU's assistance, to requests for tailoring some of the RA components.

2.22.3 Organizational Capacity

The four Tenet hospitals involved in the innovation shared a single EHR environment. Except for occasional EHR upgrades, the innovation benefited because after the EHR was rolled out in one hospital, implementing the same components in remaining hospitals was fairly straightforward. Most customization involved the way components were integrated into the workflow and ultimately delivered by the hospital staff. Because the RA component was tightly coupled with the EHR and fully integrated into the workflow, the Tenet infrastructure was an important factor in successful adoption.

On the basis of survey and interview responses, some providers felt the innovation might have benefited from more of their involvement earlier on in the development and implementation phases. While some radiologist involvement was present from the earliest stages, turnover in the ED setting and a lack of clear prioritization at the leadership level resulted in ad hoc involvement among some staff affected by the intervention. With the exception of a stall in the Better Tech program and a decision to discontinue the RealTime QA program post-beta testing, no changes in organizational capacity were noted since the 2015 annual report.

2.22.4 Innovation Adoption and Workflow Integration

According to both interview and provider survey respondents, RA did not significantly impact providers' workflow; however, several providers noted that they included more detail in the chart, changed the timing of when they include specific details in the chart, or changed when or how they signed the chart. A physician reported that, *"RadAdvisor™ makes me be a better documenter. I don't like seeing a prompt so I am careful to document my cases fully."* Respondents reported that the biggest impact on workflow was RO, which eliminated the backlog of images for radiologists would have to read each morning by providing nightly reads. Aside from the decision to discontinue them, insufficient information about the Better Tech program or the RealTime QA program was provided to evaluate their adoption or impact on workflow.

Radiology outsourcing and workflow reengineering. At the end of the funding period, IA provided all radiology services to all four Tenet hospitals. This workflow reengineering, which eliminated wet (i.e., preliminary) reads for the Tenet system and resulted in reduced turnaround time, proved to be sustainable and was successfully transferred to other markets.

Radiology Advisor. As of Q12, RA was live at all four Tenet hospitals and, according to the IA progress report, inappropriate image studies continued to decline. Despite receiving data from IA on these successes, RTI's review of claims data did not support any clear reduction in overall image ordering or a transition from higher to lower cost image ordering. IA noted that discussions with the Tenet system about expanding RA to all inpatient care and any ordering physician on the Tenet market network stalled because Tenet did not have resources to provide the necessary data on the in-house patient population. Continued support from the Tenet system to provide financial support to continue the ED program at the end of the project was also mentioned.

Refinements to the tracked key performance indicators and reports were completed to provide more specific data in a more accessible format. These refinements included changes to better align system functions, like prompting, with patient and physician needs. One interviewee commented:

> ***"The RadAdvisor™ increasingly prompted for traumatic head admissions. We had to determine if we needed to change our ordering habits or adjust the algorithm since our docs rely on it so much for guidance. Our chart review determined that a change made to the sensitivity of RadAdvisor was causing increased prompting. Education [of staff and medCPU] was done and the number of prompts has been dramatically reduced."***

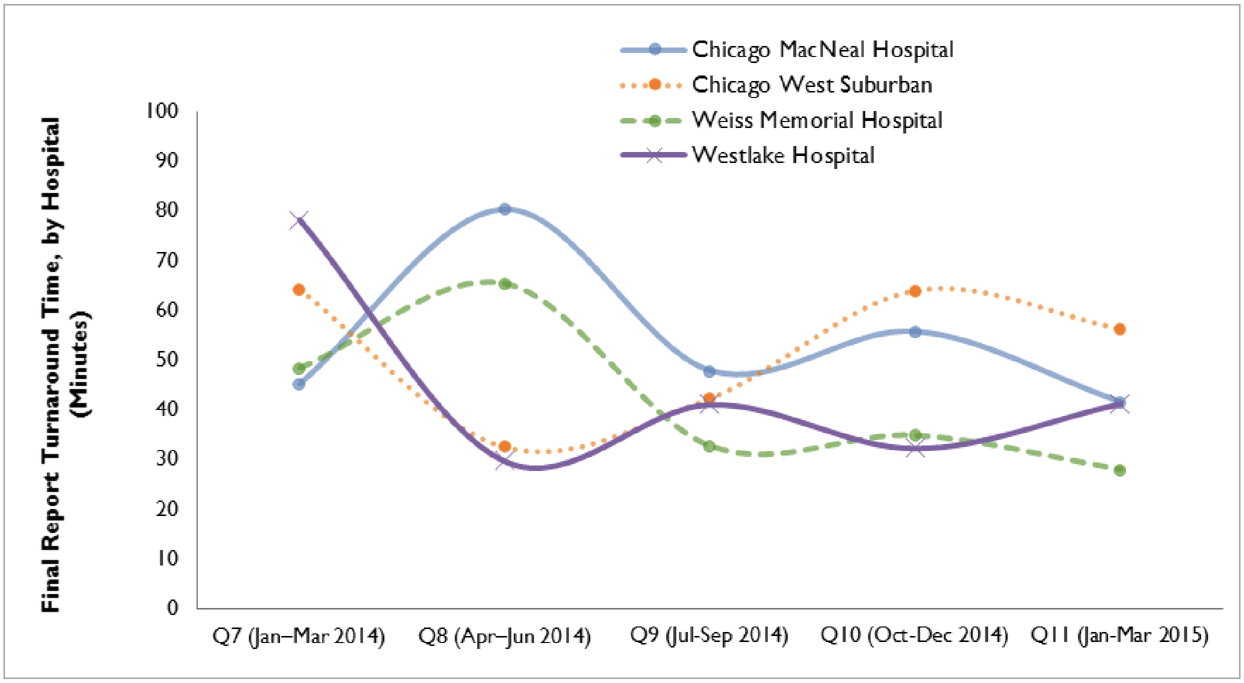
Better Tech program. Between Q10 and Q12, IA, working with radiology directors, implemented standardized x-ray, ultrasound, and CT scan protocols, along with ultrasound technologist worksheets to support the program. These were accompanied by a standardized CT questionnaire put into production in November 2014, along with data collection for the period beginning in October 2014. Though the Better Tech program was implemented during the site visit in the spring of 2015, IA reported in Q12 that the Technologist QA program stalled in Q12, perhaps due to poor participation.

RealTime QA. Workflow challenges with RealTime QA due to the limited number of physicians credentialed at each site and the short (10-minute) window to conduct a double-blind review of high-risk cases resulted in failure of the beta test. Additionally, IA challenges ensuring a double blind review complicated the basic concept of RealTime QA (in the system, double reads are marked as RealTime QA, which alerts radiologists that the image is being read twice, potentially resulting in reporting bias). Despite making revisions to the workflow and software and correcting bugs, this program was determined not viable (per the Q12 report) after unsatisfactory beta testing and was discontinued.

Turnaround Time Results

RTI received data from IA that tracked imaging report turnaround time for all imaging studies conducted in the ED of all four Chicago-area hospitals (**Figure 16**). We did not receive Q12 data for mean final report turnaround time. Therefore, the data presented are the same as presented in the 2015 annual report. Turnaround time before implementing RA was averaging 3 hours across the four EDs, with the Weiss Hospital turnaround time running 10 hours in Q3–Q4. While response to RA go-live varied across the system, all hospitals showed significant benefit achieving a mean turnaround time in Q11 of less than 45 minutes. The Weiss ED achieved the greatest improvement with Q11 turnaround time of 28.0 minutes. RTI has no data indicating which radiologists or other providers adhered to advice from RA clinical decision support (CDS), so we cannot evaluate the role of the tool in achieving the turnaround time reduction.

Figure 16. Mean Final Report Turnaround Time, by Quarter and Hospital



	Quarter	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct-Dec 2014)	Q11 (Jan-Mar 2015)
●	Chicago MacNeal Hospital	45.2	80.4	47.9	55.8	41.5
●	Chicago West Suburban	64.1	32.6	42.4	63.9	56.3
●	Weiss Memorial Hospital	48.4	65.5	32.7	34.8	28.0
●	Westlake Hospital	78.2	29.7	41.1	32.3	41.3

Q = quarter.

2.23 Implementation Effectiveness

A major focus of the evaluation is to assess the effectiveness of the implementation effort and determine whether the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

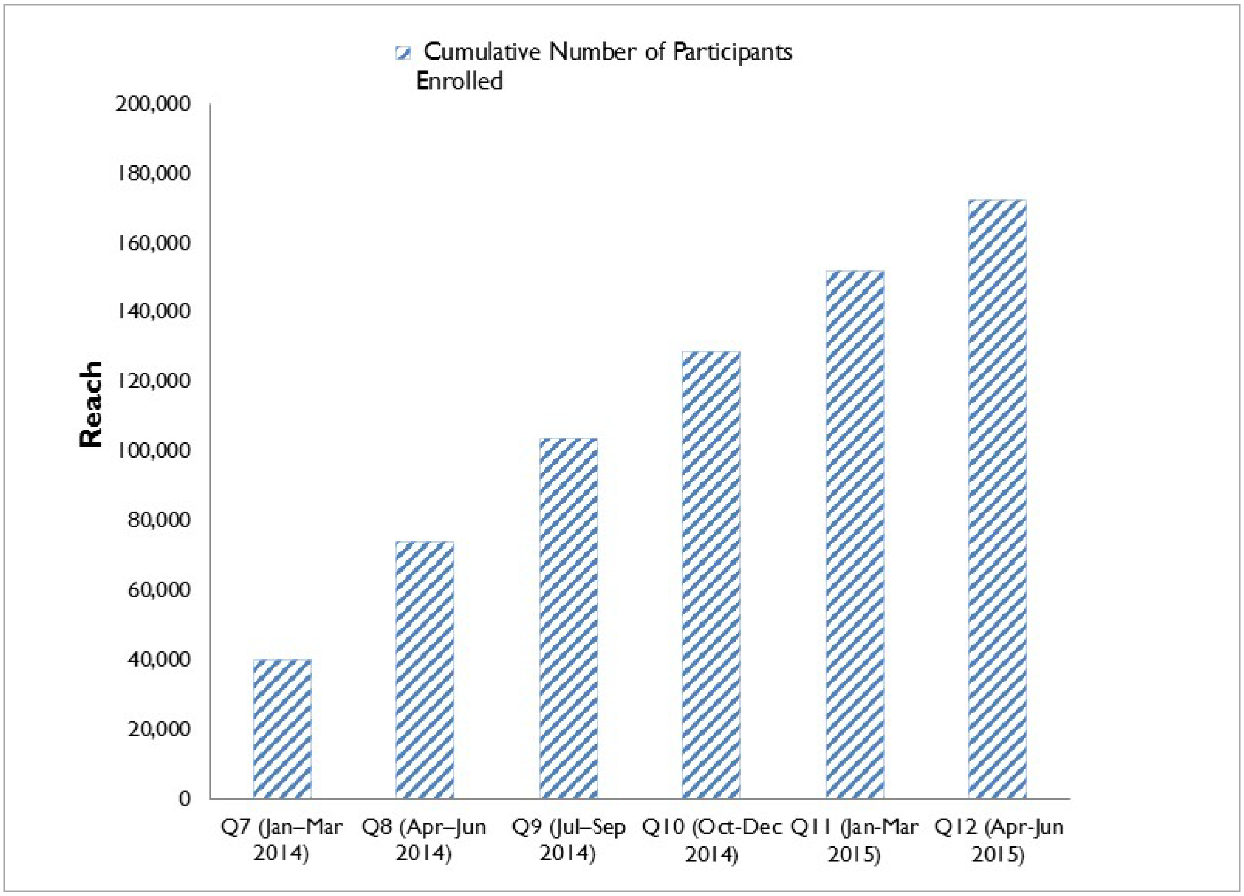
- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.23.1 Innovation Reach: Participants Exposed

IA focused on reach as an impact on patients (participants exposed). ***Figure 17*** shows cumulative participant enrollment by quarter since the launch of the innovation based on data provided by IA. Enrolled patients were defined as those who received at least one imaging study during the innovation period. We last reported reach in the 2015 annual report. An additional 20,477 patients received an imaging study across the four hospitals as of Q12. This represents only one quarter of additional data from the 2015 annual report.

Because provider adoption and use of the IA innovation have a direct impact on patient care, we determined early in the evaluation that provider adoption and use would be an important metric to track and evaluate. The summary presented in Figure 17 shows that a large volume of imaging procedures were performed in the Tenet hospital emergency departments equipped with RA. Because RTI was never granted access to data that would have enabled evaluation of health care outcomes or health outcomes attributable to the use of RA, we cannot report the extent to which radiologists who conducted the procedures for 172,073 patients were alerted by RA nor how often the radiologists altered the planned procedure in response to an alert.

Figure 17. Participant Enrollment for Each Quarter since Project Launch



(continued)

Figure 17. Participant Enrollment for Each Quarter since Project Launch (continued)

	Quarter	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct-Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)
	Cumulative number of participants enrolled	39,899	73,881	103,526	128,701	151,596	172,073

2.23.2 *Innovation Dose*

RTI determined that dose was not an appropriate measure of implementation effectiveness for this innovation, According to IA, all providers who ordered any radiology exam in the EDs were required to use the RA tool, and all patients who received those exams would have been impacted by RA.

2.24 Qualitative Findings: Sustainability

IA indicates that the RO component of their intervention was successfully rolled out in other markets and is slated to expand internationally. As a commercial entity, IA has a clear business model for the RO component, and it is a highly successful element of its work. IA and its partner, medCPU, introduced RA to additional markets and fully expect this to be sustained using a commercial business model (subscriptions). Despite some issues overall with data collection and reporting and the Better Tech program and the RealTime QA program, which were both discontinued in the Tenet hospitals, IA indicated that these, along with the RO and RA programs, will be extended beyond the grant period and in new areas. At the end of the funding period, IA indicated that there were no changes to staffing but did not elaborate on how the staff were absorbed or reallocated with grant funding ending. Evaluation is a key factor in sustainability, and IA focused on identifying and reporting on relevant key performance indicators. During the project period, access to this information through a dashboard and regular reports was a challenge for IA. This may have been due in part to challenges in correctly identifying what information should be tracked during implementation

2.25 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing IA, as well as accomplishments to date. In this section we assess IA's progress on achieving HCIA goals to date.

- **Smarter spending.** On the basis of this analysis, this innovation did not demonstrate a reduction in Medicare spending. Total Medicare spending among fee-for-service beneficiaries entering EDs in participating hospitals is higher than spending among beneficiaries entering EDs in non-participating hospitals. There is some limited evidence of reduced outpatient MRI expenditures among Medicare beneficiaries. Total Medicaid spending was lower among fee-for-service beneficiaries entering participating hospitals' EDs. It is important to interpret these results with caution because the IA innovation was not expected to generate a statistically detectable impact on total costs.

- **Better care.** The IA innovation was not expected to impact inpatient stays, readmissions or ED visits because it focused on imaging workflow. The Medicare and Medicaid claims analyses do find statistically significant differences between patients entering the ED in participating versus non-participating hospitals; however, these results should be interpreted with caution. Over the course of the innovation 172,073 patients received 430,334 radiology studies in the Tenet Hospital EDs. Due to this large sample size, the regression models were able to detect relatively small differences between the innovation and comparison groups.

- **Healthier people**. Radiation exposure over time was estimated by using an industry standard average radiation range for each procedure. Nearly four of every five radiology procedures involved no radiation or very low levels of radiation exposure for patients. This did not change over time.

Overall, the IA innovation was successfully implemented. Some components appeared to be more uniformly adopted than others (e.g., RA), though usage data was not made available for analysis. IA, medCPU, and their partners remained committed to sustaining and expanding this innovation. Innovation leaders indicated having clear plans for expanding RA and other components of the innovation both within the Tenet hospital context and to additional markets. Development and implementation of the IA innovation included a multidisciplinary team with experience implementing various components of the innovation, notably outsourced radiology services, workflow reengineering, and teleradiology. Ultimately, the innovation components taken together were moderately to highly complex and challenging to implement. IA's experience with and knowledge of radiology modalities, processes, and guidelines and medCPU's technical expertise were important to the successful implementation of the innovation.

RA represented the core component of the innovation. This electronic clinical decision support tool is a stand-alone application that appears to be connected to the ED provider's EHR system screens, thereby reaching all ED providers who use the Tenet EHR system. RTI could not assess how much RA and the other innovation components were used because we lacked access to IA's data portal. While many aspects of the evaluation analyses did not demonstrate a positive impact on reducing costs or improving care, it would be prudent to watch the Medicare outpatient ED MRI imaging claims, which showed a small, statistically significant but inconsistent reduction in cost for MRI studies over the analysis period for the innovation group.

The inability to review detailed data on adoption from the IA innovation coupled with our review of claims data for the innovation period hindered reconciliation of the improvements shown in the IA reports. Claims data suggested that the total number of images actually went up during the innovation period and there was no clear reduction in higher cost image orders in favor of lower cost image orders. Therefore, it was unclear what, if any, impact the innovation had on cost and quality. Although we were unable to measure the impact, Tenet has the data resources to be able to transition toward better care.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Imaging Advantage (IA)

Imaging Advantage (IA), a for-profit provider of hospital-based and telemedicine solutions for medical imaging located in Phoenix, Arizona, received an award of $5,977,805 and began rollout in partner hospitals in Chicago, Illinois in October 2012.

Awardee Overview

Innovation dose:	RTI determined that dose was not an appropriate measure of implementation effectiveness for this innovation.	***Innovation reach:***	172,073 patients received an imaging study.
Components:	(1) Radiology outsourcing and workflow reengineering and teleradiology services (RO) (2) IA's Radiology Advisor (RA) (3) Radiology dashboards/reports (RD) (4) IA's RealTime™ imaging quality assurance (QA)	***Participant demographics:***	Most patients (59.3%) were 25 to 64 years old and more than half (63.4%) were female.
Sustainability:	IA described plans to continue all components of the intervention beyond the grant period, having already extended some components to other markets.		
Innovation type:	Process of care	Health IT	Decision support

Key Findings

Smarter spending. Average quarterly Medicare spending per beneficiary among fee−for−service beneficiaries entering emergency departments (EDs) in participating hospitals was significantly higher than spending among beneficiaries entering EDs in nonparticipating hospitals ($827; 90% CI: $98, $1,555). There was limited evidence of reduced outpatient magnetic resonance imaging (MRI) expenditures in the first innovation quarter (−$4; 90% CI: −$7.37, −$0.67). Average quarterly Medicaid spending was lower among fee−for−service beneficiaries entering participating hospitals' EDs ($462; 90% CI: −$910, −$14). It is important to interpret these results with caution because the IA innovation was not expected to generate a statistically detectable impact on total costs.

Better care. The IA innovation was not expected to impact inpatient stays, readmissions, or ED visits because it focused on imaging workflow. The Medicare and Medicaid claims analyses found statistically significant differences between patients entering the ED in participating versus nonparticipating hospitals; however, these results should be interpreted with caution. ED visits per 1,000 participants per quarter decreased for Medicare beneficiaries (−71; 90% CI: −85, −56) and increased for Medicaid beneficiaries (63; 90% CI: 21, 106). No significant changes were found in average quarterly readmissions per 1,000 admissions for Medicaid beneficiaries (−29; 90% CI: −94, 37), but there was a significant decrease for Medicare beneficiaries (−5; 90% CI: −10, 0). Medicare inpatient admissions per 1,000 participants per quarter increased (70; 90% CI: 60, 79) and Medicaid inpatient admissions decreased (−43; 90% CI: −67, −20).

Over the course of the innovation 172,073 patients received 430,334 radiology studies in the Tenet Hospital EDs. Although we were unable to measure the impact, Tenet has the data resources to be able to transition toward better care.

Healthier people. Radiation exposure over time was estimated by using an industry standard average radiation range for each procedure. Nearly four of every five radiology procedures involved no radiation or very low levels of radiation exposure for patients. This did not change over time.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Intermountain Healthcare

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q14 (December 2015)
Quarterly Awardee Performance Report	Launch date–Q14 (December 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–December 2015

Q = quarter.

Intermountain Healthcare

2.1 Introduction

Intermountain Healthcare, Inc. (Intermountain), is a nonprofit integrated health care system headquartered in Salt Lake City, Utah. It encompasses 22 hospitals, more than 150 clinics, and the SelectHealth plan that insures 750,000 people in the state (about one-third of the population). Intermountain was awarded $9,724,142 (and began enrolling participants in June 2013) to develop and pilot its unique “disruptive innovation.” The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending through a shared savings model (SSM) for both employed and affiliated physicians. Intermountain estimates that its innovation was to have achieved a potential savings of $1.7 million in Year 1 and $37 million by the end of the award period.

2. **Better care.** Improve care by implementing a shared decision-making model that engages Intermountain patients in a dialog with their physicians to better manage their chronic illnesses. A key aspect of innovation is shared decision making and patient activation/engagement using the Archimedes IndiGO tool.

3. **Healthier people**. Improve health through population management (e.g., “hot spotting”) by first identifying and then targeting interventions to high-risk or high-cost patient populations and connecting them with the appropriate community based and primary care interventions.

Table 2 provides a summary of changes that occurred during the final 12 months of operations. These updates are based on a review of the Quarter (*Q)11–14 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through December 30, 2015.

Table 2. Summary of Updates as of Quarter 14, December 31, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Continued use of three components: patient engagement (IndiGO), population management (hot spotting), and SSM.
Program Participant Characteristics	
	In IndiGO and SSM, most participants were aged 65 and older (96.4% and 87.9%, respectively) and were female (52.3% and 56.4%, respectively). Almost all participants for whom we received data were covered by Medicare.
Workforce Development	
Hiring and retention	Hired 12.58 FTEs from project inception through Q12, which exceeded target of 11.5 new hire FTEs.
Skills, knowledge, and training	Delivered 588 cumulative training hours to 426 trainees since project inception through Q14.
Context	
Award execution	Spent 73.3% of cumulative funding through the end of the project, which was below expectation.
Leadership	Maintained strong leadership and support throughout the award.
Organizational capacity	Although the innovation leveraged existing organizational infrastructure, it experienced organizational capacity challenges due to competing priorities, mainly EHR implementation and ICD-10 implementation.
Innovation adoption and workflow integration	Integrated the IndiGO tool into the benefit design for Intermountain's health plan and the shared savings targets for providers.
Implementation Effectiveness	
Innovation reach	Less than one in four (23.6%) of activated physicians had at least one qualified IndiGO view, an increase of 2.2 percentage points since last reported in the 2015 annual report. 1.5% of IndiGO patients had a qualified view. Innovation reached 77.1% of target number of physicians for SSM.
Innovation dose	No data were available to assess dose for this innovation.
Sustainability	
	Integrated the IndiGO tool into the health plan design and the shared savings targets for providers.

Sources: *Q11-Q14 Narrative Progress Report*.
Q11-Q14 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted Feb–June 2015.

EHR = electronic health record; FTE = full-time equivalent; ICD = International Classification of Diseases; q = quarter; SSM = shared savings model.

As part of our evaluation, RTI analyzed health insurance claims for beneficiaries who participated in the IndiGO, SSM, and population management (hot spotting) components of Intermountain's innovation. Because the IndiGO and SSM components were complementary, we divided the innovation beneficiaries into four groups for analysis: those who had an IndiGO view and enrolled in SSM practices (Cohort 1), those who had an IndiGO view only (Cohort 2), those enrolled in SSM practices only (Cohort 3), and those enrolled in population management [hot spotting (Cohort 4)]. In this report, IndiGO enrollment includes those patients who ever had an IndiGO view.

Table 3 summarizes Medicare claims-based findings during the innovation period for Cohort 1. Results for Cohort 1 show that the overall average spending among innovation group individuals was $92 higher than spending among comparison group individuals, but the spending estimate is not statistically significant. The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 2 inpatient admissions per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: −14, 19). The average quarterly difference-in-differences estimate for unplanned readmissions is 4 per 1,000 inpatient admissions (0.4 percentage points), indicating that the innovation−comparison difference is 0.4 percentage points higher during the innovation period. The effect is not statistically significant (90% CI: −48, 56). The average quarterly difference−in−differences estimate for ED visits is a decrease of 15 ED visits per 1,000 participants relative to the comparison group and the effect is not statistically significant (90% CI: −43, −14).

Table 3. Summary of Medicare Claims-Based Findings: Intermountain Cohort 1 (IndiGO and SSM)

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$0.184	−$0.875, $1.244	−$0.475	−$0.943, −$0.006	$0.466	−$0.050, $0.982	$0.192	−$0.303, $0.688
Acute care inpatient stays	4	−29, 37	−27	−46, −8	13	−7, 33	18	0, 36
Hospital-wide all-cause unplanned readmissions	1	−7, 8	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−30	−86, 27	−33	−63, −3	−5	−42, 32	8	−23, 39
Average impact per quarter								
Spending per participant	$92	−$436, $619	−$619	−$1,230, −$8	$627	−$67, $1,321	$386	−$608, $1,381
Acute care inpatient stays (per 1,000 participants)	2	−14, 19	−35	−60, −10	17	−10, 44	36	0, 72
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	4	−48, 56	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−15	−43, 14	−43	−82, −4	−6	−56, 44	16	−46, 79

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicare claims-based findings during the innovation period for Cohort 2. Results for Cohort 2 show that the overall average spending among innovation group individuals was $156 lower than spending among comparison group individuals, but the estimate is not statistically significant. The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 6 inpatient admissions per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: −15, 2). The average quarterly difference−in−differences estimate for unplanned readmissions is 17 per 1,000 inpatient admissions (1.7 percentage points), indicating that the innovation−comparison difference is 1.7 percentage points higher during the innovation period. The effect is not statistically significant (90% CI: −39, 73). The average quarterly difference-in-differences estimate for ED visits is 0 ED visits per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: −12, 11).

Table 4. Summary of Medicare Claims-Based Findings: Intermountain Cohort 2 (IndiGO only)

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.687	−$2.216, $0.842	−$0.260	−$0.897, $0.376	−$0.323	−$1.067, $0.421	−$0.103	−$0.690, $0.483
Acute care inpatient stays	−28	−66, 10	4	−19, 28	−13	−36, 10	−20	−39, −1
Hospital-wide all-cause unplanned readmissions	4	−8, 15	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−2	−51, 46	0	−27, 28	−5	−34, 25	2	−24, 29
Average impact per quarter								
Spending per participant	−$156	−$503, $191	−$151	−$519, $217	−$199	−$659, $260	−$98	−$651, $456
Acute care inpatient stays (per 1,000 participants)	−6	−15, 2	3	−11, 16	−8	−22, 6	−19	−36, −1
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	17	−39, 73	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	0	−12, 11	0	−16, 16	−3	−21, 15	2	−23, 28

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 5 summarizes Medicare claims-based findings during the innovation period for Cohort 3 SSM only. Results for Cohort 3 show that the overall average spending among innovation group individuals was $582 higher than spending among comparison group individuals, and the spending estimate is statistically significant at conventional levels. The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 19 inpatient admissions per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 17, 20). The average quarterly difference-in-differences estimate for unplanned readmissions is −6 per 1,000 inpatient admissions (0.6 percentage points), indicating that the innovation-comparison difference is 0.6 percentage points lower during the innovation period. The effect is not statistically significant (90% CI: −13, 0). The average quarterly difference-in-differences estimate for ED visits is an increase of 27 ED visits per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 24, 29).

Table 5. Summary of Medicare Claims-Based Findings: Intermountain Cohort 3 (SSM only)

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$130.980	$117.480, $144.480	$67.818	$60.170, $75.467	$49.728	$41.953, $57.504	$13.432	$10.224, $16.641
Acute care inpatient stays	4,203	3,859, 4,548	2,301	2,059, 2,544	1,472	1,250, 1,693	430	327, 534
Hospital-wide all-cause unplanned readmissions	−92	−188, 3	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	6,022	5,501, 6543	3,352	2,989, 3715	2,131	1,792, 2471	539	383, 695
Average impact per quarter								
Spending per participant	$582	$522, $642	$613	$544, $682	$529	$447, $612	$657	$500, $814
Acute care inpatient stays (per 1,000 participants)	19	17, 20	21	19, 23	16	13, 18	21	16, 26
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−6	−13, 0	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	27	24, 29	30	27, 34	23	19, 26	26	19, 34

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

The Intermountain innovation was part of a broader organization-wide transformation of payment and delivery of care through a strategic initiative known as a shared accountability organization (SAO), now renamed population health. The HCIA innovation had three components:

1. The SSM is a physician compensation plan that replaces traditional fee for service (FFS) with a risk-adjusted global budget that compensates care through a combination of FFS and partially performance-based methods. The SSM component remained in pilot testing throughout 2015 and formal implementation began in 2016 after the HCIA ended. Throughout the pilot stage, Intermountain engaged providers to obtain their feedback on the measures included in the compensation plan. They also removed measures for which data were hard to obtain and those that were clinically insignificant. In the future, Intermountain plans to include other payers as part of SSM.

2. Population management (hot spotting) identifies high-cost/high-utilizing patients using advanced analytics and then uses this evidence to develop interventions that address the needs of these patients. Patients whose costs were in the top 10 percent highest-cost population in 2 of the last 3 years, lived within 30 miles of the clinic, and were older than 18 years were targeted for population management. Patients who met these criteria were referred to two targeted interventions--either a Comprehensive Care Clinic or to the Community Care Management program--for further intervention and support. Throughout the innovation, Intermountain continued to refine the algorithm used for hot spotting to help identify high-utilizing patients who would best benefit from the targeted interventions.

3. The IndiGO tool and efforts to track patient-centered measures of care facilitated patient engagement in the innovation. Unlike risk calculators that base algorithms on population risk, IndiGO uses the patient's own family and medical history, laboratory results, and behaviors to calculate individualized risk. IndiGO is a standalone tool providers used during patient visits with those who received an IndiGO benefit score of 8 or greater. IndiGO was incorporated into clinical practice workflow in one of two ways: (1) physicians routinely checked the IndiGO portion of the EHR to see if the patient was eligible, and then proceeded with the consultation; or (2) a designated practice staff person generated reports of scheduled patients who were IndiGO eligible, and informed the physician before patients' visits. IndiGO is beneficial for adult patients for whom a change in behavior will result in significant clinical improvement. During the visit, the physician showed patients the reduction in risk from certain adverse events (e.g., stroke, heart attack, death) over a specified time period if patients changed their behavior (e.g., lose weight, adhere to their medication plan).

The Patient Reported Outcomes Measurement Information System (PROMIS measure) was a component of this innovation, and aimed to harmonize disparate patient-centered measures used throughout Intermountain. However, due to competing priorities, the PROMIS measure implementation was only being piloted during the innovation timeframe.

Table 6 lists the single partner involved in the innovation as of Q12. Archimedes was contracted early in the project and remains the only partner.

Table 6. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Archimedes, Inc.	IndiGO implementation and refinement	San Francisco, CA

2.1.2 Program Participant Characteristics

Table 7 provides the demographic characteristics for Medicare and Medicaid participants ever enrolled in the innovation, which includes both IndiGO participants for whom there was a qualified IndiGO view in connection with an “eligible visit” and for patients affiliated with an SSM practice. The distribution of patient characteristics remained essentially stable during the innovation. Specifically, almost all participants (96.4% IndiGO/ 87.9% SSM) were aged 65 and older, and more than half (52.3% IndiGO / 56.4% SSM) were female. The age distribution is consistent with a population in which almost all (99.8% IndiGO / 99.4% SSM) participants for whom we received data were covered by Medicare. We did not receive sufficient data (n=109) to report participant characteristics for the population management component (i.e., hot spotting) of Intermountain’s innovation.

Table 7. Characteristics of Medicare and Medicaid Participants Ever Enrolled in the Intermountain Innovation through December 2015

Characteristic	Number of Participants (IndiGO patients with Qualified IndiGO view)	Percentage of Participants	SSM	Percentage of Participants
Total	449	100.0	41,569	100.0
Age				
< 18	0	0.0	4	0.0
18–24	0	0.0	37	0.1
25–44	1	0.2	1,248	3.0
45–64	15	3.4	3,683	8.9
65–74	161	35.9	15,663	37.7
75–84	244	54.3	13,357	32.1
85+	28	6.2	7,519	18.1
Missing	0	0.0	58	0.1
Sex				
Female	235	52.3	23,409	56.4
Male	214	47.7	18,100	43.5
Missing	0	0.0	60	0.1
Race/ethnicity				
White	—	—	—	—
Black	—	—	—	—
Hispanic	—	—	—	—
Asian	—	—	—	—
American Indian or Alaska Native	—	—	—	—
Native Hawaiian or other Pacific Islander	—	—	—	—
Other	—	—	—	—
Missing/refused	449	100.0	41,569	100.0

(continued)

Table 7. Characteristics of Medicare and Medicaid Participants Ever Enrolled in the Innovation through December 2015 (continued)

Characteristic	Number of Participants (IndiGO patients with Qualified IndiGO view)	Percentage of Participants	SSM	Percentage of Participants
Payer category				
Dual	—	—	—	—
Medicaid	1	0.2	243	0.6
Medicare	448	99.8	41,326	99.4
Medicare Advantage	—	—	—	—
Other	—	—	—	—
Uninsured	—	—	—	—
Missing	0	0.0	0	0.0

Source: Patient-level data provided to RTI.
SSM = shared savings model.
— Data not available.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 8 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 8. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	No
		Hospital unplanned readmissions rate	Yes	No
		ED visit rate	Yes	No
	Cost	Spending per patient	Yes	No
		Estimated cost savings	Yes	No

ED = emergency department.

2.3 Medicare Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focused on 29,454 Medicare beneficiaries enrolled in FFS Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with FFS Medicare living in the state of Utah during the innovation launch.

The claims analysis primarily focused on patients participating in the IndiGO, SSM, and population management (hot spotting) components of Intermountain's innovation. As previously stated, the SSM component remained in beta-test throughout the innovation period as providers' feedback helped Intermountain refine the measures included in their model. Because the IndiGO and SSM components were complementary, we divided the innovation beneficiaries into four groups for analysis: those who had an IndiGO view and enrolled in SSM practices (Cohort 1), those who had an IndiGO view only (Cohort 2), those enrolled in SSM practices only (Cohort 3), and those enrolled in hot spotting (Cohort 4). In this report, IndiGO enrollment includes those patients who ever had an IndiGO view.

We used propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries for Cohorts 1, 2, and 3. Because few patients were enrolled in hot spotting at the time of this report, we were not able to construct a comparison group for this cohort. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year before the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Tables 9–11 describe the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching across the three cohorts. ***Figures 1–3*** show the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. One innovation beneficiary in Cohort 1 and four innovation beneficiaries in Cohort 3 were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 9. Mean Values and Standardized Differences of Variables in Propensity Score Model: Intermountain Cohort 1 (IndiGO and SSM)

Variable	Full Treatment				Standardized Difference (Full Treatment vs. Comparison)	Matched Treatment				Standardized Difference (Matched Treatment vs. Comparison)
	Innovation Group		Comparison Group			Innovation Group		Comparison Group		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarter prior to enrollment	2,416.35	5,880.06	1,842.60	6,179.32	0.095	2,418.36	5,895.28	2,507.33	6,248.38	0.01
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	9,679.19	2,0743.65	6,404.14	1,6009.72	0.177	9,626.80	20,784.86	7,837.34	14,406.32	0.10
Age	72.10	7.24	71.04	12.22	0.106	72.06	7.24	71.07	12.16	0.10
Percentage male	43.01	49.51	46.32	49.86	0.067	42.71	49.47	45.49	49.80	0.06
Percentage white	94.30	23.18	91.69	27.61	0.103	94.27	23.24	93.40	24.82	0.04
Percentage disabled	12.95	33.58	19.98	39.99	0.190	13.02	33.65	14.24	34.94	0.04
Percentage ESRD	0.00	0.00	0.83	9.10	0.130	0.00	0.00	0.00	0.00	0.00
Number of dual-eligible months in the previous calendar year	0.89	3.10	1.11	3.35	0.067	0.90	3.11	1.17	3.44	0.08
Number of chronic conditions	6.77	3.19	5.26	3.76	0.433	6.73	3.17	6.65	3.68	0.03
Number of beneficiaries	193	—	1,363,329	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	207,507	—	—	192	—	576	—	—
Number of weighted beneficiaries	—	—	—	—	—	192	—	192	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ESRD = end-stage renal disease; SD = standard deviation; SSM = shared savings model.

— Data not yet available.

Table 10. Mean Values and Standardized Differences of Variables in Propensity Score Model: Intermountain Cohort 2 (IndiGO only)

Variable	Full Treatment: Innovation Group Mean	Full Treatment: Innovation Group SD	Full Treatment: Comparison Group Mean	Full Treatment: Comparison Group SD	Standardized Difference (Full Treatment vs. Comparison)	Matched Treatment: Innovation Group Mean	Matched Treatment: Innovation Group SD	Matched Treatment: Comparison Group Mean	Matched Treatment: Comparison Group SD	Standardized Difference (Matched Treatment vs. Comparison)
Payments in calendar quarter prior to enrollment	$1,814	$5,365	$1,853	$6,329	0.007	$1,814	$5,365	$1,814	$5,293	0.000
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$7,009	$15,564	$6,419	$16,050	0.037	$7,009	$15,564	$7,166	$14,127	0.011
Age	70.64	8.07	71.04	12.23	0.039	70.64	8.07	71.40	11.71	0.076
Percentage male	38.71	48.71	46.33	49.86	0.155	38.71	48.71	36.94	48.27	0.036
Percentage white	95.85	19.94	91.66	27.64	0.174	95.85	19.94	95.70	20.29	0.008
Percentage disabled	15.44	36.13	19.98	39.99	0.119	15.44	36.13	15.67	36.35	0.006
Percentage ESRD	0.46	6.77	0.83	9.07	0.046	0.46	6.77	0.54	7.31	0.011
Number of dual-eligible months in the previous calendar year	0.71	2.70	1.10	3.35	0.130	0.71	2.70	0.91	3.08	0.069
Number of chronic conditions	5.85	3.42	5.23	3.75	0.171	5.85	3.42	6.26	3.75	0.116
Number of outpatient ED visits in calendar quarter prior to enrollment	0.07	0.32	0.10	0.43	0.084	0.07	0.32	0.07	0.30	0.002
Number of inpatient stays in calendar quarter prior to enrollment	0.04	0.22	0.05	0.27	0.049	0.04	0.22	0.04	0.22	0.011
Number of beneficiaries	434	—	1,698,364	—	—	434	—	1,302	—	—
Number of unique beneficiaries[1]	—	—	207,409	—	—	434	—	1,297	—	—
Number of weighted beneficiaries	—	—	—	—	—	434	—	434	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ED = emergency department; ESRD = end-stage renal disease; SD = standard deviation.

— Data not yet available.

Table 11. Mean Values and Standardized Differences of Variables in Propensity Score Model: Intermountain Cohort 3 (SSM only)

Variable	Full Treatment: Innovation Group Mean	Full Treatment: Innovation Group SD	Full Treatment: Comparison Group Mean	Full Treatment: Comparison Group SD	Standardized Difference (Full Treatment vs. Comparison)	Matched Treatment: Innovation Group Mean	Matched Treatment: Innovation Group SD	Matched Treatment: Comparison Group Mean	Matched Treatment: Comparison Group SD	Standardized Difference (Matched Treatment vs. Comparison)
Payments in calendar quarter prior to enrollment	$2,906	$8,472	$1,681	$5,916	0.168	$2,902	$8,450	$2,480	$7,846	0.052
Total Payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$8,878	$18,726	$5,913	$15,334	0.173	$8,875	$18,723	$8,548	$24,101	0.015
Age	72.240	11.390	70.710	12.290	0.129	72.240	11.390	72.340	12.340	0.009
Percentage male	43.190	49.530	47.080	49.910	0.078	43.190	49.530	42.620	49.450	0.012
Percentage white	93.210	25.160	91.220	28.300	0.074	93.210	25.160	93.270	25.060	0.002
Percentage disabled	17.570	38.060	20.400	40.300	0.072	17.560	38.050	18.180	38.570	0.016
Percentage ESRD	1.520	12.230	0.710	8.410	0.077	1.510	12.210	1.320	11.420	0.016
Number of dual-eligible months in the previous calendar year	1.020	3.220	1.110	3.330	0.029	1.020	3.220	1.100	3.340	0.025
Number of chronic conditions	6.400	3.610	4.880	3.740	0.414	6.400	3.610	6.510	3.760	0.030
Number of outpatient ED Visits in calendar quarter prior to enrollment	0.160	0.570	0.090	0.410	0.136	0.160	0.540	0.140	0.540	0.039
Number of inpatient stays in calendar quarter prior to enrollment	0.090	0.370	0.040	0.240	0.152	0.090	0.370	0.070	0.330	0.052
Number of beneficiaries	28,786	—	1,323,226	—	—	28,783	—	86,288	—	—
Number of unique beneficiaries[1]	—	—	179,166	—	—	28,783	—	64,448	—	—
Number of weighted beneficiaries	—	—	—	—	—	28,783	—	28,783	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

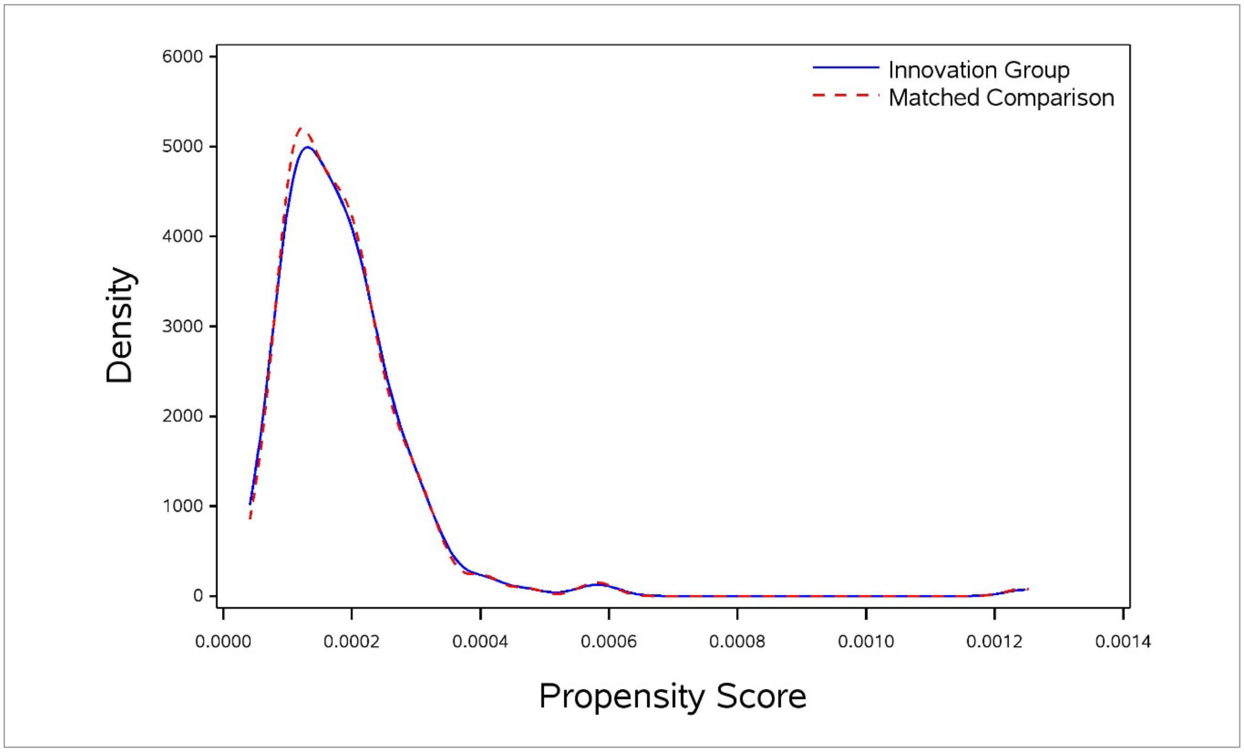
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ESRD = end-stage renal disease; SD = standard deviation; SSM = shared savings model.

— Data not yet available.

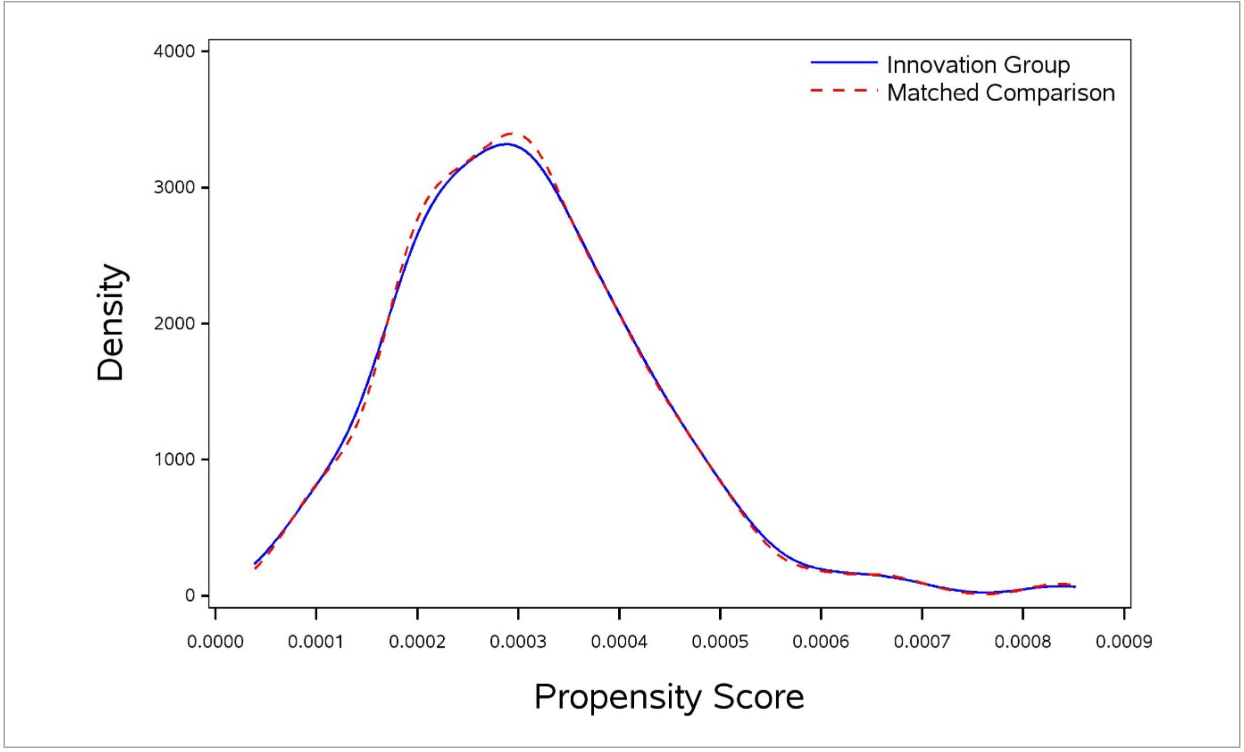
Figures 1–3 show the distribution of the propensity scores for both the innovation and comparison groups across the three cohorts.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Intermountain Cohort 1 (IndiGO and SSM)



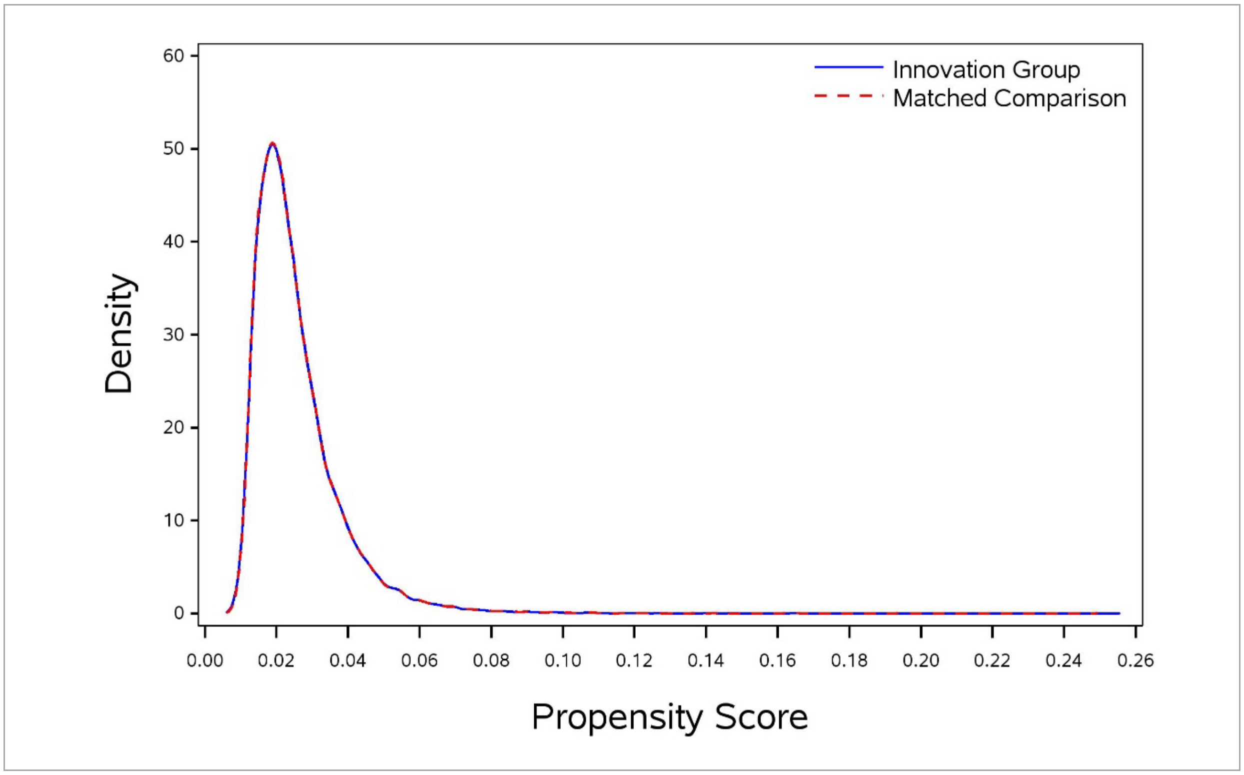
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 2. Distribution of Propensity Scores for Comparison and Innovation Groups: Intermountain Cohort 2 (IndiGO only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 3. Distribution of Propensity Scores for Comparison and Innovation Groups: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Tables 9–11). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Tables 9–11 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. Only one variable in Cohort 2 did not meet the 0.10 criteria. The variable is *Number of chronic conditions*, and the corresponding standardized difference after matching is marginally higher than 0.10 (0.116). All variables in Cohorts 2 and 3 met the criteria for acceptable balance.

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[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Tables 12–15 report Medicare spending per patient in the eight quarters before and the 11 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figures 4–7*** illustrate the Medicare spending per beneficiary in Tables 12–15 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending trends upward in Cohorts 1 and 3 in the baseline quarters for innovation beneficiaries and trends downwards in Cohorts 2 and 4 for innovation beneficiaries. Innovation period spending in Cohorts 2, 3, and 4 increases above the linear trend line after the innovation. Innovation period spending in Cohort 1 increases above the linear trend line beginning in quarter 5 after the innovation. In Cohort 1, innovation group spending is above the comparison group's spending starting in quarter 5 after the innovation. In Cohort 2, innovation and comparison group spending is similar throughout the baseline and innovation periods. In Cohort 3, innovation group spending is above comparison group spending after the start of the innovation. As shown in Tables 12–15, the standard deviation for spending is high, representing the skewed nature of expenditures.

Table 12. Medicare Spending per Participant: Intermountain Cohort 1 (IndiGO and SSM)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$2,350	$3,022	$2,182	$2,089	$2,813	$3,258	$2,800	$2,418	$2,182	$2,905	$3,339	$1,896	$3,285	$3,024	$4,424	$3,679	$3,756	$3,733	$3,816
Std dev	$5,314	$7,693	$4,887	$4,184	$5,732	$10,276	$8,540	$5,895	$5,323	$6,858	$9,316	$4,354	$6,757	$6,673	$11,982	$8,013	$10,014	$9,163	$7,887
Unique patients	144	148	149	160	167	171	174	192	192	192	192	191	191	188	185	179	176	164	158
Comparison Group																			
Spending rate	$1,636	$1,699	$2,068	$1,890	$2,194	$1,722	$2,651	$2,507	$2,850	$2,356	$2,771	$2,757	$2,315	$2,066	$2,742	$2,032	$3,114	$2,278	$2,570
Std dev	$4,240	$4,310	$5,333	$5,280	$7,110	$5,020	$7,230	$6,248	$7,244	$5,795	$8,927	$8,574	$6,384	$5,211	$8,608	$4,697	$17,527	$5,683	$7,366
Weighted patients	156	159	162	169	173	181	186	192	192	192	189	183	180	175	169	163	162	151	145
Savings per Patient																			
	−$714	−$1,323	−$115	−$199	−$619	−$1,536	−$149	$89	$668	−$549	−$568	$862	−$971	−$959	−$1,683	−$1,647	−$642	−$1,455	−$1,246

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model.

Table 13. Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	$2,281	$1,886	$1,630	$1,904	$1,945	$2,191	$1,626	$1,814	$2,617	$2,042	$2,201	$2,620	$2,330	$2,618	$2,493	$2,654	$2,442	$2,312	$3,279
Std dev	$6,237	$5,870	$4,882	$6,320	$5,330	$6,528	$5,269	$5,365	$8,092	$6,634	$5,575	$7,143	$6,222	$9,022	$6,362	$7,825	$7,274	$5,404	$8,781
Unique patients	344	357	368	383	390	403	413	434	434	434	432	427	417	410	406	387	369	357	333
Comparison Group																			
Admit rate	$1,679	$1,791	$1,665	$1,847	$1,921	$2,075	$1,971	$1,814	$2,216	$2,094	$2,244	$2,737	$2,511	$2,283	$2,131	$2,635	$2,673	$2,218	$2,221
Std dev	$5,199	$5,945	$5,795	$4,966	$5,403	$6,792	$5,827	$5,293	$8,060	$5,909	$7,454	$10,244	$6,859	$6,688	$6,025	$7,370	$7,568	$5,723	$5,589
Weighted patients	349	358	366	384	392	402	412	434	434	434	423	411	394	381	373	350	329	313	291
Innovation − Comparison Rate																			
	−$602	−$95	$35	−$57	−$24	−$115	$346	$1	−$401	$52	$43	$117	$181	−$335	−$362	−$19	$230	−$94	−$1,059

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1.

Table 14. Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	$2,165	$2,127	$2,282	$2,335	$2,378	$2,368	$2,627	$2,902	$3,798	$3,433	$3,335	$3,228	$3,376	$3,335	$3,445	$3,439	$3,553
Std dev	$6,737	$6,342	$8,626	$7,493	$7,127	$7,129	$7,783	$8,450	$10,172	$9,750	$9,085	$8,610	$10,363	$8,783	$8,767	$9,061	$12,816
Unique patients	22,377	23,319	23,838	24,466	24,955	27,492	28,114	28,783	28,783	28,235	27,345	26,335	25,370	24,054	22,828	21,665	20,452
Comparison Group																	
Admit rate	$2,069	$2,053	$2,159	$2,133	$2,274	$2,254	$2,394	$2,480	$2,650	$2,662	$2,627	$2,538	$2,627	$2,559	$2,545	$2,443	$2,567
Std dev	$8,661	$7,168	$6,554	$6,634	$10,035	$8,533	$7,665	$7,846	$12,085	$8,027	$7,493	$7,590	$7,795	$7,602	$7,362	$6,724	$7,704
Weighted patients	23,669	24,583	25,101	25,736	26,281	28,025	28,483	28,783	28,783	27,863	26,518	25,143	23,955	22,348	21,058	19,852	18,666
Innovation − Comparison Rate																	
	−$96	−$74	−$124	−$202	−$104	−$114	−$233	−$422	−$1,147	−$771	−$708	−$690	−$750	−$776	−$900	−$996	−$987

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model.

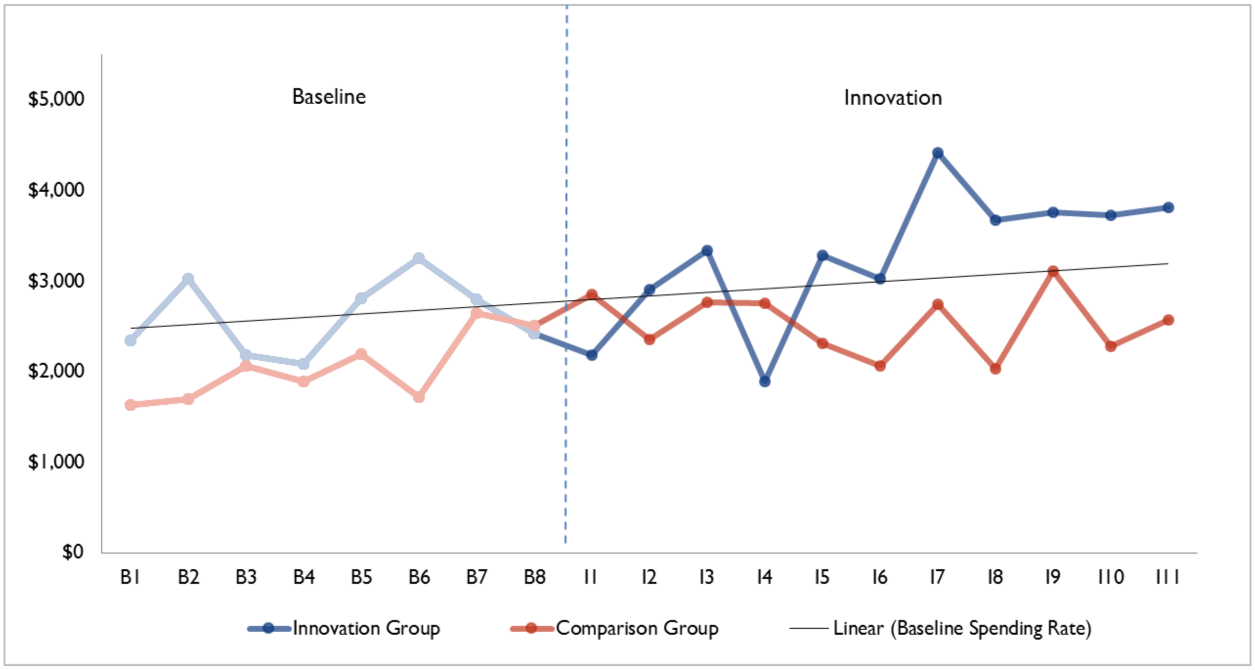
Table 15. Medicare Spending per Participant: Intermountain Cohort 4 (Hot spotting)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Spending rate	$5,843	$5,869	$5,892	$3,834	$4,794	$5,857	$5,868	$4,977	$7,996	$7,015	$5,034	$5,336	$6,882	$9,956	$8,472	$10,467	$7,699
Std dev	$9,902	$9,957	$12,328	$6,664	$7,729	$8,534	$10,222	$8,199	$15,804	$12,072	$7,263	$9,749	$18,394	$19,928	$13,240	$19,987	$15,984
Unique patients	52	55	57	57	59	59	60	63	65	67	69	75	76	78	74	68	66
Comparison Group																	
Spending rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Savings per Patient																	
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

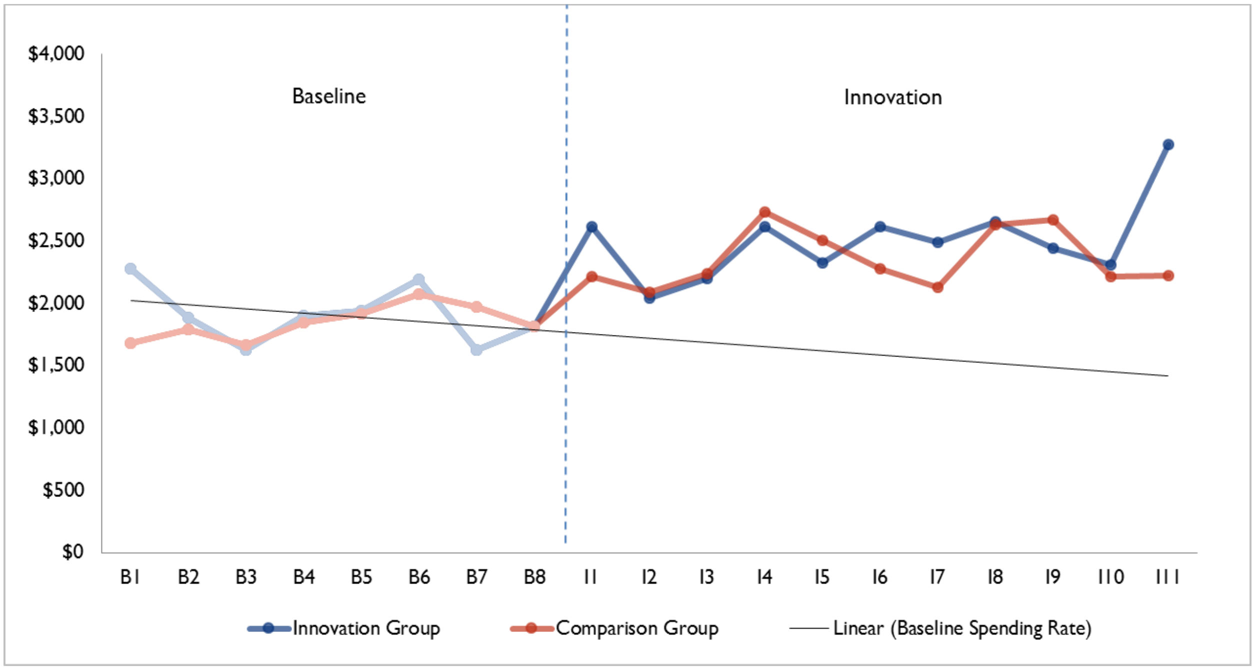
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1.
— Data not yet available.

Figure 4. Medicare Spending per Participant: Intermountain Cohort 1 (IndiGO and SSM)



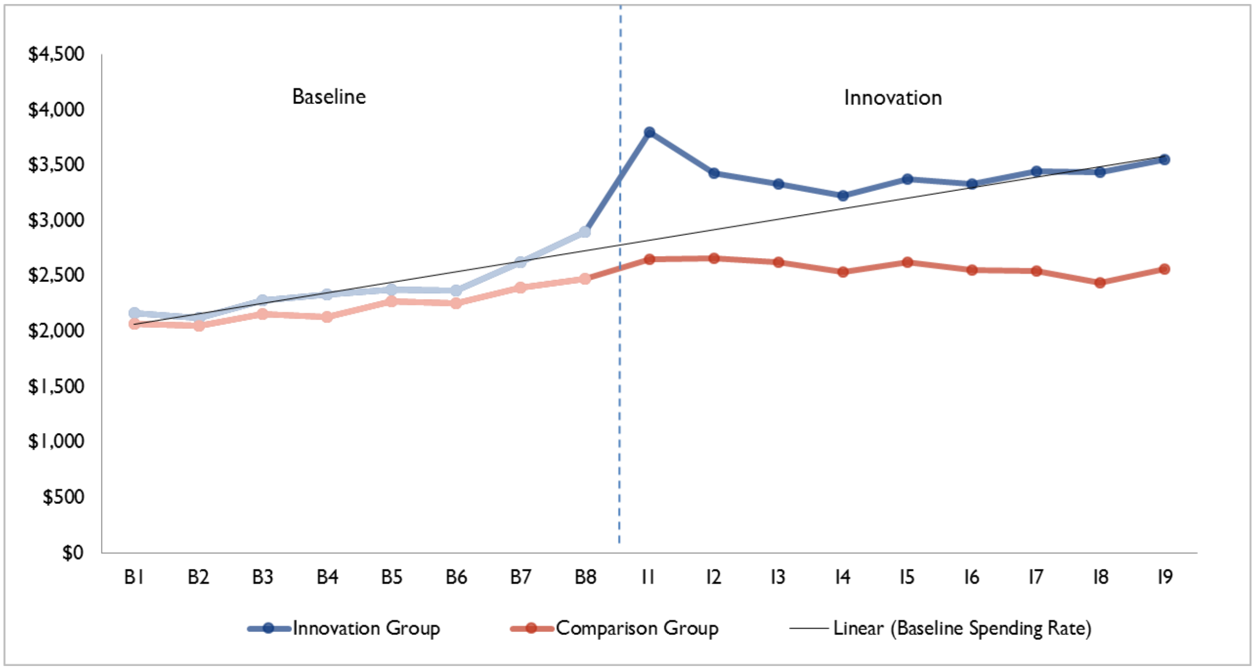
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 5. Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)



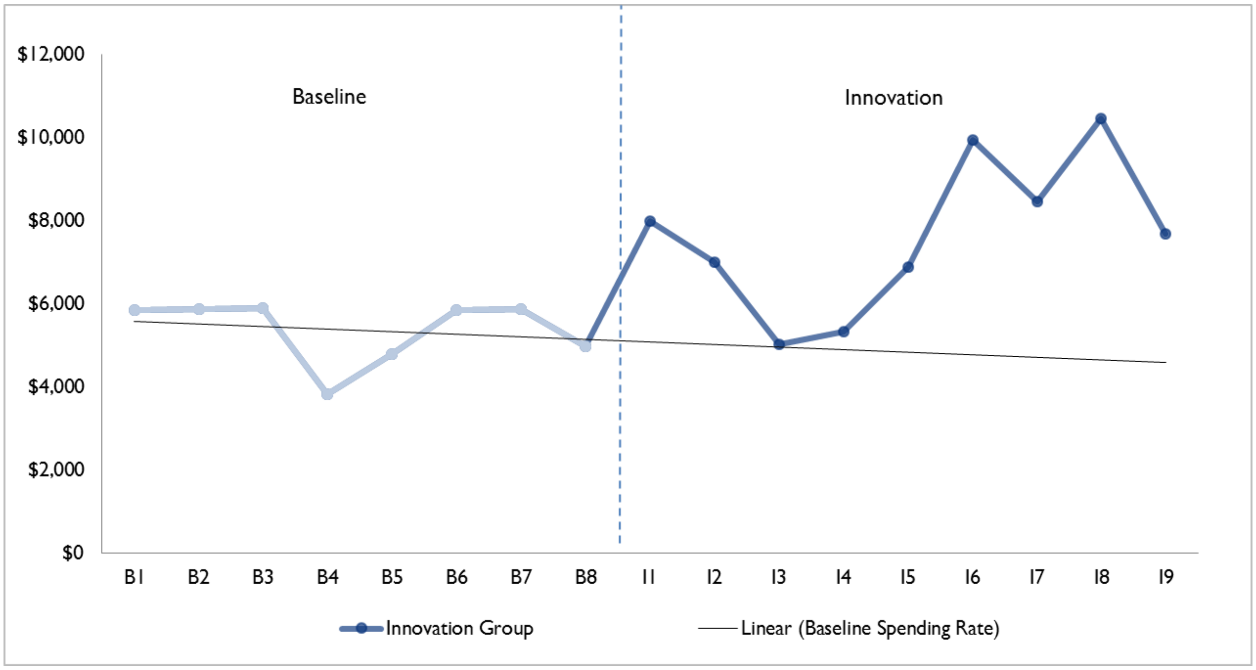
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 6. Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 7. Medicare Spending per Participant: Intermountain Cohort 4 (Hot spotting)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

2.4.2 Spending Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating losses, is $92 (90% CI: −$436, $619) for Cohort 1. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$156 (90% CI: −$503, $191) for Cohort 2. This effect is not statistically significant. The weighted average quarterly spending differential in the innovation period, indicating losses, is $582 (90% CI: $522, $642) for Cohort 3. This effect is statistically significant.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Tables 16–18*** present the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figures 8–10*** illustrate these quarterly difference-in-differences estimates.

Results for Cohort 1 show that in innovation Q1 (I1), spending among innovation group individuals is $1,143 lower than spending among comparison group individuals, and the spending estimate is statistically significant at conventional levels. In the remaining quarters, the point estimates for spending change from negative to positive. The point estimate is statistically different from zero in I4.

Table 16. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 1 (IndiGO and SSM)

Quarter	Coefficient	Standard Error	P-Values
I1	−$1,143	$455	0.012
I2	$69	$500	0.890
I3	$85	$756	0.911
I4	−$1,491	$511	0.004
I5	$306	$554	0.581
I6	$262	$565	0.643
I7	$1,009	$908	0.267
I8	$960	$594	0.106
I9	−$60	$1,085	0.956
I10	$750	$801	0.349
I11	$507	$761	0.506
Overall average	$92	$320	0.775
Overall aggregate	$184,089	$643,331	0.775
Overall aggregate (IY1)	−$474,513	$284,588	0.096
Overall aggregate (IY2)	$466,140	$313,130	0.137
Overall aggregate (IY3)	$192,462	$300,767	0.522

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; SSM = shared savings model.

Results for Cohort 2 show that in I1, spending among innovation group individuals is $274 lower than spending among comparison group individuals, and the spending estimate is not statistically significant at conventional levels. In the remaining quarters, the point estimates for spending are negative, except in quarters I6, I7, and I11. None of the point estimates are statistically different from zero.

Table 17. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)

Quarter	Coefficient	Standard Error	P-Values
I1	$274	$385	0.477
I2	−$215	$314	0.495
I3	−$247	$351	0.482
I4	−$421	$430	0.329
I5	−$503	$359	0.161
I6	$1	$463	0.999
I7	$32	$340	0.924
I8	−$327	$472	0.489
I9	−$584	$473	0.217
I10	−$288	$358	0.422
I11	$644	$529	0.223
Overall average	−$156	$211	0.460
Overall aggregate	−$686,840	$929,041	0.460
Overall aggregate (IY1)	−$260,456	$386,487	0.501
Overall aggregate (IY2)	−$322,889	$452,013	0.475
Overall aggregate (IY3)	−$103,495	$356,315	0.772

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

Results for Cohort 3 show that in I1, spending among innovation group individuals is $993 higher than spending among comparison group individuals, and the spending estimate is statistically significant at conventional levels. In the remaining quarters, the point estimates are positive and are statistically significant at conventional levels.

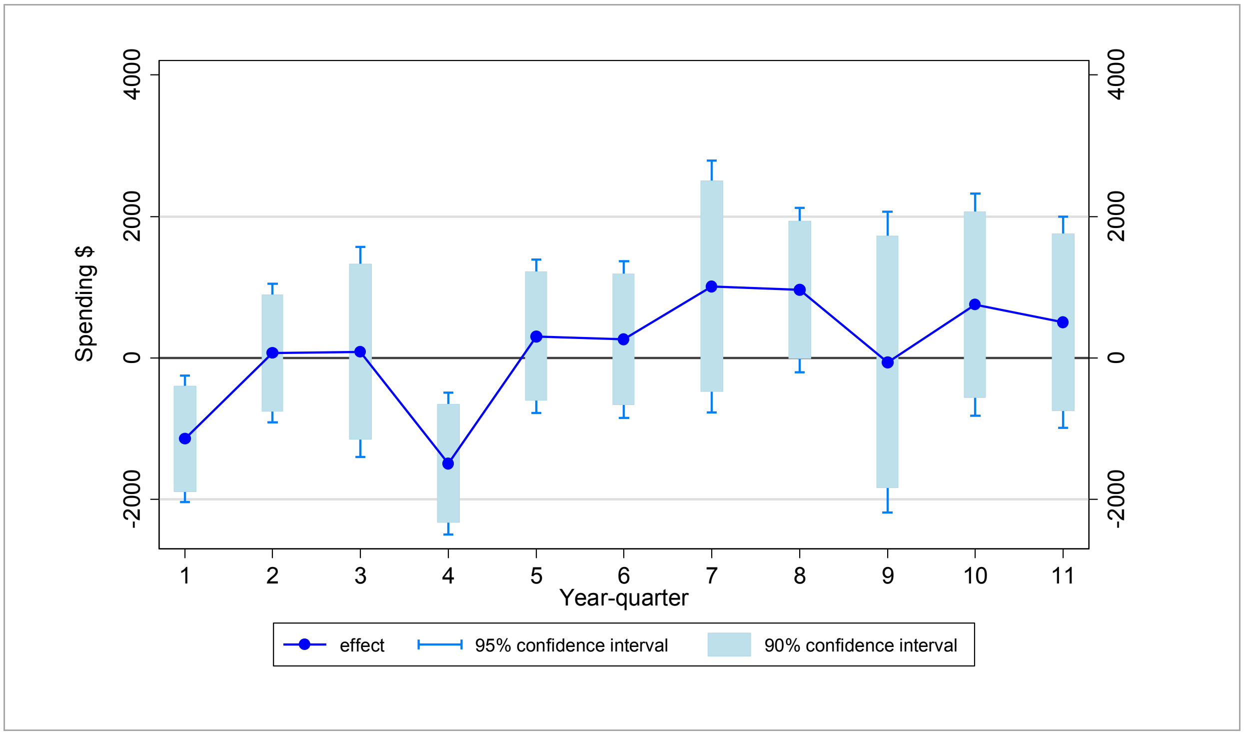
Table 18. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)

Quarter	Coefficient	Standard Error	P-Values
I1	$993	$73	<.0001
I2	$556	$68	<.0001
I3	$460	$69	<.0001
I4	$416	$65	<.0001
I5	$457	$74	<.0001
I6	$454	$71	<.0001
I7	$569	$75	<.0001
I8	$658	$77	<.0001
I9	$657	$95	<.0001
Overall average	$582	$36	<.0001
Overall aggregate	$130,980,000	$8,209,295	<.0001
Overall aggregate (IY1)	$67,818,142	$4,649,941	<.0001
Overall aggregate (IY2)	$49,728,474	$4,727,186	<.0001
Overall aggregate (IY3)	$13,432,047	$1,950,627	<.0001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; SSM = shared savings model.

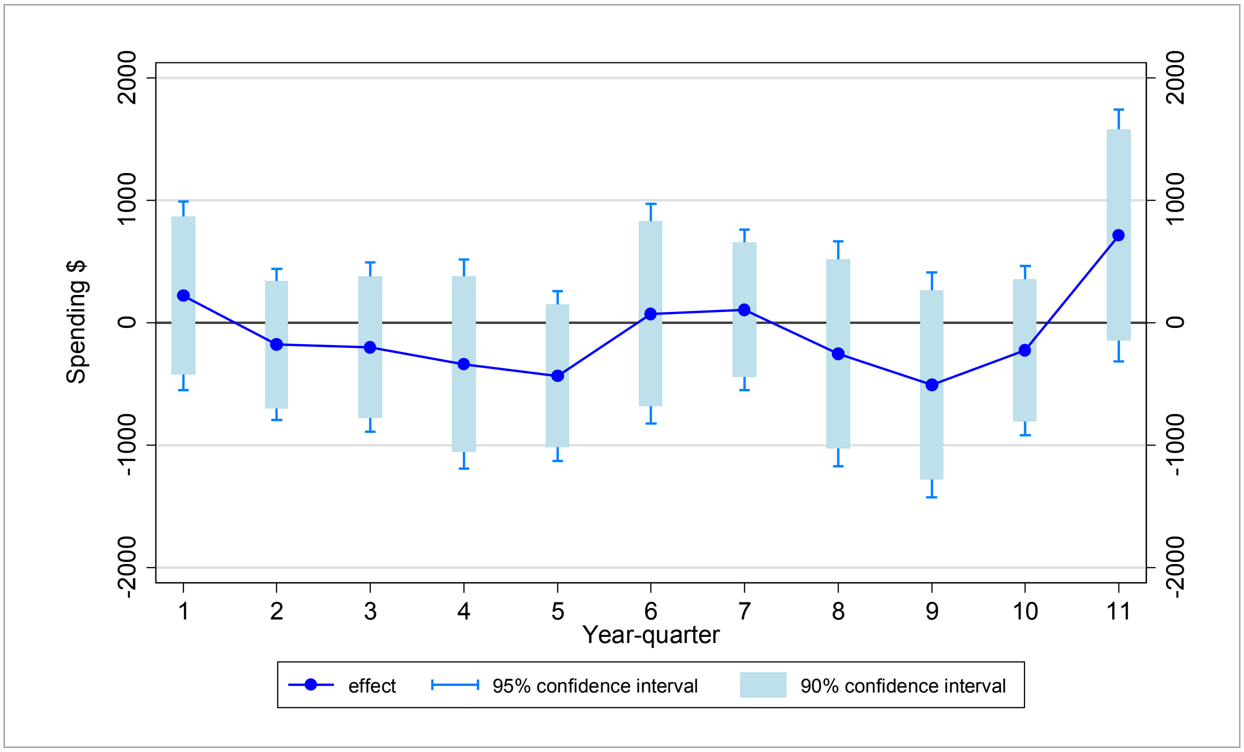
As more beneficiaries enroll in the program and more data become available, the sample size will increase and the precision of the estimated quarterly spending effects will improve. ***Figures 8–10*** illustrate the quarterly difference-in-differences estimates.

Figure 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 1 (IndiGO and SSM)



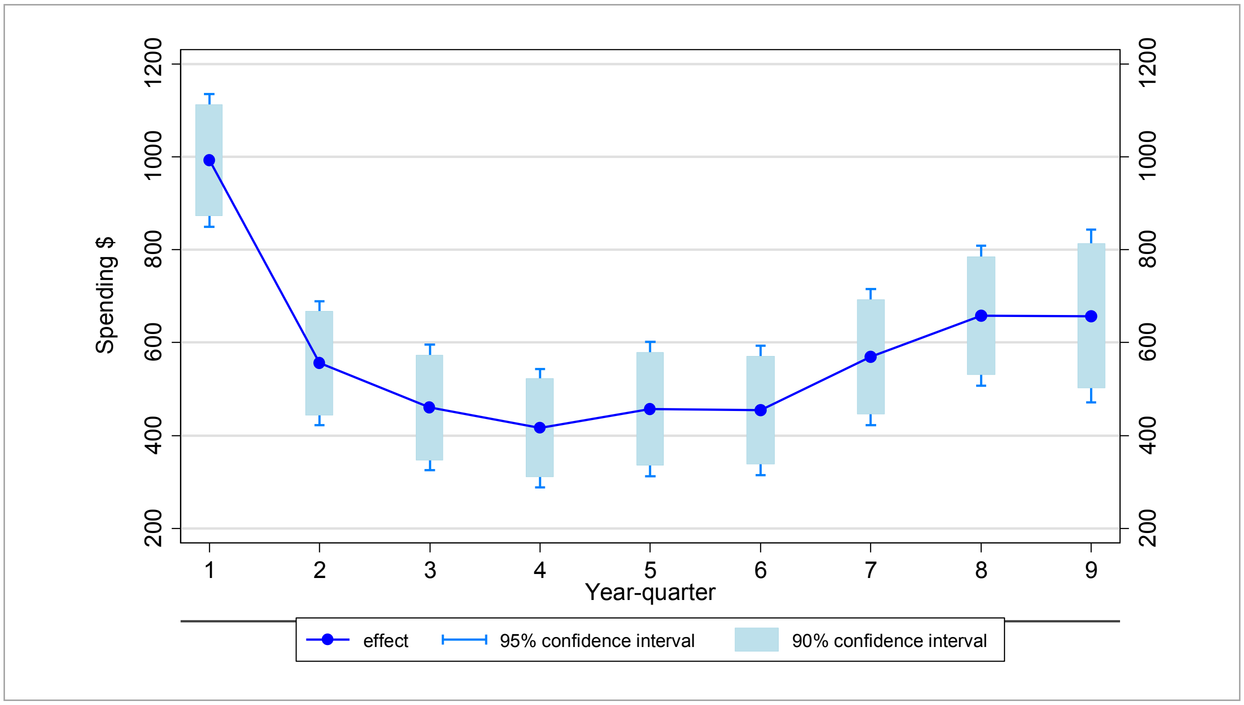
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; SSM = shared savings model.

Figure 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares.

Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; SSM = shared savings model.

Figures 11–13 present the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis.

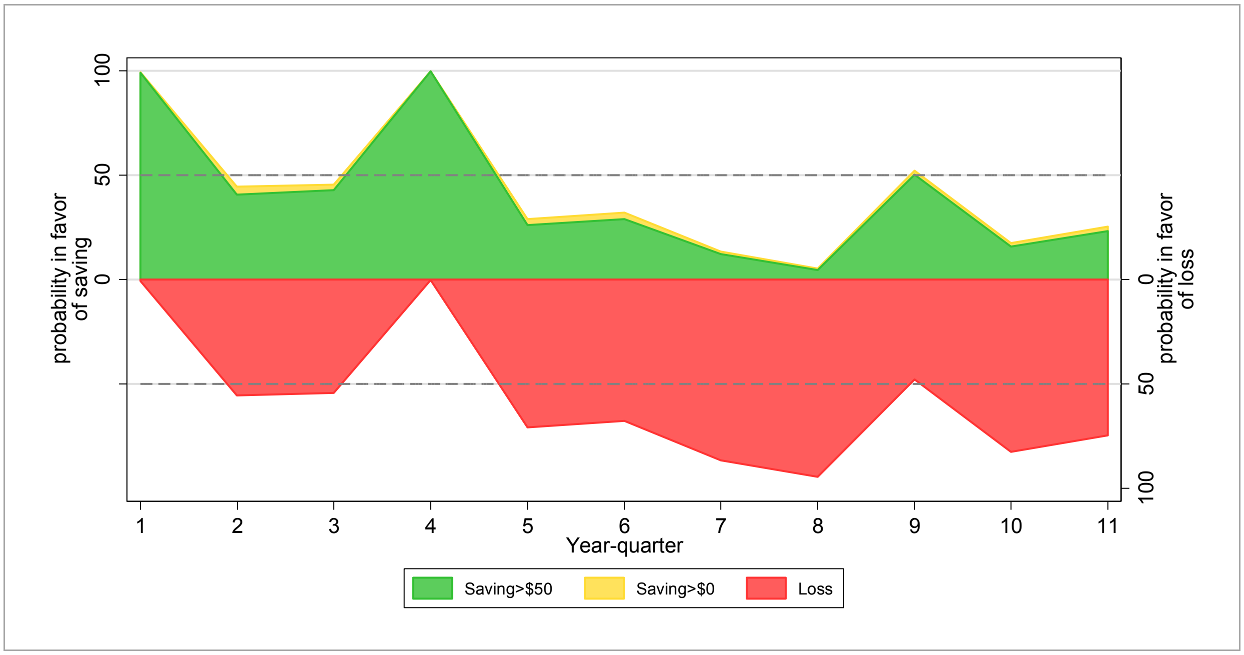
For Cohort 1, spending is higher in the innovation group than the comparison group during most innovation quarters and Figure 11 supports the conclusion that the innovation generated losses. During innovation quarters 5 through 11, the probability of a loss is very high.

For Cohort 2, Figure 12 shows the probability of a savings is mostly higher than the probability of losses; Figure 12 also supports the conclusion that the innovation generated savings.

For Cohort 3, spending is higher in the innovation group than the comparison group; Figure 13 supports the conclusion that the innovation generated losses. During all innovation quarters, the probability of a loss is 100 percent.

As more data become available for Cohorts 1 and 2, the standard errors will become smaller and we will be able to draw more firm conclusions about whether the Intermountain innovations generated savings or losses.

Figure 11. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Intermountain Cohort 1 (IndiGO and SSM)

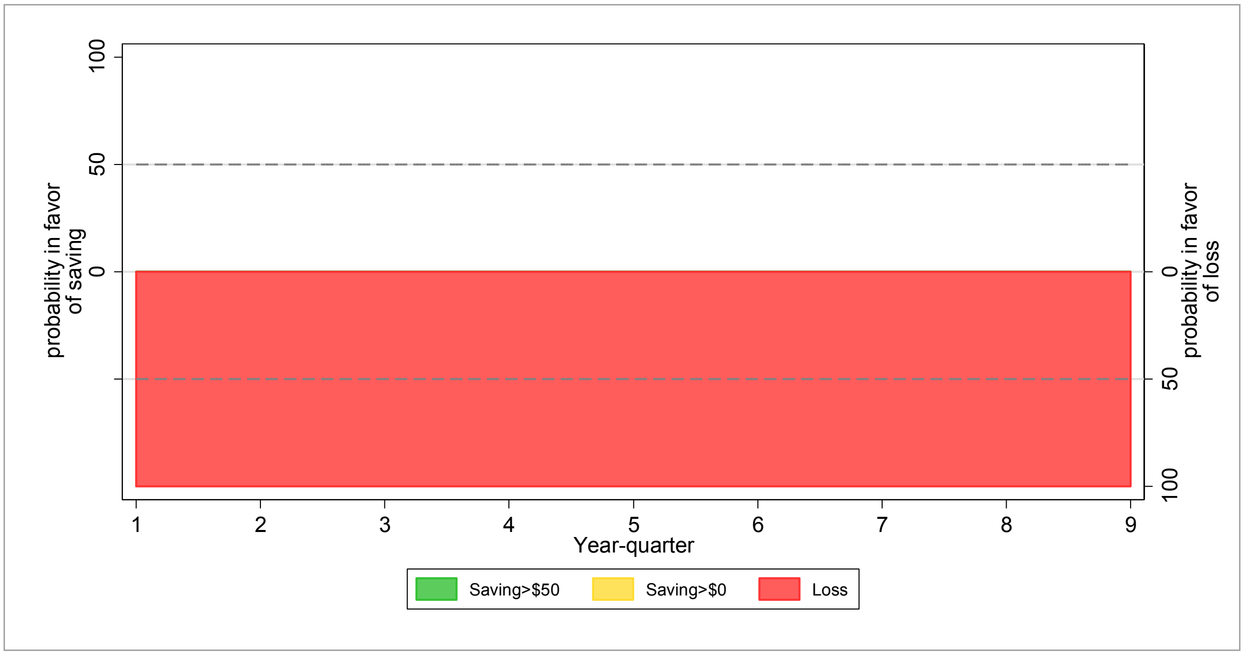


Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 12. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Intermountain Cohort 2 (IndiGO only)

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 13. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Tables 19–22*** and in ***Figures 14–17***. Inpatient admissions fluctuate slightly around the baseline trend line but rise in the baseline period for innovation beneficiaries in Cohorts 1 and 3. Inpatient admissions trend down during the baseline period for Cohorts 2 and 4. During the innovation period, the innovation group's inpatient admissions rate is higher than the comparison group's beginning in I5 for Cohort 1 and in all innovation quarters for Cohort 3. The innovation group's inpatient admissions rate is similar to the comparison group's rate for Cohort 2 during the innovation period. Cohort 4's inpatient admissions rate is above the baseline trend during the innovation period.

Table 19. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	56	115	81	81	102	117	92	89	57	94	73	52	94	80	141	89	102	116	139
Std dev	283	377	338	273	340	517	471	487	292	370	279	245	292	341	443	339	400	356	509
Unique patients	144	148	149	160	167	171	174	192	192	192	192	191	191	188	185	179	176	164	158
Comparison Group																			
Admit rate	58	52	80	75	60	42	93	83	85	59	92	80	57	38	81	59	58	51	62
Std dev	267	288	320	291	288	219	362	339	330	283	388	363	255	228	371	261	266	248	308
Weighted patients	156	159	162	169	173	181	186	192	192	192	189	183	180	175	169	163	162	151	145
Innovation − Comparison Rate																			
	−2	63	0	6	42	75	−1	5	−28	35	−19	−28	37	42	60	30	45	65	77

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model.

Table 20. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	61	56	57	68	64	42	29	39	78	48	51	80	70	56	67	49	41	36	81
Std dev	263	264	275	290	275	213	168	216	433	353	240	279	321	311	294	228	223	202	332
Unique patients	344	357	368	383	390	403	413	434	434	434	432	427	417	410	406	387	369	357	333
Comparison Group																			
Admit rate	40	45	43	70	61	55	59	41	64	50	55	70	60	52	51	73	68	51	59
Std dev	240	246	236	286	291	261	284	213	303	260	259	332	299	274	250	313	289	241	258
Weighted patients	349	358	366	384	392	402	412	434	434	434	423	411	394	381	373	350	329	313	291
Innovation − Comparison Rate																			
	21	11	14	−2	3	−13	−30	−2	14	−2	−4	10	9	4	15	−24	−27	−15	23

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1.

Table 21. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	61	66	66	63	64	73	76	83	105	97	90	85	86	93	89	86	90
Std dev	284	296	301	288	288	308	325	338	382	364	357	340	337	358	352	340	355
Unique patients	22,377	23,319	23,838	24,466	24,955	27,492	28,114	28,783	28,783	28,235	27,345	26,335	25,370	24,054	22,828	21,665	20,452
Comparison Group																	
Admit rate	53	55	56	54	55	57	58	58	60	68	62	58	61	63	57	53	55
Std dev	275	282	283	289	284	292	295	307	298	314	301	288	294	294	284	274	279
Weighted patients	23,669	24,583	25,101	25,736	26,281	28,025	28,483	28,783	28,783	27,863	26,518	25,143	23,955	22,348	21,058	19,852	18,666
Innovation − Comparison Rate																	
	7	11	10	9	9	15	18	25	45	29	28	28	26	31	33	33	35

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model.

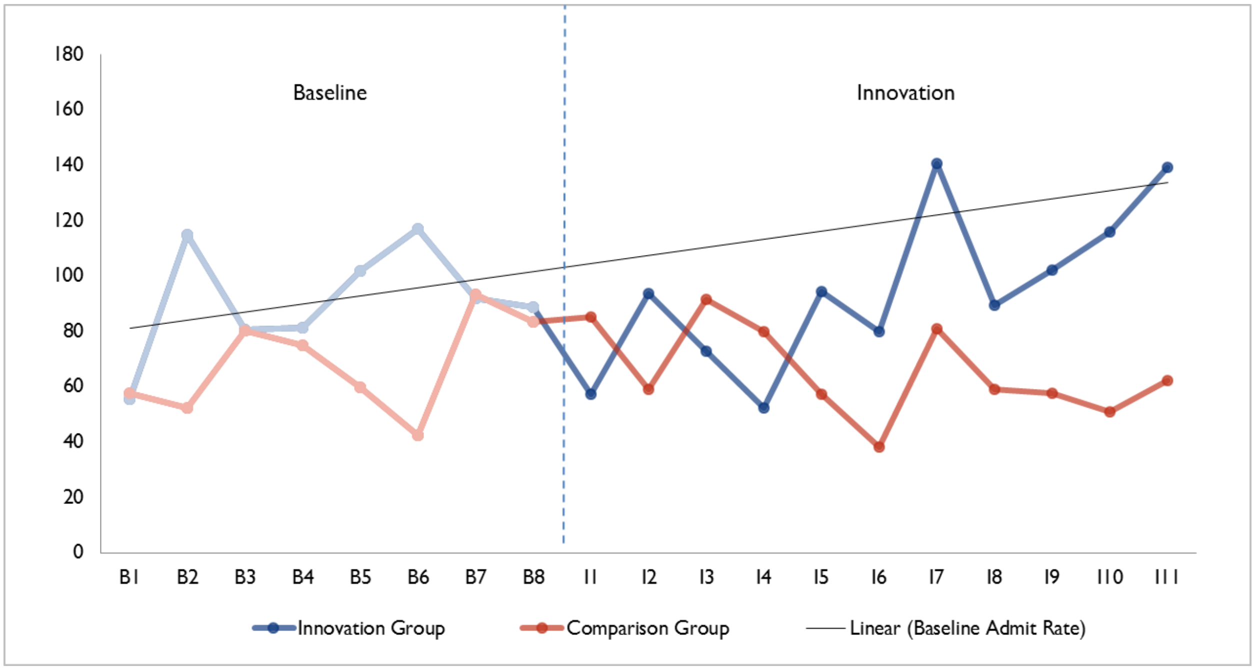
Table 22. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 4 (Hot spotting)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Spending rate	327	255	211	123	136	203	150	206	308	284	130	187	184	321	324	382	288
Std dev	849	667	449	328	342	479	477	477	722	541	377	534	601	630	660	823	1084
Unique patients	52	55	57	57	59	59	60	63	65	67	69	75	76	78	74	68	66
Comparison Group																	
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																	
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

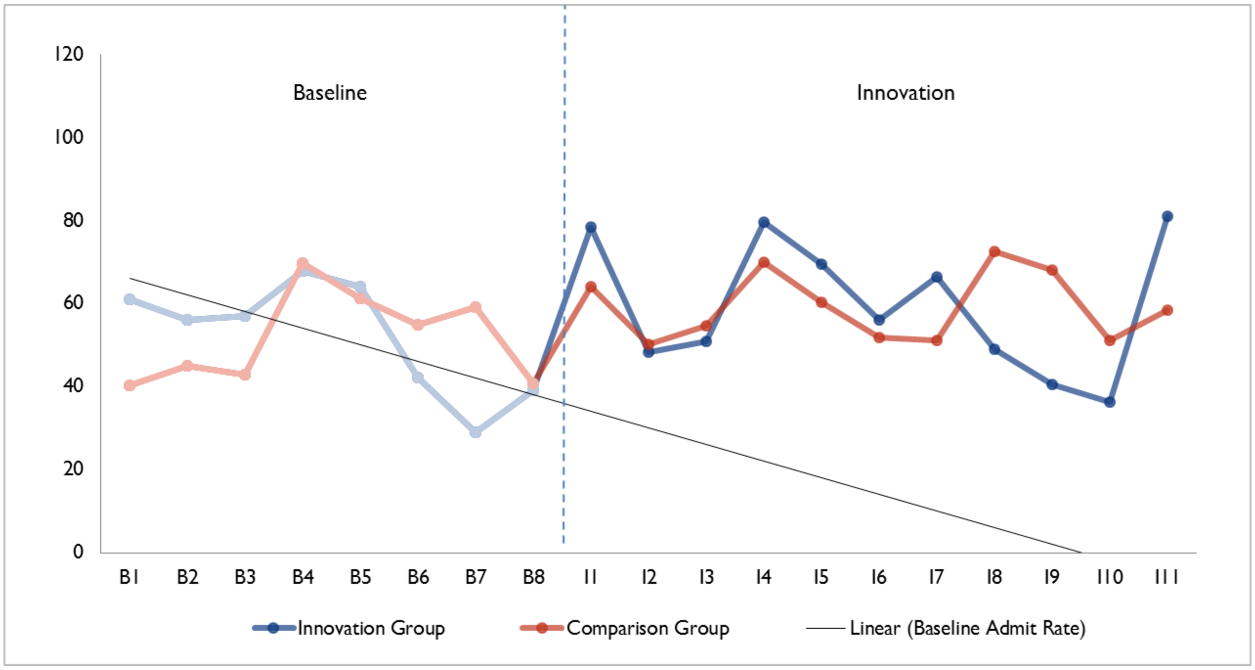
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1.
— Data not yet available.

Figure 14. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)



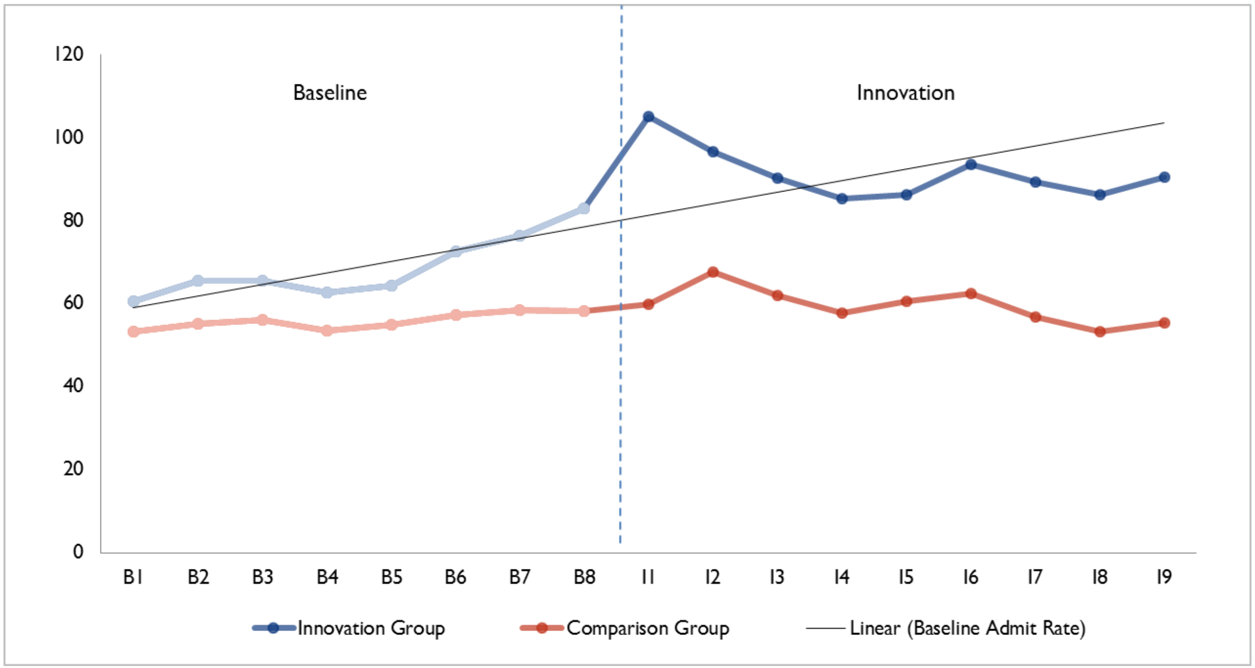
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 15. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)



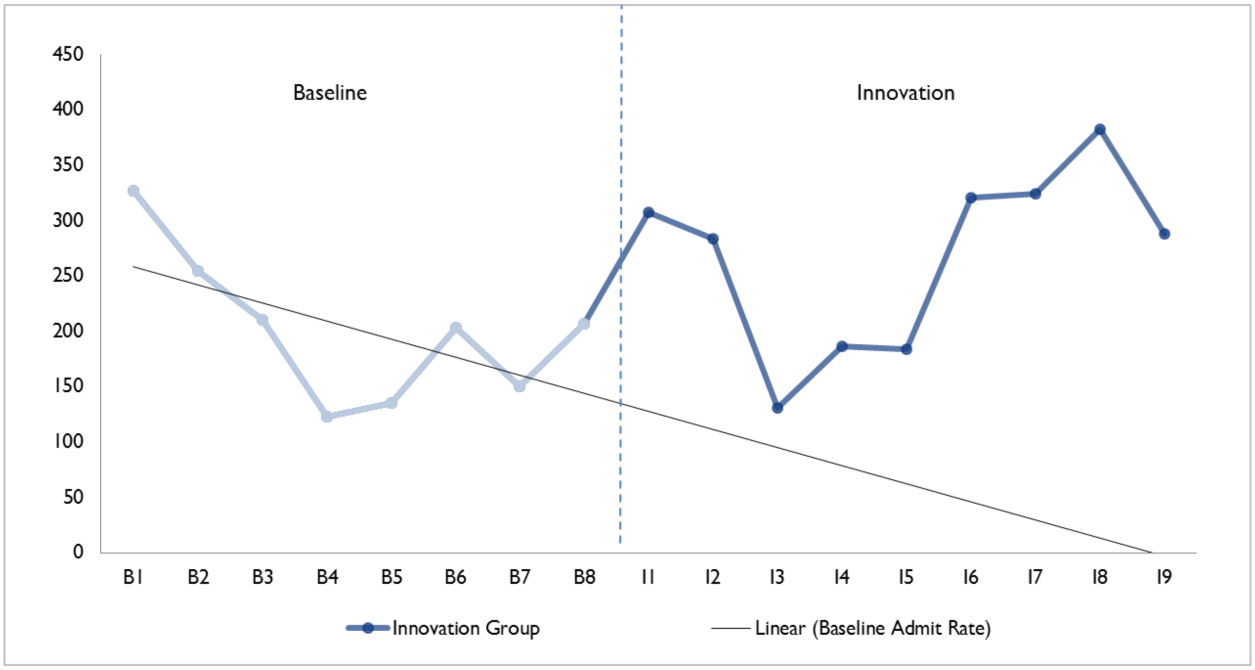
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 16. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 17. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 4 (Hot spotting)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

2.5.2 Inpatient Regression Results

Tables 23, 24, and ***25*** presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants.

For Cohort 1, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 2 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −14, 19). In addition to the average effect over the innovation period, we also present quarterly effects. Quarterly effects are not statistically significant in 9 of the 11 quarters.

Table 23. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)

Quarter	Coefficient	Standard Error	P-Values
I1	−62	31	0.043
I2	16	28	0.574
I3	−43	32	0.187
I4	−49	30	0.098
I5	12	32	0.715
I6	29	27	0.289
I7	34	39	0.389
I8	−6	33	0.865
I9	16	35	0.638
I10	46	37	0.217
I11	48	43	0.270
Overall average	2	10	0.838
Overall aggregate	4	20	0.838
Overall aggregate (IY1)	−27	12	0.022
Overall aggregate (IY2)	13	12	0.295
Overall aggregate (IY3)	18	11	0.103

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model.

For Cohort 2, the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 6 inpatient admissions per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: -15, 2). In addition to the average effect over the innovation period, we also present quarterly effects. Quarterly effects are not statistically significant in 9 of the 11 quarters.

Table 24. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)

Quarter	Coefficient	Standard Error	P-Values
I1	10	17	0.583
I2	−4	13	0.792
I3	−3	15	0.826
I4	8	19	0.688
I5	−4	18	0.833
I6	−4	15	0.798
I7	10	17	0.550
I8	−36	19	0.057
I9	−41	18	0.024
I10	−26	16	0.111
I11	15	22	0.489
Overall average	−6	5	0.220
Overall aggregate	−28	23	0.220
Overall aggregate (IY1)	4	14	0.752
Overall aggregate (IY2)	−13	14	0.352
Overall aggregate (IY3)	−20	12	0.089

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year.

For Cohort 3, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 19 inpatient admissions per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 17, 20). In addition to the average effect over the innovation period, we also present quarterly effects. All quarterly effects are positive and highly significant.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)

Quarter	Coefficient	Standard Error	P-Values
I1	35	3	0.000
I2	17	3	0.000
I3	14	3	0.000
I4	16	3	0.000
I5	11	3	0.000
I6	15	3	0.000
I7	17	3	0.000
I8	19	3	0.000
I9	21	3	0.000
Overall average	19	1	0.000
Overall aggregate	4,203	209	0.000
Overall aggregate (IY1)	2,301	147	0.000
Overall aggregate (IY2)	1,472	135	0.000
Overall aggregate (IY3)	430	63	0.000

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Tables 26–29***, and ***Figures 18–21***.

Unplanned readmissions rates fluctuate around the trend lines before the innovation's launch, as shown by the large standard deviation of the measure. Because of the low number of index admissions (the denominator in the readmissions measure) in Cohort 4 (not shown), the unplanned readmissions rate is highly variable. As more beneficiaries enroll in the innovation and more claims data become available, the sample size will increase and the readmissions measure may be reported with more precision.

Table 26. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 1 (IndiGO and SSM)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	0	77	0	0	0	231	125	125	0	0	0	0	0	77	95	77	71	59	143
Std dev	0	267	0	0	0	421	331	331	0	0	0	0	0	267	294	267	258	235	350
Unique patients	5	13	8	11	13	13	8	8	6	13	12	8	15	13	21	13	14	17	7
Comparison Group																			
Admit rate	43	105	97	0	80	150	64	56	24	67	105	88	40	0	33	0	59	0	0
Std dev	204	307	296	0	271	357	244	229	153	249	307	284	196	0	180	0	235	0	0
Weighted patients	8	6	10	10	8	7	16	12	14	10	13	11	8	5	10	7	6	6	4
Innovation − Comparison Rate																			
	−43	−28	−97	0	−80	81	61	69	−24	−67	−105	−88	−40	77	62	77	13	59	143

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model.

Table 27. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 2 (IndiGO only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	0	59	111	0	0	0	0	63	103	167	67	0	192	0	130	0	0	0	0
Std dev	0	235	314	0	0	0	0	242	305	373	249	0	394	0	337	0	0	0	0
Unique patients	17	17	18	22	19	12	11	16	29	18	15	26	26	17	23	16	12	12	18
Comparison Group																			
Admit rate	50	93	24	45	17	33	91	20	127	19	85	48	83	125	106	78	19	24	34
Std dev	218	291	153	208	130	178	288	141	333	137	279	213	276	331	308	268	136	154	183
Weighted patients	13	14	14	22	19	20	22	16	24	17	20	21	20	16	16	21	18	14	10
Innovation − Comparison Rate																			
	−50	−34	87	−45	−17	−33	−91	42	−23	147	−18	−48	109	−125	24	−78	−19	−24	−34

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1.

Table 28. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 3 (SSM only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	47	58	61	46	59	48	75	48	55	54	59	62	52	62	59	36	54
Std dev	212	234	240	209	236	214	263	214	227	226	235	242	222	241	235	186	226
Unique patients	1,043	1,157	1,179	1,157	1,249	1,585	1,666	1,865	2,347	1,988	1,825	1,576	1,672	1,711	1,517	1,365	926
Comparison Group																	
Admit rate	51	55	50	55	57	58	54	71	71	62	66	68	65	52	68	58	40
Std dev	221	229	218	227	231	234	226	256	257	241	248	251	246	222	252	233	196
Weighted patients	1,048	1,149	1,226	1,168	1,260	1,407	1,451	1,526	1,469	1,420	1,309	1,146	1,163	1,124	984	857	541
Innovation − Comparison Rate																	
	−4	3	11	−9	3	−10	21	−22	−17	−8	−7	−5	−13	10	−9	−22	14

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model.

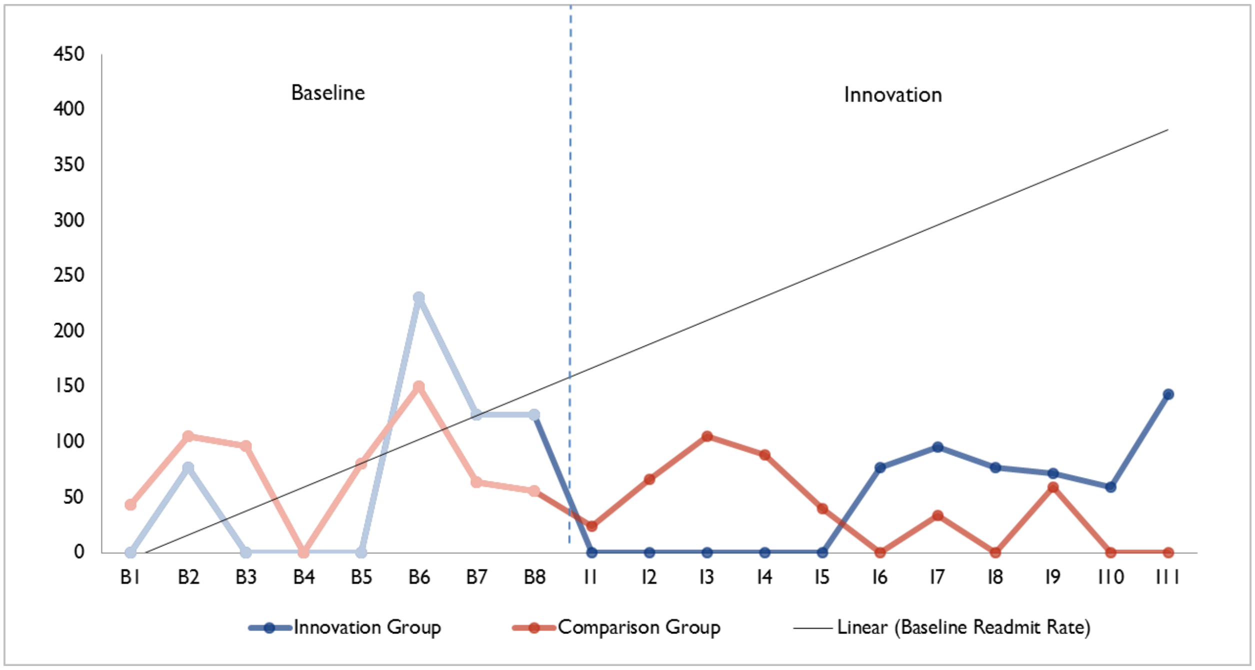
Table 29. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 4 (Hot spotting)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	0	0	250	0	0	500	0	0	0	0	0	0	0	0	167	111	333
Std dev	0	0	433	0	0	500	0	0	0	0	0	0	0	0	373	314	471
Unique patients	3	4	4	4	5	6	1	3	8	3	2	2	2	7	6	9	3
Comparison Group																	
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																	
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

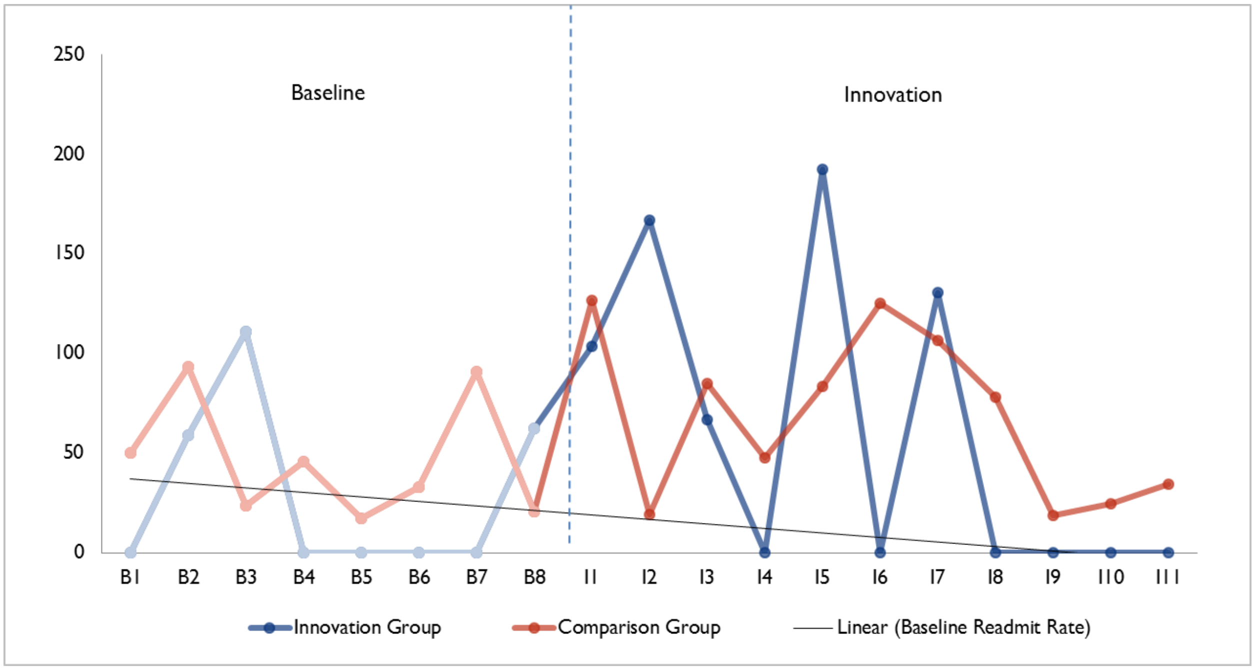
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1.
— Data not yet available.

Figure 18. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 1 (IndiGO and SSM)



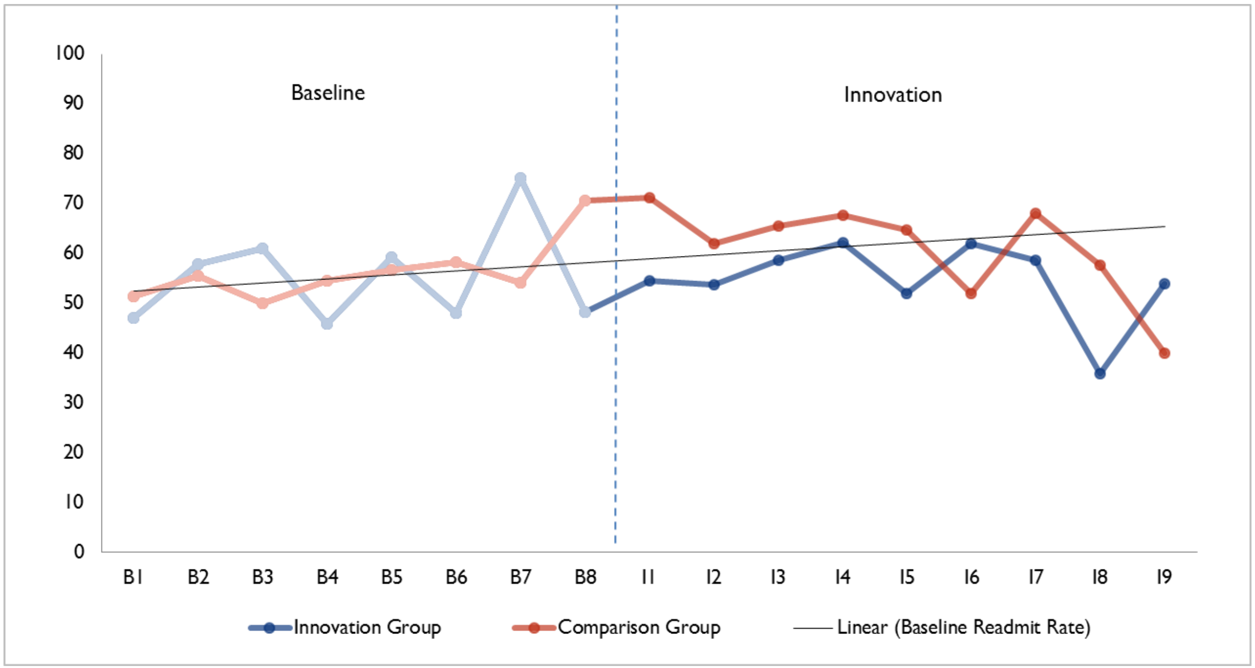
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 19. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 2 (IndiGO only)



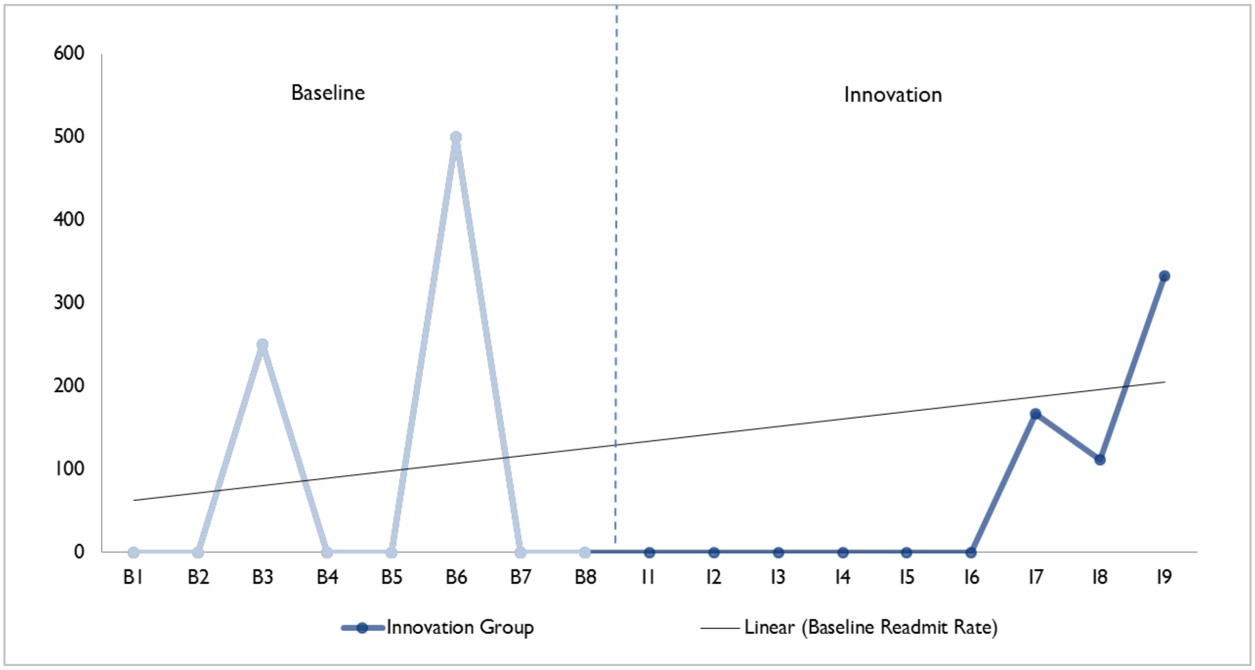
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 20. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SSM = shared savings model.

Figure 21. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 4 (Hot spotting)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

2.6.2 Readmission Regression Results

Tables 30–32 present the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days.

For Cohort 1, the average quarterly difference-in-differences estimate for unplanned readmissions is 4 per 1,000 inpatient admissions (0.04 percentage points), indicating that the innovation-comparison difference is 0.4 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −48, 56).

Table 30. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Intermountain Cohort 1 (IndiGO and SSM)

Quarter	Coefficient	Standard Error	P-Values
Overall average	4	31	0.892
Overall aggregate	1	4	0.892

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
SSM = shared savings model.

For Cohort 2, the average quarterly difference-in-differences estimate for unplanned readmissions is 17 per 1,000 inpatient admissions (1.7 percentage points), indicating that the innovation-comparison difference is 1.7 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −39, 73).

Table 31. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Intermountain Cohort 2 (IndiGO only)

Quarter	Coefficient	Standard Error	P-Values
Overall average	17	34	0.617
Overall aggregate	4	7	0.617

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

For Cohort 3, the average quarterly difference-in-differences estimate for unplanned readmissions is -6 per 1,000 inpatient admissions (0.6 percentage points), indicating that the innovation-comparison difference is 0.6 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −13, 0).

Table 32. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Intermountain Cohort 3 (SSM only)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−6	4	0.113
Overall aggregate	−92	58	0.113

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
SSM = shared savings model.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Tables 33–36*** and ***Figures 22–25.*** During both the baseline and innovation periods, the ED visit rate is similar in the innovation and comparison groups for Cohort 1 and Cohort 2. For Cohort 3, the ED visit rate is higher for the innovation group than the comparison group in both the baseline and innovation periods. Cohort 4’s ED visit rate falls below its baseline trend during the innovation period. Regression results in the next section demonstrate that quarterly differences in ED visit rates between the innovation and comparison groups are not impacted by the innovation for Cohorts 1 and 2, but are impacted by the innovation for Cohort 3.

Table 33. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	118	128	121	88	234	199	178	172	135	203	151	162	162	154	216	235	210	268	203
Std dev	535	409	434	325	1312	892	751	653	725	1209	617	808	523	530	954	1000	995	1141	646
Unique patients	144	148	149	160	167	171	174	192	192	192	192	191	191	188	185	179	176	164	158
Comparison Group																			
Admit rate	132	155	129	130	127	134	111	160	137	141	150	185	169	236	136	171	140	141	156
Std dev	620	619	451	301	463	523	344	451	453	531	499	868	784	1089	479	414	414	375	533
Weighted patients	156	159	162	169	173	181	186	192	192	192	189	183	180	175	169	163	162	151	145
Innovation − Comparison Rate																			
	−14	−26	−9	−42	107	65	67	12	−2	63	1	−23	−6	−81	80	63	70	127	46

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SSM = shared savings model.

Table 34. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	70	81	52	70	90	60	61	69	92	97	79	75	98	93	99	103	98	143	114
Std dev	287	370	266	312	328	310	258	353	341	359	294	320	350	337	379	359	332	430	417
Unique patients	344	357	368	383	390	403	413	434	434	434	432	427	417	410	406	387	369	357	333
Comparison Group																			
Admit rate	90	71	101	108	98	67	85	65	79	113	100	114	115	113	101	129	135	136	112
Std dev	208	172	222	258	189	159	199	168	206	253	236	254	263	283	255	298	319	276	266
Weighted patients	349	358	366	384	392	402	412	434	434	434	423	411	394	381	373	350	329	313	291
Innovation − Comparison Rate																			
	−20	10	−49	−37	−8	−8	−24	4	13	−16	−21	−39	−17	−20	−2	−25	−37	7	2

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1.

Table 35. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	116	121	125	131	130	134	140	153	184	162	165	171	170	164	173	172	166
Std dev	445	468	521	514	507	533	511	532	597	590	602	600	600	555	597	590	574
Unique patients	22,377	23,319	23,838	24,466	24,955	27,492	28,114	28,783	28,783	28,235	27,345	26,335	25,370	24,054	22,828	21,665	20,452
Comparison Group																	
Admit rate	103	104	110	116	112	115	118	133	121	122	122	124	122	123	123	126	117
Std dev	307	288	307	332	304	315	319	360	344	317	321	336	326	327	329	337	314
Weighted patients	23,669	24,583	25,101	25,736	26,281	28,025	28,483	28,783	28,783	27,863	26,518	25,143	23,955	22,348	21,058	19,852	18,666
Innovation − Comparison Rate																	
	14	17	15	15	18	19	22	20	63	40	43	47	48	41	50	45	49

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SSM = shared savings model.

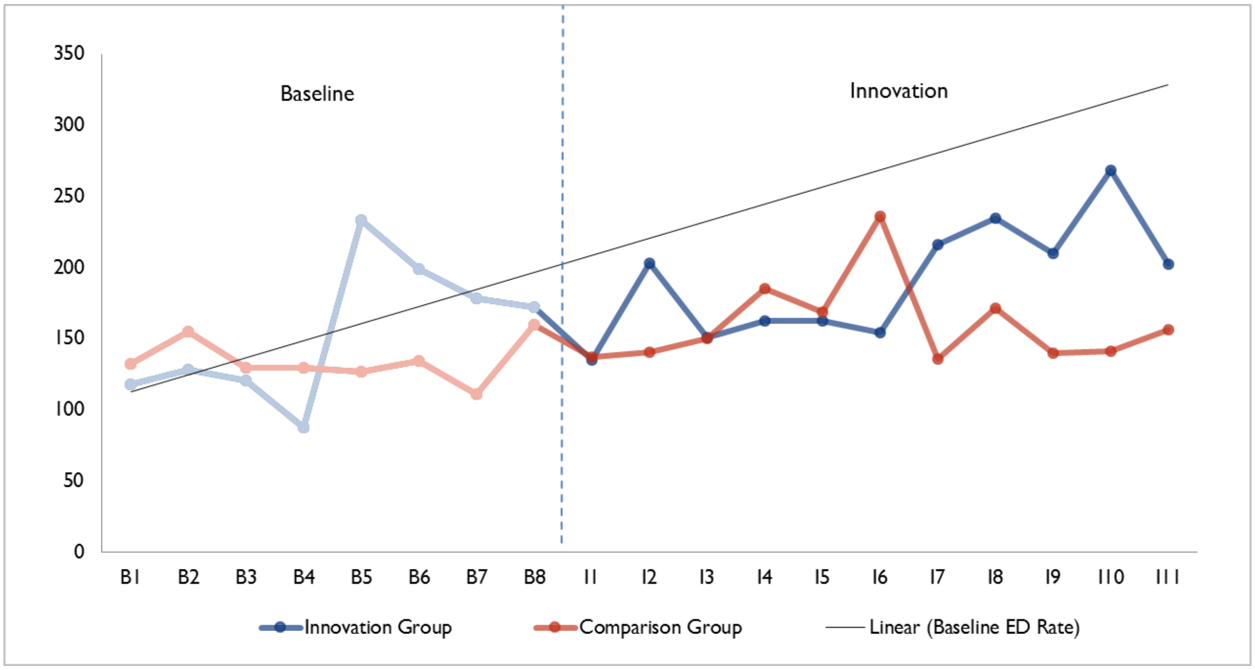
Table 36. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 4 (Hot spotting)

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	385	709	632	614	610	780	650	651	523	612	565	613	513	436	649	676	515
Std dev	1051	2455	2388	2202	1661	2158	2537	1885	1032	1466	1693	1610	1206	891	1583	1569	1127
Unique patients	52	55	57	57	59	59	60	63	65	67	69	75	76	78	74	68	66
Comparison Group																	
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																	
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

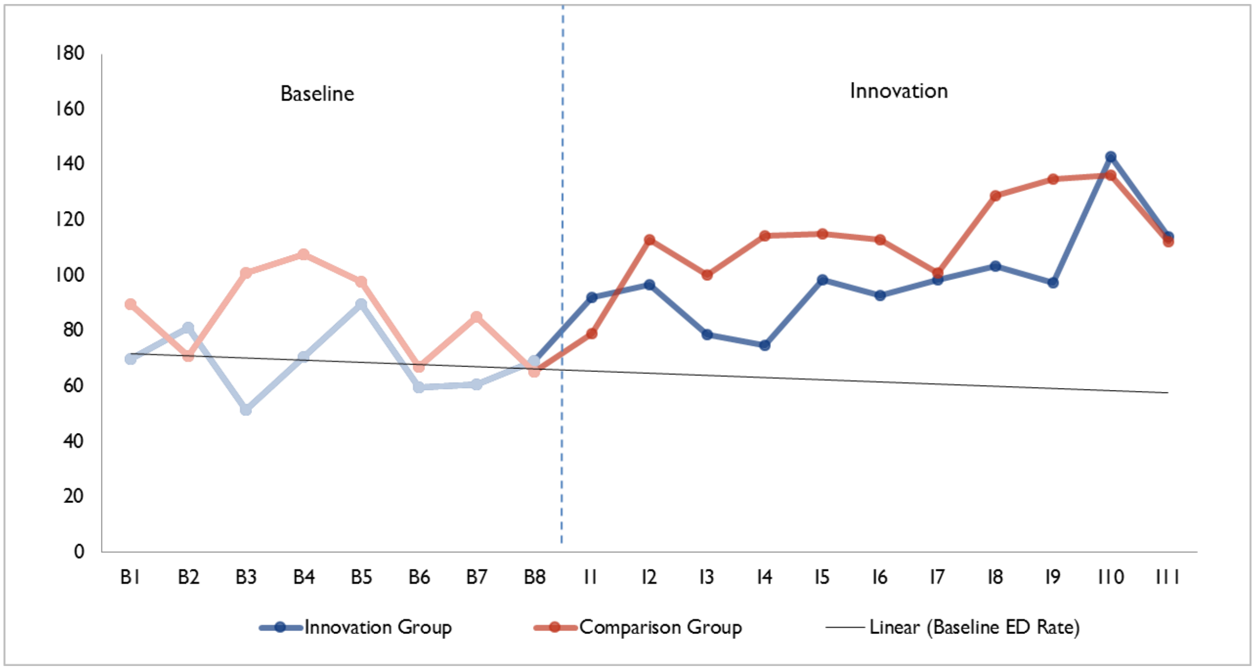
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1.
— Data not yet available.

Figure 22. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)



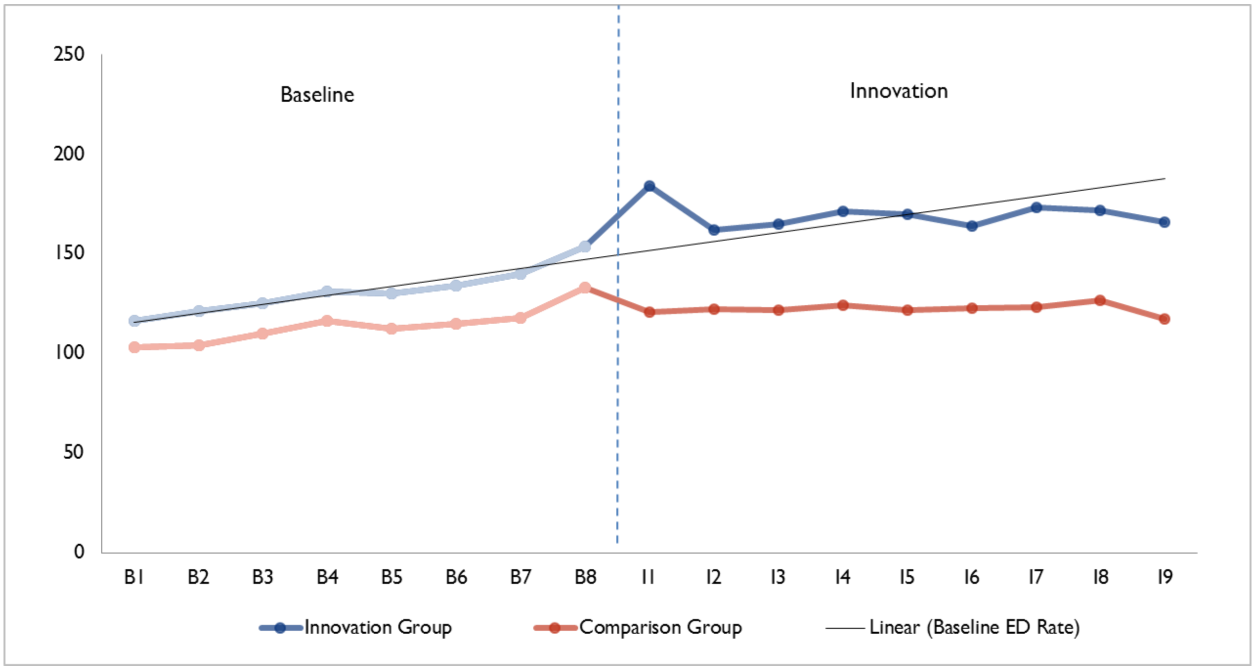
Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; SSM = shared savings model.

Figure 23. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)



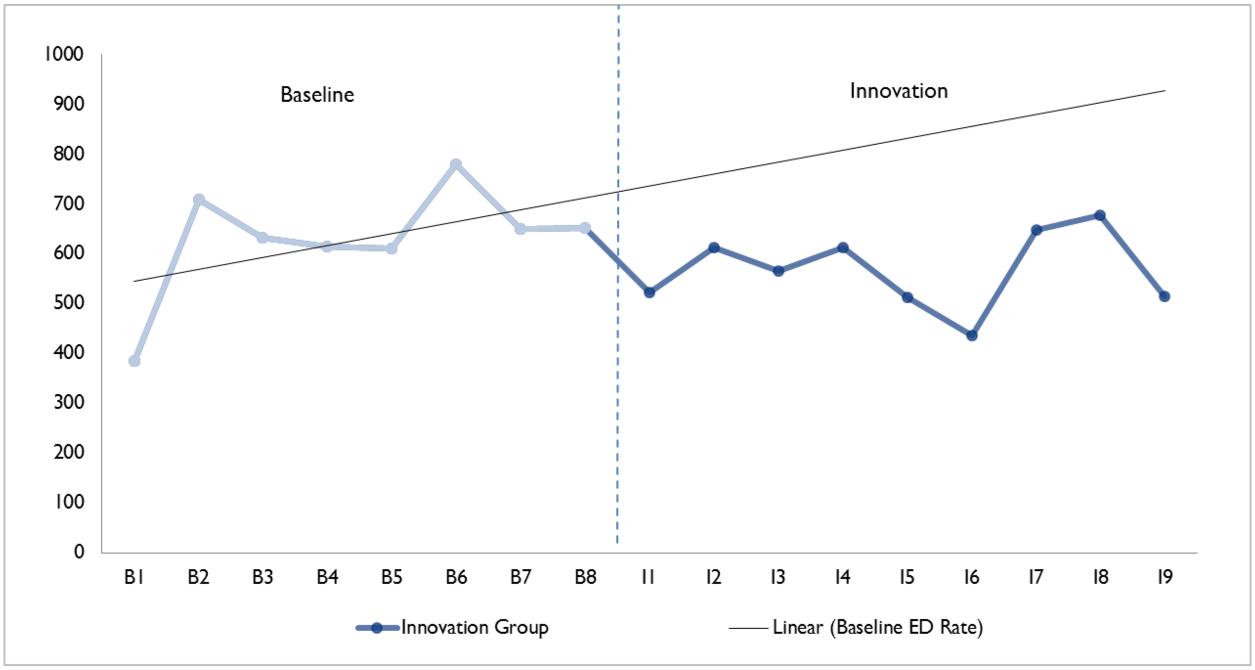
Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department.

Figure 24. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; SSM = shared savings model.

Figure 25. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 4 (Hot spotting)



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department.

2.7.2 ED Visits Regression Results

Tables 37–39 present results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants.

For Cohort 1, the average quarterly difference-in-differences estimate for ED visits is a decrease of 15 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −43, 14). In addition to the average effect over the innovation period, we also present quarterly effects. No quarterly effects are statistically significant at the 10 percent level; however, Year 1’s effect is statistically significant.

Table 37. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)

Quarter	Coefficient	Standard Error	P-Values
I1	−41	42	0.328
I2	−1	46	0.986
I3	−45	49	0.359
I4	−86	53	0.107
I5	0	58	0.997
I6	−79	61	0.201
I7	52	56	0.348
I8	3	67	0.959
I9	−14	60	0.812
I10	55	66	0.404
I11	10	72	0.890
Overall average	−15	17	0.393
Overall aggregate	−30	35	0.393
Overall aggregate (IY1)	−33	18	0.070
Overall aggregate (IY2)	−5	22	0.840
Overall aggregate (IY3)	8	19	0.670

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

ED = emergency department; I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model.

For Cohort 2, the average quarterly difference-in-differences estimate for ED visits is 0 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −12, 11). None of the quarterly effects are statistically significant.

Table 38. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)

Quarter	Coefficient	Standard Error	P-Values
I1	28	19	0.130
I2	5	21	0.821
I3	−4	19	0.830
I4	−29	20	0.157
I5	−6	22	0.804
I6	−9	21	0.689
I7	9	21	0.661
I8	−7	24	0.755
I9	−23	25	0.357
I10	19	29	0.515
I11	13	25	0.615
Overall average	0	7	0.943
Overall aggregate	−2	30	0.943
Overall aggregate (IY1)	0	17	0.983
Overall aggregate (IY2)	−5	18	0.782
Overall aggregate (IY3)	2	16	0.880

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year.

For Cohort 3, the average quarterly difference-in-differences estimate for ED visits is an increase of 27 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 24, 29). All quarterly annual effects are highly statistically significant.

Table 39. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)

Quarter	Coefficient	Standard Error	P-Values
I1	50	4	0.000
I2	22	4	0.000
I3	24	4	0.000
I4	25	4	0.000
I5	26	4	0.000
I6	19	4	0.000
I7	26	5	0.000
I8	19	5	0.000
I9	26	5	0.000
Overall average	27	1	0.000
Overall aggregate	6,022	317	0.000
Overall aggregate (IY1)	3,352	221	0.000
Overall aggregate (IY2)	2,131	206	0.000
Overall aggregate (IY3)	539	95	0.000

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model.

2.8 Discussion: Medicare Results

Cohort 1 (IndiGO and SSM) shows increased but nonsignificant rises in spending, and Cohort 2 (IndiGO only) exhibits decreased but nonsignificant changes in spending for the innovation overall. Cohort 3 (SSM only) shows significant losses overall. Innovation period changes in hospital admissions for Cohorts 1 (IndiGO and SSM) and 2 (IndiGO only) are not significant overall. Innovation period trends show a greater likelihood of hospital admission and ED visits over time for Cohort 3 (SSM only). Regression analyses could not be performed for Cohort 4 (Hot spotting) due to the limited sample size in the data.

Interpretation of results for Cohorts 1 and 3 is limited because the SSM component was still in the pilot phase during the innovation period as Intermountain worked with providers to refine the measures included in the model. Furthermore, the results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. The small sample size for Cohorts 1 and 2 may hinder detection of changes in spending and utilization.

2.9 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Intermountain submitted data to RTI that are current through December 2015. ***Table 40*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested. Results for all of the measures in the table are included in this annual report.

Table 40. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status
Clinical effectiveness	Diabetes	Percentage of patients with diabetes who received an HbA1c assessment	Data received from Intermountain
	CAD	Percentage of patients with CAD who were prescribed beta-blocker therapy	Data received from Intermountain
	Mental health	Percentage of patients with major depression who remained on an antidepressant medication treatment	Data received from Intermountain
	Weight Management	Percentage of patients with a BMI assessment	Data received from Intermountain
Health outcomes	Diabetes	Percentage of patients with diabetes with HbA1c > 8.0%	Data received from Intermountain
	CAD	Percentage of patients with CAD with blood pressure < 130/80 mm/Hg	Data received from Intermountain
		Percentage of patients with CAD with LDL-C < 100 mg/dL	Data received from Intermountain
	Mental health	Number and percentage of patients with an improvement in PHQ-9 scores	Data received from Intermountain
	Weight management	Number and percentage of patients with BMI (25 < BMI <30 = overweight) or (BMI > 30 = obese)	Data received from Intermountain

BMI = body mass index; CAD = coronary artery disease; Intermountain = Intermountain Healthcare, Inc.; LDL-C = low-density lipoprotein cholesterol; PHQ-9 = Patient Health Questionnaire.

2.10 Clinical Effectiveness: Diabetes Care

2.10.1 Descriptive Results

Evaluation Question

- Has the percentage of patients with diabetes who received an HbA1c test and a lipid assessment increased over time among those enrolled in the innovation?

Table 41 shows the number of diabetic patients who received an HbA1c assessment. More than two-thirds of patients with diabetes in SSM practices have this assessment, whereas the rate for IndiGO is about half. In the 2015 annual report, these measures were paired with a lipid assessment. Intermountain stopped reporting on the lipid assessment because the data accuracy was not reliable.

Table 41. Percentage of Patients with Diabetes Who Received an HbA1c Assessment

	Percentages	Number
Clinical Effectiveness Measure	I1-I10	I1-I10
Percentage of SSM diabetic patients who received an HbA1c assessment	68.0	4,144
	N = 6,094	
Clinical Effectiveness Measure	I1-I9	I1-I9
Percentage of IndiGO diabetic patients who received an HbA1c assessment	32.0	76
	N = 239	N/A

Source: Patient-level data provided by Intermountain.
N/A = not applicable; SSM = shared savings model.

2.11 Clinical Effectiveness: Coronary Artery Disease Care

2.11.1 Descriptive Results

Evaluation Question

- Has the percentage of patients with coronary artery disease who received beta-blocker therapy increased over time among those enrolled in the innovation?

Table 42 presents the number of CAD patients receiving beta-blockers. The vast majority of SSM patients receive beta-blockers (96.5%) whereas almost 9 of 10 (89.4%) IndiGO patients receive beta-blockers.

Table 42. Percentage of CAD Patients on Beta-blocker Therapy

	Percentages	Number
Clinical Effectiveness Measure	I1-I10	I1-I10
Percentage of SSM CAD patients on beta-blocker therapy	96.5	5,534
	N = 5,736	
Clinical Effectiveness Measure	I1-I9	I1-I9
Percentage of IndiGO CAD patients on beta-blocker therapy	89.4	203
	N = 227	N/A

Source: Patient-level data provided by Intermountain.
CAD = coronary artery disease; N/A = not applicable; SSM = shared savings model.

2.12 Clinical Effectiveness: Mental Health

2.12.1 Descriptive Results

Evaluation Question

- Has the percentage of patients with depression who received and remained on antidepressant medication therapy increased over time among those enrolled in the innovation?

Table 43 presents the rate at which patients with depression receive and are adherent to antidepressant medication. Less than 30 percent (29.5%) of the SSM patients receive and are compliant with antidepressant treatment, while fewer than one in six (16.2%) IndiGO patients with depression comply with their medication.

Table 43. Percentage of Patients Who Receive Antidepressant Medication Management

	Percentages	Number
Clinical Effectiveness Measure	**I1-I10**	**I1-I10**
Percentage of SSM patients who receive antidepressant medication management (i.e., treated with antidepressant medication and remained on an antidepressant treatment)	29.5	5,977
	N = 20294	
Clinical Effectiveness Measure	**I1-I9**	**I1-I9**
Percentage of IndiGO patients who receive antidepressant medication management (i.e., treated with antidepressant medication and remained on an antidepressant treatment)	16.2	141
	N = 869	N/A

Source: Patient-level data provided by Intermountain.
N/A = not applicable; SSM = shared savings model.

2.13 Clinical Effectiveness: Body Mass Index (BMI)

2.13.1 Descriptive Results

Evaluation Question

- Has the percentage of patients who received weight screening increased over time among those enrolled in the innovation?

Table 44 displays the number of patients who had weight screening using BMI. There is no significant difference between the SSM and IndiGO populations; the clinical screen was provided to approximately 83 percent of each group.

Table 44. Percentage of Patients Who Had a BMI Screening

Clinical Effectiveness Measure	Percentages I1-I10	Number I1-I10
Percentage of SSM patients who had weight screening completed using BMI	82.5	16,783
	N = 20,294	
Clinical Effectiveness Measure	**I1-I9**	**I1-I9**
Percentage of IndiGO patients who had weight screening completed using BMI	83.0	721
	N = 869	N/A

Source: Patient-level data provided by Intermountain.
BMI = body mass index; N/A = not applicable; SSM = shared savings model.

We examined health outcomes among patients in an SSM practice with diabetes, depression, and CAD. The following run charts take into account rolling enrollment. The Is are based on individual enrollment date. For example, I1 is equal to the first quarter of enrollment for all participants who received a specific test. We provide I data when at least 20 patients have a test or reading within the quarter.

2.14 Health Outcomes: Diabetes

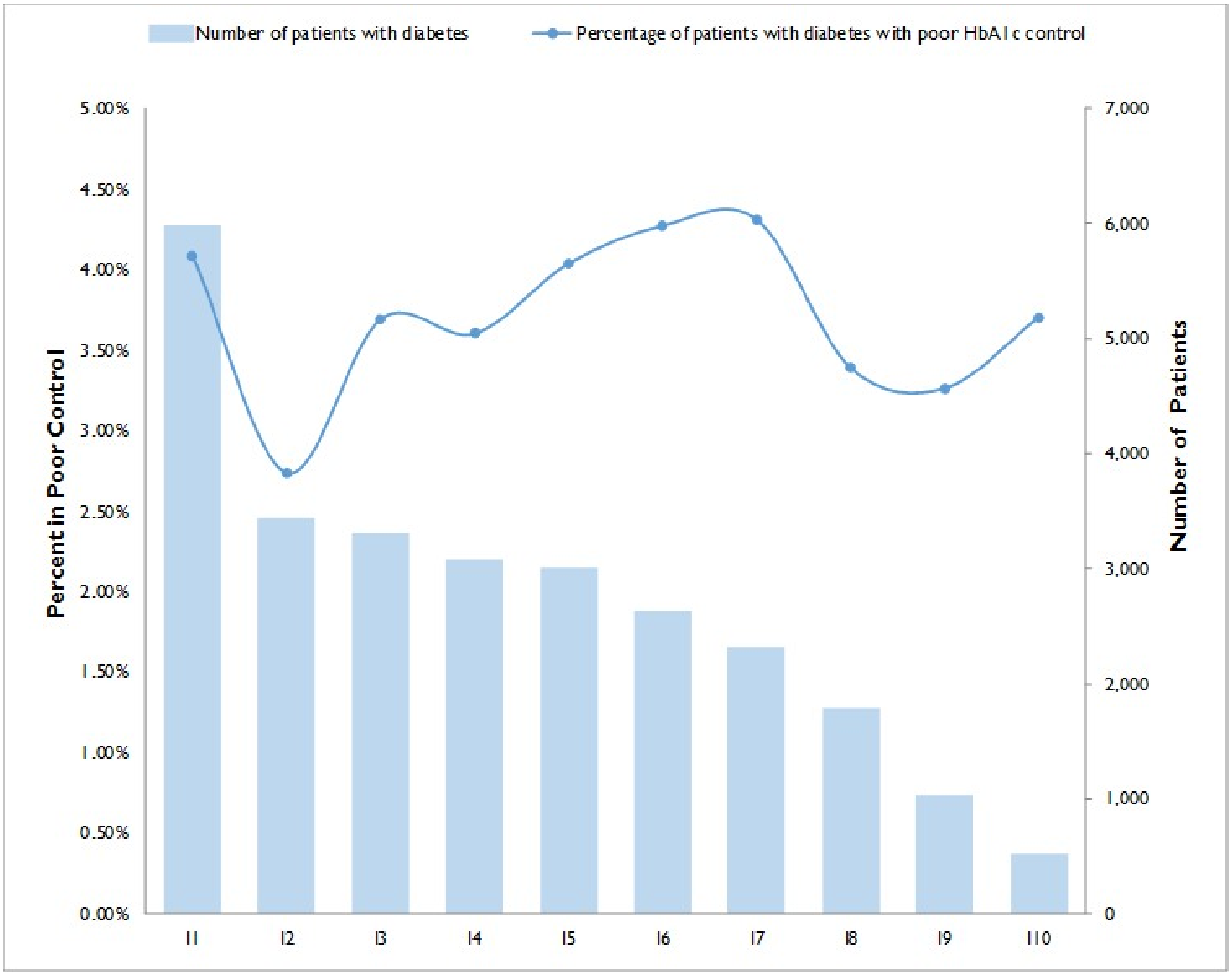
2.14.1 Descriptive Results

Evaluation Question

- Has the percentage of diabetes patients with poor HbA1c control decreased over time among those enrolled in the innovation?

Figure 26 shows the percentage of diabetic SSM patients with poorly controlled blood glucose (HbA1c > 8.0) across intervention quarters (IQ). For all 10 IQs, the percentage of patients with poorly controlled blood sugar remains within 1.0 percent point of the mean value (3.7 percent) throughout the innovation.

Figure 26. Percentage of SSM Patients with Diabetes with Poor HbA1c Control over Time



		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients with diabetes with poor HbA1c control	4.1	2.7	3.7	3.6	4.0	4.3	4.3	3.4	3.3	3.7
	Number of patients with diabetes	5,899	3,360	3,223	2,998	2,922	2,551	2,228	1,712	950	432

Source: Patient-level data provided by Intermountain.
SSM = shared savings model.

2.15 Health Outcomes: Coronary Artery Disease

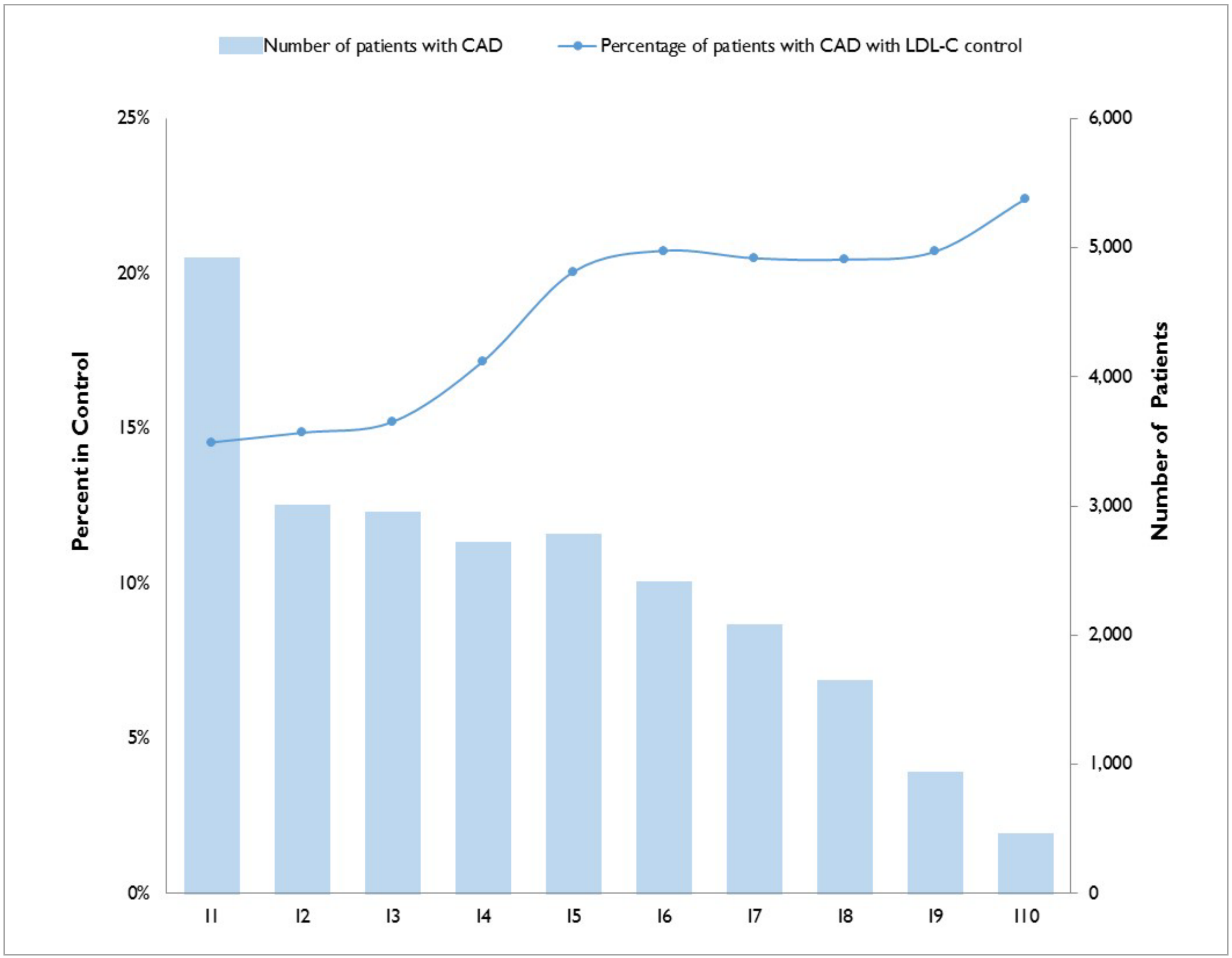
2.15.1 Descriptive Results

Evaluation Questions

- Has the percentage of patients with CAD with blood pressure control increased over time among those enrolled in the innovation?
- Has the percentage of patients with CAD with LDL-C control increased over time among those enrolled in the innovation?

Figures 27 and ***28*** display the percentage of SSM CAD patients' low-density lipoprotein cholesterol (LDL-C) control across innovation quarters. LDL-C control appears to increase in three IQs (I4–I6), rising 3–5 percent above the earlier IQs. Subsequently, through I9, the LDL-C control remains stable, followed by a 1.7 percent rise in I10. The percentage of SSM CAD patients with blood pressure control fluctuated between 40.6 percent and 44.0 percent from I1 through I7, a slight upward trend, but declined 7.0 percent in the subsequent IQs.

Figure 27. Percentage of SSM Patients with CAD with LDL-C Control over Time



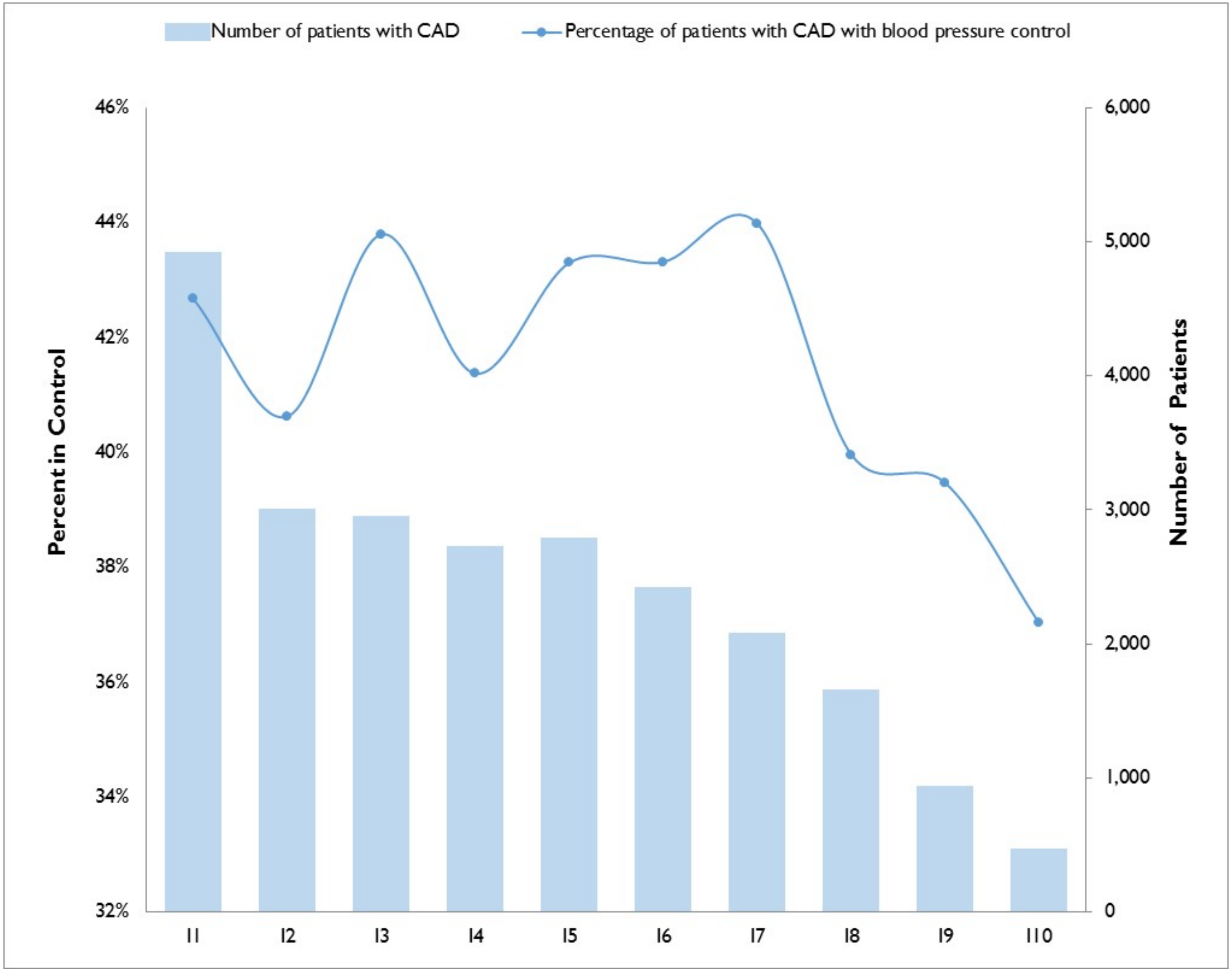
(continued)

Figure 27. Percentage of SSM Patients with CAD with LDL-C Control over Time (continued)

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients with CAD with LDL-C control	14.6	14.9	15.2	17.2	20.1	20.7	20.5	20.5	20.7	22.4
	Number of patients with CAD	4,849	2,939	2,884	2,654	2,716	2,348	2,010	1,584	869	397

Source: Patient-level data provided by Intermountain.
CAD = coronary artery disease; LDL-C = low-density lipoprotein cholesterol; SSM = shared savings model.

Figure 28. Percentage of SSM Patients with CAD with Blood Pressure Control over Time



		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients with CAD with blood pressure control	42.7	40.6	43.8	41.4	43.3	43.3	44.0	40.0	39.5	37.0
	Number of patients with CAD	4,849	2,939	2,884	2,654	2,716	2,348	2,010	1,584	869	397

Source: Patient-level data provided by Intermountain.
CAD = coronary artery disease; SSM = shared savings model.

2.16 Health Outcomes: Mental Health

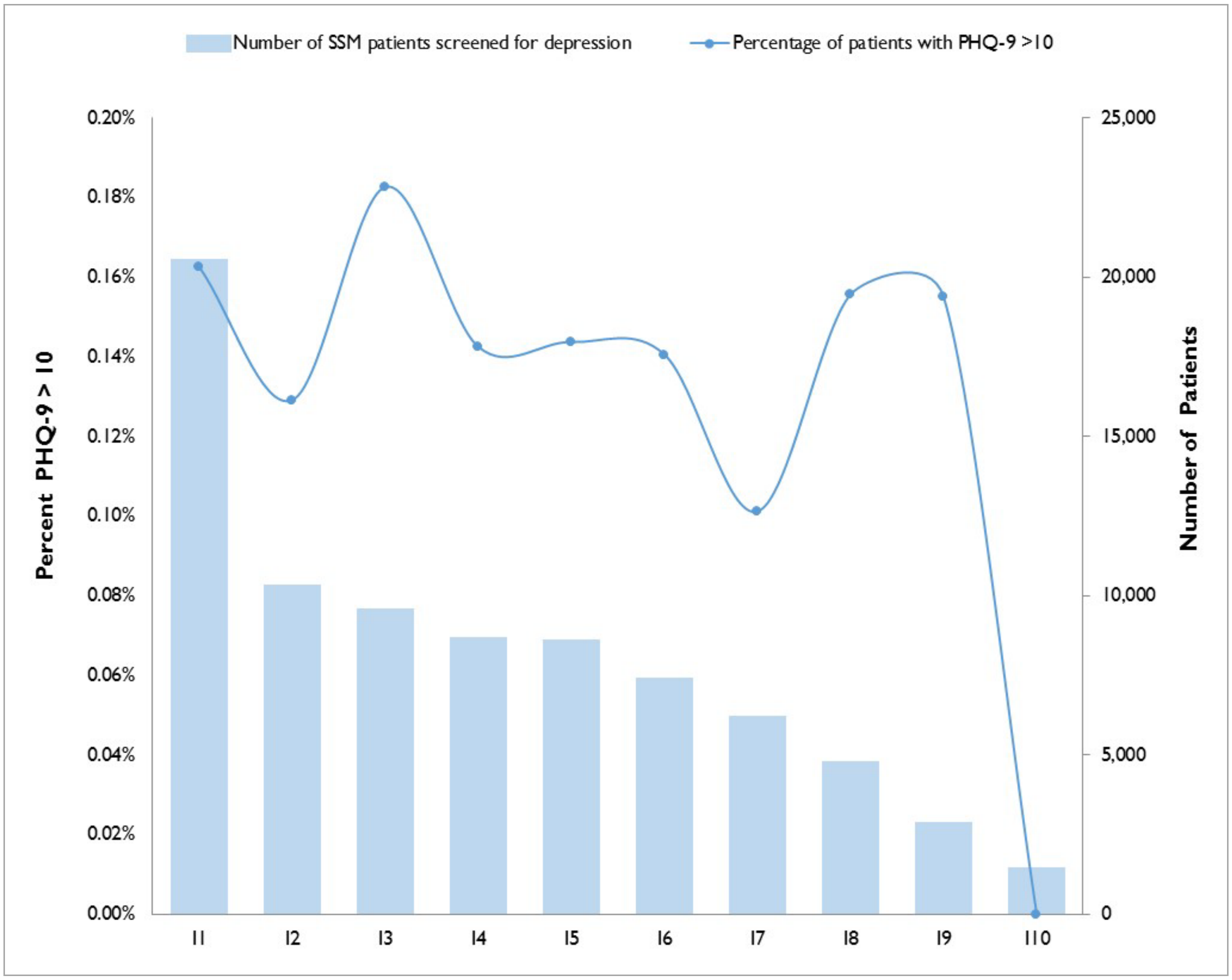
2.16.1 Descriptive Results

Evaluation Question

- Has the percentage of patients with depression with PHQ-9 score of >10 decreased over time among those enrolled in the innovation?

Figure 29 displays the percentage of SSM patients throughout the innovation who have depression with a depression screening score above 10, indicating a moderate level of depression. Overall, a very low percentage (< 2.0%) of SSM and IndiGO patients screened for depression have PHQ-9 scores over 10.

Figure 29. Percentage of SSM Patients with Depression with PHQ-9 > 10 over Time



(continued)

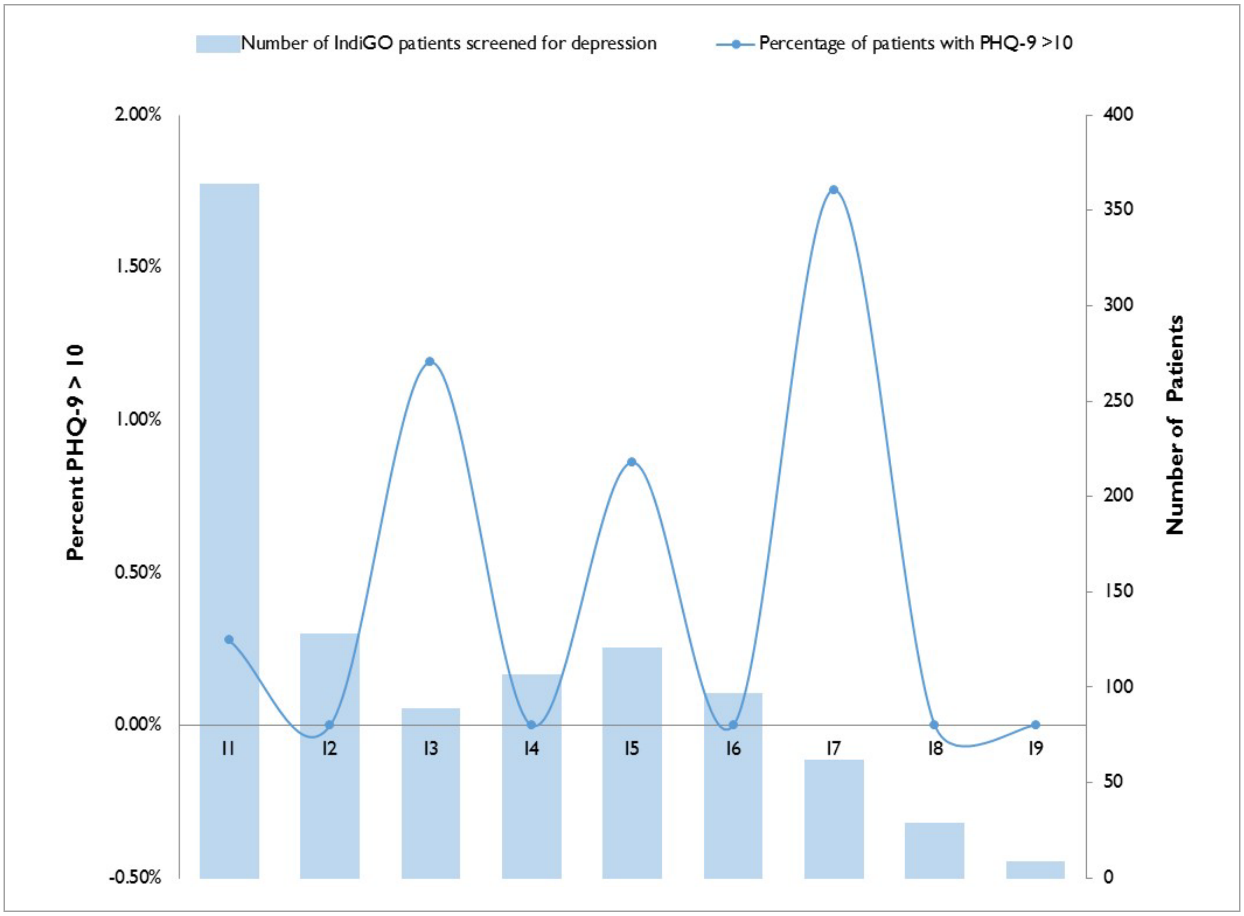
Figure 29. Percentage of SSM Patients with Depression with PHQ-9 > 10 over Time (continued)

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients with PHQ-9 >10	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.0
	Number of SSM patients screened for depression	20,294	10,060	9,304	8,419	8,346	7,112	5,927	4,494	2,580	1,188

Source: Patient-level data provided by Intermountain.
PHQ-9 = Patient Health Questionnaire; SSM = shared savings model.

Figure 30 displays the percentage of IndiGO patients who have depression with a depression screening score above 10, indicating a moderate level of depression; however, these data were volatile over each quarter.

Figure 30. Percentage of IndiGO Patients with Depression with PHQ-9 > 10 over Time



		I1	I2	I3	I4	I5	I6	I7	I8
●	Percentage of patients with PHQ-9 >10	0.3	0.0	1.2	0.0	0.9	0.0	1.8	0.0
	Number of IndiGO patients screened for depression	359	123	84	102	116	92	57	24

Source: Patient-level data provided by Intermountain.
PHQ-9 = Patient Health Questionnaire.

2.17 Health Outcomes: Body Mass Index (BMI)

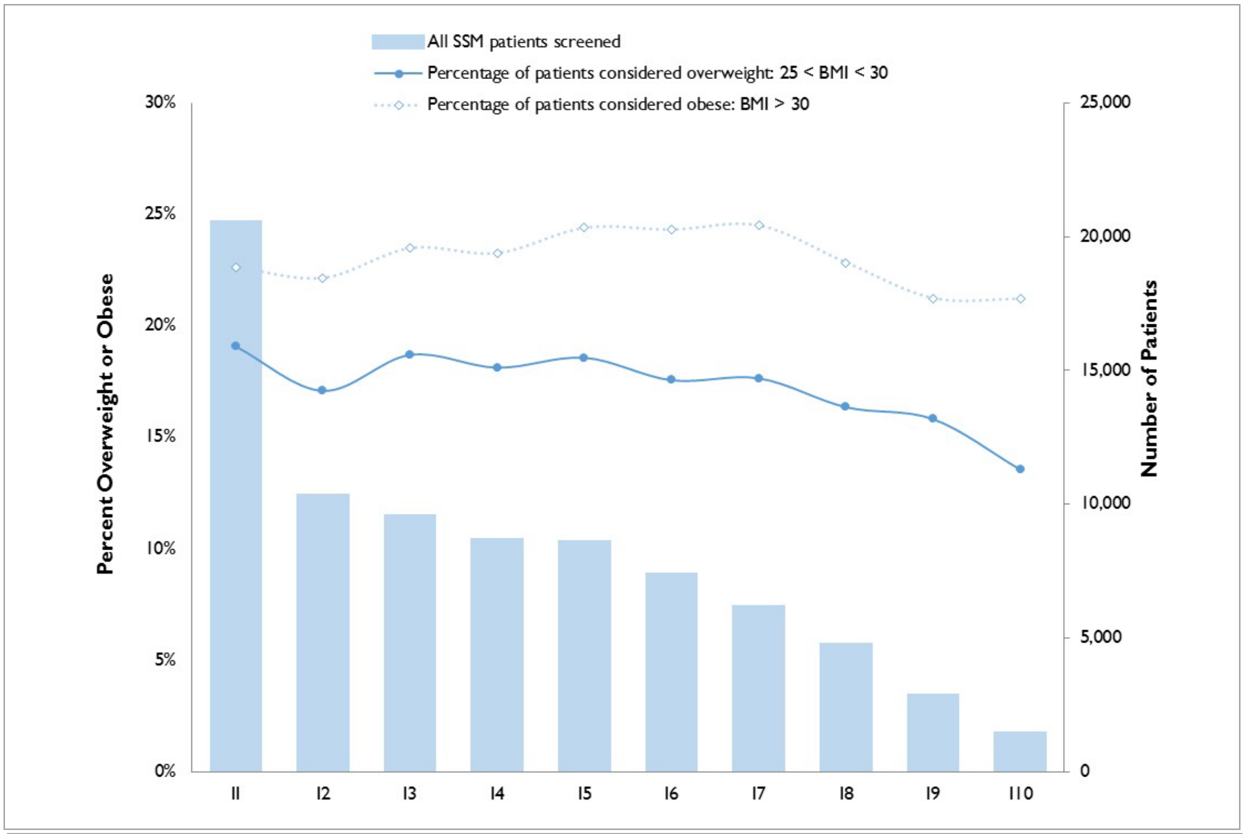
2.17.1 Descriptive Results

Evaluation Question

- Has the percentage of patients considered overweight and/or obese decreased over time among those enrolled in the innovation?

Figure 31 shows the percentage of overweight and obese patients as measured over the intervention quarters (IQ). Although the proportion of obese SSM patients remains fairly stable over time, the percentage of overweight patients gradually decreases over time so that the rate in I10 is almost 6 percentage points lower than the percent in I1.

Figure 31. Percentage of SSM Obese or Overweight Patients over Time

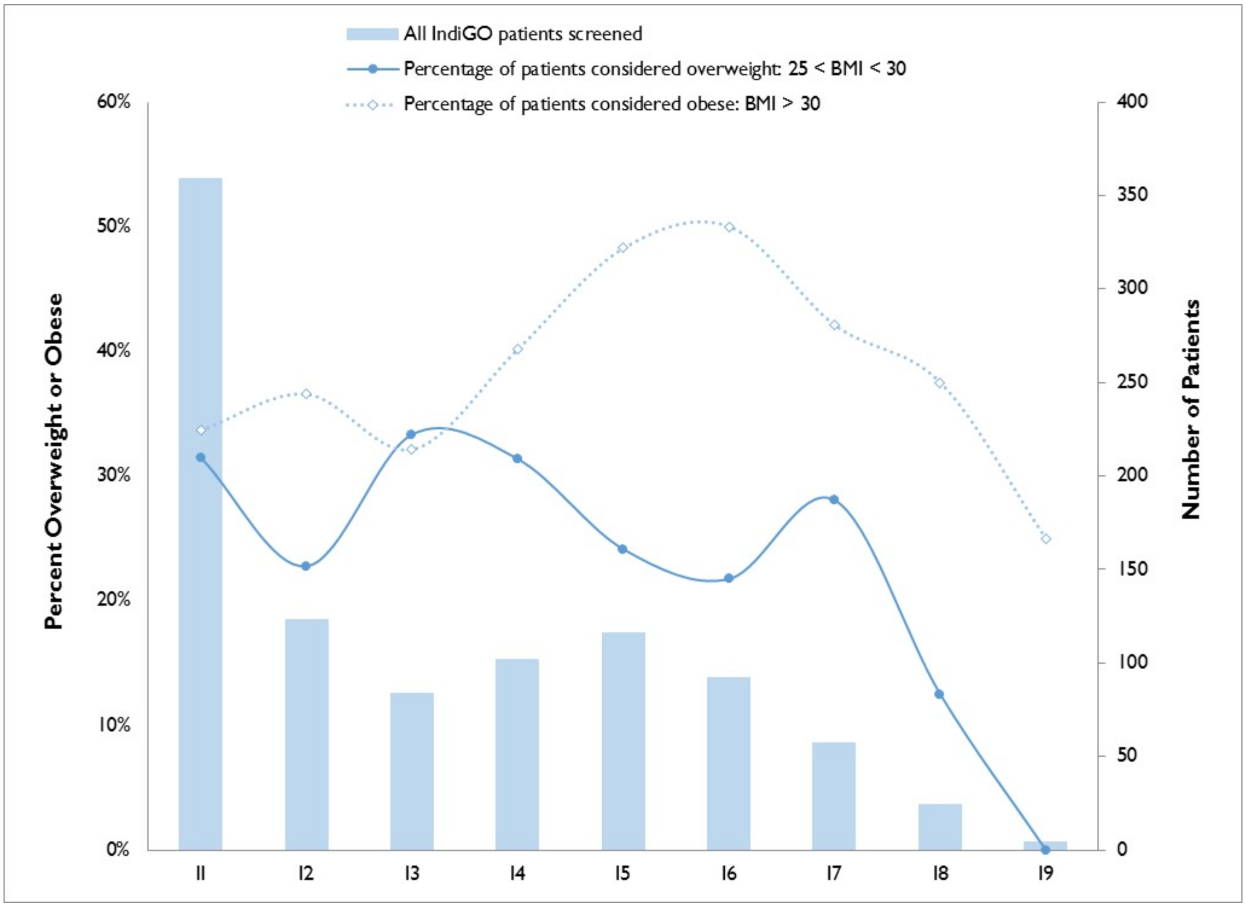


		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients considered overweight: 25 < BMI < 30	19.1	17.1	18.7	18.1	18.6	17.6	17.7	16.4	15.8	13.6
◊	Percentage of patients considered obese: BMI > 30	22.6	22.2	23.5	23.3	24.4	24.3	24.5	22.8	21.2	21.2
	All SSM patients screened	20,294	10,060	9,304	8,419	8,346	7,112	5,927	4,494	2,580	1,188

Source: Patient-level data provided by Intermountain.
BMI = body mass index; SSM = shared savings model.

Figure 32 shows the percentage of IndiGO overweight and obese patients as measured over the intervention quarters (IQ). The percentage of overweight IndiGO patients oscillates over time before declining in I7.

Figure 32. Percentage of IndiGO Obese or Overweight Patients over Time



		I1	I2	I3	I4	I5	I6	I7	I8
●	Percentage of patients considered overweight: 25 < BMI < 30	31.5	22.8	33.3	31.4	24.1	21.7	28.1	12.5
◊	Percentage of patients considered obese: BMI > 30	33.7	36.6	32.1	40.2	48.3	50.0	42.1	37.5
	All IndiGO patients screened	359	123	84	102	116	92	57	24

BMI = body mass index.

2.18 Discussion: Awardee-Specific Data

The clinical effectiveness and health outcomes measures we used are assessed during clinic visits for patients. With the exception of BMI, data were limited to flags indicated whether a parameter of interest was or was not in control, or whether a patient had received a specific diagnosis or therapy.

The IndiGO patient cohort was small (n=449), and the *IndiGO view* innovation was restricted to a single annual view per patient. We did not receive data to assess the CAD and diabetes outcomes for IndigGO patients; therefore, we do not have strong evidence that the innovation improved health outcomes for this cohort. Additionally, we did not receive data to assess outcomes for the patients in the population management component.

For SSM patients, chronic disease management is not the main focus, so the lack of improvement in health outcomes is not unexpected. Furthermore, the SSM component remained in the pilot phase throughout the innovation as Intermountain worked with providers to refine the measures included in the model. Nonetheless, for the SSM patients by providers while in the pilot phase, several measures exhibited trends across the innovation quarters, some positive and others negative. The proportion of SSM patients with LDL-C control increased, and number of patients with PHQ-9 score > 10 declined—both positive trends. The SSM overweight population followed a positive trend throughout the innovation. Although obesity in the SSM patients is essentially unchanged, at 21–23 percent, this rate of obesity is far below the U.S. adult national average: "*more than one-third (34.9%, or 78.6 million) of U.S. adults are obese.*"[2]

2.19 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 45*** lists the quantifiable measures of implementation and their status as of December 31, 2015, that RTI obtained from Intermountain's *Narrative Progress Reports* and *Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provided additional detail.

The findings presented in the following sections are based on data from Q11 and Q14 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

[2] Ogden, C. L, Carroll, M. D., Kit, B.K., and Flegal, K. M.: Prevalence of Childhood and Adult Obesity in the United States, 2011-2012. JAMA, 311(8):806-814. 2014. doi:10.1001/jama.2014.732.

Table 45. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q14	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11–Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11–Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of providers/physicians participating in the SSM	Data received from Intermountain
		Number/percentage of physician practices using IndiGO	Data received from Intermountain
		Number/percentage of eligible patients viewed in IndiGO during appointment for diabetes, hypertension, CAD, and depression and in total	Data received from Intermountain

CAD = coronary artery disease; FTE = full-time equivalent; SSM = shared savings model.

2.20 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.20.1 Hiring and Retention

At the end of Q14 (December 2015), the innovation was staffed with 12.58 full-time equivalent (FTE) staff members. Staffing levels exceeded Intermountain's target of 11.5 FTEs; however, more emphasis could have been placed on hiring technical staff to implement and support the IndiGO tool. Throughout the project, Intermountain reported challenges obtaining the necessary technical support given its competing priorities around electronic health record (EHR) implementation, Meaningful Use, and ICD-10 conversion. Additionally, Intermountain reported challenges in recruiting technical staff. Hiring more FTEs to both complete the requirements for IndiGO and educate providers on the IndiGO tool could have improved IndiGO reach and execution.

Because Intermountain sought to embed the innovation into existing operations, project team members also supported and led other quality improvement initiatives across the organization. Intermountain retained over 75 percent of project staff through the duration of the innovation. Staff members who led population management (hot spotting) and the SSM stayed through the duration of the project. These staff members also served on various work groups throughout the organization, which helped the project remain aligned with other ongoing initiatives internally.

2.20.2 Skills, Knowledge, and Training

By the end of Q11 (March 2015), Intermountain provided 588 hours of training to 426 community-based clinical and nonclinical personnel. Training offerings included those on IndiGO tool use and on the SSM. The training on the IndiGO tool was a 1-hour course. It is not clear how this training was delivered, but Intermountain expressed the need to further educate providers and their staffs on the IndiGO tool. Intermountain reported allocating time for an “IndiGO superuser” to help clinics adopt the tool. To supplement training, Intermountain also produced a video on the IndiGO tool for wide dissemination. Almost a quarter of eligible providers adopted the tool, which indicates that more provider education or outreach was needed to increase adoption.

The training for the SSM was listed as a 4-hour course. Due to the incentives and measures included in this program component, this training was adequate for their needs. No additional SSM trainings were conducted between Q12 and Q14.

Table 46. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11-Q14 (January-December, 2015)	17	17
Since inception	588	426

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.21 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

Evaluation Questions

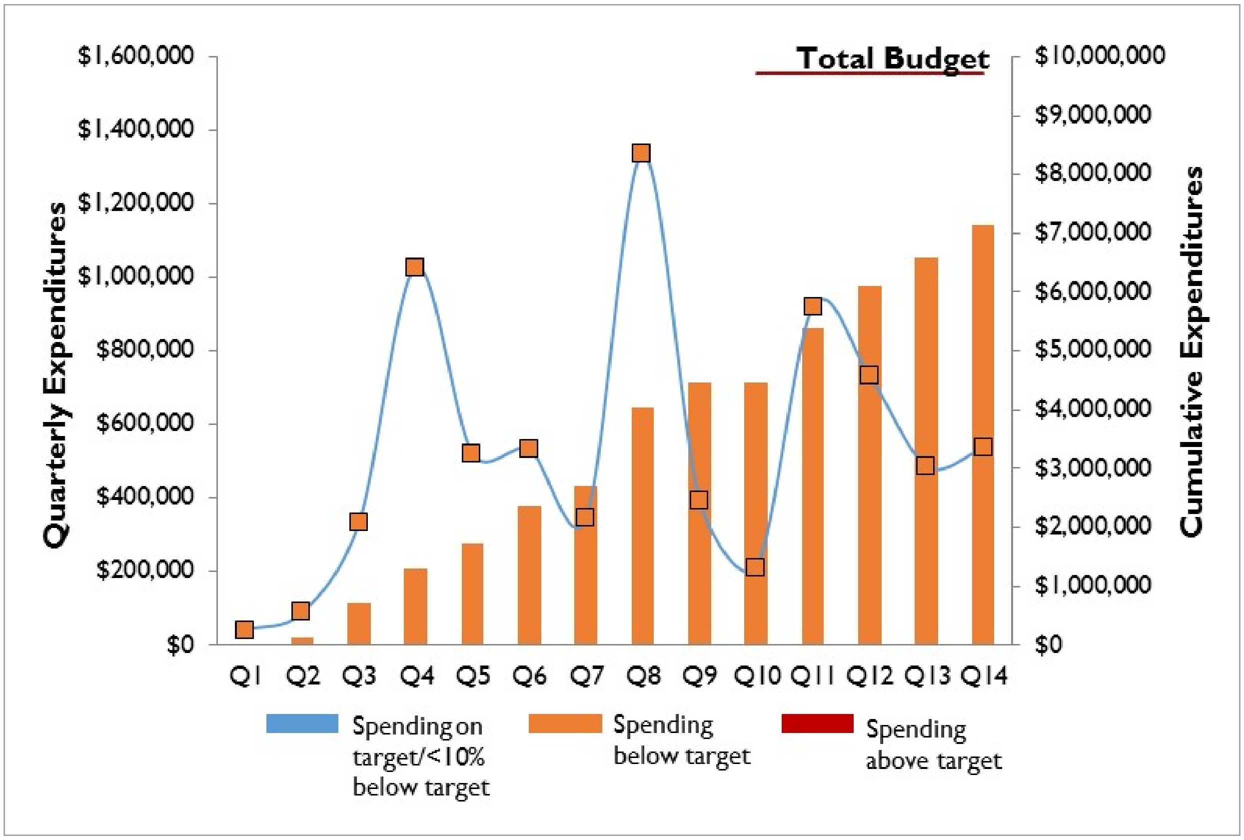
- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.21.1 Award Execution

The annual report highlights the significance of Intermountain expenditure rates on implementation. As of December 2015 (Q14), Intermountain spent 73.3 percent of its total budget, which is below the projected target (see ***Figure 33***). The spending underrun was due to multiple concurrent projects that competed for resources at Intermountain. Specifically, Intermountain's EHR implementation, Meaningful Use attestation, and medical home implementation impacted the level of IT resources and support available for IndiGO. In Q13 and Q14, Intermountain also reported ICD-10 conversion as a competing priority that consumed organizational resources. To mitigate the effects of these competing priorities, Intermountain established relationships with the EHR vendor, continued to engage organizational leaders, and hired additional IT staff.

Regarding the pace of execution of Intermountain's innovation, one staff person noted, *"(We) had a slow start overall. Once the funding period started, work at the organizational level happened to integrate/embed the innovation."* Intermountain also attributed low spending to the delays in the Year 2 carry-forward request approval and the delay of the no-cost extension approval by CMS.

Figure 33. Cumulative Spend Rate from Q1 (June 1, 2012) to Q14 (December 31, 2015)



2.21.2 Leadership

Leadership support for the innovation was strong throughout the award, according to key informant interviews. Organizational leaders worked to embed and align the innovation with other existing initiatives across the organization. For example, for the population management component, Intermountain created a Population Management Steering Committee, and the HCIA project director and a senior analyst were invited to join the committee. Other standing committees included the Hot Spotting Analytics Committee and the newly renamed Population Health organization (formerly the Shared Accountability Organization). Program leaders regularly joined these standing committees to educate organizational leaders on the components of HCIA while also determining how HCIA components could fit into internal operations.

Regarding the SSM component, the HCIA project director and Intermountain leadership worked frequently with the Population Health organization to help refine measures for the SSM and educate providers on those measures. One key informant noted, *"Organizational support and culture around value recognition were facilitators in moving from fee for service."* The steering committee for the SSM includes the medical group's CEO; providers at the pilot sites for the payment model also provide their feedback.

Finally, leadership also supported the patient engagement component of the innovation, in spite of reported bureaucracy in the approval process for the PROMIS measure. According to key informants, Intermountain decided to integrate the patient engagement tools into operations. As confirmation of their support, the chief medical and chief nursing officers who manage clinical programs included IndiGO in their budgets moving forward. Additionally, Intermountain reported that IndiGO utilization is an available goal in providers' shared savings target within Intermountain's health plan.

2.21.3 Organizational Capacity

Intermountain's longstanding culture of quality improvement and innovation benefitted its HCIA experience. The components of the project were designed to integrate into existing operations and internal initiatives. Although this integration benefitted sustainability, competing demands for organizational resources were a key challenge to implementation.

These resource constraints were particularly challenging to the patient engagement component of the innovation, the IndiGO tool. The main resource constraints occurred with technical staff; however, the competing priorities also fatigued primary care staff. The competing priorities of EHR implementation and other initiatives, such as Meaningful Use attestation, implementation of medical home models, and ICD-10 conversion constrained IT staff support and implementation resources. One key informant noted, *"Intermountain chose a vendor-based EMR which impacted the HCIA project because it took IT expertise and resources. [We] had to move money out of personnel into vendor-based purchasing and the HCIA team had to work with a vendor to get the patient-reported measures."*

Intermountain described the weariness of primary care that affected the SSM and patient engagement components: *"Primary care is overwhelmed by all the things they're asked to do (medical homes, diabetes interventions, etc.). [We] constantly have to think of ways to make new initiatives fresh."* Further illustrating these capacity challenges, an Intermountain key informant noted, *"The bandwidth/workload issues with providers are also challenging. There's a general level of fatigue to keep up with all of the federal/payer programs."*

Because of the competing priorities among primary care providers, Intermountain cited provider education as key to both the SSM and patient engagement components; however, we infer that the lack of resources may have delayed training and educating providers about these components, and possibly slowed adoption.

2.21.4 Innovation Adoption and Workflow Integration

Workflow integration was key for the patient engagement component because the IndiGO tool needed to fit into to providers' workflows to increase adoption. While providers conduct patient visits, the tool enables them to discuss risk scores with their patients and, subsequently, implement any interventions to improve or lower a patient's risk. RTI attempted to survey and interview multiple provider users of IndiGO and other innovation participants to understand how well the tool fit into workflow, but we were unable to secure the appropriate approvals despite substantial effort. For one key informant, the IndiGO tool was very beneficial and provided patients and physicians with an easy-to-use risk calculator:

> ***"I don't know how I would do my job without the tool...In my practice, I see a patient every 20 minutes versus some other primary care practices. This IndiGO tool is the key to success. It's quick and gives the (benefit) score immediately. It allows me to make quick decisions. Previously, I used time-consuming risk calculators; it was really hard on me time-wise."***

Some challenges with integrating IndiGO into providers' workflows included multiple sign-ons; lack of access to the tool outside of the local Intermountain network; and the need for more frequent updates on lab and medication data. The EHR implementation affected the availability of the lab and medication data. Data were not transferred from the EHR into Intermountain's data warehouse to populate IndiGO. Intermountain will continue to work with the EHR vendor to improve the integration of the IndiGO tool with the new EHR.

Intermountain also worked throughout the innovation to refine the algorithms for population management (hot spotting). The program used hot spotting to identify patients who would best benefit from two targeted interventions—the Community Care Management program or the Comprehensive Care Clinics. These two interventions were not funded by HCIA; as a result, we were unable to evaluate adoption and the transition of hot spotting patients into these programs.

2.22 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

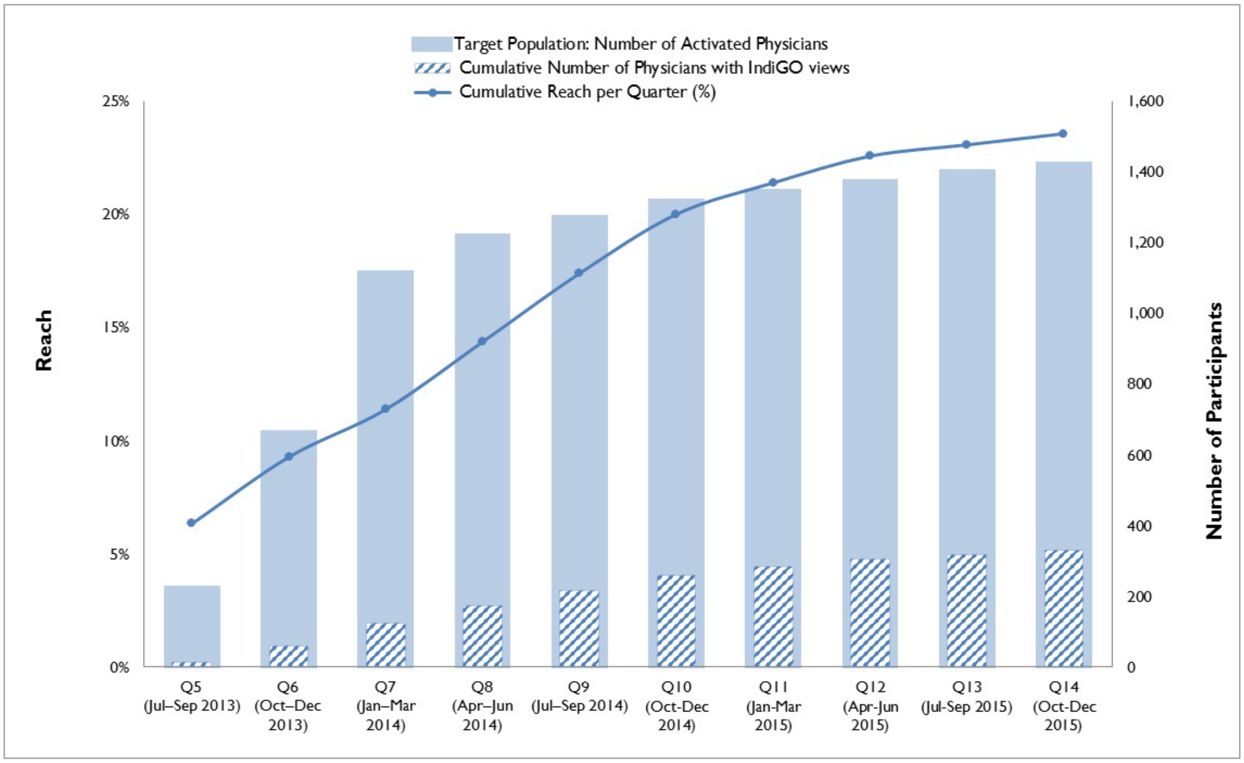
2.22.1 Innovation Reach

The number of participants reported in the 2015 annual report differs slightly from the number of participants reported in this 2016 annual report because Intermountain updates their data on a continual basis, which may include reconciling differences in previously reported quarters. Patients' IndiGO enrollment status may change based upon their PCP. A patient who has not seen a PCP (Pediatrics, Internal Medicine, Family Practice, or Geriatrics) practicing at an Intermountain primary care practice within the last three years would be excluded from IndiGO data.

Figure 34 shows reach by quarter based on the number of physicians who had at least one qualified IndiGO view since the launch of the innovation. We consider the target population to be all physicians who treated IndiGO patients during a clinical encounter. Since we last reported reach in the 2015 annual report based on data through Q11, an additional 47 physicians became involved in the innovation, increasing reach from 21.4 percent to 23.6 percent. Over the course of the innovation, reach grew at an increasing rate through March 2015 (Q11), and then slowed to the current rate.

As previously described, competing internal priorities, such as the EHR implementation, challenged technical resources and caused provider fatigue. In later quarters as EHR implementation increased, IndiGO data become unavailable. IndiGO data were pulled from the EHR; however, technical staff were still working with the new EHR vendor to ensure this functionality was operational at the end of the award. These challenges impacted the number of providers who received training on IndiGO and the SSM. Intermountain needed more resources dedicated to educating providers on the IndiGO tool.

Figure 34. IndiGO Provider Reach since Project Launch



(continued)

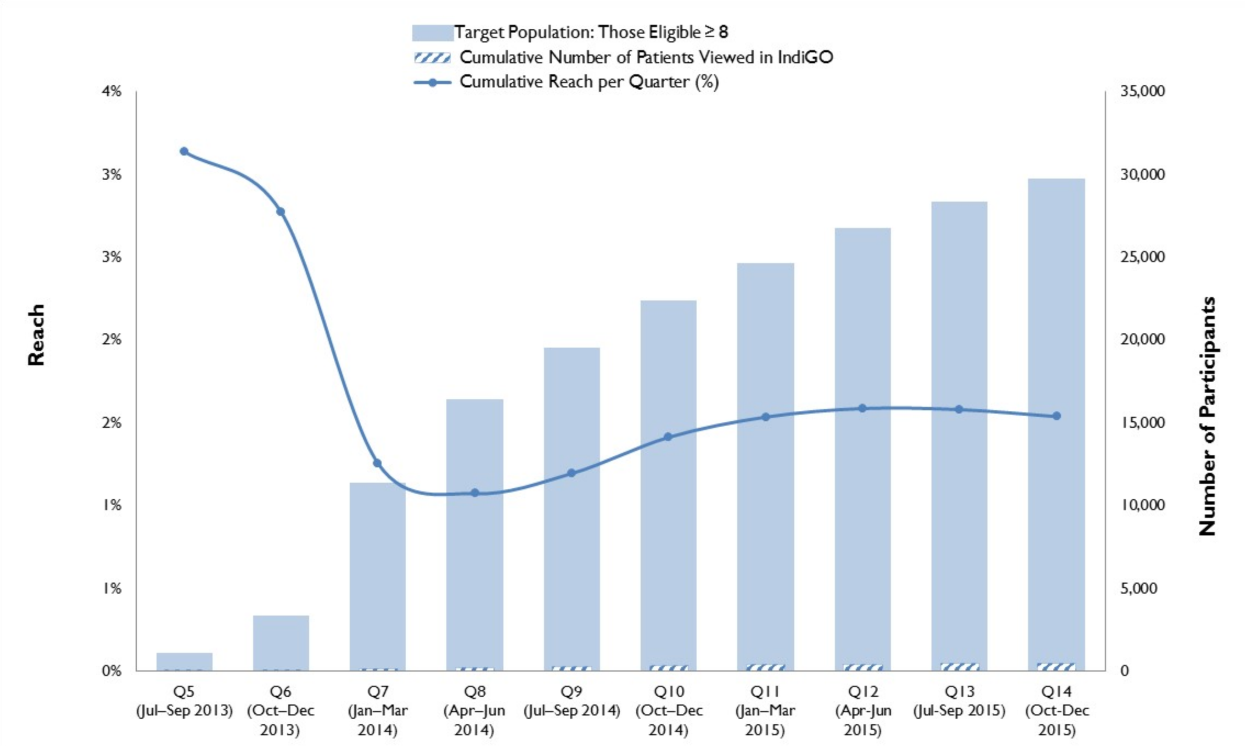
Figure 34. IndiGO Provider Reach since Project Launch (continued)

Quarter	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)	Q13 (Jul–Sep 2015)	Q14 (Oct–Dec 2015)
Cumulative reach per quarter (%)	6.3	9.3	11.4	14.4	17.4	20.0	21.4	22.6	23.1	23.6
Target population	205	646	1,097	1,203	1,253	1,299	1,327	1,355	1,382	1,404
Cumulative number of participants enrolled	13	60	125	173	218	260	284	306	319	331

Figure 35 shows that the number of IndiGO patients eligible for a physician view—those with a benefit score of 8 or greater—increased each quarter. Since Q11, an additional 80 patients had an eligible IndiGO view. However, based on the last five quarters of data from October 2014 through December 2015, the percentage of patients who ever had an IndiGO view (i.e., participants) plateaued at approximately 1.5 percent.

One factor at the organizational level impeded IndiGO reach: The rollout of the new EHR impacted the IndiGO tool given that the IndiGO data are populated from the EHR. Intermountain is working to identify the appropriate data elements in the new EHR for the IndiGO tool, and hopes to dedicate more technical resources as EHR implementation continues. The plateau in IndiGO reach coincides with the EHR implementation. At the provider level, we were unable to speak with an adequate number of providers to determine any provider-level challenges with implementing the tool.

Figure 35. IndiGO Participant Reach since Project Launch

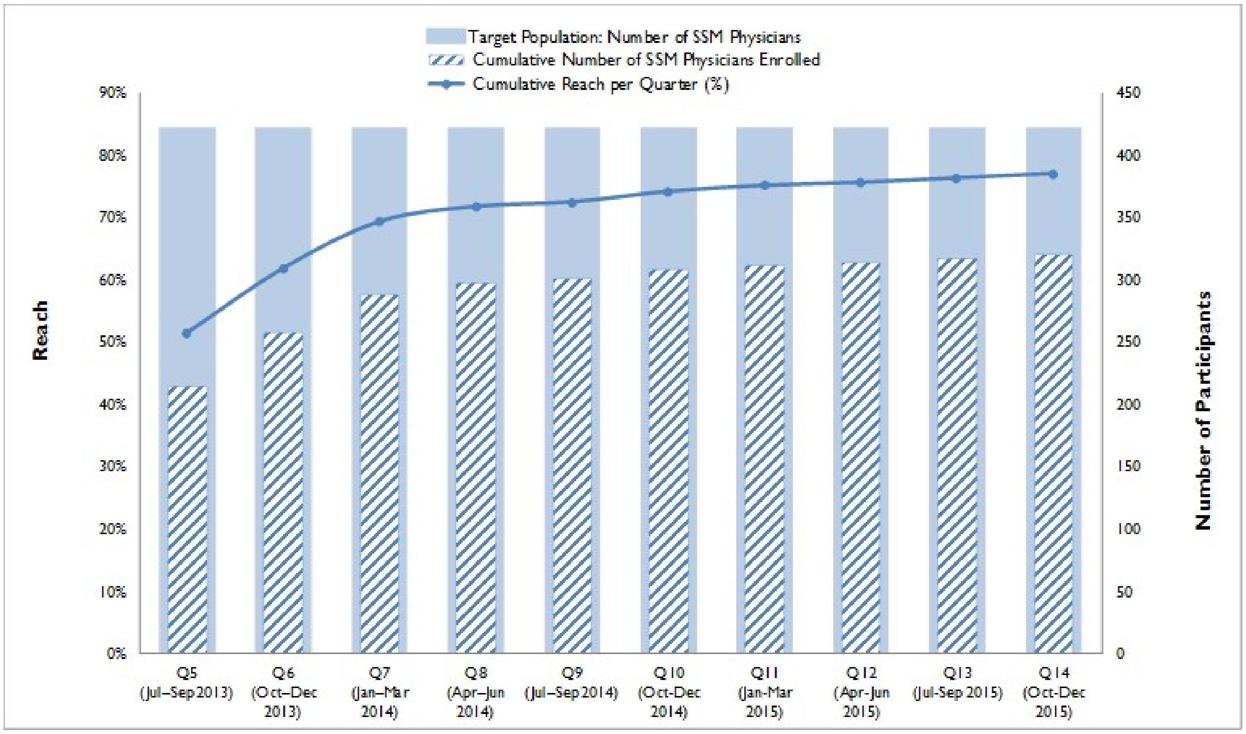


Quarter	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)	Q13 (Jul–Sep 2015)	Q14 (Oct–Dec 2015)
Cumulative reach per quarter (%)	3.1	2.8	1.3	1.1	1.2	1.4	1.5	1.6	1.6	1.5
Target population: Those eligible ≥ 8	542	2,816	10,865	15,863	19,019	21,817	24,061	26,186	27,812	29,230
Cumulative number of patients viewed in IndiGO	17	78	136	170	227	308	369	415	439	449

Source: Patient-level data provided by Intermountain.

Figure 36 shows the number of physicians in the SSM compared with the number of targeted physicians. Intermountain reached three of four targeted (77.1%) physicians for the SSM component of the innovation, a 1.9 percentage point increase since we last reported reach data through Q11 in the 2015 annual report. The SSM was in beta-test to obtain providers' feedback and help better align the incentives. According to key informant interviews, provider participation in this innovation component is relatively successful for several reasons. Primarily, Intermountain's existing infrastructure for the program was already strong. Before receiving HCIA funding, Intermountain began planning for the Population Health organization. Second, engaging physicians and getting their buy-in was key. Last, Intermountain worked to align incentives based on quality of care.

Figure 36. SSM Provider Enrollment and Reach since Project Launch



Quarter	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)	Q13 (Jul–Sep 2015)	Q14 (Oct–Dec 2015)
Cumulative reach per quarter (%)	51.6	61.9	69.4	71.8	72.5	74.2	75.2	75.7	76.4	77.1
Target population: number of SSM physicians	415	415	415	415	415	415	415	415	415	415
Cumulative number of SSM physicians enrolled	214	257	288	298	301	308	312	314	317	320

Source: Patient-level data provided by Intermountain.
SSM = shared savings model.

2.22.2 Innovation Dose

Intermountain captures dose only for the IndiGO component of the innovation. As reported previously, patients who had an IndiGO view in the past year were excluded from additional views because the quality of the conversations and insights did not appear to improve with additional exposure to the tool. We received limited reports of some providers using IndiGO repeatedly with the same patients to assess and manage their risk profiles over time. Nonetheless, without consistent data on IndiGO exposures per patient over time (i.e., how many times providers discussed IndiGO scores with eligible patients), RTI determined the data were not adequate to measure dose for this innovation.

2.23 Qualitative Findings: Sustainability

Since its inception, the innovation was integrated into Intermountain's existing quality improvement culture, making the various components more sustainable. Leveraging existing organizational infrastructure is a major component of Intermountain's sustainability plan. This is evident by the organization's standing committees and workgroups on hot spotting and analytics. Intermountain will continue to assess the impact their hot spotting identification has on costs and utilization. Furthermore, senior Intermountain leaders included IndiGO in its health plan's benefit design and as a shared savings target in 2016. In Q14, Intermountain planned to continue to assess if it is more beneficial to continue contracting for the IndiGO tool or to purchase the company.

2.24 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Intermountain as well as accomplishments to date. In this section, we assess Intermountain's progress on achieving HCIA goals:

- **Smarter spending.** Cohort 1 (IndiGO and SSM) exhibited a nonsignificant rise in spending and Cohort 2 (IndiGO only) exhibited a nonsignificant reduction in spending. Cohort 3 (SSM only) shows significant losses overall.

- **Better care.** Overall innovation period effects for hospital admissions and ED visits for Cohorts 1 (IndiGO and SSM) and 2 (IndiGO only) were not significant. Innovation period trends show a greater likelihood of hospital admission and ED visits over time for Cohort 3 (SSM only). Changes in unplanned readmissions were not statistically significant for any Cohort.

  The percentage of IndiGO providers (23.6%) and patients (1.5%) reached remained low. The vast majority of SSM patients received beta-blockers (96.5%), whereas almost 9 of 10 (89.4%) IndiGO patients received beta-blockers. Additionally, a higher percentage of diabetic SSM patients received HbA1C assessments.

- **Healthier people**. Although it was a provider-targeted component, the SSM drove some positive health trends: the proportion of SSM patients with LDL-C control increased, and the number of patients with PHQ-9 > 10 declined.

Isolating the effects on outcomes for this innovation is difficult because patients could have been involved in other improvement initiatives. Additionally, the SSM remained in beta-test throughout the award. Intermountain used the beta-test period to obtain feedback from providers and refine the quality measures to include in the payment model. Intermountain reached 77 percent of providers for the SSM component and will continue to expand after the award ends. During this pilot phase, results indicate an increase in spending in Cohorts 1 (IndiGO and SSM) and 3 (SSM only), which also coincides with the rise in hospital admissions and ED visits for the SSM cohort. Program leadership elicited feedback from providers to refine the measures included in the SSM. However, we were unable to speak with providers to gain their insights on the SSM, and what might explain the apparent relationship between increases in certain types of utilization (hospital admissions and ED visits) and increased costs for patients in the SSM versus those in the control group. Intermountain developed the SSM component as part of its overall SAO effort. As value-based purchasing efforts like these are typically designed to reduce costs while improving use of appropriate care, it would be important to understand how and why early stage rollout of the SSM appears to have had the opposite effect in some areas.

Cohort 2 (IndiGO only) had a small sample size (434 beneficiaries) and did not reach many of the Medicare beneficiaries or providers. However, this cohort experienced some positive trends such as a significant decrease in acute inpatient stays as well as a decrease in patients' BMI scores in later quarters. Providers used the IndiGO tool to discuss modification of risk factors with their patients. As use of the tool increases and reaches more beneficiaries, more effects may be detected.

Based upon the innovation components, such as the IndiGO tool and population management, more time is needed to fully determine the long-term impact on costs and outcomes among targeted chronic disease patients. We were unable to fully evaluate the population management component because we received very little data (n=109). Expanding the capacity of the Community Care Management and Comprehensive Care Clinic programs will allow more patients identified via hot spotting to receive targeted services and potentially control high utilization. Moreover, the SSM was able to improve health outcomes in some areas, notably LDL-C control in patients with CAD and in the number of patients with lower depression measure (PHQ-9) scores.

The evaluation yields several important lessons, especially in implementation of similar multifaceted innovations. These include:

1. Strong leadership support was key to embedding the innovation components into existing operations. Project leadership ensured that the components remained aligned with other existing initiatives throughout the organization.

2. Lack of adequate technical support impeded progress and reach. The limited technical resources were dedicated to other competing initiatives (Meaningful Use, medical home, EHR implementation, ICD-10 conversion). The EHR implementation was particularly critical to IndiGO implementation because data to populate IndiGO needed to be pulled from the EHR.

3. Integrating the award into existing organizational infrastructure benefited sustainability, but also challenged organizational capacity. Intermountain could have leveraged its extensive experience with other large quality improvement initiatives to detail the technical staffing needs at the start of the project. The project may have benefitted from hiring more project team members who were dedicated to physician outreach for the IndiGO tool.

With a history of innovation in quality improvement and use of health IT, the Intermountain HCIA Innovation illustrates the difficulty of implementing—and evaluating—multiple, concurrent, and overlapping initiatives focused on improving costs, utilization, and outcomes. More consistent access to data and discussions with implementation staff and innovation participants is critical to determining the impact of isolated innovation components as well as the possible interrelationship between these components and other organizational improvement efforts.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Intermountain Healthcare, Inc. (Intermountain)

Intermountain Healthcare, Inc. (Intermountain), is a nonprofit integrated health care system headquartered in Salt Lake City, Utah. It encompasses 22 hospitals, more than 150 clinics, and the SelectHealth plan that insures 750,000 people in the state (about one-third of the population). Intermountain was awarded $9,724,142 (and began enrolling participants in June 2013) to develop and pilot its unique "disruptive innovation."

Awardee Overview

Innovation dose:	No data were available to assess dose for this innovation.	***Innovation reach:***	Less than one in four (23.6%) of activated physicians had at least one qualified IndiGO view, an increase of 2.2 percentage points since last reported in the 2015 annual report. 1.5% of IndiGO patients had a qualified view. The innovation reached 77.1% of the target number of physicians for SSM.
Components:	(1) Patient engagement (IndiGO) (2) Population management (hot spotting) (3) Shared Savings Model (SSM)	***Participant demographics:***	In IndiGO and SSM, most participants were aged 65 and older (96.4% and 87.9%, respectively) and were female (52.3% and 56.4%, respectively). Almost all participants for whom we received data were covered by Medicare.
Sustainability:	Integrated the IndiGO tool into the health plan design and the shared savings targets for providers.		
Innovation type:	Health IT	Decision support	Provider payment reform

Key Findings

Smarter spending. Cohort 1 (IndiGO and SSM) exhibited a nonsignificant rise in average quarterly spending ($92; 90% CI: −$436, $619) and Cohort 2 (IndiGO only) exhibited a nonsignificant reduction in spending (−$156; 90% CI: −$503, $191). Cohort 3 (SSM only) showed significant losses overall ($582; 90% CI: $522, $642).

Better care. Overall average effects for ED visits per 1,000 participants per quarter were not significant for Cohorts 1 (IndiGO and SSM) (−15; 90% CI: −43, 14) and 2 (IndiGO only) (0; 90% CI: −12, 11). Overall average effects for hospital admissions per 1,000 participants per quarter were not significant for Cohorts 1 (IndiGO and SSM) (2; 90% CI: −14, 19) and 2 (IndiGO only) (−6; 90% CI: −15, 2). Innovation period trends showed a greater likelihood of hospital admission per 1,000 participants per quarter (19; 90% CI: 17, 20) and ED visits per 1,000 participants per quarter (27; 90% CI: 24, 29) over time for Cohort 3 (SSM only). Changes in unplanned readmissions were not statistically significant for any cohort.

The percentage of IndiGO providers (23.6%) and patients (1.5%) reached remained low. The vast majority of SSM patients received beta-blockers (96.5%), whereas almost 9 of 10 (89.4%) IndiGO patients received beta-blockers. Additionally, a higher percent of diabetic SSM patients as compared to IndiGO patients received HbA1C assessments (68% versus 32%).

Healthier people. Although it was a provider-targeted component, the SSM drove some positive health trends: the proportion of SSM patients with LDL-C control increased from 14 to 22 percent.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Mary's Center for Maternal and Child Care

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Mary's Center for Maternal and Child Care

2.1 Introduction

Mary's Center for Maternal and Child Care (Mary's Center) is a federally qualified health center (FQHC) in Washington, DC, that provides health care, social services, and family literacy programs and is the fiduciary agent (awarded $14,991,005, began enrolling in February 2013) to establish the Capital Clinical Integrated Network (CCIN). CCIN is a new entity with 501(c)(3) status that used community health workers (CHWs) and a combination of high-touch and high-tech strategies to improve access to and coordination of primary care, primarily for Medicaid beneficiaries. This report uses the term CCIN to refer to the awardee. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending related to hospitalization, ED use, prescription drug use, primary care visits, and specialty visits by $17,712,000.

2. **Better care.** Increase patient enrollment in primary care with timely, coordinated access to relevant health care information.

3. **Healthier people**. Improve control of asthma through appropriate medication use and reduce blood pressure below 140/90 mm Hg in patients with hypertension.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter* (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by CCIN and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	CCIN delivered care coordination using CHWs and implemented a HIE according to plan, but did not execute the shared savings payment model due to changes in the local Medicaid MCOs.
Program Participant Characteristics	
	Most participants (65.4%) were 25–64 years of age. More than half (61.2%) were female. Among those with data for race/ethnicity and payer category, most participants were black and were covered by Medicaid (i.e., 82.7% and 96.4%, respectively).

(continued)

Table 2 Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Workforce Development	
Hiring and retention	Since the second annual report (2015), five separations took place.
Skills, knowledge, and training	42 trainees; 168 training hours were offered in Q11 and Q12.
Context	
Award execution	Spending rates for Year 3 budget were 29.9% below projection.
Leadership	In Q11, CCIN's director of clinical services resigned. However, CCIN leadership buy-in remained high.
Organizational capacity	During Year 2, CCIN received 501(c)(3) status and the CPC–HIE was accredited by the Electronic Healthcare Network Accreditation Commission.
Innovation adoption and workflow integration	The CPC–HIE connected to the Maryland Health Information Exchange known as CRISP in August 2015.
Implementation Effectiveness	
Innovation reach	16.2% of the target population (2,963) was enrolled in Q12.
	Of the 587 providers reported to have access to the HIE through Q12, 95 used the HIE to assist with patient care.
Innovation dose	Participants received more phone calls through Q12 than through Q11, on average (as reported in the 2015 annual report): 8.4 versus 7.5 calls per patient. As of Q12 93% of participants completed a care plan with a CHW.
Sustainability	
	The CPC–HIE is being used by GWU to conduct a HCIA Round 2 project that is expected to sustain the HIE for 3 years.

Sources: *Q11–Q12 Narrative Progress Report*.
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted February–June 2015.

CCIN = Capital Clinical Integrated Network; CHW = community health worker; CPC–HIE = Capital Partners in Care–Health Information Exchange; CRISP = Chesapeake Regional Information System for our Patients; GWU = George Washington University; HCIA = Health Care Innovation Awards; HIE = health information exchange; MCO = managed care organization; Q = quarter.

2.1.1 Innovation Components

This innovation had three components: care coordination using CHWs, a health information exchange (HIE) developed by CCIN, and a shared savings model to sustain the initiative after the grant funding period ended.

The first component, care coordination, used trained CHWs to facilitate behavior changes among high ED users with one or more chronic diseases in the greater Washington, DC, area through a series of home visits. The CHWs reported to RN care coordinators who distributed work among the CHWs and supported CHWs. The CHWs provided health education, created a care plan, and helped participants set goals, manage medications, and coordinate services. CCIN also used a customized care management technology platform, SyntraNet, to support this component. SyntraNet captured CHW report information and allowed CCIN to manage CHW staff and track patient progress toward achieving care plan goals in addition to supporting analysis of claims data.

The second component, Capital Partners in Care–Health Information Exchange (CPC–HIE), developed by CCIN, connected the electronic health records (EHRs) of subscribing clinics and hospitals. The HIE provided a single login Web portal to access participant health information. Since the first annual report, the CPC–HIE connected the initial five subscribing clinics and Providence Hospital's ambulatory care clinic, outpatient hospital services, and laboratory and radiology departments to the HIE. SyntraNet is also connected to CPC–HIE.

The third component, a shared savings model, was not implemented. Savings from reduced ED use realized through care coordination provided by CHWs were to be divided 50/50 between the payer and providers on the basis of quality and savings benchmarks, after deducting the cost of the grant. This model and the Mary's Center HCIA grant application were developed with input from local managed care organizations (MCOs) operating in Washington, DC, which were committed to participating in the project. Medicaid terminated contracts with these MCOs at the start of the project period and instead contracted with different MCOs. Despite ongoing effort during the implementation period, little progress was made in engaging the current MCOs to produce a significant volume of patients and contribute to CCIN's sustainability.

Table 3 displays the partners for this innovation. During Year 3, a previous partner, Medical Mall Health Services, left the innovation because of organizational restructuring.

Table 3. HCIA Partners, Roles, and Location

Partner Name	Role in HCIA Project	Location
Thrasys, Inc.	Health information technology vendor	San Francisco, CA
Mary's Center for Maternal and Child Care	Fiduciary agent, medical provider, and HUB partner that helped create and is a close partner to CCIN	Washington, DC
District of Columbia Department of Health Care Finance	District Medicaid/Medicare agency/claims data provider	Washington, DC
Unity Health Care	Partner medical provider, HUB partner	Washington, DC
AmeriHealth DC	District Medicaid MCO, HUB partner	Washington, DC
Trusted Health Plan	District Medicaid MCO, HUB partner	Washington, DC
La Clinica del Pueblo	Care partner, partner on the technology committee	Washington, DC
So Others Might Eat	Care partner, partner on the technology committee	Washington, DC
Bread for the City	Care partner, partner on the technology committee	Washington, DC
Providence Hospital and Physician Enterprise	Care partner, partner on the technology committee	Washington, DC
DC Primary Care Association	HUB implementation and governance	Washington, DC
Street Calls	Transportation partner	Washington, DC
MTM, Inc.	Transportation partner	Washington, DC
Battle's Transportation	Transportation partner	Washington, DC
George Washington University School of Medicine, Department of Research and Evaluation	New HCIA round two awardee works with CCIN to enhance technology and workforce infrastructure	Washington, DC
Sirona	Nurse triage phone service	Portland, ME

CCIN = Capital Clinical Integrated Network; HCIA = Health Care Innovation Awards; MCO = managed care organization.

2.1.2 Program Participant Characteristics

Table 4 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report through Q11. The distribution of patient characteristics is similar to that in the 2015 annual report. More specifically, at enrollment, most participants (65.4%) were 25–64 years of age and more than half (61.2%) were female. Race/ethnicity was missing for more than half of participants (56.6%), but for those with data, most (82.7%) were black. Among those with data for the payer category, 96.4% were covered by Medicaid.

Table 4. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	2,963	100.0
Age		
< 18	586	19.8
18–24	165	5.6
25–44	725	24.5
45–64	1,212	40.9
65–74	173	5.8
75–84	56	1.9
85+	30	1.0
Missing	16	0.5
Sex		
Female	1,812	61.2
Male	1,115	37.6
Missing	36	1.2
Race/ethnicity		
White	7	0.2
Black	1,064	35.9
Hispanic	192	6.5
Asian	0	0.0
American Indian or Alaska Native	7	0.2
Native Hawaiian or other Pacific Islander	0	0.0
Other	17	0.6
Missing/refused	1,676	56.6
Payer category		
Dual	0	0.0
Medicaid	2,330	78.6
Medicare	88	3.0
Medicare Advantage	0	0.0
Other	0	0.0
Uninsured	0	0.0
Missing	545	18.4

Source: Patient-level data provided to RTI by Capital Clinical Integrated Network.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient and ED visits that did not lead to a hospitalization. We were unable to calculate inpatient admission or readmission rates due to limitations in the claims data, as described below. These measures will be calculated in future reports if the appropriate data are obtained. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation was addressing the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 5 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 5. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	No
		Hospital unplanned readmissions rate	No	No
		ED visit rate	No	Yes
	Cost	Spending per patient	No	Yes
		Estimated cost savings	No	No

ED = emergency department.

At this time, the Centers for Medicare & Medicaid Services Alpha-MAX data files are not available for the period after the innovation was launched. We were able to analyze Medicaid fee-for-service and managed care claims data obtained directly from CCIN on patients enrolled in the innovation. However, CCIN did not provide data on Medicaid enrollment spells for beneficiaries participating in the innovation. Because we do not have data on the dates individuals were enrolled in Medicaid, we used the date of their first positive expenditure claim for that individual (Medicaid fee-for-service or managed care) as their Medicaid start enrollment date and the last positive expenditure claim as their enrollment end date.

We know that Medicaid beneficiary enrollment can be volatile, with individuals enrolling and dis-enrolling throughout the year, and using expenditures as a proxy for enrollment dates may consequently under- or overestimate actual enrollment at any given time. An individual could be enrolled outside the window of the first and last claim but still enrolled during the overall study period; conversely, an individual could have a period of disenrollment within the window of the first and last claim. Our approach represents the best possible estimate of enrolled Medicaid beneficiaries given the available information. Because many of the enrolled patients are high users with one or more chronic conditions, periods of positive Medicaid expenditures likely represent periods of Medicaid eligibility. Further, any impact of the assumption of the number of enrolled Medicaid beneficiaries should be similar for both pre- and post-innovation periods and, thus, trends over time should not be greatly affected by our imputation of Medicaid enrollment periods.

2.3 Medicaid Spending

2.3.1 Descriptive Results

Table 6 reports Medicaid spending per patient in the eight quarters before and the 11 quarters after enrolling in the innovation. ***Figure 1*** illustrates the Medicaid spending per innovation beneficiary in Table 6. For fee-for-service claims, spending per beneficiary represents the amount Medicaid paid to the provider, and for managed care claims, it represents the fee-for-service equivalent amount that the managed care organization paid for an encounter claim (amount used only for statistical purposes to represent the amount that Medicaid would pay in the absence of capitation rates).

The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Although the time series exhibits a high degree of variability, the baseline trend line for spending is increasing over time. In innovation quarters 4–11 average spending decreases relative to the trend line from the baseline quarters; however, as shown in Table 6, the standard deviation for spending is very high.

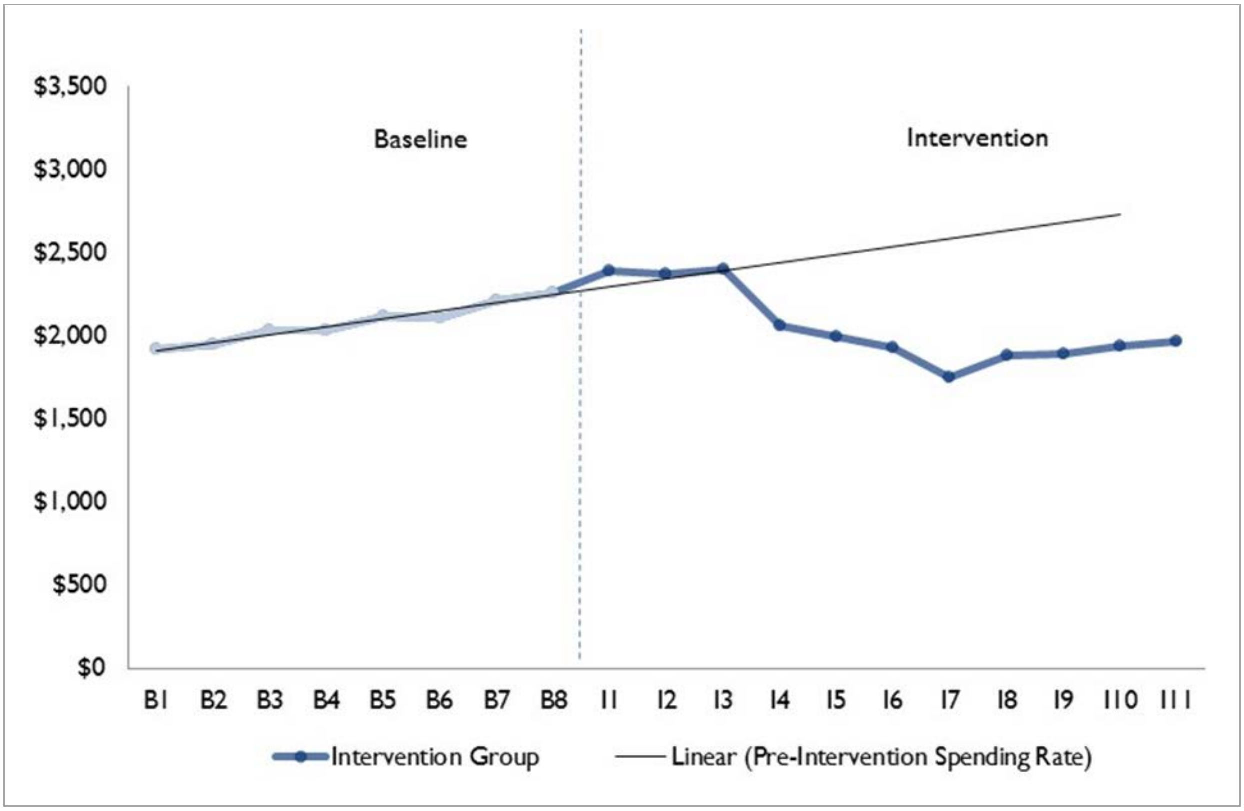
Table 6. Medicaid Spending per Participant: CCIN

Awardee Number: 1C1CMS331074
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$1,919	$1,950	$2,035	$2,032	$2,114	$2,106	$2,217	$2,262	$2,389	$2,372	$2,405	$2,058	$1,999	$1,928	$1,756	$1,881	$1,894	$1,936	$1,969
Std dev	$2,569	$3,016	$3,033	$2,919	$3,029	$2,789	$5,471	$3,408	$4,434	$3,650	$5,886	$2,985	$3,511	$3,923	$2,315	$2,754	$2,626	$2,288	$2,065
Unique patients	2,323	2,362	2,404	2,437	2,461	2,482	2,495	2,495	2,489	2,475	2,385	2,232	2,054	1,752	1,361	1,063	789	522	241
Comparison Group																			
Spending rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Savings per Patient																			
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Quarter 1; CCIN = Capital Clinical Integrated Network; I1 = Innovation Quarter 1.
— Data not yet available.

Figure 1. Medicaid Spending per Participant: CCIN



Source: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
CCIN = Capital Clinical Integrated Network.

2.4 Medicaid Emergency Department Visits

2.4.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 7*** and ***Figure 2.*** The ED visit rate trend line slopes up before enrollment for the innovation group. ED visits decrease in post-enrollment quarters until I7 when the ED visit rate increases but remains below the trend line. On average, the ED visit rate is lower in innovation quarters than in baseline quarters. Further statistical testing using a comparison group and multivariate analyses is required to draw more definitive conclusions about the impact of the innovation.

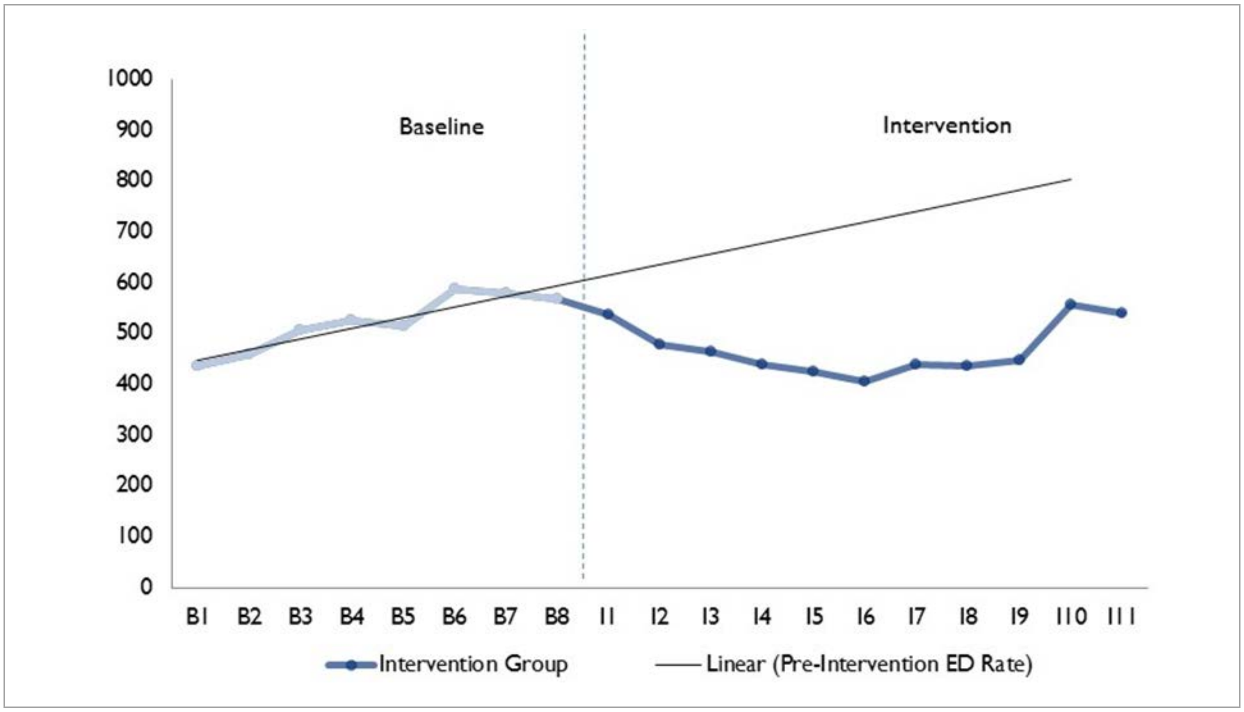
Table 7. ED Visits per 1,000 Participants: CCIN

Awardee Number: 1C1CMS33107
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	436	458	505	526	516	588	578	567	536	479	463	438	425	406	440	436	449	556	539
Std dev	1,067	1,368	1,302	1,267	1,276	1,477	1,757	1,650	1,657	1,830	1,563	1,397	1,311	1,232	1,321	998	970	1,076	953
Unique patients	2,323	2,362	2,404	2,437	2,461	2,482	2,495	2,495	2,489	2,475	2,385	2,232	2,054	1,752	1,361	1,063	789	522	241
Comparison Group																			
ED rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																			
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Quarter 1; CCIN = Capital Clinical Integrated Network; ED = emergency department; I1 = Innovation Quarter 1.
— Data not yet available.

Figure 2. ED Visits per 1,000 Participants: CCIN



Source: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
CCIN = Capital Clinical Integrated Network; ED = emergency department.

2.5 Discussion: Medicaid Results

Starting in the first year of the innovation, the rate of ED visits decreased for the entire innovation period. Spending also decreased relative to the trend line, but the decrease was slightly lagged, beginning after the fourth quarter of the innovation period. We were unable to calculate inpatient admission or readmission rates because of limitations in the claims data. Alpha-MAX data files were not available for the innovation period. However, we were able to analyze Medicaid fee-for-service and managed care claims data obtained directly from CCIN on patients enrolled in the innovation. This report uses data received from CCIN in December 2015. We received updated claims data from the awardee in June 2016; however, this did not leave adequate time to complete an analysis of the new data for this report. The final evaluation report will include analyses using the June 2016 data extract.

These beneficiaries represent most of the overall population reached by the innovation (84%).

2.6 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

CCIN submitted data to RTI that are current through June 2015. ***Table 8*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for each of these measures are included in this annual report.

Table 8. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Hypertension	Percentage of patients with hypertension who had a blood pressure reading documented	Data received from CCIN	Yes
Health outcomes	Hypertension	Percentage of patients with hypertension with their last blood pressure <140/90 mmHg	Data received from CCIN	Yes

Clinical effectiveness refers to the extent to which patients with certain health conditions are provided with appropriate clinical care. Clinical effectiveness measures for CCIN include the percentage of participants with hypertension who received a blood pressure reading and those with hypertension whose blood pressure reading was 149/90 mmHg. We examined blood pressure control among those with hypertension.

2.7 Hypertension

CCIN provided data on whether patients with hypertension received a blood pressure reading, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation. Blood pressure data for those with hypertension allowed us to address the question of whether the percentage of patients with hypertension with blood pressure control increased over the course of the innovation.

Evaluation Questions

- What percentage of patients with hypertension received a blood pressure reading during the innovation period?
- Has the percentage of hypertension patients with blood pressure control increased over time among those enrolled in the innovation?

2.7.1 Descriptive Results

Table 9 shows the percentage of patients who received clinical services. As shown in the table, most patients with hypertension (73.1%) had their blood pressure taken at least once during their enrollment period.

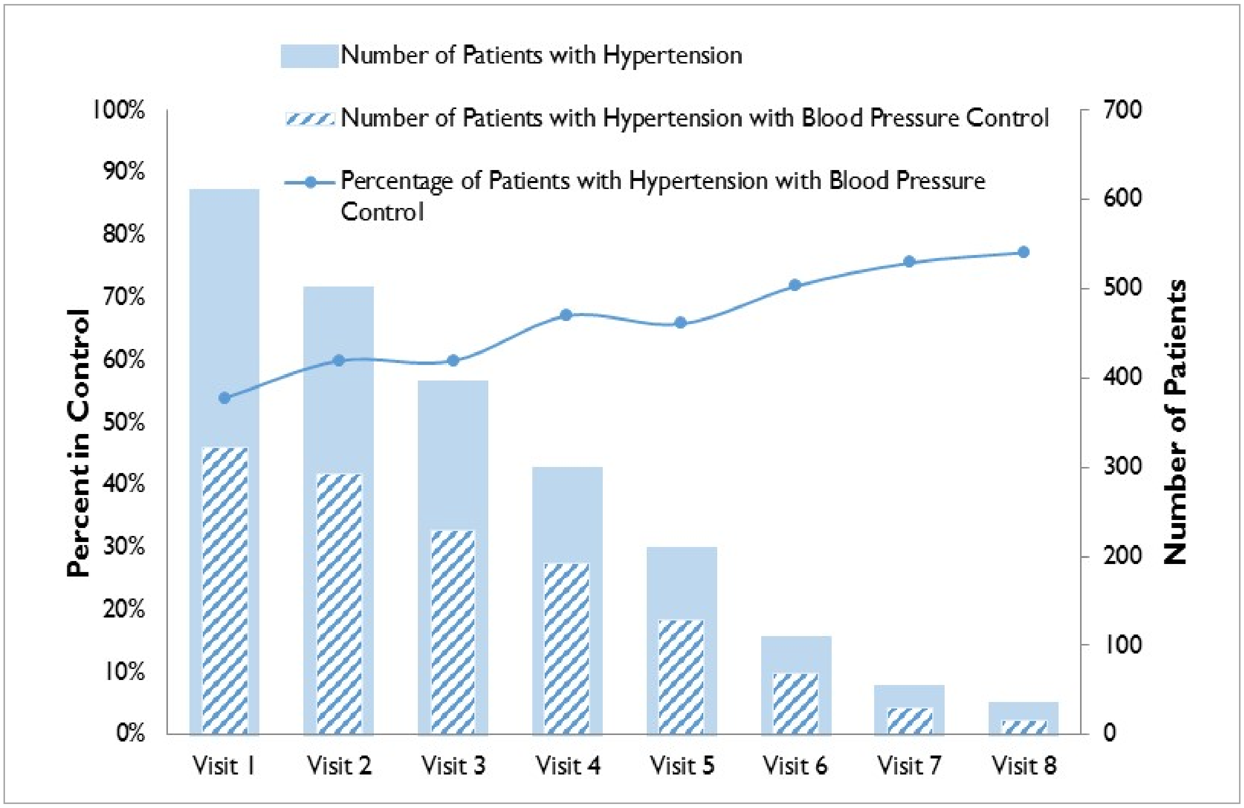
Table 9. Percentage of Patients with Hypertension who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Hypertension (n=668)	
Percentage of patients with hypertension who had a blood pressure reading	73.1%

Source: Patient-level data provided to RTI by CCIN.

Figure 3 provides the percentage of participants with hypertension with blood pressure control by CHW visit number. As shown, the percentage of patients with hypertension with blood pressure below 140/90 mm HG increased as the number of visits increased. More specifically, for the first visit, the percentage of patients with blood pressure control was more than half (53.9%). By the fourth visit, 67 percent were in control, and by the eighth visit, more than three-quarters (77.3%) were in control. However, the denominator decreases with each visit, and by the eighth visit is extremely small in comparison with the starting number of participants.

Figure 3. Percentage of Participants with Hypertension with Blood Pressure Control by Visit



(continued)

Figure 3. Percentage of Participants with Hypertension with Blood Pressure Control by Visit (continued)

	Visit Number	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8
●	Percentage of patients with hypertension with blood pressure control	53.9	59.9	59.9	67.1	65.8	71.9	75.6	77.3
	Number of patients with hypertension	597	489	384	286	196	96	41	22
	Number of patients with hypertension with blood pressure control	322	293	183	151	96	56	31	17

Source: Patient-level data provided to RTI by CCIN.

2.8 Discussion: Awardee-Specific Data

CCIN targeted Medicaid recipients who were high-cost/high-ED users. By teaming patients with CHWs to perform home visits and help patients navigate their health care into a clinic setting, costs can be reduced and overall health can be improved. Although a specific disease or condition was not required to enroll in the program, patients with hypertension, diabetes, and asthma were targeted. Data provided to RTI showed that as the number of home visits increased among patients enrolled in the program, the percentage of individuals with hypertension and blood pressure control increased. An implication of this finding is that patients who were invested in the program received more home visits and were more likely to work on improving their health conditions (although data were limited because of the small number of participants who received a seventh home visit).

2.9 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 10*** lists the quantifiable measures of implementation and their status as of June 30, 2015 that RTI obtained from CCIN's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in Sections 2.22 through 2.25 are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 10. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	Quarterly Awardee Performance Reports
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	Quarterly Awardee Performance Reports
Workforce development	Staffing	Number of FTE staff in Q12	Quarterly Awardee Performance Reports
	Training hours	Number of training hours in Q11 and Q12	Quarterly Awardee Performance Reports
		Cumulative number of training hours since inception	Quarterly Awardee Performance Reports
	Trainees	Number of trainees in Q11 and Q12	Quarterly Awardee Performance Reports
		Cumulative number of trainees since inception	Quarterly Awardee Performance Reports
Implementation effectiveness	Reach	Number/percentage of people recruited who were enrolled	Data received from CCIN
		Percentage of providers using HIE for patient care	Data received from CCIN
	Dose	Number of care plans completed by participants	Data received from CCIN
		Number and types of CHW contacts per participant	Data received from CCIN

CHW = community health worker; FTE = full-time equivalent; HIE = health information exchange; CCIN = Capital Clinical Integrated Network; Q = quarter.

2.10 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.10.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed to meet the demand of lower-than-expected patient enrollment with 30.3 full-time equivalent (FTE) staff members. During Q12, patient recruitment was discontinued to ensure those enrolled in the program experienced the entire 90 days of innovation services before September 2015. No additional staff were added during Q12 due to uncertain funding after September 2015. A small core staff located within Mary's Center continued to seek additional contracts and resume operations after the award period ended.

CCIN anticipated that staffing separations would increase as the end of the award approached. CCIN planned to hire staff for contract negotiations, marketing and communications, and community relations if additional funding had been secured, but it has instead ceased operating. CCIN sought funding from community partners and other MCOs and planned to partner with George Washington University (GWU) to conduct the HCIA Round Two Prevention at Home (PAH) project awarded by CMS. CCIN planned to provide CHWs to perform community outreach and use their SyntraNet care management system paired with the CPC–HIE. GWU elected to use the CPC–HIE but not SyntraNet and has hired former CCIN CHW staff directly rather than contract with CCIN.

CCIN identified many lessons learned with respect to hiring CHWs from their implementation experience. Initially, they sought to hire CHWs with managerial experience, but CCIN ultimately found that their most successful staff were instead distinct in terms of their personality. Effective CHWs took initiative, were gregarious, and could assert themselves in a hospital setting. Separations that occurred in the first few years of the award became less common after CCIN restructured their hiring processes to better attract and identify such individuals.

2.10.2 Skills, Knowledge, and Training

Between Q11 and Q12, CCIN provided 168 hours of training to 42 individuals. Throughout implementation, CCIN trained CHWs to orient newly hired CHW supervisors and CHWs to the innovation, recruitment strategies, the SyntraNet care coordination system, and their responsibilities. During Q11 and Q12 CCIN offered only health education topics training. CHW training and SyntraNet training were not offered because there were no new hires during Q11 or Q12.

CCIN viewed training as key to staff retention and staff satisfaction. Training that was particularly useful focused on data collection and reporting to ensure timely access to accurate data by the entire care team. One CCIN leader confirmed the success of this approach: *"The cohort [of CHWs] hired 9 months to a year ago was entirely successful."*

CCIN further developed its workforce by providing opportunities for advancement. In response to a staff satisfaction survey, they developed the CHW II position, which entailed mentoring and reviewing visit records with entry-level CHWs, interviewing CHW candidates, and contributing to hiring decisions. CHW IIs also led CHW meetings and acted as liaisons between the administrative staff and the CHWs to better understand the CHWs' needs and concerns.

Table 11. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	168	42
Since inception	6,028	315

Note: Trainees are counted more than once if they participated in more than one HCIA training course. Q = quarter.

2.11 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

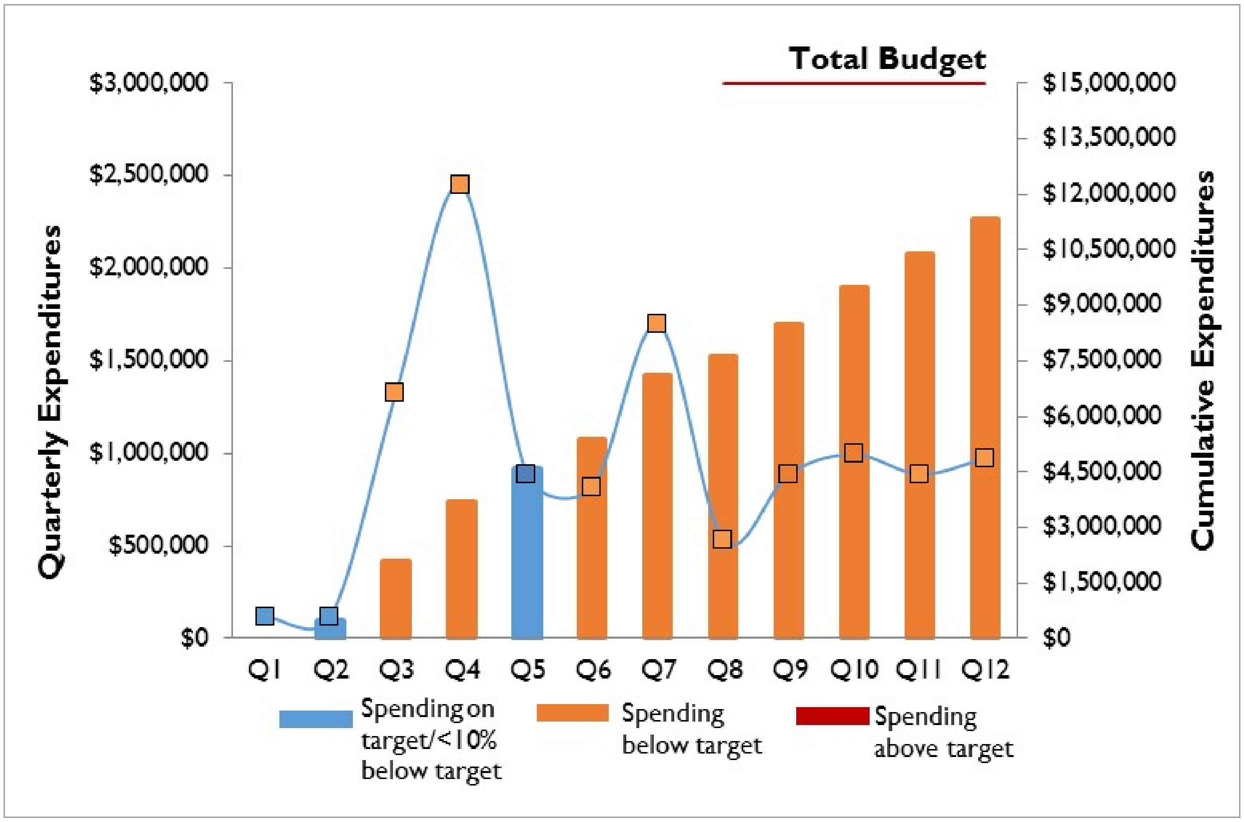
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient overall organizational capacity and leadership to implement the innovation effectively?
- How has the awardee facilitated innovation adoption and workflow integration?

2.11.1 Award Execution

The annual report highlights the significance of CCIN's expenditure rates on implementation. As of June 2015 (Q12), CCIN spent 75.8 percent of its total budget, which is below the projected target (***Figure 4***). Spending for Year 3 was below projection because CCIN had fewer staff members than expected. However, CCIN was fully staffed to meet the needs of clients and referrals in the final quarters of the project.

Figure 4. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.11.2 Leadership

CCIN was a newly formed entity with 501(c)(3) status created with HCIA funds awarded to Mary's Center for this innovation. Therefore, CCIN leadership had no competing priorities and dedicated all efforts to successfully implementing and sustaining the innovation. CCIN was a separate entity where one person served as chief operating officer for both CCIN and Mary's Center. Mary's Center's support for the innovation was consistent and unwavering, and they continued to support CCIN and participate in the innovation throughout the project period.

CCIN leadership established a participatory approach to HIE governance. A governance body representing CCIN, the DC Primary Care Association (DCPCA), and subscribing organizations met weekly to discuss implementation and policy issues for HIE operation. Five FQHCs participated in this group (Mary's Center, Unity, Inc., Bread for the City, La Clínica del Pueblo, and So Others Might Eat). The goal of the weekly meeting was to ensure that each organization subscribing to the HIE provided input into implementation and operations of the HIE. CCIN aimed to ensure that all concerns of the subscribing clinics and hospitals were addressed and, in doing so, facilitated HIE adoption by the providers at these clinics and hospitals. CPC–HIE differed from previous attempts to establish an HIE in DC. Most participating providers used eClinicalWorks as their EHR, which reduced technical challenges to integrating numerous sources of health data. CCIN demonstrated the benefits of this more manageable, lower-cost system to local providers, which increased their enthusiasm for and acceptance of HIE.

In Q11, CCIN's director of clinical services (DCS) left the organization, leaving a gap in leadership and supervision of the RN care coordinators who oversaw and worked with CHWs. The chief nursing officer temporarily supervised the RN care coordinators. While CCIN believed both positions were necessary for sustainability, they planned to delay filling the vacant DCS position until after additional funds had been acquired to continue the program. As noted in Section 2.22.1 under hiring and retention and in Section 2.25 under sustainability, CCIN continued to attempt to establish contracts with community partners, MCOs and GWU, and continued to work with the DC Department of Health Care Finance (DHCF) to advocate for reimbursements amendments.

2.11.3 Organizational Capacity

Prior to the award, CCIN worked with the two DC MCOs under contract with CMS to design the innovation and develop the award application. Both MCOs agreed to participate in the shared savings component and give CCIN lists of high-cost clients to receive additional care management from CHWs during the innovation period. After grant award, those MCO contracts were dissolved and new contracts with different MCOs (AmeriHealth DC and Trusted Health Plan) were executed. This situation became an intractable political issue; despite repeated attempts, CCIN had little success working with DHCF to engage these MCOs and obtain patient lists. The primary source of patients that CCIN was designed to serve failed to materialize; far fewer participants were recruited than planned during the innovation. The yield from supplemental sources, such as door-to-door efforts and clinic referrals, allowed CCIN to test their HIE-based care coordination model but could not provide the large numbers of patients originally targeted. CCIN had capacity to coordinate care for additional participants, but never obtained a reliable source for identifying and enrolling patients at the scale originally envisioned.

During 2015, CCIN continued to work with DHCF to engage the newly awarded DC MCOs in the shared savings model but did not make progress. The challenge, according to CCIN, was that the MCOs had no incentive to work with CCIN because (1) the MCOs already received a care management fee and (2) the risk of joining the innovation outweighed the potential benefit (the shared savings) that might have been achieved.

CCIN's perspective is that this issue could have been easily resolved by a directive from CMS instructing the MCOs to participate. Without such a directive, DHCF and the MCOs viewed it as voluntary participation in an experiment with more negative potential than positive. Potential shared savings were seen as hypothetical and delayed at best. In addition, participation was seen as self-defeating: the greater the savings realized through cost reduction, the greater the likelihood these new-to-market MCOs would appear ineffective, which could jeopardize their ability to secure future contracts. DHCF and the MCOs preferred that Medicaid develop and implement a sustainable way to pay for care coordination rather than endorse CCIN's approach and then seek a sustainable funding mechanism.

Despite these obstacles, the support for CHW-enabled care coordination appears to be gaining momentum in DC. In Q11, CCIN participated in a CHW community-wide workgroup commissioned by DHCF. DHCF asked the workgroup to provide recommendations on CHW certification and billing. DHCF also wanted the workgroup to create standards of education and training as well as guidance on payment levels for CHW care coordination.

The CPC-HIE, overall, fared better than the care coordination model. CCIN's information technology (IT) staff successfully established the CPC–HIE, which connects participating clinics and hospitals to the care management database (SyntraNet). DHCF continued to support the CPC–HIE by advocating for transfer of claims data directly to participating clinics. Using this data, clinics could identify populations that would be eligible for CCIN's care management services. Although the CPC–HIE had not received EHNAC accreditation at the time of this report, it is considered the most sustainable part of the innovation because of its value to participating organizations as a long-term regional asset. As of February 2015, the CPC–HIE connected Providence Hospital, Unity Health Care, Mary's Center, La Clinica del Pueblo, So Others Might Eat, and Bread for the City.

CCIN maintained positive trends in its own process, outcome, and access measures during Q12. CCIN attributed these trends to implementation of a quality improvement (QI) committee, development of a QI process, ongoing technical assistance by outcomes/program implementation staff, and a well-trained clinical team of RNCCs and CHWs that continued to refine program implementation, quality of documentation, and quality of interaction with participants.

2.11.4 Innovation Adoption and Workflow Integration

Subscribing clinics and hospitals successfully adopted and implemented the CPC–HIE. CCIN worked with eClincalWorks, an EHR provider for many of the subscribing clinics, to develop a single login screen for the CPC–HIE. The single login screen was key to successful implementation because it substantially reduced the changes in workflow that would otherwise have been required to implement the HIE. This facilitated HIE adoption and buy-in and increased interoperability between the existing EHRs and the HIE.

During the award closeout period, CCIN continued to encourage participating clinics to adopt the CPC–HIE. They planned to expand the CPC–HIE to include additional clinics and to connect the CPC–HIE to CRISP, the Maryland HIE. CCIN reported that the CPC–HIE increased both the number of users and the number of patient records. As of Q12, CCIN reported that the CPC–HIE contained 254,806 patient records. Although the grant award period ended June 30, 2015, GWU's use of the CPC–HIE for their HCIA Round 2 PAH Project is expected to sustain the HIE for the next 3 years.

As noted in the 2015 annual report, two providers reported that the innovation simplified workflow. One noted that access to information was *"easy; just open another section of the EMR."* These observations confirmed the value of the CPC–HIE with integrated SyntraNet case management information.

As the innovation progressed, CCIN learned the importance of proper, timely use of the case management system. As noted in the 2014 annual report, after the initial rollout, providers indicated that they wanted more information, sooner, about the services provided by CCIN CHWs. In response, CCIN trained CHWs to update the case management system promptly, and, as needed, nurse managers provided hands-on assistance to CHWs to improve the timeliness of SyntraNet recordkeeping. These efforts succeeded; during the 2015 site visit, two providers noted that timely access to this information had improved.

By design, the innovation originally featured little direct interaction between CHWs and providers, but this was not well received by providers. One provider said, *"The idea of having a member of the care team to address these challenges is great. But physically removing CHWs from where you [the clinician] are working creates new communication barriers."* A member of the CCIN leadership team conceded that the original plan of having CHWs exclusively located outside the clinical setting *"might not have been the best approach."* To address these concerns, CHWs were periodically scheduled to work on site at clinics with positive results. This increased direct interaction and improved communication between CHWs and other members of the care team. One provider representative also noted that the onsite CHW was particularly helpful at her small clinic because *"it reminds clinicians that this new valuable resource exists."*

2.12 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness measured the extent to which (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addressed the following question.

Evaluation Question

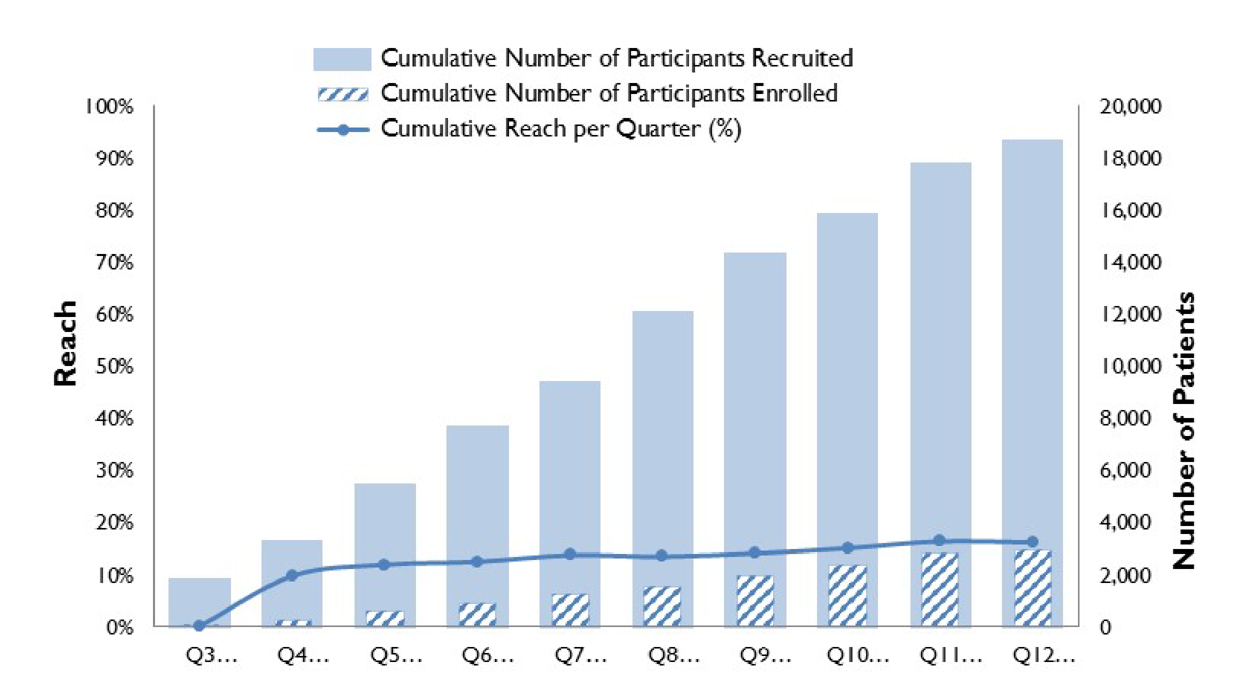
- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.12.1 Innovation Reach

Figure 5 shows reach by quarter since the launch of the innovation. We last reported reach in the 2015 annual report, based on data through Q11. CCIN enrolled an additional 106 patients in Q12, and reach decreased slightly from 16.5 percent in Q11 to 16.2 percent in Q12. RTI reports only clients who officially enrolled in the program in its reach statistics.

Because of lack of buy in from new-to-market MCOs at innovation start-up (as discussed under Leadership and Organizational Capacity), CCIN struggled to reach (enroll) patients from the target population and was unable to achieve its original goals. CCIN made modest, incremental progress since the second annual report because of CHW recruitment efforts, a partnership with Medical Mall, and the acquisition of deidentified data from the AmeriHealth MCO. However, the primary issue preventing significant improvement in reach, lack of buy-in from the MCOs, remained unresolved. No additional referrals were received from AmeriHealth while CCIN negotiated a new contract with them, and CCIN's partnership with Medical Mall was discontinued.

Figure 5. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
●	Cumulative reach per quarter (%)	0.2	9.8	12.0	12.6	13.8	13.5	14.2	15.2	16.5	16.2
	Cumulative number of participants recruited	1,375	2,850	5,013	7,250	8,954	11,666	13,914	15,447	17,362	18,248
	Cumulative number of participants enrolled	3	280	601	910	1,234	1,577	1,969	2,345	2,857	2,963

Source: Patient-level data provided to RTI by CCIN.

Table 12 provides the reach for the HIE component of the innovation. We received data for Q9, Q11, and Q12 but not Q10. Of 587 providers reported to have access to the HIE through Q12, 95 providers used the HIE in some way to assist with patient care.

CCIN's inability to achieve greater reach for the HIE component is a direct result of their inability to achieve their targeted patient volume in the innovation's care coordination component. Providers who accessed the HIE found that it contained useful information and was easy to access and use. Had CCIN achieved greater reach at the patient level, in all likelihood they would have achieved greater reach at the provider level. CCIN missed an opportunity to demonstrate the HIE's value and improve its sustainability because of low patient enrollment and HIE use.

Table 12. Provider Reach by Quarter since Launch of the CPC–HIE

Quarter	Number of Providers with Access to HIE	Number of New Providers Utilizing HIE (Any Contact)	Number of Cumulative Providers Utilizing HIE (Any Contact)	Cumulative Reach per Quarter (%)
Q9 (Jul–Sep 2014)	486	31	31	6.4%
Q10 (Oct-Dec 2014)	—	—	—	—
Q11 (Jan-Mar 2015)	577	58	89	15.4%
Q12 (Apr-Jun 2015)	587	6	95	16.2%
Total through Q12	587	95	95	16.2%

Source: Data provided to RTI by CCIN.
HIE = health information exchange.
— Data not available

2.12.2 Innovation Dose

Table 13 provides the number of services provided across participants, the number of participants receiving services, and the average number of services per participant through Q12. We last reported dose in the 2015 annual report based on data through Q11. As expected, the number of services provided and the percentage of participants receiving those services increased from Q11 to Q12. As shown in the table, 93.4 percent of participants completed a care plan, and 96.5 percent of participants exchanged an average of nine phone calls with the CHW. Patients' needs determined the frequency of service delivery, and on the basis of our analysis of health outcomes, patients appear to have received the services required to help address their health problems.

Table 13. Number and Types of Services Provided to Participants

Services	Number of Services Provided	Number (Percentage) of Participants Receiving Service	Average Number of Services
Care plan completed	2,766	2,766 (93.4)	1.0
Phone calls answered	24,897	2,859 (96.5)	8.7

Source: Patient-level data provided to RTI by CCIN.

Table 14 shows that the HIE was used 1,439 times since going online during Q9, and 169 times in Q12. As noted above, of the 587 providers granted access to the system, 94 providers used the HIE at least once for patient lookups (n=1,435), and emessages sent (n=2) and received (n=2). The limited use of the HIE, almost exclusively for patient lookup, shows that the HIE has not yet become an integral part of patient care for local providers.

Table 14. Use of HIE Services

Service	Number of Services	Number (Percentage) of Providers Using Service
Referrals incoming	0	0(0)
Referrals outgoing	0	0(0)
Patient lookup count	1,435	94 (16.0)
emessages received	2	2(0.0)
emessages sent	2	2(0.0)

Source: Patient-level data provided to RTI by CCIN.

2.13 Qualitative Findings: Sustainability

The shared savings model (the third component of this innovation) was instrumental to CCIN's sustainability but was not implemented. CCIN unsuccessfully explored alternate funding sources such as contracts with community partners, Amerigroup and other MCOs to provide care coordination services and with GWU for the HCIA Round 2 PAH Project.

CCIN developed a Memorandum of Understanding with Amerigroup to conduct a pilot project to coordinate care for their members in Maryland. However, this contract was not sufficient for long-term sustainability. As a result, this pilot was put on hold until other funding was secured. CCIN was negotiating a contract with AmeriHealth, one of the Washington, DC, MCOs, to provide services to a small portion of their members who are high users. CCIN and AmeriHealth were working to define this population and to agree upon an expected level of savings. To approve the contract, AmeriHealth required a large saving margin, which could be a barrier given that CCIN would also need enough compensation for long-term sustainability.

Since CCIN received 501(c)(3) nonprofit status, it continued to apply for other private and public funding sources. In Q11, CCIN and DCPCA submitted a grant applicant to the Transforming Clinical Practices Initiative/Practice Transformation Networks program through CMS. This grant would fund CCIN to sustain care coordination activities but was not awarded as of Q12. GWU contracted with Mary's Center but not with CCIN as a separate entity. GWU elected not to use SyntraNet and hired former CCIN CHW staff directly. CCIN's application for a 1-year, no-cost extension of the HCIA award was denied. CCIN was unable to acquire funding necessary to sustain the program; as a result, CCIN ceased CHW operations on September 30, 2015, but continues to work with the DHCF to advocate for reimbursements amendments within the State Plan Amendments for telehealth and encounters by other health care workers such RNs and CHWs.

2.14 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing CCIN and accomplishments to date. In this section, we assess CCIN's progress on achieving HCIA goals to date:

- **Smarter spending.** Trends in Medicaid spending per patient for innovation beneficiaries are decreasing in the innovation period and are below the baseline trend line. However, definitive conclusions cannot be made in the absence of a comparison group.

- **Better care.** The ED visit rate declined in the innovation period; however, a comparison group was lacking.

- **Healthier people**. The percentage of enrolled patients with hypertension and blood pressure control increased as the number of home visits increased. By the fourth visit, approximately 67 percent of patients with hypertension had blood pressure below 140/90 mm Hg. Although the percentage of patients with hypertension with a blood pressure below 140/90 mm Hg remained high in the seventh and eighth visits, the number of patients who received that number home visits (41 and 222, respectively) was so low that it is not a representative group.

A number of key learnings resulted from this innovation, detailed below.

Component 1, care coordination: CCIN successfully hired, trained, and deployed CHWs who located and assisted patients to improve their access to care and help them use available medical care resources in the community efficiently and economically. CCIN CHWs related to and communicated with patients, which allowed them to effectively provide health education, create care plans, and help patients set goals, manage medications, and coordinate services. CCIN CHWs were also effectively trained to use a customized care management technology platform to capture report information and communicate with the rest of the care team via the HIE. This care management platform allowed CCIN to manage CHW staff and track patient progress in achieving care plan goals while supporting analysis of claims data.

Staffing levels were sufficient to handle the demand even though they were far below the original number of staff originally projected to be hired. However, CCIN noted that it could have expanded its CHW staff and the capacity if demand required. Because of uncertainty in future funding, CCIN did not add or replace any CHW positions that became vacant during Q11 or Q12. CCIN expected that staff separations would increase as the end of the funding period approaches. Subsequently, all staff including all CHWs, were dismissed when CCIN ceased operating in September 2015.

Component 2, the CPC–HIE: CCIN created an HIE for the DC area and connected EHRs of subscribing clinics and hospitals. The HIE employed a single-login Web portal to access participant health information, an approach favored by participating providers. The care management system used by CHWs was connected to CPC–HIE, enabling effective communication with the rest of the care team.

The reach of the CPC–HIE was limited to five clinics and Providence Hospital, although CCIN continued to work to connect it with the Maryland CRISP HIE, which would have facilitated connections with regional hospitals and medical providers outside Washington, DC. The CPC–HIE will be sustained over the next 3 years through funding from GWU, who will use it to implement the PAH project. As the most fully realized, valuable, and sustainable component of the innovation, the CPC–HIE has buy-in from key stakeholders in Washington, DC, including the DCPCA, which leads the governance effort to establish policy and regulate the HIE.

Component 3, the shared savings model: This component of the innovation was not implemented. From the outset, CCIN faced challenges with implementation, patient recruiting, and sustainability due to lack of participation from the Washington, DC, MCOs. Minimal progress was made to resolve the issue and CCIN did not overcome the initial setback that undermined their approach to reimbursement. Despite frequent attempts by CCIN leadership to engage them, the new MCOs had no interest in partnering with CCIN to provide care coordination services to their high-use/high-cost clients. Since the 2015 annual report, CCIN continued discussions with the MCOs, but as of Q12 no contracts or agreements were implemented that would fully sustain the innovation. To fully implement the care coordination component of the innovation, CCIN needed to increase the number of participants enrolled. CCIN continually sought innovative solutions and explored approaches to recruitment independent of the MCOs. CHWs went door to door to persuade patients to participate in the program. When providers permitted, CHWs established a regular presence at health care practices and sought warm handoffs from partners such as Medical Mall. These strategies took time and effort and resulted in only modest success.

In sum, CCIN accomplished many important goals. They built the CPC-HIE that effectively connected a number of local providers and paired it with an integrated care management platform that enabled CHWs to share information about their work and its impact on patient health behaviors; they recruited and trained a workforce of CHWs who effectively engaged high-use patients in their homes. Clinicians whose patients received services from CCIN CHWs were pleased with this addition to the care team, and the limited data available indicate that these services reduced use and improved outcomes. However, the lists of high-use patients that were expected to drive the innovation never materialized, preventing the implementation of the shared savings model and preventing the innovation from achieving the expected level of acceptance and use. CCIN leadership worked throughout the period to develop other sources of patients to drive the innovation but were unable to generate the volume of patients needed to gain significant traction in the community.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Mary's Center for Maternal and Child Care (Mary's Center)

Mary's Center for Maternal and Child Care (Mary's Center) is a federally qualified health center (FQHC) in Washington, DC, that provides health care, social services, and family literacy programs and is the fiduciary agent (awarded $14,991,005, began enrolling in February 2013) to establish the Capital Clinical Integrated Network (CCIN). CCIN is a new entity with 501(c)(3) status that used community health workers (CHWs) and a combination of high-touch and high-tech strategies to improve access to and coordination of primary care, primarily for Medicaid beneficiaries.

Awardee Overview

Innovation dose:	Participants received more phone calls through Q12 than through Q11, on average (as reported in the 2015 annual report): 8.4 versus 7.5 calls per patient. As of Q12, 93% of participants completed a care plan with a CHW.	***Innovation reach:***	16.2% of the target population (2,963) was enrolled in Q12. Of the 587 providers reported to have access to the HIE, 95 used the HIE to assist with patient care.
Components:	CCIN delivered care coordination using CHWs and implemented a health information exchange (HIE) according to plan, but did not execute the shared savings payment model due to changes in the local Medicaid managed care organizations.	***Participant demographics:***	Most participants (65.4%) were 25–64 years of age, and 61.2% were female. Among those with data, most participants were black and were covered by Medicaid (i.e., 82.7% and 96.4%, respectively).
Sustainability:	George Washington University is using the Capital Partners in Care–HIE to conduct an HCIA Round 2 project that is expected to sustain the HIE for 3 years.		
Innovation type:	Coordination of care	Health IT	Provider payment reform

Key Findings

Smarter spending. Trends showed that Medicaid spending per patient per quarter for innovation beneficiaries decreased in the innovation period from $2,389 to $1,969, and was below the baseline trend line. However, definitive conclusions could not be made in the absence of a comparison group.

Better care. The emergency department (ED) visit rate per 1,000 participants per quarter declined in the innovation period from 536 to 449; however, a comparison group was lacking.

Healthier people. The percentage of enrolled patients with hypertension and blood pressure control increased as the number of home visits increased. Compared to 54 percent at the first visit, by the fourth visit approximately 67 percent of patients with hypertension had blood pressure below 140/90 mm Hg. Although the percentage of patients with hypertension with a blood pressure below 140/90 mm Hg remained high in the seventh (75.6%) and eighth visits (77.3%), the number of patients who received that number of home visits (41 and 222, respectively) was so low that it is not a representative group.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Michigan Public Health Institute

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q14 (December 2015)
Quarterly Awardee Performance Report	Launch date–Q14 (December 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–December 2015

Q = quarter.

Michigan Public Health Institute

2.1 Introduction

The nonprofit Michigan Public Health Institute (MPHI) is located in Okemos, Michigan. Awarded a total of $14,145,784, MPHI launched the Michigan Pathways to Better Health (Pathways) project in January 2013 in three Michigan counties: Saginaw, Muskegon, and Ingham. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Decrease spending by 2 percent over 1 year ($17,498,641 over 3 years) by reducing unnecessary ED visits and hospitalizations.

2. **Better care.** Shift utilization to appropriate and lower cost health and human services via the community hub[1] and community health worker (CHW) chronic disease management by 5 percent over 1 year.

3. **Healthier people.** Improve chronic disease-related health outcomes by 5 percent over 1 year.

Table 2 provides a summary of changes that occurred during 12 months of operations. These updates are based on a review of the Quarter (*Q)11–14 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through December 31, 2015.

[1] Defined as a community organization that has the infrastructure to coordinate delivery and connect at-risk individuals to health and social services while avoiding duplication of services.

Table 2. Summary of Updates as of Quarter 14, December 31, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 12/31/2015)
Innovation Components	
	In Q14, MPHI developed a CHW payment model, using learnings from the Transitional Payment model.
Program Participant Characteristics	
	Majority of participants (72.7%) were from 25 to 64 years of age, and more than one half (61.0%) were female. Over 45% were covered by Medicaid; 17.5% were covered by Medicare, including Medicare Advantage, and 21.5% were covered by both Medicare and Medicaid.
Workforce Development	
Hiring and retention	The innovation was fully staffed with 37.70 FTEs. Between Q11 (January 2015) and Q14 (December 2015) six separations occurred.
Skills, knowledge, and training	MPHI provided 981 individual trainings totalling 2,492.25 hours of training.
Context	
Award execution	MPHI spent 93.1% of its Year 3 budget, which is on target with projections.
Leadership	Leadership remained constant, engaged, and committed to successful implementation during the reporting period.
Organizational capacity	MPHI and the partnering hubs continued to work to refine the TPM. MPHI also worked with Medicaid Managed Care Plans to seek funding to sustain the Pathways program past HCIA funding period.
Innovation adoption and workflow	MPHI successfully adapted and implemented Pathways at all three sites.
Implementation Effectiveness	
Innovation reach	MPHI enrolled an additional 1,731 participants in the innovation and an additional 1,578 participants were considered active since the 2015 annual report. Overall reach increased from 72.5% to 77.1% for those enrolled and from 64.8% to 69.2% for those considered active.
Innovation dose	The most common Pathways were medical referrals, completed by over half of participants (61.8%) an average of 5.7 times, and social service referrals, completed by 76.3% of participants an average of 4.7 times.
Sustainability	
	MPHI created a sustainability committee composed of representatives from all three implementation sites.
	MPHI engaged MMCPs to develop a partnership to include the MMCPs as potential payers for services and act as current referral sources for eligible participants.

Sources: *Q11-Q14 Narrative Progress Report*.
Q11-Q14 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted May - June 2015

CHW = community health worker; FTE = full-time equivalent; HCIA = Health Care Innovation Award; IT = information technology; MMCPs = Medicaid Managed Care Plans; TPM = Transitional Payment model.

Table 3 summarizes Medicare claims-based findings during the innovation period. The MPHI innovation showed significant increases in spending overall, mainly reflecting increases in Years 1 and 2 of the program. The effect on inpatient admissions, unplanned readmissions, and ED visits was insignificant; we were unable to analyze Year 3 data for these three outcomes because of the small numbers that year.

Table 3. Summary of Medicare Claims-Based Findings: MPHI

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	**$4.92**	**$1.01, $8.83**	**$2.95**	**$0.25, $5.65**	**$1.86**	**$0.06, $3.66**	$0.11	−$0.49, $0.71
Acute care inpatient stays	108	−15, 231	69	−35, 173	39	−27, 105	N/A	N/A
Hospital-wide all-cause unplanned readmissions	8	−20, 35	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−26	−294, 242	58	−169, 284	−84	−226, 59	N/A	N/A
Average impact per quarter								
Spending per participant	**$438**	**$90, $785**	**$400**	**$34, $767**	**$557**	**$17, $1,098**	$205	−$908, $1,318
Acute care inpatient stays (per 1,000 participants)	10	−1, 22	9	−5, 23	12	−8, 32	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	9	−22, 40	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−2	−27, 23	8	−23, 39	−25	−68, 18	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. The innovation showed significant savings in both years for which we had data. However, there was no significant impact on inpatient admissions, ED visits, or readmissions. We were unable to analyze inpatient admissions in Quarters 4 and 5 because of the small number of inpatient admissions during those quarters.

Table 4. Summary of Medicaid Claims-Based Findings: MPHI

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	**−$0.60**	**−$0.98, −$0.22**	**−$0.57**	**−$0.93, −$0.20**	**−$0.03**	**−$0.05, −$0.01**	N/A	N/A
Acute care inpatient stays	−14	−34, 5	−14	−34, 5	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−3	−8, 1	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−17	−93, 59	−17	−92, 59	−1	−5, 4	N/A	N/A
Average impact per quarter								
Spending per participant	**−$1,658**	**−$2,709, −$606**	**−$1,623**	**−$2,675, −$571**	**−$2,778**	**−$4,673, −$883**	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−45	−107, 16	−45	−107, 16	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−129	−311, 53	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−48	−259, 163	−48	−265, 170	−73	−475, 329	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

The Pathways community hub model is a new program modeled after the Community Health Access Project (CHAP) in Ohio. MPHI adapted the model for adults with two or more chronic diseases to address social determinants of health. Pathways was implemented in three sites in Michigan, mainly the counties of Ingham, Muskegon, and Saginaw. The Pathways model (i.e., MiPathways) establishes networks of collaborating community agencies and outreach to Pathways' enrollees through three components:

1. Community hubs, or county-specific agencies that refer eligible participants to a care coordinating agency (CCA), which then assign participants to a CHW;
2. CHWs, who enroll participants, conduct assessments, and assist patients with social and health needs by helping them access appropriate care pathways (e.g., tobacco cessation, family planning) through the MiPathways database, a care management system developed by MPHI; and
3. A transitional payment model (TPM), which is a pay-for-deliverable model tied to CHW performance and completion of participant pathway.

We provided details on these components in the 2014 annual report and reported changes in the 2015 annual report.[2] During Q14, MPHI developed a CHW Payment Model (CHW-PM) to address challenges with the TPM in the first 3 years of implementation The CHW-PM enables value-based payments for CHW services from two sources: outside payers reimbursing for CHW services, and organizations that pay CHWs based on the achievement of targeted patient outcomes.

As part of the HCIA NCE granted to MPHI, the Center for Medicare & Medicaid Innovation (CMMI) required that the TPM be simplified and that it should not use a point system. As a result, in Year 3 of the innovation, using lessons from the TPM, MPHI developed the CHW-PM that includes two payment options: reimbursement from outside payers for CHW services and payments from organizations when CHWs achieve designated patient outcomes. In addition, three outcomes are outlined: initial, intermediate, and final. The initial outcome is defined as improvement in clients' engagement in their health. The intermediate outcome is defined as an outcome that resolves clients' need for health and social services. The final outcome is defined as improvement in clients' health and health care utilization, leading to decreased health care costs. CHW payments may be based on achievement of a single outcome or a combination of outcomes. MPHI notes that, since final outcomes take time, periodic bonuses to CHWs may by warranted for their work at this level.

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[2] Holden, D. J., Rojas Smith, L., Hoerger, T., Renaud, J., and Council, M.: (2014, October). Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2014. Prepared for the Centers for Medicare & Medicaid Services, 2014, October. https://downloads.cms.gov/files/cmmi/HCIA-CommunityRPPM-FirstEvalRpt_4_9_15.pdf
Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. Prepared for the Centers for Medicare & Medicaid Services, 2015, December.

The partners for this innovation remain unchanged since implementation began. ***Table 5*** lists the partners involved in the innovation as of Q14. The Michigan Department of Community Health (MDCH) is now part of the Michigan Department of Health and Human Services (MDHHS). Because the co-PI retired, MDHHS is no longer co-leading the program but continues to be a strong partner. MDHHS facilitated partnerships with Medicaid managed care organizations (MCOs) to potentially provide reimbursement for CHW activities in the future.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Michigan Department of Health and Human Services	• Co-director until Q12 • Project design • Technical assistance • Integration with other practice transformation initiatives	Lansing, MI
Muskegon Community Health Project	• Lead agency • Project management/administration, health IT, data collection, deployment of CHWs, care navigation	Muskegon, MI
Saginaw County Community Mental Health Authority	• Lead agency and community hub • Project management/administration, health IT, data collection, deployment of CHWs, care navigation	Saginaw, MI
Ingham County Health Department	• Lead agency • Project management/administration, health IT, data collection, deployment of CHWs, care navigation	Lansing, MI

CHW = community health worker.

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants ever enrolled in the innovation. The distribution of patient characteristics is similar to that in the 2015 annual report. More specifically, a majority of participants (72.7%) were from 25 to 64 years of age and more than half (61.0%) were female. Most participants (56.5%) were white, and nearly one-third (28.4%) were black. As would be expected based on eligibility criteria, over 45 percent were covered by Medicaid; 17.5 percent were covered by Medicare, including Medicare Advantage; and over 20 percent were covered by both Medicare and Medicaid.

Table 6. Characteristics of All Participants Ever Enrolled in the MPHI Innovation through December 2015

Characteristic	Number of Participants[1]	Percentage of Participants
Total	8,301	100.0
Age		
< 18	0	0.0
18–24	400	4.8
25–44	2,163	26.1
45–64	3,866	46.6
65–74	1,027	12.4
75–84	563	6.8
85+	279	3.3
Missing	3	0.0
Sex		
Female	5,060	61.0
Male	3,227	38.9
Missing	14	0.1
Race/ethnicity		
White	4,694	56.5
Black	2,360	28.4
Hispanic	399	4.8
Asian	40	0.5
American Indian or Alaska Native	41	0.5
Native Hawaiian or other Pacific Islander	46	0.6
Other	200	2.4
Missing/refused	521	6.3
Payer category		
Dual	1,788	21.5
Medicaid[2]	3,876	46.7
Medicare	1,130	13.6
Medicare Advantage	320	3.9
Other	0	0.0
Uninsured	0	0.0
Missing[3]	1,187	14.3

Source: Patient-level data provided to RTI by MPHI.

1 Enrollment is based on completion of a ROI.

2 Includes participants expected to be included in Medicaid expansion (i.e., county insurance).

3 Missing includes participants who indicated that they did not have Medicaid, Medicare, or Medicare Advantage and, thus, could include other types of insurance (i.e., self-pay, commercial). Missing also may include participants with pending insurance coverage as participants may be in the process for applying for coverage.

MPHI = Michigan Public Health Institute; ROI = release of information.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?
- Has the innovation reduced spending per patient?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 2,264 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period; this included dually eligible beneficiaries. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in Saginaw, Muskegon, or Ingham counties, Michigan who had two or more chronic conditions.

Enrollment often coincided with receipt of care, such as an inpatient hospitalization or ED visit that generated the enrollment referral for the innovation. In previous reports, this receipt of care created a spike in spending and utilization during the first innovation quarter, which was an artifact of enrollment co-occurring with use of care. In order to select a comparison group with a similar spike, we added 90 days (one quarter) to each innovation beneficiary's original enrollment date, so that the original first calendar quarter after the innovation is now considered the last calendar quarter before the innovation. This allowed the comparison group to match the innovation group's spike prior to enrollment.

We used propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 8 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Ten innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 8. Medicare Mean Values and Standardized Differences of Variables in Propensity Score Model: MPHI

Variable	Before Matching: Treatment Group Mean	Before Matching: Treatment Group SD	Before Matching: Comparison Group Mean	Before Matching: Comparison Group SD	Standardized Difference	After Matching: Treatment Group Mean	After Matching: Treatment Group SD	After Matching: Comparison Group Mean	After Matching: Comparison Group SD	Standardized Difference
Payments in calendar quarter prior to enrollment	$9,935	$16,219	$2,265	$7,336	0.609	$9,795	$16,082	$9,195	$22,030	0.031
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$20,190	$36,400	$8,046	$18,569	0.420	$19,537	$34,407	$19,361	$59,718	0.004
Age	61.46	14.33	69.25	13.73	0.555	61.56	14.28	60.99	16.16	0.037
Percentage male	37.86	48.5	43.64	49.59	0.118	37.81	48.49	36.56	48.16	0.026
Percent nonwhite	64.91	47.73	80.26	39.8	0.349	65.02	47.69	63.79	48.06	0.026
Percentage disabled	71.2	45.28	34.2	47.44	0.798	71.07	45.34	75.75	42.86	0.106
Percentage ESRD	4.27	20.21	1.14	10.63	0.193	4.24	20.15	3.86	19.28	0.019
Number of dual eligible months in the previous calendar year	6.81	5.62	2.61	4.83	0.802	6.79	5.62	7.18	5.69	0.068
Number of chronic conditions	7.94	4.06	6.54	3.88	0.353	7.92	4.06	8.17	4.32	0.059
Number of outpatient ED visits in calendar quarter prior to enrollment	0.88	1.88	0.15	0.55	0.527	0.83	1.62	0.55	1.34	0.183
Number of inpatient stays in calendar quarter prior to enrollment	0.53	0.87	0.08	0.33	0.687	0.52	0.83	0.45	0.92	0.075
Number of beneficiaries	2,274	—	835,012	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	90,986	—	—	2,264	—	6,539	—	—
Number of weighted beneficiaries	—	—	—	—	—	2,264	—	2,264	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims from 2011 to 2015

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

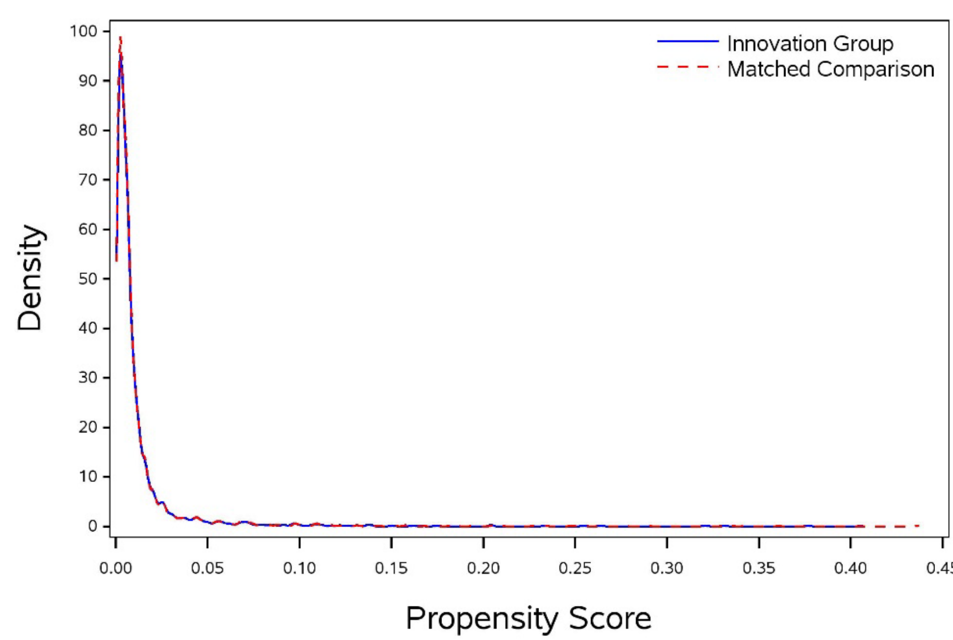
ED = emergency department; ESRD = end-stage renal disease; MPHI = Michigan Public Health Institute; SD = standard deviation.

— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 8). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[3] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 8 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables except for the number of ED visits in calendar quarter before enrollment and the percent disabled, which had standardized differences of 0.183 and 0.106, respectively.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure shows a very close overlap between the innovation and comparison groups' propensity scores.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
MPHI = Michigan Public Health Institute.

[3] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the 11 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

The per-participant Medicare spending rate for the innovation and comparison groups follows very similar trends in both the baseline and innovation periods and, overall, the spending rate is fairly flat. Both groups have a small spike in the last quarter of the baseline period, likely due to the innovation inclusion criteria of identifying individuals with high ED and inpatient utilization. Although spending for the comparison group is lower in almost all quarters, the spending rate for the innovation group approaches the comparison group rate in the last few quarters of the innovation period. We will explore this question further in the regression analysis section below.

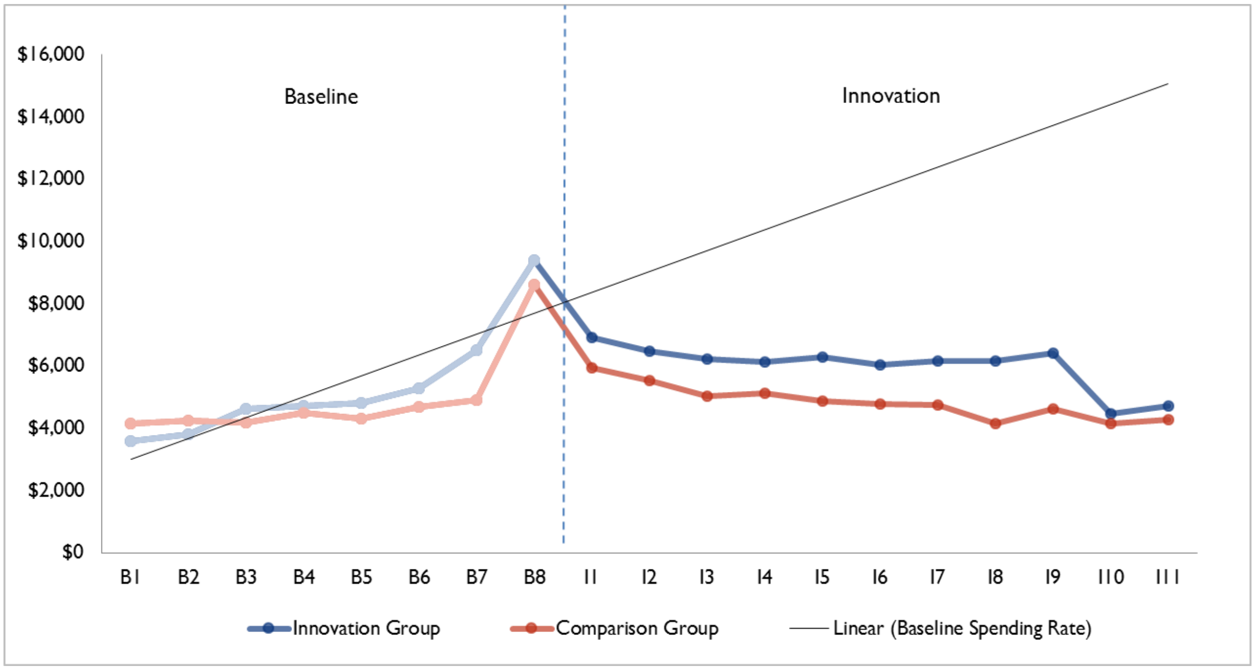
Table 9. Medicare Spending per Participant: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$3,602	$3,803	$4,635	$4,728	$4,806	$5,286	$6,526	$9,412	$6,923	$6,479	$6,225	$6,137	$6,285	$6,053	$6,176	$6,175	$6,414	$4,463	$4,735
Std dev	$8,831	$8,107	$11,545	$10,335	$11,903	$12,416	$14,048	$15,215	$13,210	$12,746	$13,111	$12,923	$13,305	$12,800	$12,675	$13,457	$14,880	$9,142	$8,771
Unique patients	1,837	1,880	1,909	1,952	1,998	2,030	2,072	2,116	2,116	1,996	1,771	1,484	1,219	942	691	482	316	187	39
Comparison Group																			
Spending rate	$4,147	$4,236	$4,181	$4,490	$4,325	$4,690	$4,925	$8,606	$5,962	$5,545	$5,045	$5,129	$4,888	$4,790	$4,762	$4,160	$4,626	$4,162	$4,293
Std dev	$11,823	$11,804	$10,774	$24,202	$11,082	$12,840	$12,410	$19,424	$14,283	$13,282	$11,847	$12,928	$11,599	$11,676	$10,621	$10,805	$11,992	$10,610	$9,177
Weighted patients	1,906	1,936	1,974	2,007	2,042	2,078	2,108	2,117	2,117	2,023	1,796	1,508	1,230	961	697	484	325	191	43
Savings per Patient																			
	$546	$433	−$454	−$238	−$482	−$597	−$1,600	−$806	−$961	−$934	−$1,180	−$1,008	−$1,397	−$1,263	−$1,414	−$2,014	−$1,788	−$301	−$442

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
I1 = Innovation Q1; B1 = Baseline Q1; MPHI = Michigan Public Health Institute.

Figure 2. Medicare Spending per Participant: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $438 per participant (90% CI: $90, $785). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. Although we do not see any significant savings or losses in any of the quarters of the innovation, losses are statistically significant for the innovation overall, as well as in Years 1 and 2 in aggregate.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	$404	$313	0.197
I2	$337	$316	0.286
I3	$552	$345	0.110
I4	$301	$372	0.418
I5	$585	$413	0.157
I6	$346	$468	0.460
I7	$499	$511	0.329
I8	$985	$640	0.124
I9	$659	$875	0.452
I10	−$443	$699	0.527
I11	−$367	$1,743	0.833
Overall average	$438	$211	0.039
Overall aggregate	$4,919,874	$2,376,379	0.039
Overall aggregate (IY1)	$2,950,297	$1,641,168	0.072
Overall aggregate (IY2)	$1,858,567	$1,096,175	0.090
Overall aggregate (IY3)	$111,010	$366,610	0.762

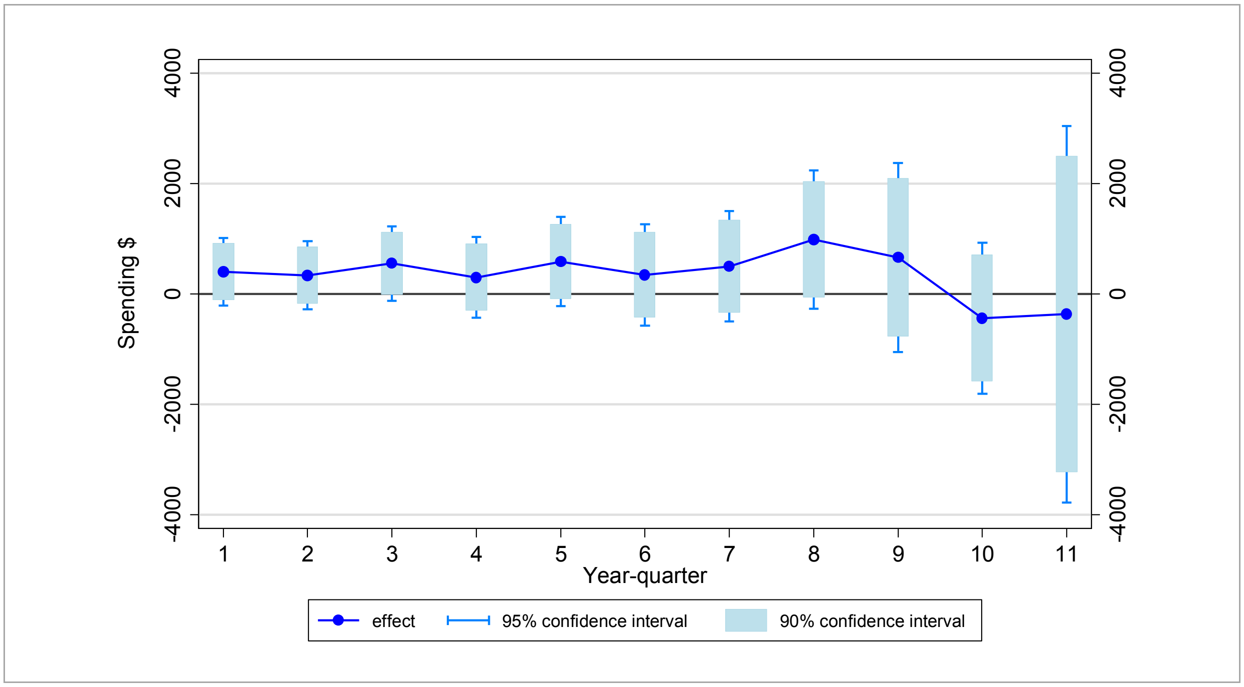
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute; OLS = ordinary least squares.

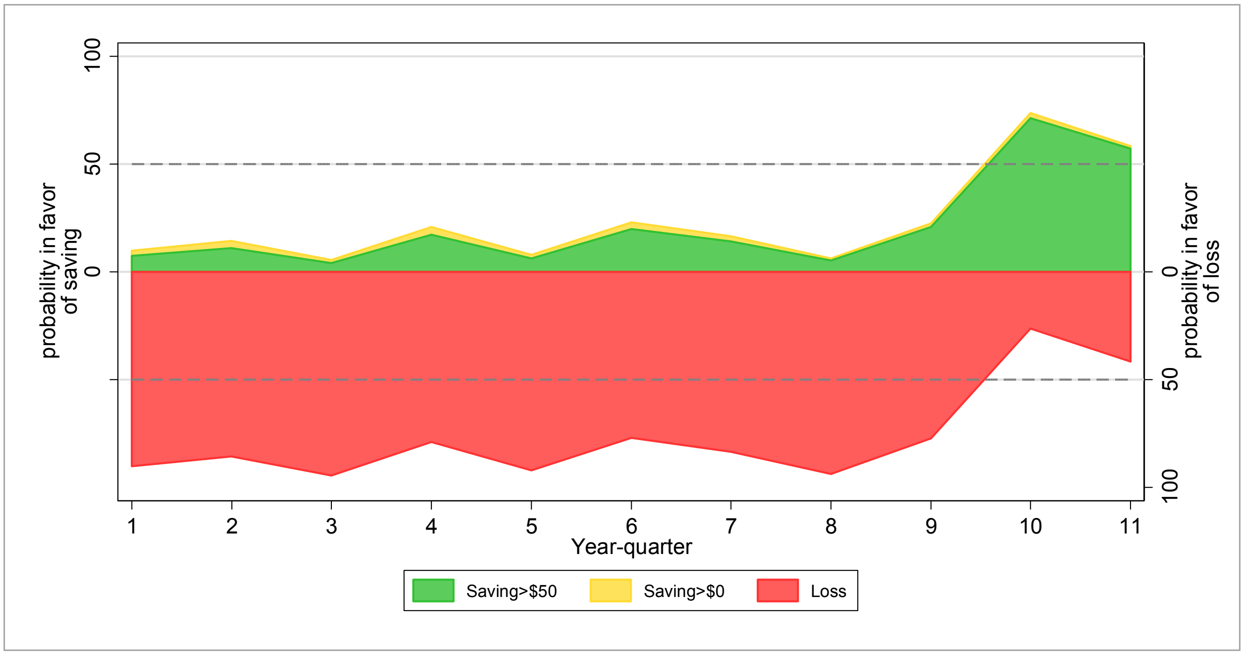
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
MPHI = Michigan Public Health Institute; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. During I1 through I9, the probability of loss outweighs the probability of savings. During I10 and I11, the probability of savings is greater than the probability of loss.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
MPHI = Michigan Public Health Institute.

Spending Dose Analysis

The MPHI innovation entails using CHWs to direct frequent users of health care services and individuals with multiple chronic conditions to the proper channels of care. In this program, the "dose" is measured by the number of pathways accessed. Pathways are access routes to appropriate care such as medical referral, social services referral, medication assessment, or fall prevention. We completed a regression analysis stratified by three levels of participation in the innovation: (1) individuals who were enrolled in the innovation but accessed no pathways, (2) individuals who were active and completed at least 1 pathway beyond the adult intake checklist (but less than 6), and (3) individuals who completed 6 or more pathways beyond the adult intake checklist (6 is the average number of pathways completed). Results for groups (2) and (3) are presented in ***Table 11***.

The innovation had no significant impact on spending for individuals who were enrolled in the program but completed no pathways, in line with our expectation in that these individuals did not utilize more services than they would have absent the program.

For individuals who completed 1−5 pathways, the innovation led to statistically significant decreases in spending in the final quarter of the innovation period (I110; −$2,616, P = 0.026). Although there was no statistically significant impact overall or in Years 1 or 2 of the program, we did find savings in Year 3 of the program (−$269,618, P = 0.091) which suggests that perhaps the program would lead to savings in the long run despite no effect on savings in the short run.

Individuals who completed 6 pathways or more incurred higher costs in the innovation period. The spending increases occurred in the early quarters of the innovation, with higher costs in Years 1 and 2 but no significant impact on costs in Year 3 (results for this subgroup shown in Table 11). The positive relationship between innovation dose and spending is likely a result of CHWs connecting high-needs patients to more services, which is consistent with the innovation's goals. In the short run, increasing access to needed services may result in higher costs. Due to the small sample size in I11 (39 participants), this quarter was excluded from the stratified analyses.

Table 11. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: MPHI

Quarter	Active and Completed 1−5 Pathways			Active and Completed 6 or More Pathways		
	Coefficient	Standard Error	P-Values	Coefficient	Standard Error	P-Values
I1	−$114	$526	0.829	$601	$378	0.112
I2	−$262	$556	0.638	$663	$390	0.090
I3	−$216	$638	0.734	$1,017	$443	0.022
I4	$64	$676	0.924	$694	$453	0.126
I5	−$150	$735	0.838	$1,217	$542	0.025
I6	−$922	$647	0.154	$1,231	$681	0.071
I7	$365	$919	0.691	$182	$671	0.787
I8	−$1,163	$988	0.239	$1,925	$990	0.052
I9	−$873	$1,093	0.424	$1,932	$1,488	0.194
I10	−$2,616	$1,173	0.026	$450	$1,056	0.670
Overall average	−$315	$354	0.375	$862	$274	0.002
Overall aggregate	−$987,167	$1,111,509	0.375	$5,652,173	$1,799,607	0.002
Overall aggregate (IY1)	−$272,645	$732,765	0.710	$3,309,397	$1,249,572	0.008
Overall aggregate (IY2)	−$444,903	$583,230	0.446	$2,013,225	$830,745	0.015
Overall aggregate (IY3)	−$269,618	$159,395	0.091	$329,551	$268,644	0.220

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute; OLS = ordinary least squares.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 12*** and ***Figure 5***. The per-participant inpatient admissions rate for the innovation and comparison groups follows very similar trends in both the baseline and innovation periods and, overall, the inpatient admissions rate is fairly flat. Both groups have a small spike in the last quarter of the baseline period, likely due to the innovation inclusion criteria of identifying individuals with high ED and inpatient utilization. The admission rate for the innovation group is lower in almost all quarters, except the first quarter of the baseline period and the final quarter of the innovation period. We test for differences between the innovation and comparison group in the regression analysis section below.

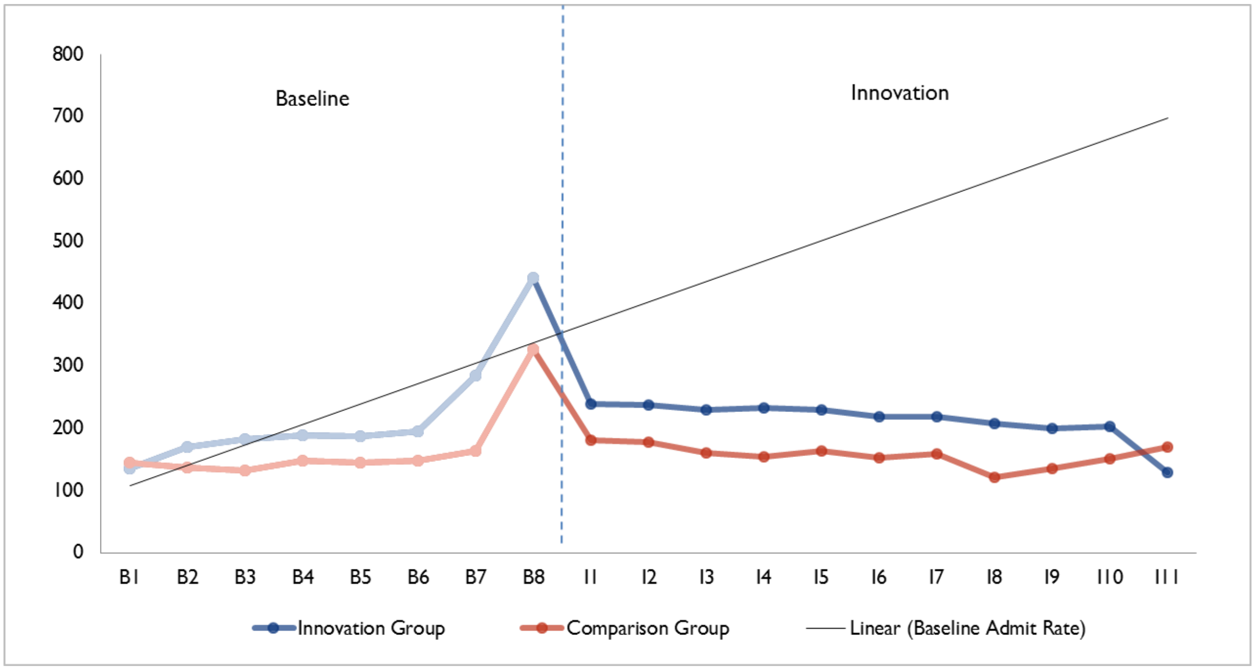
Table 12. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	135	170	182	188	188	195	284	442	239	238	230	232	230	219	219	207	199	203	128
Std dev	447	515	545	561	568	579	683	786	681	616	667	652	692	634	663	678	602	613	404
Unique patients	1,837	1,880	1,909	1,952	1,998	2,030	2,072	2,116	2,116	1,996	1,771	1,484	1,219	942	691	482	316	187	39
Comparison Group																			
Admit rate	144	137	132	149	145	149	164	327	180	178	160	154	163	153	159	121	136	150	171
Std dev	558	491	473	512	485	502	545	841	583	560	511	535	534	505	499	425	482	456	498
Weighted patients	1,906	1,936	1,974	2,007	2,042	2,078	2,108	2,117	2,117	2,023	1,796	1,508	1,230	961	697	484	325	191	43
Innovation − Comparison Rate																			
	−9	34	50	39	42	46	120	115	59	60	69	78	66	66	60	86	64	53	−42

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.5.2 *Regression Results*

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 10 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −1, 22). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 13 presents the results of a negative binomial count model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Overall, the innovation has no statistically significant effect on inpatient admissions. We found a statistically significant increase in inpatient admissions only in quarter 8, when an increase of 51 inpatient admissions occurs (P = 0.078). Quarters 9 through 11 were dropped from the negative binomial model due to the small number of inpatient admissions during those quarters; the descriptive statistics trend downward in quarter 11, which could signify that the innovation may not increase inpatient admissions in the long run.

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	1	17	0.940
I2	8	17	0.653
I3	18	17	0.289
I4	13	19	0.483
I5	−1	21	0.948
I6	8	22	0.731
I7	13	26	0.625
I8	51	29	0.078
Overall average	10	7	0.150
Overall aggregate	108	75	0.150
Overall aggregate (IY1)	69	63	0.277
Overall aggregate (IY2)	39	40	0.328

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

Inpatient Dose Analysis

Table 14 presents results of a dose analysis that stratified regressions by the number of pathways a patient received (1 to 5 pathways and 6 or more pathways). We describe results for the group of individuals who completed no pathways, but do not present them in Table 14. For individuals who were enrolled in the program but completed no pathways and for those who completed 1 to 5 pathways, the innovation had no significant impact on inpatient admissions overall; however, both subgroups had one significant quarter. For those enrolled but who completed no pathways, inpatient admissions decreased by 143 in innovation quarter 5 (P = 0.007), but no other quarters were significant, and no significant effect occurred in either year (results not shown). For individuals who completed 1 to 5 pathways, inpatient admissions decreased by 62 in the innovation quarter 1 (P = 0.041), but no other quarters were significant, and no significant effect occurred in either year (Table 14).

Individuals who completed 6 or more pathways had higher inpatient admissions in the innovation period. Although none of the individual quarterly effects were statistically significant, the innovation overall led to an increase in inpatient admissions (results for this subgroup shown below). It is not clear from this analysis whether completing more pathways led to higher inpatient admissions or whether individuals who completed more pathways did so because they were sicker, thus requiring more inpatient admissions. Due to the small number of inpatient admissions combined with a stratified analysis, innovation quarters 1 through 8 were analyzed.

Table 14. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: MPHI

	Active and Completed 1−5 Pathways			Active and Completed 6 or More Pathways		
Quarter	Coefficient	Standard Error	P-Values	P-Values	Standard Error	P-Values
I1	-62	30	0.041	16	22	0.479
I2	16	35	0.642	2	22	0.934
I3	3	35	0.937	25	22	0.263
I4	27	35	0.433	15	26	0.568
I5	14	41	0.733	14	30	0.625
I6	-37	38	0.331	26	33	0.421
I7	-4	48	0.941	-5	41	0.912
I8	68	55	0.219	41	47	0.378
Overall average	-6	13	0.626	16	9	0.090
Overall aggregate	-20	41	0.626	105	62	0.090
Overall aggregate (IY1)	-13	33	0.681	63	51	0.224
Overall aggregate (IY2)	5	23	0.843	32	33	0.333

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 15*** and ***Figure 6***. The readmission rate for the comparison group increases in a linear fashion in the quarters leading up to the innovation start date, after which the rate drops and then becomes more volatile with some fluctuations. The rate for the innovation group has more peaks and valleys but, overall, is fairly flat until the middle of the innovation period, when there was a huge spike followed by a decrease in the remaining innovation quarters. Although individuals in the innovation and the comparison groups have high costs with two or more chronic conditions, readmissions are fairly uncommon events, leading to some volatility in these descriptive statistics.

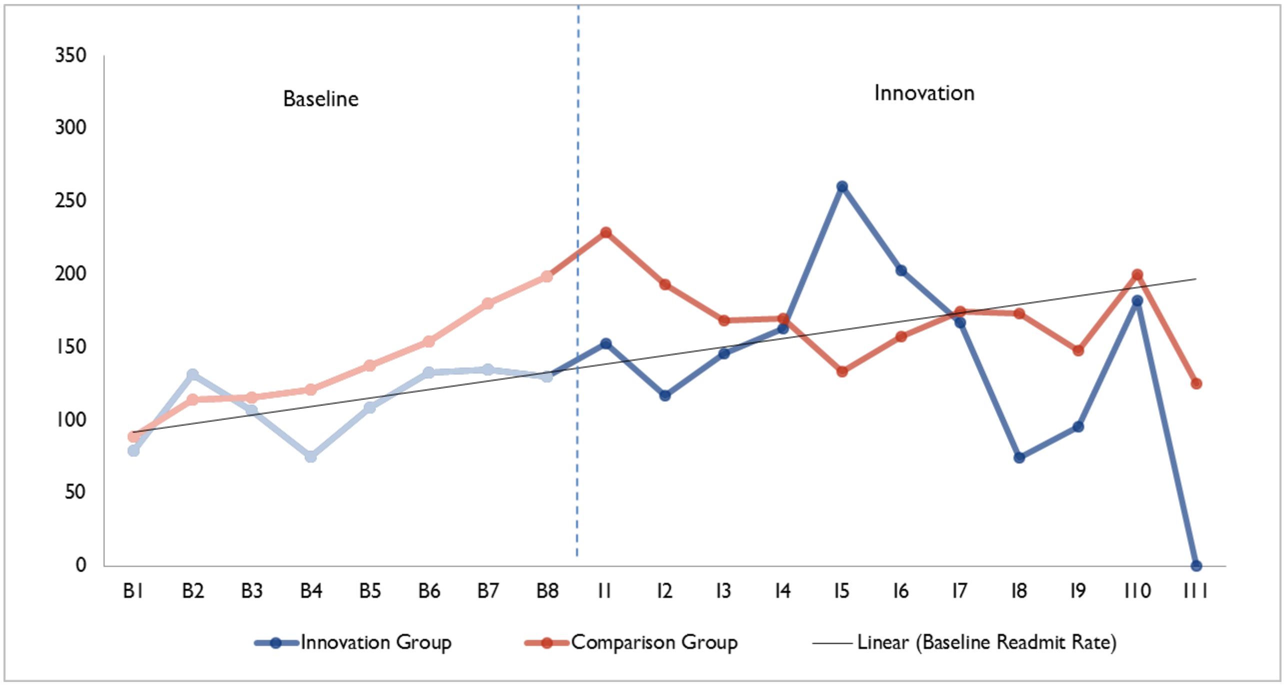
Table 15. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	79	131	106	75	109	133	135	130	153	117	146	163	260	203	167	74	95	182	0
Std dev	270	338	308	264	311	339	341	336	360	321	353	369	439	402	373	262	294	386	0
Total admissions	76	122	113	133	129	143	208	392	190	171	137	135	96	79	42	27	21	11	1
Comparison Group																			
Readmit rate	89	114	116	121	138	154	180	199	229	193	168	169	133	158	175	173	148	200	125
Std dev	284	318	320	326	344	361	385	399	420	395	374	375	340	364	380	379	355	400	331
Total admissions	109	98	110	127	120	144	175	362	181	155	112	98	90	68	48	25	20	12	3
Innovation − Comparison Rate																			
	−10	17	−9	−46	−29	−21	−46	−69	−76	−76	−22	−7	127	45	−8	−99	−52	−18	−125

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.
MPHI = Michigan Public Health Institute.

2.6.2 Regression Results

Table 16 presents the results of a logistic regression model with dependent variable set to one for hospitalized patients with an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 9 per 1,000 inpatient admissions (0.9 percentage points), indicating that the innovation group is less than 1 percentage point more likely to have a readmission during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters; the effect is not statistically significant (90% CI: −22, 40).

Table 16. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: MPHI

Quarter	Coefficient	Standard Error	P-Values
Overall average	9	19	0.646
Overall aggregate	8	17	0.646

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
MPHI = Michigan Public Health Institute.

Readmissions Dose Analysis

The innovation did not lead to significant increases in readmissions for any of the three subgroups (individuals who were active but completed no pathways, individuals who were active and completed 1−5 pathways, and individuals who were active and completed 6 or more pathways). However, these result suffer from small sample sizes because they are based on a small set of individuals in each subgroup with inpatient admissions.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 17*** and ***Figure 7.*** The ED visit rate for the comparison group is flat over the baseline and innovation periods with a small spike in the last baseline quarter. The innovation group's ED rate increases in a linear fashion in the quarters leading up to the innovation start date, after which the rate drops a little before flattening out for most of the innovation period. After a small spike in the ninth quarter of the innovation period, the ED rate for the innovation group drops to a level similar to the comparison group for the final two quarters of the innovation period.

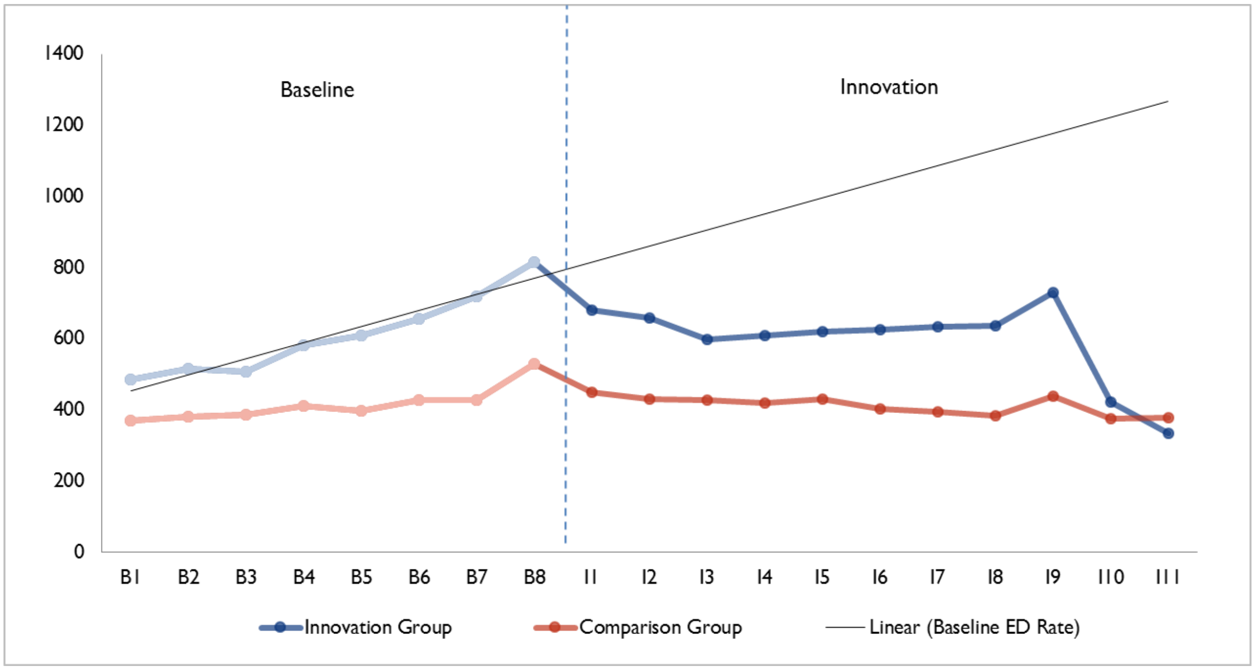
Table 17. ED Visits per 1,000 Medicare Participants: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	486	515	506	581	609	657	719	814	680	659	599	609	620	624	632	637	731	422	333
Std dev	1,243	1,394	1,426	1,477	1,640	1,776	1,752	1,720	1,664	1,566	1,464	1,611	1,806	1,953	2,107	2,184	2,710	983	577
Unique patients	1,837	1,880	1,909	1,952	1,998	2,030	2,072	2,116	2,116	1,996	1,771	1,484	1,219	942	691	482	316	187	39
Comparison Group																			
ED rate	371	380	385	411	399	428	426	530	449	430	427	418	431	403	396	383	438	376	377
Std dev	766	701	677	722	734	741	759	806	820	782	774	692	782	663	601	571	558	526	609
Weighted patients	1,906	1,936	1,974	2,007	2,042	2,078	2,108	2,117	2,117	2,023	1,796	1,508	1,230	961	697	484	325	191	43
Innovation − Comparison Rate																			
	115	135	121	171	210	229	292	284	231	229	172	191	189	221	237	254	293	46	−44

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 7. ED Visits per 1,000 Medicare Participants: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.
ED = emergency department; MPHI = Michigan Public Health Institute.

2.7.2 *Regression Results*

The average quarterly difference-in-differences estimate for ED visits is a decrease of 2 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −27, 23). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 18 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. The innovation has no statistically significant effect on ED visits overall or in any quarter. Quarters 9 through 11 were dropped from the negative binomial model due to the small number of ED visits during those quarters; the descriptive statistics show a downward trend of the innovation group in quarters 10 and 11, which could signify that the innovation may not increase ED visits in the long run.

Table 18. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicare Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	26	37	0.485
I2	40	37	0.279
I3	−26	37	0.485
I4	−20	40	0.606
I5	−53	44	0.234
I6	-5	48	0.926
I7	−19	56	0.731
I8	-3	65	0.960
Overall average	−2	15	0.873
Overall aggregate	−26	163	0.873
Overall aggregate (IY1)	58	138	0.676
Overall aggregate (IY2)	−84	87	0.334

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

ED = emergency department; I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

ED Visits Dose Analysis

The innovation had no significant impact on ED visits for individuals who were enrolled in the program but completed no pathways; this is in line with our expectation in that these individuals did not do anything differently during this innovation than the comparison group.

Table 19 presents results of a negative binomial count model for individuals who completed 1−5 pathways and individuals who completed 6 or more pathways. Individuals who completed 1−5 pathways had statistically significantly lower ED visits in quarter 3 of the innovation (−148, P = 0.033), but the innovation had no effect on ED visits in any quarter for this subgroup. Overall, the group of individuals who completed 1-5 pathways had a decrease in ED visits in Year 1 and in aggregate. On average, there were 61 fewer ED visits per 1,000 beneficiaries. The innovation has no statistically significant effect on ED visits for individuals who completed 6 or more pathways.

Table 19. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: MPHI

Quarter	Active and Completed 1−5 Pathways			Active and Completed 6 or More Pathways		
	Coefficient	Standard Error	P-Values	Coefficient	Standard Error	P-Values
I1	−55	71	0.439	60	50	0.228
I2	−46	68	0.495	65	51	0.204
I3	−148	69	0.033	−9	51	0.867
I4	−7	77	0.923	−25	56	0.654
I5	−136	86	0.114	-5	64	0.938
I6	100	93	0.283	−65	72	0.369
I7	−21	99	0.832	−97	81	0.229
I8	−120	114	0.295	53	115	0.644
Overall average	−61	28	0.029	3	21	0.876
Overall aggregate	−191	87	0.029	22	139	0.876
Overall aggregate (IY1)	−126	69	0.067	126	117	0.282
Overall aggregate (IY2)	−43	50	0.393	−60	71	0.397

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims between April 2011 and December 2015.

Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

ED = emergency department; I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

2.8 Discussion: Medicare Results

The MPHI innovation showed increased spending but had no effect on inpatient stays, readmission rates, or ED visits for innovation participants. We also completed a dose analysis that tested for innovation effects among beneficiaries with no pathways utilization, 1−5 pathways, and 6 or more pathways. Individuals who were enrolled but not active (individuals who did not complete any pathways) had few significant impacts from the program, as expected. Individuals who accessed 1−5 pathways had lower ED visits overall and reduced spending in Year 3. Individuals who accessed 6 or more pathways had higher spending and higher inpatient admissions. For these individuals, it is likely that being a high utilizer of services caused the patients to access more pathways rather than the other way around.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 27 percent of the overall population reached by the innovation.

2.9 Medicaid Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicaid claims data through April 30, 2014. The Medicaid claims analysis focused on 170 Medicaid beneficiaries enrolled during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries, 18 years or older, with fee-for-service Medicaid living in Saginaw, Muskegon, or Ingham County

Enrollment in the innovation often coincided with receipt of care, such as an inpatient hospitalization or ED visit that generated the enrollment referral for the innovation. In previous reports, this receipt of care created a spike in spending and utilization during the first innovation quarter, which was an artifact of enrollment co-occurring with use of care. To select a comparison group with a similar spike, we added 90 days (one quarter) to each innovation beneficiary's original enrollment date, so that the original first calendar quarter innovation is now considered the last calendar quarter prior to the innovation. This allowed the comparison group to match the innovation group's spike prior to enrollment.

We used PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age and a binary indicator for adult, gender, race, disability, dual Medicare-Medicaid status, number of months of dual status, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 20 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 8*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Two innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 20. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: MPHI

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Previous Medicaid	—	—	—	—	—	—	—	—	—	—
Age	49.36	12.5	50.22	19.84	0.05	49	12.56	48.94	16.02	0.02
Percentage adult	88.89	31.6	73.85	43.94	0.39	89	31.74	85.23	35.48	0.10
Percentage disabled	42.22	49.67	49.07	49.99	0.14	42	49.36	38.07	48.56	0.08
Percentage female	51.11	50.27	65.27	47.61	0.29	52	49.95	56.44	49.58	0.08
Percentage white	48.89	50.27	60.71	48.84	0.24	49	49.99	50	50	0.02
Percentage black	34.44	47.78	28.41	45.1	0.13	35	47.77	39.02	48.78	0.08
Percentage dual eligible	40	49.26	73.01	44.39	0.71	41	49.17	36.36	48.1	0.09
Number of months of Medicaid eligibility in second, third, fourth, and fifth calendar quarters prior to enrollment	8.83	4.43	11.21	2.25	0.68	9	4.41	8.42	4.52	0.10
Payments in calendar quarter prior to enrollment	3373.08	9223.3	515.05	1934.75	0.43	3,183	9149.21	2225.58	7215.72	0.12
Number of ED visits in calendar quarter prior to enrollment	1.26	2.86	0.1	0.57	0.05	1	1.79	1.04	2.82	0.05
Number of inpatient stays in calendar quarter prior to enrollment	0.13	0.4	0.01	0.11	0.39	0	0.35	0.16	0.58	0.10
Number of beneficiaries	90	—	115,836	—	—	88	—	263	—	—
Number of unique beneficiaries[1]	—	—	26,146	—	—	88	—	246	—	—
No Medicaid in previous quarter	—	—	—	—	—	—	—	—	—	—
Age	44.01	13.15	30.12	11.36	1.13	44.01	13.07	44.20	13.50	0.01
Percentage disabled	19.51	39.87	7.83	26.87	0.34	19.51	39.63	17.89	38.32	0.04
Percentage female	58.54	49.57	74.68	43.49	0.35	58.54	49.27	52.85	49.92	0.11
Percentage white	47.56	50.25	51.68	49.97	0.08	47.56	49.94	59.35	49.12	0.24
Percentage black	28.05	45.20	34.72	47.61	0.14	28.05	44.92	21.95	41.39	0.14
Percentage dual eligible	4.88	21.67	5.36	22.52	0.02	4.88	21.54	4.88	21.54	0.00
Number of beneficiaries	82	—	19,214	—	—	82	—	241	—	—
Number of unique beneficiaries[1]	—	—	16,688	—	—	82	—	219	—	—
Number of weighted beneficiaries	—	—	—	—	—	82	—	82	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

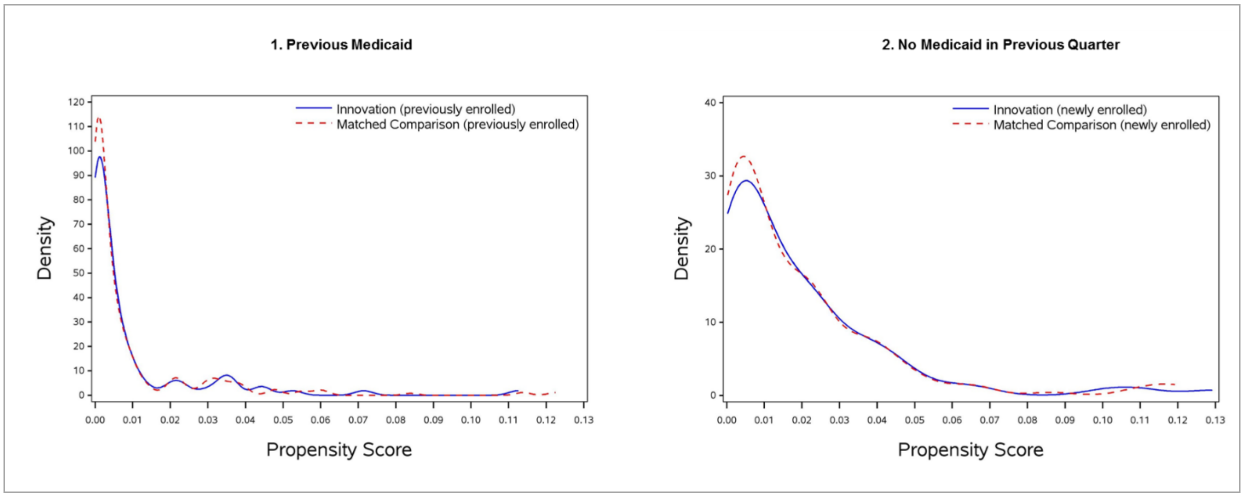
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ED = emergency department; MPHI = Michigan Public Health Institute; SD = standard deviation. — Data not yet available;

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 20). The results in Table 20 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. For the portion of the Medicaid sample with previous Medicaid, payments in the calendar quarter prior to enrollment were above the 0.1 threshold after matching, but the standardized difference was lower than before matching. For the group without Medicaid in the previous quarter, three variables (gender and two race variables) are above the 0.1 threshold. The small sample size and limited data available for this group contribute to the higher standardized differences.

The graphic depiction of the propensity score matching shows an overlap between the innovation and comparison groups, indicating that the propensity scores are similar in both groups.

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 21 reports Medicaid spending per patient in the eight quarters before and the five quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 9*** illustrates the Medicaid spending per beneficiary in Table 21 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

The baseline Medicaid spending rate for the comparison group is lower than that of the innovation group, which has a spike in spending in the final few quarters of the baseline period. In the innovation period, innovation group spending drops below comparison group spending. We test for statistically significant differences in spending due to the innovation in the regression analysis section below.

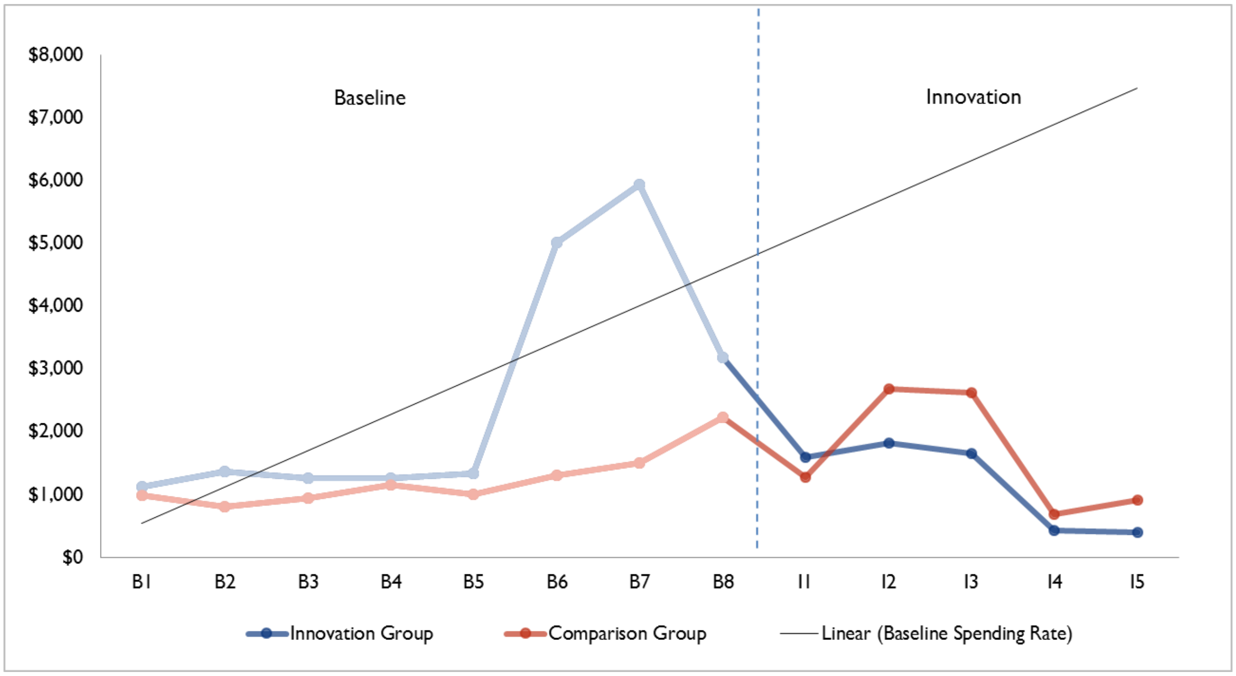
Table 21. Medicaid Spending per Participant: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Spending rate	$1,126	$1,376	$1,262	$1,259	$1,342	$5,020	$5,938	$3,183	$1,591	$1,822	$1,657	$435	$397
Std dev	$2,328	$3,094	$3,615	$2,813	$3,201	$16,662	$19,395	$9,202	$5,296	$3,749	$4,580	$787	$717
Unique patients	50	46	50	57	57	59	71	88	170	89	54	36	11
Comparison Group													
Spending rate	$1,000	$804	$949	$1,162	$1,001	$1,304	$1,507	$2,226	$1,278	$2,678	$2,627	$685	$921
Std dev	$1,885	$1,279	$1,616	$1,903	$1,535	$2,054	$1,995	$4,325	$2,856	$5,300	$7,333	$1,152	$2,041
Weighted patients	66	68	68	68	63	64	70	88	170	84	58	38	13
Savings per Patient													
	−$127	−$572	−$313	−$97	−$342	−$3,716	−$4,432	−$957	−$312	$856	$970	$250	$524

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims April 2011 – June 2015.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 9. Medicaid Spending per Participant: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$1,658 (90% CI: −$2,709, −$606). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

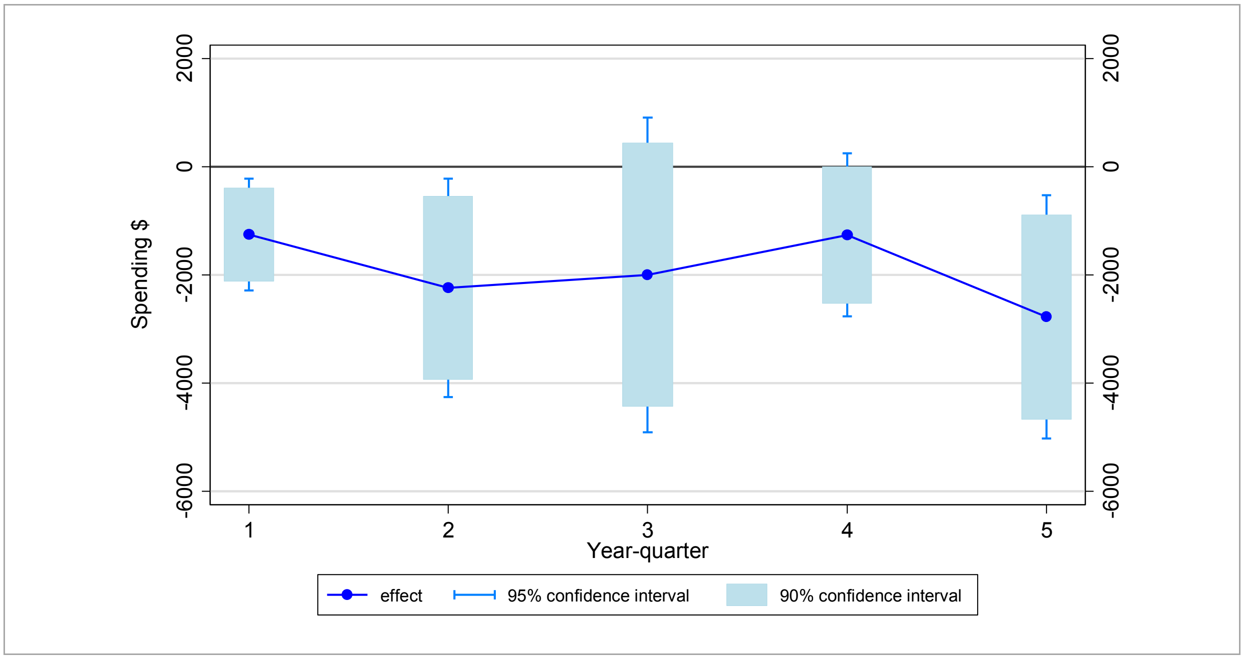
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 22*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly difference-in-differences estimates. There were statistically significant savings in three of the five quarters of the innovation period. Medicaid beneficiaries had large, significant savings in Years 1 and 2 of the program as well as for the entirety of the program to date. However, this is a small subset of the overall Medicaid beneficiaries enrolled in the innovation.

Table 22. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−$1,255	$527	0.018
I2	−$2,242	$1,030	0.030
I3	−$1,999	$1,485	0.179
I4	−$1,260	$769	0.102
I5	−$2,778	$1,150	0.016
Overall average	−$1,658	$638	0.010
Overall aggregate	−$596,823	$229,771	0.010
Overall aggregate (IY1)	−$566,261	$222,888	0.011
Overall aggregate (IY2)	−$30,561	$12,654	0.016

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, and number of months of dual eligibility status during the calendar year prior to the innovation. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute; OLS = ordinary least squares.

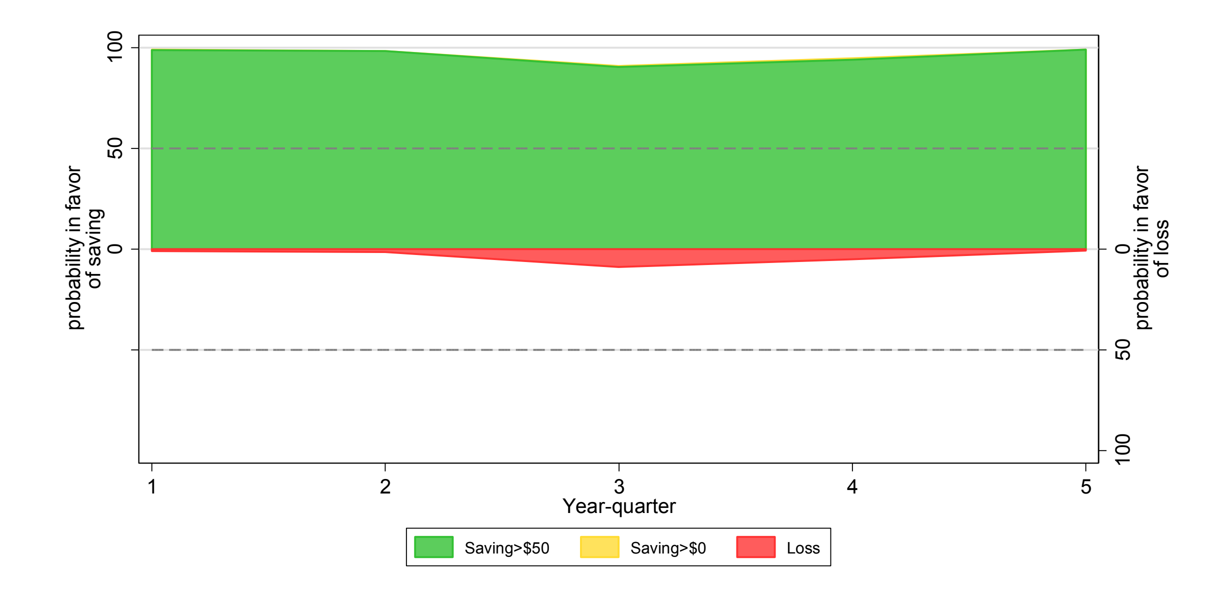
Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
MPHI = Michigan Public Health Institute; OLS = ordinary least squares.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The figure supports the conclusion that the MPHI innovation generated savings among Medicaid beneficiaries.

Figure 11. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 23*** and ***Figure 12***. The inpatient admissions rate is highly variable for both groups in the baseline and innovation period. In the baseline period, the trend for both groups is increasing. During the innovation period, the rates for both groups fall below the baseline trend. The small sample size combined with the infrequency of inpatient admissions hinders interpretation and meaningful conclusions from the descriptive statistics alone. We report results of statistical tests for differences between the innovation and comparison group in the regression analysis section below.

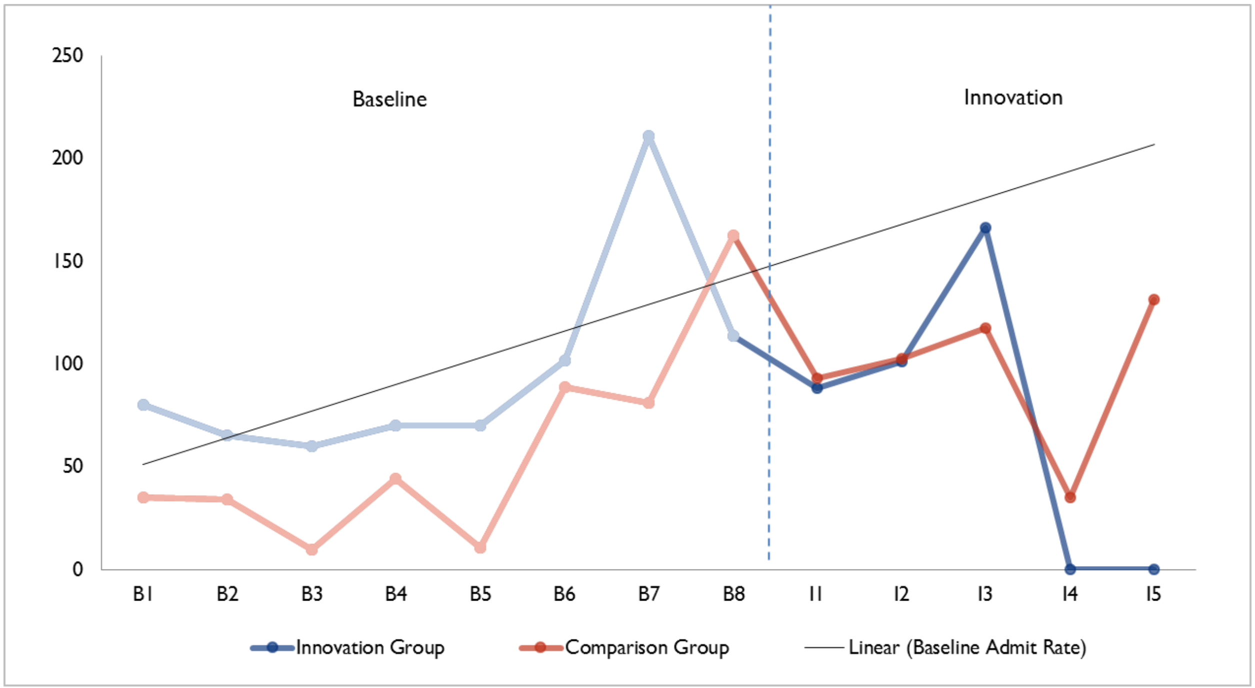
Table 23. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Admit rate	80	65	60	70	70	102	211	114	88	101	167	0	0
Std dev	274	250	314	258	258	402	583	353	419	339	637	0	0
Unique patients	50	46	50	57	57	59	71	88	170	89	54	36	11
Comparison Group													
Admit rate	35	34	10	44	11	89	81	163	93	103	118	35	132
Std dev	137	107	84	136	60	254	192	350	292	216	247	174	384
Weighted patients	66	68	68	68	63	64	70	88	170	84	58	38	13
Innovation − Comparison Rate													
	45	31	50	26	60	13	130	−49	−5	−2	49	−35	−132

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.11.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 45 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −107,16). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 24 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The intervention did not have a statistically significant effect on inpatient visits in any quarter or overall. Due to the small number of inpatient visits during I4 and I5, the negative binomial model was not able to estimate effects for these quarters.

Table 24. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−57.454	51.801	0.269
I2	−41.042	68.491	0.551
I3	−14.203	89.462	0.874
Overall average	−45.325	37.537	0.228
Overall aggregate	−14.187	11.749	0.228
Overall aggregate (IY1)	−14.187	11.749	0.228

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 25*** and ***Figure 13***. Because of the small sample size and low numbers of inpatient admissions in each quarter, we are unable to draw meaningful conclusions from the descriptive statistics on hospital readmissions rates. We will explore this question further in the regression analysis section below.

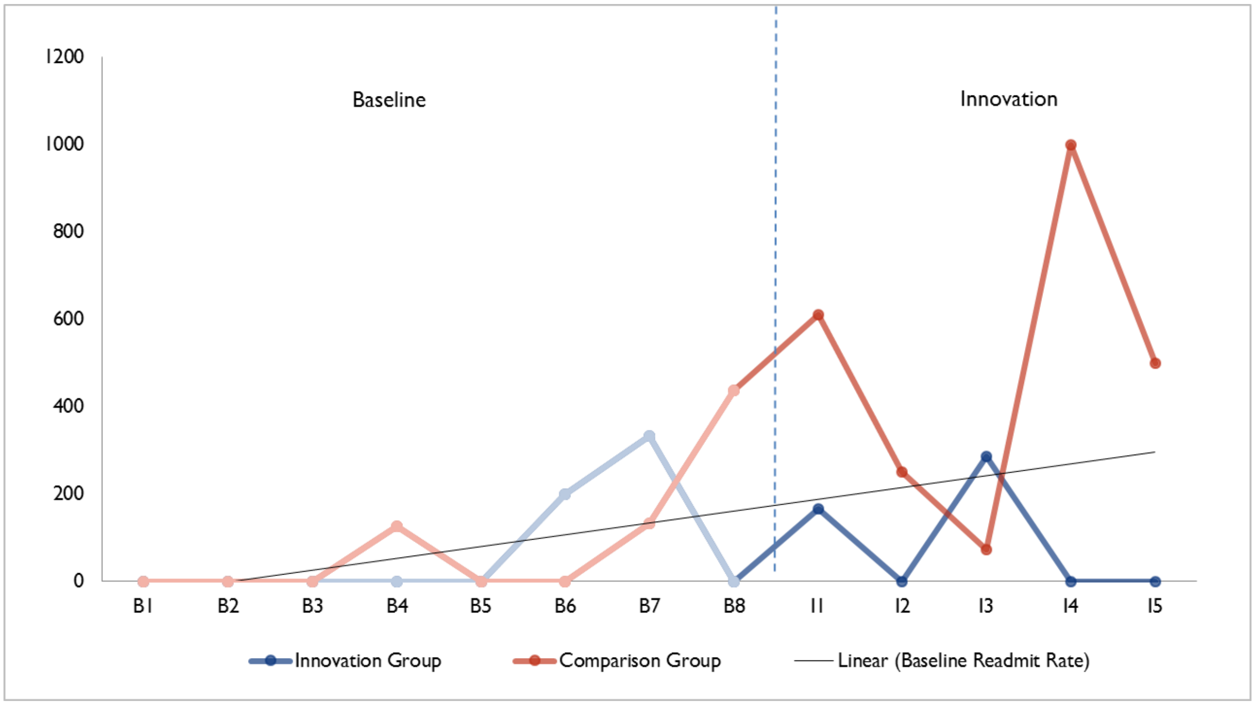
Table 25. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
Readmit rate	0	0	0	0	0	200	333	0	167	0	286	0	0
Std dev	0	0	0	0	0	400	471	0	373	0	452	0	0
Total admissions	4	2	2	4	3	5	12	8	12	6	7	0	0
Comparison Group													
Readmit rate	0	0	0	125	0	0	133	438	611	250	71	1,000	500
Std dev	0	0	0	331	0	0	340	496	488	433	258	0	500
Total admissions	1	2	1	3	1	3	5	13	12	8	5	1	1
Innovation − Comparison Rate													
	0	0	0	−125	0	200	200	−438	−444	−250	214	−1,000	−500

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
; B1 = Baseline Q1; I1 = Innovation Q1MPHI = Michigan Public Health Institute.

Figure 13. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
MPHI = Michigan Public Health Institute.

2.12.2 Regression Results

Table 26 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −129 per 1,000 inpatient admissions (−12.9 percentage points), indicating that the innovation−comparison difference is 12.9 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −311, 53).

Table 26. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Inpatient Admissions: MPHI

Quarter	Coefficient	Standard Error	P-Values
Overall average	−129	111	0.256
Overall aggregate	−3	3	0.256

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
MPHI = Michigan Public Health Institute.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 27*** and ***Figure 14.*** The ED visit rate is fairly volatile for both the innovation and comparison groups in both the baseline and innovation periods. The trend for both groups increases in the baseline period and turns downward during the innovation period. The rate for both groups follows a similar pattern: an increase in the baseline period with a peak in the last quarter of the baseline, a drop in the innovation period with a decline toward the end of the innovation period. The small sample size combined with the infrequency of ED visits hinders interpretation and meaningful conclusions from the descriptive statistics alone. We will test for differences between the innovation and comparison group in the regression analysis section below.

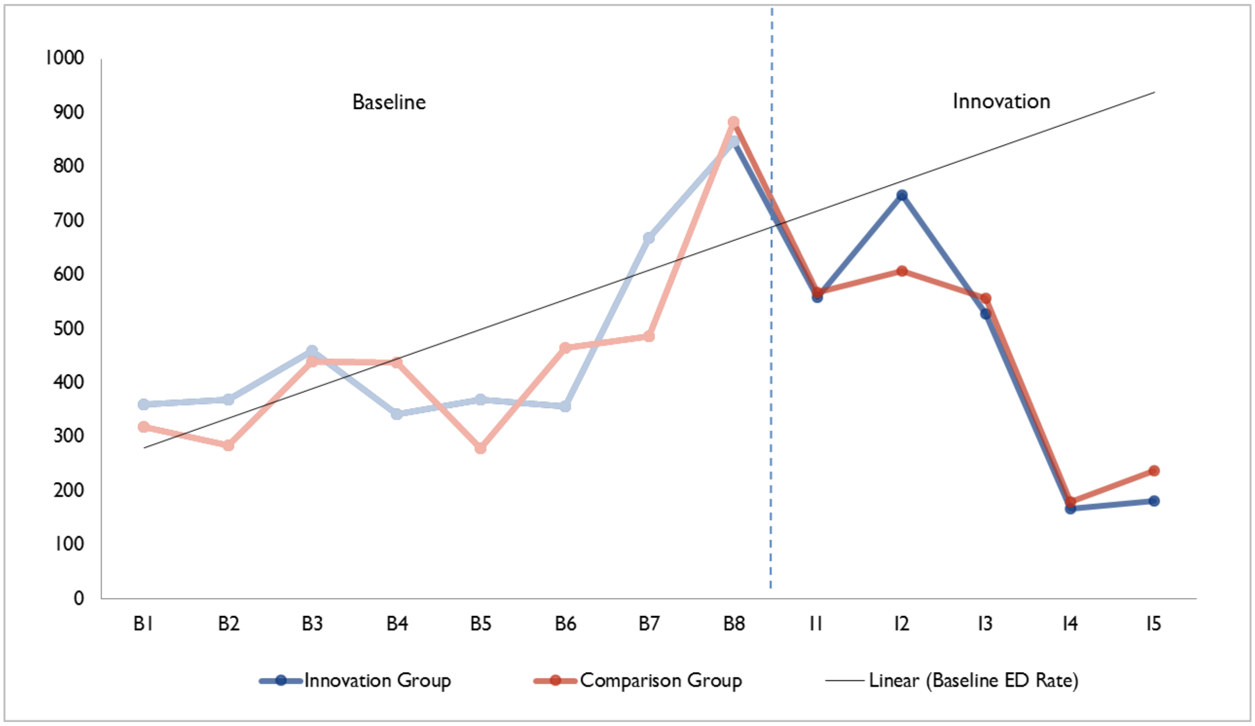
Table 27. ED Visits per 1,000 Medicaid Participants: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters				
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5
Innovation Group													
ED rate	360	370	460	342	368	356	669	847	559	747	528	167	182
Std dev	985	1,040	1,647	1,265	1,371	1,152	1,671	1,634	1,472	1,970	1,711	378	405
Unique patients	50	46	50	57	57	59	71	88	170	89	54	36	11
Comparison Group													
ED rate	319	284	440	437	279	465	486	883	568	607	557	180	237
Std dev	808	874	1,169	868	568	1,453	784	1,464	1,181	1,486	1,131	354	592
Weighted patients	66	68	68	68	63	64	70	88	170	84	58	38	13
Innovation − Comparison Rate													
	41	85	20	−95	89	−109	183	−36	−9	140	−30	−13	−55

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 14. ED Visits per 1,000 Medicaid Participants: MPHI



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ED = emergency department; MPHI = Michigan Public Health Institute.

2.13.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 48 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −259, 163). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 28 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. The innovation did not have any significant effects on ED visits, in any quarter or overall.

Table 28. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicaid Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−190	194	0.329
I2	102	273	0.710
I3	84	371	0.821
I4	57	185	0.758
I5	−73	244	0.772
Overall average	−48	128	0.707
Overall aggregate	−17	46	0.707
Overall aggregate (IY1)	−17	46	0.719
Overall aggregate (IY2)	−1	3	0.772

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, and number of months of dual eligibility status during the calendar year prior to the innovation. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

2.14 Discussion: Medicaid Results

In both years for which we have data, we found that the innovation led to significant savings for Medicaid beneficiaries. Medicaid participants were more likely to complete the Medical Home Pathway than Medicare participants, which may result in better care coordination and chronic disease monitoring and potentially lead to savings. However, MiPathways was designed to help patients receive many types of services, and some of these services would not necessarily be expected to reduce health care spending during the evaluation period (e.g., medication management). There was no significant impact on inpatient admissions, ED visits, or readmissions. We were unable to analyze inpatient admissions in quarters 4 and 5 due to the small number of inpatient admissions during those quarters.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries we were able to match with the identifiers provided by MPHI. These beneficiaries represent 2 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

MPHI submitted data to RTI that are current through December 2015. ***Table 29*** lists the awardee-specific outcome measures selected for the innovation's evaluation, and indicates the status of the data requested and whether the data are presented in this annual report. Data for all the measures listed in the table have been received from MPHI and are included in this annual report. The following sections present awardee-specific, patient-level data on the innovation's impact on clinical effectiveness and the health outcomes.

Table 29. Awardee-Specific Outcome Measures: MPHI

Evaluation Domains	Subdomains	Measure	Status
Clinical effectiveness	Diabetes	Percentage of patients with diabetes who received an HbA1c test	Data received from MPHI
		Percentage of patients with diabetes who received a LDL-C screening	Data received from MPHI
	Weight Management	Percentage of patients who received BMI assessment	Data received from MPHI
	Hypertension	Percentage of patients who received blood pressure screening	Data received from MPHI
Health outcomes	Diabetes	Percentage of patients with diabetes who had HbA1c > 9.0%	Data received from MPHI
		Percentage of patients with diabetes who had LDL-C < 100 mg/dL	Data received from MPHI
	Weight Management	Percentage of patients who are overweight (BMI 25.0–29.9) or obese (BMI > 30)	Data received from MPHI
	Hypertension	Percentage of patients with hypertension with blood pressure < 140/90 mm Hg	Data received from MPHI

BMI = body mass index; LDL-C = low-density lipoprotein cholesterol; MPHI = Michigan Public Health Institute.

Clinical effectiveness refers to the extent to which patients with certain health conditions are provided with appropriate clinical care. Clinical effectiveness measures for MPHI include the percentage of participants with diabetes who received an HbA1c test or low-density lipoprotein cholesterol (LDL-C) test, the percentage of active patients who received a body mass index (BMI) assessment, and the percentage of patients with hypertension who received a blood pressure reading. The subsections below describe the results of each of these measures.

We examined health outcomes among all active patients and among active patients with diabetes and hypertension. The following run charts take into account rolling enrollment. The innovation quarters (Is) are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation will have health outcome data in more innovation quarters over time than those enrolled later in the innovation. Therefore, the number of patients with health outcome data per innovation quarter tends to drop substantially as the number of quarters enrolled increases. We provide data when at least 20 patients had a test or reading within the innovation quarter.

Table 30 shows the number and percentage of active participants by most common health conditions and by number of health conditions. As a requirement for eligibility to enroll, participants must have had at least two chronic conditions. Most patients had three to five chronic conditions (41.5%), although 25.9 percent had six to eight chronic conditions, and 15.7 percent had nine or more chronic conditions. Hypertension (47.4%), depression (48.9%), arthritis (35.2%), diabetes (28.5%), anxiety (33.9%), and hyperlipidemia (25.2%) were the most prevalent conditions among participants. This table shows that MPHI is indeed serving a population with many chronic illnesses.

Table 30. Number and Percentage of Active Participants by Type and Number of Health Conditions for Those Enrolled through December 2015: MPHI

Type and Number of Health Conditions	All Active Patients[1] (N = 7,454) Number	Percentage
Specific Health Condition		
Hypertension	3,532	47.4
Depression	3,643	48.9
Arthritis	2,621	35.2
Diabetes type II	2,122	28.5
Anxiety disorder	2,530	33.9
Hyperlipidemia	1,881	25.2
Other[2]	4,132	55.4
Number of Health Conditions		
≤2 conditions reported	1,255	16.9
3–5 conditions reported	3,093	41.5
6–8 conditions reported	1,932	25.9
≥9 conditions reported	1,174	15.7

Source: Patient-level data provided to RTI by MPHI.
[1] Based on most recent adult checklist completed.
[2] Other includes (1) conditions in the checklist that have been mislabeled as "other" (e.g., anxiety, back pain); (2) conditions that may not be considered chronic health conditions (e.g., illiteracy); and (3) other conditions not included in the checklist (e.g., sleep apnea, fibromyalgia).
MPHI = Michigan Public Health Institute.

2.16 Diabetes

We received data on whether patients with diabetes received an HbA1c test or an LDL-C test during the innovation period. This allowed us to examine whether appropriate clinical services were provided to those with diabetes during the innovation.

Evaluation Questions

- What percentage of patients with diabetes received an HbA1c test during the innovation period?
- What percentage of patients with diabetes received an LDL-C test during the innovation period?

We received outcome data for HbA1c and LDL-C among those with diabetes, which allowed us to address whether the percentage of patients with diabetes with poor HbA1c control decreased and whether the percentage of patients with diabetes with LDL-C control increased among those with diabetes over the course of the innovation.

Evaluation Questions

- Has the percentage of patients with diabetes with poor HbA1c control decreased over time?
- Has the percentage of patients with diabetes with LDL-C control increased over time?

2.16.1 Descriptive Results

Table 31 shows the percentage of patients with diabetes who received an HbA1c test or LDL-C test during the innovation period. Less than one-third of diabetes patients received an HbA1c test or an LDL-C test (31.6% and 20.8%, respectively).

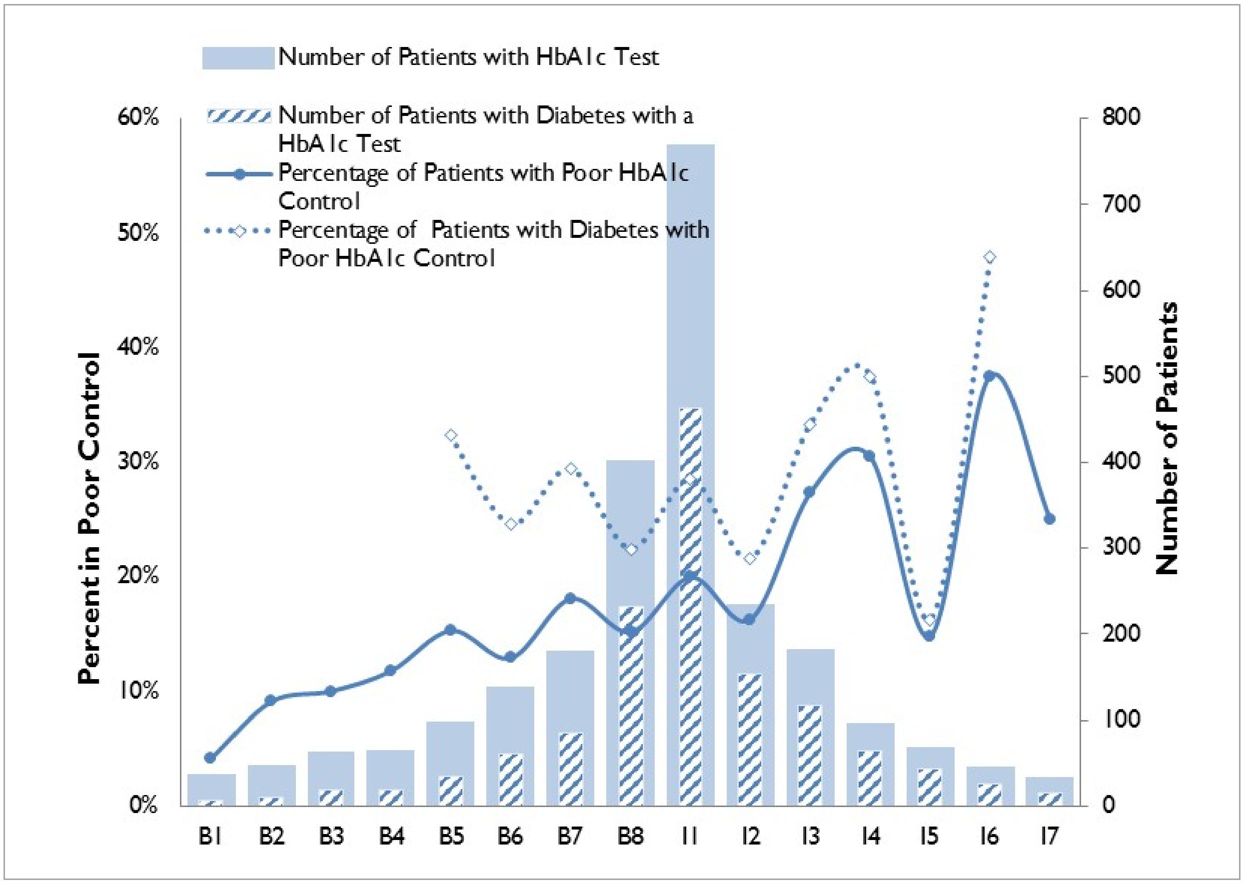
Table 31. Percentage of Patients with Diabetes Who Received Clinical Services: MPHI

	Percentage of Patients Receiving Clinical Services
Diabetes (n=2,122)	
Percentage of patients with diabetes who received an HbA1c test	31.6
Percentage of patients with diabetes who received an LDL-C test	20.8

Source: Patient-level data provided to RTI by MPHI.
LDL-C = low-density lipoprotein cholesterol; MPHI = Michigan Public Health Institute.

Figure 15 presents the percentage of all patients who received an HbA1c test, and those specifically indicating that they had diabetes who had an HbA1c test indicating poor control (i.e., HbA1c > 9%) over time. Given that not all patients who received an HbA1c test indicated they were diabetic on the adult checklist, we include both populations in the figure. The denominators represents the number of active patients who received an HbA1c test for each quarter and the number of patients with diabetes who received an HbA1c test for each quarter. The numerators represent the number of patients who received an HbA1c test result that was > 9.0 percent. As shown in the figure, the percentage of patients with poor HbA1c control and the percentage of diabetes patients with poor HbA1c control fluctuate over time before decreasing in I5 to 14.8 percent and 16.3 percent, respectively. In I6, however, the percentages increase to 37.5 percent and 48 percent, respectively.

Figure 15. Percentage of Patients with Poor HbA1c Control over Time: MPHI

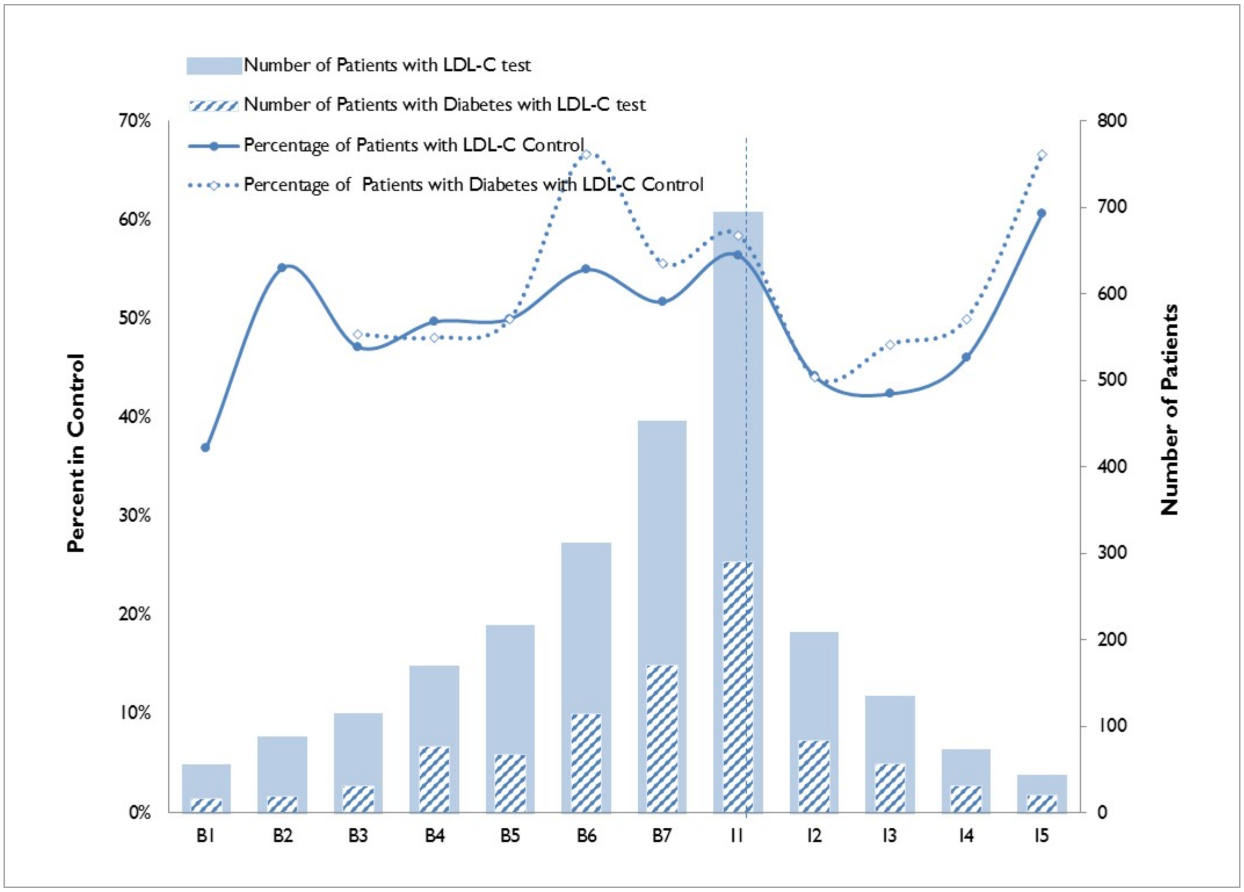


	Quarter	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7
●	Percentage of patients with poor HbA1c control	4.2	9.1	10.0	11.8	15.3	12.9	18.1	15.2	20.0	16.3	27.4	30.5	14.8	37.5	25.0
◊	Percentage of patients with diabetes with poor HbA1c control	—	—	—	—	32.4	24.6	29.4	22.4	28.5	21.6	33.3	37.5	16.3	48.0	—
	Number of patients with HbA1c test	24	33	50	51	85	124	166	388	756	221	168	82	54	32	20
	Number of patients with diabetes with an HbA1c test	7	10	18	18	34	61	85	232	463	153	117	64	43	25	16

Source: Patient-level data provided to RTI by MPHI.
MPHI = Michigan Public Health Institute.
— = Data not applicable.

Figure 16 presents the percentage of active patients with an LDL-C test and patients with diabetes who had an LDL-C test indicating good control (i.e., < 100 mg/dL) over time. The denominators represent the number of diabetes patients and the number of patients who received an LDL-C test for each quarter. The numerators represent the number of diabetes patients who received an LDL-C test result that was < 100 mg/dL. As shown in the figure, the percentage of patients with LDL-C control fluctuates somewhat over time for both sets of patients, especially during the baseline quarters. After I2, however, LDL-C increases steadily until I5, from 44 percent among patients with diabetes and 44.2 percent among patients with an LDL-C test to 66.7 percent and 60.6 percent, respectively. This result could indicate that the innovation may help to increase LDL-C control over time for patients with diabetes. However, the number of patients with a LDL-C test (i.e., the denominator) decreases over time.

Figure 16. Percentage of Patients with LDL-C Control over Time: MPHI



	Quarter	B1	B2	B3	B4	B5	B6	B7	I1	I2	I3	I4	I5
●	Percentage of patients with LDL-C control	37.0	55.1	47.1	49.7	50.0	55.0	51.7	56.4	44.2	42.4	46.0	60.6
◊	Percentage of patients with diabetes with LDL-C control	—	—	48.4	48.1	50.0	66.7	55.6	58.4	44.0	47.4	50.0	66.7
	Number of patients with LDL-C test	46	78	104	159	206	302	443	684	199	125	63	33
	Number of patients with diabetes with LDL-C test	16	19	31	77	68	114	171	291	84	57	32	21

Source: Patient-level data provided to RTI by MPHI.
LDL-C = low-density lipoprotein cholesterol; MPHI = Michigan Public Health Institute; — = Data not applicable.

2.17 Weight Management

MPHI provided data on whether active patients received a BMI assessment, allowing us to address the question of whether appropriate weight management services were provided to patients during the innovation.

Evaluation Question

- What percentage of patients received a body mass index (BMI) assessment during the innovation period?

We received outcome data for BMI among all active patients, which allowed us to address whether the percentage of obese and overweight participants decreased over the course of the innovation.

Evaluation Questions

- Has the percentage of overweight patients decreased over time?
- Has the percentage of obese patients decreased over time?

2.17.1 Descriptive Results

Table 32 shows that over one-third of active patients (37.9%) received a BMI assessment during the innovation period.

Table 32. Percentage of Patients Who Received Clinical Services: MPHI

	Percentage of Patients Receiving Clinical Services
Active Patients (n =7,454)	
Percentage of patients who received a BMI assessment	37.9

Source: Patient-level data provided to RTI by MPHI.
BMI = body mass index; MPHI = Michigan Public Health Institute.

Table 33 presents the BMI over the baseline and innovation quarters. The percentage of obese participants (BMI > 30) stayed relatively the same in I1 through I5, ranging from 20.3 percent to 20.8 percent before dropping in I6 and I7 to 11.9 percent and 7.7 percent, respectively. Fewer than 10 patients, however, received a BMI assessment in the last two quarters. The percentage of overweight patients fluctuates over the course over the innovation, ranging from 48.1 percent in B7 to 79.5 percent in I7. It is possible, however, that some of the obese patients lost weight, placing them in the overweight category, which would cause the percentage of overweight patients to increase over time.

Table 33. Percentage of Overweight and Obese Patients over Time: MPHI

Quarter	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7
Percentage of patients who are overweight: 25 < BMI < 29.9	63.6	57.7	51.4	57.7	58.0	54.1	48.1	58.1	53.1	57.0	61.8	60.2	59.7	65.7	79.5
Number of patients who are overweight: 25 < BMI < 29.9	7	15	18	30	51	72	104	332	1,040	316	247	124	86	44	31
Percentage of patients who are obese: BMI > 30	36.4	7.7	14.3	17.3	13.6	18.8	22.2	21.9	20.8	20.6	20.3	20.4	20.8	11.9	7.7
Number of patients who are obese: BMI > 30	4	2	5	9	12	25	48	125	407	114	81	42	30	8	3

Source: Patient-level data provided to RTI by MPHI.
BMI = body mass index; MPHI = Michigan Public Health Institute.

2.18 Hypertension

MPHI provided data on whether patients with hypertension received a blood pressure reading, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation. Blood pressure data for those with hypertension allowed us to address the question of whether the percentage of patients with hypertension with blood pressure control increased over the course of the innovation.

Evaluation Questions

- What percentage of patients with hypertension received a blood pressure reading during the innovation period?
- Has the percentage of patients with hypertension with blood pressure control increased over time?

2.18.1 Descriptive Results

Table 34 shows that slightly less than one-half of patients with hypertension received a blood pressure reading during the innovation period (42.8%).

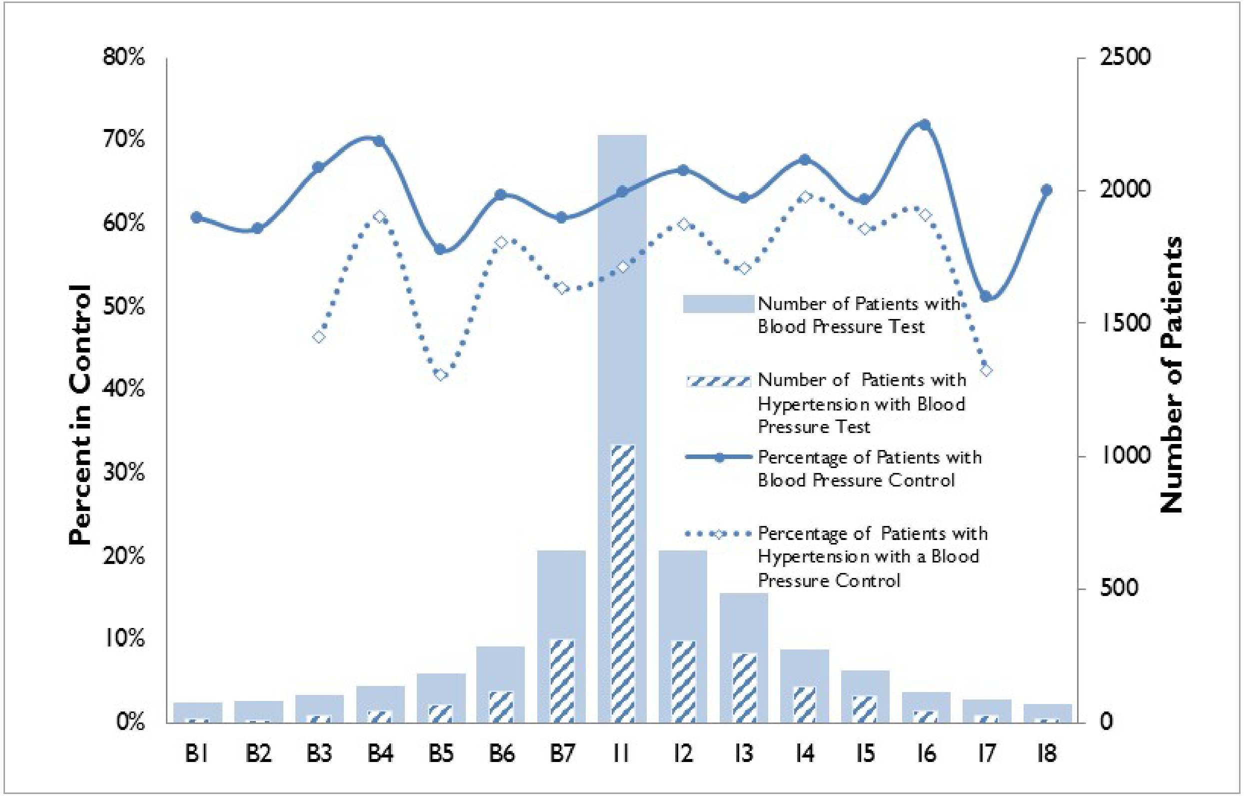
Table 34. Percentage of Patients with Hypertension Who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
Hypertension (n=3,532)	
Percentage of patients with hypertension who received a blood pressure reading	42.8

Source: Patient-level data provided to RTI by MPHI.
MPHI = Michigan Public Health Institute.

Figure 17 presents the percentage of all patients who received a blood pressure reading within the quarter indicating good control (i.e., < 140/90 mm Hg) over time. Because not all patients who received a blood pressure reading indicated they were hypertensive on the adult checklist, we include both populations in the figure. The denominators represent the number of active patients who received a blood pressure reading for each quarter and the number of patients with hypertension who received a blood pressure reading for each quarter. The numerators represent the number of patients who received a blood pressure reading that was < 140/90 mm Hg. As shown in the figure, the percentage of patients and the percentage of hypertensive patients with good blood pressure control fluctuates over time. The percentage of all patients with a blood pressure reading showing good control ranges from 51.28 percent in I7 to 71.8 percent in I6, while the percentage of hypertensive patients with good control ranges from 41.8 percent in B5 to 63.2 percent in I4.

Figure 17. Percentage of Patients with Blood Pressure Control over Time: MPHI



(continued)

Figure 17. Percentage of Patients with Blood Pressure Control over Time: MPHI (continued)

	Quarter	B1	B2	B3	B4	B5	B6	B7	I1	I2	I3	I4	I5	I6	I7	I8
●	Percentage of patients with blood pressure control	60.7	59.5	66.7	69.9	56.8	63.4	60.7	63.8	66.4	63.0	67.7	62.8	71.8	51.2	64.0
◊	Percentage of patients with hypertension with blood pressure control	—	—	46.4	60.9	41.8	57.8	52.2	54.8	60.0	54.6	63.2	59.4	61.0	42.3	—
	Number of patients with blood pressure test	28	37	60	93	139	243	603	2,164	599	441	229	148	71	43	25
	Number of patients with hypertension with blood pressure test	13	12	28	46	67	116	314	1,044	305	262	136	101	41	26	16

Source: Patient-level data provided to RTI by MPHI.
MPHI = Michigan Public Health Institute.
— = Data not applicable.

2.19 Discussion: Awardee-Specific Data

The awardee-specific outcome data analyzed to date demonstrate that MPHI is recruiting a chronically ill population, although that does not necessarily mean that MPHI is reaching those with the highest ED use. Although MPHI is reaching a chronically ill population, the data do not suggest that the innovation has significantly affected all health outcomes in the long run, as rates have fluctuated over time. The most notable improvements are the increase in the percentage of participants with diabetes with LDL-C control over time, although given our limited sample size, any conclusions must be reached with caution.

The lack of improvement in health outcomes, however, is not overly surprising, because Pathways was designed to help patients receive many types of services, including social services, not just services for a single chronic condition. Also, MPHI does not provide direct clinical services to patients, but relies on clinical-based data systems such as electronic health records (EHRs) to capture and report these data. Therefore, the clinical assessments used to calculate health outcomes are not taken at any specific intervals or with the goal of demonstrating improved outcomes; rather, they are administered by the health care provider to the CHWs whenever a patient happens to be at their office. Pathways may lead to long-term improvements in factors that were not assessed as part of this innovation, such as medication compliance.

2.20 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 35*** lists the quantifiable measures of implementation and their status as of December 31, 2015, that RTI obtained from MPHI's

Narrative Progress Reports, Quarterly Awardee Performance Reports. Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q14, and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 35. Measures of Implementation: MPHI

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q14	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11-Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11-Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of clients enrolled (i.e., completed ROI) based on clients referred	Data received from MPHI
		Number/percentage of active clients (i.e., completed ROI + adult checklist) based on clients referred	Data received from MPHI
	Dose	Number and type of pathways completed per participant)	Data received from MPHI

FTE = full-time equivalent; MPHI = Michigan Public Health Institute; ROI = release of information.

2.21 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.21.1 Hiring and Retention

At the end of Q14 (December 2015), the innovation had with 37.70 full-time equivalent (FTE) staff members.[4] Between Q11 (January 2015) and Q14 (December 2015), the awardee reported six separations. As noted in the 2015 annual report, MPHI expected turnover to increase as the grant period ended. The primary reason for many of the separations reported thus far was that staff sought permanent employment elsewhere.

As the lead organization of the innovation, MPHI experienced turnover in the project manager and data analyst roles during Q11. Project manager responsibilities were distributed to other team members, including the project assistant, who was promoted to project coordinator. Although the data analyst was considered a key staff member, another employee filled the position with minimal disruption to the project. The internal structure and ample staff resources at MPHI enabled vacant positions to be filled, which was key in the successful implementation of the Pathways program.

CHW turnover throughout the program generally remained low. MPHI recruited CHWs from the communities where the program was being implemented, which contributed to high CHW engagement and may explain the low turnover. Evaluation interviews likewise suggest that MPHI hired CHWs who were well suited to their role: *"[MPHI] found people in the community that are interested in this work. They determined who the best fit for CHW work is. Not everyone is cut out for it. I have seen reports that this is part of their process."* Also, ongoing CHW training may have kept turnover low.

Because this innovation was new to the awardee, MPHI required new staff for implementation of Pathways. Ingham County CHWs are unionized, which posed a hiring challenge and caused hiring delays at the start of the program.

2.21.2 Skills, Knowledge, and Training

By the end of Q14 (December 2015), MPHI provided 15,561.75 hours of training to 2,590 individuals. Newly hired CHWs received a 1-week intensive CHW training session as well as at least 13 trainings per year. Administrative members receive 2 trainings per year (***Table 36***). Specifically, MPHI provided trainings on workflow processes and the transitional payment model (TPM). Other trainings included new CHW and clinical supervisor training (Pathways model, chronic conditions, the MiPathways database, and roles). MPHI developed training materials and a user guide for MiPathways. The manual, as well as MiPathways software training, was provided to all hub managers, clinical supervisors, and CHWs.

In addition to the training offered by MPHI, implementing sites provided training to CHWs. Specific trainings varied by site. Topic areas included diabetes, arthritis, human trafficking, cultural competency and social justice, nursing home placement, and mental health first aid.

[4] The number of separations since the 2015 annual report and the number of FTE reported do not align. As hubs seek other funding, MPHI may not account for those organizations leaving the workforce.

To improve training, MPHI gathered staff feedback through a training satisfaction survey and training needs assessment. Staff who received training generally believed that the trainings were useful. They noted that trainings were frequent and aimed at the needs of the CHWs. Training topics included chronic disease, home visiting safety, local community resources, motivational interviewing, and tobacco cessation. These trainings may have helped contribute to CHW retention as well as CHW success in implementing pathways.

Table 36. Training Provided to Staff: MPHI

Time Frame	Number of Training Hours	Number of Trainees
Q11-Q14	2,492.25	981
Since inception	15,561.75	2,590

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
MPHI = Michigan Public Health Institute; Q = quarter. Q11-Q14=January-December 2015.

2.22 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

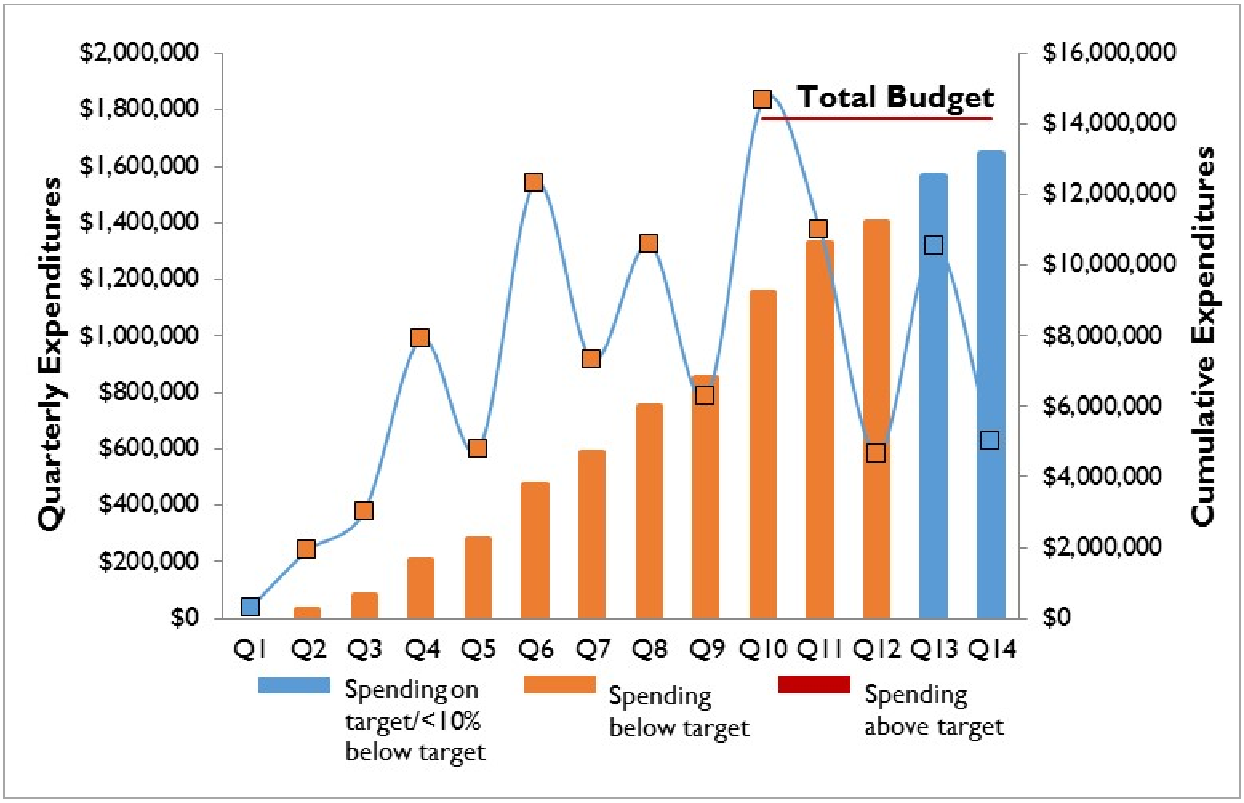
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.22.1 Award Execution

The annual report highlights the significance of MPHI's expenditure rates on implementation. As of December 2015 (Q14), MPHI spent 93.1 percent of its total budget, which is at the projected target (see ***Figure 18***). This is expected given MPHI received a no-cost extension for an additional 12 months (starting in June 2015); thus, much of the funds remaining after Year 3 were spent during Year 4. MPHI noted that the remaining funds were spent in Year 4 on developing and refining the TPM or given to implementation sites to continue enrollment.

Figure 18. Cumulative Spend Rate from Q1 (June 1 2012) to Q12 (June 30 2015)



2.22.2 Leadership

Support from project leadership was consistently high at MPHI and the three implementing sites. MPHI and the Pathways project director have experience conducing similar federal and state-funded innovations that address health disparities in Michigan. The principal investigator was described as being *"well respected with many years of experience, and is the champion of the program. She has gathered the support of many smart people that help add to her vision of the program."* The leadership at MPHI and the Pathways project not only helped secure and sustain partners at each of the implementation sites (Saginaw, Muskegon, Ingham), but also helped garner statewide support for developing reimbursement mechanisms for CHWs.

Given the complexity of the program, MPHI had to select supportive organizations to serve as community hubs with strong leaders that could bring together the necessary stakeholders in their respective communities. Each community hub partnered with 7 to 12 local partners in its service area. MPHI facilitated coordination and communication with the communities through frequent meetings and conference calls, and opportunities and trainings for the CHWs to learn and support one another.

2.22.3 Organizational Capacity

MPHI has an internal structure and access to resources that support implementation of the Pathways innovation at each of the three implementation sites. MPHI offered fiduciary and federal compliance support, data system capabilities, multisite project management expertise, collaboration and subrecipient contracting with lead agencies, and technical assistance. MPHI provided the MiPathways data system and training to sites and staff. The MiPathways data system was developed in-house for the Pathways innovation as a customized care management data collection tool. MPHI also constructed and managed an internal database used for project data collection after uncovering issues with the existing database used for data collection.

The hubs partner with CCAs to hire, support, and deploy CHWs, and their established infrastructure facilitated the implementation of Pathways. This infrastructure includes experienced management staff, community connections, and various sources to provide referrals to medical providers and social services agencies. The three hubs overcame organizational issues and challenges unique to each location. In Ingham, MPHI noted that bringing all relevant stakeholders together was difficult, as many key organizations in Ingham are siloed in their respective activities. Collaboration efforts in Muskegon and Saginaw, however, were less challenging because many necessary relationships were already in place. MPHI staff considered the collaboration across all sites to be sufficient, and overall implementation effectiveness was not limited by organizational capacity issues. One evaluation interviewee explained,

> ***"MPHI has been around for a while… They chose the three counties correctly, developing great partnerships in those counties. It seems like the backbone of each of these three counties, that serve as a hubs, or a backbone organization, has really helped and has added to their success... I think they have smart people and a deep bench, the people who have come to pick up the slack have not missed a beat."***

2.22.4 Innovation Adoption and Workflow Integration

The Pathways model was originally developed by Drs. Mark and Sarah Redding through their work with the Community Health Access Project (CHAP) in Ohio, which exclusively focused on teen pregnancy. MPHI adapted the model for adults with two or more chronic diseases, to address social determinants of health. An individual from MPHI said:

> ***"MPHI recognize[s] that people with chronic disease are not going to sufficiently deal with the day-to-day oversight and these people need to have actual lifestyle and life issues dealt with sufficiently before even getting the chronic disease under control. They've operationalized this in a way that has been really progressive, looking at housing, transportation, food, and childcare."***

In addition, the three sites have adapted the Pathways to fit the local community. One important adaptation was having a lead agency at each site in addition to a hub due to the complexity of the award and associated finances. The hub is a neutral organization helping to connect potential participants to a CHW through a CCA. Neutral hubs reduces the risk of a "turf war" among the CCAs. The original model does not include a lead agency. However, MPHI established a lead agency at each site to ensure sites had the capacity to manage the financial responsibilities associated with implementing the Pathways innovation. MPHI also adjusted the model to enable hubs to partner with community service agencies in addition to local federally qualified health centers and hospitals. CHWs work with participants to complete a checklist of pathways following a health needs assessment. These pathways address participants' social and health needs. For example, a participant may require a primary care visit and assistance with utilities. The CHW will work with the participant to complete these pathways by facilitating a primary care visit or guiding the participant to appropriate social services. Overall, MPHI successfully adapted and implemented Pathways at all three sites.

2.23 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort, because the evaluation cannot make conclusive assessments about the innovation's impact without first determining if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness, including reach and dose, of the innovation thus far?

2.23.1 Innovation Reach

Pathways program participants were adults 18 years of age or older who were either enrolled in or eligible for Medicare or Medicaid and lived in Saginaw, Muskegon, or Ingham Counties or selected adjacent counties. To qualify for enrollment, participants must also have had two or more chronic conditions. Pathways targets high ED users (i.e., five or more visits) and hospital inpatient services (i.e., three or more visits), although MPHI does not limit enrollment to high service users.

We provide two calculations of reach for MPHI. First, we examined the number enrolled, defined as participants who signed a release of information (ROI) as a percentage of those referred to Pathways. Second, we examined the number of active participants as a percentage of those referred to Pathways. This definition requires participants to have signed an ROI and to have completed the mandatory adult checklist. According to the Pathways data provided to RTI, and as shown in ***Table 37***, 8,301 participants were enrolled across the three sites, but only 7,454 were considered active through December 2015 (Q14).

The number of enrolled and active participants reported vary across the three sites. Differences are likely because Muskegon operates within a single health system, Mercy Health, a part of Trinity Health. The organizational structure at Muskegon allows for access to system-wide EHRs, which helps clinical supervisors use real-time clinical data to locate and verify high ED users.

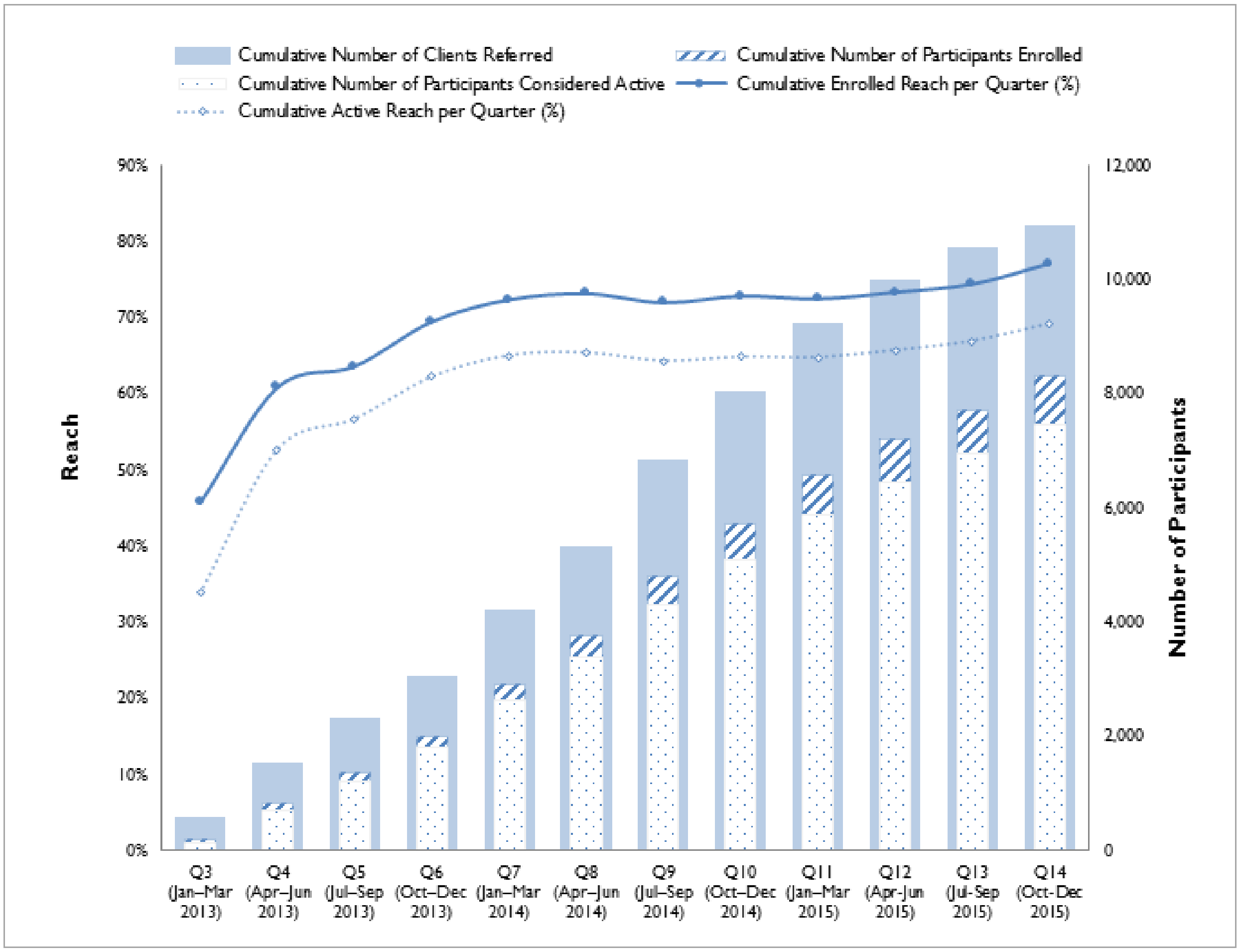
Table 37. MPHI Enrolled and Active Participants as of Q14

Participants	Saginaw	Muskegon	Ingham	Total
Number enrolled: ROI signed	1,965	3,378	2,958	8,301
Number active: ROI signed + adult checklist	1,819	2,824	2,811	7,454
Difference in participants: ROI signed but no adult checklist	146	554	147	847

Source: Patient-level data provided to RTI by MPHI.
MPHI = Michigan Public Health Institute; ROI = release of information.

Figure 19 shows reach by quarter since the launch of the innovation. Since the 2015 annual report, MPHI enrolled an additional 1,731 participants, and an additional 1,578 participants are considered active. We last reported reach in the 2015 annual report based on data through Q11. Reach has increased from 72.5 percent in Q11 to 77.1 percent in Q14 for those enrolled, and 64.8 percent in Q11 to 69.2 percent in Q14 for those considered active. These numbers vary slightly from what was reported in the 2015 annual report, as MPHI provided new cumulative data that contain slight modifications in previously reported quarters. MPHI was successful in enrolling and engaging participants as they hired CHWs from the targeted communities that were committed to working with participants to complete necessary pathways. Sites also tried to target participants who had unmet needs and/or were high users of care who greatly benefit from the program and were likely to stay engaged and complete the relevant pathways.

Figure 19. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)	Q13 (Jul–Sep 2015)	Q14 (Oct–Dec 2015)
●	Cumulative enrolled reach per quarter (%)	45.7	60.8	63.6	69.5	72.3	73.1	72.2	72.8	72.5	73.3	74.4	77.1
◊	Cumulative active reach per quarter (%)	33.8	52.7	56.7	62.2	65.0	65.4	64.1	64.9	64.8	65.7	66.9	69.2
	Cumulative number of clients referred	429	1,353	2,141	2,888	4,034	5,168	6,675	7,861	9,068	9,828	10,378	10,766
	Cumulative number of participants enrolled	196	823	1,362	2,006	2,918	3,779	4,817	5,724	6,570	7,206	7,720	8,301[1]
	Cumulative number of participants considered active	145	713	1,214	1,797	2,624	3,379	4,282	5,099	5,876	6,460	6,947	7,454

Source: Patient-level data provided to RTI by MPHI.
[1]Includes two patients with missing enrollment dates.
MPHI = Michigan Public Health Institute.

2.23.2 Innovation Dose

A standard or target dose does not exist for this innovation, given that the number, type, and duration of the specific pathways vary by participant. As expected, the number of services provided and the percentage of participants receiving those services increased since the 2015 annual report. ***Table 38*** provides the total number of pathways provided to participants, the number of participants completing each pathway, and the average number of pathways per participant. The most common pathways are medical referrals, completed by over half of participants (61.8%) an average of 5.7 times, and social service referrals, completed by 76.3 percent of participants an average of 4.7 times. In addition, half (49.9%) of all participants completed the Medication Assessment Pathway an average of 1.3 times. Education and PHQ-9 Screening Tool Pathways had the largest increases in the percent of participants receiving the service number compared to the 2015 annual report. Education participation increased by nearly 8 percentage points from the 2015 annual report (to 42.8%) while PHQ-9 increased by nearly 6 percentage points (to 29.5%). Fewer than 25 percent of participants completed the remaining pathways. Overall, participants completed an average of approximately three pathways.

Table 38. Number and Types of Pathways Provided to Participants

Pathway Name	Total Number Completed Pathways[1]	Number (Percentage) of Participants Receiving Service[2]	Average Number of Services per Participant
Medical referral	26,316	4,606 (61.8)	5.7
Social service referral	26,552	5,689 (76.3)	4.7
Medication assessment	4,683	3,717 (49.9)	1.3
Education	10,853	3,191 (42.8)	3.4
Health insurance	1,375	1,230 (16.5)	1.1
Medical home	1,768	1,373 (18.4)	1.3
PHQ-9 screening tool	3,426	2,202 (29.5)	1.6
Fall prevention tool	2,234	1,688 (22.6)	1.3
Medication management	630	520 (7.0)	1.2
Healthy Changes Plan	1,194	681 (9.1)	1.8
Healthy Homes Checklist	526	452 (6.1)	1.2
Tobacco cessation	244	235 (3.2)	1.0
CAGE AID	281	206 (2.8)	1.4
Family planning	54	48 (0.6)	1.1
Pregnancy	67	63 (0.8)	1.1
Postpartum	36	35 (0.5)	1.0
Total number completed	80,239	25,936	3.1

Source: Patient-level data provided to RTI by MPHI.
1 Individuals may have completed Pathways multiple times.
2 Counts only one completed Pathway per participant.
CAGE AID = CAGE Questionnaire Adapted to Include Drugs; MPHI = Michigan Public Health Institute; PHQ-9 = Patient Health Questionnaire.

The initial implementation of the TPM revealed that CHWs were "gaming the points system." Certain pathways were chosen over others because that pathway was of higher value and would yield a higher financial award for the CHW. This also led to neglecting less lucrative pathways. Since then, MPHI adjusted the model and provided additional training to mitigate this challenge. It is unclear, however, based on the data provided, whether participants received all relevant pathways.

2.24 Qualitative Findings: Sustainability

MPHI, MDHHS, the lead agencies, and hubs are working together to identify and secure ongoing funding to sustain the Pathways innovation past HCIA funding, which ended in June 2016. Since the 2014 annual report, a major focus of the innovation has been on sustainability, including the development of the TPM as described above. In Year 2, MPHI developed, virtually tested, and refined the TPM. This virtual test allowed MPHI and the participating CCAs to understand the amount of pay that employed CHWs would receive if the innovation were sustained using the TPM. This virtual test included a review of the MiPathways database and the process in which CHWs' performance is assessed using points. These points are given for partially and fully completed pathways to drive outcomes of better care, better health, and lower costs. The initial virtual test revealed that CHWs were targeting the most financially lucrative pathways, as described in the previous section. Strategies were put into place to mitigate these issues and block the "gaming," including targeted training by Pathways staff and reassessment of the points assigned for each pathway to more accurately reflect CHW effort. Other efforts to support implementation of the TPM included engaging project officers, hubs, and lead agencies to implement the TPM and sustainability plan. In addition, MPHI provided the sites with supporting documents to implement the TPM, such as a statement of work, invoicing guidance, and programmed forms for billing. Despite the TPM adjustments and supporting documents, the TPM remained complex and challenging to implement.

Additional sustainability efforts included the development of a sustainability committee composed of representatives from all three implementation sites, which met twice per month. MPHI also reached out to the Medicaid Managed Care Plans (MMCPs) to enlist MMCPs as potential payers for services following the end of the grant period, and to act as referral sources for eligible participants. MMCPs could hire CHWs and have shown interest in contracting with the hubs for CHW services. MPHI and its partners are working to sustain the program through MMCPs and the Michigan Association of Health Plans. However, CHW services are not currently covered by Medicaid in Michigan, so a contract with a health plan would need to be funded through the health plan's administrative funds. In May 2015, guidance from MDHHS Medical Services Administration for the Medicaid contract rebidding process required CHW services for certain populations. The guidance encouraged MMCPs to work with community-based organizations such as the hubs to provide access to CHW services for these populations. The hubs, as of the writing of this report, were currently negotiating with the MMCPs to sustain their programs past HCIA funding period.

Each hub also initiated its own efforts to achieving sustainability. Ingham conducted outreach to local funding sources including Community Foundations, United Way, Michigan State University, local hospitals, and payers. Muskegon applied to Trinity Health, Call to Care, and the MDHHS for funding. The project director reported that Mercy Health, part of the larger Trinity Health, will likely fund parts of the innovation in Muskegon not covered by the NCE. Lastly, Saginaw was awarded hub certification. The hub continues to work with MiCHW Alliance on CHW certification and reimbursement. Saginaw is also working with the Saginaw County Mental Health Authority to discuss creating a Peer Partner Team for behavioral health patient-centered medical homes that would include CHWs. MPHI and the sites submitted a concept paper to the W.K. Kellogg Foundation for funding following the end of the grant period. MPHI is considering other grants and federal contracts as possible sources of post-grant funding.

Moving forward, there are two additional avenues for sustainability of Pathways. First, the Centers for Medicare & Medicaid Services (CMS) is now allowing state Medicaid agencies to reimburse for preventive services provided by CHWs. However, the state must submit a State Plan Amendment to CMS for approval to finalize this change. MPHI is working with and encouraging Michigan Medical Services Administration and MDHHS leadership to submit the amendment. MPHI is also encouraging use of Pathways outcomes to justify this amendment. Second, MDHHS is part of the State Innovation Model (SIM) Initiative. As part of the SIM Initiative, the state will address population health, and can do so by contracting with Pathways hubs.

2.25 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing MPHI as well as accomplishments to date. In this section, we assess MPHI's progress on achieving HCIA goals to date:

- **Smarter spending.** The Pathways innovation showed increased spending among Medicare participants enrolled in the innovation, which may result from the innovation's focus on improving beneficiaries' use of appropriate services. Individuals who utilized 6 or more pathways had higher spending than the comparison group; however, this may be because high-needs patients were appropriately connected to more pathways by CHWs. Statistically significant savings were found for Medicaid beneficiaries of the Pathways innovation; however, this was for a small subset of the Medicaid population served by the innovation. Medicaid savings were found in both years of the innovation for which data were available, possibly because Medicaid individuals were younger and slightly healthier (had fewer chronic conditions) than Medicare beneficiaries. We also noted that Medicaid participants were more likely to complete the Medical Home Pathway than Medicare beneficiaries, which may result in better care coordination and chronic disease monitoring which, in turn, could produce savings.

- **Better care.** There was no effect of the innovation on inpatient admissions or ED visits for Medicare beneficiaries enrolled in the MPHI program. Individuals who had a higher "dose" of the program (those who completed more pathways) had more inpatient visits; however, this result may have been caused by sicker patients being referred to more pathways. Individuals who completed some pathways (but fewer than the mean) saw a decrease in ED visits due to the innovation. The Pathways innovation did not have a significant impact on readmissions. There was no statistically significant impact on inpatient stays, readmissions, or ED visits for Medicaid beneficiaries enrolled in the innovation.

  Overall reach increased from 72.5 percent in Q11 to 77.1 percent in Q14 for those enrolled, and 64.8 percent in Q11 to 69.2 percent in Q14 for those considered active. In addition, participants completed an average of approximately 3 Pathways. The most common pathways were medical referrals, completed by over half of participants (61.8%) an average of 5.7 times, and social service referrals, completed by 76.3 percent of participants an average of 4.7 times.

- **Healthier people**. Overall, the data suggest that the innovation may be somewhat affecting health outcomes in the long run, but the rates have fluctuated over time. The most notable improvement is the increase in the percent of participants with diabetes with LDL-C control, although again given the limited sample size, results should be interpreted with caution.

Overall, MPHI was successful at implementing the Pathways innovation in three communities in Michigan: Saginaw, Muskegon, and Ingham. Although MPHI faced early challenges related to the implementation of the data collection and reporting database, MPHI has a strong, nimble organizational capacity and structure that allowed it to develop its own internal database, MiPathways, as well as replace staff when turnover occurred. MPHI has also tried to help the sites sustain the programs after HCIA funding. MPHI and its partners are working to sustain the program through MMCPs and the Michigan Association of Health Plans, as well as through private foundations and grants. In addition, MDHHS is part of the SIM Initiative. As part of the SIM Initiative, the state will address population health, and can do so by contracting with Pathways hubs.

Although the claims analyses do not demonstrate any Medicare savings, the findings suggest that the innovation yielded Medicaid savings, possibly because the population is slightly younger and healthier. The dose analyses for Medicare also demonstrated savings in the long run for participants who completed 1–6 pathways. Dose analyses were not completed for Medicaid due to the small sample size.

The lack of notable improvements in health or claims outcomes, however, is not surprising, as Pathways was designed to help patients receive many types of services, including social services, and not services specifically for a single chronic condition. The Pathways innovation may lead to improvements in long-term health factors that were not assessed as part of this innovation, such as medication compliance.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Michigan Public Health Institute (MPHI)

The nonprofit Michigan Public Health Institute (MPHI) is located in Okemos, Michigan. Awarded a total of $14,145,784, MPHI launched the Michigan Pathways to Better Health (Pathways) project in January 2013 in three Michigan counties: Saginaw, Muskegon, and Ingham.

Awardee Overview

Innovation dose:	Medical referral pathways were completed by 61.8% of participants an average of 5.7 times. Social service referrals were completed by 76.3% of participants an average of 4.7 times.	***Innovation reach:***	Overall reach was 77.1% for those enrolled and 69.2% for those considered active.
Components:	(1) Community hubs and care coordinating agencies that assign participants to a community health worker (CHW) (2) CHWs who enroll participants, conduct assessments, and assist patients with social and health needs (3) A transitional payment model, which is a pay-for-deliverable model tied to CHW performance and completion of participant pathways	***Participant demographics:***	Majority of participants (72.7%) were from 25 to 64 years of age, and 61.0% were female. Over 45% were covered by Medicaid; 17.5% were covered by Medicare, including Medicare Advantage, and 21.5% were covered by both Medicare and Medicaid.
Sustainability:	MPHI created a sustainability committee with representatives from all three implementation sites, and engaged Medicaid Managed Care Plans (MMCPs) in a partnership to include the MMCPs as potential payers for services and act as current referral sources for eligible participants.		
Innovation type:	Coordination of care; Provider payment reform	Direct health care/ dental care	Health care workforce

Key Findings

Smarter spending. Among Medicare beneficiaries, the average quarterly impact on spending per person was statistically significant, indicating an increase in Medicare spending ($438; 90% CI: $90, $785). Average quarterly Medicaid spending decreased significantly (−$1,658; 90% CI: −$2,709, −$606). The increase in Medicare spending may result from the innovation's focus on improving beneficiaries' use of appropriate services. Medicaid participants were more likely to complete the Medical Home Pathway, which may result in better care coordination and chronic disease monitoring that, in turn, could produce savings.

Better care. Changes in inpatient stays (10; 90% CI: −1, 22), ED visits (−2; 90% CI: −27, 23), and unplanned readmissions (9; 90% CI: −22, 40) did not change significantly for Medicare beneficiaries. Changes in inpatient stays (−45; 90% CI: −107, 16), ED visits (−48; 90% CI: −259, 163), and unplanned readmissions (−129; 90% CI: −311, 53) did not change significantly for Medicaid beneficiaries. Participants completed an average of approximately three pathways.

Healthier people. Overall, the data suggest that the innovation had minimal effects on health outcomes. The most notable improvement is the increase in the percentage of participants with diabetes with LDL-C control, increasing from 58.4 percent in the first innovation quarter to 66.7 percent in the fifth innovation quarter. Given limited sample size, results should be interpreted with caution.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Mineral Regional Health Center

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Mineral Regional Health Center

2.1 Introduction

The Mineral Regional Health Center (Mineral Regional) was a nonprofit regional collaborative in Superior, Montana, that served as the grant convener for the Frontier Medicine Better Health Partnership (FMBHP). FMBHP was Mineral Regional's innovation, a partnership of 25 critical access hospitals (CAHs) across the state. Mineral Regional received an award of $10,499,899 and began enrolling CAHs in November 2012. The FMBHP sought to standardize the coordination of care in participating CAHs across the spectrum of medical services in five key improvement areas (program pillars), ensuring that patients receive the right care at the right time from the right provider. The innovation worked to achieve the following HCIA goals:

1. **Smarter spending.** Lower total expenditures by 7 to 15 percent over 3 years for frontier and rural populations, patients, and communities.

2. **Better care.** Increase patients' satisfaction and improve their experience by 30 percent over 3 years for frontier and rural populations, patients, and communities.

3. **Healthier people**. Improve outcomes by 10 percent over 3 years for frontier and rural populations, patients, and communities.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11-12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by Mineral Regional and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Primary focus workforce development (Component 1), community engagement (Component 2), and the provider-based research network (FRIN; Component 3), and some work with value-based purchasing (Component 4) in Year 2. Conducted an inventory of electronic systems across the CAHs in Year 2 but did not integrate the EHR systems (Component 5) as planned.
Program Participant Characteristics	
	Characteristics of the CAHs remained the same over time. A majority of CAHs had 21 to 25 beds (76.0%) while only 16.0% had 6 to 10 beds. CAHs were located across the state and most CAHs were nonprofit (68.0%).
Workforce Development	
Hiring and retention	Significant changes occurred in hiring and retention in Year 3 as the funding period ended. At the end of Q12, the innovation was staffed with 2 FTE staff members. Between Q11 (June 2014) and Q12, 31 staff members left their positions.
Skills, knowledge, and training	During Q11 and Q12, the FMBHP provided 2,562 hours of training to 709 individuals.
	Final two professional development educational series (training) were held for the BHIS and CAH community.
Context	
Award execution	Spent 96.97% of Year 3 budget, at target.
Leadership	Leadership of the organization remained stable over the reporting period.
Organizational capacity	Organizational capacity remained stable over the reporting period.
Innovation adoption and workflow integration	Each BHIS began collecting and reporting comparative data through the KnowledgeWeb over the reporting period. FMBHP implemented two projects focusing on swing-bed and EOL care and standardized education and registry materials for broader dissemination.
Implementation Effectiveness	
Innovation reach	The number of enrolled CAHs (25) has remained the same over time.
Innovation dose	For Component 1 (workforce development), 68% of CAHs completed a BHIP, 92% hired a BHIS, and 60% completed a BHIP and hired a BHIS.
	For Component 2 (community participation), 88% of CAHs completed a CNA, 48% established a community collaborative, and 44% completed a CNA and established a community collaborative.
	For Component 3 (provider-based research network), 84% of CAHs participated in the formulary management project, 44% in the EOL registry project, 20% in the swing-bed research study, and 16% completed all three projects. No data for dose were available for Components 4 and 5.
Sustainability	
	Mineral Regional did not sustain FMBHP after June 30, 2015. FMBHP staff and CAH leaders formed a 501(c)(3) nonprofit entity, FRIN. Over 3/4 of CAH CEOs committed to funding the BHIS position past the grant period with some shifts in work responsibilities.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 4 and 5, 2015.

BHIP = Better Health Improvement Plan; BHIS = Better Health Improvement Specialists; CAH = critical access hospital; CEO = chief executive officer; CNA = community needs assessment; EHR = electronic health record; EOL = end-of-life; FMBHP = Frontier Medicine Better Health Partnership; FRIN = Frontier Rural Innovation Network; FTE = full-time equivalent.

Table 3 summarizes Medicare claims-based findings during the innovation period. There is no statistically significant difference in the average quarterly effect of the program on total spending over 3 years of the innovation. The effect was an $8 (90% CI: −$2, $18) increase in spending per member per quarter. On average, approximately, 12,000 people attended the participating CAHs each quarter; this small increase translated into $4,329,115 in higher spending within the participating CAHs compared to nonparticipating CAHs, over 4 years. In the first year of the innovation, however, we find significant savings equal to $22 (90% CI: $10, $35) per participant per quarter. The innovation is associated with significantly higher spending in Years 2, 3, and 4. The economic significance of the first year of savings is small. This result is statistically significant because it is a byproduct of the large sample size as suggested by the statistically significant but small increases in spending in Years 2, 3, and 4. Total decreases in inpatient stays and increases in ED visits are also statistically significant, but small over the entire innovation period, and amount to 1 fewer inpatient stay and 12 more ED visits per 1,000 participants per quarter. ED visits were higher for Mineral Regional both before and after the intervention, as will be discussed in subsequent sections. The difference between participating and nonparticipating CAHs was lowest in the first year for this outcome. The innovation did not show a statistically significant effect on readmissions.

Table 3. Summary of Medicare Claims-Based Findings: Mineral Regional

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI	Year 4	90% CI
Aggregated results										
Total spending (in millions)	$4.329	−$1.047, $9.706	−$4.220	−$6.613, −$1.827	$3.730	$1.241, $6.218	$3.573	$1.372, $5.773	$1.247	$723, $1,771
Acute care inpatient stays	−449	−747, −151	−277	−460, −94	−87	−264, 91	−160	−307, −13	74	27, 121
Hospital-wide all-cause unplanned readmissions	42	−15, 98	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	6595	5414, 7,777	374	−361, 1,110	3815	3,106, 4,523	1,752	1,187, 2317	655	472, 837
Average impact per quarter										
Spending per participant	$8	−$2, $18	−$22	−$35, −$10	$20	$7, $33	$25	$10, $40	$76	$44, $108
Acute care inpatient stays (per 1,000 participants)	−1	−1, 0	−1	−2, 0	0	−1, 0	−1	−2, 0	5	2, 7
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	8	−3, 19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	12	10, 15	2	−2, 6	21	17, 24	12	8, 16	40	29, 51

Definitions

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions is the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. Because only six innovation quarters of Medicaid claims are available, no summary statistics are available for Year 3 for Medicaid beneficiaries. The average quarterly effect of the program on total spending over 2 years of innovation periods is not statistically significant. The effect was a $100 (90% CI: -$75, $275) increase in spending per member per quarter, but this is not statistically significant. Total increases in inpatient stays are statistically significant but small over the entire innovation period, and amount to seven more inpatient stays per 1,000 participants per quarter. ED visits among participating CAHs also increased (4 per 1,000 participants), but the difference compared to nonparticipating CAHs is not statistically significant. The innovation did not show a statistically significant effect on readmissions.

Table 4. Summary of Medicaid Claims-Based Findings: Mineral Regional

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$3.042	−$2.285, $8.369	$4.014	−$2.094, $10.121	−$0.972	−$4.021, $2.078	N/A	N/A
Acute care inpatient stays	202	115, 289	151	72, 230	51	14, 87		,
Hospital-wide all-cause unplanned readmissions	−1	−27, 26	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	107	−34, 248	14	−111, 138	93	27, 159		,
Average impact per quarter								
Spending per participant	$100	−$75, $275	$168	−$88, $425	−$146	−$604, $312	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	7	4, 9	6	3, 10	8	2, 13		,
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−1	−17, 16	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	4	−1, 8	1	−5, 6	14	4, 24	N/A	N/A

Definitions

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions is the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

This innovation consisted of five components: (1) workforce development through the hiring and training of a cadre of Better Health Improvement Specialists (BHIS) to spearhead Lean quality improvement initiatives at the participating CAHs; (2) community participation in a planning process that engages the CAHs and their community partners in a community needs assessment (CNA) and guides improvement initiatives through CAH-specific Better Health Improvement Plans (BHIPs); (3) a provider-based research network known as the Frontier Rural Innovation Network (FRIN) that brought together providers in rural and frontier areas who wished to collaborate and carry out practice-based research relevant to their settings; (4) providing CAHs data on their financial performance and educating CAH chief executive officers (CEOs) on value-based purchasing; and (5) assisting CAHs to integrate and adopt electronic health record (EHR) systems. Work within all these components was facilitated by the BHIS, who worked closely with partners and participating CAHs to promote evidence-based, community-responsive health delivery innovations.

During Year 2, efforts in workforce development (Component 1), community participation (Component 2), and the provider-based network (Component 3) increased. FMBHP initiated efforts in value-based purchasing (Component 4) in Year 2. According to interviews with project staff at the end of Year 2 and in Year 3, FMBHP staff reported limited activities in Component 5 beyond providing training to CAHs on EHR systems and ensuring each CAH developed an EHR system. Instead, FMBHP began to create a data crosswalk to standardized collection of heath care data that will be distributed in late 2015. In addition, FMBHP worked with CAHs who had EHR systems in place to establish meaningful use of the EHR.

The statewide FMBHP innovation involved over 40 partners. Two partners, Vree Health and Holy Rosary Health Care, left the innovation team during Year 3. Although they gave no reason for their departure, their roles (including training, health information technology (HIT), and transitional aftercare) may have ended. Since the first annual report, 12 new partners joined the innovation team to provide HIT and research support or training for the BHIS. Other partners such as HealthLink joined to provide clinical depression screening tools, research, and referral resources to all CAH communities. Mountain Pacific Quality Health Foundation also joined to provide training to all BHIS on the scopes and aims of the quality improvement organization, including but not limited to the Agency for Healthcare Research and Quality (AHRQ) reference material (see ***Table 5***).

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Regional Health Center Partners		
Partnership Health Center	Project management/administration, PCMH guidance	Missoula, MT
Made You Think	Training, community-based and physician leadership	Missoula, MT
Montana State University School of Nursing	Journal submissions and publishing	Bozeman, MT
Montana Medical Association	Training, Physicians Leadership Forum	Helena, MT
Montana Health Co-op	HIT	Helena, MT
Montana Hospital Association	Training, HIT, value-based purchasing interventions	Helena, MT
Lucris Clinical and Research Consultants, LLC	Training, swing-bed research and criteria	Lexington, KY
U. Kentucky Research Foundation	Training, research, and publishing	Lexington, KY
HealthLink	Training, clinical depression screening tools, research	Sacramento, CA
Mountain Pacific Quality Health Foundation	AHRQ reference material training	Helena, MT
Northwest Montana AHEC	Health education pilot project for workforce development/reporting and compliance	Missoula, MT
Health Facilities Planning and Development`	Training, support, and planning for communities and grantees concerning BHIPs	Seattle, WA

AHRQ = Agency for Healthcare Research and Quality; BHIP = Better Health Improvement Plans; HCIA = Health Care Innovation Awards; HIT = health information technology; PCMH = patient-centered medical home.

2.1.2 Program Participant Characteristics

The FMBHP did not work directly with providers or patients as part of the innovation, but rather assisted CAHs in implementing initiatives by developing better health/better care plans and deploying BHIS to implement the innovation's five components. As described in the 2015 annual report, FMBHP reached its target of enrolling 25 CAHs, which was considered at capacity for this innovation. ***Table 6*** provides the characteristics of all CAHs involved in the innovation. The distribution of CAH characteristics did not change over time: A majority of CAHs (76.0%) had 21 to 25 beds while only 16 percent had 6 to 10 beds. The CAHs were spread across the state: 32 percent were located in northeastern Montana, 28 percent in western Montana, 24 percent in central Montana, and 16 percent in southeastern Montana. In addition, the majority (68%) of CAHs are nonprofit (***Figure 1***).

Table 6. Characteristics of All CAHs Ever Enrolled in the Innovation through June 2015

Characteristic	Number of CAHs	Percentage of CAHs
Total	25	100.0
Size (number of beds)		
1–5	0	0.0
6–10	4	16.0
11–15	0	0.0
16–20	2	8.0
21–25	19	76.0

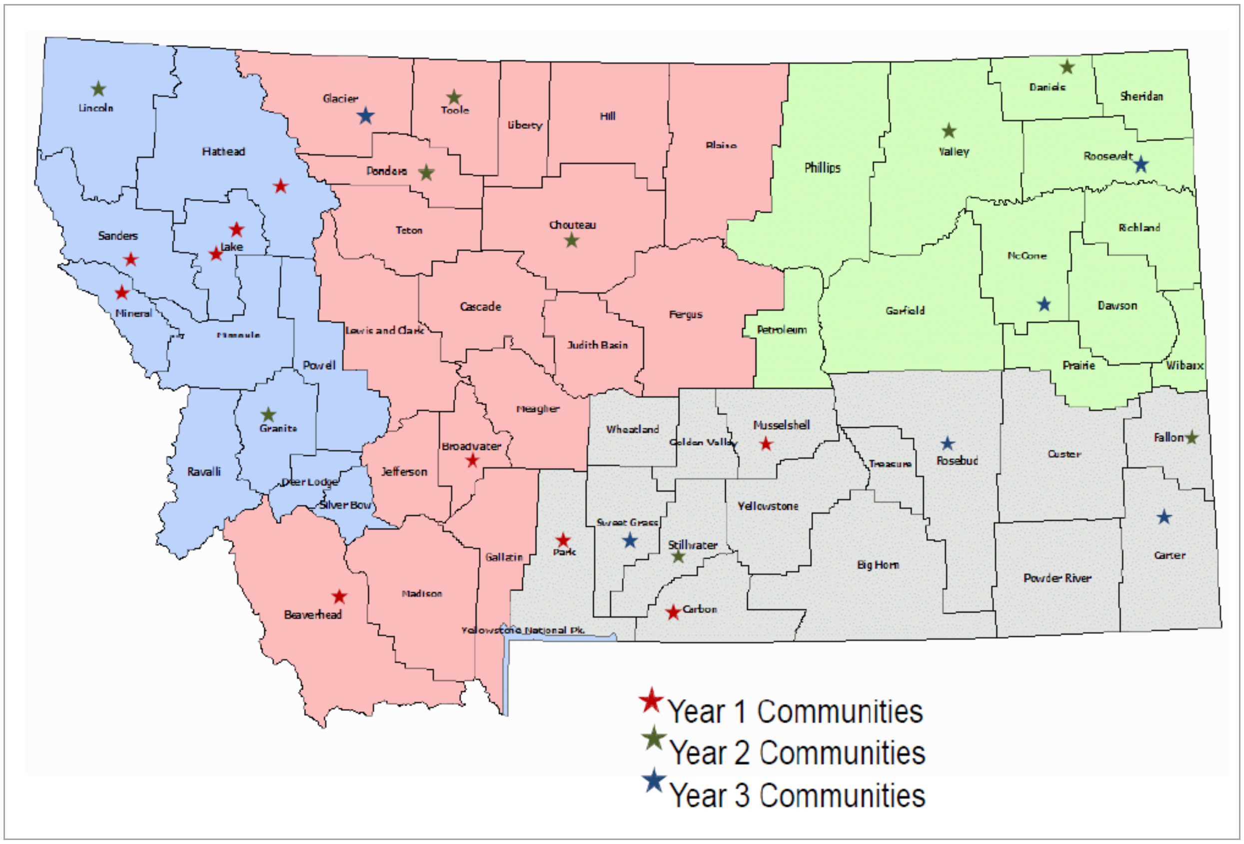
(continued)

Table 6. Characteristics of All CAHs Ever Enrolled in the Innovation through June 2015 (continued)

Characteristic	Number of CAHs	Percentage of CAHs
Location		
Northeastern Montana	8	32.0
Southeastern Montana	4	16.0
Western Montana	7	28.0
Central Montana	6	24.0
Ownership		
Nonprofit	17	68.0
Government	8	32.0

Source: Hospital-level data provided to RTI.
CAH = critical access hospital.

Figure 1. Statewide Location of All CAHs Ever Enrolled in the Innovation through June 2015



Source: Hospital-level data provided to RTI.
CAH = critical access hospital.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We report health care utilization and costs for patients who attended 25 CAHs participating in the Mineral Regional innovation before and after the innovation period, as well as individuals attending any of the 23 nonparticipating CAHs in Montana. The Medicare claims analysis focuses on 47,721 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B between quarter 1, 2010, and quarter 4, 2015, in the innovation group, and 40,414 Medicare beneficiaries in the comparison group. We focus only on utilization within CAHs during a given quarter; thus, results represent cost and utilization conditional on attending a CAH and do not necessarily represent a unique cohort over time. Because our analysis centers on patient outcomes, we assume that users are randomly distributed across CAHs, so that people use the CAHs nearest to them. ***Table 8*** describes the mean patient characteristics of the population served by innovation and comparison CAHs. The most salient difference between innovation and comparison CAHs is that, on average, comparison CAHs serve a larger fraction (approximately 10% more) of Native Americans than innovation CAHs. This may be related to the dual Medicare-Medicaid enrollees served by the two CAH groups: Native Americans account for 21 percent of the Medicaid population and 5 percent of the population in the state, whereas 75 percent of the state Medicaid population is white.[1]

Table 8. Medicare Mean CAH Values of Patient Characteristics Used as Explanatory Variables in the Regression Analyses

Population Characteristics	Innovation CAHs			Comparison CAHs				
	N	Mean	SD	N	Mean	SD	Difference	P-Value
Caucasian	25	92.7%	0.078	23	82.9%	0.285	9.8%	0.118
African American	25	0.1%	0.001	23	0.1%	0.001	0.0%	0.590
Asian	25	0.2%	0.002	23	0.2%	0.001	0.0%	0.854
Hispanic	25	0.6%	0.004	23	0.6%	0.005	0.0%	0.773
Native American	25	5.3%	0.079	23	15.3%	0.288	−9.9%	0.117
Disabled	25	21.8%	0.074	23	22.3%	0.079	−0.4%	0.842
Dually eligible	25	15.9%	0.051	23	18.5%	0.088	−2.6%	0.218
Age	25	72.2	1.836	23	72.2	2.258	0.01	0.992
Female	25	53.4%	0.026	23	53.7%	0.034	−0.4%	0.693
Number of chronic conditions	25	5.65	0.343	23	5.88	0.435	−0.23	0.051

CAH = critical access hospital.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the 13 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between individuals attending the comparison CAHs and the innovation CAHs, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group CAHs. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Average spending per beneficiary is very similar for the intervention and comparison group in the baseline period. Spending in participating CAHs follows the baseline trend line after the innovation begins, but increases faster relative to the comparison CAHs from I6 onwards.

[1] The Montana Medicaid Program. Montana Department of Public Health and Human Services Report to the 2015 Legislature. State Fiscal Years 2013/2014.2015, January. Accessed at: https://dphhs.mt.gov/Portals/85/Documents/2015MedicaidReport.pdf

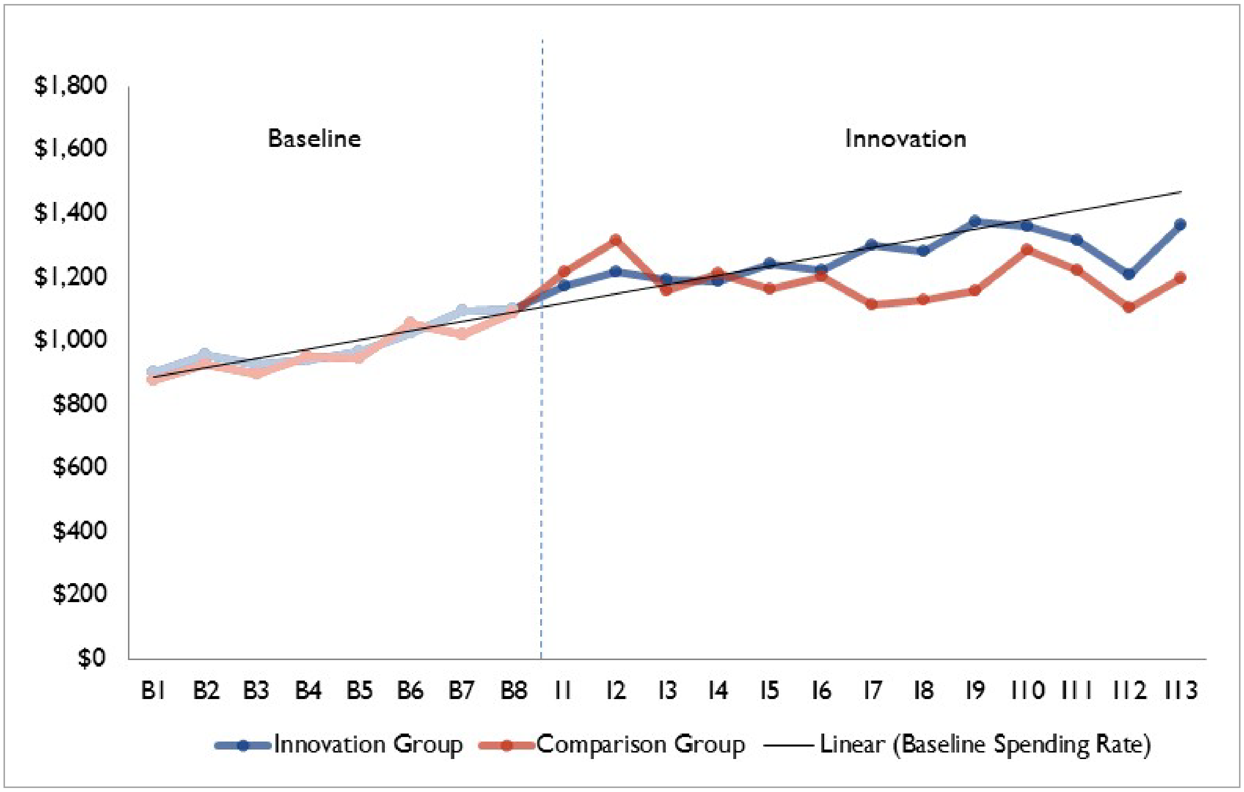
Table 9. Medicare Spending per Participant: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters												
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Spending rate	$900	$955	$926	$941	$968	$1,025	$1,096	$1,101	$1,174	$1,215	$1,190	$1,188	$1,242	$1,224	$1,302	$1,282	$1,372	$1,358	$1,317	$1,206	$1,363
Std dev	$1,334	$1,440	$1,325	$1,488	$1,418	$1,439	$1,570	$1,669	$1,828	$1,822	$1,757	$1,891	$1,915	$1,737	$1,955	$1,904	$2,015	$2,040	$1,955	$1,772	$2,123
Unique patients	11,008	11,470	12,096	12,480	12,340	12,578	13,177	13,870	13,822	13,654	13,953	14,174	13,507	13,064	13,707	13,614	12,478	11,965	9,371	8,788	5,552
Comparison Group																					
Spending rate	$877	$926	$897	$952	$944	$1,055	$1,017	$1,089	$1,215	$1,316	$1,155	$1,213	$1,161	$1,200	$1,113	$1,126	$1,157	$1,284	$1,222	$1,103	$1,196
Std dev	$1,336	$1,490	$1,403	$1,453	$1,412	$1,603	$1,663	$1,877	$2,100	$2,053	$1,744	$1,976	$1,822	$1,916	$1,776	$1,760	$1,896	$1,975	$2,063	$1,785	$1,889
Unique patients	9,580	9,703	10,639	10,866	10,739	10,609	11,448	11,811	11,897	11,504	12,145	12,386	11,959	11,294	12,251	12,235	12,136	11,630	12,619	12,664	12,224
Savings per Patient																					
	−$23	−$28	−$28	$11	−$24	$30	−$78	−$12	$41	$101	−$35	$26	−$81	−$24	−$189	−$156	−$215	−$74	−$95	−$102	−$167

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 2. Medicare Spending per Participant: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.4.2 Regression Results

We present the average innovation effect per quarter during the innovation period for beneficiaries attending the innovation CAHs compared to beneficiaries attending the remaining CAHs in the State of Montana. Notice that because we do not follow a cohort over time, the same beneficiary might attend several CAHs, including both innovation and comparison CAHs.

Regressions for all outcomes include an indicator variable for the innovation group, an indicator variable for each calendar quarter from Q1 2010 to Q4 2014, and quarterly indicators interacted with the innovation group variable in the intervention period. We control for age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions.

The weighted average quarterly spending differential in the innovation period is $8 (90% CI: −$3, $18), indicating a loss. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison CAHs, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

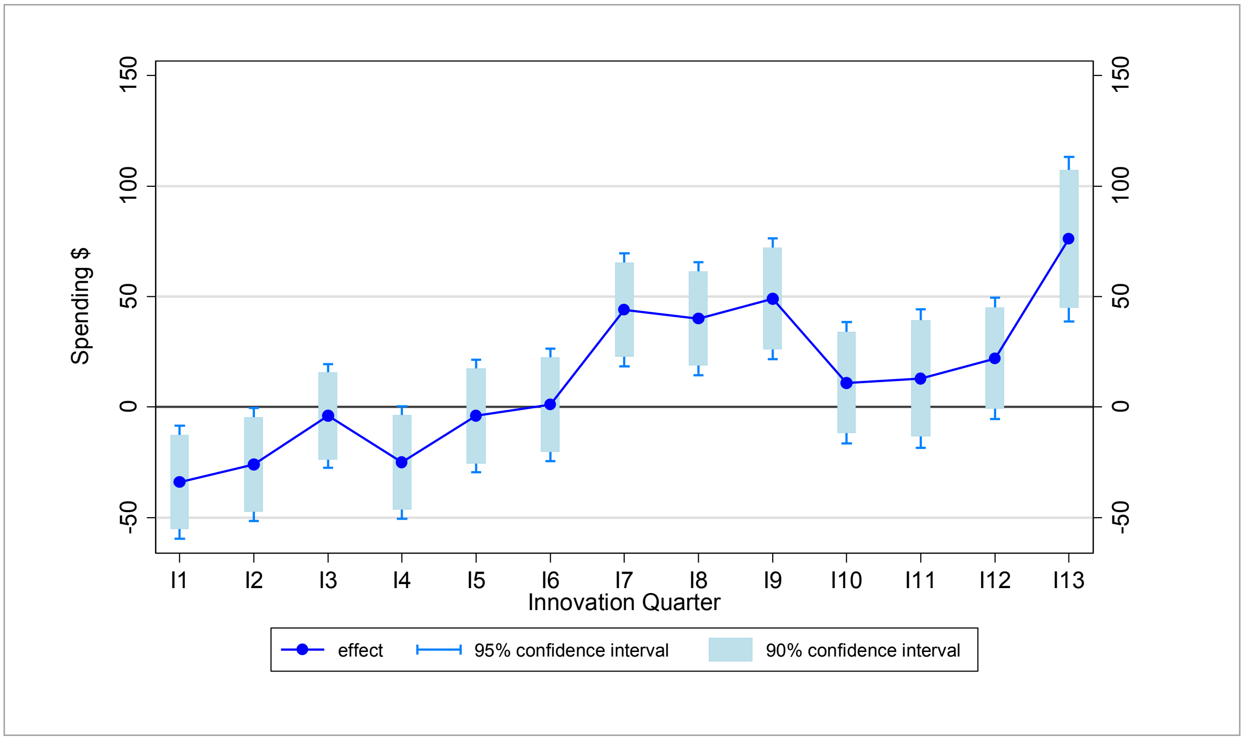
In addition to the average effect over the innovation period, we present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. The evidence on savings is mixed. In I1, I2, and I4, statistically significant quarterly savings of $34, $26, and $25 are present; however, in four of the later quarters, the program generates statistically significant losses. Large sample size translates into narrow confidence intervals. Therefore, the change from savings to loss result is significant because of sample size, but it is economically small.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−$34	$13	0.008
I2	−$26	$13	0.047
I3	−$4	$12	0.723
I4	−$25	$13	0.049
I5	−$4	$13	0.769
I6	$1	$13	0.937
I7	$44	$13	0.001
I8	$40	$13	0.002
I9	$49	$14	0.000
I10	$11	$14	0.435
I11	$13	$16	0.404
I12	$22	$14	0.133
I13	$76	$19	<.0001
Overall average	$8	$6	0.185
Overall aggregate	$4,329,115	$3,268,614	0.185
Overall aggregate (IY1)	−$4,220,077	$1,455,006	0.004
Overall aggregate (IY2)	$3,729,618	$1,512,862	0.014
Overall aggregate (IY3)	$3,572,592	$1,337,567	0.008
Overall aggregate (IY3)	$1,246,981	$318,779	<.0001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Mineral Regional = Mineral Regional Health Center; OLS = ordinary least squares.

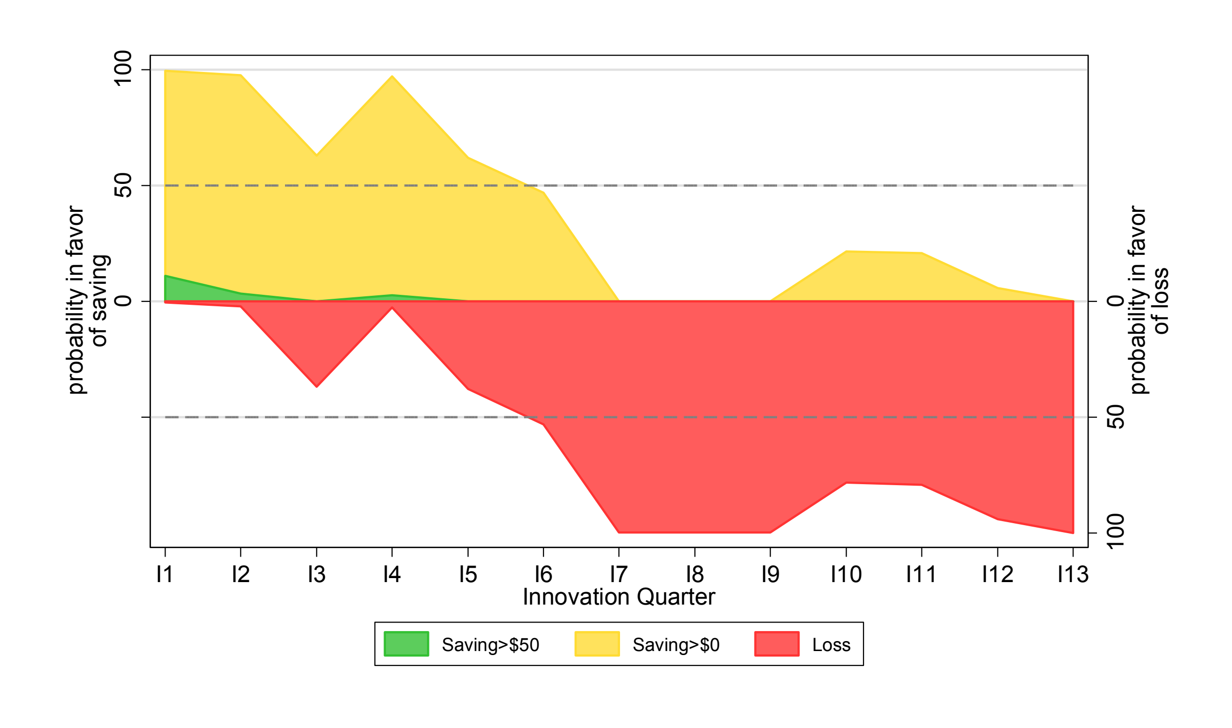
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Mineral Regional = Mineral Regional Health Center; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Overall, the innovation shows a high probability of loss in later quarters and a higher probability of savings between $0-50 in the early innovation quarters.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 5***. Inpatient admissions are consistently higher for comparison CAHs than for participating CAHs.

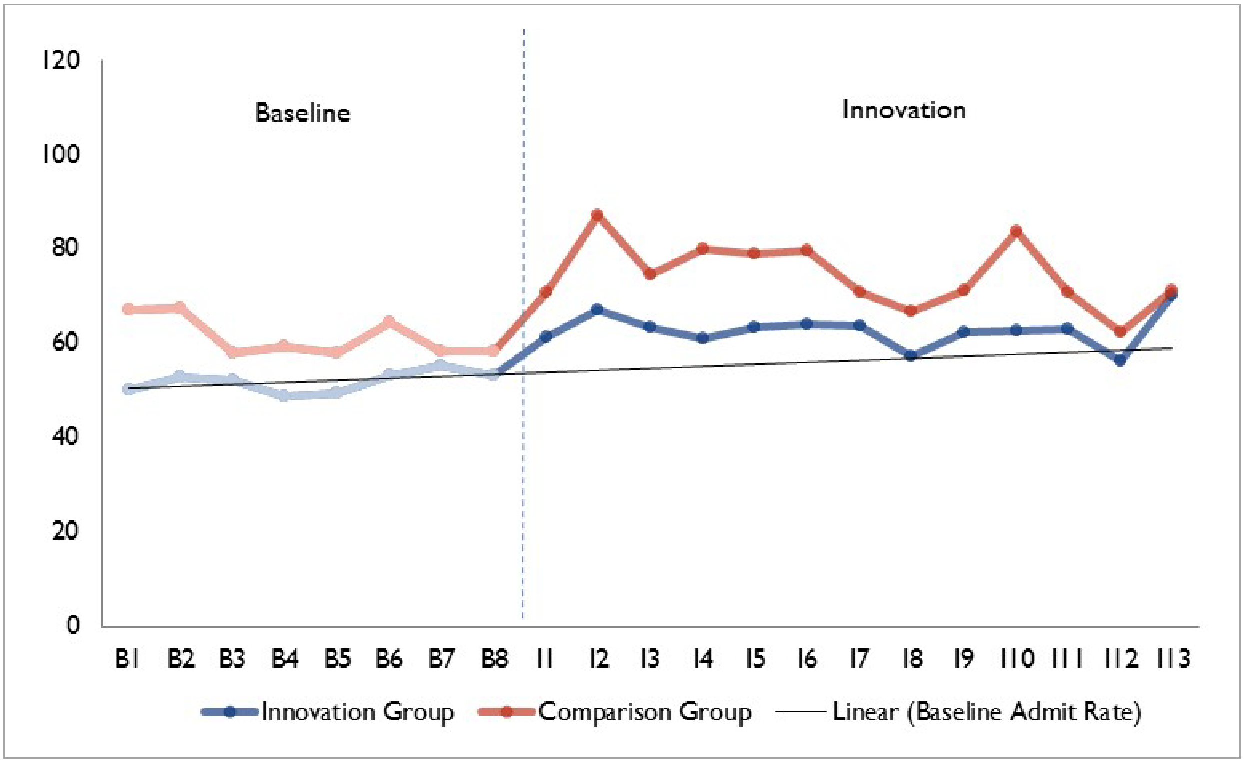
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Admit rate	50	53	52	49	50	53	55	53	61	67	63	61	63	64	64	57	63	63	63	56	70
Std dev	128	131	133	133	128	131	137	137	147	153	149	148	149	147	152	140	148	150	154	146	174
Unique patients	11,008	11,470	12,096	12,480	12,340	12,578	13,177	13,870	13,822	13,654	13,953	14,174	13,507	13,064	13,707	13,614	12,478	11,965	9,371	8,788	5,552
Comparison Group																					
Admit rate	67	68	58	59	58	64	58	58	71	87	75	80	79	80	71	67	71	84	71	63	71
Std dev	157	159	144	149	141	148	146	148	166	177	164	182	172	167	164	155	163	172	167	157	168
Unique patients	9,580	9,703	10,639	10,866	10,739	10,609	11,448	11,811	11,897	11,504	12,145	12,386	11,959	11,294	12,251	12,235	12,136	11,630	12,619	12,664	12,224
Innovation – Comparison Rate																					
	−17	−14	−6	−10	−9	−11	−3	−5	−10	−20	−11	−19	−16	−15	−7	−9	−9	−21	−8	−6	−1

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 1 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −1, 0).

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 12*** presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−1	1	0.640
I2	−1	1	0.504
I3	−1	1	0.309
I4	−3	1	0.005
I5	−3	1	0.020
I6	−1	1	0.444
I7	2	1	0.126
I8	0	1	0.878
I9	0	1	0.989
I10	−4	1	0.001
I11	0	1	0.930
I12	0	1	0.812
I13	5	2	0.009
Overall average	−1	0	0.013
Overall aggregate	−449	181	0.013
Overall aggregate (IY1)	−277	111	0.013
Overall aggregate (IY2)	−87	108	0.423
Overall aggregate (IY3)	−160	89	0.073
Overall aggregate (IY4)	74	28	0.009

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Mineral Regional = Mineral Regional Health Center.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 6***. Readmissions rates were computed as a 30-day rehospitalization within the same CAH only. However, individuals could be readmitted to a different CAH or hospital within 30 days of a prior hospitalization. Thus, the results might be underestimations of the overall readmission rate of the population. Unplanned readmissions rates are higher in the nonparticipating CAHs across all baseline periods and 9 out of 13 innovation periods.

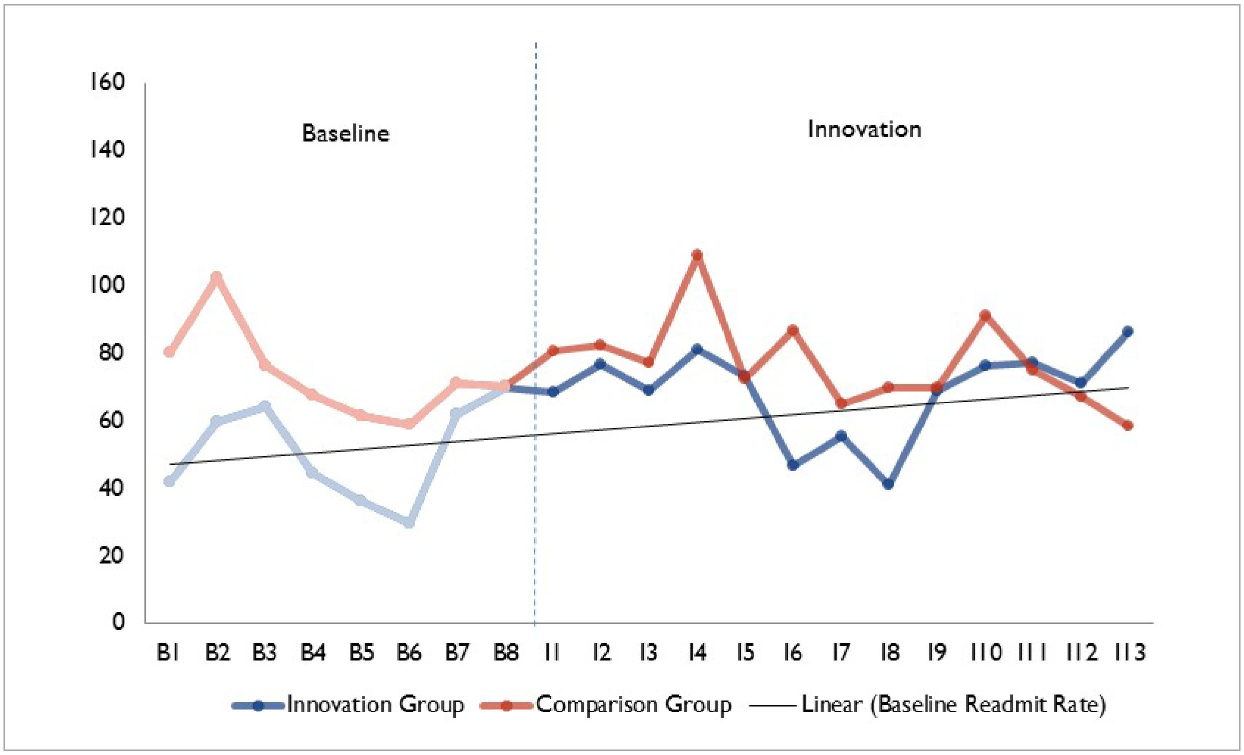
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Readmit rate	42	60	64	44	36	30	62	70	68	77	69	81	73	47	55	41	69	76	77	71	86
Std dev	200	237	245	206	187	170	241	255	253	267	254	273	260	211	228	199	254	265	267	257	281
Total admissions	431	453	499	473	494	540	582	588	672	728	710	665	656	623	652	583	594	538	453	351	185
Comparison Group																					
Readmit rate	80	102	76	68	62	59	71	70	81	83	77	109	73	87	65	70	70	91	75	67	58
Std dev	272	303	266	251	241	236	257	255	273	275	267	311	259	282	247	255	255	288	264	251	234
Total admissions	511	527	497	518	503	560	535	556	693	787	701	781	731	680	675	632	644	790	718	609	463
Innovation – Comparison Rate																					
	−38	−43	−12	−23	−25	−29	−9	0	−12	−6	−8	−28	1	−40	−10	−28	−1	−15	2	4	28

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.6.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 8 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is 0.8 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −3, 19).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Inpatient Admissions: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
Overall average	8	7	0.228
Overall aggregate	42	34	0.228

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups. Mineral Regional = Mineral Regional Health Center.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 7.*** ED visit rates are, on average, higher for comparison CAHs than for innovation CAHs in the baseline period. In the innovation period, differences in ED visits narrow between innovation and comparison CAHs.

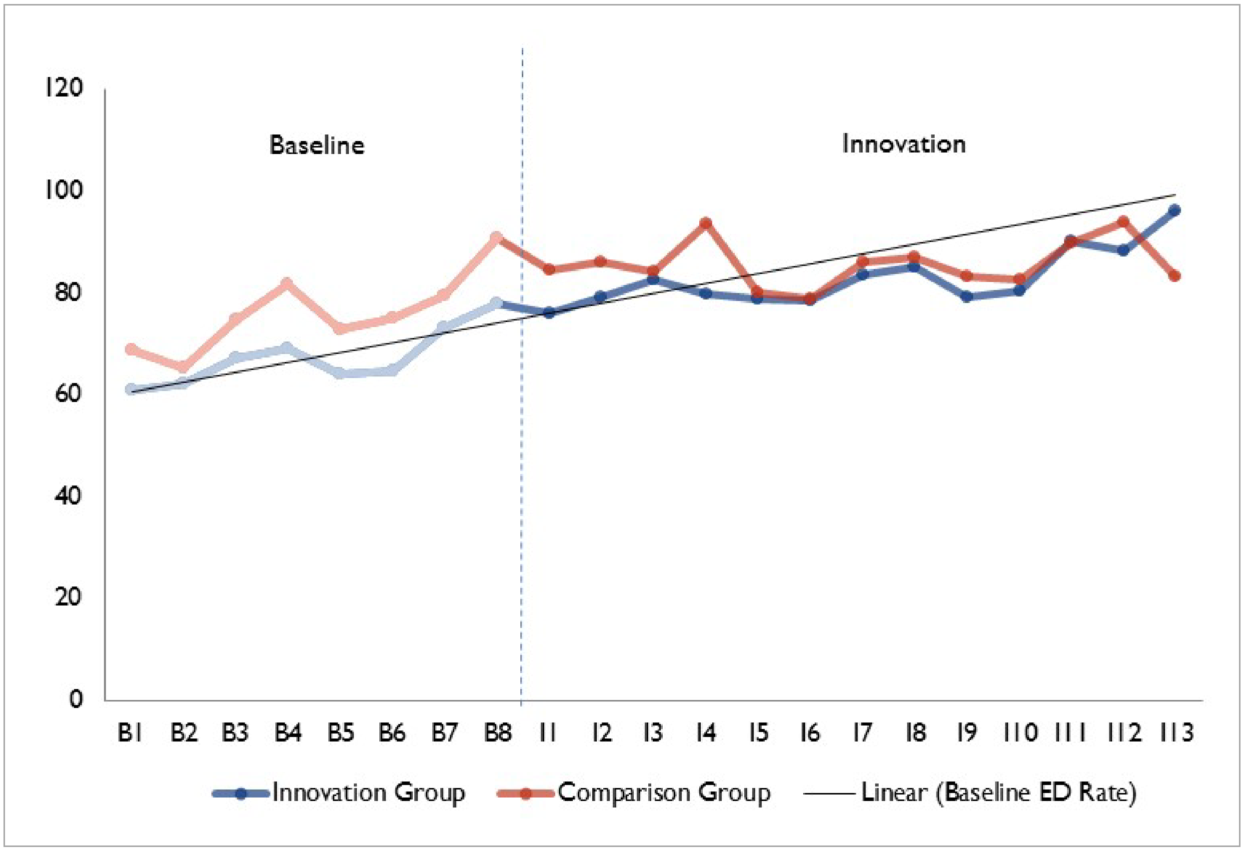
Table 15. ED Visits per 1,000 Medicare Participants: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters												
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Innovation Group																					
Readmit rate	61	62	67	69	64	65	73	78	76	79	83	80	79	79	84	85	79	80	90	88	96
Std dev	363	386	394	359	340	351	403	397	437	384	391	371	389	383	375	404	398	365	393	420	424
Total admissions	11,008	11,470	12,096	12,480	12,340	12,578	13,177	13,870	13,822	13,654	13,953	14,174	13,507	13,064	13,707	13,614	12,478	11,965	9,371	8,788	5,552
Comparison Group																					
Readmit rate	69	65	75	82	73	75	80	91	85	86	84	94	80	79	86	87	83	83	90	94	83
Std dev	349	328	359	360	349	357	367	402	389	385	371	557	404	365	382	385	360	368	387	386	375
Total admissions	9,580	9,703	10,639	10,866	10,739	10,609	11,448	11,811	11,897	11,504	12,145	12,386	11,959	11,294	12,251	12,235	12,136	11,630	12,619	12,664	12,224
Innovation – Comparison Rate																					
	−8	−3	−7	−13	−9	−10	−6	−13	−9	−7	−1	−14	−1	0	−3	−2	−4	−2	0	−5	13

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; ED = emergency department; Mineral Regional = Mineral Regional Health Center.

Figure 7. ED Visits per 1,000 Medicare Participants: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; Mineral Regional = Mineral Regional Health Center.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 12 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 10, 15). In addition to the average effect over the innovation period, we present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. Ten of the 13 quarters show significant increases in ED visits relative to the comparison group.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−6	5	0.202
I2	10	4	0.033
I3	4	5	0.373
I4	0	5	0.976
I5	17	5	0.000
I6	20	4	0.000
I7	26	5	0.000
I8	18	5	0.000
I9	9	5	0.054
I10	10	5	0.036
I11	18	5	0.000
I12	15	5	0.003
I13	40	7	0.000
Overall average	12	1	0.000
Overall aggregate	6,595	718	0.000
Overall aggregate (IY1)	374	447	0.403
Overall aggregate (IY2)	3,815	431	0.000
Overall aggregate (IY3)	1,752	343	0.000
Overall aggregate (IY4)	655	111	0.000

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Mineral Regional = Mineral Regional Health Center.

2.8 Discussion: Medicare Results

The overall effects of the innovation on spending were insignificant. Small but significant savings during Year 1 of the innovation were balanced by small but significant increases in Years 2 and 3. We find small significant effects of the innovation on utilization and ED visits. While inpatient visits significantly decreased, ED visits statistically increased during the innovation period.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries. Mineral Regional CAHs also serve privately insured, Medicaid, and uninsured patients. Our approach examines exclusively utilization and spending within the CAH, rather than the entire medical utilization of people ever going to a CAH. That said, the innovation may have little direct effect on utilization and costs; it focused mostly on process improvement efforts in hospitals such as patient flow and supply chain efficiencies. CAHs did not dedicate much effort to quality of care, which could have impacted health outcomes.

2.9 Medicaid Comparison Group

We included patients enrolled prior to December 31, 2013, to ensure that we have at least one full quarter of Alpha-MAX data for analysis because Medicaid claims for the State of Montana are only available until Q1 2014. The constraint on data availability means that we can only analyze 20 out of the 25 participating CAHs because 5 CAHs started their programs after 2014. The Medicaid claims analysis focuses on approximately 7,000 Medicaid beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. The comparison group consists of Medicaid beneficiaries who have utilization at one of the 23 nonparticipating CAHs in Montana. Three of these comparison CAHs are located in American Indian reservations and do not serve any Medicaid fee-for-service beneficiaries. On average, each participating CAH served more Medicaid beneficiaries than nonparticipating CAHs. The reason for this disparity might be that, on average, nonparticipating CAHs serve a larger fraction (approximately 7% more) of Native Americans than participating CAHs. The Indian Health Service (IHS) is the primary federal health care provider for Native Americans. Some Native Americans are eligible only for Medicaid; others are eligible for both IHS and Medicaid. This group accounts for 21 percent of the Medicaid population and 5 percent of the population in the state, whereas 75 percent of the state Medicaid population is white.[2] No propensity score matching was performed. The characteristics of innovation and comparison CAHs are summarized in Table 17. The characteristics of Medicaid beneficiaries using innovation CAHs and comparison CAHs are similar in that—as with the Medicare population—more Caucasians and fewer Native Americans use the innovation CAHs. There are significantly more females in the innovation CAHs than in the comparison CAHs.

Table 17. Medicaid Mean CAH Values of Patient Characteristics Used as Explanatory Variables in the Regression Analyses

Population Characteristics	Innovation CAHs			Comparison CAHs			Difference	P-Value
	N	Mean	SD	N	Mean	SD		
Caucasian	20	88.2%	0.125	20	82.2%	0.236	6.0%	0.314
African American	20	0.7%	0.007	20	0.6%	0.005	0.2%	0.432
Native American	20	8.2%	0.122	20	13.8%	0.234	−5.6%	0.333
Other	20	3.0%	0.015	20	3.4%	0.012	−0.5%	0.288
Disabled	20	23.5%	0.086	20	20.1%	0.061	3.5%	0.157
Dual	20	25.6%	0.071	20	27.8%	0.126	−2.2%	0.485
Age	20	31.3	4.748	20	30.3	9.987	1.07	0.658
Female	20	61.1%	0.025	20	57.3%	0.083	3.7%	0.053

CAH = critical access hospital; SD = standard deviation.

[2] The Montana Medicaid Program. Montana Department of Public Health and Human Services Report to the 2015 Legislature. State Fiscal Years 2013/2014.2015, January. Accessed at: https://dphhs.mt.gov/Portals/85/Documents/2015MedicaidReport.pdf

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 18 reports Medicaid spending per patient in the eight quarters before and the six quarters after enrolling in the innovation. An I1 date was assigned to comparison hospitals to correspond to the earliest date of enrollment of a CAH in the Mineral Regional group. This assignment was done to mimic the output required for other HCIA awardees. However, as explained in the Medicare section, the regression analysis reflects calendar quarters, and thus more accurately reflects differences between participating and nonparticipating CAHs. Similar to Medicare spending, we consider only the costs incurred within the CAHs for the cohort of individuals who ever attended one in the innovation period. ***Figure 8*** illustrates the Medicaid spending per beneficiary in Table 18 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Average spending per beneficiary is higher for the innovation group than for the comparison group throughout all baseline and innovation periods.

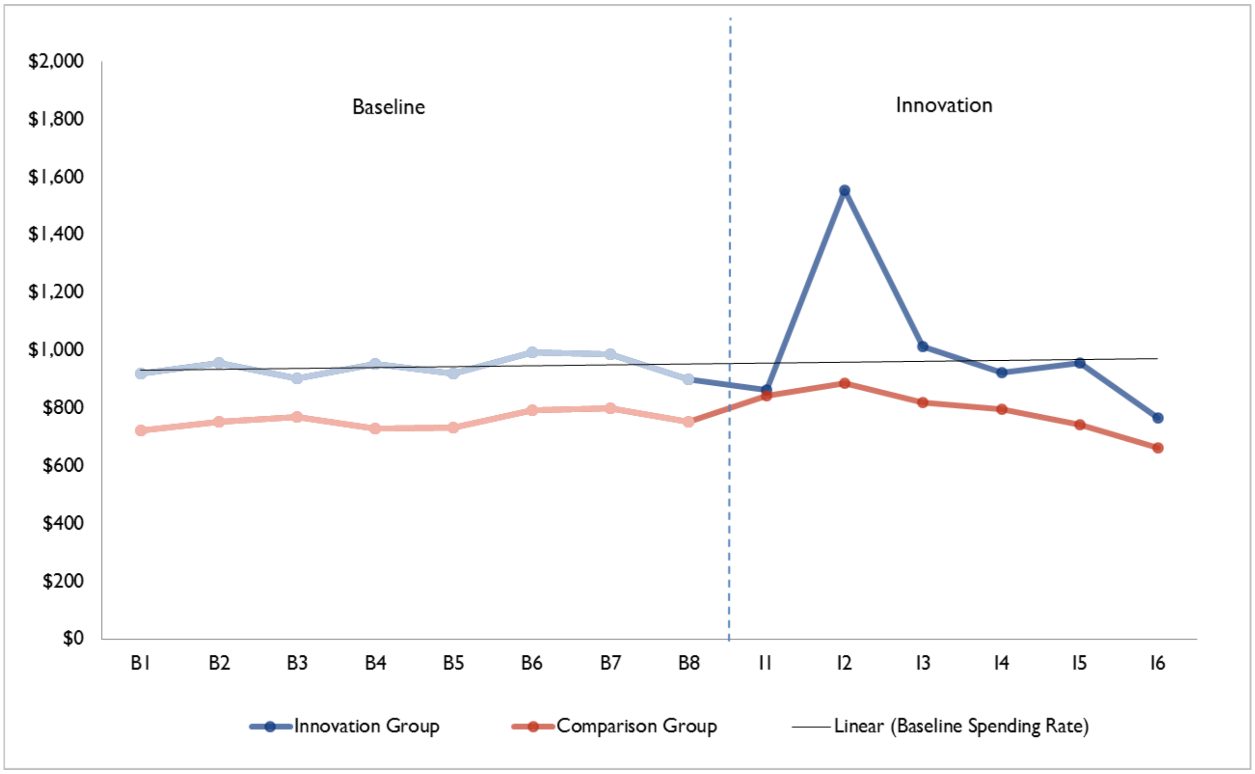
Table 18. Medicaid Spending per Participant: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Spending rate	$920	$957	$903	$954	$921	$994	$986	$901	$863	$1,553	$1,013	$925	$957	$765
Std dev	$2,218	$2,556	$2,055	$2,408	$2,227	$2,408	$2,481	$2,149	$2,071	$55,364	$2,446	$2,146	$2,496	$1,871
Unique patients	6,584	6,756	6,821	6,562	6,596	6,944	7,080	6,889	6,591	6,894	6,093	4,246	3,927	2,728
Comparison Group														
Spending rate	$722	$754	$769	$730	$734	$794	$801	$754	$843	$888	$818	$795	$742	$664
Std dev	$1,951	$2,045	$1,916	$1,988	$1,825	$2,018	$2,208	$2,131	$2,428	$2,741	$2,566	$2,052	$1,734	$1,970
Weighted patients	5,129	5,574	5,190	5,214	5,091	5,458	5,286	5,124	5,141	5,590	4,971	5,246	4,971	4,103
Savings per Patient														
	−$198	−$203	−$134	−$223	−$187	−$200	−$184	−$147	−$20	−$666	−$195	−$129	−$215	−$101

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 8. Medicaid Spending per Participant: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.10.2 Regression Results

We present the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period is $100 (90% CI: −$75, $275), indicating a loss. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 19*** presents the results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 9*** illustrates these quarterly difference-in-differences estimates. No quarterly estimate is statistically significant.

Table 19. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Mineral Regional

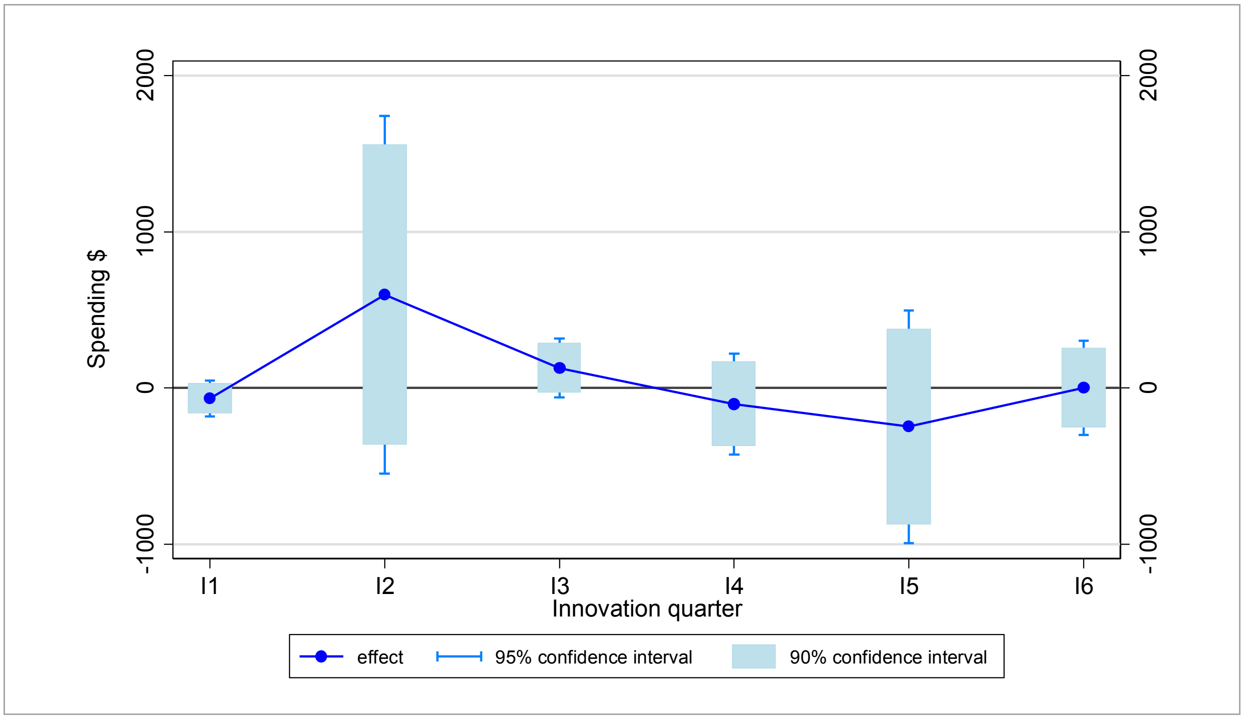
Quarter	Coefficient	Standard Error	P-Values
I1	−$68	$58	0.250
I2	$597	$585	0.314
I3	$128	$97	0.195
I4	−$103	$165	0.537
I5	−$248	$380	0.519
I6	$1	$154	0.997
Overall average	$100	$104	0.342
Overall aggregate	$3,042,092	$3,161,692	0.342
Overall aggregate (IY1)	$4,013,782	$3,624,849	0.275
Overall aggregate (IY2)	−$971,690	$1,809,989	0.594

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups. The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Mineral Regional = Mineral Regional Health Center; OLS = ordinary least squares.

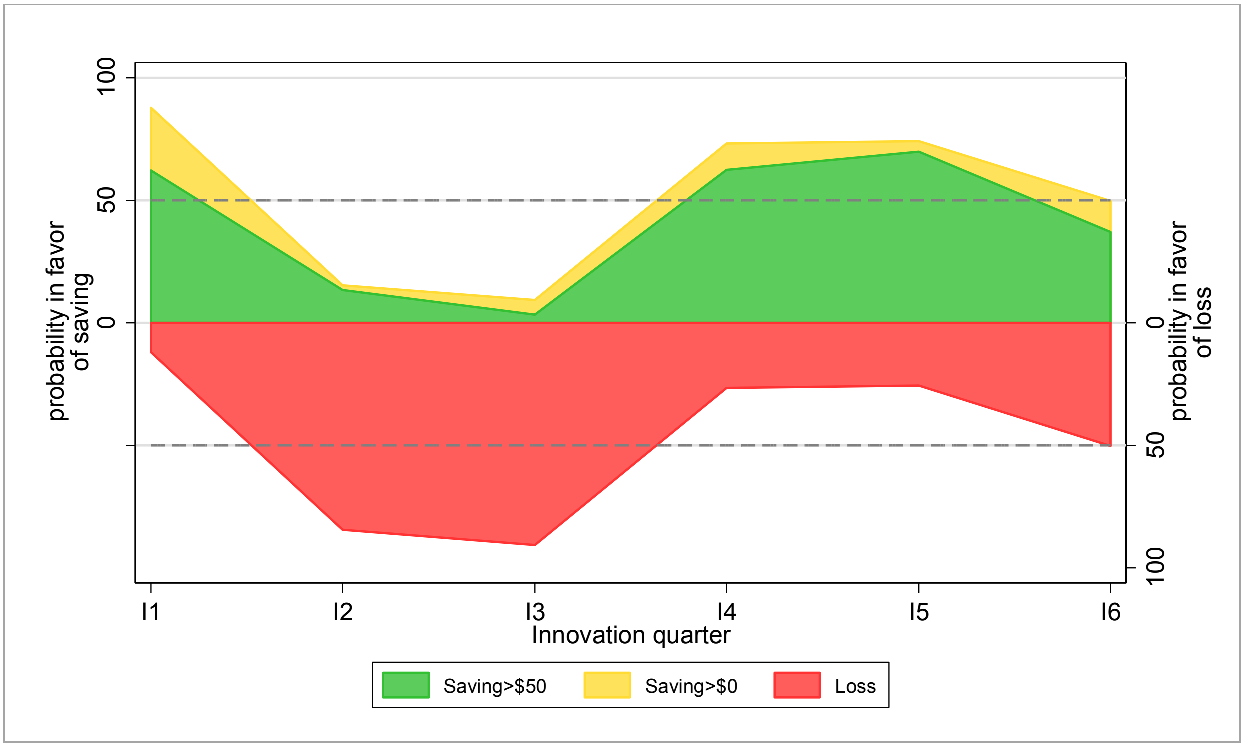
Figure 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Mineral Regional = Mineral Regional Health Center; OLS = ordinary least squares.

Figure 10 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Across all periods, there is no evidence of substantial differences in terms of savings and losses resulting from the innovation.

Figure 10. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 20*** and ***Figure 11***. The inpatient admissions rates for participating CAHs in the baseline quarters are consistently higher than the rates in the comparison CAHs. In the innovation quarters, differences in admission rates occur between CAHs in the Mineral Regional network and nonparticipating CAHs. These differences may be driven by the number of CAHs present in each quarter (20 in Quarter 1 and 7 in Quarter 6, corresponding to the time the CAHs are present in the sample) and, hence, by differences across participating CAHs.

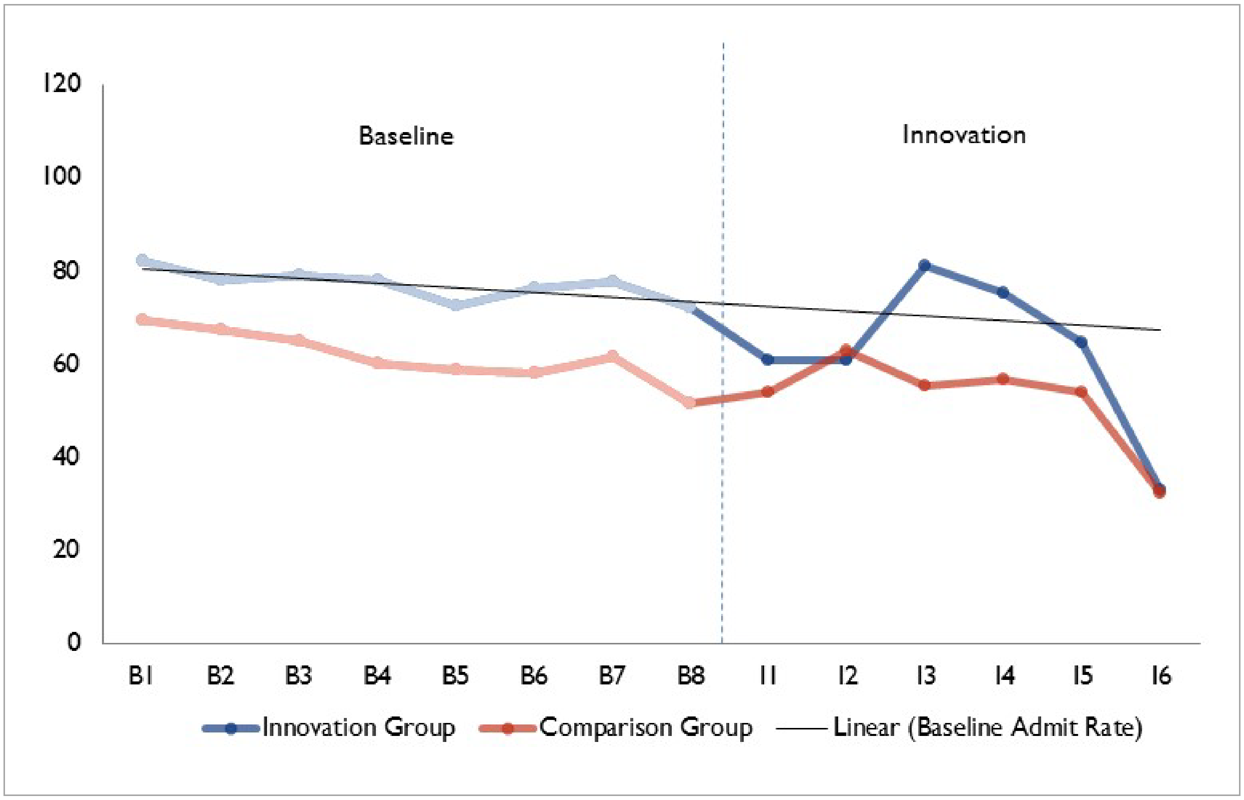
Table 20. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Admit rate	82	78	79	78	73	76	78	72	61	61	81	75	65	33
Std dev	282	284	284	282	269	280	278	271	246	252	282	272	261	189
Unique patients	6,584	6,756	6,821	6,562	6,596	6,944	7,080	6,889	6,591	6,894	6,093	4,246	3,927	2,728
Comparison Group														
Admit rate	69	67	65	60	59	58	62	52	54	63	55	57	54	32
Std dev	277	269	259	252	247	241	258	235	238	260	238	246	232	187
Weighted patients	5,129	5,574	5,190	5,214	5,091	5,458	5,286	5,124	5,141	5,590	4,971	5,246	4,971	4,103
Innovation − Comparison Rate														
	13	11	14	18	14	18	16	20	7	−2	26	19	11	1

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 11. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.11.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 7 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 4, 9). In addition to the average effect over the innovation period, we present quarterly effects.

Table 21 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Three out of six quarters have statistically significant differences between participating and nonparticipating CAHs.

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Medicaid Participants: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−5	4	0.164
I2	−3	4	0.373
I3	25	4	0.000
I4	14	5	0.006
I5	12	5	0.012
I6	1	4	0.796
Overall average	7	2	0.000
Overall aggregate	202	53	0.000
Overall aggregate (IY1)	151	48	0.002
Overall aggregate (IY2)	51	22	0.022
Overall aggregate (IY3)	N/A	N/A	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Mineral Regional = Mineral Regional Health Center; N/A = data not applicable.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 22*** and ***Figure 12***. These represent 30-day readmissions within CAHs only. We ignore transfers because we are not looking at the medical history of beneficiaries but rather at readmissions within CAHs. There are no notable differences between participating and nonparticipating CAHs among Medicaid beneficiaries, except in innovation quarter 2.

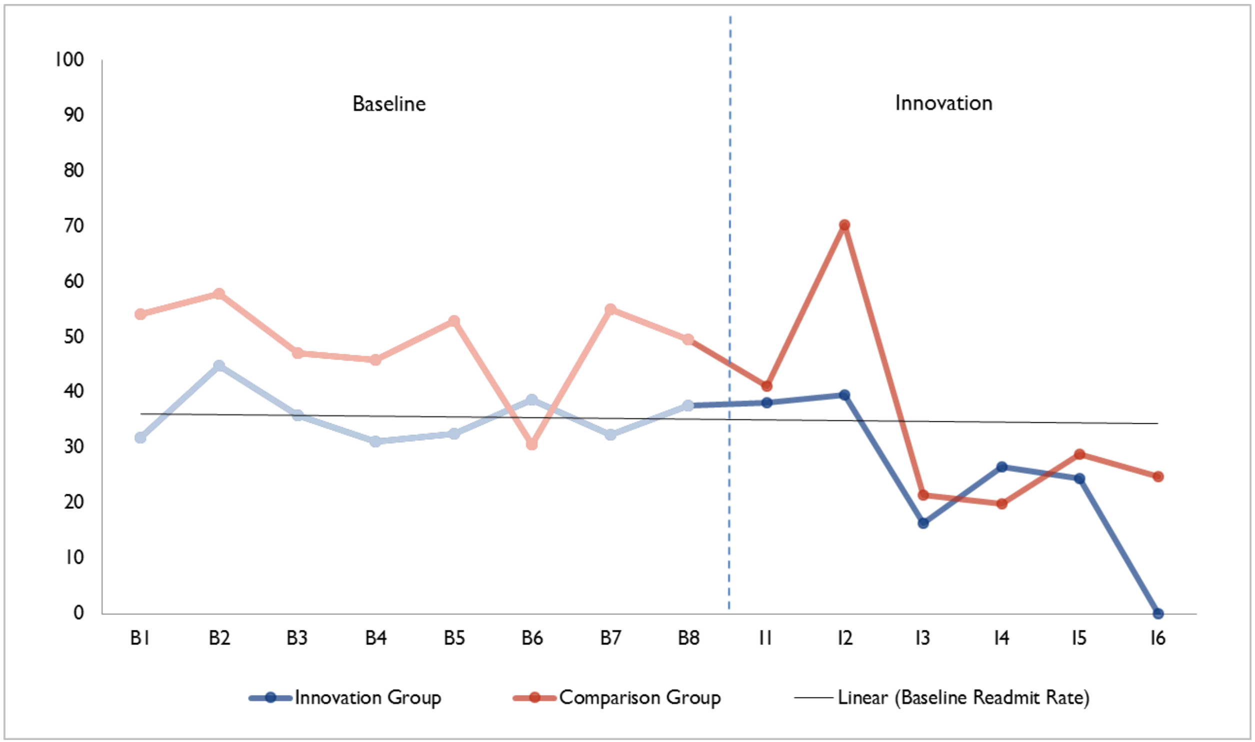
Table 22. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
Readmit rate	32	45	36	31	33	39	32	38	38	40	16	27	25	0
Std dev	176	207	186	174	178	193	177	190	191	195	127	161	155	0
Total admissions	440	424	447	418	399	440	463	399	315	354	367	264	204	80
Comparison Group														
Readmit rate	54	58	47	46	53	31	55	50	41	70	21	20	29	25
Std dev	226	234	212	209	224	172	228	217	199	255	145	140	167	155
Total admissions	296	311	276	262	246	261	273	222	243	285	234	251	208	121
Innovation − Comparison Rate														
	−22	−13	−11	−15	−20	8	−23	−12	−3	−31	−5	7	−4	−25

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 12. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Mineral Regional = Mineral Regional Health Center.

2.12.2 Regression Results

Table 23 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −1 per 1,000 inpatient admissions. This represents a 0.1 percentage point decrease in the average probability of an unplanned readmission. The effect is not statistically significant (90% CI: −17, 16).

Table 23. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicaid Inpatient Admissions: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
Overall average	−1	10	0.960
Overall aggregate	−1	16	0.960

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Mineral Regional = Mineral Regional Health Center.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 24*** and ***Figure 13.*** ED visit rates are, on average, higher for comparison CAHs than for innovation CAHs in the baseline period. During the innovation quarters, however, participating CAHs have ED visit rates that are very similar to comparison CAHs.

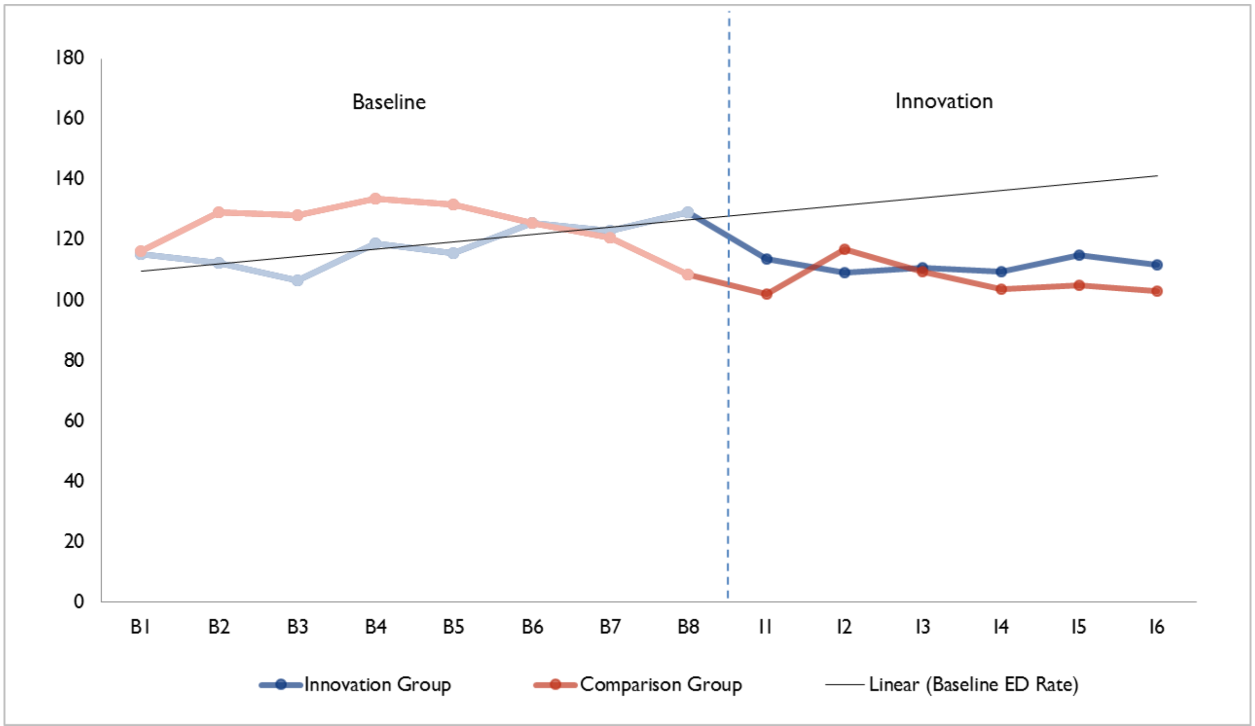
Table 24. ED Visits per 1,000 Medicaid Participants: Mineral Regional

Awardee Number: 1C1CMS331058
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters					
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
Innovation Group														
ED rate	115	112	106	119	116	126	123	129	114	109	111	109	115	112
Std dev	435	459	421	446	449	472	438	445	438	423	424	403	430	402
Unique patients	6,584	6,756	6,821	6,562	6,596	6,944	7,080	6,889	6,591	6,894	6,093	4,246	3,927	2,728
Comparison Group														
ED rate	116	129	128	134	132	126	121	109	102	117	109	104	105	103
Std dev	452	457	468	500	513	470	458	422	427	424	419	400	420	391
Weighted patients	5,129	5,574	5,190	5,214	5,091	5,458	5,286	5,124	5,141	5,590	4,971	5,246	4,971	4,103
Innovation − Comparison Rate														
	−17	−22	−15	−16	0	2	20	12	−8	1	6	10	9	−1

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 13. ED Visits per 1,000 Medicaid Participants: Mineral Regional



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ED = emergency department; Mineral Regional = Mineral Regional Health Center.

2.13.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of four ED visits, indicating that the innovation-comparison difference is higher during the innovation period. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −1, 8). In addition to the average effect over the innovation period, we present quarterly effects.

Table 25 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. The quarterly estimate is only statistically significant in I6.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	5	6	0.447
I2	−5	6	0.410
I3	2	6	0.736
I4	1	7	0.901
I5	11	8	0.183
I6	19	9	0.040
Overall average	4	3	0.212
Overall aggregate	107	86	0.212
Overall aggregate (IY1)	14	76	0.855
Overall aggregate (IY2)	93	40	0.020
Overall aggregate (IY3)	N/A	N/A	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Mineral Regional = Mineral Regional Health Center; N/A = data not applicable.

2.14 Discussion: Medicaid Results

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries. The results point to a possible increase in spending for participating CAHs. None of the individual spending coefficients are statistically significant, nor is the average weighted quarterly spending estimate, indicating a $100 increase in spending per patient. A small, but significant increase in inpatient admissions occurs, but no significant change in ED visits is evident. This analysis can only use six quarters after the first CAH implemented the innovation, therefore five participating CAHs are not represented, because they have no innovation data. Because participating CAHs implement their programs over a 2-year period and there is considerable lag between the first CAH enrolled and the last CAH enrolled in the sample, variations present in the data are also driven by the composition of CAHs in the sample and not only by the impact of the innovation. Similar to the Medicare results, the differences between innovation and comparison groups are adjusted by observable patient characteristics but contain no multivariate adjustment for CAHs' characteristics.

Although results are only for a short time with fewer CAHs represented in the data, any direct effect on utilization is unlikely. As noted with Medicare results, the innovation focused on process improvement designed to increase efficiency and cost of care in areas such as supply chain enhancements. The CAHs did not dedicate much effort to quality of care, which could have resulted in reductions in utilization.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Mineral Regional did not provide any patient-level data to RTI; therefore, we do not include any awardee-specific analyses in this report.

2.16 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 26*** lists the quantifiable measures of implementation and their status as of June 30, 2015, obtained from Mineral Regional's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail. The findings presented in the following sections are based on data from January to June, 2015, and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 26. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participating CAHs	Data received from Mineral Regional
	Dose	Number/percentage of CAHs participating in Component 1, workforce development activities (e.g., completed/updated BHIP, hired a BHIS)	Data received from Mineral Regional

(continued)

Table 26. Measures of Implementation (continued)

Evaluation Domains	Subdomains	Measures	Source
Implementation effectiveness (continued)	Dose (continued)	Number/percentage of CAHs participating in Component 2, community participation (e.g., completed a CNA, established a community collaborative)	Data received from Mineral Regional
		Number/percentage of CAHs participating in Component 3, provider-based research network (e.g., swing-bed study, formulary management study, EOL registry)	Data received from Mineral Regional
		Number and type of Lean projects	Data received from Mineral Regional

[1] Data received from Mineral Regional is through May 31, 2015.
CAH = critical access hospital; CNA = community needs assessment; BHIP = Better Health Improvement Plan; BHIS = Better Health Improvement Specialist; EOL = end-of-life; FTE = full-time equivalent.

2.17 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.17.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was staffed with two full-time equivalent (FTE) staff members. Between January-June, 2015 (Q11 and Q12) 31 staff members left their positions as the funding period ended.

FMBHP stated that it retained 85 percent of the BHIS workforce throughout the project. FMBHP attributed the low turnover rate to the training and support that FMBHP and the CAH network provided to BHIS (see Section 2.17.2), which enabled BHIS to apply their skills and continue to be challenged in their work. Also, BHIS qualifications and background aligned with the needs and goals of the hospital that hired the BHIS. Approximately 80 percent of CAH CEOs committed to continuing to fund the BHIS position in their hospitals, although the job responsibilities of that position may change when it is no longer driven by the innovation. The FMBHP staff hope that this newly trained workforce can transition into similar community health positions that allow them to use their skills in community assessment and collaboration and data-driven approaches to improving health.

2.17.2 Skills, Knowledge, and Training

Between Q11 and Q12, Mineral Regional, in collaboration with partner organizations, provided 2,562 hours of training to 709 individuals. Since the innovation start, Mineral Regional provided 30,530 hours of training to 3,040 individuals (***Table 27***).

Table 27. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12 (January–June 2015)	2,562	709
Since inception	30,530	3,040

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

This innovation focused on hiring and training BHIS throughout implementation. Training offered to BHIS included Lean health care training and the Lean Six Sigma™ certification, which enabled BHIS to support applied continuous quality improvement efforts in the health care setting aimed specifically at reducing waste and increasing efficiency. As of Q12, 25 BHIS were certified as Lean instructors. BHIS also received training on health care improvement, leadership development, community collaboration, data analytics, community health needs assessment, cultural competence, and media advocacy. The FMBHP staff was instrumental in organizing and executing training with partner organizations for BHIS, CEOs, clinical personnel, and community members that included many topics and delivery modes.

Three master Lean instructor trainers formalized a Lean instructor network with an elected codirector and by-laws. Network members will continue to provide training in the Lean approach and serve as a conduit with the newly formed Montana Critical Access Hospital Best Practice Sharing Directory, which will house Lean projects and encourage collaboration.

Originally, FMBHP staff members did not believe the Lean training would play such a central role in workforce development. However, Lean methodologies enabled BHIS to tailor their efforts to specific needs identified in the hospital and larger community. Because Lean methodologies are team-based and involve varying levels of an organization, CAH CEOs were engaged in health care improvement efforts and the innovation itself. Through the Lean process, CEOs could see the direct results of the BHIS's work in cost savings and efficiencies for their hospitals: *"Looking back I would say it [Lean] is one of the biggest things we did. Lean was what hospitals bought into the most, that we could give them cost savings. I'm glad we did that."*

In addition to Lean training for the BHIS, FMBHP led efforts to provide financial performance data from iVantage to CAHs and educated hospital staff on value-based purchasing. FMBHP provided training on value-based purchasing to 38 CEOs of Montana's CAHs, including the 25 participating in the innovation; FMBHP also initiated discussion about value-based payments and shared savings. FMBHP assisted seven hospitals in applying for the rural accountable care organization (ACO) designation as a result of CEOs' increased understanding of the value-based approach. FMBHP partnered with the

Montana Hospital Association (MHA) to conduct research before and after value-based purchasing. In partnership with CEOs, they plan to develop a white paper and recommendations to the Centers for Medicare & Medicaid Services (CMS) on defining value in rural and frontier health care.

Using virtual technologies such as KnowledgeWeb helped expand training opportunities so individuals could participate remotely. In addition, FMBHP staff recorded many trainings and collaborated with partner organizations such as the Montana Performance Improvement Network to disseminate findings and training materials to a broader audience. Mineral Regional also offered trainings to community members in addition to the health care workforce as part of the community collaborative.

2.18 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

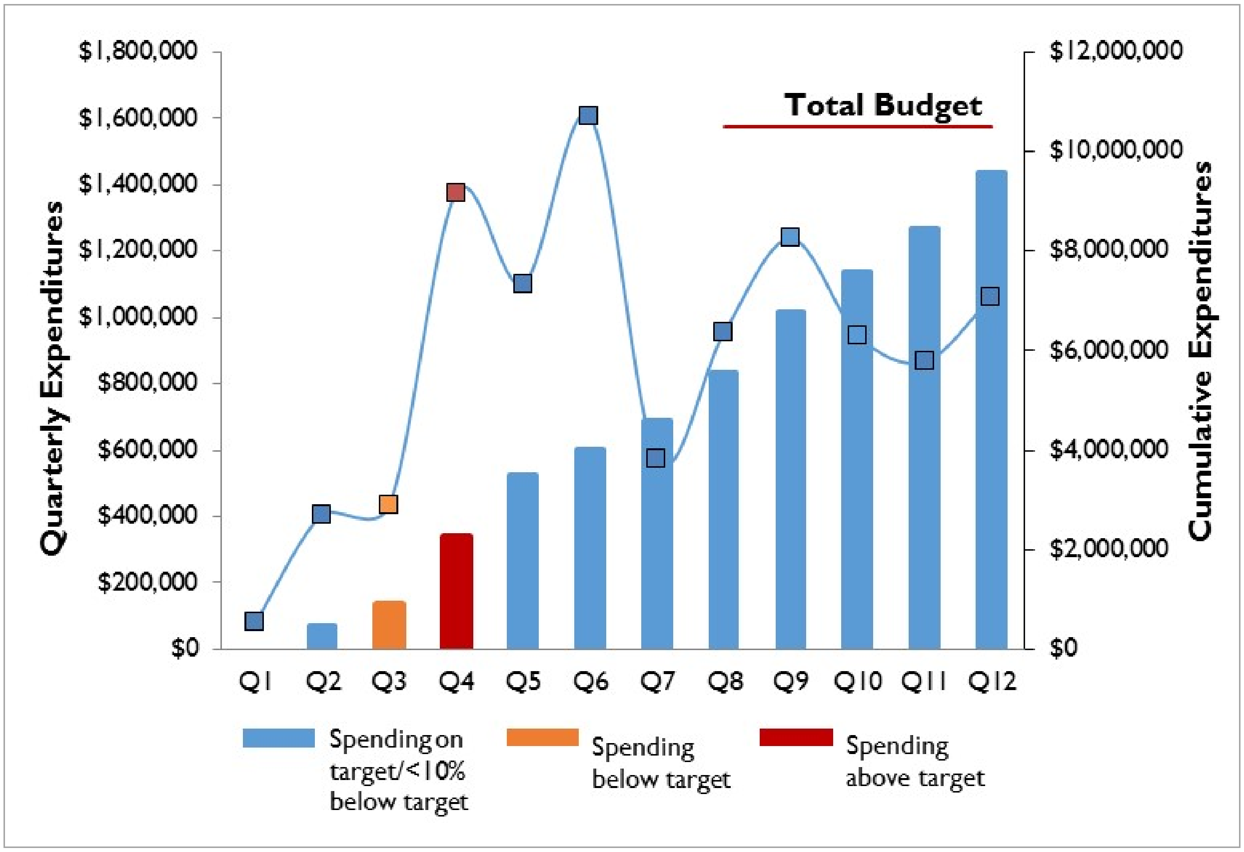
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.18.1 Award Execution

The annual report highlights the significance of Mineral Regional's expenditure rates on implementation. As of June 2015 (Q12), Mineral Regional spent 91.2 percent of its total budget, which is at the projected target. Spending was generally reported on target since the 2014 annual report (***Figure 14***).

Figure 14. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.18.2 Leadership

Mineral Regional served as the fiduciary agent for the FMBHP, and its leadership remained constant during the project period. Throughout implementation, organizational leaders at Mineral Regional were mostly uninvolved in the day-to-day aspects. However, they monitored fiscal activities closely following administrative challenges in Year 1. Mineral Regional's CEO actively led the work of the Leadership Advisory Committee (LAC) made of up the CEOs from the 25 participating CAHs. Despite the CEO's involvement, FMBHP staff reported that Mineral Regional's leadership could have more actively engaged external partners and promoted the innovation across the state.

Early in the project, Mineral Regional faced significant administrative challenges and leadership changes that hindered engagement of the CAHs and regional partners and their participation in the innovation. After the original FMBHP project director left, a new project director was hired at the end of Year 1 who served for the remainder of the project period. She focused on securing the trust and confidence of the CAHs and the mandated reporting and oversight by CMS that followed. The FMBHP project director and other staff spent considerable time meeting individually with CAH CEOs and other staff to answer questions and quell any concerns about the innovation's ability to succeed. This one-on-one approach paid off: innovation staff successfully enrolled all 25 CAHs by the end of the second year. Engagement in the LAC, which generally met monthly and served as a decision-making body and support network for CAHs, further strengthened CAHs' confidence. The FMBHP project director and Mineral Regional's CEO essentially engaged the CAH CEOs as coleaders in the innovation by designating the LAC as the decision-making body of the innovation.

Project staff reported that they and Mineral Regional leadership could have done more to engage the CAH leadership beyond the LAC, which might have helped CAHs become vested in the actual innovation work. For instance, staff could have offered more formal professional development activities to CEOs that might have clarified their role in the innovation. In addition, staff reported that they could have more fully engaged the MHA earlier in the project to promote the innovation in the MHA network. The MHA works closely with CAH CEOs and could promote credibility to the CAHs' involvement in the innovation. Additionally, Mineral Regional's leadership could have promoted the innovation more with the CAHs' boards to gain their support for the CEOs involvement in this effort.

2.18.3 Organizational Capacity

Organizational capacity for the innovation increased over time as a result of leadership changes, particularly hiring and training of BHIS and other staff to implement the innovation. FMBHP staff organized training and strategies for virtual collaboration to bridge the great distances between the CAH sites. Over time, staff learned ways to successfully overcome the geographic barriers through the use of virtual tools such as KnowledgeWeb, WebEx, and other webinar training platforms. They also increasingly recognized when to bring leadership and staff together for in-person meetings to strengthen networks and relationships.

Throughout the innovation, FMBHP staff were the leaders in developing and implementing training and other workforce development activities to accelerate the work of the BHIS. FMBHP's capacity as an organization increased dramatically during the innovation, most likely because of better understanding of the need to have a strong network of BHIS to execute the innovation in their communities. Because the activities within the five innovation components are so diffuse and tailored to individual communities, having trained BHIS who could use approaches such as Lean to tailor interventions was crucial in the implementation process. FMBHP staff's ability to engage the CAHs and external partners in implementation ultimately helped to ensure that many of FMBHP's innovation projects can be continued, at least in part, through various collaboratives and networks in Montana.

The FRIN, a research network established by FMBHP, brought together providers in rural and frontier areas who wished to collaborate and carry out practice-based research to their relevant settings. FRIN used the KnowledgeWeb networking platform to give participating members access to ongoing research projects, research expertise, and Internal Review Board services. iVantage, an innovation partner, provided technical support for the KnowledgeWeb. FMBHP used KnowledgeWeb to discuss recruitment and relevant research topics and processes. In Years 2 and 3, FMBHP focused on ensuring that each BHIS could collect and report comparative data through the KnowledgeWeb to store and share knowledge as well as use it as a platform for collaboration.

2.18.4 Innovation Adoption and Workflow Integration

As a result of the FRIN, FMBHP implemented two projects focusing on swing-bed studies and EOL care. Five CAHs are participating in the swing-bed research project with support from the FRIN research support team. The swing-bed research team developed four indicators and a swing-bed overview education website. The EOL research project included 11 CAHs and the FRIN research support team. After conducting initial research on EOL and gathering education materials, the team used Lean methodologies to prioritize issues for EOL use and to standardize an EOL registry inquiry and patient education materials.

In addition to increasing connectivity across CAHs through the FRIN, FMBHP originally intended to integrate EHR systems in each CAH. Integration posed challenges because some CAHs did not have EHRs. In addition, the CAHs with EHRs had different systems that did not easily communicate with one another; thus, integration of EHR systems across the partnership became even more challenging. In response, FMBHP brought together local stakeholders involved in data-reporting processes, such as the Montana Healthcare Improvement Consortium (the local quality improvement organization), MHA, HealthShare Montana, Monida Health Network, and Health Technology Services (the regional extension center), to work on decreasing duplication, maximizing available resources, developing data-sharing agreements, identifying data definitions, and creating standardized report formats. The Montana Healthcare Improvement Consortium and participating CAHs worked toward creating a standardized health care data collection crosswalk that was projected to be distributed in late 2015. In Year 3, FMBHP staff also focused on providing training and facilitating the adoption of EHRs for CAHs without an EHR system. An additional part of this component is helping CAHs use EHRs to achieve meaningful use of the EHR itself. Mineral Regional did not report the extent to which this work was accomplished.

2.19 Implementation Effectiveness

A major focus of the evaluation is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses this question.

Evaluation Question

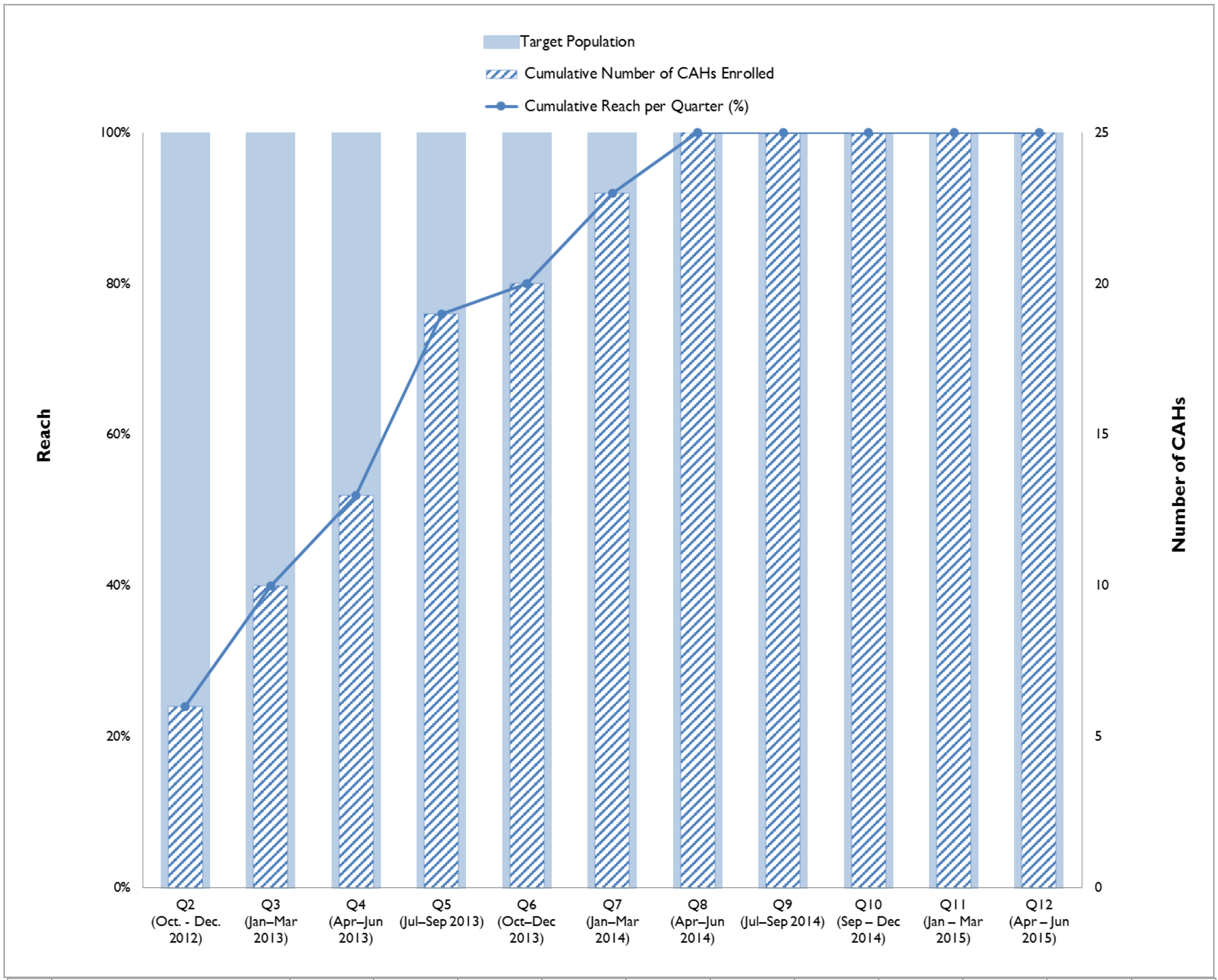
- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.19.1 Innovation Reach

RTI defined reach for this innovation as the number of CAHs recruited for the innovation overall. ***Figure 15*** provides reach by quarter since the launch of the innovation. Since reach was last reported in the 2015 annual report, FMBHP did not recruit any additional CAHs beyond the targeted 25 CAHs. They recruited only 6 CAHs in 2012, but recruited 14 CAHs in 2013 and 5 CAHs in 2014.

We cannot ascertain the number of patients whose care may have been impacted by the innovation, because the CAHs mostly focused on process improvements to improve the efficiency and cost of care rather than care improvements.

Figure 15. CAH Recruitment for Each Quarter since Project Launch



Quarter	Q2 (Oct–Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
Cumulative reach per quarter (%)	24.0	40.0	52.0	76.0	80.0	92.0	100.0	100.0	100.0	100.0	100.0
Cumulative target number	25	25	25	25	25	25	25	25	25	25	25
Cumulative number of participants enrolled	6	10	13	19	20	23	25	25	25	25	25

CAH = critical access hospital.

2.19.2 Innovation Dose

Table 28 provides the number and percentage of CAHs that participated in the three main innovation components (i.e., workforce development, community participation, provider-based research network) through Q12. Dose is assessed by the extent to which a set of benchmark activities are conducted in these three components. We last reported dose in the 2015 annual report based on data through Q11, and Mineral Regional did not provide new data since that report—thus, the numbers are the same. Dose as related to Component 1 (workforce development) can be assessed by whether CAHs (1) completed a BHIP and/or (2) hired a BHIS. During the innovation, 60 percent of CAHs completed a BHIP and hired a BHIS. In addition, 68 percent completed a BHIP and 92 percent hired a BHIS.

Table 28. Number and Percentage of CAHs Participating in Three Main Innovation Components

Component	Number of CAHs	Percentage of Total Enrolled CAHs (n=25)
Workforce Development (Component 1)		
Completed a BHIP	17	68.0
Hired a BHIS	23	92.0
Completed a BHIP and hired a BHIS	15	60.0
Community Participation (Component 2)		
Completed a CNA[1]	22	88.0
Established a community collaborative	12	48.0
Completed a CNA and established a community collaborative	11	44.0
Provider-based Research Network (FRIN) (Component 3)		
Participated in formulary management	21	84.0
Participated in EOL registry	11	44.0
Participated in swing-bed research study	5	20.0
Participated in formulary management, EOL registry, and swing-bed research study	4	16.0

Source: Hospital-level data provided to RTI.
[1] CNA completed when a hospital completed survey, focus groups, and report.
BHIP = Better Health Improvement Plan; BHIS = Better Health Improvement Specialist; CAH = critical access hospital; CNA = community needs assessment; EOL = end-of-life; FRIN = Frontier Rural Information Network.

For Component 2 (community participation), we examined dose by assessing whether CAHs (1) completed the CNA and/or (2) established a community collaborative in their respective communities. Although the vast majority of CAHs completed the CNA process with the Office of Rural Health in Montana (88.0%), only 48.0 percent of CAHs established a community collaborative. However, 11 of the 12 CAHs that created a community collaborative also completed the CNA process.

Finally, for Component 3 (provider-based research network), we examined dose by assessing whether CAHs participated in three main research projects: (1) medication cost study, (2) EOL registry project, and (3) swing-bed research study. The majority of CAHs participated in the formulary management project through the FRIN (84.0%), while fewer CAHs participated in the EOL registry and swing-bed research study—44.0 percent and 20.0 percent, respectively. In addition, only 16.0 percent of CAHs participated in all three research projects.

Despite leadership engagement, keeping CEOs involved in implementing specific innovation activities was challenging. Some CEOs were reluctant to sign up for specific interventions such as the FRIN's swing-bed or EOL registry; they were concerned about the amount of work involved. In addition, some CEOs did not fully support or understand the role of the BHIS and used that position to perform tasks that were not part of the innovation.

We also examined dose by the number and type of projects completed at the CAHs as part of the overall innovation. No changes occurred since dose was last reported in the 2015 annual report. Across the entire innovation time period, the most common projects were strategic planning (72.0% of all CAHs completed), community resource and data (64.0% of CAHs completed), and relationship building (52.0% of CAHs completed). Among CAHs, the following numbers of projects were completed, on average: 2.5 strategic planning, 2.3 community resource, 3.1 data, and 1.8 relationship building, media advocacy, or consumer engagement. The remaining projects are presented in ***Table 29***.

Table 29. Cumulative Number and Types of Projects Completed at CAHs

Project Type	Number of Projects	Number (Percentage) of CAHs Completing Projects	Average Number of Projects per CAH
Strategic planning	45	18 (72.0)	2.5
Community resources	37	16 (64.0)	2.3
Data	49	16 (64.0)	3.1
Media advocacy	22	12 (48.0)	1.8
Relationship building	23	13 (52.0)	1.8
Fostering consumer engagement	7	4 (16.0)	1.8
Community health education opportunity	5	2 (8.0)	2.5

Source: CAH-level data provided to RTI.
CAH = critical access hospital.

2.20 Qualitative Findings: Sustainability

Mineral Regional did not sustain the FMBHP after June 30, 2015. Instead, FMBHP staff and CAH leadership formed a 501(c)(3) nonprofit entity, FRIN, that will provide an infrastructure for future collaboration with partners and enable them to apply for their own funding. Toward the end of the project, FMBHP staff successfully transferred several innovation initiatives to partner organizations to ensure that the projects continued in some capacity. For example, FMBHP transferred the BHIS professional development curriculum and recordings and clinical research learnings from the swing-bed project to the Montana Performance Improvement Network. The FMBHP Lean Instructor network will continue via a collaboration among FMBHP, Mountain Pacific Quality Health Foundation, and the Montana Performance Improvement Network. FRIN, a key component of the innovation, will continue to serve as a resource for clinical research and collaboration, and will house learnings from the clinical research therapeutic project and the swing-bed project.

The LAC will sustain some elements of the FMBHP beyond the funding period, such as the Lean health improvement efforts, community engagement, and clinical research collaboration. Over three-quarters of the CAH CEOs also committed to funding the BHIS position beyond the innovation funding period. Moving forward, the BHIS position will involve a partial role in better health improvement activities while taking on other responsibilities in the hospital.

2.21 Overall Program Effectiveness to Date

This annual report describes various implementation challenges and issues facing Mineral Regional as well as accomplishments to date. In this section we assess Mineral Regional's progress on achieving HCIA goals to date:

- **Smarter spending.** Medicare and Medicaid average quarterly spending per patient is not statistically significant from zero.
- **Better care.** The intervention did not have a systematic effect on inpatient admissions for Medicare patients, but it was associated with a significant increase in Medicaid inpatient admissions. The intervention was associated with significantly higher Medicare ED visit rates but did not have a significant effect on the Medicaid ED visit rate. The intervention had no impact on readmissions.
- **Healthier people**. We did not receive any health outcomes data from the FMBHP innovation.

FMBHP faced many challenges during the first year of the project but achieved many milestones in Years 2 and 3 that kept the innovation on track, especially for three innovation components: workforce development, community participation, and the provider-based research network. The EHR component of the innovation was not as successful because participating CAHs did not have EHR systems. However, FMBHP created a data crosswalk to standardize health care data collection, distributed statewide in late 2015. In addition, FMBHP and the CAHs who had EHR systems worked toward achieving meaningful use and the associated incentives. These milestones were achieved by reengaging CAHs in the innovation, enrolling those that had not signed on, hiring and training BHIS to carry out health care improvement and community engagement activities as well as engage the CAHs in the LAC and implement collaborative processes to address the innovation components. These efforts were accomplished because of the project staff's skillful execution and dedication, especially the second project director. Their ability to engage CAHs through the work of the BHIS and to establish data-driven best practices through efforts such as Lean methodologies, community needs assessment, and FRIN helped to establish their credibility.

Other than fiscal oversight, Mineral Regional gave staff considerable freedom and latitude to carry out their work. Mineral Regional leaders saw their role as primarily fiduciary, especially following fiscal reporting changes in Year 1 and need for additional oversight by CMMI. Mineral Regional's "hands off" approach with the FMBPH innovation regarding program implementation had some benefits for implementation, but also impeded implementation in other ways. For example, the CAHs engaged in the innovation were sited across considerable geographical distances within the state, so the ability to work remotely enabled them to be more flexible to the emerging needs of the innovation. On the other hand, Mineral Regional leadership did not promote and support the project externally, which hindered FMBHP staff in establishing inroads with critical stakeholders that could have supported the innovation's work and promoted the credibility of the CAHs. FMBHP staff and CAH leadership formed a 501(c)(3) nonprofit entity, FRIN, to sustain innovation efforts beyond the funding period. The nonprofit entity will provide an infrastructure for future collaboration with partners and enable them to apply for their own funding. Even without additional funding at the end of the grant period, the LAC plans to sustain some elements of the FMBHP, including the Lean health improvement efforts, community engagement, and clinical research collaboration. Over three-quarters of the CAH CEOs also committed to continue funding the BHIS position. Moving forward, the BHIS position will involve a partial role in better health improvement activities while taking on other responsibilities in the hospital.

FMBHP staff successfully transferred several innovation initiatives to partner organizations to ensure they continued in some capacity. Partner organizations will continue to serve as resources for clinical research and collaboration and will house learnings from the clinical research therapeutic project and the swing-bed project. Efforts related to other innovation components including promotion of rural participation in value-based purchasing and integration and adoption of EHR systems by the CAHs were discontinued at the end of the funding period. In addition, no FMBHP staff members were retained in the employ of Mineral Regional.

Demonstrating a link between the FMBHP and health outcomes such as smarter spending, better care, and healthier people remains a challenge for this innovation. As of this report, there is no evidence of impact of the innovation on health outcomes. Furthermore, the extent to which innovation activities targeted these outcomes is questionable, as the focus was primarily on decreasing CAH operational costs through improved system delivery. It is unlikely that FMBHP had an effect on patient-level outcomes during the evaluation period.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Mineral Regional Health Center (Mineral Regional)

The Mineral Regional Health Center (Mineral Regional) was a nonprofit regional collaborative in Superior, Montana, that convened the Frontier Medicine Better Health Partnership (FMBHP) innovation, a partnership of 25 critical access hospitals (CAHs) across the state. Mineral Regional received an award of $10,499,899 and began enrolling CAHs in November 2012. The FMBHP sought to standardize the coordination of care in participating CAHs across the spectrum of medical services in five key improvement areas, ensuring that patients receive the right care at the right time from the right provider.

Awardee Overview

Innovation dose:	68% of CAHs completed a Better Health Improvement Plan, 92% hired a Better Health Improvement Specialist (BHIS), and 60% completed both. 88% of CAHs completed a community needs assessment, 48% established a community collaborative, and 44% did both. 84% of CAHs participated in the formulary management project, 44% in the end-of-life registry project, 20% in the swing-bed research study, and 16% completed all three projects.	***Innovation reach:***	The number of enrolled CAHs (25) remained the same over time.
Components:	(1) Workforce development (2) Community engagement (3) Provider-based research network (4) Value-based purchasing (5) Electronic health record system integration (not implemented as planned)	***Participant demographics:***	Characteristics of the CAHs remained the same over time. A majority of CAHs had 21 to 25 beds (76%) while only 16.0% had 6 to 10 beds. CAHs were located statewide and 68% were nonprofit.
Sustainability:	Mineral Regional did not sustain FMBHP after June 30, 2015. FMBHP staff and CAH leaders formed a 501(c)(3) nonprofit entity, Frontier Rural Innovation Network (FRIN). Over three-quarters of CAH CEOs committed to funding the BHIS position past the grant period with some shifts in work responsibilities.		
Innovation type:	Process of care; Health IT	Provider payment reform	Health care workforce

Key Findings:

Smarter spending. Average quarterly spending effects per patient were not significant for Medicare ($8; 90% CI: −$2, $18) or Medicaid ($100; 90% CI: −$75, $275).

Better care. The intervention significantly reduced inpatient admissions per 1,000 Medicare patients per quarter (−1; 90% CI: −1, 0), but it was associated with a significant increase in Medicaid inpatient admissions per 1,000 participants per quarter (7; 90% CI: 4, 9). The intervention was associated with significantly higher Medicare ED visit rates per 1,000 participants per quarter (12; 90% CI: 10, 15) but did not have a significant effect on the Medicaid ED visit rate per 1,000 participants per quarter (4; 90% CI: −1, 8). The intervention had no impact on unplanned readmissions per 1,000 admissions per quarter for Medicare (8; 90% CI: −3, 19) or Medicaid (−1; 90% CI: −17, 16).

Healthier people. We did not receive any health outcomes data from the FMBHP innovation.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

National Health Care for the Homeless Council

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness, health outcomes, utilization, and spending. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	9 months before start of innovation–9 months after start of innovation
Medicaid	9 months before start of innovation –9 months after start of innovation
Awardee-specific data	Launch date–September 2015

Q = quarter.

National Health Care for the Homeless Council (NHCHC)

2.1 Introduction

The National Health Care for the Homeless Council (NHCHC) is a nonprofit organization that received an award of $2,681,877 to implement an innovation (launched in February 2013[1]) in 12 locations nationwide. The goal of the innovation was to transition 500 people experiencing homelessness and who frequently used emergency departments (EDs) for health care into appropriate primary care. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Decrease hospital/ED utilization for nonurgent care and associated spending among people who are homeless and frequent users of EDs by $4,544 per patient per year.

2. **Better care.** Collaborate with 12 selected Health Care for the Homeless (HCH) primary care programs and local hospitals to increase access to quality health care through the employment of community health workers (CHWs) and linkages to medical homes.

3. **Healthier people.** Reduce health disparities, broadly defined, and decrease the number of patients with diabetes with poor HbA1c control (> 9.0) and increase the number of patients with hypertension with blood pressure control (> 140/90 mm Hg).

Table 2 provides a summary of changes that occurred during the final 9 months of operations. These updates are based on a review of the Quarter (*Q)11-12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data most recently received through September 30, 2015. Readers should note that although NHCHC received a 3-month No-Cost Extension (NCE), it did not submit narrative or performance reports for that period (Q13).

[1] Data available in the *Q9 Quarterly Awardee Performance Report* indicate the start date as January 2013, but the awardee stated in the review process that patients were not enrolled until February 2013.

Table 2. Summary of Updates as of Quarter 13, September 30, 2015

Evaluation Domains and Subdomains	Updated Information through 9/30/2015
Innovation Components	
	Continued to use a single innovation component, CHWs, to help people experiencing homelessness access medical care and social services.
Program Participant Characteristics	
	The majority (94.4%) of participants were 25 to 64 years of age; 66.0% were male. Nearly half (46.3%) of participants were white; 36.9% were black. A quarter (24.1%) were covered by Medicaid, and less than 10% by Medicare.
Workforce Development	
Hiring and retention	12.20 FTEs were on staff in Q12, down from 15.20 in Q11.
	Staffing was below projection by 4.80 FTEs.
	Despite high levels of job satisfaction, at least half of all CHWs identified at least one indicator for job burnout in each quarter since June 2013.
Skills, knowledge, and training	Provided 186 cumulative trainees with 1,880 cumulative hours of training as of Q12.
	157.5 training hours offered to 15 staff members in Q12: developing workshops for, and attending, NHCHC's 2015 National Conference and Policy Symposium.
Context	
Award execution	93.3% of Year 3 budget expended as of Q12, on target with projected rate.
Leadership	NHCHC continued to coordinate and support implementation across the 12 HCH sites.
	Local clinic personnel not financially supported by HCIA continued to provide structure and supervision to CHWs.
	CHWs' supervisors/administrators transitioned from monthly conference calls with CHWs to monthly updates in January 2015.
Organizational capacity	Maintained significant organizational capacity at the national level, with varying resources available to CHWs across HCH communities.
	Continued to experience challenges collecting data from hospital partners due to complex hospital policies for data sharing and competing priorities.
Innovation adoption and workflow integration	CHWs established strong relationships with clinical providers and social workers after improving communication with patients and extending care to nonclinical settings.
	CHWs led workshops promoting the CHW model for treating populations experiencing homelessness at the NHCHC's 2015 National Conference and Policy Symposium.
Implementation Effectiveness	
Innovation reach	74.8% of the target population was enrolled through August 2014. Due to the removal of 40 patients in the new cumulative data file provided by NHCHC, reach is lower than what was reported in the 2015 annual report (82.8%).
Innovation dose	76.2% of participants received at least one service. Transportation and health education/supportive counseling were provided to the greatest number of participants (253 and 252, respectively).
Sustainability	
	Sustaining CHWs at 10 of the 12 HCH clinics.
	Struggled to develop a sustainability plan at some HCH health centers with limited resources.

Source: *Q11–Q12 Narrative Progress Report.*
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI by NHCHC.
Key informant interviews conducted June 2015.

CHW = community health worker; FTE = full-time equivalent; HCH = Health Care for the Homeless; NHCHC = National Health Care for the Homeless Council.

2.1.1 Innovation Components

NHCHC's innovation had one component, CHWs, who provided care coordination, patient navigation, and many social services to address the complex needs of people experiencing homelessness who frequently sought care at the ED. Twelve HCH programs throughout the United States employed one to two HCIA-funded CHWs, many with personal experiences of homelessness in their service areas. Depending on the site, CHWs identified eligible patients using information or referrals from hospitals and advocacy organizations, data stored in internal or external medical records, and personal referrals. After a patient consented to participate and completed program intake, CHWs supported patient care transitions from hospitals to medical homes at the HCH programs. CHWs drew on their personal experiences with homelessness to help them locate patients, empathize with them, and provide them with quality care. CHWs maintained extensive contacts with organizations in their local communities, including state agencies, nonprofits, hospitals, and providers. The resources available to CHWs and their patients varied dramatically as a result of differences in the cities participating in the innovation. NHCHC oversaw and coordinated the work of participating HCH sites, but played no direct role in patient care or CHW services (see Section 2.23.2 for more information).

Table 3 displays the 12 HCH programs responsible for implementing NHCHC's innovation. These programs did not function as traditional partners, given that they serve as extensions of NHCHC and implemented the innovation in the cities where they provide services.

Table 3. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Boston Health Care for the Homeless Program	Implementation site	Boston, MA
Care Alliance Health Center	Implementation site	Cleveland, OH
Charles Drew Health Center, Inc.	Implementation site	Omaha, NE
Duffy Health Center	Implementation site	Hyannis, MA
Harbor Homes, Inc.	Implementation site	Nashua, NH
Healthcare for the Homeless – Houston (HHH)	Implementation site	Houston, TX
HCH Manchester at Catholic Medical Center	Implementation site	Manchester, NH
Heartland Health Outreach	Implementation site	Chicago, IL
John Wesley Community Health (JWCH) Institute	Implementation site	Los Angeles, CA
Lincoln Community Health Center	Implementation site	Durham, NC
Northeast Valley Health Corporation	Implementation site	San Fernando, CA
Santa Clara Valley Health & Hospital System	Implementation site	Santa Clara, CA

HCH programs established contracts with local hospitals to monitor ED use among enrolled patients and access hospital data. Each program also cooperated with a wide variety of local partners to identify patients and obtain social and medical services to best meet their needs.

2.1.2 Program Participant Characteristics

Patient characteristics data were last reported in the 2015 annual report, based on data through Q11. However, due to identification of errors with its data, NHCHC provided a new cumulative file with data through September 2015. The new file included 40 fewer participants due to either nonexistent intake forms (n = 39) or not meeting the homeless eligibility criterion (n = 1). Although the new data file included fewer participants, the distribution of patient characteristics in ***Table 4*** is similar to what was

Table 4. Characteristics of All Participants Ever Enrolled in NHCHC Innovation through September 2015

Characteristic	Number of Participants	Percentage of Participants
Total	374	100.0
Age		
< 18	0	0.0
18–24	11	2.9
25–44	120	32.1
45–64	233	62.3
65–74	8	2.1
75–84	2	0.6
85+	0	0.0
Missing	0	0.0
Sex		
Female	118	31.6
Male	247	66.0
Transgender	2	0.5
Missing	7	1.9
Race/ethnicity		
White	173	46.3
Black	138	36.9
Hispanic	20	5.4
Asian	5	1.3
American Indian or Alaska Native	11	2.9
Native Hawaiian or other Pacific Islander	0	0.0
Other	18	4.8
Missing/refused	9	2.4
Payer category		
Dual	33	8.8
Medicaid	90	24.1
Medicare	23	6.2
Medicare Advantage	0	0.0
Other	63	16.8
Uninsured	145	38.8
Missing	20	5.3

Source: Patient-level data provided to RTI by NHCHC.

reported in the 2015 annual report. More specifically, most (94.4%) participants were 25 to 64 years of age and more than half (66%) were male. Nearly half (46.3%) of participants were white, and more than one-third were black (36.9%). More than one-third (38.8%) of participants were uninsured; approximately one-quarter (24.1%) were covered by Medicaid, and less than 10 percent were covered by Medicare.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced ED visits?

The claims-based results for NHCHC are based on a participant-level file of Medicaid and Medicare participants with complete baseline and innovation data (provided directly by NHCHC). Unlike other awardees, no patient identifiers are available to be linked to Medicare or Medicaid claims data. Thus, comparison groups cannot be constructed, and we are only able to perform before and after comparisons for innovation participants. ***Table 5*** lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report. We report on two measures, separately for the Medicare and Medicaid populations

Table 5. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
	Utilization	ED visits	Yes	Yes
	Cost	Hospital and ED visit spending per participant	Yes	Yes

ED = emergency department.

2.3 Medicare Spending and ED Visits

We report the average hospital and ED Medicare spending per participant and the associated standard deviations for the 9 months prior to the start of the innovation and for the 9 months after the start of the innovation. NHCHC constructed the data for spending based on two sources. For some participants, the data were based on costs estimated by each site for each participant. For the remaining participants, the data were based on applying a cost-to-charge ratio of 0.32 to the charges provided by each site for each participant. The cost-to-charge ratio did not vary by Medicare or Medicaid coverage. NHCHC constructed the ratio using Boston-area hospital data and applied it to charges to generate costs. Further, NHCHC collected data on spending from sites 24 months before the innovation began and prorated the costs to calculate spending for the 9 months before the innovation. Then direct comparisons could be made with data on spending 9 months after the innovation start.

We also report on the average number of ED visits per participant and the associated standard deviations for the 9 months before the innovation began and for the 9 months after the start. Similarly, NHCHC collected data on ED visits from its sites 24 months before the innovation began, and prorated the costs to calculate ED visits for the 9 months before the start to allow for direct comparisons with data on ED visits 9 months after the start.

Table 6 summarizes findings on the enrolled Medicare population. On average, spending was $34,418 for participants in the baseline period. It was lower in the innovation period: $6,188. The difference is significant at the 10 percent level (p = 0.02). The standard deviation is high in the baseline and innovation periods, in part due to the small number of beneficiaries in the data. Among the 37 Medicare participants in the data, 27 participants (73.0% of participants) had reduced spending in the innovation period. The ED visit data show an average reduction in ED visits from 6.82 visits per participant in the baseline period to 6.32 visits per participant in the innovation period. The difference is not significant at the 10 percent level (p = 0.42). Overall, ED visits decreased for 23 participants (62.2% of participants).

Table 6. Summary of Medicare Claims-Based Findings: NHCHC

Outcome	9 Months before Start of Innovation	Standard Deviation	9 Months after Start of Innovation	Standard Deviation
Hospital and ED spending per participant	$34,417.92	67,813.14	$6,188.06	12,493.61
ED visits	6.82	9.78	6.32	12.12

ED = emergency department.
Data source: Participant-level file Medicare participants provided directly by NHCHC.

2.4 Medicaid Spending and ED Visits

Table 7 summarizes findings on the enrolled Medicaid population. On average, spending was $25,831 per participant in the baseline period. It was lower in the innovation period, $12,017.73. The difference is significant at the 10 percent level (p = 0.02). Among the 89 Medicaid patients represented in the data, 58 patients (65.2% of patients) had reduced spending in the innovation period. The ED visit data show that ED visits increased from 5.66 visits per patient in the baseline period to 6.75 visits per patient in the innovation period; however, the standard deviation is particularly high in the innovation period (17.21). The difference is not significant at the 10 percent level (p = 0.71). Overall, ED visits decreased for 54 patients (60.7% of patients).

Table 7. Summary of Medicaid Claims-Based Findings: NHCHC

Outcome	9 Months before Start of Innovation	Standard Deviation	9 Months after Start of Innovation	Standard Deviation
Hospital and ED spending per participant	$25,830.73	52,941.22	$12,017.73	32,415.34
ED visits	5.66	7.95	6.75	17.21

ED = emergency department.
Data source: participant-level file Medicaid participants provided directly by NHCHC.

2.5 Discussion: Medicare and Medicaid Results

In summary, the results show reductions in spending when comparing 9 months before the innovation to 9 months after the start of the innovation. These results suggest that CHWs may have helped participants manage their health more effectively. However, because no comparison group exists, we cannot necessarily attribute the reduction in spending to the innovation, and must interpret these results cautiously. Reductions in spending may be due to other factors, such as regression to the mean or selection. For example, a sick participant in the baseline period may have improved over time and had reduced costs in the absence of the innovation. Further, the findings do not show any significant differences for ED visits in the innovation period compared with the baseline period. Another limitation of these results is the small sample size, which hinders detection of significant changes in the measures.

2.6 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

NHCHC submitted data to RTI that are current through September 2015. As noted previously, NHCHC discovered some issues with the data they previously provided to RTI. Therefore, NHCHC provided RTI a new cumulative data file. ***Table 8*** lists the awardee-specific outcome measures selected for the innovation’s evaluation with an indication of the status of the data requested. NHCHC provided data for all the measures listed in the table and are included in this annual report.

Table 8. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status
Clinical effectiveness	Asthma	Percentage of patients with asthma who received medication management	Data received from NHCHC
	Diabetes	Percentage of patients with diabetes who received an HbA1c test	Data received from NHCHC
		Percentage of patients with diabetes who received a foot exam	Data received from NHCHC
	Hypertension	Percentage of patients with hypertension who received a blood pressure reading	Data received from NHCHC
	Mental health	Percentage of patients with mental illness for whom appropriate medications were dispensed	Data received from NHCHC
Health outcomes	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c > 9.0%	Data received from NHCHC
	Hypertension	Percentage of patients with hypertension with blood pressure < 140/90 mm Hg	Data received from NHCHC
	Patient perceived health and functioning	Quality of life scale	Data received from NHCHC
		General self-efficacy scale	Data received from NHCHC

NHCHC = National Health Care for the Homeless Council.

We examined clinical effectiveness and health outcomes among patients with diabetes or hypertension. The run charts in the following sections take into account rolling enrollment. The innovation quarters (Is) are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation will have health outcome data in more innovation quarters over time than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tends to drop substantially as the number of quarters enrolled increases. We provide data when at least 20 patients had a test or reading within the innovation quarter.

2.7 Asthma

NHCHC provided data on whether patients with asthma received medication management, allowing us to address the question of whether medication management services were provided to those with asthma during the 12 months they were enrolled in the innovation.

Evaluation Question

- Did patients with asthma receive medication management services during the innovation period?

2.7.1 Descriptive Results

Table 9 shows the percentage of patients with asthma who received medication management services by site. Between 29.6 percent (Houston, TX) and 85.7 percent (Nashua, NH) of patients with asthma received medication management services. Of the 127 total patients with asthma (34.0% of the total enrolled) across all sites, less than half (46.5%) received medication management services. It is important to keep in mind that it may not have been necessary for all patients with asthma to receive asthma medication management, and the need for medication management services varies with the severity of asthma symptoms.[2] Thus, although the percentages of those who received medication management were relatively low, it is unclear how many asthmatic patients could have benefitted from additional care.

Table 9. Percentage of Patients with Asthma Who Received Medication Management, by Site

Site	Percentage of Patients with Asthma Who Received Medication Management
Boston, MA (n = 7)	42.9
Chicago, IL (n = 11)	45.5
Cleveland, OH (n = 7)	42.9
Durham, NC (n = 13)	53.8
Houston, TX (n = 27)	29.6
Hyannis, MA (n = 2)	50.0
Los Angeles, CA (n = 4)	50.0
Manchester, NH (n = 6)	33.3
Nashua, NH (n = 14)	85.7
Omaha, NE (n = 16)	56.3
San Fernando, CA (n = 10)	30.0
Santa Clara, CA (n = 10)	40.0
Total (n = 127)	*46.5*

Source: Patient-level data provided to RTI by NHCHC.

2.8 Diabetes

We received clinical effectiveness data on HbA1c tests and foot exams from NHCHC, allowing us to determine whether patients with diabetes received important clinical services during the 12 months they were enrolled in the innovation. We also received outcome data for HbA1c, allowing us determine whether the percentage of patients with diabetes with poor HbA1c control decreased over the course of the innovation.

Evaluation Questions

- Did patients with diabetes receive at least one HbA1c test during the innovation period?
- Did patients with diabetes receive at least one foot exam during the innovation period?
- Has the percentage of diabetes patients with poor HbA1c control decreased over time among those enrolled in the innovation?

[2] American College of Allergy, Asthma, & Immunology: Asthma treatment. 2014. Retrieved from http://acaai.org/asthma/asthma-treatment.

2.8.1 Descriptive Results

Ninety patients (24.1%) enrolled in the innovation had diabetes. ***Table 10*** shows the percentage of patients with diabetes who received an HbA1c test and/or foot exam by site. Between 0.0 percent (Santa Clara, CA) and 75.0 percent (Boston, MA) of patients with diabetes received an HbA1c test. Between 0.0 percent (Santa Clara, CA) and 66.7 percent (Chicago, IL) received a foot exam. Of the 90 patients with diabetes (24.1% of the total enrolled) across all sites, less than one-third of patients (30.0%) received an HbA1c test, and less than one-fourth (23.3%) received a foot exam during the innovation period. The percentages of those who received an HbA1c test or foot exam are lower than would be expected for patients enrolled in the innovation.

Table 10. Percentage of Patients with Diabetes who Received an HbA1c Test or Foot Exam, by Site

Site	Percentage of Patients with Diabetes who Received an HbA1c Test	Percentage of Patients with Diabetes who Received a Foot Exam
Boston, MA (n = 4)	75.0	25.0
Chicago, IL (n = 3)	66.7	66.7
Cleveland, OH (n = 3)	33.3	33.3
Durham, NC (n = 12)	41.7	33.3
Houston, TX (n = 24)	4.2	4.2
Hyannis, MA (n = 3)	66.7	33.3
Los Angeles, CA (n = 9)	33.3	0.0
Manchester, NH (n = 4)	25.0	50.0
Nashua, NH (n = 5)	60.0	40.0
Omaha, NE (n = 11)	45.5	54.5
San Fernando, CA (n = 10)	10.0	10.0
Santa Clara, CA (n = 2)	0.0	0.0
Total (n = 90)	*30.0*	*23.3*

Source: Patient-level data provided to RTI by NHCHC.

For any given quarter, there were between 3 and 16 patients with diabetes who received an HbA1c test, which does not meet the minimum number of 20 patients with an HbA1c test in order to generate a run chart. Therefore, no run chart is included for the percentage of patients with diabetes with poor HbA1c control over time.

2.9 Hypertension

We received systolic and diastolic blood pressure values from NHCHC. This data allowed us to determine whether patients with hypertension received important clinical services during the 12 months they were enrolled in the innovation, and whether the percentage of patients with hypertension who had blood pressure control increased over the course of the innovation.

Evaluation Question

- Did patients with hypertension receive at least one blood pressure reading during the innovation period?
- To what extent have health outcomes (e.g., blood pressure) improved over time among patients with hypertension enrolled in the innovation?

2.9.1 Descriptive Results

Approximately 53 percent of patients (n = 198) enrolled in the innovation had hypertension. ***Table 11*** shows the percentage of patients with hypertension who received a blood pressure reading, by site. Between 23.1 percent (San Fernando, CA) and 100.0 percent (Boston, MA; Hyannis, MA) received a blood pressure reading. Of the 198 patients with hypertension (52.9% of the total enrolled) across all sites, less than three-quarters of patients with hypertension (70.2%) received at least one blood pressure reading during the innovation period.

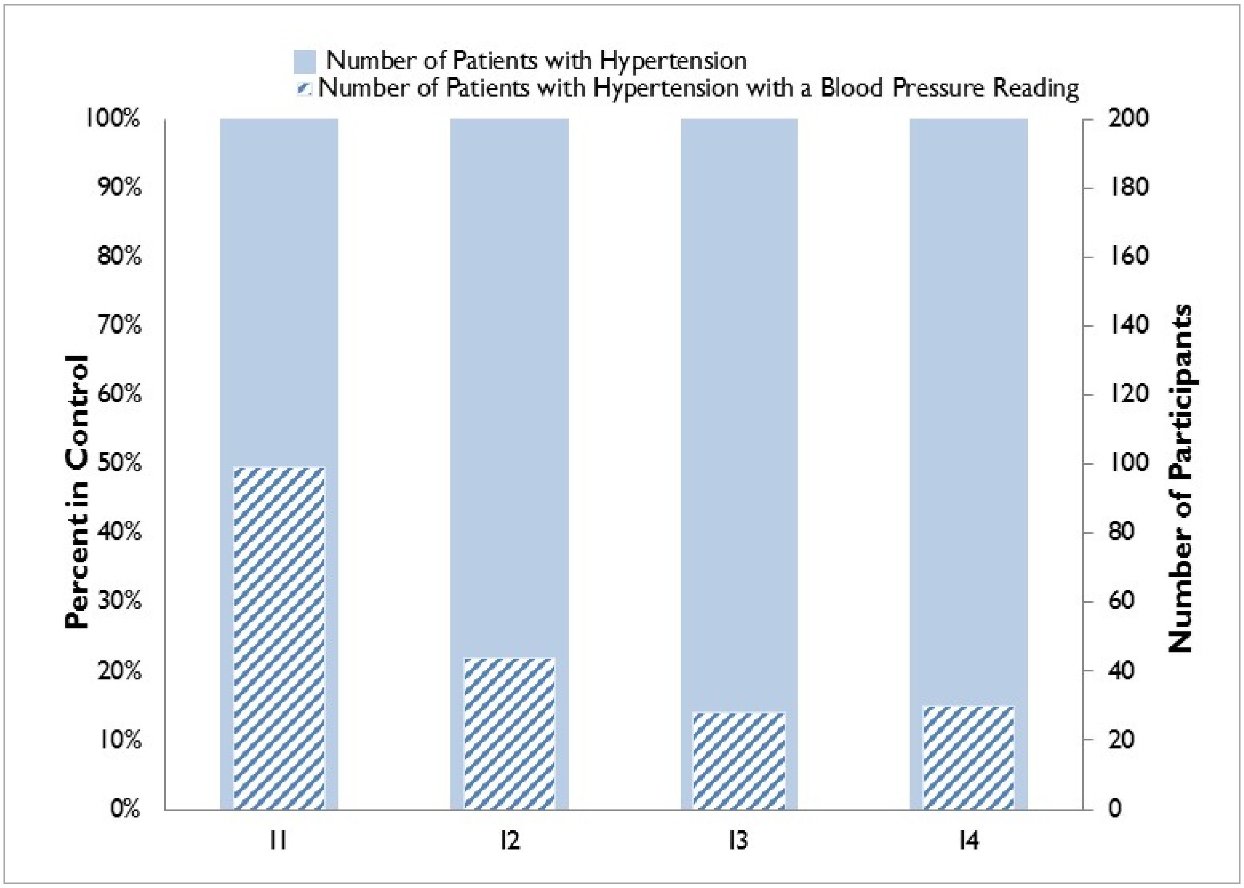
Table 11. Percentage of Patients with Hypertension who Received a Blood Pressure Reading, by Site

Site	Percentage of Patients with Hypertension Who Received a Blood Pressure Reading
Boston, MA (n = 9)	100.0
Chicago, IL (n = 13)	69.2
Cleveland, OH (n = 10)	50.0
Durham, NC (n = 18)	94.4
Houston, TX (n = 60)	63.3
Hyannis, MA (n = 11)	100.0
Los Angeles, CA (n = 10)	90.0
Manchester, NH (n = 8)	62.5
Nashua, NH (n = 12)	25.0
Omaha, NE (n = 26)	88.5
San Fernando, CA (n = 13)	23.1
Santa Clara, CA (n = 8)	87.5
Total (n = 198)	*70.2*

Source: Patient-level data provided to RTI by NHCHC.

Figure 1 presents the percentage of patients with hypertension who had a blood pressure reading indicating good control (i.e., <140/90 mm Hg) over time. The denominator represents the number of hypertension patients who received a blood pressure reading for each quarter. The numerator represents the number of hypertension patients who received a blood pressure reading that was lower than 140/90 mm Hg. As shown in the figure, the percent of patients with blood pressure control increased from 57.6 percent in I1 to 71.4 percent in I3, but then dropped to 50 percent in I4. It is important to note the decrease in the denominator across the innovation quarters due to patient attrition. Thus, interpretation of the findings should not be considered conclusive.

Figure 1. Percentage of Patients with Hypertension with Blood Pressure Control over Time



	Quarter	I1	I2	I3	I4
●	Percentage of patients with hypertension with blood pressure control	57.6	65.9	71.4	50.0
	Number of patients with hypertension	198	198	198	198
	Number of patients with hypertension with blood pressure reading	99	44	28	30

Source: Patient-level data provided to RTI by NHCHC.

2.10 Mental Health

We received data on antidepressant medication management from NHCHC, allowing us to address the question of whether patients with mental illness received medication management during the 12 months they were enrolled in the innovation.

Evaluation Question

- Did patients with mental illness receive antidepressant medication management during the innovation period?

2.10.1 Descriptive Results

Table 12 shows the percentage of patients with mental illness who received antidepressant medication management by site. Between 0 percent (Los Angeles, CA) and 80.0 percent (Boston, MA) of patients received antidepressant medication management. Of the 134 patients with mental illness (60.2% of the total enrolled) across all sites, nearly half (48.4%) received antidepressant medication management during the innovation period.

Table 12. Number and Percentage of Patients with Mental Illness Who Received Antidepressant Medication Management, by Site

Site	Percentage of Patients with Mental Illness Who Received Medication Management
Boston, MA (n =10)	80.0
Chicago, IL (n = 11)	45.5
Cleveland, OH (n = 8)	62.5
Durham, NC (n = 25)	68.0
Houston, TX (n = 60)	30.0
Hyannis, MA (n = 14)	50.0
Los Angeles, CA (n = 9)	0.0
Manchester, NH (n = 17)	17.6
Nashua, NH (n = 23)	65.2
Omaha, NE (n = 35)	77.1
San Fernando, CA (n = 5)	40.0
San Jose, CA (n = 8)	25.0
Total (n = 225)	*48.4*

Source: Patient-level data provided to RTI by NHCHC.

2.11 Patient-perceived Health and Functioning

We received data on quality of life and self-efficacy over time from NHCHC, which allowed us determine whether patients perceived that their health and functioning improved over the course of the innovation.

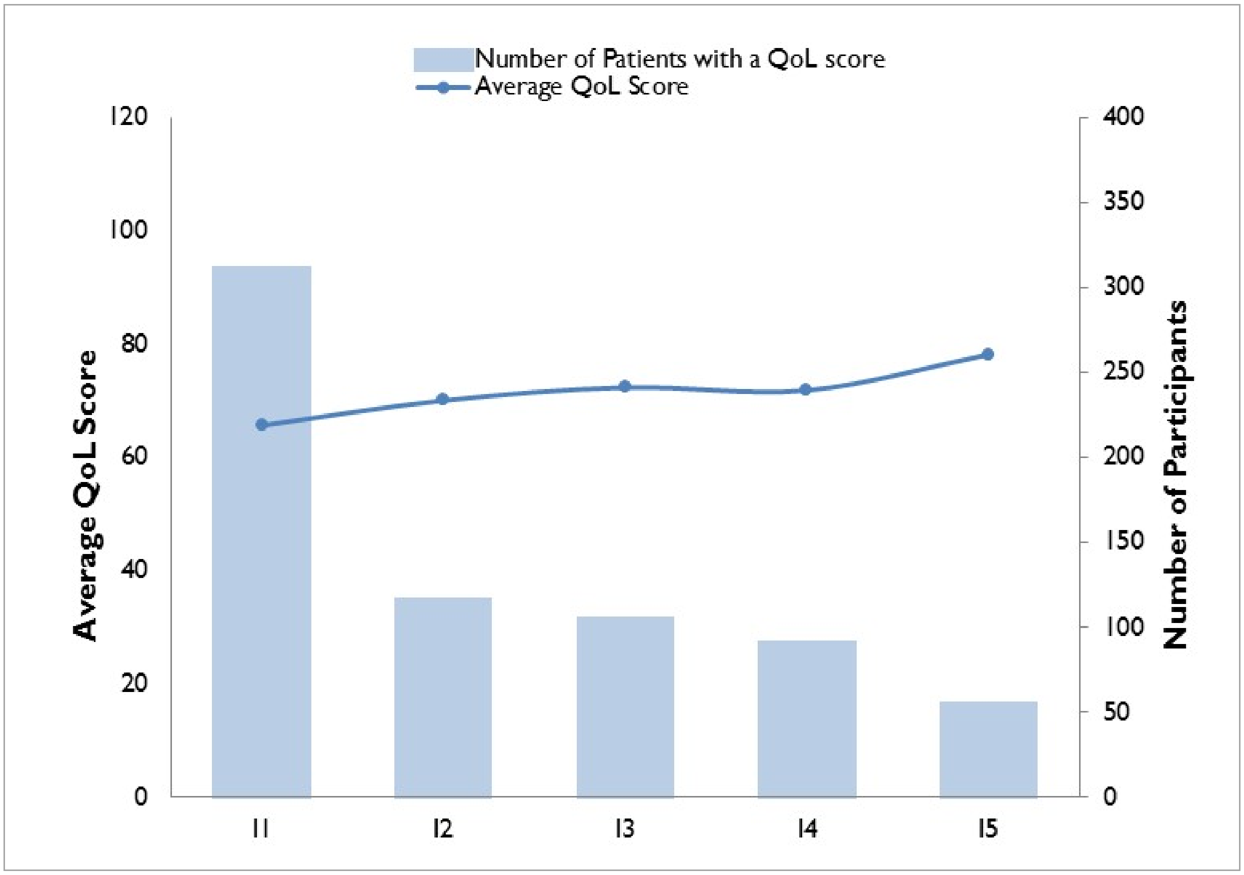
Evaluation Question

- To what extent has patient-perceived health and functioning changed over time among those enrolled in the innovation?

2.11.1 Descriptive Results

Figure 2 shows perceived quality of life over time for participants enrolled in the innovation. The Quality of Life Scale (QoLS) is a self-reported score that measures quality of life in a variety of ways including family, housing stability, and recreation. Higher scores indicate a perceived higher quality of life. The highest score that can be obtained on the QoLS is 120. As shown in the figure, patients reported that, on average, their quality of life increased from 65.7 (I1) to 78.2 (I5) over the course of the innovation. However, as noted above, the denominator decreased substantially across the innovation quarters due to patient attrition. Thus, interpretation of the findings should not be considered conclusive.

Figure 2. Perceived Quality of Life over Time

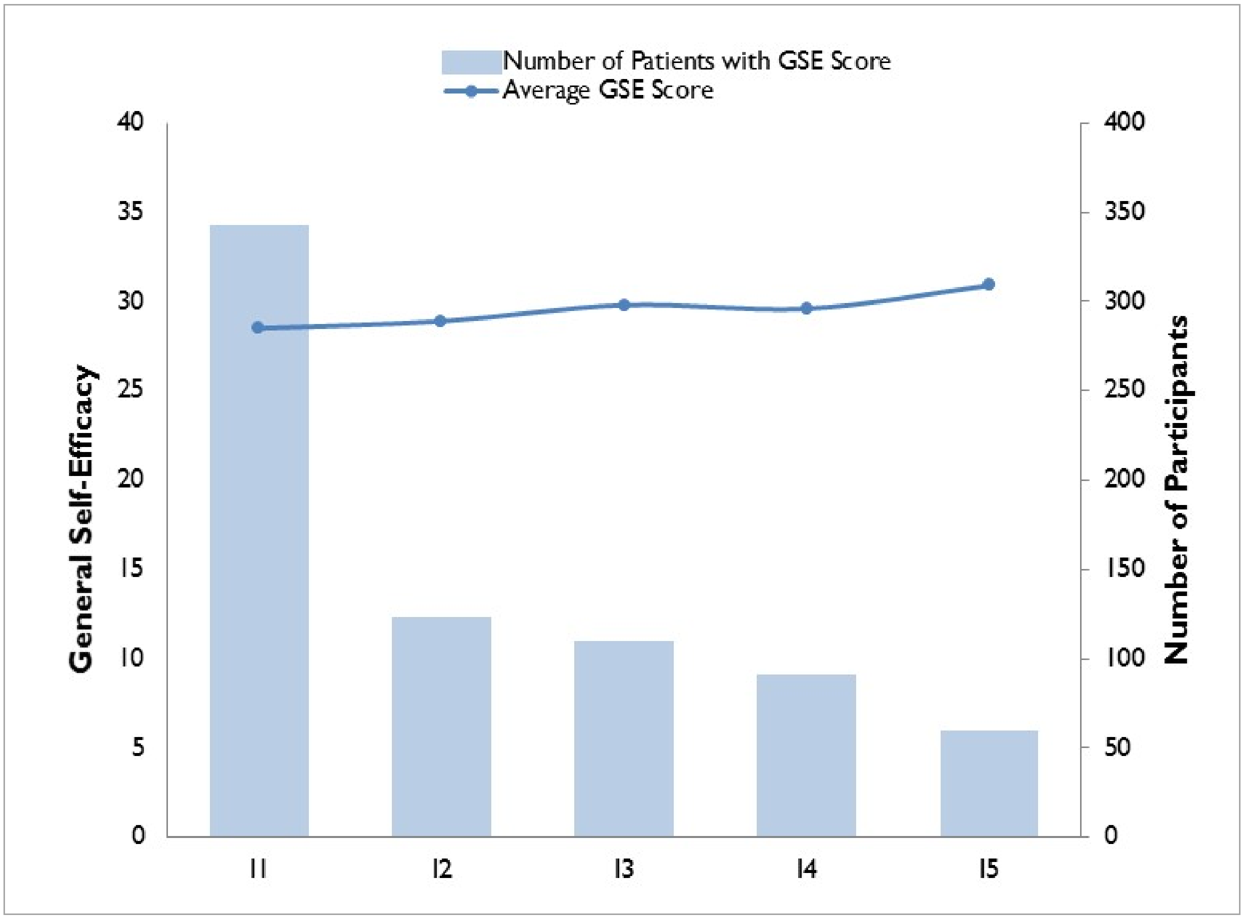


	Quarter	I1	I2	I3	I4	I5
	Average QoL score	65.7	70.1	72.4	71.9	78.2
	Number of patients with QoL score	305	110	99	85	49

Source: Patient-level data provided to RTI by NHCHC.
QoL = quality of life.

Figure 3 shows general self-efficacy over time for participants. The self-reported General Self-Efficacy (GSE) Scale measures the belief in one's competence to cope with a broad range of stressful or challenging demands. The higher the score, the more confident a person is in his/her ability to handle stressful situations, with a possible total score of 40. As the figure shows, GSE remained fairly consistent over time, at an average score of about 30. GSE increased slightly from 28.5 (I1) to 30.9 (I5). Again, due to the decreased denominator in the later innovation quarters, interpretation of the findings should not be considered conclusive.

Figure 3. General Self-Efficacy over Time



	Quarter	I1	I2	I3	I4	I5
●	Average GSE score	28.5	28.9	29.8	29.6	30.9
	Number of patients with GSE score	336	116	103	84	53

Source: Patient-level data provided to RTI by NHCHC.
GSE = general self-efficacy.

2.12 Discussion: Awardee-Specific Data

Our findings show that across all programs, hypertension is the most common health condition, followed by asthma and diabetes. Of these, hypertension patients were the most likely to receive clinical services: 70.2 percent received a blood pressure reading. Nearly half of patients with asthma received medication management. Less than one-third of patients with diabetes received an HbA1c test or foot exam. The percentage of hypertension patients with blood pressure control increased over the first three quarters of the innovation, but in the fourth innovation quarter the percentage dropped below that of the first innovation quarter. Patients' perceived QoL and GSE increased slightly during enrollment in the innovation. Thus, overall, we did not find that the innovation had a major impact on patients' receipt of clinical services or improvement in health outcomes over time.

Interviews with project leaders suggest that the intense social needs of the target population sometimes undermined CHWs' ability to address participants' medical needs. Specifically, when participants lacked access to stable housing or reliable meals, they were not prepared to manage their health. One interviewee remarked,

> ***"People who are struggling with diabetes are more concerned with where their next meal is going to come from or where they're going to be sleeping at night. So the CHWs approach can't be 'I understand that you don't know where you're going to sleep at night, but let's talk about your diabetes or your asthma.' That's not going to work. You have to address what it is that's their priority and then you get to how it's affecting their health care."***

Successfully addressing participants' unmet social needs also posed challenges due to inconsistent community resources across HCH sites and frequent behavioral health problems, which made it difficult for participants to maintain stable housing situations and sustain healthy lifestyles.

2.13 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. RTI evaluates these components through NHCHC's *Narrative Progress Reports, Quarterly Awardee Performance Reports,* and qualitative interviews with key staff that provide additional context and detail. The findings presented in the following sections include NHCHC's reports from Q11 through Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient overall organizational capacity and leadership to implement the innovation effectively?

Table 13 lists the quantifiable measures obtained through awardee reports and secondary data provided to RTI by NHCHC as of September 30, 2015.

Table 13. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participants eligible for services	Data received from NHCHC
	Dose	Number and type(s) of enabling services, e.g., transportation, interpretation services, health education/supportive counselling, outreach, case management (assessment, treatment and referral), eligibility assistance/ financial counselling	Data received from NHCHC

FTE = full-time equivalent

2.14 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.14.1 Hiring and Retention

NHCHC lost 3.0 full-time equivalent (FTE) staff between Q11 and Q12, ending the innovation with 12.2 FTEs. CHWs stopped enrolling new patients in the innovation on August 31, 2014, and the employment of CHWs varied across HCH programs as each of the local sites negotiated funding for CHW services with local partners (see Section 2.15).

NHCHC successfully retained between 15 and 17 FTE staff members for most of the implementation period. Internal efforts to collect quarterly data on CHW satisfaction and feedback revealed that the vast majority of CHWs were satisfied with their role in the innovation. CHWs appeared highly invested in their patients and the CHW care delivery model more generally. One CHW commented, "*It is truly rewarding to be in this position and be part of a team that can help a vulnerable people access the healthcare they deserve. It makes coming to work a privilege*."

Despite consistently high job satisfaction, at least half of all CHWs reported at least one indicator of burnout from Q4 forward. Burnout resulted in at least one resignation during the implementation period (Q8). Innovation leaders acknowledged that working with individuals experiencing homelessness is emotionally demanding, and that many CHWs experienced vicarious trauma as they empathized with innovation patients. According to an EOY interviewee, burnout resulted not only from dealing with high-need clients, but also from "*being disheartened by larger organizations*." CHWs struggled against bureaucracies and policies insensitive to the realities of homelessness, creating frustration as CHWs found themselves unable to help their clients. Burnout became increasingly common toward the end of innovation, as CHWs pushed to "close out" their caseloads and experienced uncertainty regarding the sustainability of their positions following the HCIA funding period.

NHCHC took several actions to address burnout and support CHWs more generally. First, monitoring burnout allowed innovation leaders to identify problems quickly and intervene to provide self-care resources as needed. Even before burnout became common at the end of Year 1, NHCHC had been continually surveying staff and sharing burnout mitigation techniques with the CHWs. Second, NHCHC provided structured trainings and workshops to help CHWs practice self-care. For instance, during NHCHC's annual National Conference and Policy Symposia, CHWs learned about time management, identifying priorities, leadership, resilience, and coping with the death of patients. The annual conferences also allowed CHWs to connect with their peers. A project leader explained, *"We've observed that conferences and trainings not only provide learning opportunities for the CHWs, but also provide a space for networking, support, and time to re-energize."* Finally, NHCHC hosted monthly calls with the HCH sites during which the CHWs could share their experiences and receive social support. Despite NHCHC's multipronged approach and CHWs' positive feedback on the resources available to them, burnout remained high in the final innovation quarters.

2.14.2 Skills, Knowledge, and Training

In Q12, NHCHC provided 157.5 hours of CHW training to 15 HCIA-employed clinical personnel during the annual NHCHC Conference in Washington, DC—the first in-person training delivered since the previous year, and the third time CHWs attended the conference. No trainings were reported during Q11 (***Table 14***).

Table 14. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12 (January–June 2015)	157.5	15
Since inception	1,880	186

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

The CHWs took an active role in planning and presenting workshops at the 2015 NHCHC National Conference and Policy Symposium, including presenting at a full-day preconference on cultural humility and vulnerable populations; facilitating a workshop on partnering with hospitals and using CHWs to improve the continuity of care and a roundtable discussion on integrating CHWs into the HCH health centers; and meeting with HCH staff to discuss the challenges and successes of implementing this innovation at each site. CHWs also supported a conference table where attendees could learn more about the role of CHWs in care for individuals experiencing homelessness.

CHWs attended four mandatory conference workshops: (1) Partnering with Hospitals: Community Health Workers and Care Coordination (facilitated by the CHWs), (2) Research in 30 Minutes, (3) Intimate Partner Violence and Homelessness: The Dilemma of Providing Services to the Couple in Conflict, and (4) Clinical and Ethical Challenges of Permanent Supportive Housing. Conference feedback suggests that the content was positively received and that the Partnering with Hospitals workshop was the most popular among the CHWs.

Throughout implementation, NHCHC provided additional training on a wide range of topics. In addition to the self-care trainings described in Section 2.22.1, CHWs received training in the following areas:

- essential CHW responsibilities, including core competencies of CHWs, case management, outreach, data collection, and ethics;
- patient relationships, including outreach, adult learning styles, communication, stages of change, and de-escalation strategies;
- specific medical issues, including conditions prevalent among persons experiencing homelessness, medical terminology, appropriate use of the ED, overdose/opioid abuse, and tobacco use among the mentally ill; and
- content particularly relevant to serving persons experiencing homelessness, including cultural humility, working with law enforcement, and homeless youth.

It is unclear whether more extensive or targeted training would have benefitted CHWs, particularly with respect to burnout. Evaluation data suggest that NHCHC provided more hours of training than originally projected, responded to emerging training needs (e.g., for self-care, coping with the death of patients), and increased CHW knowledge (as evidenced in pre- and post-training assessments). However, CHWs preferred in-person, interactive, and hands-on training over Web-based training. It was likely difficult for

NHCHC to offer such training routinely with the resources available and significant distance between the HCH sites.

NHCHC intended to use the no-cost extension (NCE) period to develop a training curriculum for HCH sites to integrate CHWs into their clinical practice and model of care. Although RTI does not have documentation to verify progress on the curriculum, NHCHC anticipated that the curriculum outline would be completed in August 2015 and the content developed in September 2015.

2.15 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

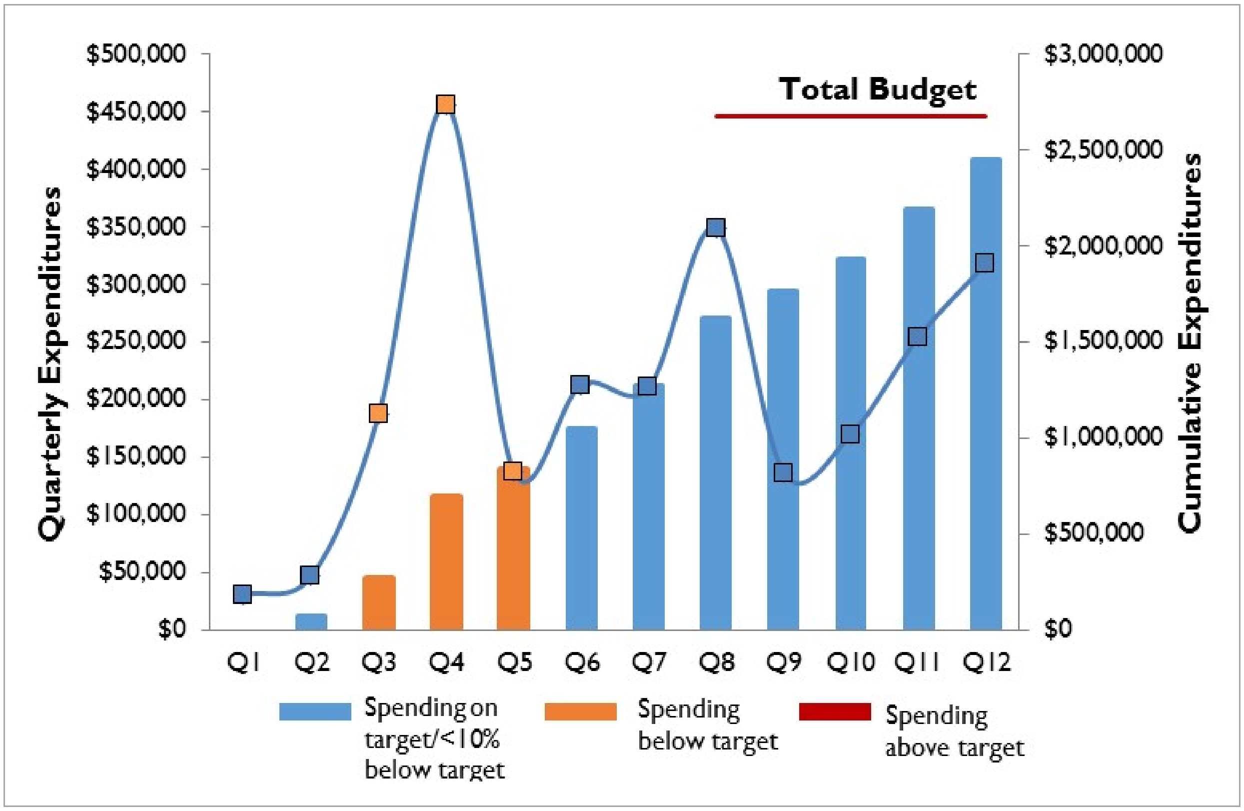
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.15.1 Award Execution

The annual report highlights the significance of NHCHC's expenditure rates on implementation. As of June 2015 (Q12), NHCHC spent 91.4 percent of its total budget, which is on target with the projected target of spending (see ***Figure 4***). NHCHC received an NCE of 3 months to spend the remainder of its budget. NHCHC has generally spent its award according to projections, with minor variations in spending across quarters resulting from subcontractor invoicing.

Figure 4. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.15.2 Leadership

Throughout implementation, NHCHC's innovation received support from three different types of leaders: staff at the national organization, including a project director, project coordinator, and data specialist; local leaders of the HCH sites; and administrative champions at the HCH sites. Staff at NHCHC supported the HCH programs by overseeing the project and providing technical assistance to the HCH sites, such as providing quality assurance, completing innovation paperwork, and addressing questions posed by the sites. The project director described herself as "heavily involved" in the innovation from the beginning, and led the innovation through the end of the NCE period. The project coordinator played a major role in creating the CHW position, onboarding CHWs, and helping HCH sites establish agreements with local hospitals. The data specialist developed forms and systems for capturing data from each of the HCH sites. The NHCHC staff interviewed for this innovation expressed dedication to and passion for involving CHWs in the delivery of care to persons experiencing homelessness.

NHCHC interacted with HCH sites during monthly program improvement calls and on an as-needed basis. An NHCHC interviewee described the national organization as "closely interwoven" with particular HCH programs, but interacting with some more so than others. Interaction decreased as the innovation ended, with monthly check-in calls transitioning to monthly email updates.

RTI evaluated HCH-level leadership primarily from Healthcare for the Homeless Houston (HHH), one of the 12 programs that implemented NHCHC's innovation. During our site visit, we learned that the office of the HHH CEO is down the hall from the workplace of the CHWs and the project director and, with her open-door policy, the CEO facilitated communication and strengthened team relations. One of the CHWs explained, "*This organization is different in that we work like brothers and sisters teaching each other"* (versus a hierarchical approach to management). This environment built trust and respect among program staff and leadership. As the innovation matured and staff developed a "flow," the CEO gradually became less involved, and she provided vision, focus, and guidance. Leaders' declining involvement did not reflect a lack of concern for the innovation, however; organization leaders demonstrated their commitment to the innovation through their efforts to sustain the CHW positions beyond the HCIA funding period. For example, HHH planned to work toward sustainability of the program through Medicaid revenue, and the CEO noted, *"If that doesn't cover the two CHWs, then I will find a way to do it!"*

When asked about other champions of the innovation, an NHCHC interviewee stated that administrative staff at the HCH programs (not funded by the project) spearheaded efforts to integrate the innovation into their clinics, fulfill data collection and reporting requirements, and identify problems. They provided essential supervision and support for staff in the CHW role. The interviewee also explained how providers became champions after seeing CHWs identify previously unknown obstacles to care and observing the ability of the CHWs to extend care from clinical to nonclinical settings.

2.15.3 Organizational Capacity

NHCHC began the HCIA project with significant capacity to implement its innovation. NHCHC has a history of providing training and technical assistance with the goal of improving the health and health care of those experiencing homelessness. The organization received 14 consecutive cooperative agreements from the Health Resources and Services Administration to provide technical assistance to federally qualified health centers (FQHCs) funded under Section 330(h), demonstrating its financial strength and stability, as well as its potential to support the innovation beyond the 3-year project period.[3] Additionally, all participating NHCHC sites are members of the Practice-Based Research Network (PBRN), which provides board-level oversight to the program. The PBRN was created in 2007 from the HCH's Research Coordinating Committee to facilitate improvement of health care practice and policy for individuals and families experiencing homelessness through effective use of research.[4]

Despite the strengths of NHCHC and the HCH sites going into the innovation, the HCH programs varied dramatically in capacity as a result of differences in their organizational structures, partnerships, and local resources. For instance, some cities began the innovation with stronger housing assistance resources than others; thus, CHWs working in those cities could help their clients more easily than CHWs working in cities without such supports. Monthly calls raised awareness among staff members about resources available to other programs that were lacking in their own communities. The calls also

[3] Source: Funding application.
[4] National Health Care for the Homeless (HCH) Council: Practice-Based Research Network Background. 2016. Available from https://www.nhchc.org/pbrn/

promoted cooperation among programs that are geographically close to one another (e.g., Boston, MA, and Hyannis, MA). In these instances, patients residing in one HCH community could travel to other nearby sites for services that were otherwise unavailable to them.

Other capacity challenges faced by some HCH programs entailed establishing memoranda of agreements (MOAs) and data exchange processes with partnering public hospitals. NHCHC's innovation design involved enlisting hospitals as partners so that the HCH sites could identify patients eligible for the program and access data on patients' health care utilization and costs. Complicated hospital policies and bureaucracies across the programs resulted in extended negotiations with some partners, such that the initial contracts took 12 months to formalize in some sites instead of the 3 months that NHCHC had planned. Even after HCH programs finalized agreements, they found that partnering hospitals struggled to provide data as intended. In some cases, providing data appeared to be a low priority at the hospitals. In other instances, HCH programs struggled to identify a hospital staff member capable of accessing the data needed for the innovation. Data issues became increasingly consequential as the innovation ended and NHCHC did not have the analyses necessary to demonstrate that the innovation had been effective. One program administrator expressed that *"it is difficult to pitch the project without the data results."*

2.15.4 Innovation Adoption and Workflow Integration

The CHWs employed as part of NHCHC's HCIA innovation became advocates for the adoption of CHWs to deliver medical care to people experiencing homelessness in their communities. CHWs led informational sessions and promoted care coordination at the three NHCHC National Conference and Policy Symposia they attended during the project period. Locally, CHWs supported adoption by helping hospitals identify existing gaps in care. A CHW who worked at the Durham, NC, site made such a powerful impression in her hospital and larger community that the city allocated money to sustain her CHW position. Although she plans to attend graduate school, she played an active role in the creation of this position. CHWs further support adoption by inspiring their clients to get involved in the HCH model. One former client began volunteering with her local HCH after her positive experience with the innovation.

Within HCH programs, providers, social workers, and CHWs developed working relationships with other health care professionals that improved care. For example, one CHW took a patient into her caseload after a social worker referred him as a result of his complex dental needs. The CHW subsequently worked with an oral surgeon, dental coordinator, and dental director over many weeks to obtain approval for pro bono surgical work, arrange a surgical consult, and help the patient physically navigate to the surgery and post-op appointments. The surgery would not have taken place without the CHW's collaboration with the dental school and advocacy. In Q12, NHCHC concluded that:

> ***"The most meaningful contribution [of the innovation] to better health care and smarter spending was validating the model of integrating Community Health Workers into the health care system. They were very dedicated to doing outreach and engagement to a very hard to reach vulnerable population. This was a true work force development demonstrative project."***

2.16 Implementation Effectiveness

A major focus of the evaluation is to assess the effectiveness of the implementation effort because the evaluation cannot make conclusive assessments about the innovation's impact without first determining if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses this question.

Evaluation Question

- What is the implementation effectiveness, including reach and dose, of the innovation thus far?

2.16.1 Innovation Reach

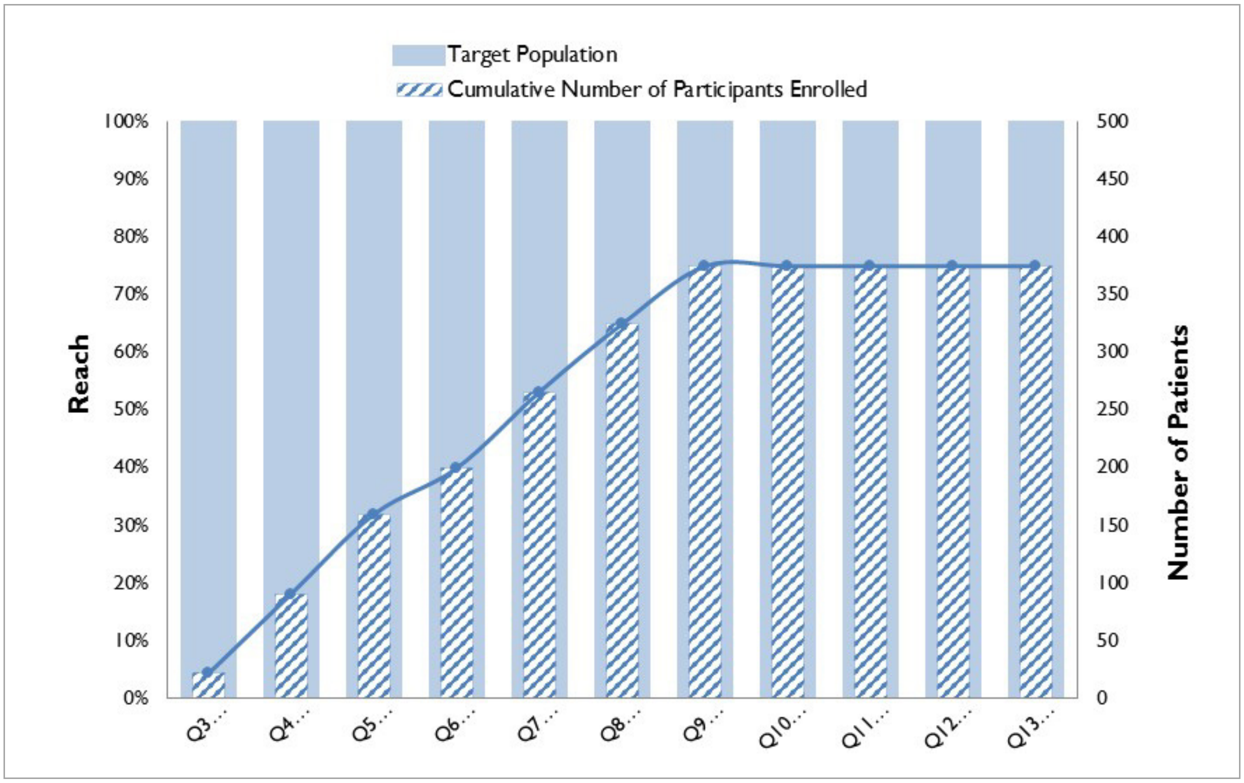
Figure 5 shows reach by quarter since the launch of the innovation. We last reported reach in the 2015 annual report, based on data through Q11. Overall reach increased 21.2 percent between Q8 and Q9 (the last quarter of enrollment). Reach rose steadily during each quarter until leveling off in Q9, the final quarter in which participants were enrolled. However, as noted above, NHCHC discovered data issues that led them to provide a new cumulative file to RTI. The new file included 40 fewer participants due to either nonexistent intake forms (n = 39) or failure to meet homeless eligibility criterion (n = 1). Therefore, overall reach is lower in this annual report (74.8%) than reported in the 2015 annual report (82.8%). However, we are confident that the reach reported in this annual report is accurate. NHCHC came close to meeting its enrollment target, but ultimately found that the target population was more challenging to reach than originally anticipated. In Q12, an innovation leader at NHCHC stated,

> ***"One of the most difficult aims to achieve was trying to reach and enroll clients in the project. We aimed high; however, soon recognized that we were dealing with a very sick population who were disenfranchised, not trusting of humankind or the health care system, because of the various traumas they experienced. It took time for CHWs to build relationships with individuals to gain their trust before enrolling project."***

In many cases, the very medical and social needs that CHWs were enlisted to address could themselves be barriers to enrolling the target population in the innovation. In some cases, patients went missing and could not be located by CHWs after initial contact, because these patients did not have stable housing and lived a transitory lifestyle. CHWs might also lose contact with patients as a result of mental illness or substance abuse issues. One CHW could not enroll a patient in the innovation because the individual was never sober enough to provide the informed consent necessary to qualify for services.

NHCHC's success in reaching the target population ultimately resulted from the significant time that CHWs invested in building relationships with eligible patients. When early efforts to recruit patients based on hospital referrals proved unsuccessful, CHWs assumed a more active role in patient identification. They went into their local communities, meeting with people experiencing homelessness several times before patients were successfully recruited. They also strategically managed their caseloads to include patients that had needs ranging from highly to moderately complex, so that they could address patients with the greatest need but also help others who could more easily be transitioned out of the ED with fewer services.

Figure 5. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct-Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)	Q13 (Jul-Sep 2015)
●	Cumulative reach per quarter (%)	4.2	18.0	31.8	39.8	53.0	64.8	74.8	74.8	74.8	74.8	74.8
	Target population	500	500	500	500	500	500	500	500	500	500	500
	Cumulative number of participants enrolled	21	90	159	199	265	324	374	374	374	374	374

2.16.2 Innovation Dose

Table 15 lists the number of services provided across participants, the number of participants receiving services, and the average number of services per participant through Q13 based on the data RTI received from NHCHC. The most commonly received enabling services were transportation (67.6%) and health education and supportive counseling (67.4%). Overall, approximately three-quarters (76.2%)

of participants received at least one enabling service, with the average number of services per participant at 3.2.

Table 15. Number and Types of Services Provided to Participants

Type of Service	Number of Services Provided Across Participants	Number (%) of Participants Receiving Service	Average Number of Services per Participant
Enabling services			
Eligibility assistance/financial counseling	179	138 (36.9)	1.3
Health education/supportive counseling	447	252 (67.4)	1.8
Interpretation services	36	36 (9.6)	1.0
Transportation	253	253 (67.6)	1.0
Total number of services	915	285 (76.2)	3.2

Source: Patient-level data provided to RTI by NHCHC.

Qualitative evaluation data suggest that the activities of CHWs extended far beyond the services captured above. CHWs spent a great deal of time helping participants access housing and reliable meals, because patients would not be prepared to address their medical problems before these more basic needs were met. CHWs also responded to patients' behavioral health needs, which awardee data suggest were the primary reason that participants inappropriately visited the ED. Patients themselves frequently reported that they suffered from multiple conditions (comorbidities), which required CHWs to connect them to a wide variety of services. Awardee-prepared analyses suggest an average of four comorbidities per client.

RTI also lacks data on the intensity with which patients received services from CHWs. Without such information, innovation services may appear less involved and transformative than they really were. For instance, one CHW shared an anecdote in Q12 describing how the innovation helped a participant access mental health treatment, day programming, medication management, housing, benefits, and case management starting in May 2014, only to lose contact after a drug relapse. Over a year later, the participant recontacted the CHW and asked for help in starting over. The CHW explained, *"He is grateful for being able to reach out to me and that I have not given up on him. I consider this a success because relapse is a part of recovery and it's important to keep an open door when people are ready for change."* The needs of the target population thus appear incompatible with short-term, light-touch service delivery, and CHWs accommodated these needs through a long-term commitment to their clients not reflected in the data.

2.17 Qualitative Findings: Sustainability

NHCHC focused intensely on sustaining CHW services during Year 3. As the national body responsible for coordinating innovation activities, NHCHC cannot sustain innovation services directly, but offered nonfinancial support in strategy and vision. For instance, NHCHC worked to develop a curriculum on integrating CHWs into HCH programs and drafted documents on how to create effective supervisors for the CHW role.

HCH site leaders expressed a commitment to maintaining the CHW positions beyond the HCIA funding period. Ten of the 12 sites made arrangements to continue CHW services as of June 2015. Local programs led ongoing discussions with their partner hospitals and community agencies to strategize on sustainability plans. In some locations, hospitals agreed to supplement the cost of the program, and an interviewee at NHCHC attributed this to the strong relationships several hospitals have with HCH programs. Other selected programs will sustain CHWs by cutting other expenses or through new funding. For example, the HHH site secured grant monies to dramatically expand CHW-delivered services. The limited capacity and resources of HCH health centers have been a barrier to planning for sustainability in some locations.

2.18 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing NHCHC as well as accomplishments to date. In this section, we assess NHCHC'S progress on achieving HCIA goals to date:

- **Smarter spending.** On average, Medicare and Medicaid patients enrolled in the innovation had significant reductions in hospital and ED-related costs between the baseline and innovation periods. Without a comparison group, determining whether the innovation caused the reduction in spending is not possible.

- **Better care.** On average, Medicare and Medicaid patients enrolled in the innovation did not have significant reductions in ED visits between the baseline and innovation periods**.**

  NHCHC stopped enrolling patients in August 2014, and provided a new cumulative data file for this annual report. Final overall reach was 74.8 percent (374 patients out of a target of 500). Nearly half of patients with asthma received medication management, and less than a third of diabetic patients received an HbA1c test or foot exam. Approximately 70 percent of those with hypertension received a blood pressure reading, and nearly half of patients with mental illness received medication management. Patients' perceived quality of life and self-efficacy increased slightly over the innovation period. Qualitative data suggest that CHWs delivered a greater variety and intensity of services than NHCHC's secondary data indicate.

- **Healthier people**. The percentage of hypertension patients with blood pressure control increased during the first three quarters of the innovation, but then dropped in the fourth innovation quarter. Interviews and progress reports indicate that patients suffered from multiple comorbidities that complicated care, and that improvement in health outcomes may not be linear in the targeted population.

NHCHC successfully coordinated 12 HCH programs that employed CHWs to reduce inappropriate ED use and increase linkages to primary care among individuals experiencing homelessness. NHCHC advocated for CHW services on a national scale, provided opportunities for workforce development, and offered technical assistance to HCH sites and their partners. NHCHC fostered communication and learning across the HCH programs, both through routine communications with HCH sites and national conferences that allowed CHWs to convene for professional development and support.

CHWs employed as part of NHCHC's innovation expressed commitment to helping their clients, but encountered many barriers to reaching the target population and delivering care. Patients often had multiple comorbid conditions, including mental health problems and substance abuse, and did not trust medical providers to help them access social and medical services. CHWs drew on their personal experiences with homelessness and their knowledge of community resources to establish rapport with participants and link them to a wide variety of services, including many not captured in their self-monitoring data. CHWs took on this role sometimes with limited supportive resources or supervision at their local HCH sites. They frequently experienced burnout as a result of the intense needs of the population, institutional barriers to helping their clients, and vicarious trauma.

Local hospitals exhibited varying levels of commitment to and capacity for responding to the needs of the innovation team. Select HCH sites experienced delays in contracting with hospitals, did not receive the anticipated number of referrals from hospitals, and were unable to obtain the service utilization and cost data that they were relying on to demonstrate the impact of the innovation. At some hospitals, it appeared that the innovation ranked low among hospital priorities. At others, HCH programs struggled to identify hospital staff with the ability to deliver the data requested.

The effects of the innovation on the goals of smarter spending, better care, and heathier people are difficult to assess. RTI received deidentified claims data for a small number of Medicare and Medicaid patients aggregated at various time points, and NHCHC calculated its spending and ED visit outcomes 9 months prior to the intervention using data collected 24 months before the innovation began. Results indicating savings should be interpreted with caution, especially since RTI cannot detect statistically significant reductions in ED visits. The design of NHCHC's innovation entailed reducing spending by decreasing inappropriate ED use and transitioning patients into primary care.

Ten of the 12 HCH programs that employed CHWs for this innovation will continue to provide CHW services after the HCIA funding ends. NHCHC noted that, without evidence of cost savings or improvement in health, local partners were reluctant to offer funding for ongoing services.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

National Health Care for the Homeless Council (NHCHC)

The National Health Care for the Homeless Council (NHCHC) is a nonprofit organization that received an award of $2,681,877 to implement an innovation (launched in February 2013) in 12 locations nationwide. The goal of the innovation was to transition 500 people experiencing homelessness and who frequently used emergency departments (EDs) for health care into appropriate primary care.

Awardee Overview

Innovation dose:	76.2% of participants received at least one service. Transportation and health education/supportive counseling were provided to the greatest number of participants (253 and 252, respectively).	***Innovation reach:***	74.8% of the target population (374 out of 500) was enrolled through August 2014. 40 patients had been removed in the new cumulative data file NHCHC provided, so reach was lower than the figure reported in the 2015 annual report (82.8%).
Components:	Used a single innovation component, community health workers (CHWs), to help people experiencing homelessness access medical care and social services.	***Participant demographics:***	The majority (94.4%) of participants were 25 to 64 years of age; 66.0% were male. Nearly half (46.3%) of participants were white; 36.9% were black. A quarter (24.1%) were covered by Medicaid, and less than 10% were covered by Medicare.
Sustainability:	Sustaining CHWs at 10 of the 12 Health Care for the Homeless (HCH) centers. Struggled to develop a sustainability plan at some HCH centers with limited resources.		
Innovation type:	Coordination of care		Direct health care/dental care

Key Findings

Smarter spending. On average, Medicare and Medicaid patients enrolled in the innovation had significant reductions in hospital and ED-related costs between the baseline and innovation periods. Average spending per patient for Medicare was significantly lower in the innovation period ($6,188) than in in the baseline period ($34,418) (p=0.02). Average spending per patient for Medicaid was also significantly lower in the innovation period ($12,018) than in the baseline period ($25,831) (p=0.02). Without a comparison group, determining whether the innovation caused the reduction in spending is not possible.

Better care. On average, Medicare and Medicaid patients enrolled in the innovation did not have significant reductions in ED visits between the baseline and innovation periods**.** For the Medicare population, ED visits decreased from an average of 6.82 visits per participant at baseline to 6.32 visits per participant during the innovation (p=0.42). ED visits for Medicaid patients increased from an average of 5.66 visits per patient at baseline to 6.75 visits per patient during the innovation (p=0.71).

Nearly half of patients (46.5%) with asthma received medication management, and less than a third of diabetic patients received an HbA1c test or foot exam (30.0% and 23.3%, respectively). Approximately 70 percent of those with hypertension received a blood pressure reading, and nearly half (48.4%) of patients with mental illness received medication management. Patients' perceived quality of life score increased from 65.7 (n=305) to 78.2 (n=49), and patients' general self-efficacy increased slightly from 28.5 (n=336) to 30.9 (n=53). Qualitative data suggest that CHWs delivered a greater variety and intensity of services than NHCHC's secondary data indicate.

Healthier people. The percentage of hypertension patients with blood pressure control increased (from 57.6% to 71.4%) during the first three quarters of the innovation, but then dropped to 50 percent in the fourth innovation quarter. Interviews and progress reports indicate that patients suffered from multiple comorbidities that complicated care, and that improvement in health outcomes may not be linear in the targeted population.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Northeastern University

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Northeastern University

2.1 Introduction

Northeastern University (NEU) is a private university in Boston, Massachusetts. Awarded $8,000,002, NEU began enrolling health systems into its HCIA Community Resource innovation in November 2012. The aim of this innovation is to develop and enable professional collaboration between NEU and various health systems to promote the application of industrial and systems engineering (ISyE) in process improvement projects. The innovation seeks to achieve the following HCIA goals:

1. **Smarter spending.** Reduce expenditures by $60.8 million through quality improvement projects implemented at health systems (up to three projects per health system) in a 3-year period.

2. **Better care.** Improve care by applying ISyE methods to health care systems in Years 1–3 and developing a workforce of health systems engineers.

3. **Healthier people**. Improve health outcomes through more effective and efficient processes of care and service delivery.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports* and secondary data received from NEU through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Completed 45 projects across 23 health systems, exceeding its goal of 15 projects.
Program Participant Characteristics	
	No new data since June 2015; most participants (83.2%) were younger than 64 years old. A majority (58.0%) were covered by Medicaid.
Workforce Development	
Hiring and retention	Total FTEs increased by 13 in Q12; fully staffed with 49 FTEs.
Skills, knowledge, and training	NEU provided 2,336 hours of training to 345 community-based clinical and nonclinical personnel between Q11 and Q12.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Award execution	90.2% of Year 3 budget; below target.
Leadership	Leadership was effective in motivating students and staff about the project's vision but was challenged in managing day-to-day operations.
Organizational capacity	Heavy staff workload and lack of standardized processes was a challenge to implementation.
Innovation adoption and workflow integration	Data not available.
Implementation Effectiveness	
Innovation reach	NEU has now completed 45 projects across 23 health systems; five projects affected the care of 14,153 patients through Q11.
Innovation dose	No new data since June 2015; NEU spent 417 hours scoping projects in Q11 and 16,556 hours scoping projects since the start of the innovation.
Sustainability	
	NEU reports it will use the REC model to integrate systems engineering into practice with its new grant from AHRQ for establishing a patient safety center at Brigham and Women's Hospital.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 12, 2015.

AHRQ = Agency for Healthcare Research and Quality; FTE = full-time equivalent; HCIA = Health Care Innovation Award; NEU = Northeastern University; Q = quarter; REC = regional extension center.

Table 3 summarizes Medicare claims-based findings during the innovation for the Cambridge Health Alliance (CHA) innovation. Over the 3 innovation years examined, no evidence supports that the CHA innovation had any statistically significant impact on inpatient stays, hospital readmissions, or ED visits. Given the innovation's focus on continuity of care, we did not expect to see a large impact on these outcomes. There was no statistically significant impact on spending overall during Years 2 or 3. In Year 1, spending increases approached statistical significance.

Table 3. Summary of Medicare Claims-Based Findings: CHA

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$2.161	−$0.651, $4.972	$1.552	$0.000, $3.104	$0.086	−$1.338, $1.509	$0.523	−$0.337, $1.382
Acute care inpatient stays	55	–14, 125	25	–21, 712	18	–26, 62	12	–16, 40
Hospital-wide all-cause unplanned readmissions	–6	–28, 15	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	–106	–255, 43	–30	–134, 74	–87	–178, 3	12	–44, 68
Average impact per quarter								
Spending per participant	$268	−$81, $616	$422	$0, $843	$27	−$430, $485	$410	−$264, $1,084
Acute care inpatient stays (per 1,000 participants)	7	–2, 15	7	–6, 19	6	–8, 20	9	–12, 31
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	–18	–76, 41	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	–13	–32, 5	–8	–36, 20	–28	–57, 1	9	–34, 53

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed-effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed-effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CHA = Cambridge Health Alliance; CI = confidence interval; ED = emergency department; N/A = data not applicable.

Table 4 summarizes Medicare claims-based findings during the innovation period for the Lahey Health System–Congestive Heart Failure (Lahey–CHF) innovation. We found losses in spending for the innovation overall, mainly driven by significant increases in Year 1 (the innovation did not have a statistically significant effect on spending in Years 2 or 3). We also found increases in inpatient stays and ED visits, although neither of those effects were statistically significant for Year 3. However, the sample size for Lahey was small with only 170 impacted beneficiaries.

Table 4. Summary of Medicare Claims-Based Findings: Lahey–CHF

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$3.760	$1.675, $5.839	$3.39	$2.020, $4.754	$0.54	–$0.384, $1.463	–$0.17	–$0.629, $0.290
Acute care inpatient stays	264	201, 328	205	154, 255	53	19, 86	7	–12, 25
Hospital-wide all-cause unplanned readmissions	–7	–40, 26	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	122	77, 167	75	42, 108	35	8, 61	12	–3, 26
Average impact per quarter								
Spending per participant	$2,699	$1,203, $4,195	$4,818	$2,874, $6,763	$1,085	–$772, $2,943	–$884	–$3,276, $1,509
Acute care inpatient stays (per 1,000 participants)	190	144, 235	291	219, 363	106	39, 174	35	–60, 130
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	–12	–65, 42	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	87	55, 120	107	60, 154	70	16, 124	62	–13, 137

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed-effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed-effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; Lahey = Lahey Health System; N/A = data not applicable.

Table 5 summarizes Medicaid claims-based findings during the innovation period for the CHA innovation. We only have three quarters of data on Medicaid enrollees. In the first three quarters of the innovation period, we saw a statistically significant decrease in hospitalizations and ED visits. The effect on spending, however, was not statistically significant.

Table 5. Summary of Medicaid Claims-Based Findings: CHA

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	–$0.213	–0.434, 0.008	–$0.213	–0.434, 0.008	N/A	N/A	N/A	N/A
Acute care inpatient stays	–39	–68, –10	–39	–68, –10	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions	–5	–11, 1	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	–64	–105, –23	–64	–105, –23	N/A	N/A	N/A	N/A
Average impact per quarter								
Spending per participant	–$132	–$269, $5	–$132	–$269, $5	N/A	N/A	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	–27	–48, –7	–27	–48, –7	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	–90	–191, 12	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	–45	–74, –16	–45	–74, –16	N/A	N/A	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed-effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed-effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CHA = Cambridge Health Alliance; CI = confidence interval; ED = emergency department; N/A = data not applicable.

2.1.1 Innovation Components

NEU's innovation applied principles of ISyE to improve health care processes by working with health systems, including health systems in the Boston-Cambridge-Newton Metropolitan Statistical Area in Massachusetts (Middlesex, Essex, Norfolk, Plymouth, and Suffolk Counties; referred to as the "Boston area") in Years 1–3, and health systems in Seattle, Washington, and Charlotte, North Carolina, in Year 3. As of Q12, NEU had completed projects with several health systems in the Boston area, Seattle, and in other states across the country, including Georgia, Florida, and Texas. Projects in Charlotte were listed as active (not completed) at the end of the award.

This innovation had two components: the regional extension center (REC) model, or the macro-level aspects of the innovation that identifies common threads across projects, and the process improvement projects, or micro-level innovations implemented in participating health systems. These are described below:

- REC model (macro level): Every project in NEU's innovation used core principles of ISyE, and deploys NEU students and staff to work with health care systems to improve processes on the basis of these principles. To select projects that are based on principles of ISyE and consistent with the goals of the award, NEU first considered multiple projects based on individual health system needs and priorities. This component involved assessing the time taken to scope projects, engaging health care partners, and determining how to sustain the project beyond the initial implementation period.

- Process improvement projects (micro level): This component focused on individual projects resulting from the scoping process within each health system. Because no two projects were identical, each project had different evaluation measures. Because we only conducted claims analyses on two process improvement projects, we highlighted their project descriptions below to provide context.

  – Cambridge Health Alliance's (CHA) Resident Team Scheduling—Primary Care Continuity project aimed to increase continuity of care, in terms of patients seeing their primary care provider or someone from their team by using an improved scheduling system. The scheduling system was designed to increase the availability of primary care teams, thus improving access to the clinic.

  – Lahey's Congestive Heart Failure (CHF) Post-discharge Scheduling project sought to increase the proportion of CHF patients who received a cardio follow-up appointment within 7 days of discharge. To improve scheduling, the team analyzed its processes by using statistical tools. The team identified areas to improve including educating resident clinicians on ideal follow-up timing, understanding the value of having scheduling resources go to patient room before discharge, and identifying the reasons for missed and cancelled appointments.

NEU is renowned for its cooperative education program (coop), allowing undergraduate students to gain 12 to 18 months of work experience during their time at the university. To support the two innovation components, NEU leveraged the coop education program extensively to staff each health system project. NEU followed a staffing model across projects in which a project-specific team worked with health system staff to design and implement projects. Postdoctoral fellows supported the students conducting the work, and health system leads provided overall advisory support for the project.

Because of the difficulty in obtaining data for all completed projects from NEU, the Center for Medicare & Medicaid Innovation (CMMI) and NEU, with input from RTI, worked to prioritize 10 projects for evaluation in Year 3, as shown in ***Table 6***. NEU designed these projects and the health system implemented them. Level 1 projects were the highest priority and had the full attention of NEU and RTI to obtain and analyze data.

Table 6. Summary of Prioritized Health System Projects

Partner Name[1]	Project Name	Location
Level 1 Prioritization		
Cambridge Health Alliance	Resident Team Scheduling—Primary Care Continuity	Boston, MA
Hallmark Health	Breast Cancer Patient Access	Boston, MA
Lahey Health System	CHF Post-discharge Scheduling	Boston, MA
	COPD Readmissions Reduction	
Massachusetts General Hospital	CLABSI	Boston, MA
	Neurology Department Appointment Access	
Maine Health	OR Block Optimization	Portland, ME
Level 2 Prioritization		
Hallmark Health	ED Opioid Abuse	Boston, MA
Lahey Health System	Surgery Nurse Staffing Optimization	Boston, MA
Maine Health	Perioperative Inventory	Portland, ME
Other		
Boston Medical Center	OB/GYN Ambulatory Clinic	Boston, MA

CHF = congestive heart failure; CLABSI = central line–associated blood infection; COPD = chronic obstructive pulmonary disorder; ED = emergency department; OB/GYN = obstetrics and gynecology; OR = operating room.

2.1.2 Program Participant Characteristics

NEU's innovation aimed to change health systems and processes. Thus, under NEU's innovation, no direct participants and patients or providers included in the projects were indirect participants. As of June 30, 2015, RTI received patient-level data for five prioritized projects: CHA, Primary Care Continuity project, the Lahey CHF Post-discharge Scheduling project, the Lahey Chronic Obstructive Pulmonary Disease (COPD) project, and the Hallmark Health Breast Cancer Patient Access project. In addition, we received data from one nonprioritized project, the Boston Medical Center Obstetrics and Gynecology (OB/GYN) Ambulatory Appointment Access project.

Table 7 provides the demographic characteristics of participants included in all five projects. We last reported patient demographic characteristics in the 2015 annual report, on the basis of data through Q11. No new data were provided after that report, so the patient characteristics are the same as reported in the 2015 annual report. More specifically, nearly two-thirds of participants (63.7%) were between 25 and 64 years old. More than half (58.0%) were covered by Medicaid, and less than 10 percent were covered by Medicare or Medicare Advantage or were dually eligible for both Medicare and Medicaid. Nearly two-thirds of participants were missing data on sex and race or ethnicity. We received data on sex for three of the projects (i.e., Hallmark Health Breast Cancer Patient Access, Lahey COPD, and Boston Medical Center OB/GYN Ambulatory Appointment Access projects). Among those with data for sex, over a third (36.6%) were female. We received data on race or ethnicity from two projects (i.e., Hallmark Health Breast Cancer Patient Access and Lahey COPD projects). Almost a third of those patients (32.2%) were white.

Table 7. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	14,153	100.0
Age		
< 18	2,013	14.2
18–24	757	5.3
25–44	4,100	29.0
45–64	4,915	34.7
65–74	1,314	9.3
75–84	617	4.4
85+	174	1.2
Missing	263	1.9
Sex		
Female	5,182	36.6
Male	57	0.4
Missing	8,914	63.0
Race/ethnicity		
White	4,552	32.2
Black	133	0.9
Hispanic	0	0.0
Asian	186	1.3
American Indian or Alaska Native	2	0.0
Native Hawaiian or other Pacific Islander	5	0.0
Other	79	0.6
Missing/refused	9,196	65.0
Payer category		
Dual	876	6.2
Medicaid	8,213	58.0
Medicare	166	1.2
Medicare Advantage	45	0.3
Other	4,590	32.4
Uninsured	0	0.0
Missing	263	1.9

Source: Patient-level data provided to RTI for the following five projects: Lahey Health System–Congestive Heart Failure, Lahey Health System Chronic Obstructive Pulmonary Disease Readmissions Reduction, Cambridge Health Alliance Primary Care Continuity, Hallmark Health Breast Cancer Patient Access, and Boston Medical Center Obstetrics and Gynecology Ambulatory Appointment Access.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 8 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 8. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.
Note: Medicare claims-based outcomes are reported for both Cambridge Health Alliance and Lahey Health System and Medicaid claims-based outcomes are reported for Cambridge Health Alliance only.

2.3 Medicare Comparison Group

Medicare claims analyses are reported for two project sites: CHA and Lahey-CHF. We include patients who were enrolled before December 31, 2015, and we present Medicare claims data through December 31, 2015. The CHA analysis focuses on 950 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. These patients attended the Malden Family Medicine Center. The first date of hospitalization for CHF after innovation launch date was used as the innovation start date for each patient. The Lahey analysis focuses on 170 beneficiaries impacted by the Lahey innovations who were fee-for-service Medicare Part A and Part B beneficiaries. For each site, we present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in the Boston area.

We used propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, number of months of dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar year before the innovation, and total Medicare payments in the calendar quarter and calendar year before the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 9 describes the mean values and standardized differences of the variables of interest that are included in the propensity score mode for CHA before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 9. Mean Values and Standardized Differences of Variables in Propensity Score Model: CHA

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarters prior to enrollment	$3,821	$10,738	$2,491	$9,103	0.134	$3,821	$10,738	$3,965	$13,430	0.012
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$11,155	$28,188	$8,922	$23,773	0.086	$11,155	$28,188	$11,775	$27,396	0.022
Age	60.900	16.020	70.630	13.280	0.662	60.900	16.020	62.060	16.550	0.072
Percentage male	44.630	49.710	43.340	49.550	0.026	44.630	49.710	43.470	49.570	0.023
Percentage nonwhite	73.160	44.310	84.290	36.390	0.275	73.160	44.310	70.180	45.750	0.066
Percentage disabled	58.950	49.190	26.120	43.930	0.704	58.950	49.190	57.300	49.460	0.033
Percentage ESRD	0.950	9.690	0.690	8.250	0.029	0.950	9.690	1.160	10.700	0.021
Number of dual eligible months in the previous calendar year	7.420	5.560	3.030	5.130	0.821	7.420	5.560	7.770	5.570	0.062
Number of chronic conditions	5.490	3.640	6.090	3.890	0.162	5.490	3.640	5.940	3.910	0.120
Number of outpatient ED visits in calendar quarter prior to enrollment	0.420	2.060	0.130	0.520	0.195	0.420	2.060	0.230	0.900	0.119
Number of inpatient stays in calendar quarter prior to enrollment	0.160	0.610	0.080	0.350	0.179	0.160	0.610	0.140	0.530	0.038
Number of beneficiaries	950	—	2,733,167	—	—	950	—	2,845	—	—
Number of unique beneficiaries[1]	—	—	504,112	—	—	950	—	2,845	—	—
Number of weighted beneficiaries	—	—	—	—	—	950	—	950	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

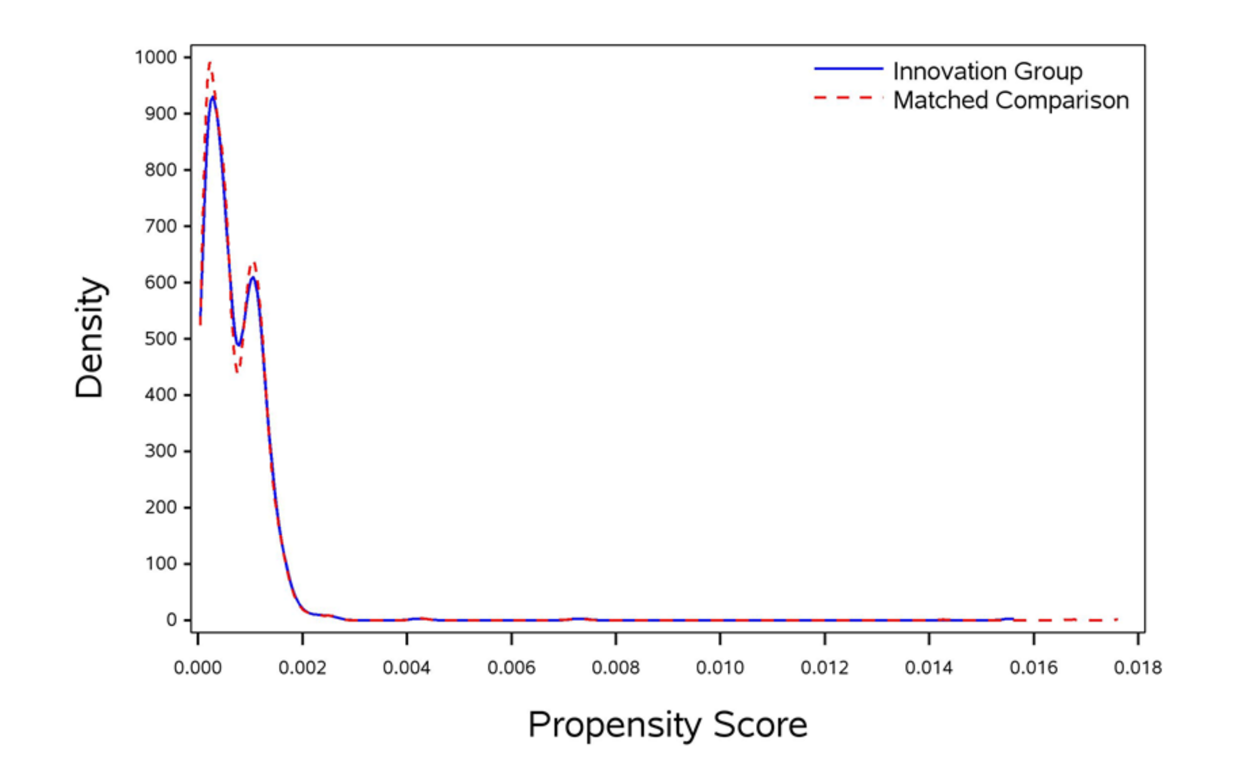
CHA = Cambridge Health Alliance; ED = emergency department; ESRD = end-stage renal disease; SD = standard deviation.

— Data not applicable.

After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and checked whether matching decreased the absolute standardized differences and achieved acceptable balance (Table 9). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 9 show that matching reduced the absolute standardized differences and achieved adequate balance for all but two variables. The standardized difference between the number of outpatient ED visits in calendar quarter before enrollment and the number of chronic conditions were just above 0.1 after matching but were lower than the standardized differences between the two groups before matching.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure shows a very close overlap between the innovation and comparison groups' propensity scores.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

Table 10 describes the mean values and standardized differences of the variables of interest that are included in the propensity score mode for Lahey before and after matching. ***Figure 2*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 10. Mean Values and Standardized Differences of Variables in Propensity Score Model: Lahey–CHF

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarters prior to enrollment	$14,894	$22,242	$5,563	$13,457	0.508	$14,894	$22,242	$13,425	$26,521	0.060
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$32,226	$42,753	$20,031	$33,443	0.318	$32,226	$42,753	$29,879	$44,336	0.054
Age	81.100	8.770	77.620	11.420	0.342	81.100	8.770	81.300	8.850	0.022
Percentage male	52.130	49.950	44.210	49.660	0.159	52.130	49.950	53.720	49.860	0.032
Percentage nonwhite	95.740	20.180	87.730	32.810	0.294	95.740	20.180	96.450	18.490	0.037
Percentage disabled	11.170	31.500	22.200	41.560	0.299	11.170	31.500	10.110	30.140	0.035
Percentage ESRD	3.190	17.580	2.350	15.140	0.051	3.190	17.580	4.080	19.780	0.047
Number of dual eligible months in the previous calendar year	1.360	3.690	3.320	5.270	0.432	1.360	3.690	1.140	3.430	0.060
Number of chronic conditions	11.640	2.950	10.310	3.170	0.435	11.640	2.950	11.770	3.260	0.044
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	1.280	1.720	0.660	1.280	0.406	1.280	1.720	1.260	2.190	0.006
Number of beneficiaries	188	—	1,058,046	—	—	188	—	563	—	—
Number of unique beneficiaries[1]	—	—	115,721	—	—	188	—	563	—	—
Number of weighted beneficiaries	—	—	—	—	—	188	—	188	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

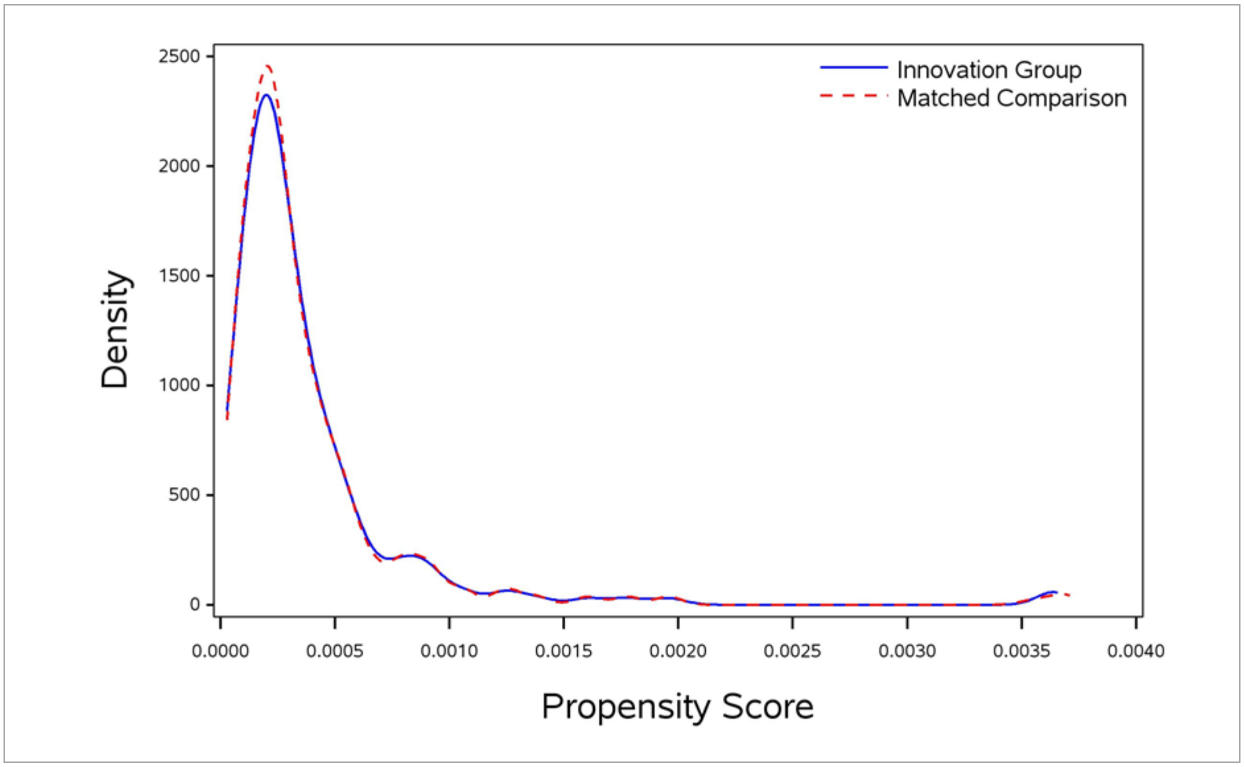
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ESRD = end-stage renal disease; Lahey–CHF = Lahey Health System–Congestive Heart Failure; SD = standard deviation.

— Data not applicable.

The results in Table 10 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables. ***Figure 2*** shows the distribution of the propensity scores for both the innovation and comparison groups. The figure shows a very close overlap between the innovation and comparison groups' propensity scores.

Figure 2. Distribution of Propensity Scores for Comparison and Innovation Groups: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.4 Medicare Spending: CHA

2.4.1 Descriptive Results

Table 11 reports Medicare spending per patient in the eight quarters before and 11 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 3*** illustrates the Medicare spending per beneficiary in Table 11 for the innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

Spending per patient for the innovation group is similar to the comparison group rate in baseline quarters. The spending rate of the innovation group increased in the first three quarters of the innovation period with a sharp spike towards the final quarters of the innovation period; however, in the final innovation quarter, spending for the innovation group drops below that of the comparison group. Further statistical testing on the impact of the innovation is performed in the regression analysis section that follows.

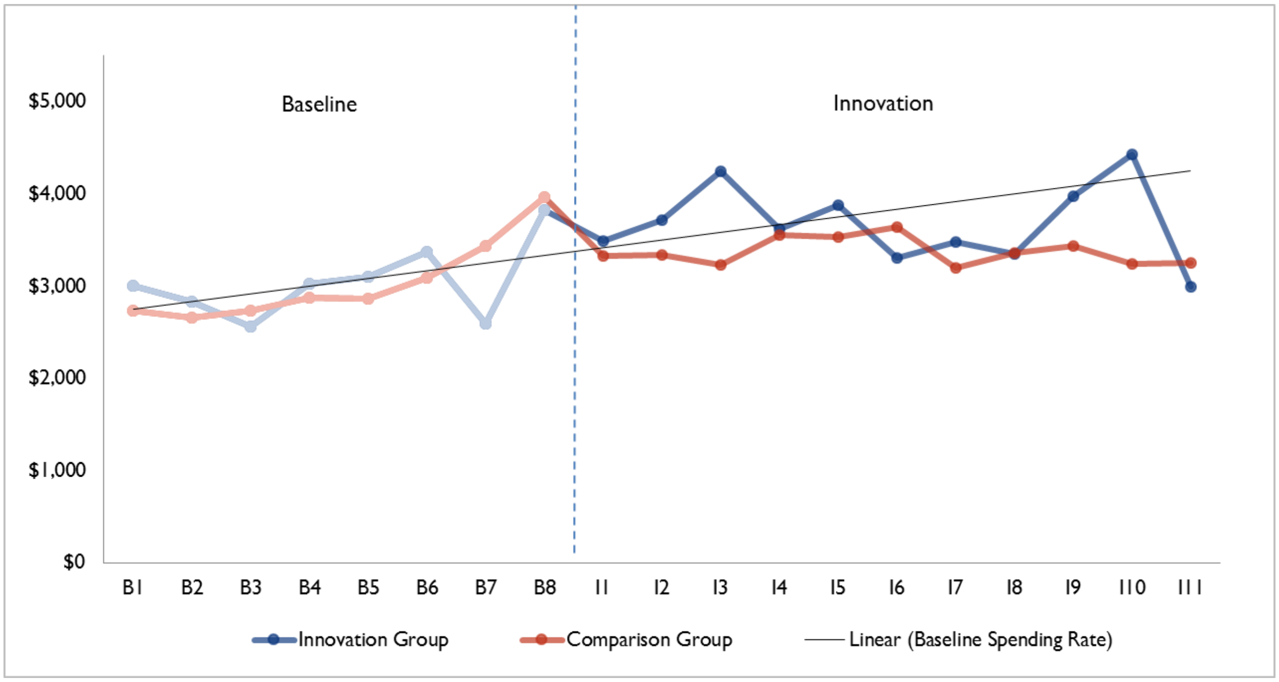
Table 11. Medicare Spending per Participant: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$3,005	$2,829	$2,567	$3,030	$3,098	$3,375	$2,594	$3,821	$3,486	$3,712	$4,249	$3,621	$3,882	$3,312	$3,477	$3,349	$3,980	$4,425	$2,996
Std dev	$7,590	$8,211	$8,086	$9,990	$10,174	$11,642	$7,468	$10,738	$10,461	$11,753	$12,539	$9,497	$9,859	$9,309	$10,651	$9,341	$12,266	$11,227	$6,779
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	761	683	598	474	203
Comparison Group																			
Spending rate	$2,733	$2,656	$2,730	$2,880	$2,864	$3,095	$3,438	$3,965	$3,327	$3,338	$3,235	$3,555	$3,536	$3,639	$3,200	$3,365	$3,439	$3,244	$3,251
Std dev	$8,162	$7,659	$8,329	$11,213	$8,474	$9,331	$10,300	$13,430	$9,618	$9,722	$9,853	$11,758	$10,513	$13,299	$9,213	$14,804	$9,480	$9,900	$8,544
Weighted patients	813	836	857	877	900	920	941	950	950	946	920	888	869	844	777	701	615	492	220
Savings per Patient																			
	−$272	−$174	$163	−$150	−$234	−$281	$844	$143	−$160	−$374	−$1,014	−$65	−$347	$327	−$276	$16	−$540	−$1,181	$255

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 3. Medicare Spending per Participant: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance.

2.4.2 *Regression Results*

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $268 (90% CI: −$81, $616). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

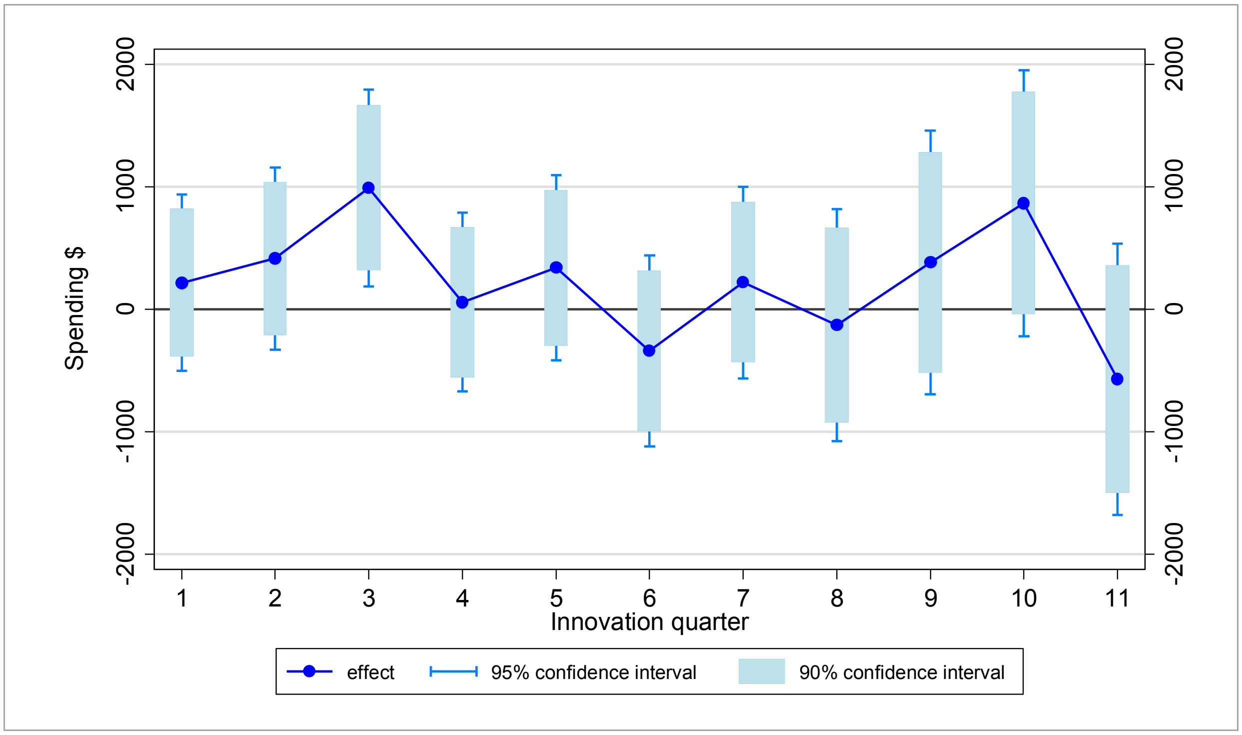
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 12*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 4*** illustrates these quarterly difference-in-differences estimates. Overall, the difference-in-differences quarterly results are inconclusive because the signs flip from positive to negative, and only 1 of the 11 quarterly effects was statistically significant. The overall aggregate results, in any one year of the innovation or all together, were also not statistically significant.

Table 12. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	$217	$368	0.555
I2	$415	$380	0.274
I3	$990	$410	0.016
I4	$59	$373	0.874
I5	$339	$386	0.380
I6	−$340	$399	0.394
I7	$219	$399	0.582
I8	−$129	$484	0.791
I9	$381	$550	0.489
I10	$867	$554	0.117
I11	−$571	$566	0.313
Overall average	$268	−$81	0.206
Overall aggregate	$2,160,524	−$651,187	0.206
Overall aggregate (IY1)	$1,552,058	−$227	0.100
Overall aggregate (IY2)	$85,583	−$1,337,867	0.921
Overall aggregate (IY3)	$522,882	−$336,519	0.317

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison group and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
CHA = Cambridge Health Alliance; I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

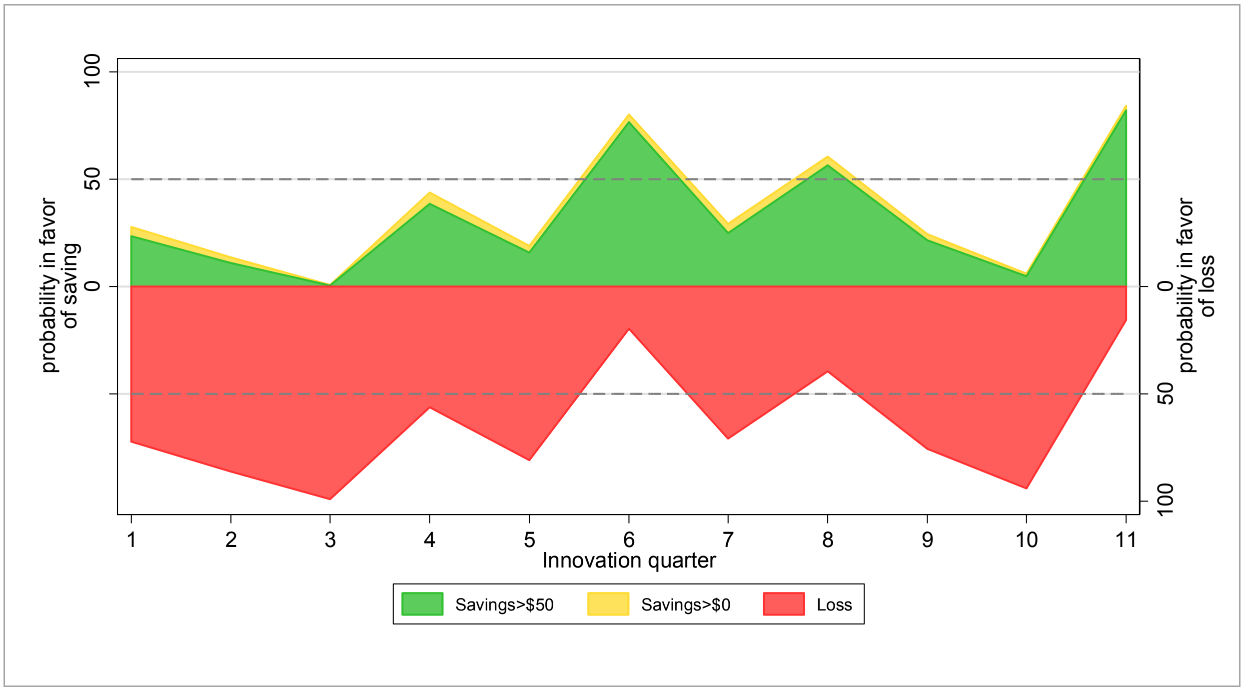
Figure 4. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance; OLSs = ordinary least squares.

Figure 5 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Overall, more red (loss) than green (savings) is shown in this figure; however, we cannot draw conclusive evidence from this figure.

Figure 5. Quarterly Strength of Evidence in Favor of Savings/Loss: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance.

2.5 Medicare Spending—Lahey–CHF

2.5.1 Descriptive Results

Table 13 reports Medicare spending per patient in the eight quarters before and 11 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 6*** illustrates the Medicare spending per beneficiary in Table 13for innovation and comparison group beneficiaries.

The spending trend for Lahey–CHF is increasing in the baseline quarters, as shown by the trend line. Spending for the innovation group is above the trend line in the first innovation quarter (I1), and falls below the trend line in other innovation quarters (I2−I12). Spending for the comparison group follows a similar trend in the baseline period, although the spending rate of the comparison group is consistently lower than the innovation group in the innovation period. Because these statistics are descriptive, it is premature to conclude whether the innovation had a statistically significant effect on the spending rate. We will explore this question further in the regression analysis section.

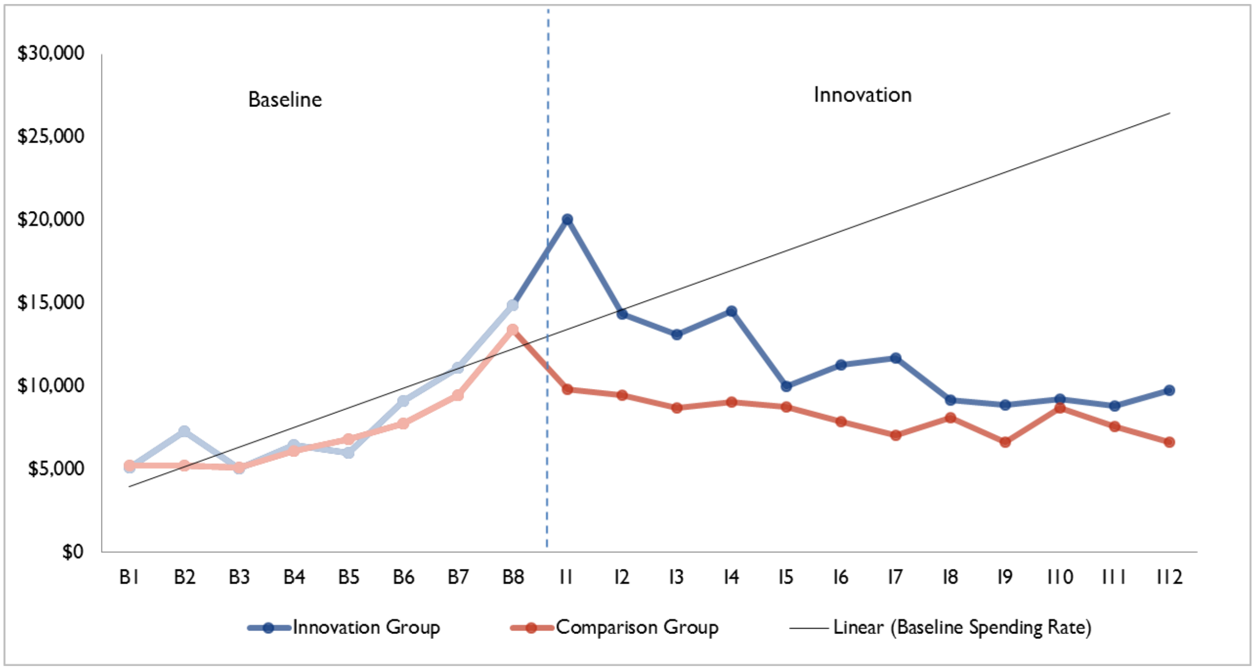
Table 13. Medicare Spending per Participant: Lahey–CHF

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters											
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Spending rate	$5,105	$7,264	$5,038	$6,490	$6,017	$9,092	$11,100	$14,894	$20,059	$14,384	$13,131	$14,550	$10,028	$11,278	$11,717	$9,147	$8,868	$9,218	$8,841	$9,759
Std dev	$10,811	$12,984	$8,937	$13,180	$12,572	$23,135	$21,487	$22,242	$21,915	$17,468	$15,613	$27,484	$14,762	$17,764	$15,483	$15,211	$14,603	$12,266	$13,864	$13,157
Unique patients	177	178	180	183	185	185	187	188	188	184	170	161	143	133	119	102	78	60	39	15
Comparison Group																				
Spending rate	$5,202	$5,211	$5,104	$6,102	$6,846	$7,748	$9,499	$13,425	$9,836	$9,493	$8,675	$9,060	$8,734	$7,876	$7,061	$8,098	$6,657	$8,732	$7,573	$6,633
Std dev	$12,352	$11,483	$11,304	$14,138	$14,762	$14,063	$19,803	$26,521	$22,293	$19,315	$15,794	$17,396	$18,599	$14,392	$13,874	$17,105	$14,972	$19,300	$17,525	$14,572
Weighted patients	181	183	183	184	185	186	188	188	188	188	180	170	155	145	134	122	100	80	57	30
Savings per Patient																				
	$97	–$2,053	$66	–$388	$828	–$1,344	–$1,601	–$1,470	–$10,223	–$4,890	–$4,456	–$5,491	–$1,294	–$3,402	–$4,657	–$1,049	–$2,211	–$486	–$1,268	–$3,126

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.
— Data not yet available.

Figure 6. Medicare Spending per Participant: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.5.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $2,699 (90% CI: $1,203, $4,195). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 14*** presents the results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 7*** illustrates these quarterly difference-in-differences estimates. Quarterly estimates that indicate losses are statistically significant in Qs 1-4 and in I7. Quarters 8, and 10-12 suggest decreased spending, however, these results are not significant. Losses are statistically significant for the innovation period as a whole, as well as Year 1 of the innovation.

Table 14. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
I1	$8,657	$1,757	<.0001
I2	$3,334	$1,549	0.032
I3	$2,941	$1,488	0.048
I4	$4,014	$2,355	0.089
I5	–$137	$1,455	0.925
I6	$1,877	$1,632	0.250
I7	$3,089	$1,621	0.057
I8	–$571	$1,686	0.735
I9	$170	$1,969	0.931
I10	–$1,881	$2,039	0.357
I11	–$1,170	$2,517	0.642
I12	–$1,628	$2,595	0.531
Overall average	$2,699	$908	0.003
Overall aggregate	$3,756,949	$1,264,448	0.003
Overall aggregate (IY1)	$3,387,205	$830,076	<.0001
Overall aggregate (IY2)	$539,413	$0	0.336
Overall aggregate (IY3)	–$169,669	$278,909	0.543

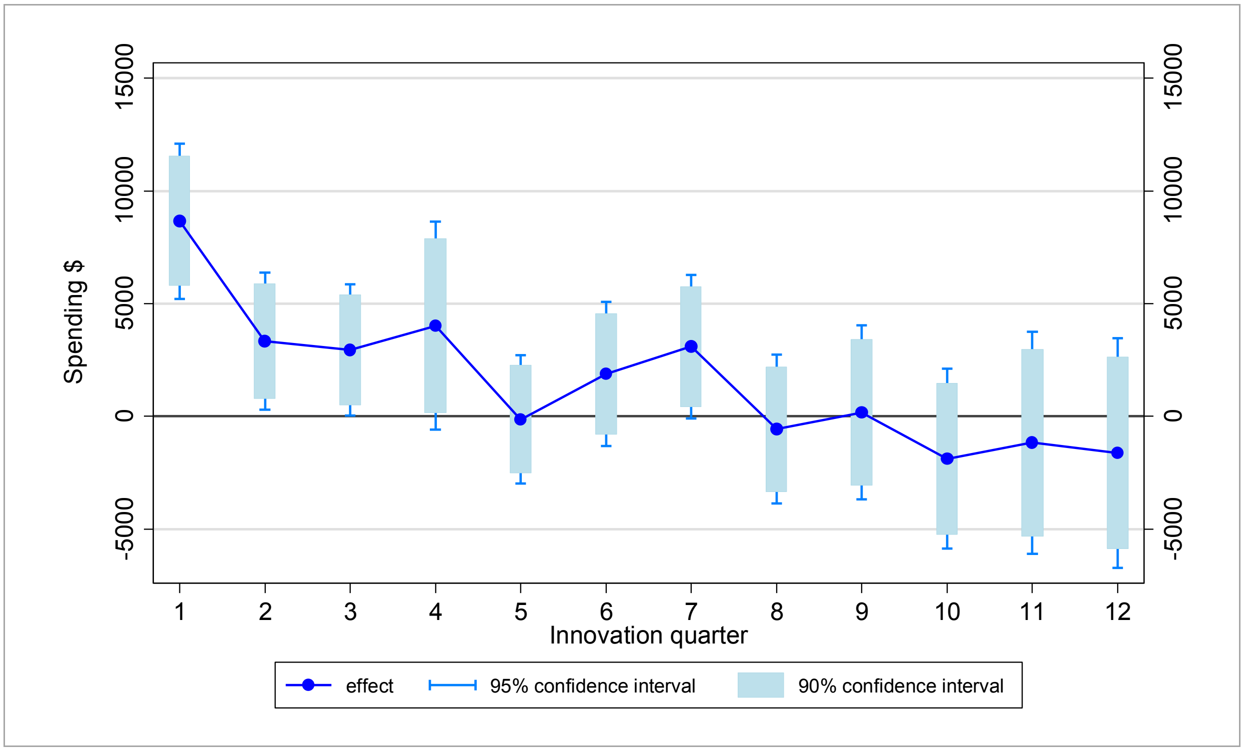
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Lahey–CHF = Lahey Health System–Congestive Heart Failure; OLS = ordinary least squares.

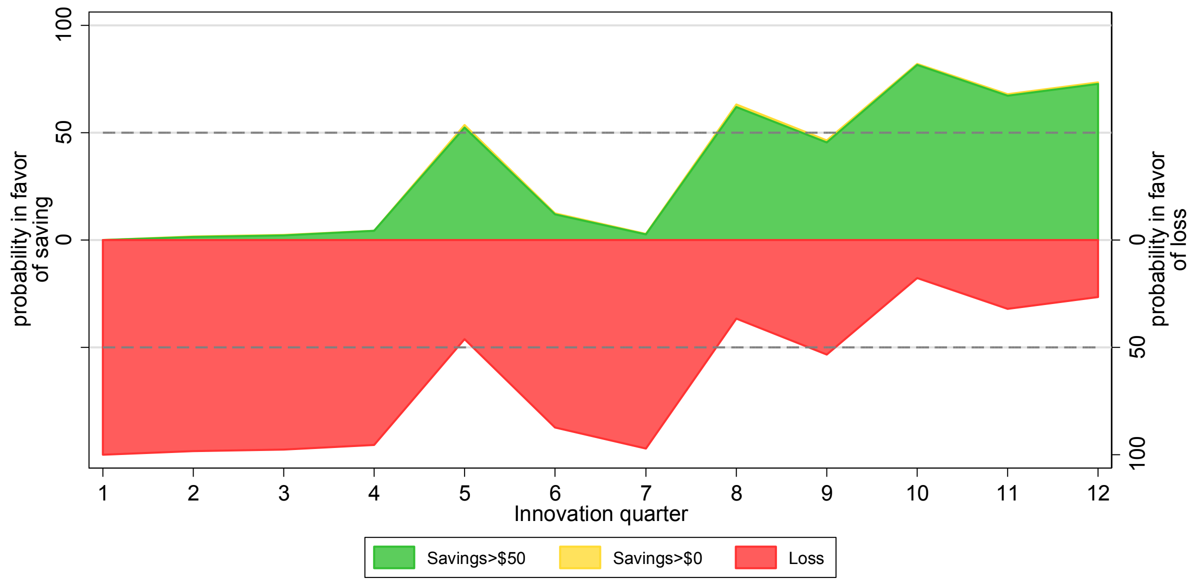
Figure 7. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Lahey–CHF = Lahey Health System–Congestive Heart Failure; OLS = ordinary least squares.

Figure 8 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Even though the results were mixed in the later innovation quarters, showing signs of savings, the evidence mostly supports the supposition that the innovation did not generate savings.

Figure 8. Quarterly Strength of Evidence in Favor of Savings/Loss: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.6 Medicare Inpatient Admissions—CHA

2.6.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 15*** and ***Figure 9***. Both the innovation and comparison group inpatient admission rates are similar and trending slightly upward in the baseline period, although the innovation group rate exhibits more fluctuation. After the innovation, the comparison group inpatient admissions rate decreases and remains lower than the trend line while the innovation group rate has large fluctuations. Further statistical testing on the impact of the innovation is performed in the regression analysis section that follows.

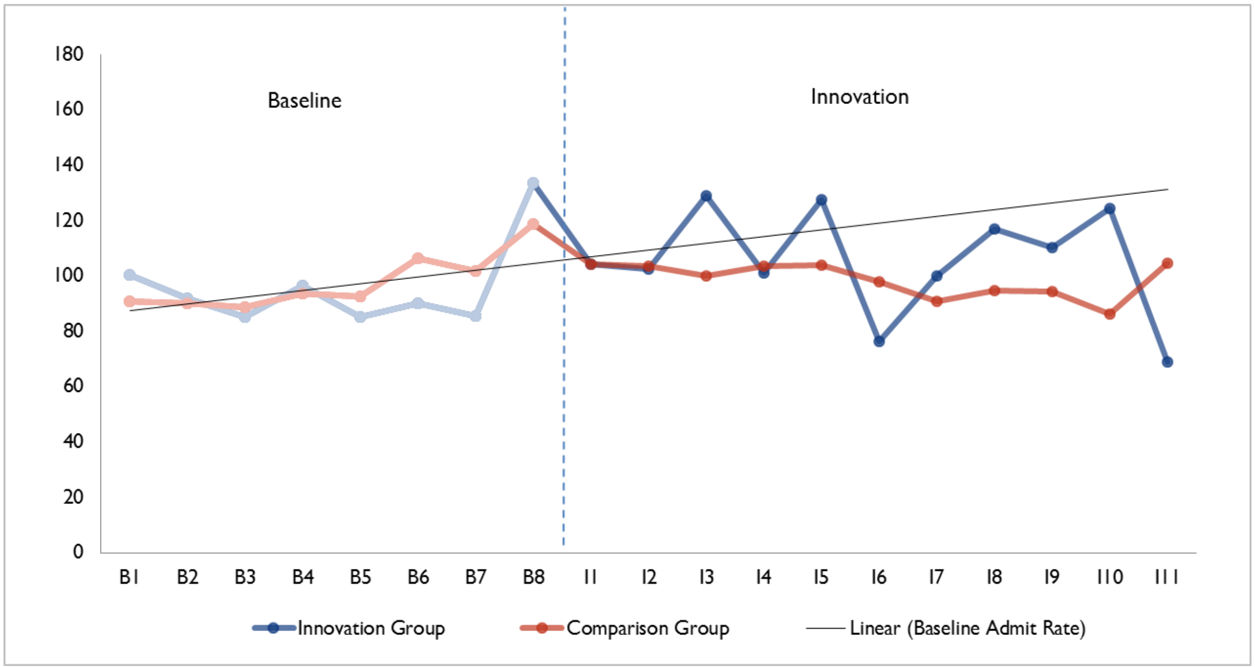
Table 15. All-Cause Inpatient Admissions Rate per 1,000 Participants: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	100	92	85	96	85	90	85	134	104	102	129	101	128	76	100	117	110	124	69
Std dev	388	409	380	435	342	366	362	527	480	443	482	413	486	327	411	470	438	472	290
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	761	683	598	474	203
Comparison Group																			
Admit rate	91	90	89	94	93	106	102	119	104	103	100	103	104	98	91	95	95	86	105
Std dev	403	360	429	423	420	471	401	467	459	409	456	445	446	445	394	398	424	374	393
Weighted patients	813	836	857	877	900	920	941	950	950	946	920	888	869	844	777	701	615	492	220
Innovation − Comparison Rate																			
	10	2	−4	3	−7	−16	−16	15	0	−1	29	−2	24	−21	9	22	16	38	−36

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 9. All-Cause Inpatient Admissions Rate per 1,000 Participants: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance.

2.6.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 7 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: –2, 15). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 16 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits per beneficiary during the quarter. Only one of the quarterly effects was statistically significant, and the significant effect was positive, indicating an increase in inpatient admissions. In Q3, the innovation group had 29 more inpatient admissions per 1,000 beneficiaries. The overall effect of the innovation (and the effect of the innovation in each year individually) had no statistically significant impact on inpatient admission for the innovation group.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions, per 1,000 Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	0	15	0.978
I2	–4	15	0.769
I3	29	16	0.077
I4	3	15	0.864
I5	24	18	0.183
I6	–23	15	0.125
I7	2	17	0.897
I8	22	19	0.251
I9	10	19	0.619
I10	33	23	0.144
I11	–47	29	0.112
Overall average	7	5	0.191
Overall aggregate	55	42	0.191
Overall aggregate (IY1)	25	28	0.373
Overall aggregate (IY2)	18	27	0.498
Overall aggregate (IY3)	12	17	0.474

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The linear probability model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
CHA = Cambridge Health Alliance; I = Innovation Quarter; IY = Innovation Year.

2.7 Medicare Inpatient Admissions—Lahey–CHF

2.7.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 17*** and ***Figure 10***. The inpatient admissions rates for the innovation and comparison groups are similar in the baseline period. The innovation group rate has a spike in the first quarter of the innovation period, most likely because the first date of hospitalization for CHF was used as a start date for the innovation group. In the remaining innovation quarters, the admissions rate for the innovation group drops below the trend line but remains higher than the comparison group rate. Further statistical testing on the impact of the innovation on admissions rate is performed in the next section.

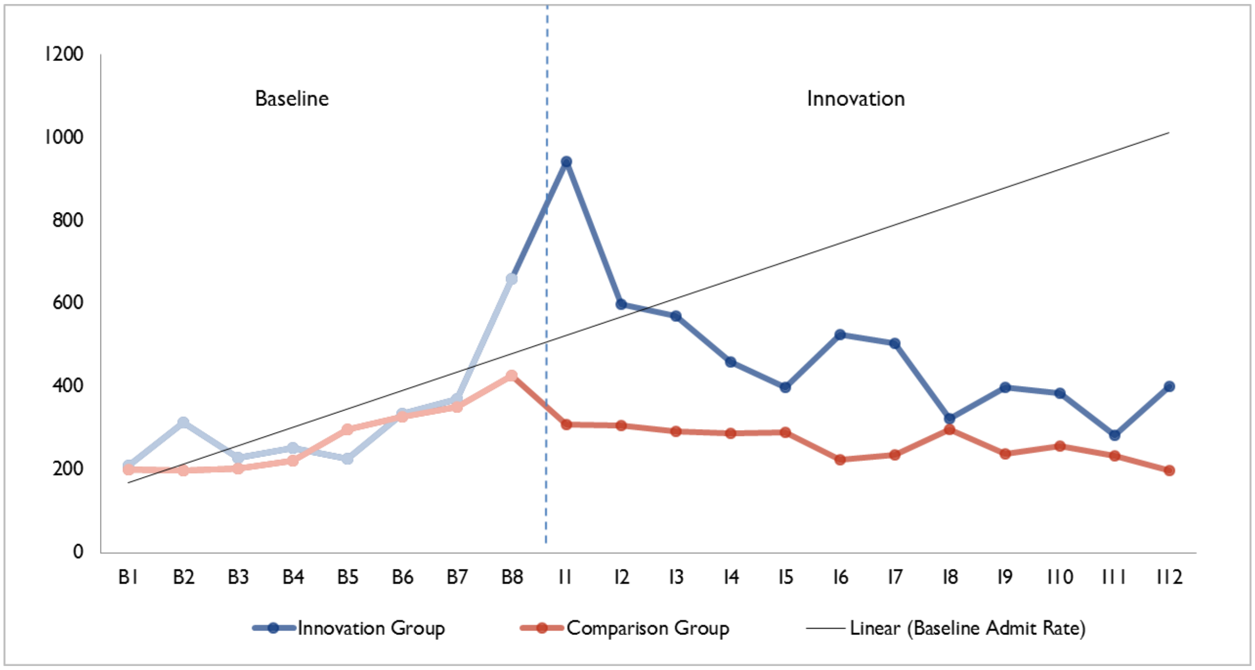
Table 17. All-Cause Inpatient Admissions Rate per 1,000 Participants: Lahey–CHF

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Admit rate	209	315	228	251	227	335	369	660	941	598	571	460	399	526	504	324	397	383	282	400
Std dev	588	736	595	603	617	702	876	935	924	879	913	772	749	1,030	720	674	790	755	638	712
Unique patients	177	178	180	183	185	185	187	188	188	184	170	161	143	133	119	102	78	60	39	15
Comparison Group																				
Admit rate	201	199	203	223	297	329	351	426	309	306	293	288	290	224	236	298	239	257	234	198
Std dev	571	615	547	616	702	763	811	829	715	714	712	675	658	571	548	797	654	717	704	518
Weighted patients	181	183	183	184	185	186	188	188	188	188	180	170	155	145	134	122	100	80	57	30
Innovation − Comparison Rate																				
	8	115	25	29	-70	7	18	233	632	292	278	172	109	303	268	26	158	126	48	202

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure; I1 = Innovation Q1.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 190 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 144, 235). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 18 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits per beneficiary during the quarter. The innovation group had a statistically significantly higher inpatient admissions rate in the first three quarters, followed by significantly higher inpatient admissions in Qs 6 and 7 as well; the other seven quarters were not statistically significant. Despite having no impact on inpatient admission in the later quarters, the innovation group has higher overall admission rates on average, and in Years 1 and 2 of the innovation. The effect of the innovation on inpatient admissions in Year 3 was not statistically significant.

Table 18. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions, per 1,000 Participants: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
I1	620	105	0.000
I2	213	81	0.009
I3	210	82	0.011
I4	82	75	0.274
I5	34	76	0.651
I6	228	82	0.006
I7	209	88	0.019
I8	–72	80	0.376
I9	76	93	0.415
I10	24	108	0.823
I11	–41	113	0.721
I12	58	198	0.775
Overall average	190	28	0.000
Overall aggregate	264	39	0.000
Overall aggregate (IY1)	205	31	0.000
Overall aggregate (IY2)	53	20	0.010
Overall aggregate (IY3)	7	11	0.548

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The linear probability model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.8 Medicare Unplanned Readmissions – CHA

2.8.1 Descriptive Results

Hospital unplanned readmission rates per 1,000 admissions are shown in ***Table 19*** and ***Figure 11***. The readmission rate is volatile in all baseline and innovation quarters for both groups, although more so for the innovation group. Overall, the comparison group rate is relatively flat with a gentle decrease in the later innovation quarters while the innovation group rate has large fluctuations throughout the baseline and innovation quarters with sharp increases and decreases in the final innovation quarters. In all quarters, the readmission rate should be interpreted with caution because the total number of admissions are low for both groups. Further statistical testing on the impact of the innovation on the readmission rates will be provided in the regression analysis section.

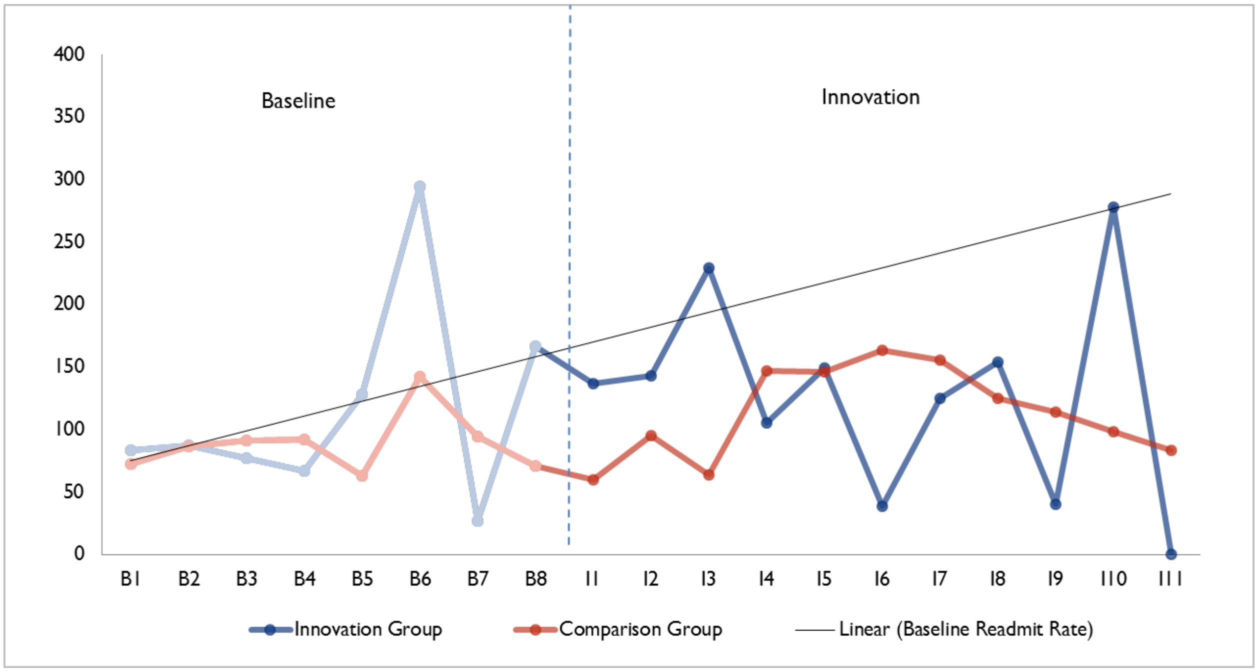
Table 19. Hospital Unplanned Readmissions Rates per 1,000 Admissions: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	83	87	77	67	128	294	27	167	136	143	230	105	149	38	125	154	40	278	0
Std dev	276	282	267	249	334	456	162	373	343	350	421	307	356	192	331	361	196	448	0
Total admissions	36	23	26	30	39	34	37	60	44	49	61	38	47	26	24	26	25	18	2
Comparison Group																			
Readmit rate	72	87	91	92	63	142	95	71	60	95	64	147	146	163	155	125	114	98	83
Std dev	259	281	288	289	242	349	293	257	237	293	244	354	353	370	362	331	318	297	276
Total admissions	32	35	29	33	32	45	49	56	39	46	37	48	41	35	34	29	23	17	8
Innovation − Comparison Rate																			
	11	0	−14	−25	66	152	−68	96	77	48	166	−42	3	−125	−30	29	−74	180	−83

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Admissions: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance.

2.8.2 *Regression Results*

Table 20 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −18 per 1,000 inpatient admissions (−1.8 percentage points), indicating that the innovation group is almost 2 percentage points less likely to have a readmission during the innovation period. This is the average difference in the probability of unplanned readmissions for all innovation quarters. The effect is not statistically significant (90% CI: −76, 41).

Table 20. Difference-In-Differences Linear Probability Model Regression Estimates for Probability that Participant Had Hospital Unplanned Readmission: CHA

	Coefficient	Standard Error	P-Values
Overall average	–18	36	0.623
Overall aggregate	–6	13	0.623

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The linear probability model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
CHA = Cambridge Health Alliance.

2.9 Medicare Unplanned Readmissions—Lahey–CHF

2.9.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 21*** and ***Figure 12***. The trend line gently decreases and the readmission rate is volatile in all baseline and innovation periods for both groups, although more so for the innovation group. Overall, the comparison group rate is relatively flat with some increasing fluctuations in the innovation period while the innovation group rate fluctuates widely throughout the baseline and innovation period with a sharp decrease in the final quarters of the innovation period. In all quarters, the readmission rate should be interpreted with caution because the total number of admissions is low for both groups in this quarter. Further statistical testing on the impact of the innovation on the readmission rates will be provided in the regression analysis section.

Table 21. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Lahey–CHF

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Readmit rate	257	140	273	154	256	143	169	204	205	126	182	123	205	304	122	125	391	235	200	0
Std dev	437	347	445	361	437	350	375	403	404	332	386	328	403	460	328	331	488	424	400	0
Total admissions	35	50	33	39	39	49	59	113	161	87	88	57	44	56	49	24	23	17	5	4
Comparison Group																				
Readmit rate	85	96	185	146	165	160	136	139	135	131	171	155	176	78	96	157	137	150	194	182
Std dev	279	295	388	353	372	366	343	346	342	337	377	362	381	268	294	364	344	357	395	386
Total admissions	31	28	31	34	46	48	51	67	47	48	39	37	34	26	24	23	17	13	10	4
Innovation − Comparison Rate																				
	172	44	88	8	91	−17	33	64	70	−5	11	−32	28	226	27	−32	254	85	6	−182

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.
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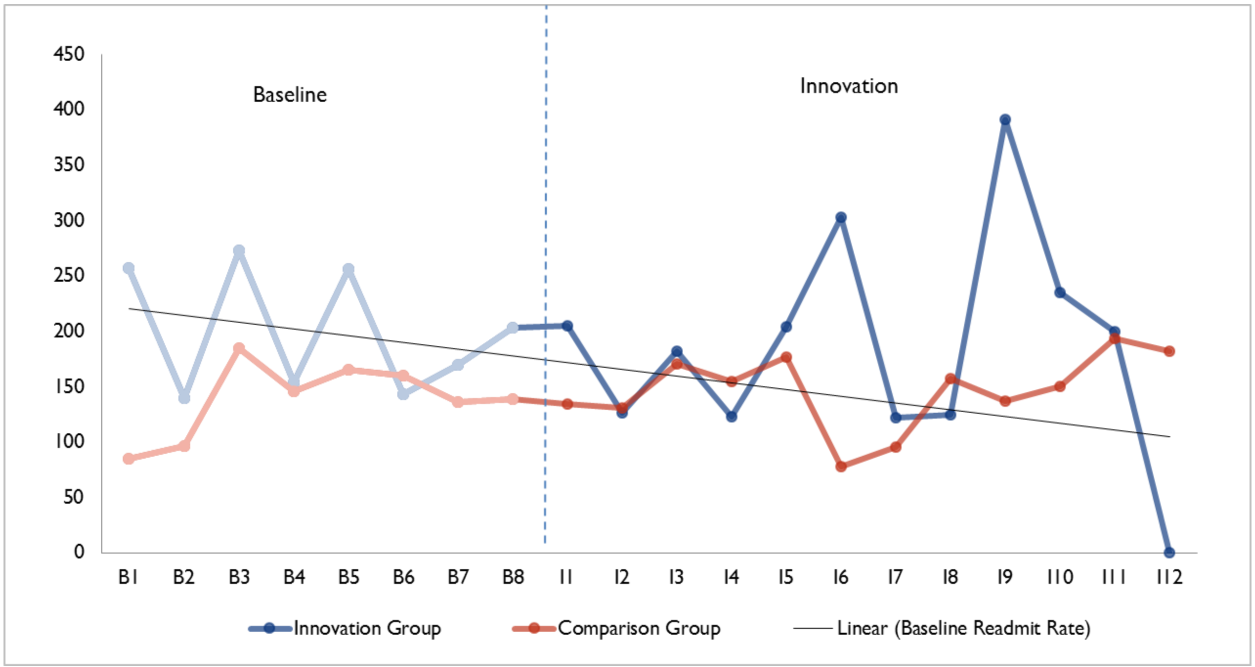
Figure 12. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.9.2 Regression Results

Table 22 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −12 per 1,000 inpatient admissions (−1.2 percentage points), indicating that the innovation group is just over 1 percentage point less likely to have a readmission during the innovation period. This is the average difference in the probability of unplanned readmissions for all innovation quarters. The effect is not statistically significant (90% CI: −65, 42).

Table 22. Difference-In-Differences Linear Probability Model Regression Estimates for Probability that Participant Had Hospital Unplanned Readmission: Lahey–CHF

	Coefficient	Standard Error	P-Values
Overall average	−12	33	0.715
Overall aggregate	−7	20	0.715

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The linear probability model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.10 Medicare Emergency Department Visits—CHA

2.10.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 23*** and ***Figure 13.*** The ED visit rate for the innovation group increases slightly in the baseline period with a small increase in the last baseline quarter followed by a gradual decrease. The comparison group ED visit rate follows a similar trend but is consistently lower than the innovation group in all quarters. Further statistical testing on the impact of the innovation is discussed in the next section.

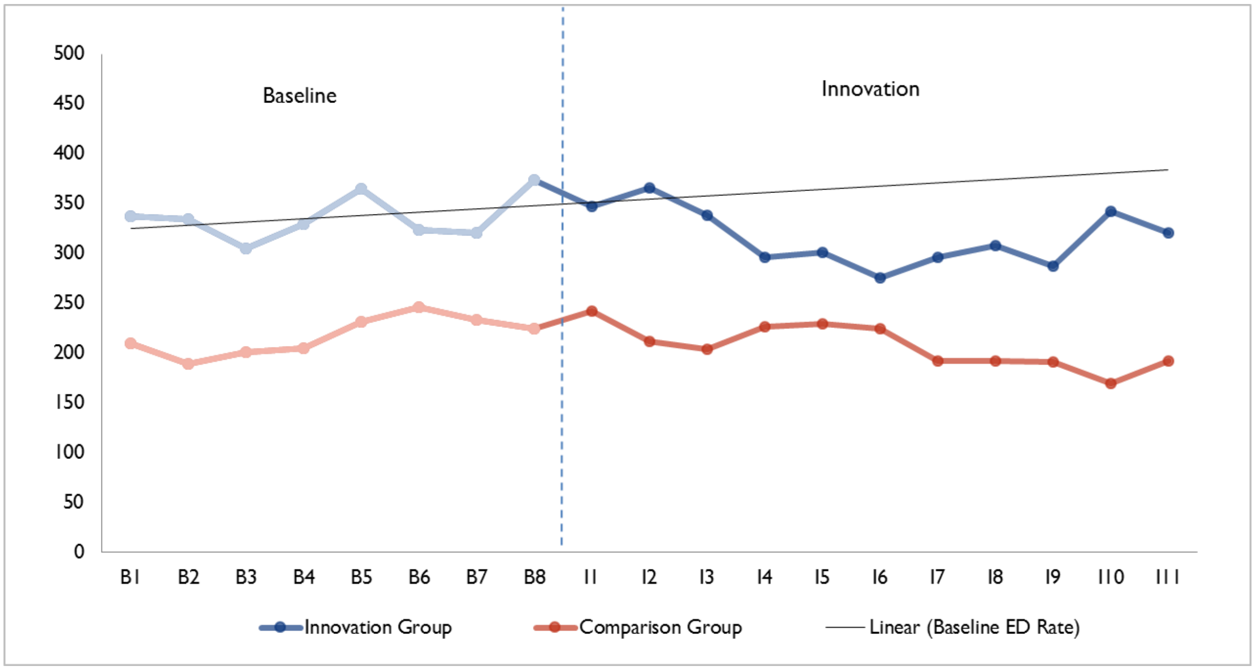
Table 23. ED Visits per 1,000 Participants: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	338	334	305	330	364	323	321	374	347	366	338	296	301	275	296	307	288	342	320
Std dev	1,337	1,201	1,028	1,130	1,519	1,272	1,365	1,242	1,215	1,518	1,312	1,000	930	753	1,059	1,137	721	1,278	851
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	761	683	598	474	203
Comparison Group																			
ED rate	209	189	201	205	231	246	233	225	242	211	203	227	229	225	192	192	191	169	192
Std dev	407	394	405	443	503	487	471	487	551	431	443	636	483	497	358	386	355	330	357
Weighted patients	813	836	857	877	900	920	941	950	950	946	920	888	869	844	777	701	615	492	220
Innovation − Comparison Rate																			
	128	146	103	125	133	78	88	149	105	155	135	69	72	51	104	116	96	172	128

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B = Baseline Q1; CHA = Cambridge Health Alliance; ED = emergency department; I1 = Innovation Q1.

Figure 13. ED Visits per 1,000 Participants: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
CHA = Cambridge Health Alliance; ED = emergency department.

2.10.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 13 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −32, 5). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 24 presents results of a negative binomial count model with the dependent variable equal to the number of ED visits per beneficiary during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so the adjusted estimates show ED visits per 1,000 participants. There are no statistically significant quarterly estimated coefficients, and overall, the innovation had no statistically significant effect on ED visits.

Table 24. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits, per 1,000 Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	−32	36	0.368
I2	29	34	0.399
I3	13	33	0.687
I4	−44	34	0.194
I5	−36	36	0.310
I6	−57	35	0.101
I7	−7	35	0.850
I8	−7	36	0.848
I9	−19	39	0.630
I10	42	43	0.327
I11	17	68	0.806
Overall average	−13	11	0.243
Overall aggregate	−106	91	0.243
Overall aggregate (IY1)	−30	63	0.633
Overall aggregate (IY2)	−87	55	0.113
Overall aggregate (IY3)	12	34	0.724

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The linear probability model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
CHA = Cambridge Health Alliance; ED = emergency department; I = Innovation Quarter; IY = Innovation Year.

2.11 Medicare Emergency Department Visits—Lahey–CHF

2.11.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 25*** and ***Figure 14.*** The ED visit rate for the innovation group and comparison group are similar in the -innovation period, but the innovation group rate is higher in the first few innovation quarters. The innovation group rate fluctuates widely, especially in the innovation period. The rate for the innovation and comparison are more similar in the final few quarters of the innovation period; however, the frequent fluctuations in the observed readmissions rates in the innovation group makes interpreting trends difficult. Further statistical testing on the impact of the innovation is discussed in the next section.

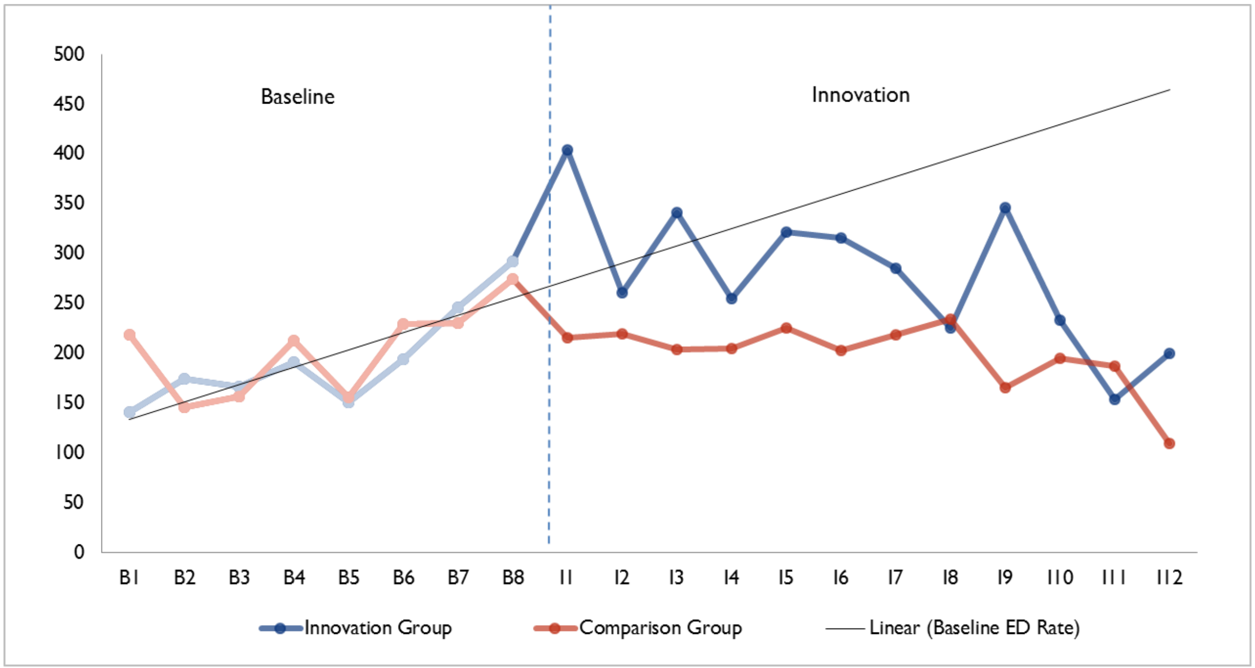
Table 25. ED Visits per 1,000 Participants: Lahey–CHF

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
ED rate	141	174	167	191	151	195	246	293	404	261	341	255	322	316	286	225	346	233	154	200
Std dev	461	485	429	471	388	526	552	616	778	499	808	551	718	940	626	596	1366	500	432	561
Unique patients	177	178	180	183	185	185	187	188	188	184	170	161	143	133	119	102	78	60	39	15
Comparison Group																				
ED rate	219	146	157	213	156	229	231	275	216	220	204	205	225	203	219	235	166	195	187	110
Std dev	350	365	299	350	302	355	459	428	394	350	328	409	389	314	342	392	244	298	266	278
Weighted patients	181	183	183	184	185	186	188	188	188	188	180	170	155	145	134	122	100	80	57	30
Innovation − Comparison Rate																				
	−78	28	10	−22	−5	−35	15	18	188	41	137	49	96	113	67	−9	180	38	−33	90

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 14. ED Visits per 1,000 Participants: Lahey–CHF



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.11.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 87 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 55, 120). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 26 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so the adjusted estimates show ED visits per 1,000 participants. Four of the 12 quarterly effects are positive and statistically significant indicating that the innovation group had more ED visits than the comparison group (P<0.10). The innovation group had more ED visits per 1,000 participants in Quarters 1 (190 more), 3 (138 more), 6 (111 more), and 9 (154 more). Overall, the innovation group had higher ED visits cumulatively over the 3 innovation years, on average, and in Years 1 and 2.

Table 26. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits, per 1,000 Participants: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
I1	190	62	0.003
I2	40	52	0.444
I3	138	60	0.023
I4	54	54	0.322
I5	88	65	0.178
I6	111	64	0.086
I7	67	66	0.312
I8	−6	64	0.929
I9	154	82	0.063
I10	13	80	0.871
I11	−52	80	0.519
I12	74	126	0.565
Overall average	87	20	0.000
Overall aggregate	122	27	0.000
Overall aggregate (IY1)	75	20	0.000
Overall aggregate (IY2)	35	16	0.033
Overall aggregate (IY3)	12	9	0.177

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The linear probability model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year before the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.12 Discussion: Medicare Results

In the 11 innovation quarters examined, no evidence supports the supposition that the CHA innovation has any statistically significant impact on reducing spending, hospital readmissions, or ED visits. With the innovation’s focus on care coordination, we did not expect to see a significant impact on these outcomes.

For the Lahey–CHF innovation, losses occurred for the innovation overall; however, the effect was only significant in Year 1 (no impact on spending in Years 2 or 3). Increases occurred in inpatient admissions and ED visits overall, in Year 1, and in Year 2. Because the Lahey innovation focused on helping CHF patients access needed post-discharge care, we expected to see a reduction in readmissions, instead we found no significant effect.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries whom we were able to match with the identifiers provided by the site. These beneficiaries represent 13 percent of the overall population reached by the innovation.

2.13 Medicaid Comparison Group—CHA

We include patients who were enrolled before December 31, 2015, and we present Medicaid claims data through July 31, 2013. The Medicaid claims analysis focuses on 771 Medicaid beneficiaries of the CHA site during the innovation period. There were not enough fee-for-service Medicaid beneficiaries enrolled in the Lahey–CHF innovation to support a Medicaid claims analysis for that group. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in the Boston area.

We use PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, number of ED visits and inpatient stays in the calendar quarter before the innovation, and total Medicare payments in the calendar quarter and calendar year before the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 27 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 15*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 27. Mean Values and Standardized Differences of Variables in Propensity Score Model: CHA

	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized	Treatment Group		Comparison Group		Standardized
Variable	Mean	SD	Mean	SD	Difference	Mean	SD	Mean	SD	Difference
Previous Medicaid										
Age	31.210	24.110	37.140	25.340	0.240	31.210	24.090	32.470	22.980	0.054
Percentage adult	50.760	50.030	52.140	49.950	0.028	50.760	49.990	52.790	49.920	0.041
Payments in calendar quarter prior to enrollment	$704	$2,158	$1,458	$4,619	0.209	$704	$2,156	$589	$1,997	0.055
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$2,723	$5,768	$5,563	$17,155	0.222	$2,723	$5,764	$2,381	$6,600	0.055
Percentage female	58.660	49.280	55.290	49.720	0.068	58.660	49.240	57.290	49.460	0.028
Percentage white	16.110	36.790	34.770	47.620	0.439	16.110	36.760	16.720	37.310	0.016
Percentage disabled	14.740	35.480	36.620	48.180	0.517	14.740	35.450	15.750	36.430	0.028
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.150	0.430	0.130	0.580	0.039	0.150	0.430	0.140	0.850	0.010
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	0.560	1.310	0.640	2.030	0.051	0.560	1.310	0.550	1.750	0.004
Number of ED visits in calendar quarter prior to enrollment	0.180	0.530	0.170	0.690	0.008	0.180	0.530	0.140	0.620	0.069
Number of inpatient stays in calendar quarter prior to enrollment	0.030	0.210	0.030	0.220	0.004	0.030	0.210	0.030	0.250	0.017
Number of beneficiaries	658	—	1,002,628	—	—	658	—	1,902	—	—
Number of unique beneficiaries[1]	—	—	356,016	—	—	658	—	1,902	—	—
Number of weighted beneficiaries	—	—	—	—	—	658	—	658	—	—
No Medicaid in Previous Quarter										
Age	19.566	24.542	17.390	19.108	0.099	19.566	24.433	19.575	24.444	0.000
Percentage female	56.637	49.778	54.890	49.761	0.035	56.637	49.558	56.342	49.596	0.006
Percentage white	12.389	33.093	19.810	39.860	0.203	12.389	32.946	12.389	32.946	0.000
Percentage disabled	6.195	24.213	9.800	29.732	0.133	6.195	24.106	6.195	24.106	0.000
Number of beneficiaries	113	—	41,907	—	—	113	—	213	—	—
Number of unique beneficiaries[1]	—	—	41,756	—	—	113	—	213	—	—
Number of weighted beneficiaries	—	—	—	—	—	113	—	113	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

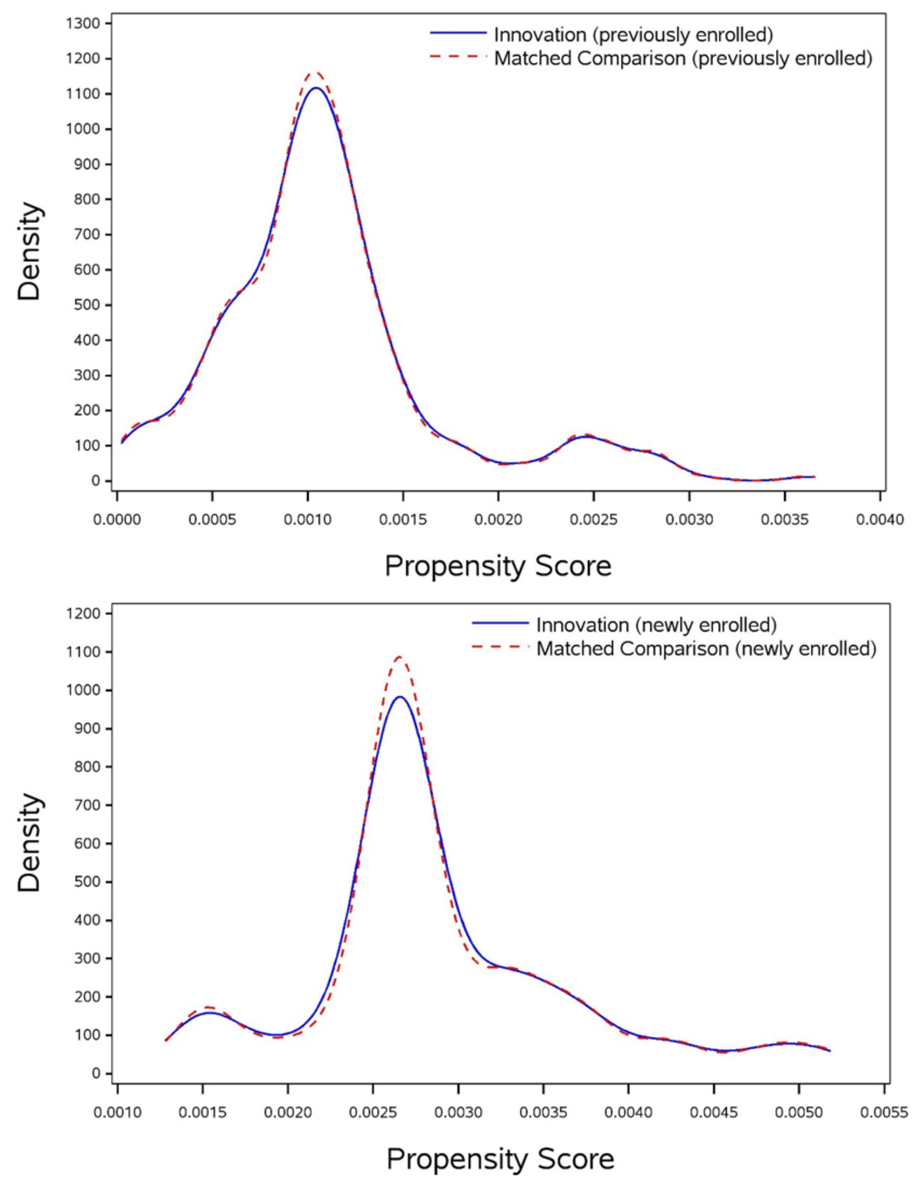
CHA = Cambridge Health Alliance; ED = emergency department; SD = standard deviation.

— Data not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 27). The results in Table 27 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 15 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure shows a very close overlap between treatment and comparison groups' propensity scores for both those with and without previous Medicaid enrollment.

Figure 15. Distribution of Propensity Scores for Comparison and Innovation Groups: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA = Cambridge Health Alliance.

2.14 Medicaid Spending—CHA

2.14.1 Descriptive Results

Table 28 reports Medicaid spending per patient in the eight quarters before and the three quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 16*** illustrates the Medicaid spending per beneficiary in Table 28 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

Spending increases slightly in the baseline period for the innovation group. The spending rate for the innovation group is a little more volatile than that of the comparison group. The spending rate for the innovation group drops in Qs 2 and 3, perhaps suggesting the potential for future savings. The spending rate for the control group is lower that of the innovation group in both the baseline and innovation periods with the exception of Q2, when the two rates are very similar. We explore the differences between the two groups further in the regression analysis section.

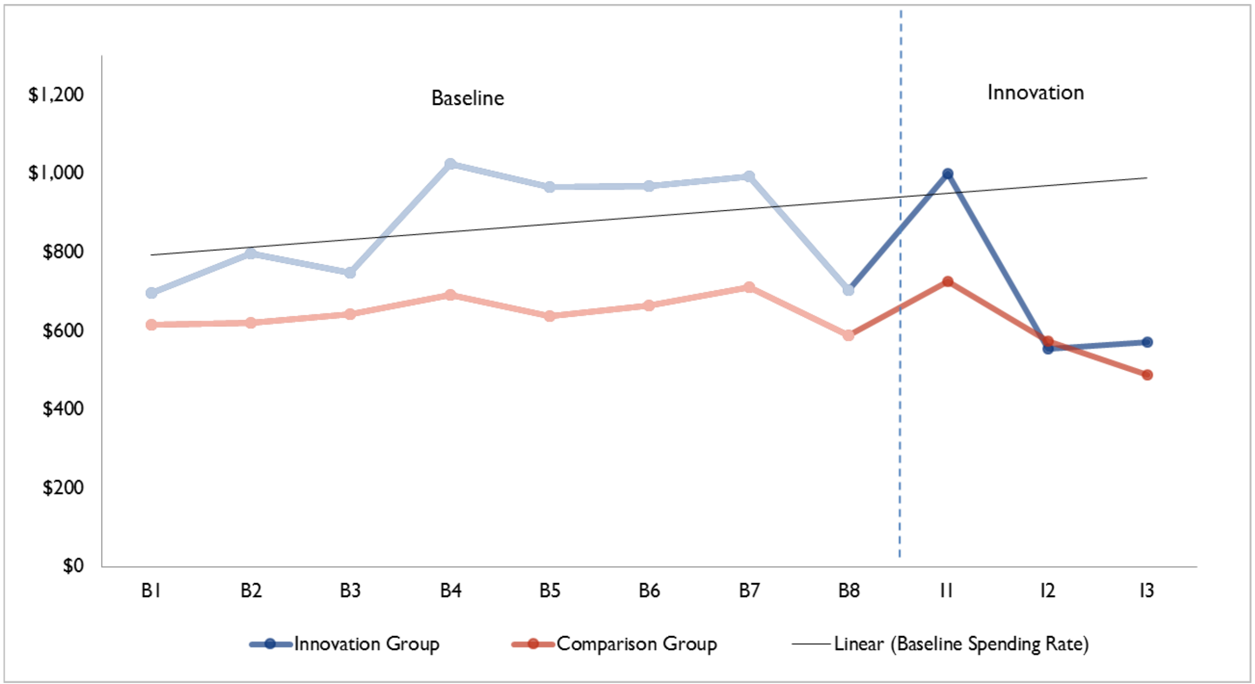
Table 28. Medicaid Spending per Participant: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Spending rate	$696	$796	$749	$1,025	$966	$969	$992	$704	$1,002	$556	$571
Std dev	$1,788	$2,103	$1,975	$2,980	$2,407	$2,806	$2,489	$2,158	$2,223	$1,616	$1,310
Unique patients	180	254	308	361	430	491	559	658	771	611	230
Comparison Group											
Spending rate	$615	$620	$643	$691	$637	$666	$712	$589	$725	$574	$488
Std dev	$1,156	$1,139	$1,226	$1,391	$1,247	$1,296	$1,419	$1,175	$1,353	$1,153	$894
Weighted patients	510	575	591	607	621	623	630	658	771	598	230
Savings per Patient											
	−$82	−$176	−$106	−$334	−$329	−$304	−$280	−$115	−$277	$18	−$82

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 16. Medicaid Spending per Participant: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA = Cambridge Health Alliance.

2.14.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is $132 (90% CI: −$269, $5). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

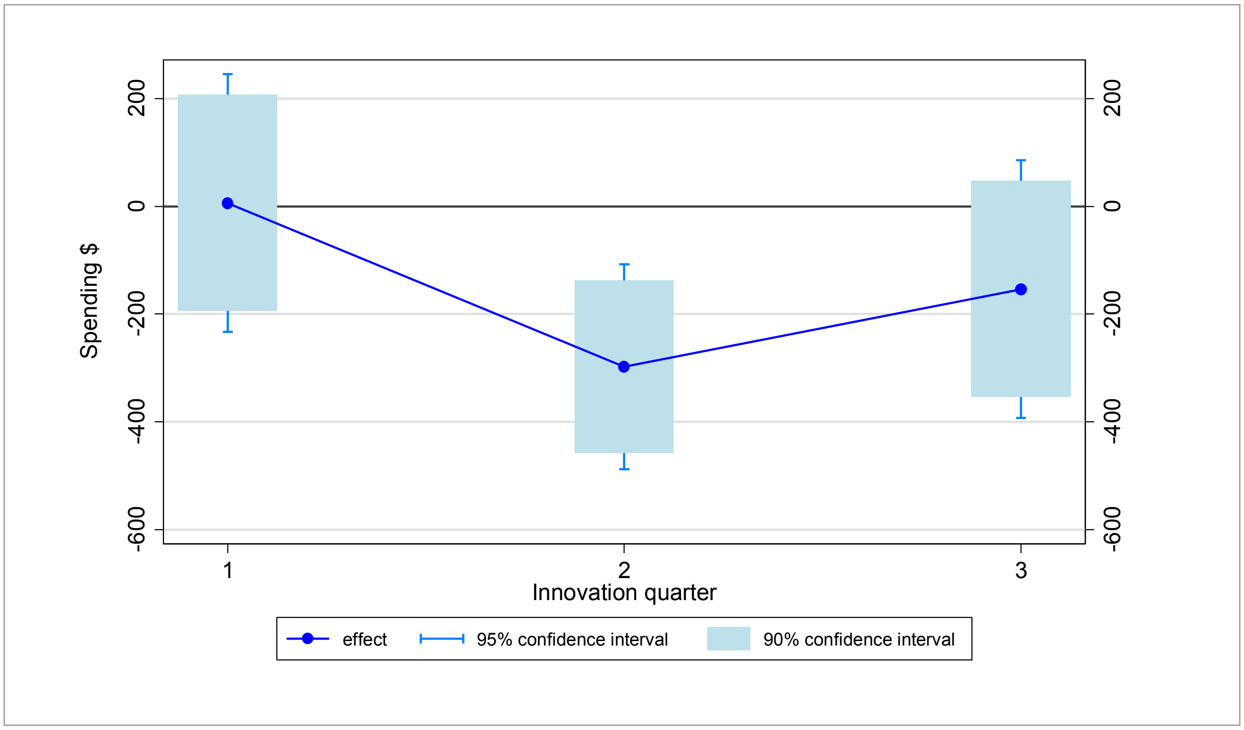
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 29*** presents the results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 17*** illustrates these quarterly difference-in-differences estimates. A statistically significant decrease in spending occurred in Q2 indicating that the program led to decreased spending early in the innovation. Although the decrease is not significant over the three quarters in aggregate, savings are possible in future quarters once more data are available.

Table 29. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	$6	$122	0.962
I2	−$298	$97	0.002
I3	−$154	$122	0.208
Overall average	−$132	$83	0.113
Overall aggregate	−$213,236	$134,346	0.113
Overall aggregate (IY1)	−$213,236	$134,346	0.113

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, and number of months of dual eligibility status during the calendar year before the innovation. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares.

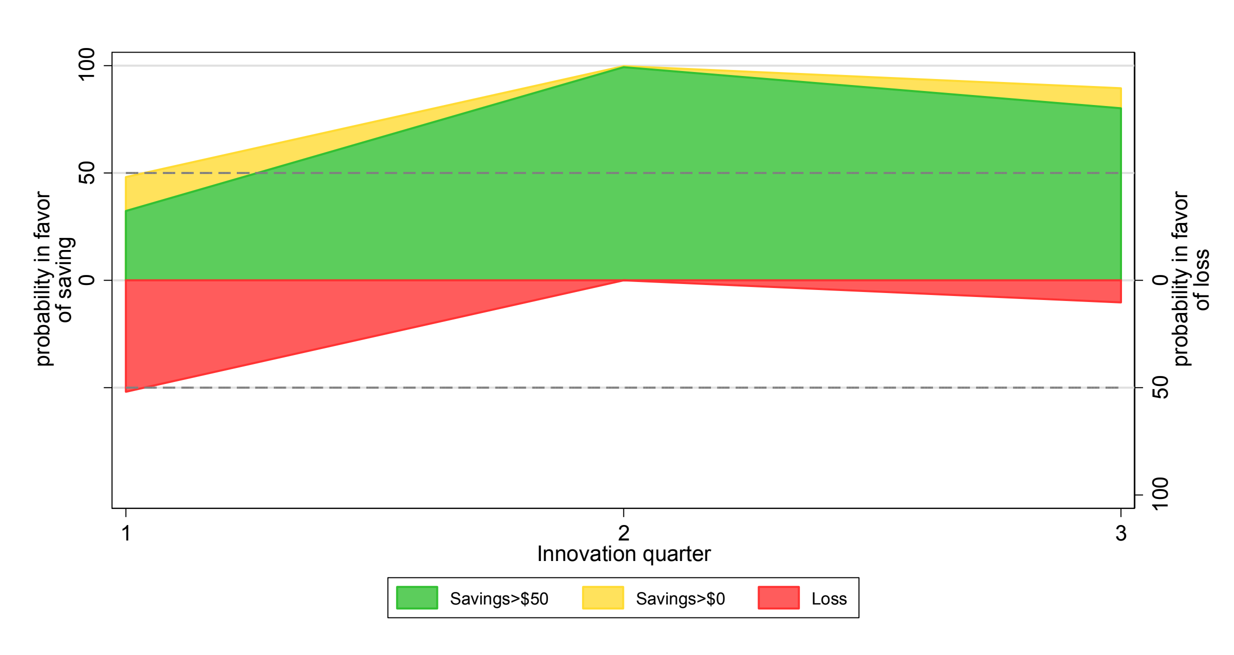
Figure 17. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA =Cambridge Health Alliance; OLS = ordinary least squares.

Figure 18 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. This figure shows significant savings in Q2. Although some potential losses are indicated in Q1 and some, but less, in Q3, far more savings are indicated, as exhibited by the green bar in this figure.

Figure 18. Quarterly Strength of Evidence in Favor of Savings/Loss: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA = Cambridge Health Alliance.

2.15 Medicaid Inpatient Admissions—CHA

2.15.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 30*** and ***Figure 19***. The inpatient admissions rate slightly increases in the baseline period for both the innovation and comparison groups, although the inpatient admissions rate for the innovation group is higher in almost all eight periods (except for the third baseline quarter when the two rates are very similar). Both group rates spike in the first innovation quarter (larger for the innovation group), most likely because the first date of hospitalization for CHF was used as a start date. In the remaining innovation quarters, the admissions rate for the innovation group drops below the trend line and below the comparison group rate. We will explore the differences between the two groups further in the regression analysis section.

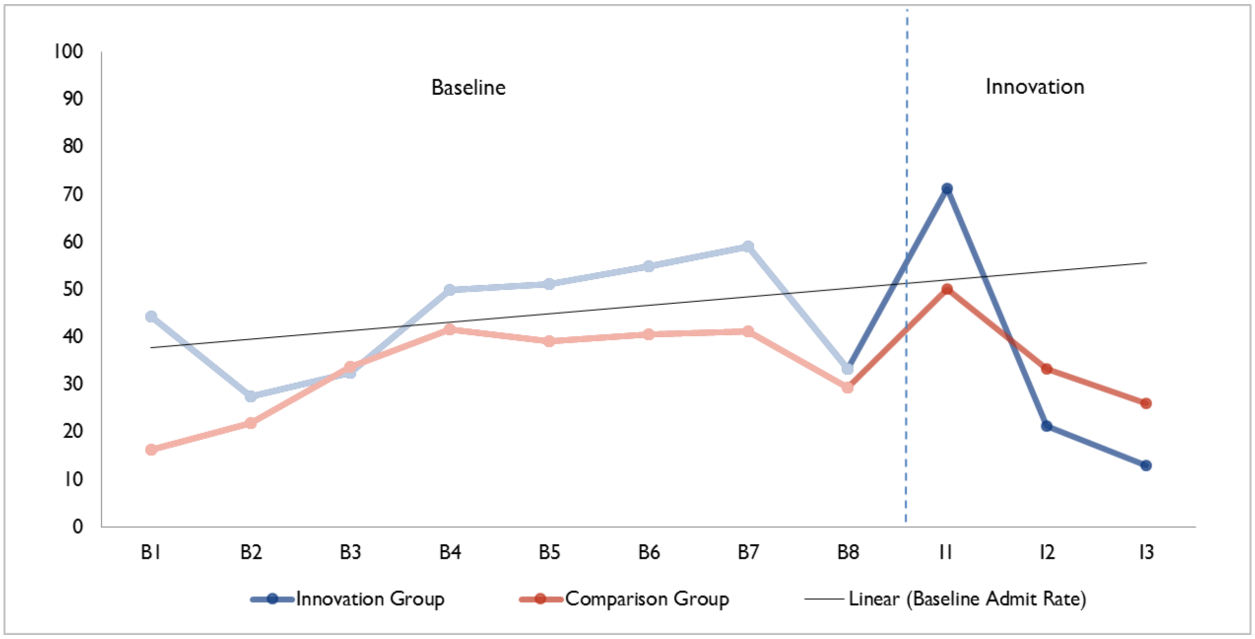
Table 30. All-Cause Inpatient Admissions Rate per 1,000 Participants: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Admit rate	44	28	32	50	51	55	59	33	71	21	13
Std dev	276	164	178	230	231	245	251	211	272	144	114
Unique patients	180	254	308	361	430	491	559	658	771	611	230
Comparison Group											
Admit rate	16	22	34	42	39	41	41	29	50	33	26
Std dev	74	91	128	182	160	180	195	150	191	184	150
Weighted patients	510	575	591	607	621	623	630	658	771	598	230
Innovation − Comparison Rate											
	28	6	−1	8	12	14	18	4	21	−12	−13

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 19. All-Cause Inpatient Admissions Rate per 1,000 Participants: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA = Cambridge Health Alliance.

2.15.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 27 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −48, −7). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 31 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so the adjusted estimates show inpatient admissions per 1,000 participants. The results show a decrease in patient visits overall for the innovation group in the innovation period. In Qs 2 and 3 respectively, individuals in the innovation had, on average, 34 and 26 fewer inpatient admissions per 1,000 participants compared with the comparison group. Overall, the innovation group exhibited a statistically significant decrease in inpatient admissions over the innovation period.

Table 31. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Participants: CHA

	Coefficient	Standard Error	P-Values
I1	−23	23	0.319
I2	−34	14	0.015
I3	−26	16	0.096
Overall average	−27	12	0.025
Overall aggregate	−39	17	0.025
Overall aggregate (IY1)	−39	17	0.025

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The linear probability model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, and number of months of dual eligibility status during the calendar year before the innovation. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
CHA = Cambridge Health Alliance; I = Innovation Quarter; IY = Innovation Year.

2.16 Medicaid Unplanned Readmissions—CHA

2.16.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 32*** and ***Figure 20***. The readmissions rate is incredibly volatile for both the innovation and comparison groups. The fluctuations in the readmissions rate are mostly due to the small number of admissions in a given quarter. The readmissions rate is higher for the comparison group in most quarters; however, the frequent fluctuations in the observed readmissions rates among both groups makes comparing and interpreting trends difficult. We will further explore the differences between the two groups in the regression analysis section.

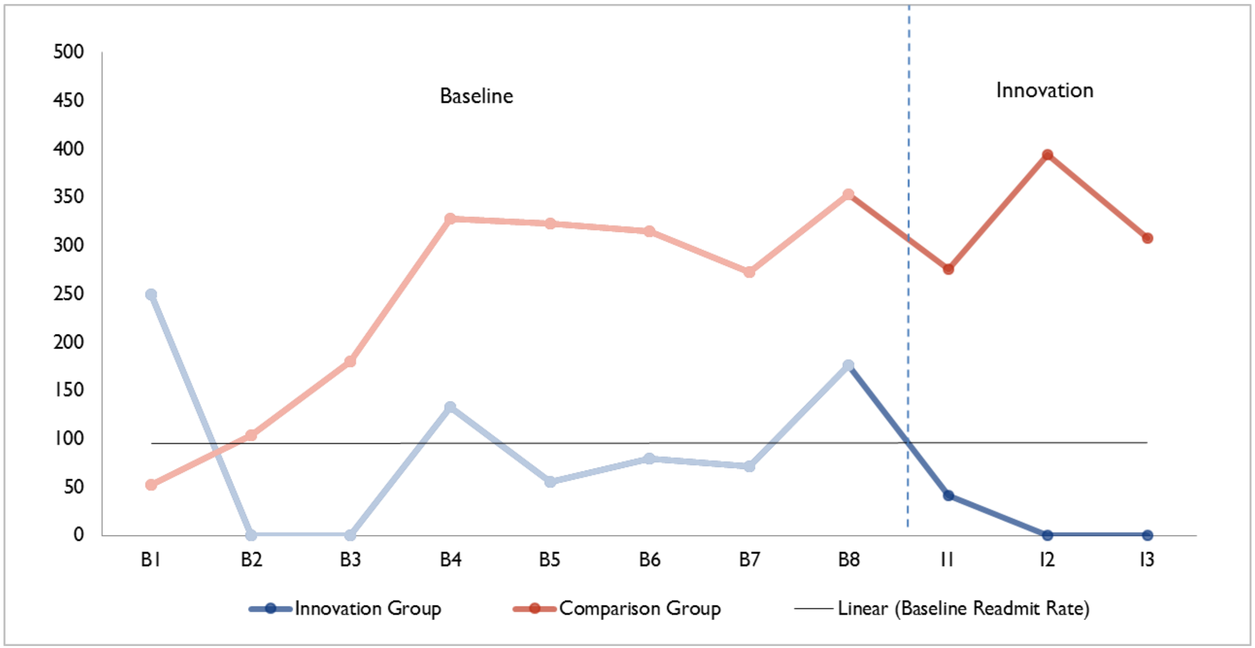
Table 32. Hospital Unplanned Readmissions Rates per 1,000 Admissions: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Readmit rate	250	0	0	133	56	80	71	176	42	0	0
Std dev	433	0	0	340	229	271	258	381	200	0	0
Total admissions	8	6	8	15	18	25	28	17	48	6	1
Comparison Group											
Readmit rate	53	103	180	328	323	315	273	353	276	395	308
Std dev	223	305	384	470	467	464	445	478	447	489	462
Total admissions	6	10	17	21	21	18	22	17	33	13	4
Innovation − Comparison Rate											
	197	−103	−180	−195	−267	−235	−201	−176	−234	−395	−308

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 20. Hospital Unplanned Readmissions Rates per 1,000 Admissions: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA = Cambridge Health Alliance.

2.16.2 Regression Results

Table 33 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is -90 per 1,000 inpatient admissions (−9.0 percentage points), indicating that the innovation group is 9 percentage points more likely to have a readmission during the innovation period. This is the average difference in the probability of unplanned readmissions for all innovation quarters. The effect is not statistically significant (90% CI: −191, 12).

Table 33. Difference-In-Differences Linear Probability Model Regression Estimates for Probability that Participant Had Hospital Unplanned Readmission: CHA

Quarter	Coefficient	Standard Error	P-Values
Overall average	−90	62	0.151
Overall aggregate	−5	3	0.151

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The linear probability model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, dual eligibility, and number of months of dual eligibility status during the calendar year before the innovation. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
CHA = Cambridge Health Alliance.

2.17 Medicaid Emergency Department Visits—CHA

2.17.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 34*** and ***Figure 21.*** The ED visit rate increases for the innovation group in the baseline period. During the innovation quarters, the ED visit rate for the innovation group decreases and drops below the baseline trend and the comparison group rate. We will further explore the differences between the two groups in the regression analysis section.

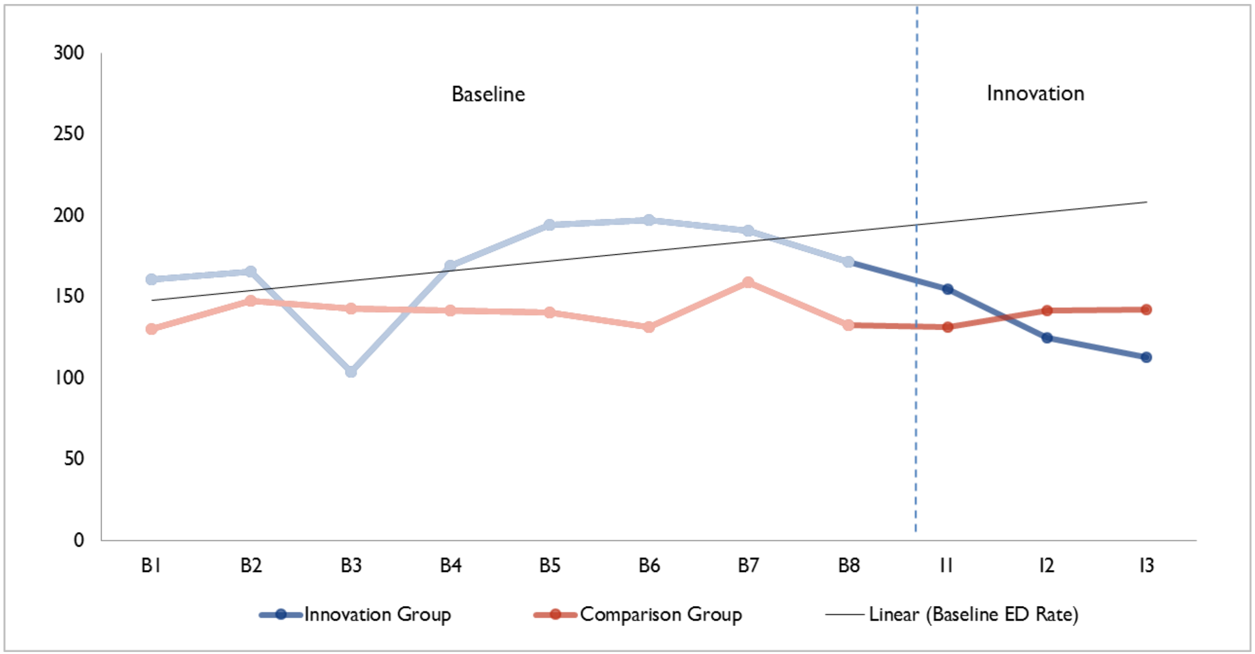
Table 34. ED Visits per 1,000 Participants: CHA

Awardee Number: 1C1CMS331050
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
ED rate	161	165	104	169	194	198	191	172	155	125	113
Std dev	551	554	388	522	575	605	537	513	519	414	356
Unique patients	180	254	308	361	430	491	559	658	771	611	230
Comparison Group											
ED rate	130	148	143	141	141	132	159	132	131	142	142
Std dev	326	366	325	374	290	283	421	352	367	332	408
Weighted patients	510	575	591	607	621	623	630	658	771	598	230
Innovation − Comparison Rate											
	31	18	−39	28	54	66	32	39	24	−16	−29

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; CHA = Cambridge Health Alliance; ED = emergency department; I1 = Innovation Q1.

Figure 21. ED Visits per 1,000 Participants: CHA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
CHA = Cambridge Health Alliance; ED = emergency department.

2.17.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 45 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −74, −16). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 35 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so the adjusted estimates show ED visits per 1,000 participants. The innovation group had 54 fewer ED visits in Q2 and 70 fewer in Q3 compared with the comparison group. Overall, the innovation decreased ED visits by 64 in the first three innovation quarters. It is possible that the innovation's focus on continuity of care and improved access to primary care were factors in the decreased use of the ED.

Table 35. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	−30	26	0.265
I2	−54	28	0.056
I3	−70	41	0.086
Overall average	−45	18	0.011
Overall aggregate	−64	25	0.011
Overall aggregate (IY1)	−64	25	0.011

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The linear probability model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, and number of months of dual eligibility status during the calendar year before the innovation. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
CHA = Cambridge Health Alliance; I = Innovation Quarter; IY = Innovation Year.

2.18 Discussion: Medicaid Results—CHA

The descriptive results for Medicaid beneficiaries in the CHA innovation show the potential for savings and fewer inpatient admissions and ED visits. The trends on all three of these outcomes are decreasing for the innovation group compared to baseline trend lines and relative to the comparison group. The regression results show that after controlling for baseline differences between the comparison and innovation groups, the innovation did lead to statistically significant decreases in inpatient admissions and ED visits but had no significant impact on spending. Given the programmatic intentions of the innovation, improved access to primary care, we would not expect the innovation to affect inpatient admissions or spending in the short term. In fact, we might expect spending to increase. However, it is possible that improved access to primary care led to decreases in ED visits as individuals received more appropriate care.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries whom we were able to match with the identifiers provided by the site. These beneficiaries represent 9 percent of the overall population reached by the innovation. The identifiers provided by the site contained 1,199 unique IDs that were in the correct format to link individuals to Chronic Conditions Data Warehouse (CCW) Medicaid data. After matching the awardee-provided IDs to the CCW, then subsetting to individuals with fee-for-service Medicaid who enrolled in the innovation before July 31, 2013 (the date that the CCW Medicaid data are available), the final sample was 771.

2.19 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

NEU has a unique innovation: it executes multiple projects at various health systems and no two projects are identical. Thus, we present a two-tier evaluation of NEU's innovation:

- Component 1: REC model
- Component 2: Process Improvement Projects

Outcome measures for the REC-level were also used for the claims-based analysis listed in ***Table 36.*** Table 36 lists the process improvement project-level outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. As described in ***Section 2.1.1***, Level 1 projects were those of highest priority based upon the ability to obtain data from the health system. The data we present in this section are current through June 2015. We received some data from the Hallmark Health Breast Cancer Patient Access project but were unable to analyze the data because of content issues, including various inconsistencies and extreme values. We requested data for the measures for all other projects listed in Table 36. To request data, we had to rely heavily on NEU facilitating conversation with the health system. However, for various reasons (long delays in response times from NEU, resistance to RTI contacting the health systems, and the health systems' inability to share data), we did not receive outcome measures data for the remaining nine prioritized projects.

Table 36. Quantitative Outcome Measures for Prioritized Process Improvement Projects

Project Site	Project Description	Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Level 1 Prioritization						
Cambridge Health Alliance	Resident Team Scheduling—Primary Care Continuity	Coordinated care	Efficiency	Percentage of appointments that occurred with patients' primary care providers or someone on their subteam	Dropped; data not received	No
Hallmark Health	Breast Cancer Patient Access	Coordinated care	Timeliness of care	The number of business days between booking an appointment and the calendar date of that appointment	Dropped; data unusable	No
Massachusetts General Hospital	CLABSI	Coordinated care	Timeliness of care	Length of hospital stay associated with central line infections	Dropped; data not received	No
	Neurology Department Epilepsy Appointment Access	Coordinated care	Timeliness of care	Percentage of patients whose appointments are made within 21 days of request date	Dropped; data not received	No
				Percentage of new patients given the third next available appointment	Dropped; data not received	No

CLABSI = central line-associated blood infection.

We requested but did not receive patient-level data used to generate each measure listed in ***Table 36*** for each quarter through Q12 (June 30, 2015). Table 37 summarizes the process and status of the data requests for the prioritized projects as of June 30, 2015. We received some data from the Hallmark Health Breast Cancer Patient Access project but were unable to analyze the data because of content issues, including various inconsistencies and extreme values.

Table 37. Data Request Status of Prioritized Projects

Health System	Project Name	Data Requested from Health System	Patient Identifiers Received	Outcome Measures Received
Level 1 Prioritization				
Cambridge Health Alliance	Resident Team Scheduling—Primary Care Continuity	Yes	Yes	No
Lahey Health System	CHF Post-discharge Scheduling	Yes	Yes	Yes
	COPD Readmission Reduction	Yes	Yes	Yes
Massachusetts General Hospital	CLABSI	Yes	No	No
	Neurology Department Epilepsy Appointment Access	Yes	No	No
Maine Health	OR Block Optimization	Yes	No	No
Hallmark Health	Breast Cancer Patient Access	Yes	Yes	Yes
Level 2 Prioritization				
Hallmark Health	ED Opioid Abuse	Yes	No	No
Lahey Health System	Surgery Staff Scheduling	Yes	No	No
Maine Health	Perioperative Inventory	Yes	No	No

CHF = congestive heart failure; CLABSI = central line-associated blood infection; COPD = chronic obstructive pulmonary disorder; ED = emergency department; OR = operating room

2.20 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 38*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from NEU's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in Sections 2.21 through 2.24 are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 38. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	Quarterly Awardee Performance Reports
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	Quarterly Awardee Performance Reports
Workforce development	Staffing	Number of staff (including undergraduate cooperative education students, graduate students, and postdoctoral fellows) that have been a part of NEU's HCIA projects	Quarterly Awardee Performance Reports
	Training hours	Number of training hours in Q11 and Q12	Quarterly Awardee Performance Reports
		Cumulative number of training hours since inception	Quarterly Awardee Performance Reports
	Trainees	Number of trainees in Q11 and Q12	Quarterly Awardee Performance Reports
		Cumulative number of trainees since inception	Quarterly Awardee Performance Reports
Implementation effectiveness	Reach	Number of targeted projects completed	Data received from NEU
		Number of health systems conducting at least one project	Data received from NEU
	Dose	Number of contacts with health systems on the following topics: outreach, scoping, implementation, wrap-up, and evaluation of potential for scalability	Data unavailable
	Sustainability	Number of process improvement projects sustained after project period	Data received from NEU
	Replicability	Number of process improvement projects scaled to other units or departments within health system or spread to other health systems	Data received from NEU

HCIA = Health Care Innovation Award; NEU = Northeastern University; Q = quarter.

We attempted to collect explanatory measures for the prioritized projects regarding reach, workflow processes, and care coordination; however, for various reasons (including the health system's inability to share data), we did not receive explanatory measures data for nine of the 10 prioritized projects. We also did not receive explanatory measures data for the BMC OB/GYN Ambulatory Clinic project, a nonprioritized project. We received some data from the Hallmark Health Breast Cancer Patient Access project but were unable to analyze the data because of content issues, including inconsistencies and extreme values. We requested data for the measures for all the other projects listed in Table 6.

2.21 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.21.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed with 49 full-time equivalent (FTE) staff members, including administrative staff and students (e.g., coop, graduate, postdoctoral, summer interns). Between Q11 (June 2014) and Q12, the number of FTEs increased with the addition of 13 FTE new hires. Ninety-seven FTEs were hired since project inception. NEU cited one lesson learned about hiring and retention: the failure to hire people immediately at the start of the award negatively impacted execution. This delay in hiring occurred because of difficulty in finding staff with the unique mix of engineering and health care skills. Thus, NEU reported that it did not have full staffing capacity until 1 year into the award. NEU is also seeking to hire a grants manager to better manage operations and the progress of the process improvement projects.

2.21.2 Skills, Knowledge, and Training

Between Q11 and Q12, NEU provided 2,336 hours of training to 345 community-based clinical and nonclinical personnel. Over the duration of the project, 9,375 training hours were provided and 1,700 personnel were trained (see ***Table 39***). These personnel include HCIA project staff and community-based personnel. The trainings offered relate to process improvement in health care, which meets NEU's aim of increasing visibility. These trainings offer NEU the opportunity to engage with health systems for potential process improvement projects.

NEU reported that 42 former coop students were placed in various health care systems and research and consulting organizations during the award. Placement after graduation continued to increase throughout the award, which potentially indicates some success in training students to meet the needs of health systems. NEU would like to build on its postdoctoral training program, experiential education, and seminars to establish a well-educated workforce to meet the demand for health systems engineering.

Table 39. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	2,336	345
Since inception	9,375	1,700

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.22 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

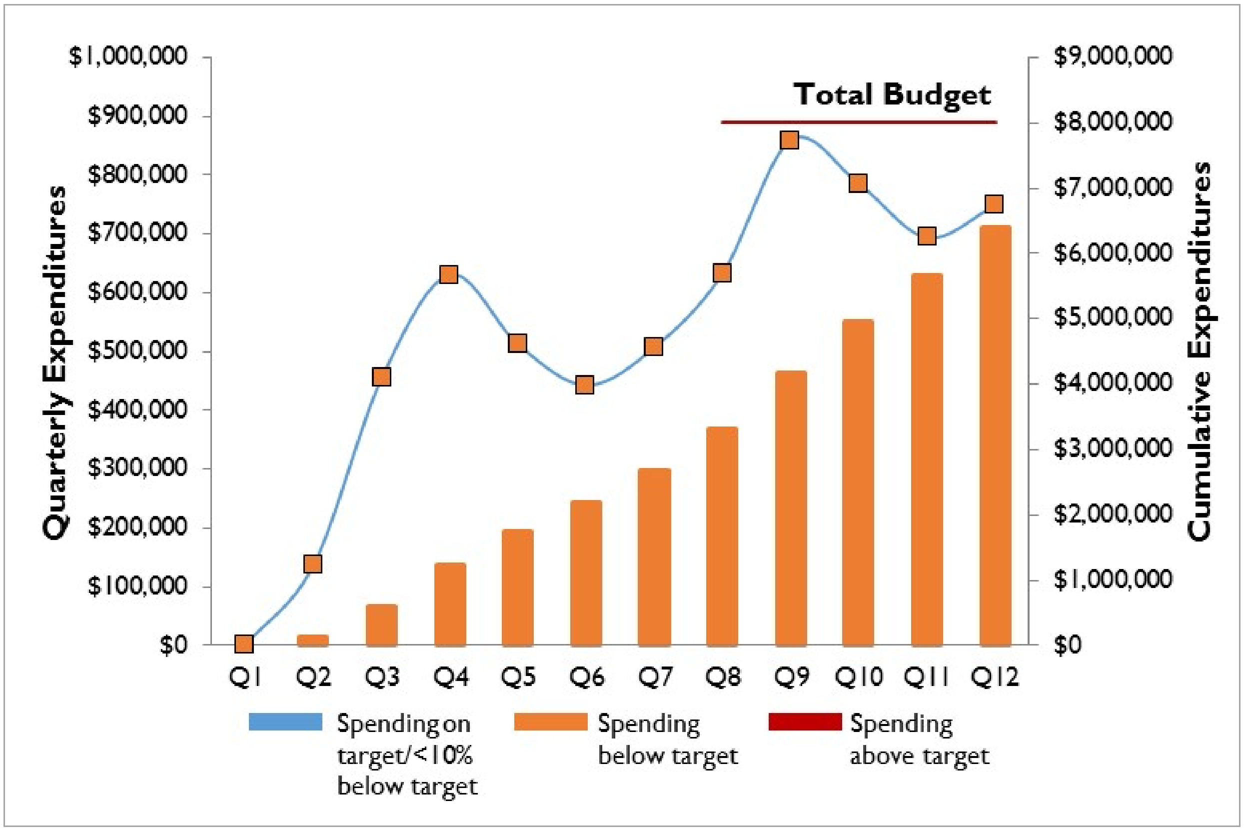
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.22.1 Award Execution

The annual report highlights the significance of NEU's expenditure rates on implementation. As of June 2015 (Q12), NEU spent 80.1 percent of its Year 3 budget, which is below the projected target. Challenges with maintaining the focus of projects, continuing to engage health systems, and overall internal project management at the REC level negatively impacted execution. Specifically, at the REC level, the heavy workload of staff made managing the timelines and scoping process of the health system projects difficult. Also, through Q11, NEU reported spending 16,556 hours on scoping.

Figure 22. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



Q = quarter.

2.22.2 Leadership

Although NEU's leadership had initial success in motivating and engaging health systems by presenting process improvement project opportunities, NEU struggled to maintain high engagement with the health systems and management of day-to-day operations. NEU attempted to address this concern by adding a clinical champion to the team in the second half of the award. NEU's intent was that the clinical champion would help engage health system leads and provide credibility and clinical context. Throughout the course of the award, NEU staff noted that wider support from the university was lacking. Additionally, NEU reported that hiring a grants manager may have provided necessary support to help manage projects at the health systems. The grants manager would help manage timelines of the health system projects and standardize some of the processes. NEU did not report any changes or updates to leadership in Q11 or Q12.

2.22.3 Organizational Capacity

NEU's innovation applies principles of ISyE to improve health care processes. NEU helps health systems incorporate ISyE principles to solve problems within systems. NEU is well known for its coop, and the availability of these coop students to staff various projects was a great benefit for NEU's innovation.

Throughout the award, NEU cited heavy staff workload, overall center management, and lack of standardized processes as challenges to implementation across both evaluation components, the REC level and health system level. At the REC level, staff's workload made managing the timelines and scoping process of the health system projects difficult. The health system leads also had competing priorities, such as electronic health record implementations and other initiatives, which created bottlenecks to data acquisition and slowed progress. Regarding the reported challenge of overall center management, NEU was delayed in starting the project because internal management processes were not in place at the start. Describing the first year as a prototype year, NEU stated the project did not begin until Year 2. This delayed startup also negatively impacted execution and spending. The lengthy process of finalizing legal agreements, such as memorandums of understanding, business associate agreements, and data use agreements, also caused projects to stall. The lack of standardized processes challenged organizational capacity. These processes include scoping; closing out completed projects (required forms, project summaries, dissemination plans, and surveys for the health system and students); collecting uniform data across projects; maintaining timelines; and ensuring smooth, timely communication among all parties. Projects stagnated in the scoping phase.

In summary, streamlining processes and having a standard procedure in place to aid in finalizing legal agreements were all lessons learned that could mitigate capacity challenges.

2.22.4 Innovation Adoption and Workflow Integration

RTI was unable to collect data from health systems or providers participating in NEU's innovation. Because of this difficulty, RTI is not able to provide insight on workflow or adoption barriers and facilitators.

2.23 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question
• What is the implementation effectiveness as measured by reach and dose of the innovation?

2.23.1 Innovation Reach

NEU planned to conduct at least 15 projects over 3 years. As shown in ***Table 40***, NEU exceeded its goal and completed 45 projects across 23 health systems. As of Q12, eight additional projects were pending, and 21 other projects were discontinued. The large number of projects indicates that NEU's leadership succeeded in engaging health systems. NEU engaged health systems through their external educational events, showcasing the importance of applying process improvement to health system processes. Over 60 percent of the health systems had two or more completed projects, indicating NEU's penetration within health systems.

Table 40. Health System Project Completion and Reach for Each Quarter

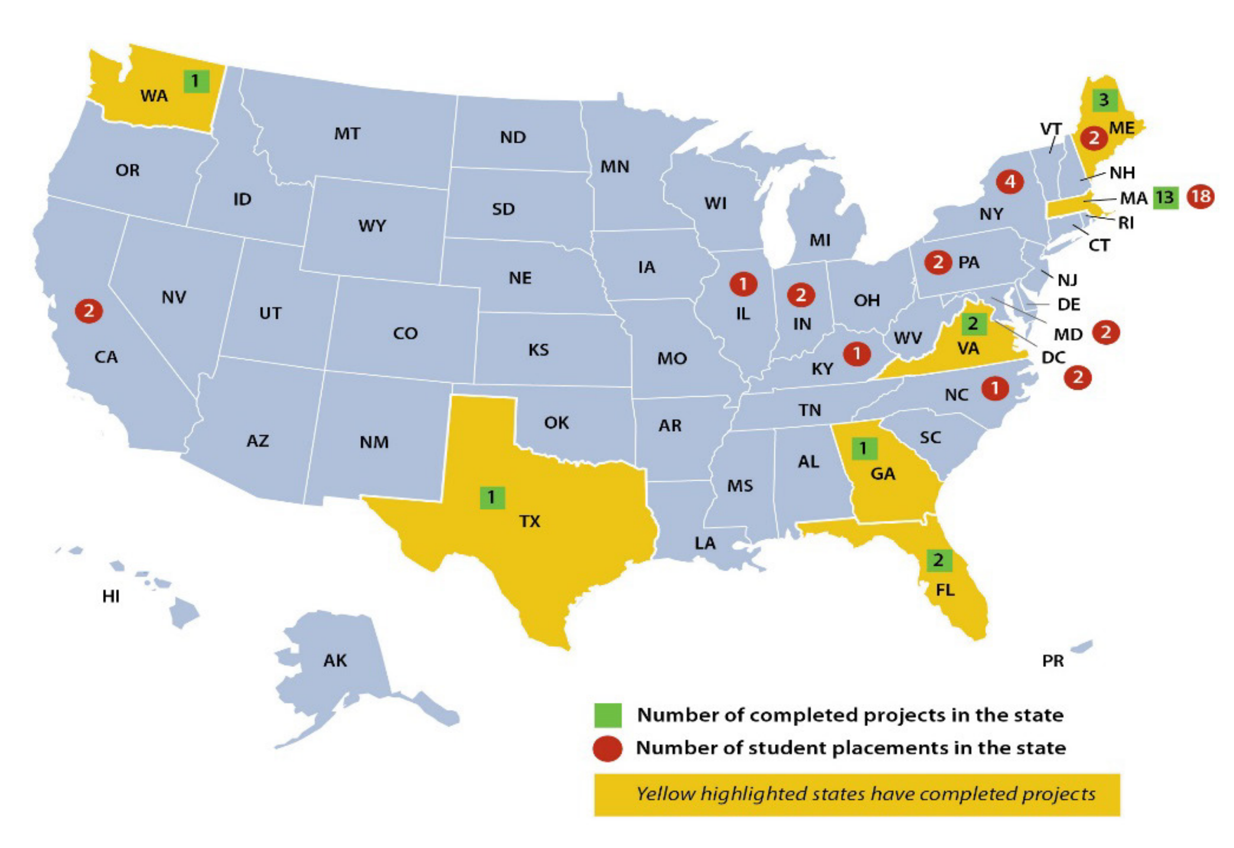
Quarter	Target Number of Completed Projects	Cumulative Number of Projects Completed	Cumulative Reach per Quarter (%)
Q7 (Jan–Mar 2014)	15	4	26.7%
Q8 (Apr–Jun 2014)	15	8	53.3%
Q9 (Jul–Sep 2014)	15	14	93.3%
Q10 (Oct-Dec 2014)	15	18	120.0%
Q11 (Jan-Mar 2015)	15	20	133.3%
Q12 (Apr-Jun 2015)	15	45	300.0%

Q = quarter

NEU completed 20.4 percent (20 projects) of a total of 98 projects scoped through Q11 (the last quarter for which we have scoping data). The percentage of projects completed versus those scoped demonstrates that although NEU successfully engaged many health systems and exceeded their reach goal, projects were often not feasible or viable enough to move beyond the scoping phase. Additionally, NEU was unable to obtain evaluative data from most health systems, preventing determination of impact of the completed projects.

NEU leveraged their relationships with hospitals in Massachusetts and surrounding states to conduct health system projects. **Figure 23** demonstrates the locations of completed projects along with the locations of student placements after graduation. Many students were placed in jobs in Massachusetts and surrounding states after graduation.

Figure 23. NEU Completed Projects and Student Placements after Graduation



NEU = Northeastern University.

We received patient-level data from five health systems implementing ISyE innovations. Included patients totaled 14,153, the same number reported in the 2015 annual report. ***Table 41*** describes the participant enrollment for the health systems from which we were able to obtain data.

Table 41. Participant Enrollment by Project

Project Site	Project Name	Number of Unique Patients Included
Cambridge Health Alliance	Resident Team Scheduling—Primary Care Continuity	8,651
Lahey Health System	CHF Post-discharge Scheduling	263
Lahey Health System	COPD Readmissions Reduction	27
Hallmark Health	Breast Cancer Patient Access	4,972
Boston Medical Center	OB/GYN Ambulatory Appointment Access	240

Source: Patient-level data provided to RTI.
CHF = congestive heart failure; COPD = chronic obstructive pulmonary disorder; OB/GYN = obstetrics and gynecology; Q = quarter.

2.23.2 Innovation Dose

RTI determined that dose was not an appropriate measure of implementation effectiveness for this innovation. The projects focused on systems changes, rather than on patient-level changes.

2.24 Qualitative Findings: Sustainability

At the REC level, NEU is sustaining its innovation by exploring opportunities with states, federal agencies, and quality improvement organizations to secure additional funding. In Q12, NEU reported that it received a grant from the Agency for Healthcare Research and Quality (AHRQ) to establish a patient safety center with Brigham and Women's Hospital. NEU reports that it will use the same REC project team and model to integrate systems engineering teams into its new grant from AHRQ. Additionally, NEU is exploring collaboration with states and applying for additional funding through other CMMI mechanisms. NEU is also considering a business model to make its projects, workforce development, and trainings available to members. Additional details on this business model were not provided.

At the process-improvement level, NEU defines sustainability as the number of projects that continue to be active at health systems beyond their initial implementation period; 18 projects were sustained by health systems beyond their initial end date. Additionally, 12 projects were replicated across health systems. Beyond the HCIA funding period, NEU plans to maintain relationships with participating health systems and expand projects within health systems that have demonstrated impact. NEU reports that expanding its coop in the future to include more students will contribute to improving sustainability.

2.25 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing NEU and its accomplishments. In this section we discuss NEU's progress on achieving HCIA goals to date:

- **Smarter spending**.
  - For both Medicare and Medicaid patients enrolled in the CHA innovation, no statistically significant impact was found on total spending during the innovation period. For Medicare patients enrolled in the CHA innovation, the spending increase in Year 1 was on the margin of statistical significance.
  - Medicare patients enrolled in the Lahey–CHF innovation had a higher spending rate overall and during Year 1 of the innovation. Spending differences between the innovation and comparison groups were not statistically significant during Years 2 or 3.
- **Better care**. The CHA innovation focused on improving patients' access to primary care providers. Better access to primary care may have contributed to the decline in ED visits and inpatient admissions seen among Medicaid beneficiaries. The Lahey innovation targeted CHF patients' post-discharge care to avoid preventable readmissions. Enhanced follow up care could positively impact readmissions; however, no changes in readmissions were detected.
  - In the Medicare sample, CHA had no statistically significant impact on inpatient stays or ED visits. For individuals in the CHA innovation enrolled in Medicaid, the innovation led to

statistically significant decreases in inpatient admissions and ED visits over the first three innovation quarters (the only period for which we have data). There were no statistically significant impacts on readmissions for Medicare or Medicaid patients enrolled in the CHA innovation.

  – In the Medicare sample, the Lahey–CHF innovation had an increase in inpatient admissions and ED visits overall and during Years 1 and 2, though no significant effect in Year 3. No statistically significant effects on readmissions were found.

- **Healthier people**. We did not receive any of the requested health outcome data. Therefore, we are unable to provide a summary of findings related to health outcomes.

NEU used the university's existing coop to implement ISyE process improvement projects across various health systems. NEU substantially exceeded its goal of completing at least 15 process improvement projects by completing 45 in 23 health systems across the nation. Educational events conducted by NEU effectively generated interest among health systems, which is evident by the number of completed projects. The number of completed projects provided training opportunities for NEU's coop students and helped NEU work toward its goal of expanding the workforce of health systems engineers.

However, progress was hindered by challenges of leadership and organizational capacity. Although NEU's leadership motivated both NEU staff and health system leaders to conduct the process improvement projects, strong managerial support at the REC level was lacking. This lack of detailed oversight and project management contributed to challenges in collecting uniform data across projects; maintaining timelines; and ensuring smooth, timely communication among all parties. As NEU noted, the innovation would have benefited from a project or grants manager to help the project director ensure projects were meeting timelines and progressing as expected. In regards to staffing, NEU cited difficulty in hiring people with the ideal mix of engineering and health care knowledge, which impacted the startup time.

With respect to sustainability, NEU will leverage funding from AHRQ to embed systems engineering staff into an initiative designed to create a patient safety center in collaboration with Brigham and Women's Hospital. NEU reports that it will continue its work with health systems, implementing projects that had been replicated within the health system and streamlining processes. NEU will also explore other funding opportunities with states and develop a business model to continue this work. NEU hopes to standardize processes to keep projects from stagnating in the scoping phase. NEU reports that it would like to make data acquisition easier in the future by discussing this need early in the process of engaging health systems. This practice will aid in evaluation efforts.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Northeastern University (NEU)

Northeastern University (NEU) is a private university in Boston, Massachusetts. Awarded $8,000,002, NEU began enrolling health systems into its HCIA Community Resource innovation in November 2012. The aim of this innovation is to develop and enable professional collaboration between NEU and various health systems to promote the application of industrial and systems engineering (ISyE) in process improvement projects.

Awardee Overview

Innovation dose:	NEU spent 417 hours scoping projects in Q11 and 16,556 hours scoping projects since the start of the innovation.	***Innovation reach:***	NEU completed 45 projects across 23 health systems; five projects affected the care of 14,153 patients.
Components:	(1) Regional extension centers (RECs) (2) Process improvement projects at participating health systems	***Participant demographics:***	Most participants (83.2%) were younger than 64 years old. A majority (58.0%) were covered by Medicaid.
Sustainability:	NEU reported it will use the REC model to integrate systems engineering into practice with its new grant from the Agency for Healthcare Research and Quality to establish a patient safety center at Brigham and Women's Hospital.		
Innovation type:	Health IT		Direct health care/ dental care

Key Findings:

Smarter spending. For the Cambridge Health Alliance (CHA) innovation, there was no statistically significant average quarterly savings per participant for Medicare ($268; 90% CI: −$81, $616) or Medicaid (−$132; 90% CI: −$269, $5). For Medicare patients enrolled in the CHA innovation, the increase in average spending per participant per quarter in Year 1 was on the margin of statistical significance ($422; 90% CI: $0, $843).

Medicare patients enrolled in the Lahey-Congestive Heart Failure (Lahey-CHF) innovation had a higher average quarterly spending rate overall ($2,699; 90% CI: $1,203, $4,195) and during Year 1 ($4,818; 90% CI: $2,874, $6,763) of the innovation. Differences in average quarterly spending between the innovation and comparison groups were not statistically significant during Year 2 ($1,085; 90% CI: −$772, $2,943) or Year 3 (−$884; 90% CI: −$3,276, $1,509).

Better care. The CHA innovation focused on improving patients' access to primary care providers. In the Medicare sample, CHA had no statistically significant impact on inpatient stays per 1,000 participants per quarter (7; 90% CI: −2, 15) or emergency department (ED) visits per 1,000 participants per quarter (−13; 90% CI: −32, 5). Patients in the CHA innovation enrolled in Medicaid had statistically significant decreases in inpatient admissions per 1,000 participants per quarter (−27; 90% CI: −48, −7) and ED visits per 1,000 participants per quarter (−45; 90% CI: −74, −16) over the first three innovation quarters (the only period for which we had data). No statistically significant impacts were found on readmissions per 1,000 admissions per quarter in the CHA innovation for Medicare (−18; 90% CI: −76, 41) or Medicaid (−90; 90% CI: −191, 12).

The Lahey innovation targeted CHF patients' post-discharge care to avoid preventable readmissions. In the Medicare sample, the Lahey-CHF innovation had an increase in inpatient admissions per 1,000 participants both overall (190; 90% CI: 144, 235) and during Years 1 (291; 90% CI: 219, 363) and 2 (106; 90% CI: 39, 174), though no significant effect in Year 3 (35; 90% CI: −60, 130). The same Medicare sample showed an increase in ED visits per 1,000 patients both overall (87; 90% CI: 55, 120) and during Years 1 (107; 90% CI: 60, 154) and 2 (70; 90% CI: 16, 124), though no significant effect in Year 3 (62; 90% CI: −13, 137). Enhanced follow−up care could positively affect readmissions; however, no changes in readmissions were detected (−12; 90% CI: −65, 42).

Healthier people. We did not receive any of the requested health outcome data. Therefore, we were unable to provide a summary of findings related to health outcomes.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Prosser Public Hospital District

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Prosser Public Hospital District

2.1 Introduction

Prosser Public Hospital District (Prosser), a critical access hospital in Prosser, Washington, received an award of $1,470,017 to implement a community paramedic program (CPP) in which trained CPs provided a one-time follow-up health service for targeted high-risk patients to prevent hospital readmissions and ED visits. The innovation began enrolling participants on January 1, 2013, and sought to achieve the following HCIA goals:

1. **Smarter spending.** Lower spending by reducing unexpected encounters for patients with a history of frequent use of emergency medical services, and reducing unplanned hospital readmissions; anticipate savings of $1.8 million for 100 Cohort 1 patients.

2. **Better care.** Improve care by increasing the number of patients who understand their discharge instructions, attend follow-up appointments, and fill prescriptions according to discharge instructions.

3. **Healthier people**. Improve health by reducing the number of unexpected encounters for targeted patients.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11-12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received from Prosser through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Continued use of trained CPs to provide a one-time follow-up visit to targeted patients to prevent hospital readmissions and ED visits
Program Participant Characteristics	
	About half of participants (50.7%) were 25 to 64 years of age, and more than half (64.2%) were female. More than half of participants (51.1%) were Hispanic, and 45.5% were white. More than one-third (37.8%) were covered by Medicare or Medicare Advantage, and almost one-third (30.1%) were covered by Medicaid.
Workforce Development	
Hiring and retention	As of Q12, had 4.85 FTEs as projected; high turnover of three paramedics in Q11; five new CPs hired in Q12.
Skills, knowledge, and training	Five newly hired CPs participated in 100 instruction hours of training to become certified as CPs. The revised training includes completing a minimum of 10 visits with certified CPs.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Award execution	Expenditures at 100% of projected target for Year 3.
Leadership	The new project director and RN nurse case manager continue to share leadership role for the program.
Organizational capacity	Prosser created office space for the RN case manager within the EMS building for closer communication. Prosser staff developed a structure for tracking and referral that improved reach.
Innovation adoption and workflow integration	Prosser expanded role of case manager and integration into the EMS team to improve workflow and increase referrals.
Implementation Effectiveness	
Innovation reach	Overall, through Q12, 1,016 total participants were enrolled across all three cohorts, which corresponds to 69.6% reach for Cohort 1, 85.0% reach for Cohort 2, and 63.0% reach for Cohort 3 based on the number of clients referred.
Innovation dose	Following the preassessment conducted at each CP visit, 27.3% of all 1,169 CP visits were followed up with at least one CP service. For the remaining 72.7% of visits, patients did not need additional services.
Sustainability	
	Prosser committed to continuing the CPP and developed a multifaceted approach to fund the services, including discussions with private payers for reimbursement.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 4 and 5, 2015.

CPP = community paramedic program; ED = emergency department; EMS = emergency medical services; FTE = full-time equivalent; RN = registered nurse.

Table 3 summarizes Medicare claims-based findings during the innovation period. The weighted average quarterly impact in spending, representing an increase in spending, was $1,162 (90% CI: −$537, $2,860) per participant per quarter. This effect is not statistically significant. Because innovation data are available up to 10 quarters, total values for Year 3 include 6 months of data. Increases in inpatient stays and unplanned readmissions are statistically significant over the entire innovation period, and amount to 73 more inpatient stays and 97 more readmissions per 1,000 participants per quarter. We also see an increase in ED visits of 88 more ED visits per 1,000 beneficiaries per quarter.

Table 3. Summary of Medicare Claims-Based Findings: Prosser

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$2.091	−$0.966, $5.148	$0.850	−$1.173, $2.874	$1.124	−$0.059, $2.307	$0.117	−$0.488, $0.721
Acute care inpatient stays	132	43, 221	90	10, 169	24	−13, 60	18	0, 37
Hospital-wide all-cause unplanned readmissions	33	20, 46	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	159	0, 318	114	−23, 251	26	−45, 97	19	−20, 57
Average impact per quarter								
Spending per participant	$1,162	−$537, $2,860	$839	−$1,158, $2,837	$1,793	−$94, $3,680	$728	−$3,052, $4,508
Acute care inpatient stays (per 1,000 participants)	73	24, 123	89	10, 167	38	−20, 96	115	−2, 232
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	97	58, 137	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	88	0, 177	112	−23, 248	42	−71, 155	117	−123, 358

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. The weighted average quarterly impact in spending, representing a decrease in spending, was $986 (90% CI: −$2,707, $735) per participant per quarter. This effect is not statistically significant. Participants in the innovation have more inpatient hospitalizations post-participation compared to people who opted out of the program, and the change is statistically significant. ED visits are not statistically significant, albeit lower for participants compared to nonparticipants. The number of observations is insufficient to support regression analyses for readmissions.

Table 4. Summary of Medicaid Claims-Based Findings: Prosser

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.437	−$1.199, $0.325	−$0.251	−$0.868, $0.365	−$0.185	−$0.615, $0.244	N/A	N/A
Acute care inpatient stays	41	21, 61	43	23, 62	−2	−7, 3	N/A	N/A
Hospital-wide all-cause unplanned readmissions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−18	−76, 41	−20	−79, 38	2	0, 5	N/A	N/A
Average impact per quarter								
Spending per participant	−$986	−$2,707, $735	−$685	−$2,364, $995	−$2,441	−$8,087, $3,205	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	92	47, 138	116	63, 169	−23	−91, 45	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−40	−172, 92	−55	−214, 104	33	−6, 71	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Component

The Prosser innovation consisted of one component: a community paramedic program (CPP) in which trained CPs provided a one-time follow-up visit to targeted patients to attempt to prevent hospital readmissions and ED visits. During the visit, the CP checked that patients obtained prescriptions, made the necessary follow-up appointments with their primary care provider (PCP), and helped patients understand and follow the discharge instructions. The focus and structure of the follow-up visit remained constant throughout the innovation.

Prosser based its CPP on Eagle County, Colorado's program, a nationally recognized, evidence-based model implemented since 2009 in a similar rural county. The Prosser CPP was intended to improve care and reduce ED visits and readmissions for certain types of patients who overused—or had the potential to overuse—the health care system. They included already-identified high users in Prosser County, patients who had certain types of surgery, and adults with complex chronic illnesses. Patients who were eligible to receive the same CP services were categorized into three cohorts, described below. Every patient who met these criteria, who was discharged from the ED or from surgery at Prosser or from Kadlec Regional Medical Center, and lived in Prosser was enrolled to receive a CP visit (although patients could refuse services). Health care providers also referred high-risk patients they believed would benefit.

Prosser's innovation served three cohorts of patients and all received the same CP services:

- **Cohort 1.** Patients with a history of system overuse- they had presented to Prosser Memorial Hospital more than five times (ED, observation, or inpatient) between January 1, 2011, and June 30, 2012. This cohort had been identified prior to the innovation.
- **Cohort 2.** Patients who underwent surgery at Prosser for open abdominal, total joint replacement, and other selected surgeries.
- **Cohort 3**. Patients who were referred to the innovation by a provider because they have chronic conditions that the provider thought would benefit from a CP visit. This included patients released from nearby Kadlec Hospital who lived within the Prosser catchment area.

Patients can be included in multiple cohorts. Since we first described these components in the 2014 annual report, Prosser made the following changes to its referral protocols beginning in Q8: (1) paramedics in the field can make CP referrals, whereas health care providers previously made all referrals; and (2) the CPP now serves patients who live in the Prosser service area but were seen at Kadlec Regional Medical Center (another local hospital). During Q9, Prosser changed its referral system to allow the registered nurse (RN) case manager at Prosser to regularly track patients transferred to Kadlec Regional Medical Center via Prosser's ambulance service.

Yakima Valley Community College continues to serve as the sole partner for this innovation (***Table 5***), providing training to the CPs. In the 2014 annual report, we listed Sue Jetter Consulting Services as a partner. However, in Q8 we learned that Ms. Jetter is the local evaluator and an integral member of the staffing team. We now consider Ms. Jetter's role to be a contractor rather than a partner.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Yakima Valley Community College	Provides training to the CPs	Yakima, WA

CP = community paramedic.

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants ever enrolled in the innovation. More specifically, about half of participants (50.7%) were 25 to 64 years of age and more than half (64.2%) were female. Most participants (51.1%) were Hispanic, and about 45.5% were white. Over one-third (37.8%) were covered by Medicare or Medicare Advantage, and almost one-third (30.1%) were covered by Medicaid. The distribution of age, sex, and race/ethnicity is similar to that presented in the 2015 annual report based on data through Q11.

Table 6. Characteristics of All Participants Ever Enrolled in Prosser Innovation through June 2015

Characteristic	Number of Participants[1]	Percentage of Participants
Total	1,016	100.0
Age		
< 18	36	3.5
18–24	90	8.9
25–44	270	26.6
45–64	245	24.1
65–74	147	14.5
75–84	132	13.0
85+	86	8.5
Missing	10	0.9
Sex		
Female	652	64.2
Male	356	35.0
Missing	8	0.8
Race/ethnicity		
White	462	45.5
Black	4	0.4
Hispanic	519	51.1
Asian	1	0.1
American Indian or Alaska Native	3	0.3
Native Hawaiian or other Pacific Islander	0	0.0
Other	0	0.0
Missing/refused	27	2.6

(continued)

Table 6. Characteristics of All Participants Ever Enrolled in the Prosser Innovation through June 2015 (continued)

Characteristic	Number of Participants[1]	Percentage of Participants
Payer category		
Dual	—	—
Medicaid	306	30.1
Medicare	318	31.3
Medicare Advantage	66	6.5
Other[2]	295	29.0
Uninsured	0	0.0
Missing	31	3.1

Source: Patient-level data provided to RTI by Prosser.
[1] Unique patients by cohort.
[2] Other includes private commercial insurance, self-pay, or other government-funded insurance (i.e., Veteran's Health, state employee).
— Data not available.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focused on 268 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in any of the three cohorts that are part of the innovation, as well as a comparison group of beneficiaries with fee-for-service Medicare who were eligible nonparticipants (i.e., individuals who were offered participation but declined).

We considered the tradeoff of using propensity score matching (PSM) to further refine the comparison group. However, PSM did not appreciably improve the statistical balance of characteristics between the innovation and comparison groups, and would have excluded 72 participants in the innovation group who could not be closely matched to people in the comparison group. In addition, the potential comparison group was quite small originally, limiting the ability of PSM to find close matches. Therefore, we did not use the PSM results and instead retained everyone in the innovation and comparison groups.

Table 8 presents the mean values and standardized differences of the observable characteristics of participants and eligible nonparticipants. Six innovation beneficiaries and seven nonparticipants were not eligible for Medicare fee-for-service in the year prior to the innovation and were dropped from the comparison table because they did not contribute information on baseline values.

Table 8. Medicare Mean Values and Standardized Differences of Innovation Participants and Nonparticipants: Prosser

Variable	Full Innovation Mean	Full Innovation SD	Full Comparison Mean	Full Comparison SD	Standardized Difference (Full Treat vs. Comparison)
Payments in calendar quarter prior to enrollment	$6,359	$23,709	$5,794	$13,566	0.029
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$10,821	$18,903	$12,368	$25,112	0.070
Age	74.83	11.44	72.37	13.12	0.200
Percentage male	48.47	49.98	50	50	0.031
Percentage white	72.14	44.83	75.56	42.98	0.078
Percentage disabled	25.57	43.63	31.11	46.29	0.123
Number of dual-eligible months in the previous calendar year	3.11	5	3.06	5.08	0.011
Number of chronic conditions	8.27	3.97	7.74	4.2	0.129
Percentage with chronic kidney disease ever	30.92	46.21	30	45.83	0.020
Percentage with COPD ever	37.4	48.39	35.56	47.87	0.038
Percentage with heart failure ever	36.64	48.18	26.67	44.22	0.216
Percentage with diabetes ever	41.98	49.35	38.89	48.75	0.063

(continued)

Table 8. Medicare Mean Values and Standardized Differences of Innovation Participants and Nonparticipants: Prosser (continued)

Variable	Full Innovation Mean	Full Innovation SD	Full Comparison Mean	Full Comparison SD	Standardized Difference (Full Treat vs. Comparison)
Percentage with asthma ever	20.61	40.45	20	40	0.015
Percentage with hypertension ever	80.92	39.3	72.22	44.79	0.206
Number of outpatient ED visits in calendar quarter prior to enrollment	0.49	1.13	0.43	0.93	0.053
Number of outpatient ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.56	3	1.61	2.88	0.018
Number of inpatient stays in calendar quarter prior to enrollment	0.17	0.49	0.19	0.51	0.034
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.33	0.83	0.47	1.25	0.127
Percentage with surgical event in calendar quarter prior to enrollment	10.31	35.07	12.22	44.29	0.061
Percentage in Cohort 1	12.98	33.61	6.67	24.94	0.213
Percentage in Cohort 2	19.85	39.89	8.89	28.46	0.316
Percentage in Cohort 3	75.57	42.97	85.56	35.15	0.254
Number of beneficiaries	262	--	90	--	--

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
COPD = chronic obstructive pulmonary disease; ED = emergency department; Prosser = Prosser Public Hospital District; SD = standard deviation.

The absolute standardized differences between the innovation group and the comparison group show an acceptable level of balance on many variables (***Table 8***), even without the use of PSM. Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. On average, individuals who chose to participate are 2 years older and significantly more likely to have certain chronic conditions than those who chose not to participate. Individuals can participate in multiple cohorts. While people are more likely to choose to participate than to select nonparticipation, those who are eligible because of a surgical event (Cohort 2) are twice as likely to participate as those in other cohorts.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the eleven quarters after enrolling in the innovation. One more quarter of data is available; however, we do not have comparison individuals because no eligible person opted out in the first quarter of the innovation. Savings per patient reflect the spending differential between the comparison group and the innovation group, not controlling for other factors. The small number of individuals enrolled in the first two innovation quarters translate into few observations in the last two quarters of patient- specific, post-intervention data available and, hence, into wide confidence intervals around quarterly averages. ***Figure 1*** illustrates the Medicare spending per beneficiary in ***Table 9*** for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Medicare spending for participants and nonparticipants is very similar. These are raw data, however; tests for statistical significance follow later in this report. The spike during the first innovation quarter occurs as a result of the selection criteria, which require eligibles to attend Prosser Hospital to obtain a CP visit, hence incur medical costs. Eligibles enter the sample in one of three cohorts: Cohort 1 selects individuals with a history of system overuse, Cohort 2 selects individuals with certain surgical procedures, and Cohort 3 includes patients enrolled at the time of an ED visit.

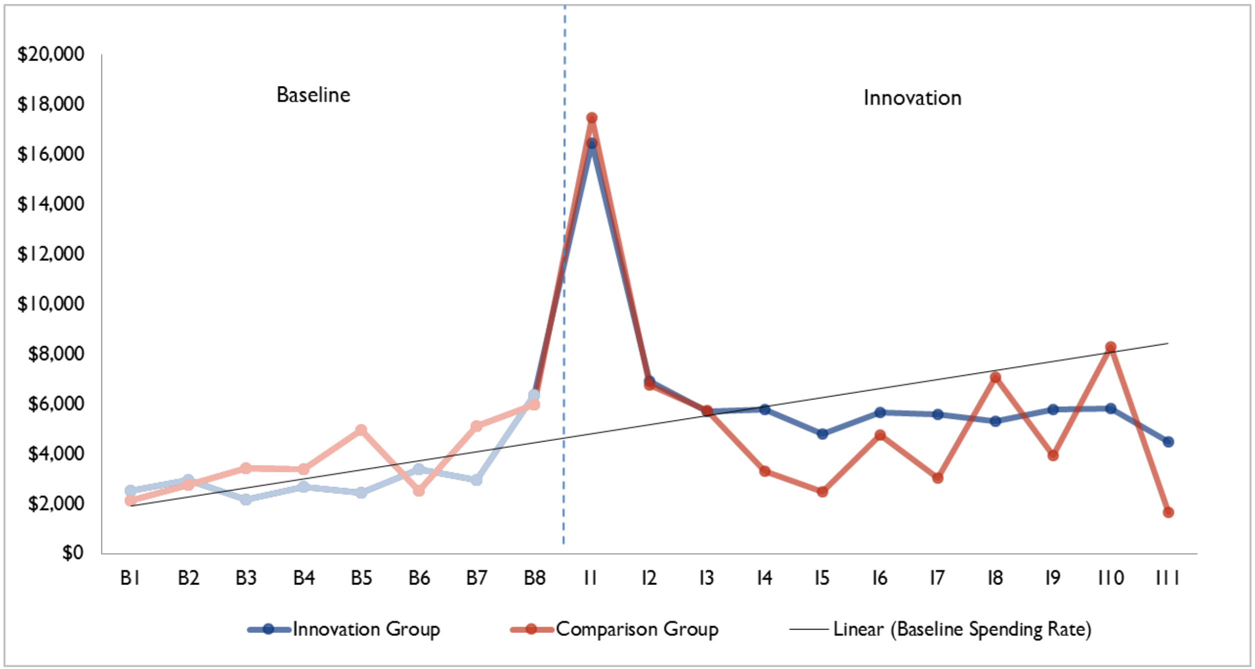
Table 9. Medicare Spending per Participant: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$2,507	$2,945	$2,180	$2,666	$2,458	$3,390	$2,942	$6,359	$16,464	$6,941	$5,713	$5,776	$4,811	$5,655	$5,603	$5,318	$5,780	$5,813	$4,490
Std dev	$6,913	$9,506	$4,556	$7,311	$6,045	$10,100	$7,418	$23,709	$22,966	$18,685	$12,527	$12,648	$11,320	$12,326	$12,151	$11,648	$14,947	$13,576	$11,774
Unique patients	224	227	229	234	246	251	259	262	268	265	257	223	198	170	143	116	90	70	53
Comparison Group																			
Spending rate	$2,139	$2,778	$3,446	$3,394	$4,947	$2,526	$5,111	$5,979	$17,493	$6,759	$5,764	$3,323	$2,484	$4,753	$3,021	$7,084	$3,938	$8,282	$1,645
Std dev	$5,119	$8,186	$9,251	$9,534	$13,204	$7,139	$15,240	$13,619	$21,265	$11,654	$10,612	$5,342	$4,236	$8,467	$4,172	$14,600	$6,837	$14,942	$2,161
Unique patients	84	86	87	89	90	94	95	97	97	96	91	69	58	47	40	35	29	20	11
Savings per Patient																			
	−$368	−$167	$1,266	$728	$2,489	−$864	$2,169	−$381	$1,029	−$182	$52	−$2,453	−$2,327	−$902	−$2,582	$1,766	−$1,843	$2,469	−$2,845

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.

Figure 1. Medicare Spending per Participant: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.4.2 Regression Results

We present the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $1,162 (90% CI: −$537, $2,860). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence. Note that we only report 10 innovation quarters for uniformity across all outcomes, as no quarterly interaction effect is possible in the case of inpatient visits because no individuals in the comparison group have a hospital admission in that last quarter.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 2*** illustrates these quarterly difference-in-differences estimates. Although we found three quarters of statistically significant differences in spending between the innovation and comparison groups that indicated greater spending by innovation participants (out of 10 innovation quarters), these differences could reflect sample characteristics rather than innovation-driven outcomes.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	−$513	$2,586	0.843
I2	$742	$1,667	0.657
I3	$459	$1,508	0.761
I4	$3,019	$1,274	0.018
I5	$2,898	$1,139	0.011
I6	$1,388	$1,637	0.397
I7	$3,143	$1,376	0.023
I8	−$1,164	$2,839	0.682
I9	$2,582	$2,063	0.212
I10	−$1,655	$3,849	0.667
Overall average	$1,162	$1,030	0.260
Overall aggregate	$2,090,905	$1,854,462	0.260
Overall aggregate (IY1)	$850,249	$1,227,293	0.489
Overall aggregate (IY2)	$1,124,148	$717,563	0.118
Overall aggregate (IY3)	$116,507	$366,868	0.751

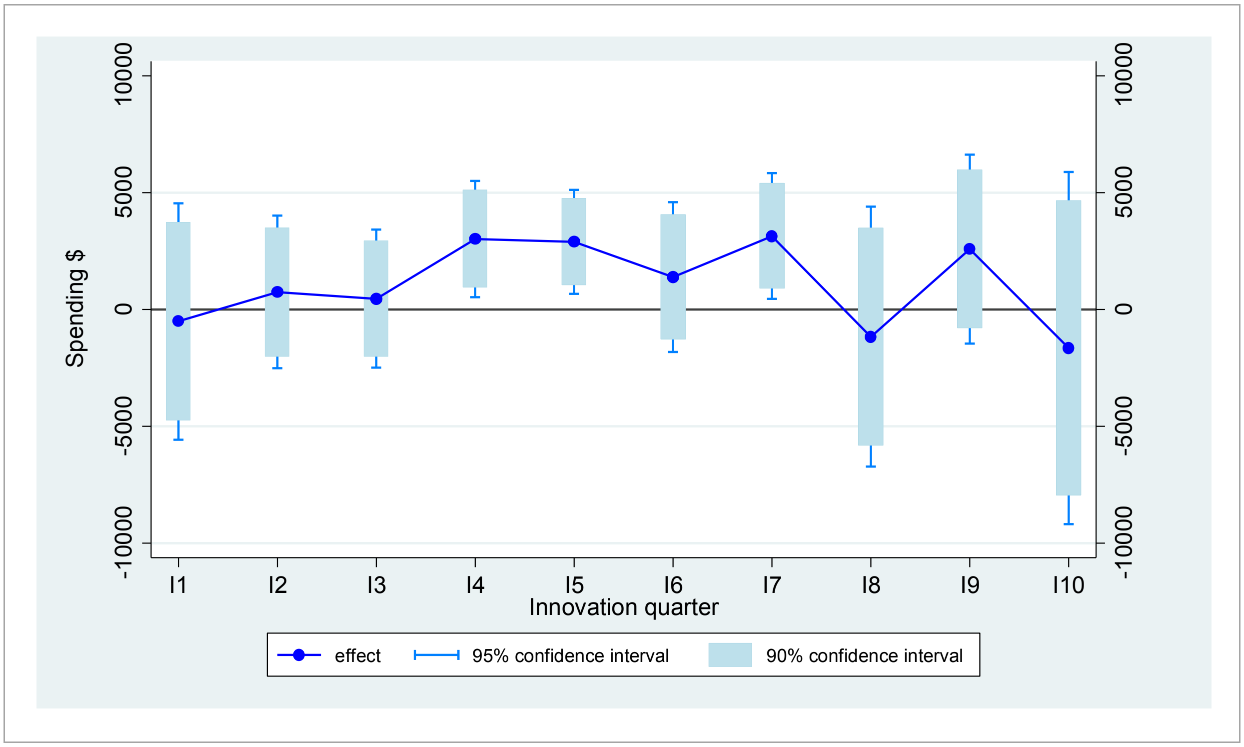
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, the number of chronic conditions, and dummy variables denoting the cohort of enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Prosser = Prosser Public Hospital District.

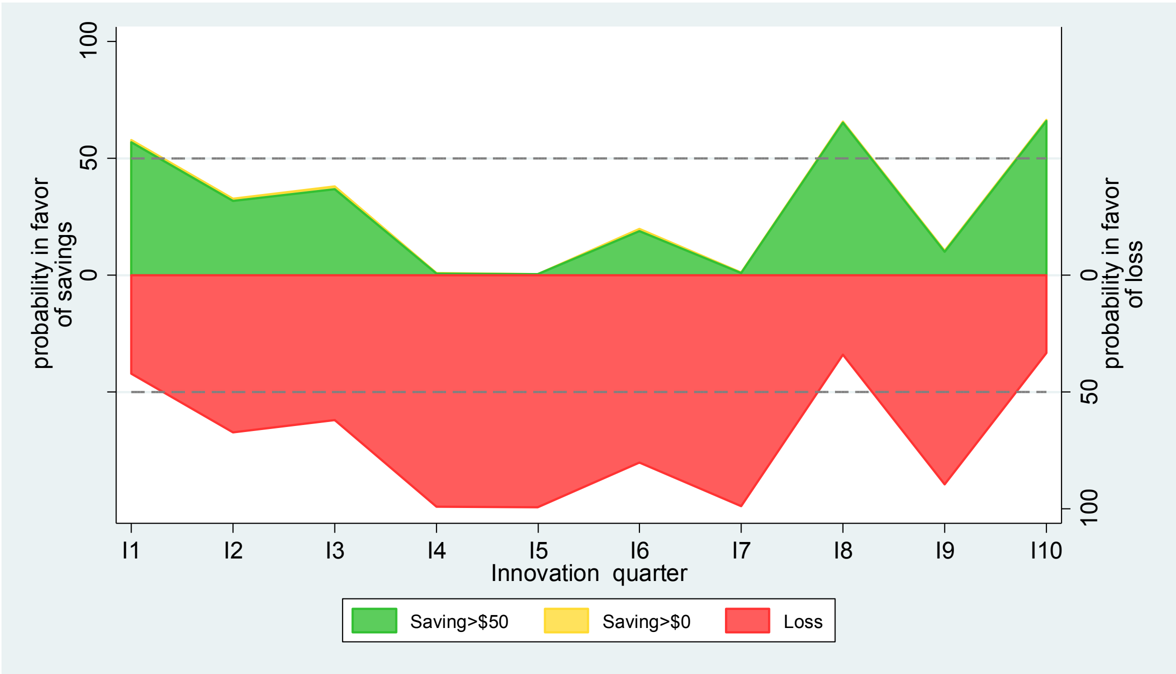
Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; Prosser = Prosser Public Hospital District.

Figure 3 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Results show that in seven out of 10 quarters the probability of a loss is more likely than the probability of savings.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 4***. The pattern of inpatient admissions closely mirrors the pattern of spending. After the I1 spike, the inpatient admissions rate among nonparticipants and individuals who had CP visits reverts toward baseline levels.

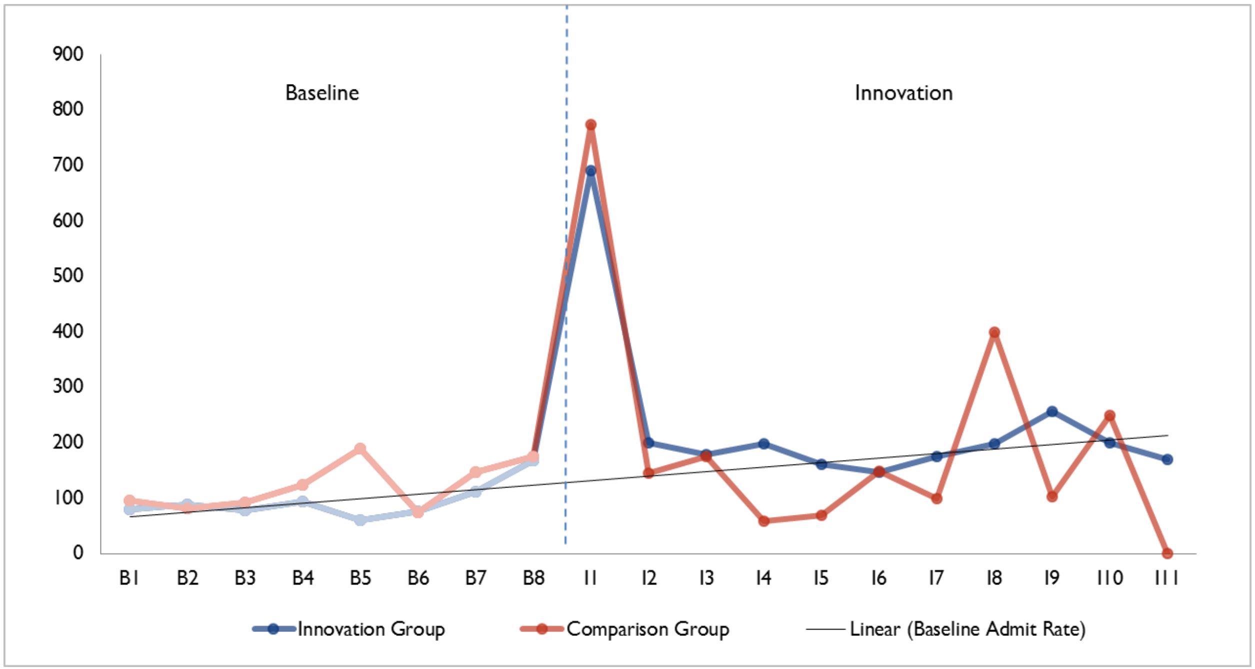
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	80	88	79	94	61	76	112	168	690	200	179	197	162	147	175	198	256	200	170
Std dev	317	353	314	392	286	306	496	481	813	523	550	498	526	469	640	757	797	524	863
Unique patients	224	227	229	234	246	251	259	262	268	265	257	223	198	170	143	116	90	70	53
Comparison Group																			
Admit rate	95	81	92	124	189	74	147	175	773	146	176	58	69	149	100	400	103	250	0
Std dev	590	348	326	419	594	300	502	498	819	408	459	234	253	356	300	725	305	536	0
Weighted patients	84	86	87	89	90	94	95	97	97	96	91	69	58	47	40	35	29	20	11
Innovation − Comparison Rate																			
	−15	7	−13	−30	−128	1	−35	−7	−83	54	3	139	93	−2	75	−202	152	−50	170

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.5.2 *Regression Results*

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 73 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 24, 123).

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 12*** presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Four of the 10 quarterly effects show a statistically significant higher number of inpatient admissions among the innovation group at the 10 percent level.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	96	162	0.551
I2	81	50	0.105
I3	35	54	0.519
I4	150	42	0.000
I5	108	44	0.014
I6	10	67	0.878
I7	102	60	0.094
I8	−120	126	0.342
I9	188	85	0.030
I10	22	121	0.856
Overall average	73	30	0.015
Overall aggregate	132	54	0.015
Overall aggregate (IY1)	90	48	0.063
Overall aggregate (IY2)	24	22	0.285
Overall aggregate (IY3)	18	11	0.108

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, the number of chronic conditions, and dummy variables denoting the cohort of enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups. The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Prosser = Prosser Public Hospital District.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 5***. Readmissions rates are highly volatile, even after combining the three eligible cohorts due to a relatively low number of index admissions.

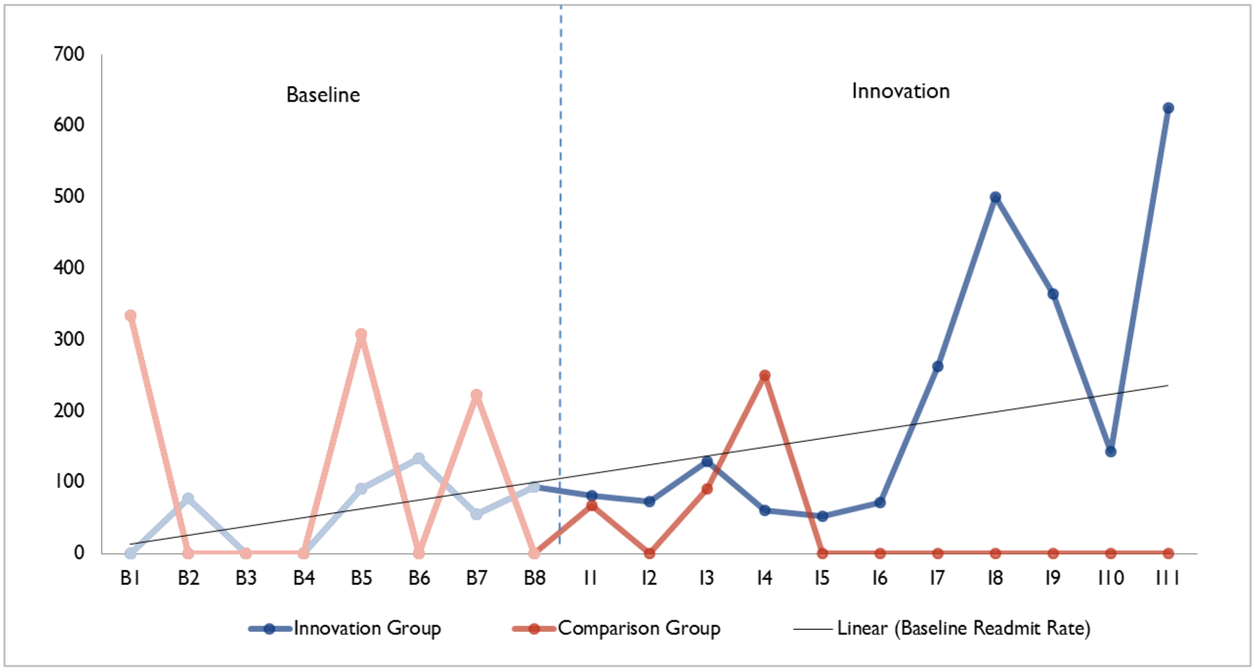
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	0	77	0	0	91	133	56	94	81	73	129	61	53	71	263	500	364	143	625
Std dev	0	267	0	0	288	340	229	292	273	260	335	239	223	258	440	500	481	350	484
Total admissions	17	13	17	15	11	15	18	32	148	41	31	33	19	14	19	16	11	7	8
Comparison Group																			
Readmit rate	333	0	0	0	308	0	222	0	68	0	91	250	0	0	0	0	0	0	0
Std dev	471	0	0	0	462	0	416	0	251	0	288	433	0	0	0	0	0	0	0
Total admissions	3	4	3	5	13	4	9	14	59	10	11	4	4	4	2	9	2	1	0
Innovation − Comparison Rate																			
	−333	77	0	0	−217	133	−167	94	13	73	38	−189	53	71	263	500	364	143	625

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; B1 = Baseline Q1; Prosser = Prosser Public Hospital District.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.6.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is 97 per 1,000 inpatient admissions (9.7 percentage points), indicating that the innovation-comparison difference is 9.7 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 58, 137).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Inpatient Admissions: Prosser

Quarter	Coefficient	Standard Error	P-Values
Overall average	97	24	< 0.001
Overall aggregate	33	8	< 0.001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression model regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, dual eligibility, the number of chronic conditions, and dummy variables denoting the cohort of enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Prosser = Prosser Public Hospital District.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 6.*** ED visits for participants and nonparticipants are similar throughout the baseline and innovation periods. These results are expected because the ED visit rate is the eligibility criterion in Cohorts 1 and 3.

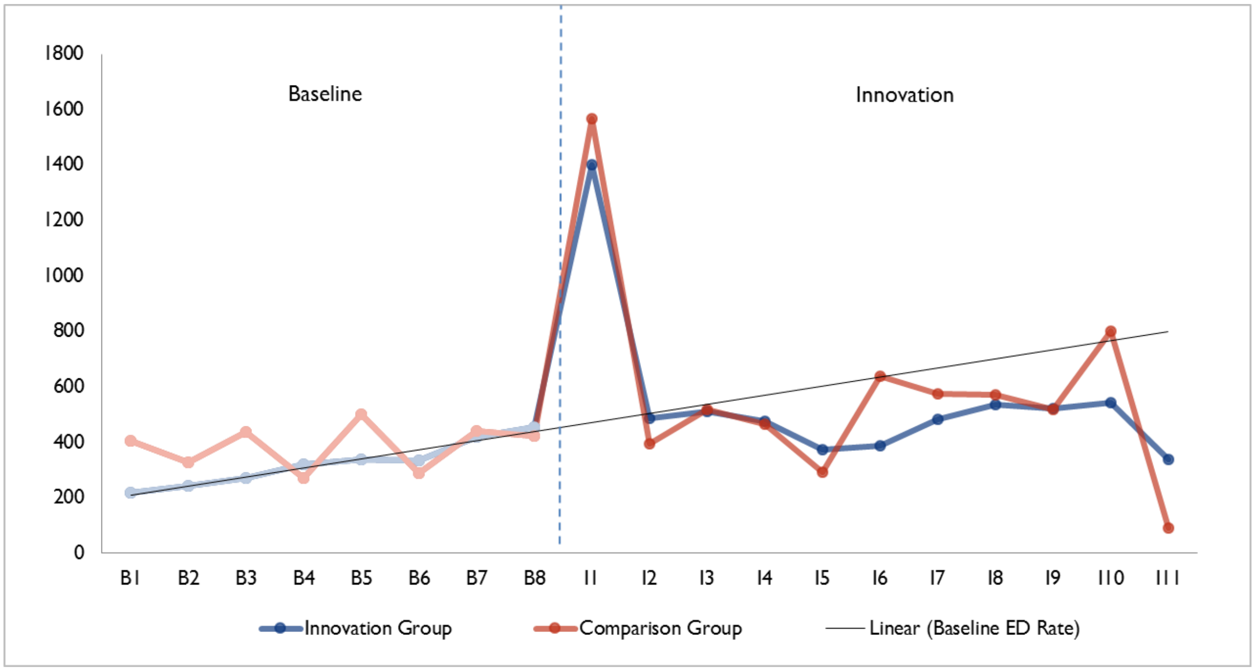
Table 15. ED Visits per 1,000 Medicare Participants: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	219	242	271	321	337	335	421	454	1,403	487	510	475	374	388	483	534	522	543	340
Std dev	629	586	793	755	892	759	1,467	1,038	1,701	1,030	985	869	844	771	1,215	1,017	1,192	1,073	807
Unique patients	224	227	229	234	246	251	259	262	268	265	257	223	198	170	143	116	90	70	53
Comparison Group																			
ED rate	405	326	437	270	500	287	442	423	1,567	396	516	464	293	638	575	571	517	800	91
Std dev	920	774	1,246	635	1,368	598	1,218	988	1,825	1,000	1,109	1,106	817	1,206	958	1,195	1,703	2,353	302
Weighted patients	84	86	87	89	90	94	95	97	97	96	91	69	58	47	40	35	29	20	11
Innovation − Comparison Rate																			
	−186	−83	−166	51	−163	47	−21	32	−164	91	−7	12	81	−250	−92	−37	5	−257	249

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.

Figure 6. ED Visits per 1,000 Medicare Participants: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; Prosser = Prosser Public Hospital District.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 88 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant at the 10 percent level (90% CI: 0, 177); however, it is on the margin of significance (p-value = 0.101). In addition to the average effect over the innovation period, we present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. Estimates for ED visits are positive, representing an increase, in nine out of 10 quarters; however, the quarterly estimates are never statistically significant.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicare Participants: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	117	264	0.659
I2	131	90	0.149
I3	74	108	0.490
I4	129	109	0.240
I5	140	92	0.128
I6	-108	151	0.476
I7	43	154	0.782
I8	92	168	0.585
I9	179	171	0.298
I10	38	251	0.881
Overall average	88	54	0.101
Overall aggregate	159	97	0.101
Overall aggregate (IY1)	114	83	0.172
Overall aggregate (IY2)	26	43	0.544
Overall aggregate (IY3)	19	23	0.423

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, the number of chronic conditions, and dummy variables denoting the cohort of enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups. The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Prosser = Prosser Public Hospital District.

2.8 Discussion: Medicare Results

There were no statistically significant changes in spending; however, inpatient stays, readmissions, and ED visits were higher in the innovation group. Effects on inpatient visits, readmissions, and ED visits appear to be driven by a relatively small number of high users.

Enrollment in the program is complete, but the number of observations in the sample (268) is insufficient to perform separate analyses for the three Prosser cohorts, and power is insufficient to investigate interaction terms between the innovation effect and each cohort to determine whether the CPP had different impacts across different cohorts.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent approximately 26 percent of the overall population reached by the innovation. In addition, the small sample size can hinder detection of changes in spending.

2.9 Medicaid Comparison Group

In the comparison group, we included patients who were enrolled prior to December 31, 2013. The sample was composed of 130 fee-for-service Medicaid beneficiaries who chose to receive a CP visit and 45 fee-for-service Medicaid beneficiaries who were offered CP visits but did not participate in the innovation. None opted out of the program in the first two quarters; therefore, no data are presented for quarters seven and eight in the group. We do not use PSM matching in this analysis because doing so halves our sample. This sharp decline happens first because of lack of Medicaid eligibility in the quarter prior to participation and second because of a lack of comparison beneficiaries with a propensity score within the caliper.

2.9.1 Descriptive Results

Table 17 reports Medicaid spending per patient in the eight quarters before and the eight quarters after enrolling in the innovation. Savings per patient reflect the spending differential between those who chose to participate and those who did not participate, not controlling for other factors. ***Figure 7*** illustrates the Medicaid spending per beneficiary in Table 17 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. On average, participants have higher spending in baseline quarters than nonparticipants. In innovation quarters, uncertainty in the estimated averages increases as the number of people included in each innovation quarter decreases.

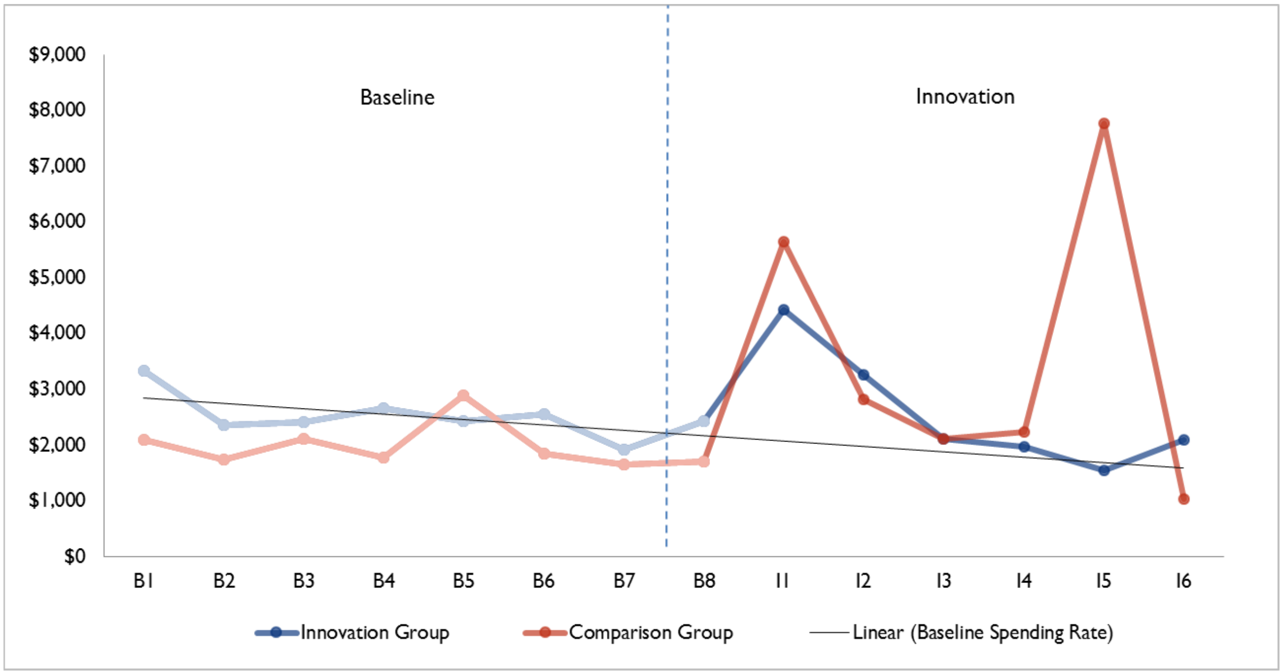
Table 17. Medicaid Spending per Participant: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Spending rate	$3,327	$2,353	$2,413	$2,659	$2,429	$2,561	$1,925	$2,429	$4,436	$3,265	$2,120	$1,971	$1,553	$2,089	$1,602	$1,685
Std dev	$7,026	$2,895	$2,946	$3,225	$2,995	$3,445	$2,474	$3,599	$8,190	$7,480	$3,485	$5,782	$2,156	$2,389	$2,045	$1,767
Unique patients	76	72	75	79	83	86	85	99	130	100	78	59	41	35	28	12
Comparison Group																
Spending rate	$2,087	$1,739	$2,105	$1,784	$2,886	$1,845	$1,658	$1,708	$5,651	$2,824	$2,105	$2,236	$7,780	$1,040	—	—
Std dev	$4,428	$3,776	$5,364	$3,745	$5,275	$3,891	$3,776	$4,162	$15,562	$8,021	$4,686	$4,390	$24,445	$2,202	—	—
Weighted patients	22	22	26	27	26	31	32	31	45	31	28	25	14	11	—	—
Savings per Patient																
	−$1,241	−$615	−$309	−$875	$457	−$715	−$267	−$721	$1,214	−$441	−$15	$265	$6,227	−$1,049	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.
— = not applicable;

Figure 7. Medicaid Spending per Participant: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.9.2 *Regression Results*

We present the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$986 (90% CI: −$2,707, $735). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

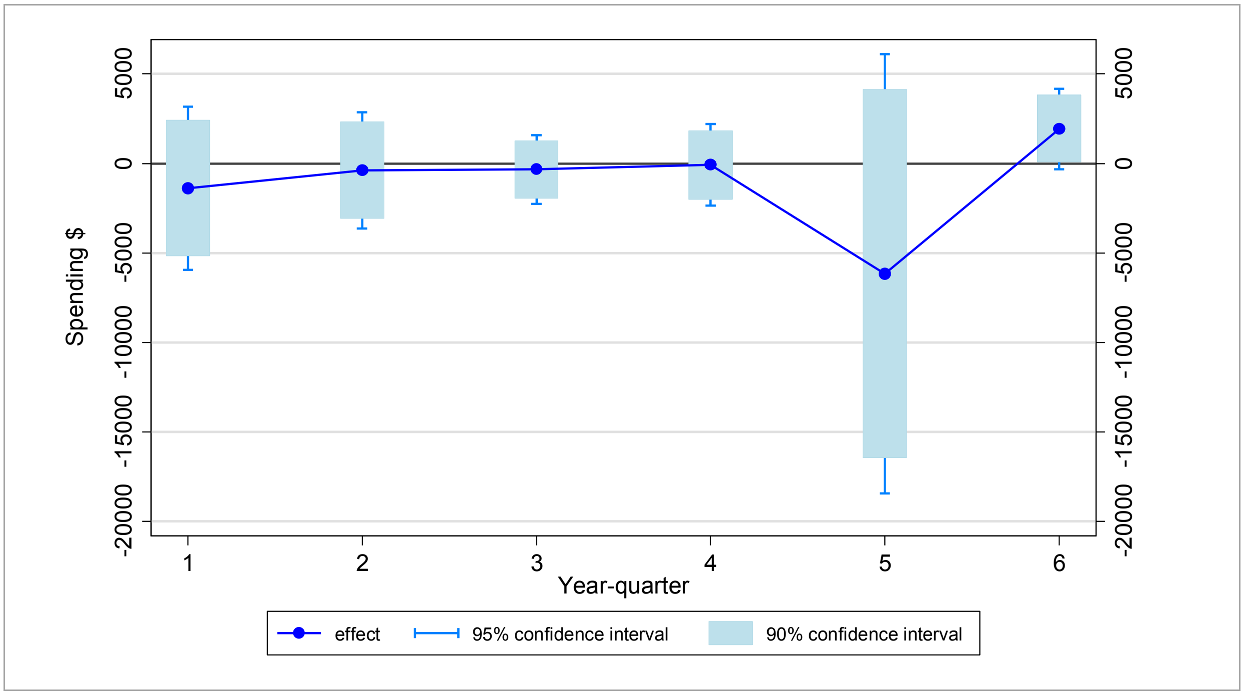
In addition to the average effect over the innovation period, we present quarterly effects. ***Table 18*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 8*** illustrates these quarterly difference-in-differences estimates. Although five out of six quarters show savings, none of these quarterly estimates are statistically significant. In I6, the estimated coefficient is positive (indicating losses) and statistically significant; however, the smaller sample size in I6 makes the estimate less reliable than other quarters' estimates.

Table 18. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	−$1,386	$2,322	0.551
I2	−$397	$1,658	0.811
I3	−$341	$977	0.727
I4	−$83	$1,166	0.943
I5	−$6,171	$6,260	0.324
I6	$1,929	$1,152	0.094
Overall average	−$986	$1,045	0.346
Overall aggregate	−$436,828	$463,128	0.346
Overall aggregate (IY1)	−$251,331	$374,513	0.502
Overall aggregate (IY2)	−$185,498	$260,706	0.477

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, the number of chronic conditions, and dummy variables denoting the cohort of enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Prosser = Prosser Public Hospital District.

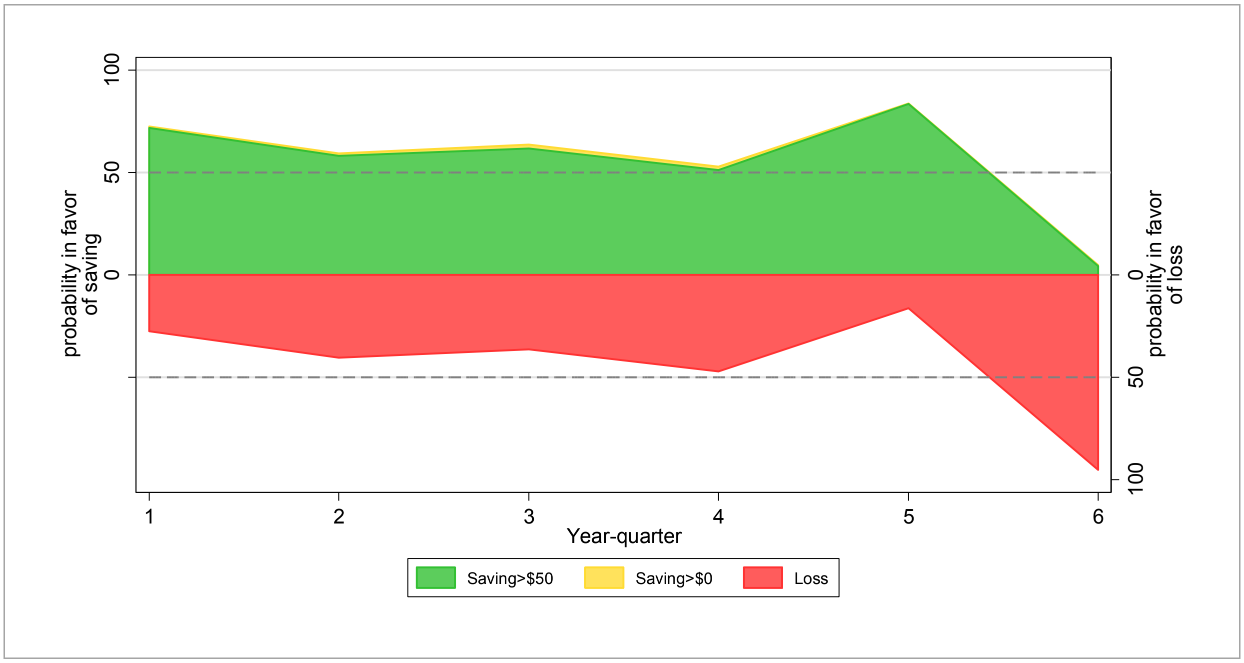
Figure 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
OLS = ordinary least squares; Prosser = Prosser Public Hospital District.

Figure 9 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Innovation quarters 1 through 5 show a higher probability of savings, while quarter 6 shows a higher probability of losses.

Figure 9. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.10 Medicaid Inpatient Admissions

2.10.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 19*** and ***Figure 10***. Both participants and nonparticipants have higher inpatient visits in the first intervention quarter. This is by construction part of their eligibility criteria. Individuals are more likely to self-select in the program if they have had an inpatient admission in the same quarter relative to those who were not hospitalized.

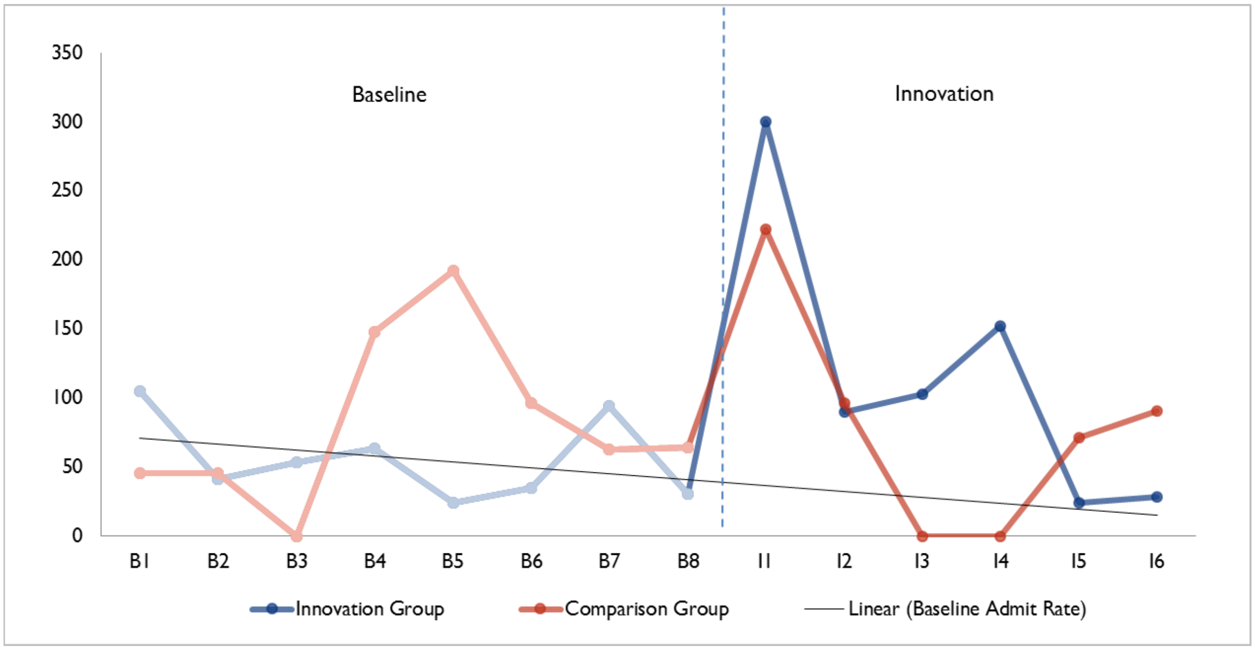
Table 19. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Admit rate	105	42	53	63	24	35	94	30	300	90	103	153	24	29	71	250
Std dev	309	201	226	245	154	185	294	172	523	379	414	582	156	169	262	452
Unique patients	76	72	75	79	83	86	85	99	130	100	78	59	41	35	28	12
Comparison Group																
Admit rate	45	45	0	148	192	97	63	65	222	97	0	0	71	91	—	—
Std dev	213	213	0	362	491	301	246	250	420	301	0	0	267	302	—	—
Weighted patients	22	22	26	27	26	31	32	31	45	31	28	25	14	11	—	—
Innovation − Comparison Rate																
	60	−4	53	−85	−168	−62	32	−34	78	−7	103	153	−47	−62	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.
— = not applicable.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.10.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 92 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 47, 138). The increase in spending may be due to Cohort 2, who had high costs in I1 because they had surgery. There were fewer comparison individuals who had high costs from surgery in I1 because individuals in Cohort 2 were less likely to opt out of the innovation.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 20*** presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. After the first innovation year, participants' higher rate of inpatient admissions decreased and were comparable to nonparticipants' rate. In the first year, the innovation group had higher admissions than the comparison group for three of the four quarters, which may have influenced the result—in addition, in the second year, only two quarters of data were available.

Table 20. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Medicaid Participants: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	180	75	0.017
I2	22	53	0.677
I3	102	37	0.007
I4	151	52	0.005
I5	−21	54	0.698
I6	−25	64	0.698
Overall average	92	28	0.001
Overall aggregate	41	12	0.001
Overall aggregate (IY1)	43	12	0.000
Overall aggregate (IY2)	−2	3	0.582

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and dummy variables denoting the eligibility cohort. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Prosser = Prosser Public Hospital District.

2.11 Medicaid Unplanned Readmissions

2.11.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 21*** and ***Figure 11***. No individual in the comparison group had an unplanned readmission; consequently, no regression estimates are possible because of the small sample size and low number of index admissions.

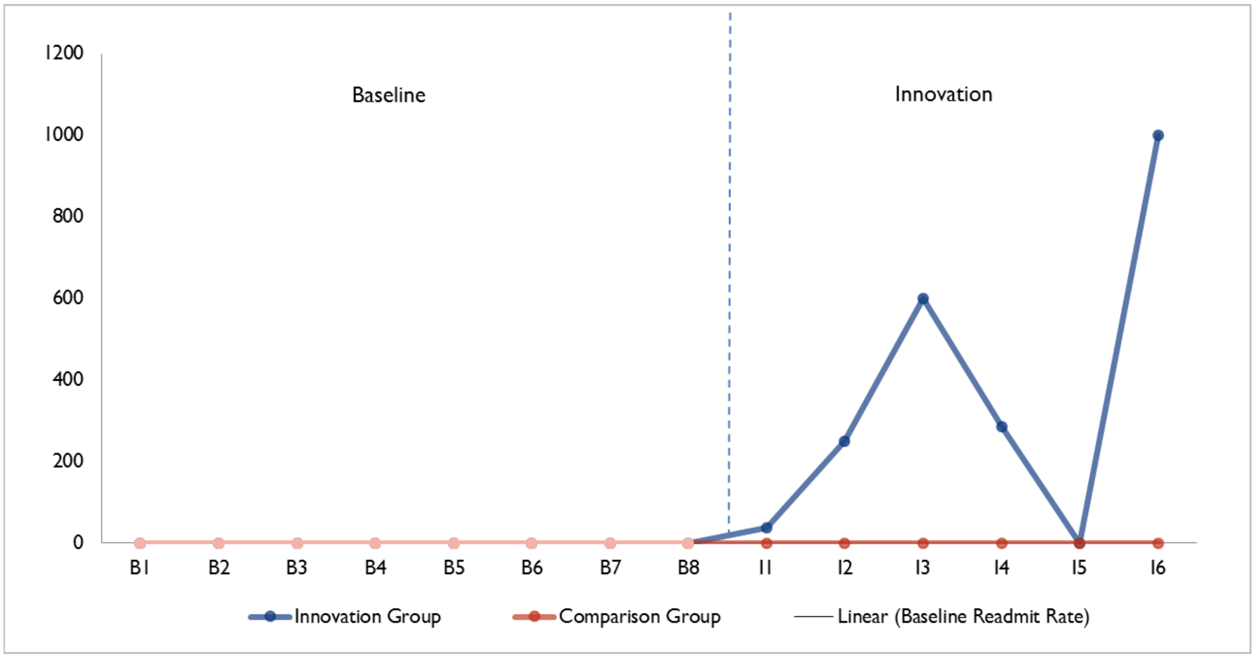
Table 21. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Readmit rate	0	0	0	0	0	0	0	0	37	250	600	286	0	1,000	0	0
Std dev	0	0	0	0	0	0	0	0	189	433	490	452	0	0	0	0
Total admissions	5	2	4	4	2	1	6	2	27	8	5	7	1	1	2	1
Comparison Group																
Readmit rate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Std dev	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Total admissions	1	1	0	4	4	2	2	1	5	2	0	0	0	0	—	—
Innovation − Comparison Rate																
	0	0	0	0	0	0	0	0	37	250	600	286	0	1,000	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.
— = not available.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Prosser = Prosser Public Hospital District.

2.12 Medicaid Emergency Department Visits

2.12.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 22*** and ***Figure 12.*** ED visit rates are similar for the innovation and comparison groups.

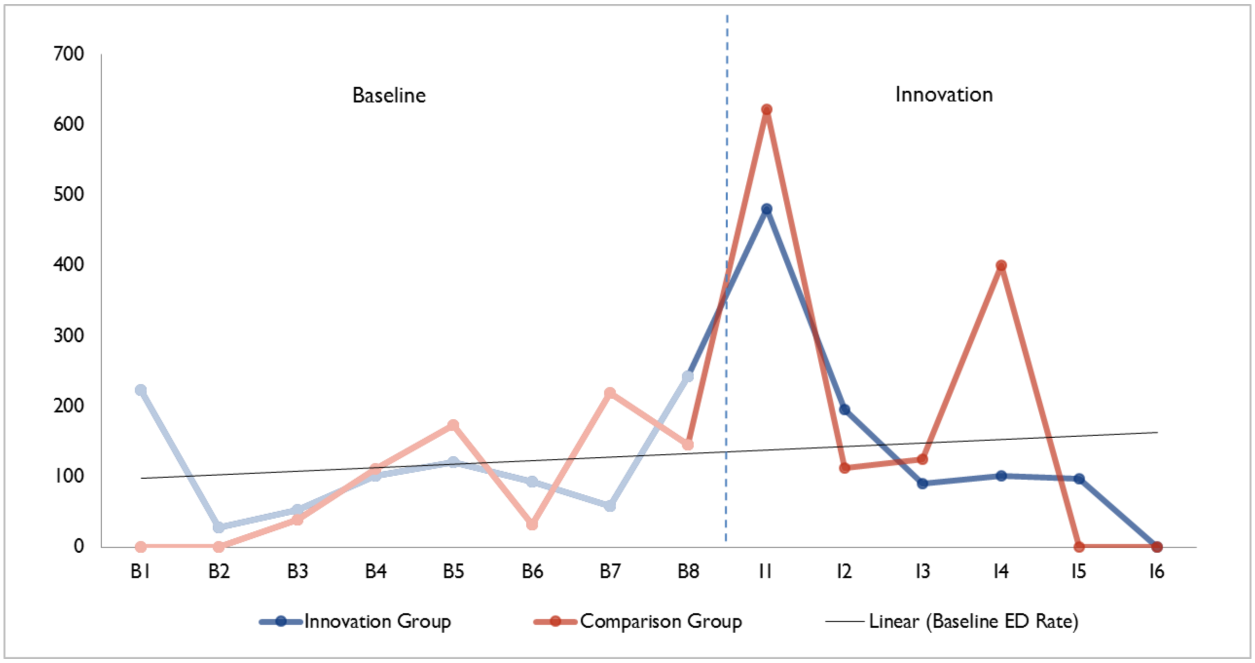
Table 22. ED Visits per 1,000 Medicaid Participants: Prosser

Awardee Number: 1C1CMS331036
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
ED rate	224	28	53	101	120	93	59	242	481	195	90	102	98	0	36	83
Std dev	1,127	236	364	691	593	545	357	1,378	1,502	813	793	662	490	0	189	289
Unique patients	76	72	75	79	83	86	85	99	130	100	78	59	41	35	28	12
Comparison Group																
ED rate	0	0	38	111	173	32	219	145	622	113	125	400	0	0	—	—
Std dev	0	0	196	577	647	180	1,070	808	1,800	442	376	1,323	0	0	—	—
Weighted patients	22	22	26	27	26	31	32	31	45	31	28	25	14	11	—	—
Innovation − Comparison Rate																
	224	28	15	−10	−53	61	−160	97	−141	82	−35	−298	98	0	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.
— = not available.

Figure 12. ED Visits per 1,000 Medicaid Participants: Prosser



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ED = emergency department; Prosser = Prosser Public Hospital District.

2.12.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 40 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −172, 92).

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 23*** presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. Four of the five quarterly estimates are negative and not statistically significant. The estimate from I6 is zero because no ED visits occurred in the innovation or comparison groups. In addition, aggregate and annual effects are not statistically significant.

Table 23. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicaid Participants: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	−6	168	0.973
I2	−133	250	0.597
I3	−55	137	0.690
I4	−33	113	0.769
I5	61	43	0.168
I6	0	0	0.000
Overall average	−40	80	0.617
Overall aggregate	−18	36	0.617
Overall aggregate (IY1)	−20	36	0.569
Overall aggregate (IY2)	2	2	0.165

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial count model regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and dummy variables indicating cohort eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average innovation effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Prosser = Prosser Public Hospital District.

2.13 Discussion: Medicaid Results

Because of the small sample size (99 people with at least one baseline quarter) available for regression, we were unable to conduct propensity score matching. While the data replicate the spikes in I1 for both participants and nonparticipants, a major caveat of the Medicaid results is that they do not control for selection into the sample or use interaction terms to denote treatment effect by cohorts. The only statistically significant effect is higher inpatient admissions, but this is likely to be a data selection construct because individuals in Cohort 2 are more likely to have a hospitalization and less likely to opt out from CP services than individuals in other cohorts. A more general caveat is that the results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries who we were able to match with the identifiers provided by the site. These beneficiaries represent 13 percent of the overall population reached by the innovation. In addition, the small sample size can hinder detection of changes in spending.

2.14 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

Prosser submitted data to RTI that are current through June 2015. ***Table 24*** lists the awardee-specific outcome measures selected for the innovation's evaluation, with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for all of these measures are included in this annual report.

Table 24. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Coordinated care	Percentage of patients who:		
		make follow-up appointments,	Data received from Prosser	Yes
		fill their prescriptions, and	Data received from Prosser	Yes
		understand their discharge instructions from beginning until end.	Data received from Prosser	Yes

Prosser = Prosser Public Hospital District.

2.15 Clinical Effectiveness: Coordinated Care

Patients were asked to complete an assessment before and after their CP visit. This assessment included questions about whether patients were able to make their own PCP appointments, fill their own prescriptions, and understand their discharge instructions. The goal of the preassessment was to determine what services are needed during the CP visit, and the postassessment determined whether the patient believed the CP provided the services. We used these data to address the following evaluation question.

Evaluation Question

- To what extent has a CP visit increased the proportion of patients who (1) make their follow-up appointments, (2) fill prescriptions according to discharge instructions, and (3) understand their discharge instructions from beginning until end?

2.15.1 Descriptive Results

Table 25 includes the total percentage of patients who indicated "yes" on the postassessment as a percentage of those receiving the services at all (i.e., those indicating "no" on the preassessment). Although the majority of patients who received help reviewing their discharge instructions indicated that they understood their discharge instructions after the CP visit (92.5%), the majority of patients did not note a change in their ability to make PCP appointments or fill their prescriptions after the CP visit (46.7% and 28.6%, respectively).

Table 25. Number and Percentage of Patients Achieving Outcomes Based on Specific CP Services Provided: Prosser

CP Service	Total Number of Participants Receiving CP Service[1]	Total Number of Participants Post-CP Visit Achieving Outcome[2]	Percentage of Participants Receiving CP Service that Achieved Outcome Post-CP Visit
Help making PCP appointments	169	79	46.7
Help filling prescriptions	77	22	28.6
Review of discharge instructions	146	135	92.5
Total	286	183	64.0

Source: Patient-level data provided to RTI.
[1] Includes all patients who indicated "no" on the preassessment of activities (i.e., they had not made a PCP appointment, filled their prescription, and/or had not reviewed their discharge instructions) to be provided by CP.
[2] Includes all patients who indicated "yes" on the postassessment of activities (i.e., they made a PCP appointment, filled their prescription, and/or reviewed their discharge instructions) provided by CP.
CP = community paramedic; PCP = primary care provider; Prosser = Prosser Public Hospital District.

2.16 Discussion: Awardee-Specific Data

Overall, the majority of patients Prosser reached indicated that they did not need help with filling their prescriptions, making a PCP appointment, or reviewing their discharge instructions. Of those who indicated that they needed help filling their prescriptions during the preassessment, only about a third reported that the CP visit resulted in a filled prescription. Also, although some patients received the CP's help during the visit to make an appointment, slightly fewer than half noted that the visit resulted in an actual appointment after the CP visit.

Interestingly, many patients noted that they did not understand their discharge instructions before the CP visit, whereas the vast majority noted they did understand their instructions after the CP visit. The difference in following through with the three services may have occurred because the CP can easily explain the discharge instructions with the participant during the visit, whereas the other two services, making appointments and filling prescriptions, are more complex and rely on further interactions with the health care system, such as the PCP office or pharmacy. This finding is based on a small sample size (146 participants); therefore, we cannot conclude whether the innovation is affecting participants' understanding of instructions.

2.17 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 26*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from Prosser's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11/Q12 (January–June 2015) and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 26. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of patients referred to the CPP who had a CP visit within 7 days of discharge from Prosser (ED, observation, or inpatient admission) by cohort	Data received from Prosser
	Dose	Number and type(s) of contacts received by patients from CPs	Data received from Prosser
		Help with making follow-up appointment	Data received from Prosser
		Help with filling a prescription	Data received from Prosser
		Review discharge instructions	Data received from Prosser

CP = community paramedic; CPP = community paramedic program; ED = emergency department; FTE = full-time equivalent; Prosser = Prosser Public Hospital District; Q = quarter.
Q11 and Q12 cover January–June 2015.

2.18 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.18.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was fully staffed with 4.85 full-time equivalent (FTE) staff members. Three paramedics left the program during Q11, a relatively high turnover rate for the innovation in that reporting quarter. In Q12, Prosser hired five new paramedics to replace the three who resigned.

Project staff attributed the high turnover to lack of understanding the CP role. At Prosser, paramedics had multiple responsibilities beyond responding to 911 calls, and expectations for the CP role were often unclear or misinterpreted. To prevent future turnover, in the last round of hiring Prosser implemented a new interview strategy using a panel of emergency medical services (EMS) staff to conduct interviews and explain the innovation to potential new hires. The panel spent more time explaining the additional training and unique job responsibilities and work environment of CPs, and how they differed from regular paramedic duties. By explaining the CP's role in providing education, counseling, and social support—versus the traditional paramedic role in triage and patient transport—the innovation leadership could improve Prosser's ability to identify CPs who were interested in these nontraditional paramedic roles.

2.18.2 Skills, Knowledge, and Training

During the innovation, staff developed, implemented, and refined a comprehensive curriculum to train paramedics to become CPs and deliver at-home services that improve health outcomes and reduce ED and other unplanned visits. Since the program's inception, Prosser conducted three comprehensive certified CP training programs, providing 2,886 hours of training to f 41 paramedics (***Table 27***), which included individuals from other areas.

Table 27. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12 (January–June 2015)	500	5
Since inception	2,886	41

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

As the innovation unfolded and the project team learned more about the needs of CPs in the field, it effectively adapted the curriculum to improve CP training. The original curriculum developed for Prosser was not designed by paramedics. After the team first delivered the curriculum with its partner, Heritage University, participating paramedics suggested that the training needed to be more applied and better matched with the knowledge and skills of certified paramedics. In response, Prosser had two paramedics review the original curriculum. Prosser subsequently redesigned several sections to include more clinical practice and rotation in the field with Prosser's certified CPs, and enlisted experienced paramedics as lead trainers. The new curriculum included about 80 hours of ride time; classroom training focused on the types of patients (including types of medications and chronic illnesses) CPs are likely to see, and included observations of medical floor and ED discharges. Staff reported that the revised training program was more relevant and better able to meet the needs of paramedics. Staff plan to continually improve the curriculum based on feedback from training participants.

Not until after the training was redesigned with significant involvement of CPs did project leadership report a shift in job satisfaction and their support of the program. Project leadership, in hindsight, noted that they should have included CPs' involvement from the beginning of the innovation to help the innovation team establish roles, responsibilities, and training needs. Perhaps the most important factor was that engaging the CPs in the design of the curriculum gave them ownership of the innovation, which they did not have previously.

2.19 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

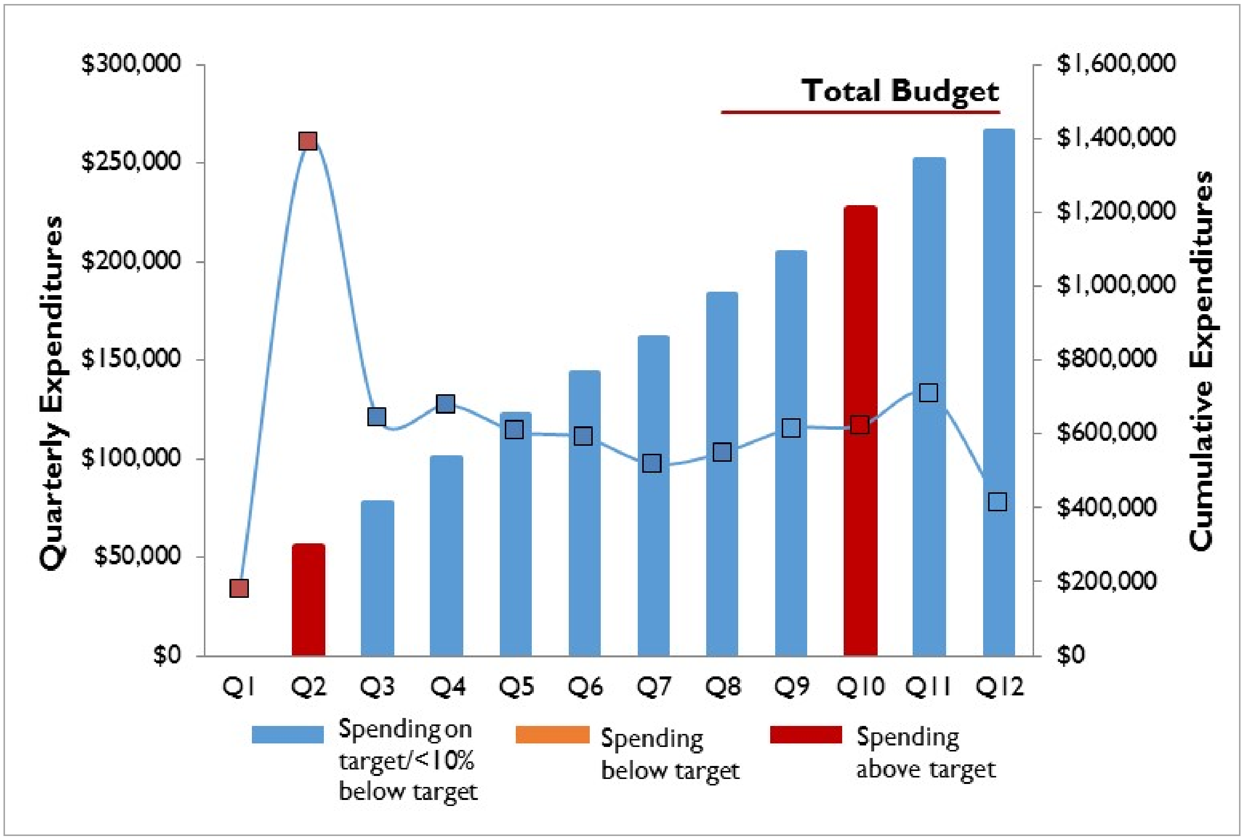
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.19.1 Award Execution

The annual report highlights the significance of Prosser's expenditure rates on implementation. As of June 2015 (Q12), Prosser spent 100 percent of its Year 3 budget and 96.6 percent of its total award (***Figure 13***). Prosser's spending deviated from target during the first few quarters of implementation, and then remained on target through almost all of the remaining quarters.

Figure 13. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.19.2 Leadership

For 2 years of the project, its leadership remained stable. The original project director was an experienced paramedic and director of EMS at Prosser and was a key champion of the project. He wrote the grant proposal and when it was awarded, gained the support of leadership within Prosser and the larger community. As the EMS manager for Prosser, he did not work full time on the innovation, and administrative and management tasks often fell to the nurse case manager and local evaluator. He viewed his primary role as promoting the innovation and obtaining buy-in from key stakeholders. Both the nurse case manager and local evaluator were only partially supported by the innovation, but stated that they understood that their role was to manage the reporting and administrative tasks, freeing the project director to focus on promoting the innovation among stakeholders.

The project director's resignation in February 2015 provided an opportunity to redefine leadership responsibilities of the nurse case manager and a new project director to better meet the needs of the innovation. The new project director focused his activities on managing staff and budget, and representing the program to the hospital management team, CEO, and Board. The nurse case manager took on an expanded role in patient case management, program promotion, CP training development, patient scheduling, data collection, and physician contact/follow-up. This reorganization improved leadership's ability to effectively manage and promote the innovation and ensure that all administrative and programmatic tasks were better integrated into the hospital structure.

Over the course of the innovation, project staff took steps to build support for the innovation both within the Prosser leadership and the larger community. Initially at Prosser, there was some skepticism about the innovation, largely due to a lack of awareness among hospital leadership and other providers regarding the program and how it would impact their work. The project director and other innovation staff spent considerable time early on reaching out one-on-one and through regular meetings with hospital departments to share information and answer questions. The project staff met regularly with the chief medical officer and CEO to keep them informed. They also held monthly steering committee meetings with hospital and community leadership, although it was difficult to engage hospital management to participate. Staff also developed a newsletter with innovation updates and disseminated it to all Prosser employees who interfaced with the program. The newsletter contained data on the number of visits completed, legislative updates, sustainability plans, interventions, and cost savings. Project staff reported receiving multiple positive emails from hospital and clinic staff about the newsletter. They planned to distribute the newsletter semiannually.

Throughout the project, innovation staff reported that they felt leadership supported their work and gave them autonomy—the freedom and flexibility to make improvements where necessary. Leadership support, in combination with the hospital's small size and close community, contributed to implementation of the innovation. Staff reported they could make changes midstream in training design and delivery and in referral and scheduling processes to improve implementation efforts without the layers of approval and oversight that a larger organization might have required. Innovation staff were given time to work on the project and were supported in their work. One interviewee stated, *"The leadership empowered the group to run the innovation with little decision making."*

2.19.3 Organizational Capacity

Prosser's capacity to deliver the innovation improved in several ways, First, Prosser created office space for the RN case manager within the EMS building, allowing for closer communication between and nurse case manager and CPs, as well as management of CP activities. In addition, Prosser staff developed a structure for tracking and referral that realigned the nurse case manager's responsibilities, enabling her to track patients more closely and ensure that new referrals were included in the scheduling system. Organizational capacity to serve more patients was also improved through the establishment of formal referral linkages with the Kadlec Regional Medical Center. This referral structure enabled innovation staff to effectively monitor referred patients from the medical center and determine if these patients received follow-up visits.

2.19.4 Innovation Adoption and Workflow Integration

Initially, none of the innovation staff were funded full-time on this innovation, creating time management challenges for project leaders with competing clinical and management responsibilities. In particular, the reorganization of the nurse case manager's responsibilities and focus on programmatic aspects beyond case management integrated her role into the program more effectively. She oversaw recruiting and training of CPs, training, tracking, and referral and reporting. She also acted as a clinical resource to CPs and liaison between the CPs and other departments in the hospital. Her expanded role and integration into the EMS team increased the organization's capacity to follow through on critical pieces of the innovation. For example, with more time devoted to tracking patients and accessing electronic medical records, the CP nurse manager could more quickly communicate with CPs to address issues and coordinate appropriate follow-up. In addition, relocating the case manager's office to the EMS building improved communication between the CP nurse manager and CPs. Colocation also increased the CP nurse manager's access to CP visit reports.

In Year 2, CPs were becoming more comfortable in their role and spent more time in the field. They learned from community members about other individuals who could benefit from a CP visit. As a result, CPs began making referrals directly for individuals in the community who met the criteria for the program and who may not have had regular contact with a health care provider. The CP nurse case manager gathered information on these referred patients from the paramedic log and entered it into the scheduling system. These individuals would then receive a call to schedule a CP appointment without needing to be seen first by a health care provider. Staff described this process as efficient, and noted that it ensured integration of the CP referrals into the scheduling system. In addition to the establishment of a referral linkage with Kadlec Regional Medical Center, the number of referrals increased as a result of CP direct referrals.

2.20 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.20.1 Innovation Reach

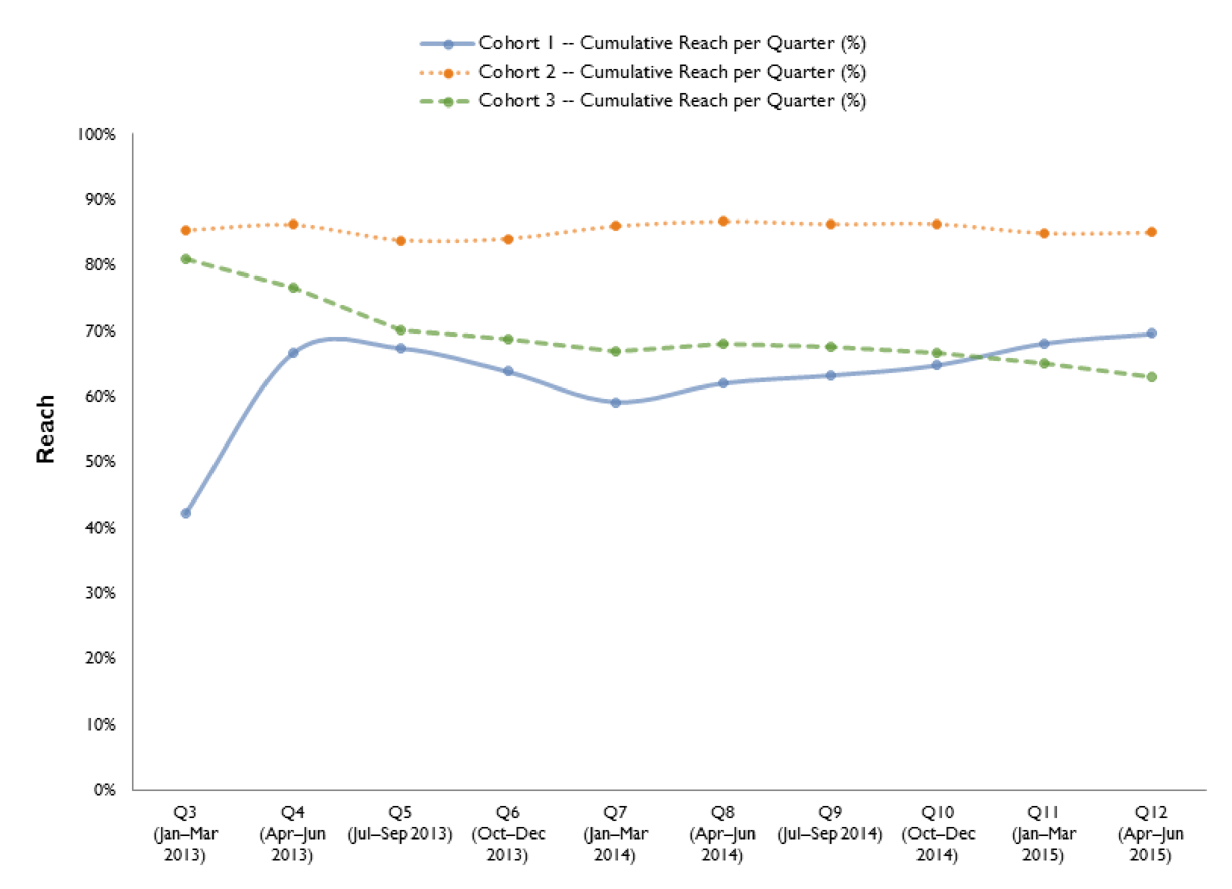
We define “reach” for Prosser as the percentage of unique patients referred to the program who ultimately: (1) enrolled in the program; and (2) received a CP visit within 7 days of discharge from Prosser Memorial Hospital (PMH) Medical Center. ***Figure 14*** shows reach by quarter since the program launch. Overall, through Q12, 1,016 total participants were enrolled across all three cohorts (including those with missing enrollment dates and cohorts). Prosser enrolled a total of 64 patients in Cohort 1, 482 patients in Cohort 2, and 465 patients in Cohort 3. Therefore, Prosser achieved its overall reach targets for each cohort: 50 (Cohort 1), 150 (Cohorts 2 and 3, respectively).

For Cohort 1, overall reach increased over time—from 42.1 percent in Q3 to 69.6 percent at the end of the innovation (Q12). One challenge in reaching Cohort 1 patients was their reluctance to give up their familiar source of care: the ED. Patients, particularly those older than age 75, had multiple chronic health issues that kept them sick; others were near death but not yet eligible for hospice care. In these instances, staff reported that a one-time follow-up visit did not keep these high-risk patients out of the hospital or ED and, as a result, was ineffective in reducing costs. Scheduling visits with patients once they left the hospital was also difficult, and likely influenced reach rates, especially among Cohort 1 patients, who were more transitory and difficult to reach via phone or in person than patients in other cohorts. In addition, these Cohort 1 patients reportedly often distrusted anyone visiting their home to provide follow-up services and did not respond to scheduling calls. EMS staff assisted with scheduling when needed, making repeated phone calls, with some reported success, although the process was not efficient and required considerable time and resources. Despite scheduling challenges, at the same time, project staff expanded the referral networks with agencies such as the Kadlec Regional Medical Center and allowed CPs themselves to refer patients to reach eligible individuals.

Reach was highest for Cohort 2, at 85 percent at the end of the innovation (Q12). Since inception, Cohort 2 reach was steady throughout the innovation, ranging from 83.8 percent in Q5 to 86.7 percent in Q8. Staff reported more success at reaching Cohort 2 patients, most likely because these patients had received surgery and were highly motivated to stay out of the hospital; they also may have been low utilizers of the health system.

Finally, Cohort 3 reach was highest in Q3 (80.9%), but decreased slightly over time to about two-thirds in Q12 (63.0%). Average reach rates were similar over time for patients in Cohort 1 (high utilizers) and Cohort 3 patients (those with chronic disease). For both cohorts, based on local demographic data, staff reported that the innovation was more successful in reaching individuals 50 to 75 years of age who, staff speculated, may have been more motivated than older patients to manage their diseases and avoid the ED. Cohort 3 individuals, particularly those 50 to 75 years of age, may have been motivated to receive a CP visit to better manage their diseases and avoid another trip to the ED.

Figure 14. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan-Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
●	Cohort 1—Cumulative reach per quarter (%)	42.1	66.7	67.4	63.8	59.2	62.0	63.2	64.8	68.1	69.6
	Cohort 1—Cumulative number enrolled	8	24	31	37	42	49	55	57	62	64
●	Cohort 2—Cumulative reach per quarter (%)	85.4	86.2	83.8	84.0	86.0	86.7	86.3	86.4	84.9	85.0
	Cohort 2—Cumulative number enrolled	35	75	119	179	234	288	322	374	427	482
●	Cohort 3—Cumulative reach per quarter (%)	80.9	76.6	70.2	68.7	67.0	67.9	67.7	66.6	65.0	63.0
	Cohort 3—Cumulative number enrolled	55	105	134	158	207	248	308	371	418	465

Source: Patient-level data provided to RTI.
Note: The sum of unique participants is 1,016 given that cohort indications are missing for three participants and enrollment date is missing for two participants.

2.20.2 Innovation Dose

Table 28 shows the total number of visits conducted by the CP per cohort. During each visit patients received targeted services from the CP. These services were: (1) help making PCP appointments, (2) help filling prescriptions, and (3) review of discharge instructions.

Table 28. Total Visits per Cohort

Cohort	Total Number of Visits
Cohort 1	125
Cohort 2	494
Cohort 3	547
Missing	3
Total	1,169

Source: Patient-level data provided to RTI.

Table 29 provides the number of targeted services provided across all CP visits among participants in all three cohorts. Since most participants only received one CP visit as part of the innovation, we define dose as the number of different services offered during that one visit. The most common of these CP services were assisting in making a PCP appointment (9.9% of visits) and reviewing hospital discharge instructions (8.6% of visits). Only 2.3 percent of visits included all three services. Overall, 27.3 percent of all 1,169 CP visits included at least one CP service. The 72.7 percent of patients who did not receive a service indicated that they had already had completed or received one of the offered services. The percentage of CP visits in which a service was provided decreased slightly from the 29.3 percent reported in the last annual report (2015) to 27.3 percent in this annual report (2016).

Although less than a third of patients received a specific service during the CP visit, the CP visit alone may have reassured patients that they were on the right track for follow-up care. The CP visit reminded them to follow through on their PCP appointment, to fill prescriptions, and to review their discharge information, even if they did not need these services from the CP at the time of the visit (which, in turn, could prevent further ED and hospital visits).

Table 29. Number and Types of Services Provided to Participants across All Cohorts

CP Specific Services[1]	Number of Services Provided across CP Visits[2]	Percentage of CP Visits in Which a Specific Service Was Provided
Help making PCP appointments	116	9.9
Help filling prescriptions	26	2.2
Review of discharge instructions	101	8.6
Help making PCP appointments and help filling prescriptions	20	1.7
Help making PCP appointments and review of discharge instructions	23	2.0
Help filling prescriptions and review of discharge instructions	6	0.6
All three services	27	2.3
Needs assessed but no service indicated	850	72.7
Total	1,169	100.0

Source: Patient-level data provided to RTI.
[1] Includes all participants who indicated “no” on the preassessment of activities to be provided by CP.
[2] Includes total number of services provided across all CP visits.
CP = community paramedic; PCP = primary care provider.

2.21 Qualitative Findings: Sustainability

In June 2015, Prosser approved a budget to continue essential elements of the CP innovation beyond the project period. In addition, the project staff and organizational leaders continued to look for other avenues to support the program through commercial insurers, private hospitals, foundations, and federal agencies.

PMH applied for but did not receive a Health Resources and Services Administration (HRSA) Rural Health Care Services Outreach Grant that PMH planned to use to extend the CP service area to patients who were discharged from larger hospitals in the region. The CEO at Prosser plans instead to ask leaders at Yakima and Kadlec Regional Hospitals to fund expansion of the program to those areas. As of this report, we have not been informed if this request was made.

Hospital leadership also worked to sustain the program by seeking reimbursement for CP services from insurance providers. The chief financial officer discussed the CP program with Prosser’s health insurance providers in the annual contract negotiations. The discussions were reportedly well received, although no signed commitments were made. Prosser has a verbal agreement from one health insurance provider to pay $100 per visit to partially reimburse CP visit costs to the patients.

Support for and interest in the innovation beyond the Prosser community and the state grew throughout implementation. Project staff responded to numerous requests for program information from interested agencies in Washington and Oregon. Project staff spent considerable time talking one-on-one to interested individuals, attending face-to-face meetings, and presenting at health conferences. They also presented information about the CPP and its effectiveness to the Washington State Legislative

Health and Wellness Committee, which is interested in modeling a state program after the CPP. In April 2015, the Washington State Hospital Association) used the CP innovation as an example to sponsor legislation that now promotes community paramedicine as part of the paramedic scope of practice with oversight of CPPs from the Department of Health.

Finally, with recent legislative changes and possible approval of CP as a professional job title with the Washington Department of Health, the CP innovation may get more recognition at the state level, which may lead to greater support from funding agencies or insurance providers. The Washington Department of Health is currently creating requirements and standards for a CP/health worker program geared toward public health agencies. Prosser staff continues discussions with the state as they work on these standards, and hopes that CP programs will be supported in various settings in the future.

2.22 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing Prosser as well as accomplishments to date. In this section, we assess Prosser's progress on achieving HCIA goals to date:

- **Smarter spending.** The Prosser innovation had no statistically significant decreases or increases in total costs for Medicare or Medicaid beneficiaries compared to those who did not participate in the innovation.

- **Better care.** Medicare beneficiaries who participated in the program had significantly higher inpatient and ED utilization than those who opted out. Medicaid participants had higher inpatient stays than nonparticipants, but no statistically significant difference in ED visits. Selection into the sample was made through a history of high ED utilization and inpatient admissions; thus, the results in these outcomes may depend heavily on the distribution of self-selection into the program across the three cohorts. The increases in utilization are not likely due to the innovation, because CP visits were designed to reduce inpatient admissions and readmissions.

  Reach was fairly consistent across the three cohorts over time. Reach was highest, however, for Cohort 2 (84.7%).

  Although all patients had a needs assessment, the majority did not receive a specific service from the CP (72.7%). The innovation seemed to be most effective in helping patients understand their discharge instructions after the CP visit (92.5% reported that they understood instructions more completely). A smaller percentage of patients noted a change in their ability to make PCP appointments or fill their prescriptions after the CP visit (46.7% and 28.6%, respectively).

- **Healthier people**. Because we do not receive health outcome data from Prosser, we are unable to assess the effect of the innovation on patients' health.

Over the course of the innovation, project staff (with increasing support from organizational leadership and the larger community) improved the capacity to effectively implement the innovation. Recognition and respect from the medical community enabled staff members to embrace their roles and integrate the program more fully into the hospital and community structure. In addition, because the innovation was implemented in a small rural community, hospital staff and community providers worked more closely together than they might in many larger city environments. Even more important, hospital leadership was flexible in overseeing the innovation and gave project staff the autonomy to make improvement changes midstream. These changes in the training curriculum, scheduling protocol, and roles and responsibilities of the nurse case manager and project director over time helped to improve the innovation's execution.

Reach was highest for Cohort 2 patients who underwent surgery at Prosser and received a CP visit, and the high reach in this group remained steady throughout the innovation. Cohort 2 patients were less likely to opt out than individuals in the other cohorts likely because they were not chronic users of the health care system and may have been more motivated to stay out of the hospital post-surgery. Reach rates were similar for patients in Cohorts 1 and 3. Project staff reported the innovation was likely more effective in reaching certain age groups that were more motivated to manage their diseases and avoid another trip to the ED or hospital.

Even working in a small community, the ability to produce significant improvements in health outcomes among these three cohorts of patients was challenging for innovation staff. Due to the small sample size, staff were unable to report significant improvements although they perceived that the innovation may have been more effective with particular subpopulations as described above. RTI was also unable to detect statistically significant declines in health care utilization, which the innovation was designed to decrease.

Prosser continues to explore ways to sustain the innovation in the community. The hospital approved a budget that sustains key elements of the innovation, including the CP training and workforce development, CP visits, tracking, and referral process. Prosser continues to explore sustainability with local hospitals and payers. In addition, the considerable momentum in Washington State to standardize a CP/health worker model holds promise for the sustainability and expansion of the innovation. Prosser played a key role in advancing the field, and staff are hopeful that recent legislative changes and proposed standards (that they helped develop) will further support their efforts.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Prosser Public Hospital District (Prosser)

Prosser Public Hospital District (Prosser), a critical access hospital in Prosser, Washington, received an award of $1,470,017 to implement a community paramedic program (CPP) in which trained CPs provided a one-time follow-up health service for targeted high-risk patients to prevent hospital readmissions and emergency department (ED) visits. The innovation began enrolling participants on January 1, 2013.

Awardee Overview

Innovation dose:	Following the pre-assessment conducted at each CP visit, 27.3% of all 1,169 CP visits were followed up with at least one CP service. For the remaining 72.7% of visits, patients did not need additional services.	***Innovation reach:***	Overall, 1,016 total participants were enrolled across all three cohorts, which corresponds to 69.6% reach for Cohort 1, 85.0% reach for Cohort 2, and 63.0% reach for Cohort 3 based on the number of clients referred.
Components:	Used trained CPs to provide a one-time follow-up visit to targeted patients to prevent hospital readmissions and ED visits.	***Participant demographics:***	About half of participants (50.7%) were 25 to 64 years of age, 64.2% were female, 51.1% were Hispanic, and 45.5% were white. More than one-third (37.8%) were covered by Medicare or Medicare Advantage, and 30.1% were covered by Medicaid.
Sustainability:	Prosser committed to continue the CPP and developed a multifaceted approach to fund the services, including discussions with private payers for reimbursement.		
Innovation type:	Coordination of care		

Key Findings

Smarter spending. The Prosser innovation had no statistically significant average quarterly effects per participant for Medicare ($1,162; 90% CI: −$537, $2,860) or Medicaid (−$986; 90% CI: −$2,707, $735) beneficiaries compared to those who did not participate in the innovation.

Better care. Medicare beneficiaries who participated in the program had significantly higher inpatient admissions per quarter per 1,000 patients (73; 90% CI: 24, 123) than those who opted out. ED utilization per quarter per 1,000 participants for Medicare beneficiaries was marginally significantly higher (88; 90% CI: 0, 177) than those who opted out. Among Medicare beneficiaries, readmissions per 1,000 admissions per quarter were greater than for the comparison group (97; 90% CI: 58, 137). Medicaid participants had higher rates of inpatient stays per 1,000 participants per quarter (92; 90% CI: 47, 138) than nonparticipants, but no statistically significant difference in ED visits per 1,000 participants per quarter (−40; 90% CI: −172, 92). Selection into the sample was made through a history of high ED utilization and inpatient admissions; thus, the results in these outcomes may depend heavily on self−selection into the program.

The innovation seemed to be most effective in helping patients understand their discharge instructions after the CP visit (92.5% reported that they understood instructions more completely). A smaller percentage of patients noted a change in their ability to make primary care provider appointments or fill their prescriptions after the CP visit (46.7% and 28.6%, respectively).

Healthier people. Because we did not receive health outcome data from Prosser, we were unable to assess the effect of the innovation on patients' health.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Regional Emergency Medical Services Authority

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RTI INTERNATIONAL

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q14 (December 2015)
Quarterly Awardee Performance Report	Launch date–Q14 (December 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–December 2015

Q = quarter.

Regional Emergency Medical Services Authority (REMSA)

2.1 Introduction

The Regional Emergency Medical Services Authority (REMSA) is a nonprofit emergency medical services (EMS) provider in Reno, NV, which is the exclusive provider of ground transport services for the cities of Reno and Sparks and for Washoe County. REMSA received an award of $10,824,025, beginning on December 10, 2012 to implement programs to promote the appropriate utilization of health care services. The innovation seeks to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending (per-patient cost by $10.5 million over 3 years for Washoe County acute and nonacute patients) by reforming existing payment systems to achieve sustainable funding for patient care services.

2. **Better care.** Improve care by establishing new linkages between the emergency ambulance delivery system and the broader health care delivery system by engaging key health care partners, community stakeholders, and target patient populations, and by finding alternative pathways for patients seeking evaluation of urgent medical conditions.

3. **Healthier people**. Improve management of or recovery from congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), myocardial infarction (MI), open heart surgery, and other urgent medical conditions.

Table 2 provides a summary of changes that occurred during the fourth year of operations. These updates are based on a review of the Quarter (*Q) 11–14 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through December 31, 2015.

Table 2. Summary of Updates as of Quarter 14, December 31, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through Dec 31, 2015)
Innovation Components	
	REMSA's Community Health Program included four unique components: CP (which included two subcomponents), ATA, and the NHL.
	The CP program had two parts, the 30-day enrollment program and the E&R program.
Program Participant Characteristics	
	Across the innovation's four components, 20,593 individuals enrolled or had an encounter. Almost one-third (29.8%) of participants were younger than 18 years of age; 60.5% were female; 9.7% of participants were covered by Medicare, less than 1% by Medicare Advantage, 24.6% by Medicaid, and the remaining 64.8% were either uninsured, covered by private or other types of insurance, or had missing data.
Workforce Development	
Hiring and retention	At the end of Q14, REMSA had 16 FTEs, and 6 separations occurred in Qs 11–14.
Skills, knowledge, and training	From inception through Q14, REMSA provided 18,870 hours of training to 176 personnel.
Context	
Award execution	Through Q14 spending was below target, at 77.1% of this year's budget.
Leadership	This innovation had a clearly established leader with the experience, skills, and authority to marshal resources and make decisions.
Organizational capacity	REMSA had adequate space, technology, and equipment to operate this innovation with few challenges or issues.
Innovation adoption and workflow integration	REMSA used existing relationships and skills to ensure innovation adoption and workflow integration both internally at REMSA and externally with partners.
Implementation Effectiveness	
Innovation reach	Reach is based on encounter-level data for CP E&R, ATA, and NHL while the CP component is based on the number of unique participants. The CP component reached 73.4% of the target population, CP E&R reached 95.8% of the target population, ATA reached 11.5% of the target population, and NHL enrolled a total of 35,001 people.
Innovation dose	Dose is only relevant to the CP component. Patients enrolled in the CP program received on average 4.4 home visits during the 30 days of their enrollment.
Sustainability	
	REMSA worked with the Nevada legislature to successfully pass a bill which authorizes, regulates, and supports reimbursement for community paramedicine services beginning in July 2016.
	REMSA worked with local health systems and key clinical partners to identify funding from other sources (e.g., state, private, etc.).

Sources: *Q11-Q14 Narrative Progress Report*.
Q11-Q14 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 2015.
ATA = Ambulance Transport Alternatives; CP = Community Paramedic; E&R = Evaluate and Refer; FTE = full-time equivalent; NHL = Nurse Health Line; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

Tables 3 and ***4*** summarize Medicare claims-based findings during the innovation period for two distinct programs: Nurse Health Line (NHL) and Community Paramedic 30-day enrollment program (CP – 30 days). The weighted average quarterly saving differential over 3 years of the innovation period for the NHL was $12 (90% CI: −$418, $395) per member per quarter. This effect is not statistically significant. Total decreases in inpatient stays and readmissions are also not statistically significant over the entire innovation period and amount to three fewer inpatient stays per 1,000 participants and 35 fewer readmissions per 1,000 admissions per quarter. The impact on ED visits is statistically significant and amounts to 64 more ED visits in the innovation per 1,000 participants per quarter.

Table 3. Summary of Medicare Claims-Based Findings: NHL

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.069	−$2.512, $2.374	−$0.153	−$2.024, $1.718	$0.096	−$1.056, $1.248	−$0.012	−$0.217, $0.193
Acute care inpatient stays	−20	−115, 75	−12	−97, 72	−2	−45, 41	−6	−14, 3
Hospital-wide all-cause unplanned readmissions	−20	−46, 6	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	387	155, 619	242	37, 447	152	45, 258	−7	−22, 8
Average impact per quarter								
Spending per participant	−$12	−$418, $395	−$37	−$491, $416	$52	−$578, $683	−$188	−$3,393, $3,018
Acute care inpatient stays (per 1,000 participants)	−3	−19, 13	−3	−23, 18	−1	−25, 22	−6	−220, 45
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−35	−80, 11	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	64	26, 103	59	9, 108	83	25, 141	−112	−349, 125

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters Estimates are derived using a negative binomial count model.
- CI = confidence interval; CP = Community Paramedic; ED = emergency department; N/A = data not applicable; NHL = Nurse Health Line.

Table 4 summarizes Medicare claims-based findings during the innovation period for the CP- 30 days' innovation. The weighted average quarterly saving differential over 3 years of the innovation period was −$2,394 (90% CI: $235, $4553) per member per quarter. This effect is statistically significant and translates into $2,096,866 savings generated by the program. Savings are highest in the first year, and equal to $4,156 (90% CI: $1,772, $6,541) per participant per quarter. The impact of the program decreases thereafter. Total decreases in inpatient stays are also statistically significant over the entire innovation period and amount to 543 fewer inpatient stays per 1,000 participants per quarter. The impact on ED visits and readmissions is not statistically significant.

Table 4. Summary of Medicare Claims-Based Findings: CP-30 days

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$2.097	−$3.988, −$0.206	−$2.589	−$4.075, −$1.104	$0.108	−$0.558, $0.774	$0.384	−$0.132, $0.900
Acute care inpatient stays	−475	−568, −383	−410	−498, −321	−59	−82, −35	−7	−16, 2
Hospital-wide all-cause unplanned readmissions	12	−13, 37	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	24	−27, 76	18	−27, 62	5	−19, 30	1	−7, 9
Average impact per quarter								
Spending per participant	−$2,394	−$4,553, −$235	−$4,156	−$6,541, −$1,772	$474	−$2,435, $3,382	$16,005	−$5,483, $37,492
Acute care inpatient stays (per 1,000 participants)	−543	−648, −438	−657	−800, −515	−256	−359, −153	−7	−675, 69
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	45	−48, 138	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	28	−31, 86	28	−43, 100	23	−85, 132	43	−274, 360

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters Estimates are derived using a negative binomial count model.
- CI = confidence interval; CP = Community Paramedic; ED = emergency department; N/A = data not applicable.

2.1.1 Innovation Components

REMSA's Community Health Program (CHP) is complex and includes four components. The first component uses Community Paramedics (CPs) to reduce avoidable hospital admissions and chronic obstructive pulmonary disease (COPD), myocardial infarction (MI), who had open heart surgery, or are readmissions. The CP component had two subcomponents: the 30-day enrollment program, and the Evaluate and Refer (E&R) program. The 30-day enrollment program targets at-risk patients discharged from the hospital for 30 days of post-discharge support (i.e., patients with congestive heart failure (CHF), who were chronic 911 users). During the 30 days, CPs conduct home visits, perform medication reconciliation, and discuss healthy living behavioral changes with patients. Through the E&R program, local physicians contact the CPs when a patient calls with complications or complaints and the physician believes the patient should be assessed, but is unsure about the need for an ED visit. The CP assesses the patient's condition at home, describes the situation to the physician, and decides the patient's care plan, potentially avoiding an ED visit (if no emergency is evident). The third component, Ambulance Transport Alternatives (ATA), involves transporting (by ambulance) low-acuity patients who call 911 to a more appropriate location than the ED (urgent care center, community triage center, detoxification center, mental health hospital, or clinic). The fourth and final component is the Nurse Health Line (NHL), an alternate non-911 number that callers with low-acuity problems use to reach a health professional who triages the call and determines a recommended level of care. Health information technology (HIT) and a community outreach program supported these components. We provided details on these components in the 2014 annual report and reported any changes in the 2015 second annual report; no additional changes to these components were made.

The partners for this innovation remain unchanged since the 2015 annual report. ***Table 5*** lists those partners. By the end of Q14, REMSA arranged for 16 non-ED locations to receive patient transports. REMSA completed contracts with the HOPES clinic to provide primary care office visits to uninsured patients transported or referred by REMSA, and with the WestCare community triage center to provide observational office visits to uninsured patients transported or referred by REMSA.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
University of Nevada, Reno	Evaluation	Reno, NV
TrueSimple, LLC	Project management/administration consultant	Austin, TX
Priority Solutions, Inc.	HIT (provides NHL system)	Salt Lake City, UT
FirstWatch Solutions, Inc.	HIT (provides data integration)	Encinitas, CA
KPS3 Marketing	Marketing contractor (e.g., developed the campaign for NHL)	Reno, NV
Renown Health	Primary liaison for CP component, training, care management, and HIT integration support	Reno, NV
Community health providers	Alternative care for low-acuity patients, acceptance of low-acuity patients in the ATA program (e.g., 16 urgent care centers, alternative sites such as the local triage/detoxification center)	Washoe County, NV

ATA = Ambulance Transport Alternatives; CP = Community Paramedic; HCIA = Health Care Innovation Award; NHL = Nurse Health Line.

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report, based on data through Q10. The distribution of patient characteristics is similar to that in the 2015 annual report. Demographic data are separated below by program component, showing the different distribution of characteristics for participants in each of the four program components. In general, data presented for the ATA, NHL, and CP E&R components are encounter-level. The participant characteristics, however, only include unique individuals (not encounters) to avoid counting patients multiple times. Thus, the numbers in Table 6 will differ from the number of encounters presented in the reach tables for the ATA, NHL, and CP E&R component. The 30-day CP enrollment program examines participants at the individual level, not the encounter level.

Participants in each component have increased steadily since the 2015 annual report. The majority of the ATA participants (73.1%) were 25 to 64 years old and more than half (64%) were male. One-third of NHL participants were children under 18 (33.0%), probably because of the high volume of calls from parents; more than half (62.9%) were female. More than half of CP E&R component (53.5%) participants were 85 years or older, and the majority were female (61.7%). More than one-fourth of CP program participants (29.1%) were 45 to 64 years old, and over half (53.7%) were male. Payer data are now available for all programs. More than 10 percent of participants were covered by Medicare or Medicare Advantage (10.6%), 24.6 percent by Medicaid, and 33.2 percent were uninsured. This payer data differ from those presented in the 2015 annual report because retrospective payer data are now available for the ATA and NHL components.

Table 6. Characteristics of All Participants Ever Enrolled in the Innovation through Q14[1]

	ATA Participants		CP-30 Participants		CP E&R Patients Referred		NHL Participants		Participants In All Components	
Characteristic	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Total Number	Percentage
Total	850	100	1027	100	172	100	18,544	100	20,593	100
Age										
<18	25	2.9	2	0.2	2	1.2	6,121	33.0	6,150	29.8
18–24	71	8.4	4	0.4	0	0.0	2,035	11.1	2,110	10.2
25–44	266	31.3	42	4.1	4	2.3	4,504	24.3	4,816	23.4
45–64	355	41.8	299	29.1	9	5.2	3,457	18.6	4,120	20.0
65–74	85	10.0	274	26.7	22	12.8	1,374	7.4	1,755	8.5
75–84	24	2.8	222	21.6	43	25.0	692	3.7	981	4.8
85+	12	1.4	184	17.9	92	53.5	361	1.9	649	3.2
Missing	12	1.4	0	0.0	0	0.0	0	0	12	0.1
Sex										
Female	232	27.3	453	44.1	106	61.7	11,663	62.9	12,454	60.5
Male	544	64.0	551	53.7	63	36.6	6,881	37.1	8,039	39.0
Missing	74	8.7	23	2.2	3	1.7	0	0.0	100	0.5
Race/ethnicity										
White	—	—	—	—	—	—	—	—	—	—
Black	—	—	—	—	—	—	—	—	—	—
Hispanic	—	—	—	—	—	—	—	—	—	—
Asian	—	—	—	—	—	—	—	—	—	—
American Indian or Alaska Native	—	—	—	—	—	—	—	—	—	—
Native Hawaiian or other Pacific Islander	—	—	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—	—	—	—
Missing/ refused	—	—	—	—	—	—	—	—	—	—

(continued)

Table 6. Characteristics of All Participants Ever Enrolled in the Innovation through Q14[1] (continued)

	ATA Participants		CP Participants		CP E&R Patients Referred		NHL Participants		Participants In All Components	
Characteristic	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Total Number	Percentage
Payer Category[2]										
Dual	0	0.0	7	0.7	0	0.0	0	0.0	7	0.0
Medicaid	145	17.1	121	11.8	2	1.2	4804	25.9	5,072	24.6
Medicare	16	1.9	370	36.0	49	28.5	1557	8.4	1,992	9.7
Medicare Advantage	0	0.0	173	16.8	10	5.8	0	0.0	183	0.9
Other	188	22.1	48	4.7	9	5.2	1,746	9.4	1,991	9.7
Uninsured	224	26.3	80	7.8	18	10.5	6,521	35.2	6,843	33.2
Missing	277	32.6	228	22.2	84	48.8	3,916	21.1	4,505	21.9

Source: Patient-level data provided to RTI by REMSA.
Note: Due to long-standing EMS operating procedures, REMSA does not collect data regarding race/ethnicity.
[1] The participant characteristics includes unique individuals (not encounters); thus, the numbers in this table differ from the number of encounters presented in the reach tables for each program component.
[2] REMSA provided 21 individuals with a secondary payer. That information is not included here because it is less than 0.1 percent of those enrolled in the innovation. RTI currently only reports payer category data for the CP and CP E&R components of the innovation. RTI expects to receive payer information for the other components for reporting in the next annual report.
ATA = Ambulance Transport Alternatives; CP = Community Paramedic; E&R = Evaluate and Refer; FTE = full-time equivalent; NHL = Nurse Health Line; Q = quarter.
— Data not available.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group: NHL

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 1,157 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living primarily in Washoe County, Nevada. Our data also include a small number of callers living in adjacent counties and states.

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. In order to mirror the spike in utilization seen in participant beneficiaries, we move enrollment forward by 1 quarter. Enrollment is now defined as the first call to NHL plus 3 months. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 8 describes the mean values and standardized differences of the variables of interest included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. One innovation beneficiary was dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 8. Mean Values and Standardized Differences of Variables in Propensity Score Model: REMSA (NHL)

	Full Treatment				Standardized Difference (Full Treatment vs. Comparison)	Matched Treatment				Standardized Difference (Matched Treatment vs. Comparison)
	Innovation Group		Comparison Group			Innovation Group		Comparison Group		
Variable	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarter prior to enrollment	$6,466	$12,235	$2,118	$7,686	0.426	$6,419	$12,138	$6,466	$16,185	0.003
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$13,058	$22,483	$7,371	$18,906	0.274	$13,016	$22,448	$11,713	$21,453	0.059
Age	66.29	14.4	70.07	10.96	0.295	66.32	14.36	66.23	14.12	0.007
Percentage male	33.07	47.05	48.9	49.99	0.326	33.02	47.03	30.55	46.06	0.053
Percentage white	84.54	36.15	76.3	42.53	0.209	84.53	36.16	83.82	36.82	0.019
Percentage disabled	45.94	49.83	21.15	40.84	0.544	45.89	49.83	50.55	50	0.093
Percentage ESRD	1.64	12.7	1.14	10.61	0.043	1.64	12.71	1.41	11.8	0.019
Number of chronic conditions	6.75	3.89	5.27	3.96	0.375	6.75	3.89	7.21	4.22	0.113
Number of outpatient ED visits in calendar quarter prior to enrollment	0.88	1.62	0.09	0.43	0.665	0.87	1.58	0.39	1.38	0.319
Number of outpatient ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.93	4.87	0.45	1.37	0.413	1.92	4.86	1.23	3.91	0.157
Number of inpatient stays in calendar quarter prior to enrollment	0.32	0.71	0.06	0.31	0.480	0.31	0.66	0.3	0.82	0.016
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.55	1.2	0.21	0.71	0.350	0.55	1.19	0.42	1.16	0.107
Number of beneficiaries	1,158		1,885,213	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	254,920	—	—	1,157		3,446	—	—
Number of weighted beneficiaries	—	—	—	—	—	1,157	—	1,157	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

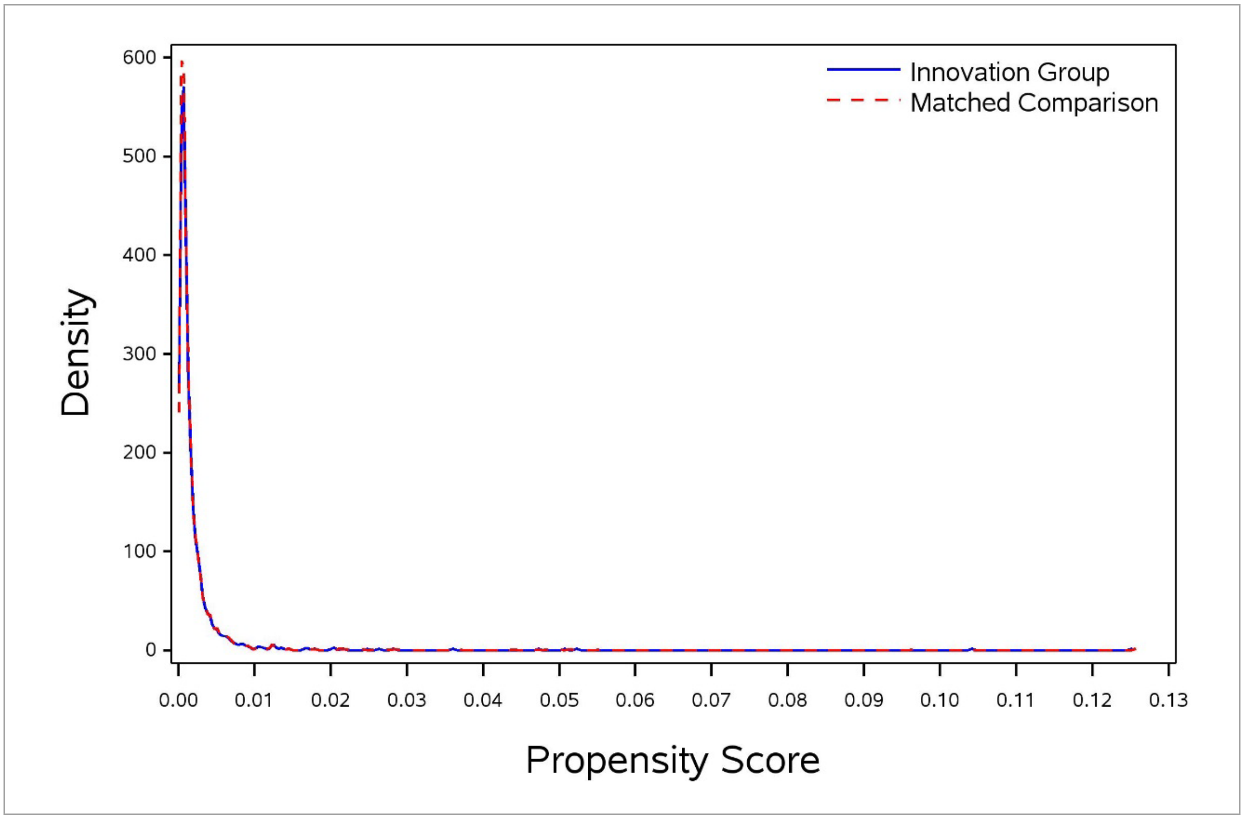
ED = emergency department; ESRD = end-stage renal disease; NHL = Nurse Health Line; REMSA = Regional Emergency Medical Services Authority; SD = standard deviation.

— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 8). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 8 show that matching reduces the absolute standardized differences and achieves adequate balance for most variables, except for number of chronic conditions and history of ED utilization.

Figure 1 shows the distribution of propensity scores for the innovation and comparison groups.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.3.1 Medicare Spending

2.3.1.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the nine quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. The pattern of spending is similar for participants and nonparticipants in the baseline and innovation periods.

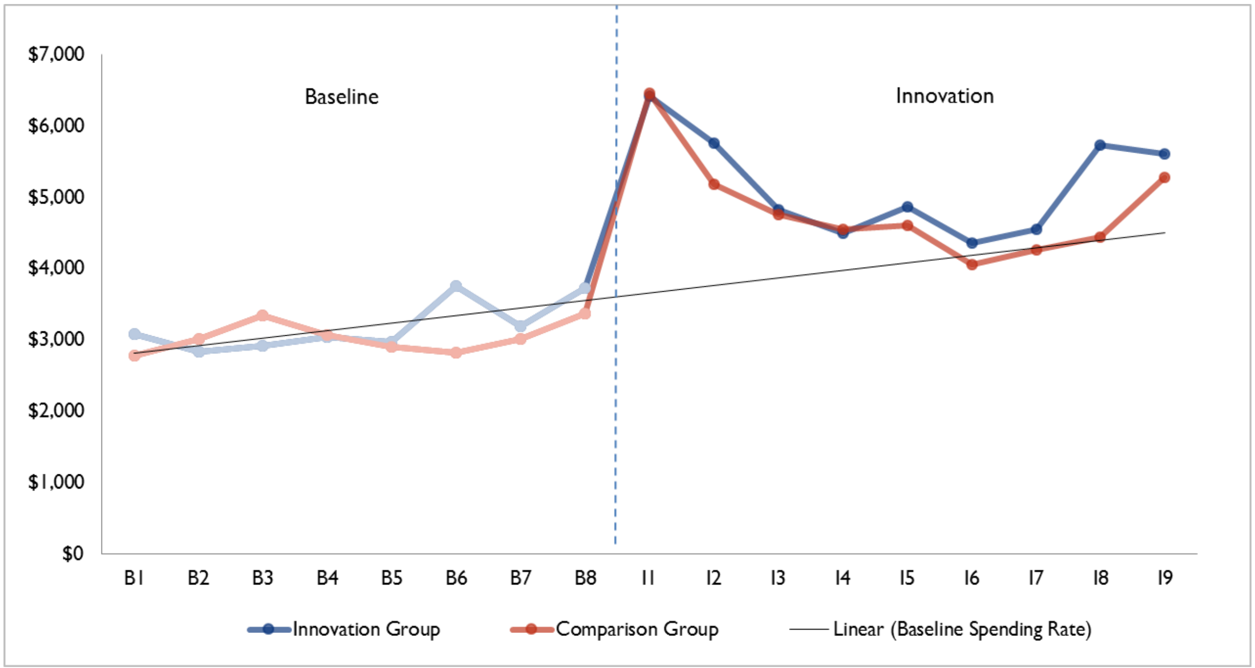
Table 9. Medicare Spending per Participant: REMSA–NHL

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Spending rate	$3,077	$2,830	$2,916	$3,040	$2,970	$3,755	$3,199	$3,727	$6,419	$5,764	$4,832	$4,492	$4,863	$4,365	$4,556	$5,733	$5,608
Std dev	$6,877	$7,172	$8,024	$7,684	$8,294	$8,951	$7,522	$9,217	$12,138	$14,293	$10,726	$10,227	$11,847	$8,865	$9,723	$22,113	$13,471
Unique patients	988	1,000	1,019	1,046	1,064	1,095	1,112	1,135	1,157	1,157	1,024	788	643	621	376	186	64
Comparison Group																	
Spending rate	$2,784	$3,015	$3,351	$3,075	$2,909	$2,819	$3,013	$3,366	$6,466	$5,187	$4,764	$4,559	$4,614	$4,056	$4,264	$4,441	$5,283
Std dev	$7,161	$8,641	$10,129	$8,811	$7,131	$7,300	$7,579	$8,327	$16,185	$15,869	$12,391	$12,321	$13,237	$10,778	$12,029	$13,918	$14,196
Weighted patients	1,002	1,022	1,045	1,068	1,089	1,107	1,127	1,148	1,157	1,157	1,031	790	640	614	370	183	69
Savings per Patient																	
	−$293	$185	$435	$35	−$61	−$935	−$186	−$361	$46	−$577	−$68	$67	−$249	−$309	−$292	−$1,292	−$325

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 2. Medicare Spending per Participant: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.1.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is $12 (90% CI: −$418, $395). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA–NHL

Quarter	Coefficient	Standard Error	P-Values
I1	−$210	$421	0.618
I2	$403	$471	0.392
I3	−$178	$383	0.641
I4	−$245	$419	0.559
I5	−$22	$520	0.967
I6	−$34	$406	0.934
I7	−$123	$579	0.832
I8	$952	$1,707	0.577
I9	−$188	$1,948	0.923
Overall average	−$12	$247	0.963
Overall aggregate	−$69,427	$1,484,902	0.963
Overall aggregate (IY1)	−$153,138	$1,137,378	0.893
Overall aggregate (IY2)	$95,737	$700,175	0.891
Overall aggregate (IY3)	−$12,026	$124,698	0.923

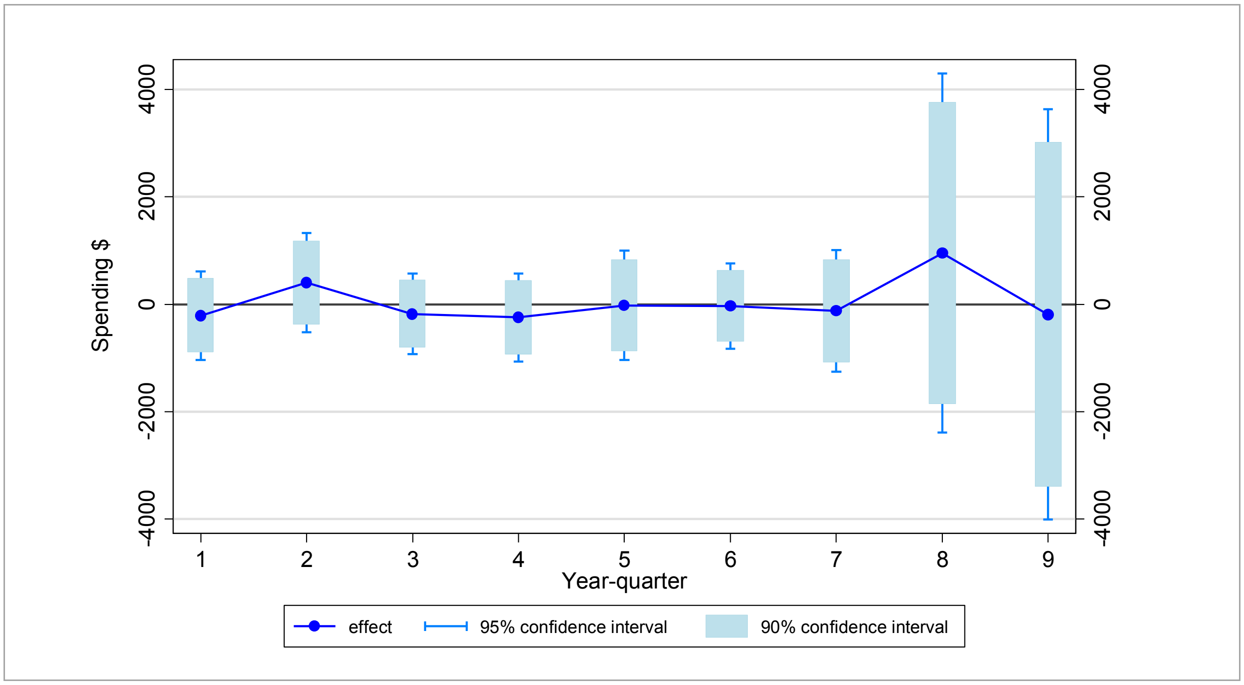
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

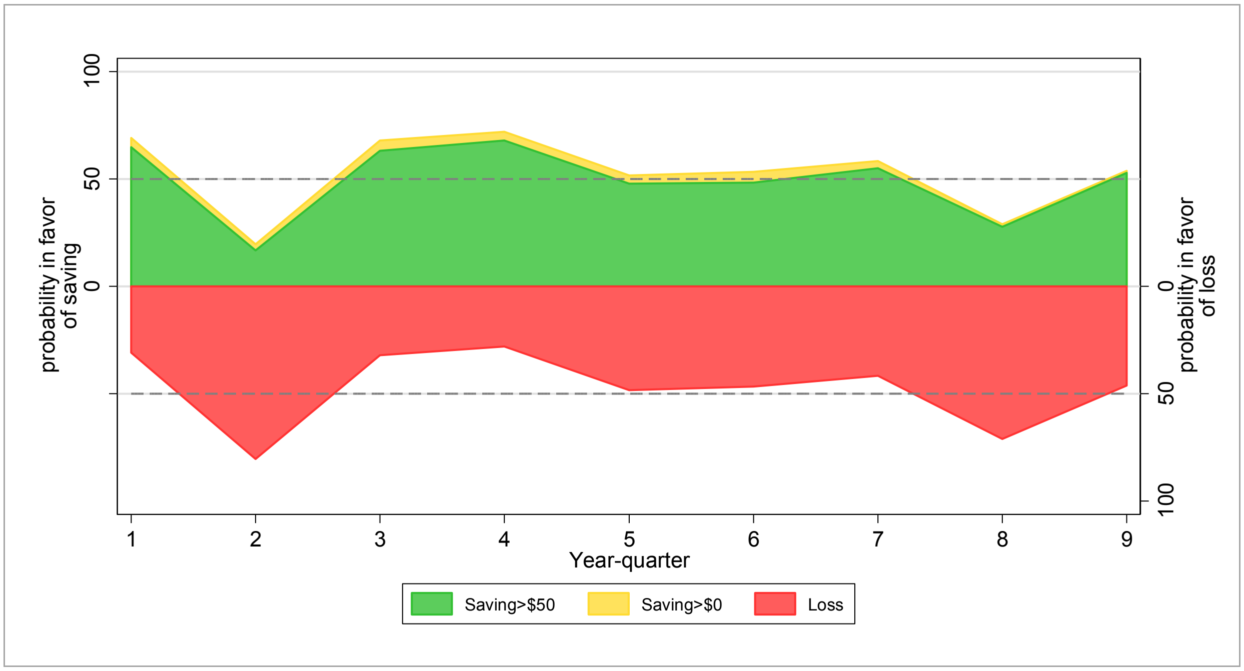
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Savings and losses are equally likely among participants relative to nonparticipants.

Figure 4. Quarterly Strength of Evidence in Favor of Savings/Loss: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.2 *Medicare Inpatient Admissions*

2.3.2.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 5***. The pattern of inpatient admissions with a spike in spending in I1 closely follows the spending pattern.

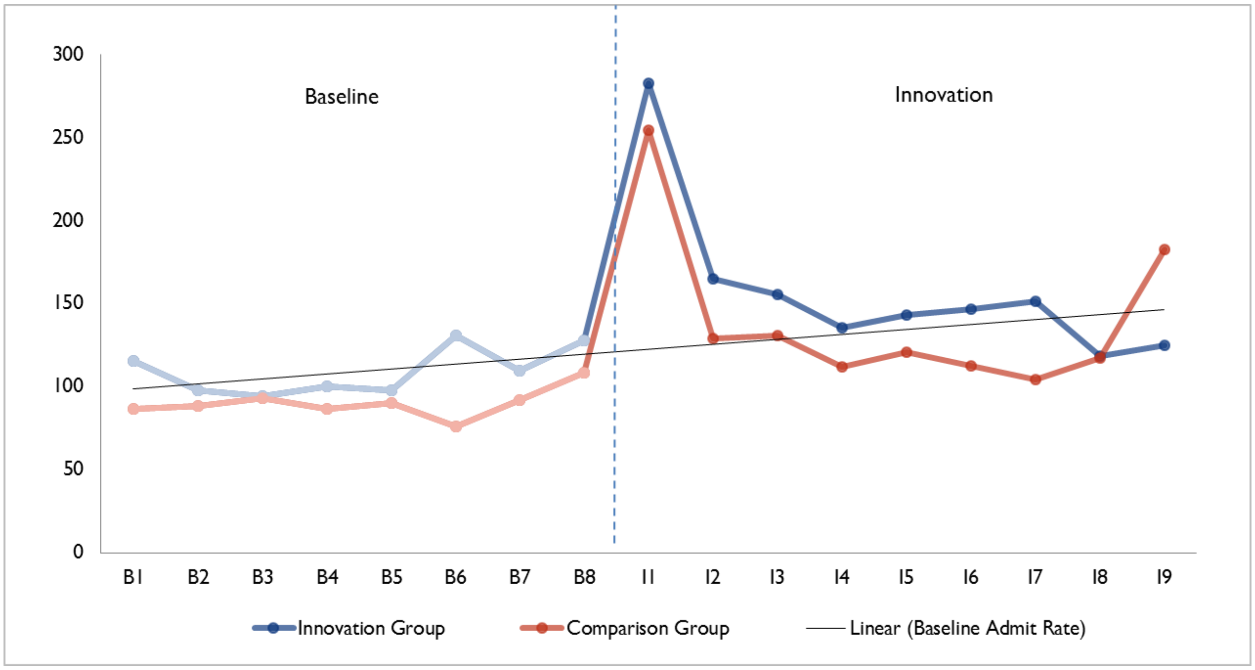
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA–NHL

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	115	98	94	100	98	131	110	128	283	165	155	136	143	147	152	118	125
Std dev	396	400	353	379	341	428	394	435	611	486	496	454	455	464	474	355	415
Unique patients	988	1,000	1,019	1,046	1,064	1,095	1,112	1,135	1,157	1,157	1,024	788	643	621	376	186	64
Comparison Group																	
Admit rate	87	89	93	87	90	76	92	109	254	129	131	112	121	112	104	117	183
Std dev	359	371	402	358	383	340	371	427	721	475	468	431	436	422	399	454	647
Weighted patients	1,002	1,022	1,045	1,068	1,089	1,107	1,127	1,148	1,157	1,157	1,031	790	640	614	370	183	69
Innovation − Comparison Rate																	
	29	9	1	14	7	55	18	19	28	36	24	24	22	34	47	1	−58

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.2.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is -3 admissions per 1,000 participants, indicating that the innovation-comparison difference is lower during the innovation period. This is the average difference in inpatient admissions probability for all innovation quarters, weighted by number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −19, 13). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 12 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. None of the quarter average treatment effects are statistically significant.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Participants: REMSA–NHL

Quarter	Coefficient	Standard Error	P-Values
I1	−12	32	0.705
I2	8	20	0.673
I3	−5	20	0.789
I4	−3	21	0.896
I5	−13	24	0.587
I6	5	24	0.821
I7	20	32	0.531
I8	−25	41	0.537
I9	−87	81	0.283
Overall average	−3	10	0.730
Overall aggregate	−20	58	0.730
Overall aggregate (IY1)	−12	51	0.812
Overall aggregate (IY2)	−2	26	0.935
Overall aggregate (IY3)	−6	5	0.283

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.3 Medicare Unplanned Readmissions

2.3.3.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 6***. Because of rolling enrollment, sample size decreases over time, resulting in a smaller number of inpatient admissions and more volatile readmissions rate. Nonetheless, readmissions rates are comparable for the innovation and the comparison group.

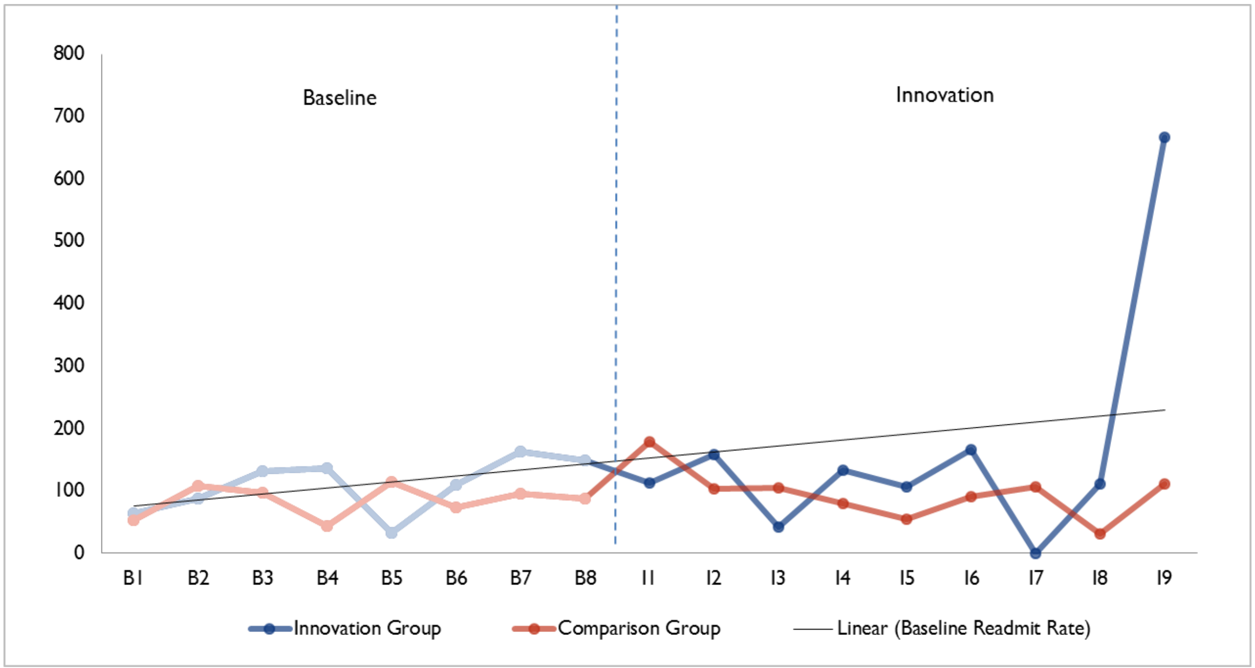
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA–NHL

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Readmit rate	63	87	131	136	33	110	162	149	113	158	42	133	106	167	0	111	667
Std dev	244	282	338	342	178	313	369	357	316	365	200	340	308	373	0	314	471
Total admissions	63	46	61	59	61	82	74	87	222	101	72	60	47	36	22	9	3
Comparison Group																	
Readmit rate	52	108	96	43	113	74	96	87	178	103	105	79	54	91	107	31	111
Std dev	223	310	295	204	317	261	294	282	382	304	306	270	226	288	309	174	314
Total admissions	45	46	45	46	47	41	52	61	156	75	64	42	37	33	19	11	6
Innovation − Comparison Rate																	
	11	−21	35	92	−81	36	67	62	−65	56	−63	54	52	75	−107	80	556

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.3.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −35 readmissions per 1,000 index admissions; the innovation-comparison difference is 3.5 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −80, 11).

Table 14. Difference-In-Differences Linear Probability Model Regression Estimates for Probability that Participant Had Hospital Unplanned Readmission per 1,000 Inpatient Admissions: REMSA–NHL

Quarter	Coefficient	Standard Error	P-Values
Overall average	−35	28	0.213
Overall aggregate	−20	16	0.213

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.4 Medicare Emergency Department Visits

2.3.4.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 7.*** In both the baseline and innovation periods, ED visits are higher for innovation participants than for the comparison group.

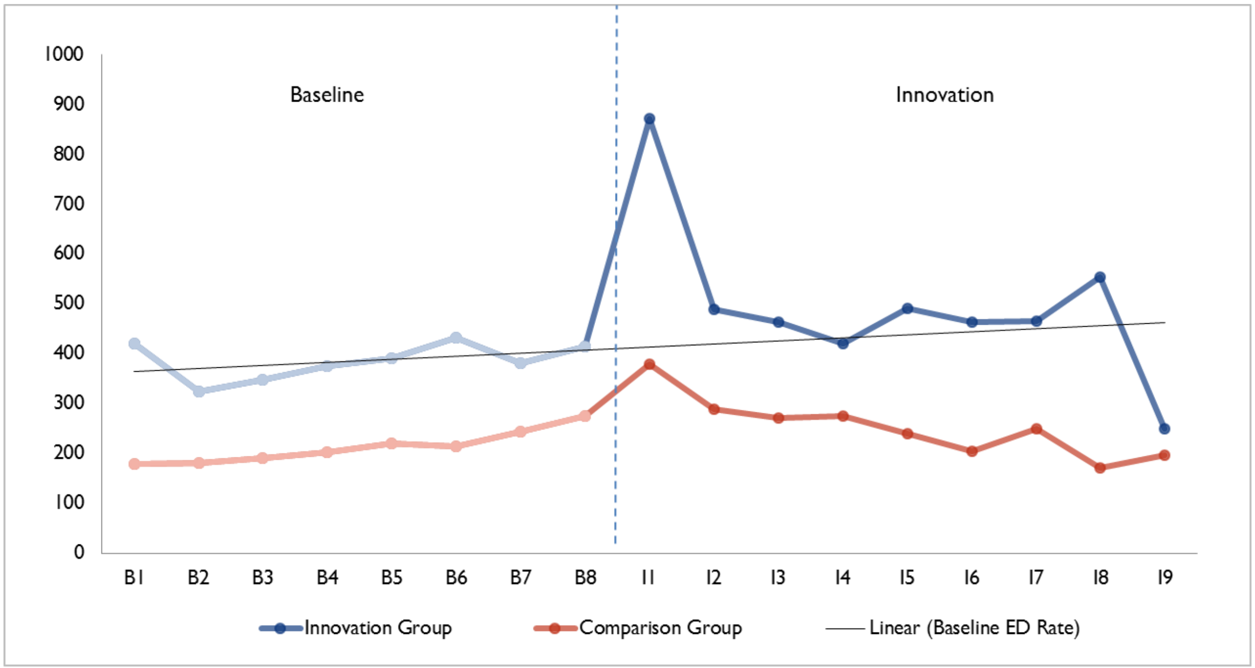
Table 15. ED Visits per 1,000 Participants: REMSA–NHL

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I6	I7	I8	I9	I6
Innovation Group																	
ED rate	420	323	348	375	391	432	380	414	871	488	463	420	491	464	465	554	250
Std dev	1,423	1,018	1,328	1,245	1,361	1,368	1,398	1,288	1,602	1,393	1,352	1,281	1,421	1,383	1,505	1,492	667
Unique patients	988	1,000	1,019	1,046	1,064	1,095	1,112	1,135	1,157	1,157	1,024	788	643	621	376	186	64
Comparison Group																	
ED rate	178	181	191	202	219	213	244	274	378	288	270	274	240	204	249	171	197
Std dev	357	448	530	451	500	488	599	706	785	694	613	630	470	432	525	348	434
Weighted patients	1,002	1,022	1,045	1,068	1,089	1,107	1,127	1,148	1,157	1,157	1,031	790	640	614	370	183	69
Innovation − Comparison Rate																	
	242	142	157	172	172	219	137	140	493	200	193	146	252	259	216	383	53

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; ED = emergency department; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 7. ED Visits per 1,000 Participants: REMSA–NHL



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.4.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is 64 visits per 1,000 participants, indicating that the innovation-comparison difference is higher during the innovation period. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 26, 103). In addition to the average effect over the innovation period, we also present quarterly effects. The overall increase in ED visits is driven primarily by the much higher ED utilization in I1 among innovation group participants who call the NHL, relative to the comparison group.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Participants: REMSA–NHL

Quarter	Coefficient	Standard Error	P-Values
I1	345	79	0.000
I2	−46	48	0.342
I3	−34	49	0.483
I4	−87	51	0.090
I5	52	62	0.402
I6	94	57	0.101
I7	45	77	0.555
I8	228	118	0.056
I9	−112	144	0.440
Overall average	64	23	0.006
Overall aggregate	387	141	0.006
Overall aggregate (IY1)	242	125	0.052
Overall aggregate (IY2)	152	65	0.019
Overall aggregate (IY3)	−7	9	0.440

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.3.5 Discussion: Medicare NHL Results

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 6 percent of the overall population reached by the innovation and 6 percent of the beneficiaries in the NHL innovation component. In addition, we have a small sample size, which can hinder detection of changes in spending.

It is likely that high medical utilization triggers participation in the innovation. To match the baseline quarter increase in utilization, we added 3 months to the first phone call the participant made to the NHL, which denotes enrollment in the innovation. Although this solution improves matching considerably (because the quarter before enrollment becomes the first innovation quarter), it is possible that we lose up to 90 days of innovation data for beneficiaries.

2.4 Medicare Comparison Group: ATA

We present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 118 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present descriptive statistics for beneficiaries enrolled in the innovation as well as individuals with fee-for-service Medicare who either were (a) eligible for but opted out of alternative transport or (b) for whom alternative transportation was deemed unsuitable based on REMSA's triage system. No data were collected to differentiate between groups (a) and (b), and the mixture of these groups presents challenges for interpreting the combined group as a true comparison group. Individuals in group (a) are probably comparable to ATA participants, but individuals in group (b) are not because they were deemed ineligible based on the program's triage algorithms. We used PSM to try to identify a better comparison group using the entire sample of nonparticipating individuals who had at least one outpatient ED visit in Washoe County during the post-intervention period, but we did not achieve adequate balance between the innovation group and the PSM-based comparison group on key variables. Therefore, we do not present regression results. We will continue to seek a better comparison group in later reports. For the purpose of descriptive statistics, we present the comparison group of those who chose not to be transported, but we do not present regression estimates for this group.

2.4.1 Medicare Spending

2.4.1.1 Descriptive Results

Table 17 reports Medicare spending per patient among all individuals who were contacted by REMSA (participants and nonparticipants) in the eight quarters before and the 11 quarters after enrolling in the innovation. We do not report information on the last quarters of data because less than 10 people are present in the sample. ***Figure 8*** illustrates the Medicare spending per beneficiary in Table 17 for innovation and comparison group beneficiaries, not controlling for individuals' characteristics. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Spending is higher on average for ATA participants through both the baseline and innovation periods. Comparison beneficiaries experience a higher spike in I1 spending despite having higher ED rates as discussed later.

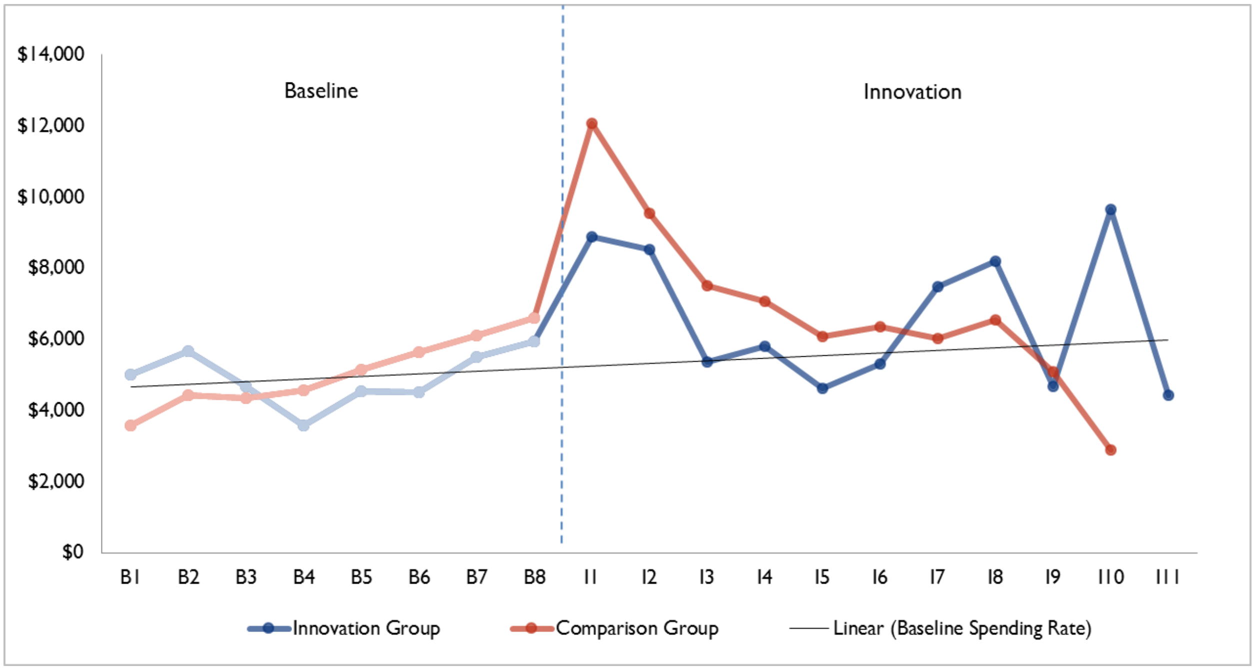
Table 17. Medicare Spending per Participant: REMSA–ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters										
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**	**I11**
Innovation Group																			
Spending rate	$5,012	$5,673	$4,670	$3,583	$4,543	$4,507	$5,512	$5,935	$8,888	$8,525	$5,382	$5,815	$4,613	$5,318	$7,480	$8,189	$4,677	$9,644	$4,442
Std dev	$12,981	$20,126	$11,704	$7,936	$13,329	$11,706	$13,538	$11,193	$14,372	$14,384	$9,031	$12,384	$8,893	$10,057	$11,449	$12,449	$6,355	$12,112	$6,073
Unique patients	104	106	107	108	110	111	114	118	118	113	92	79	66	61	57	43	31	25	17
Comparison Group																			
Spending rate	$3,589	$4,446	$4,351	$4,578	$5,136	$5,642	$6,121	$6,610	$12,067	$9,547	$7,505	$7,075	$6,092	$6,347	$6,039	$6,560	$5,087	$2,891	N/A
Std dev	$7,356	$10,631	$11,027	$12,217	$11,548	$12,127	$13,742	$12,887	$15,572	$18,988	$16,052	$15,270	$12,905	$12,394	$10,643	$13,079	$8,768	$4,874	N/A
Weighted patients	795	804	816	829	844	853	869	885	904	899	878	851	825	752	538	315	160	47	N/A
Savings per Patient																			
	−$1,423	−$1,227	−$320	$995	$593	$1,135	$609	$675	$3,179	$1,022	$2,123	$1,260	$1,479	$1,030	−$1,441	−$1,629	$410	−$6,753	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
N/A = not applicable.

Figure 8. Medicare Spending per Participant: REMSA–ATA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.4.2 Medicare Inpatient Admissions

2.4.2.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 18*** and ***Figure 9***. Participants have considerably higher inpatient admissions in the first innovation quarter than in previous quarters. The difference in inpatient admissions between the innovation and comparison groups during I1 may result from the restriction that no one in the comparison group had an inpatient stay within 7 days of the ED visit that defines enrollment. In contrast, 3 percent of the innovation group had an inpatient stay within 7 days of enrollment.

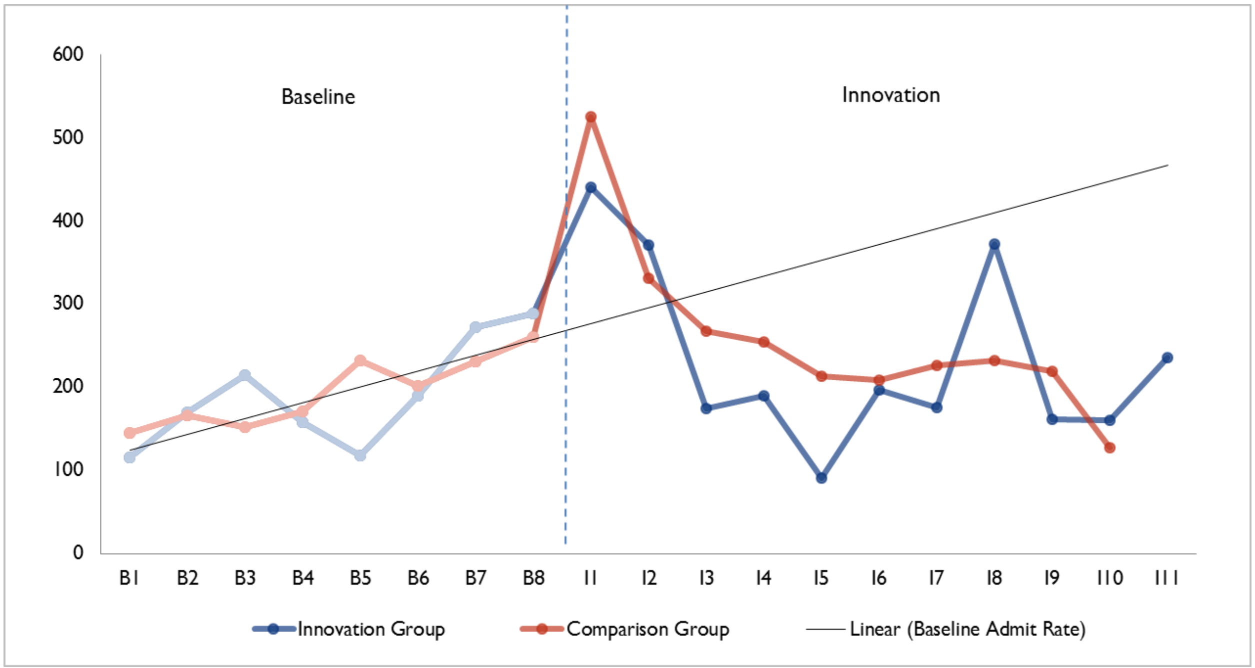
Table 18. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA-ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	115	170	215	157	118	189	272	288	441	372	174	190	91	197	175	372	161	160	235
Std dev	375	504	684	455	375	562	871	639	1021	961	457	530	287	596	625	1121	368	463	546
Unique patients	104	106	107	108	110	111	114	118	118	113	92	79	66	61	57	43	31	25	17
Comparison Group																			
Admit rate	145	167	152	171	232	202	231	260	525	331	268	255	213	209	227	232	219	128	N/A
Std dev	468	520	494	503	612	541	584	647	862	779	695	622	591	570	582	662	555	334	N/A
Weighted patients	795	804	816	829	844	853	869	885	904	899	878	851	825	752	538	315	160	47	N/A
Innovation − Comparison Rate																			
	−29	3	63	−14	−114	−12	41	28	−85	40	−94	−65	−122	−12	−51	140	−57	32	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

Figure 9. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA–ATA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.4.3 Medicare Unplanned Readmissions

2.4.3.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 19*** and ***Figure 10***. Readmission rates for participants transported to alternative locations appears more volatile than the rate for nonparticipants. This is likely because there are nine times more nonparticipants than participants and hence more index admissions for nonparticipants by construction.

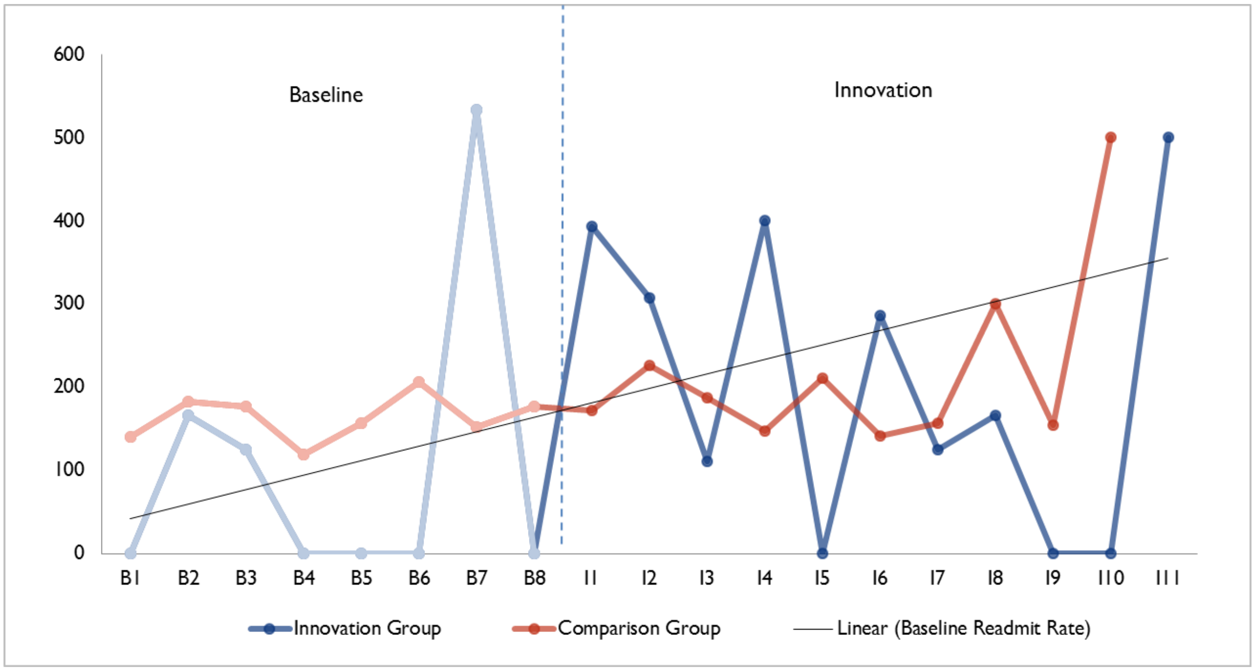
Table 19. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA–ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	0	167	125	0	0	0	533	0	393	308	111	400	0	286	125	167	0	0	500
Std dev	0	373	331	0	0	0	499	0	488	462	314	490	0	452	331	373	0	0	500
Total admissions	7	6	8	7	2	12	15	15	28	26	9	5	1	7	8	6	2	2	2
Comparison Group																			
Readmit rate	141	183	176	119	157	206	153	177	172	226	187	147	211	141	157	300	154	500	N/A
Std dev	348	387	381	324	363	405	360	382	377	419	390	354	408	348	364	458	361	500	N/A
Total admissions	64	71	68	84	115	97	118	130	285	159	123	109	90	78	51	30	13	2	N/A
Innovation − Comparison Rate																			
	-141	-16	-51	-119	-157	-206	381	-177	221	81	-76	253	-211	145	-32	-133	-154	-500	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
N/A = data not applicable.

Figure 10. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA–ATA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.4.4 Medicare Emergency Department Visits

2.4.4.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 20*** and ***Figure 11.*** There is a spike in the ED visit rate for both participants and nonparticipants in the first innovation quarter. Overall, participants have higher rates of ED visits in both the baseline and innovation periods.

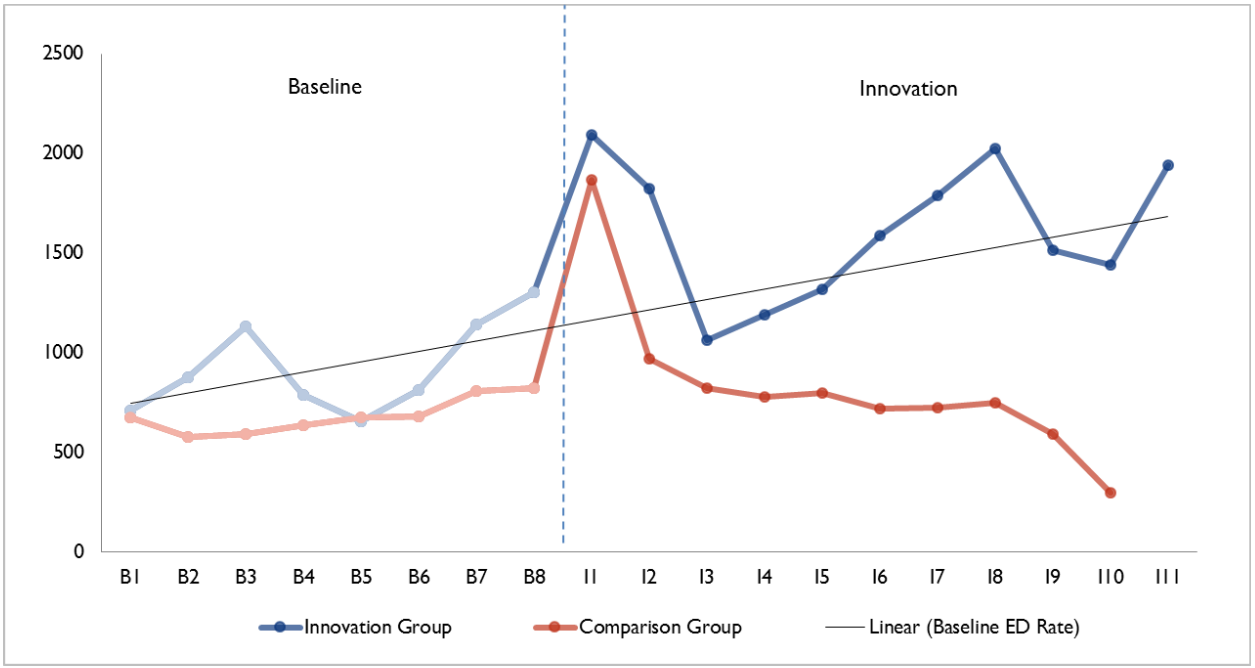
Table 20. ED Visits per 1,000 Participants: REMSA–ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	712	877	1,131	787	655	811	1,140	1,305	2,093	1,823	1,065	1,190	1,318	1,590	1,789	2,023	1,516	1,440	1,941
Std dev	1,543	2,146	2,741	1,535	1,547	1,730	2,153	2,078	3,361	2,904	2,153	2,537	2,993	3,866	4,021	3,745	2,279	2,501	4,380
Unique patients	104	106	107	108	110	111	114	118	118	113	92	79	66	61	57	43	31	25	17
Comparison Group																			
ED rate	674	577	592	637	678	679	808	820	1867	971	823	780	799	718	725	749	594	298	N/A
Std dev	1,911	1,575	1,671	1,636	1,725	1,671	2,263	2,272	2,917	2,641	2,735	2,290	2,855	1,977	1,815	2,432	1,220	778	N/A
Weighted patients	795	804	816	829	844	853	869	885	904	899	878	851	825	752	538	315	160	47	N/A
Innovation − Comparison Rate																			
	37	300	539	150	−23	132	333	485	226	852	242	410	519	872	1,065	1274	922	1,142	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
N/A = data not applicable.

Figure 11. ED Visits per 1,000 Participants: REMSA–ATA



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.4.5 Discussion: Medicare Results—REMSA ATA

As noted previously, we do not present Medicare regression results for ATA because we were unable to identify a comparison group that was well-balanced compared to the treatment group. We will continue to seek a better comparison group in subsequent reports.

2.5 Medicare Comparison Group: Community Paramedics (30 Days)

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 182 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in Washoe County in the state of Nevada. The CP–30 Days innovation's eligibility criteria is to enroll individuals previously admitted to the hospital with CHF, MI, or COPD. The comparison group is composed of individuals (not in the innovation group) who were hospitalized in the innovation period for one of those three conditions. To construct the comparison group for this innovation, we collect information for individuals with one of the three conditions leading to an inpatient admission that determines eligibility for the program; I1 is determined by the date of the inpatient visit. In regression estimates, we control for the underlying condition that determines eligibility in the sample because CHF, MI, and COPD have different cost trajectories over time.

Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, total Medicare payments in the calendar quarter and calendar year prior to the innovation as well as an indicator for MI, CHF, or COPD inpatient admission during I1. We use one-to-variable matching with replacement, matching each treatment beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 21 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 12*** shows the distribution of the propensity scores for the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Nine innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 21. Mean Values and Standardized Differences of Variables in Propensity Score Model: REMSA CP–30 Days

	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized	Treatment Group		Comparison Group		Standardized
Variable	Mean	SD	Mean	SD	Difference	Mean	SD	Mean	SD	Difference
Payments in calendar quarter prior to enrollment	$7,154	$13,329	$4,137	$9,774	0.258	$6,101	$10,277	$3,113	$6,653	0.345
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$18,374	$28,947	$15,446	$24,569	0.109	$17,556	$27,505	$10,443	$18,986	0.301
Age	70.41	13.13	75.26	11.28	0.396	71.37	12.03	71.54	12.38	0.014
Percentage male	58.12	49.34	48.28	49.97	0.198	58.24	49.32	59.71	49.05	0.030
Percentage white	80.1	39.92	86.56	34.1	0.174	81.87	38.53	79.67	40.25	0.056
Percentage disabled	36.13	48.04	24.64	43.09	0.252	34.07	47.39	35.35	47.81	0.027
Percentage ESRD	4.71	21.19	5.02	21.83	0.014	4.95	21.68	2.56	15.81	0.126
Number of dual-eligible months in the previous calendar year	2.23	4.53	2.3	4.55	0.015	2.01	4.33	1.73	4.07	0.068
Number of chronic conditions	9.31	3.78	10.42	3.18	0.317	9.4	3.69	8.79	3.27	0.173
Number of ED visits in calendar quarter prior to enrollment	0.8	2.03	0.34	0.84	0.292	0.55	1.02	0.38	0.92	0.180
Number of inpatient stays in calendar quarter prior to enrollment	0.39	0.76	0.14	0.46	0.409	0.34	0.7	0.12	0.5	0.370
Percentage hospitalized in the enrollment quarter for MI	47.64	49.94	46.84	49.9	0.016	48.35	49.97	49.27	49.99	0.018
Percentage hospitalized in the enrollment quarter for CHF	66.49	47.2	50.86	49.99	0.322	66.48	47.2	66.94	47.04	0.010
Percentage hospitalized in the enrollment quarter for COPD	27.23	44.51	41.07	49.2	0.295	27.47	44.64	25.18	43.41	0.052
Number of beneficiaries	191	—	2910	—	—	182	—	520	—	—
Number of unique beneficiaries[1]	191	—	2910	—	—	182	—	413	—	—
Number of weighted beneficiaries	—	—	—	—	—	182	—	182	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

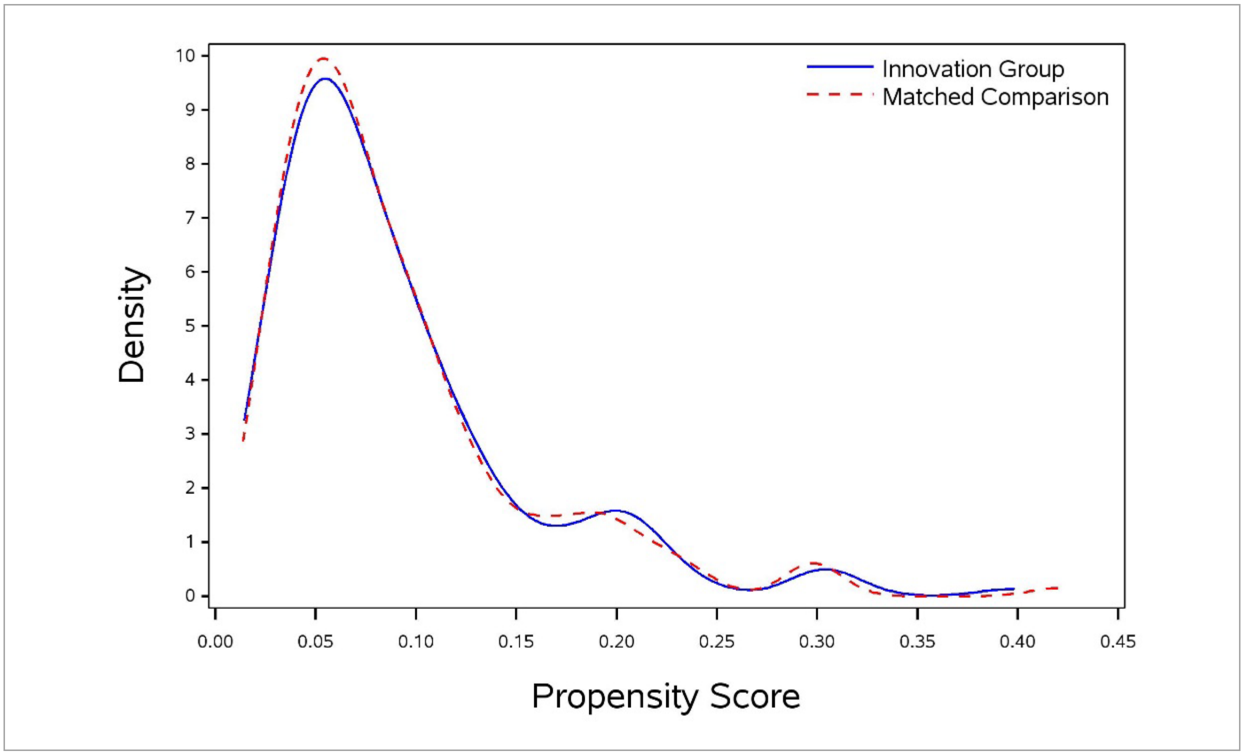
CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; ESRD = end-stage renal disease; MI = myocardial infarction; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days); SD = standard deviation.

— = not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 21). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 21 show that matching reduced the absolute standardized differences. Payments prior to enrollment, ED visits and the rate of inpatient hospitalizations prior to enrollment, number of chronic conditions and ESRD have standardized differences greater than 0.10 between the matched innovation and comparison group. Importantly, however, the standardized differences for MI, CHF, and COPD achieve adequate balance.

Figure 12 shows the distribution of the propensity scores for both the innovation and comparison groups. The two distributions are closely matched.

Figure 12. Distribution of Propensity Scores for Comparison and Innovation Groups: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.5.1 Medicare Spending

2.5.1.1 Descriptive Results

Table 22 reports Medicare spending per patient in the eight quarters before and the nine quarters after enrolling in the innovation. Overall, 10 quarters of innovation data are available. We use all quarters in the regression analysis; however, we do not present summary statistics whenever fewer than 10 individuals are in the sample. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 13*** illustrates the Medicare spending per beneficiary in Table 22 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

By selecting individuals with similar types of hospitalization as those eligible for the innovation, we successfully match the I1 spike in spending. Spending is similar across the innovation and comparison groups during the baseline and innovation period.

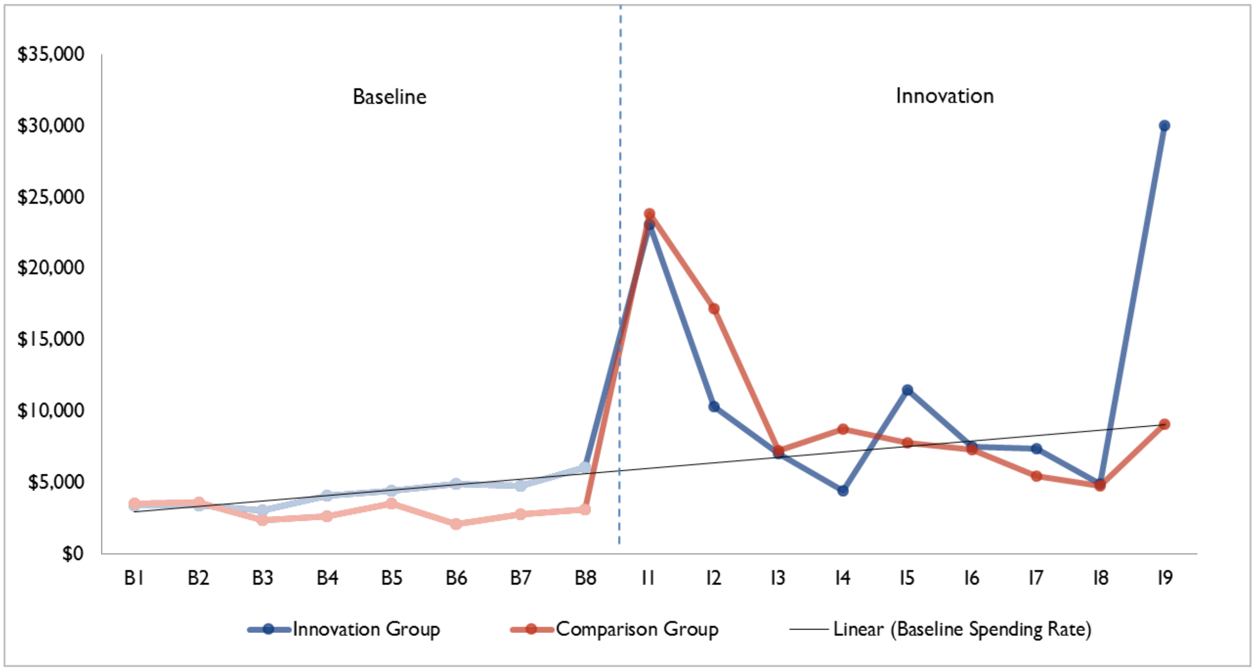
Table 22. Medicare Spending per Participant: REMSA CP–30 Days

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters								
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**
Innovation Group																	
Spending rate	$3,362	$3,390	$3,052	$4,080	$4,434	$4,937	$4,777	$6,101	$23,143	$10,360	$7,050	$4,420	$11,505	$7,529	$7,351	$4,885	$30,050
Std dev	$7,131	$6,433	$5,640	$11,137	$10,854	$11,714	$11,160	$10,277	$20,355	$21,582	$14,467	$6,968	$35,449	$14,644	$15,650	$7,323	$76,101
Unique patients	159	162	166	168	175	177	180	182	182	174	151	116	89	63	47	30	17
Comparison Group																	
Spending rate	$3,503	$3,584	$2,354	$2,614	$3,533	$2,119	$2,775	$3,113	$23,867	$17,184	$7,224	$8,763	$7,774	$7,319	$5,490	$4,743	$9,080
Std dev	$13,282	$9,479	$6,705	$7,525	$10,154	$4,910	$6,978	$6,653	$28,363	$36,306	$17,376	$26,458	$15,676	$13,963	$10,586	$9,118	$15,130
Weighted patients	163	164	164	167	170	172	180	182	182	181	158	128	98	71	53	36	18
Savings per Patient																	
	$141	$194	−$699	−$1,466	−$901	−$2,818	−$2,002	−$2,989	$724	$6,824	$175	$4,342	−$3,731	−$210	−$1,861	−$142	−$20,970

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

Figure 13. Medicare Spending per Participant: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.1.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$2,394 (90% CI: −$4,553, −$235). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 23*** shows the results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 14*** illustrates these quarterly difference-in-differences estimates.

Table 23. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA CP–30 Days

Quarter	Coefficient	Standard Error	P-Values
I1	−$1,929	$2,114	0.362
I2	−$7,884	$2,933	0.007
I3	−$1,386	$1,488	0.352
I4	−$5,667	$2,300	0.014
I5	$2,083	$3,860	0.590
I6	−$1,010	$2,035	0.620
I7	$496	$2,232	0.824
I8	−$1,221	$1,635	0.456
I9	$19,613	$18,410	0.287
Overall average	−$2,394	$1,310	0.068
Overall aggregate	−$2,096,866	$1,147,950	0.068
Overall aggregate (IY1)	−$2,589,449	$901,723	0.004
Overall aggregate (IY2)	$108,466	$404,256	0.789
Overall aggregate (IY3)	$384,118	$313,034	0.220

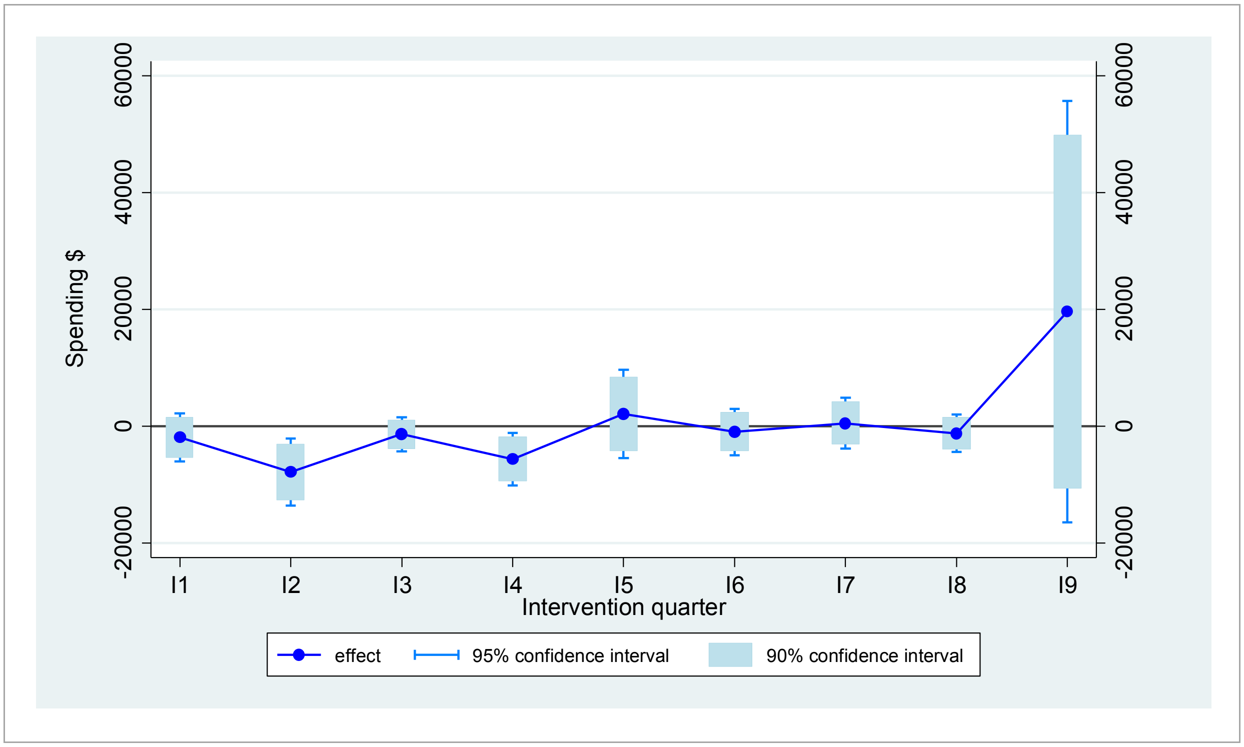
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

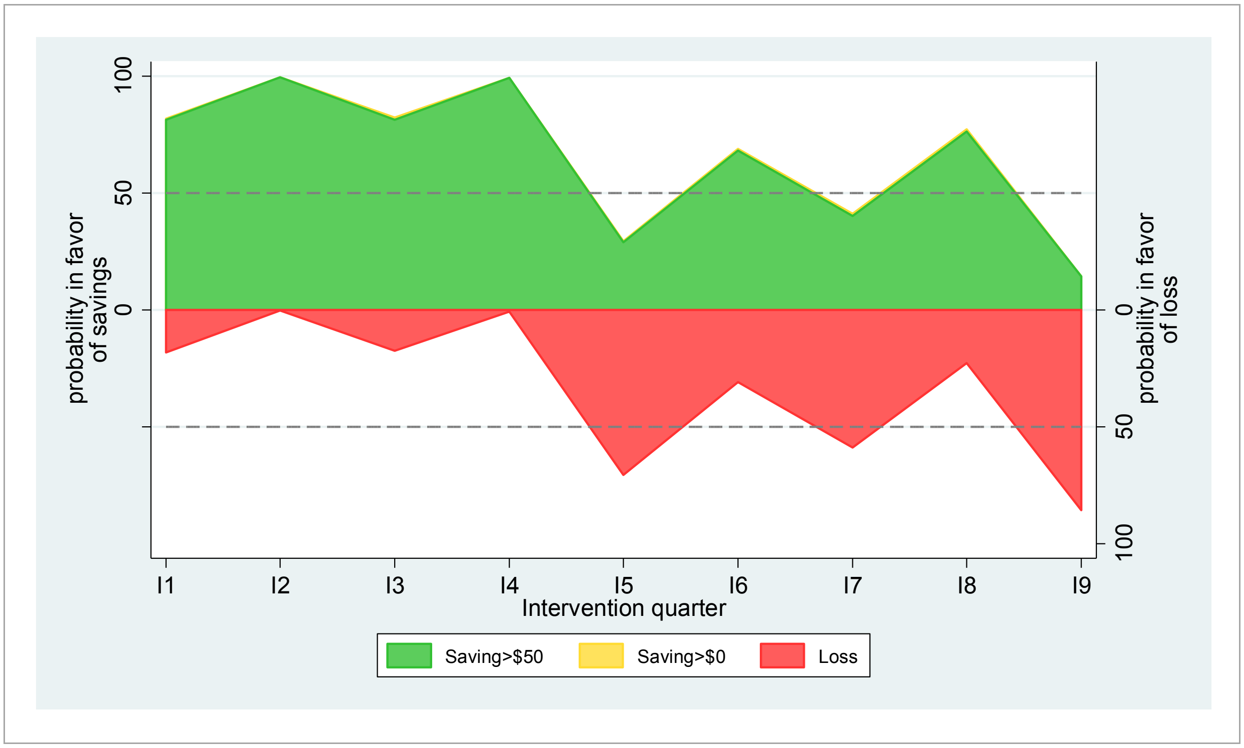
Figure 14. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

Figure 15 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Figure 15 supports the finding that the innovation generated savings during its first year. Thereafter, the probability of savings and losses is roughly comparable.

Figure 15. Quarterly Strength of Evidence in Favor of Savings/Loss: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.2 *Medicare Inpatient Admissions*

2.5.2.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 24*** and ***Figure 16***. The comparison group has slightly lower inpatient admission rates than the innovation group throughout all baseline quarters; this difference disappears and reverses during the innovation quarters.

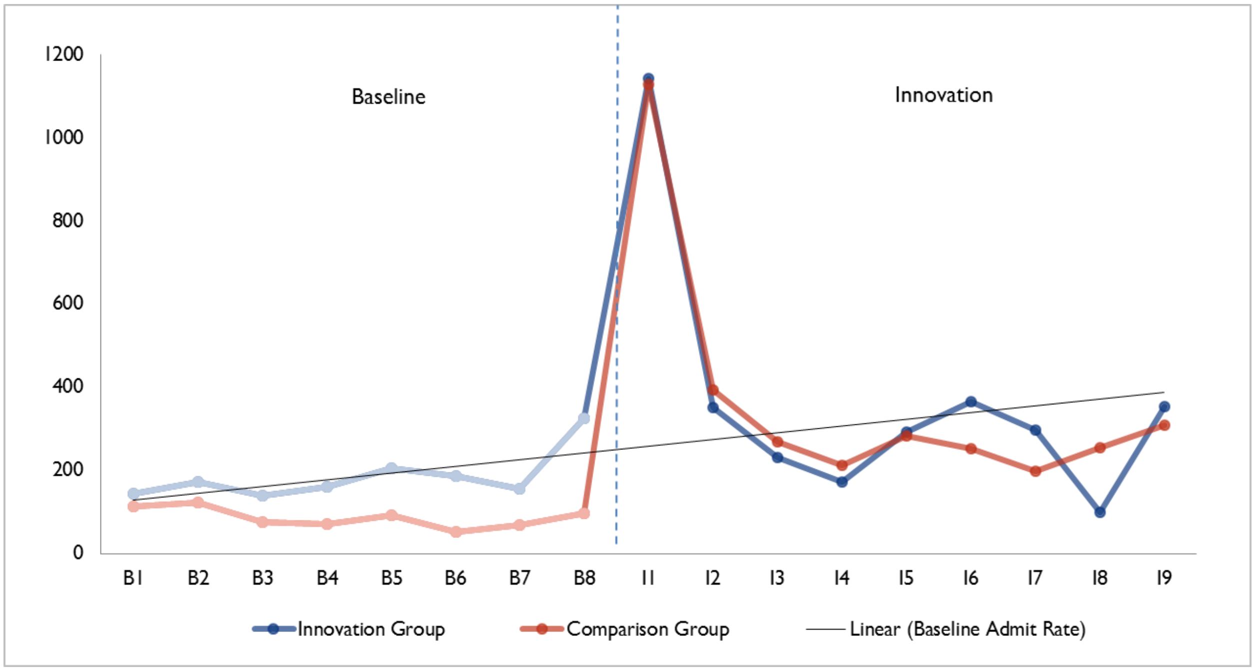
Table 24. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA CP–30 Days

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Admit rate	145	173	139	161	206	186	156	324	1143	351	232	172	292	365	298	100	353
Std dev	352	466	394	413	470	536	445	662	921	779	507	378	565	783	741	300	681
Unique patients	159	162	166	168	175	177	180	182	182	174	151	116	89	63	47	30	17
Comparison Group																	
Admit rate	113	123	76	72	91	53	69	97	1128	394	269	213	284	251	198	256	310
Std dev	393	416	259	304	375	232	270	454	679	816	554	498	637	554	518	607	818
Weighted patients	163	164	164	167	170	172	180	182	182	181	158	128	98	71	53	36	18
Innovation − Comparison Rate																	
	32	50	63	89	115	134	87	227	15	−44	−37	−41	8	114	99	−156	43

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

Figure 16. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.2.2 Regression Results

Table 25 represents the results of a negative binomial count model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The average quarterly difference-in-differences estimate is −543 inpatient admissions per 1,000 lower during the innovation period. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (CI: −648, −438). The gains of the program, for inpatient visits avoided, decrease over time.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Participants: REMSA CP–30 Days

Quarter	Coefficient	Standard Error	P-Values
I1	−1310	260	0.000
I2	−600	122	0.000
I3	−260	78	0.001
I4	−236	74	0.002
I5	−344	112	0.003
I6	−190	124	0.130

(continued)

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions: REMSA CP–30 Days (continued)

Quarter	Coefficient	Standard Error	P-Values
I7	−97	117	0.413
I8	−382	127	0.005
I9	−510	295	0.103
I10	198	298	0.531
Overall average	−543	64	0.000
Overall aggregate	−475	56	0.000
Overall aggregate (IY1)	−410	54	0.000
Overall aggregate (IY2)	−59	14	0.000
Overall aggregate (IY3)	−7	5	0.193

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.3 Medicare Unplanned Readmissions

2.5.3.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 26*** and ***Figure 17***. The unplanned readmissions rate varies highly for both innovation and comparison groups. In five out of eight baseline quarters, the readmissions rate is higher for participants than for nonparticipants.

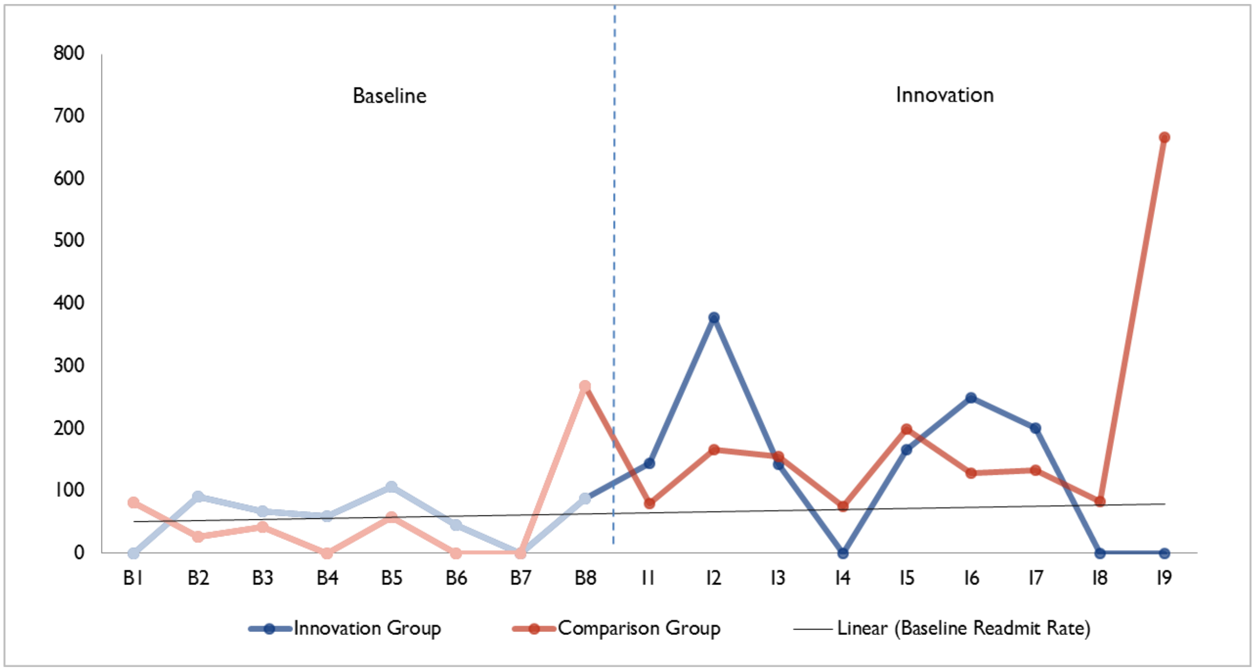
Table 26. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA CP–30 Days

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
Readmit rate	0	91	67	59	107	45	0	88	145	378	143	0	167	250	200	0	0
Std dev	0	288	249	235	309	208	0	284	352	485	350	0	373	433	400	0	0
Total admissions	15	22	15	17	28	22	20	34	159	37	21	11	12	16	5	2	2
Comparison Group																	
Readmit rate	81	27	42	0	57	0	0	267	80	167	155	75	198	129	133	83	667
Std dev	273	161	200	0	232	0	0	443	271	373	362	263	399	335	340	276	471
Total admissions	12	13	8	6	12	7	8	14	146	46	24	13	19	10	5	4	1
Innovation − Comparison Rate																	
	−81	64	25	59	50	45	0	−179	65	212	−12	−75	−32	121	67	−83	−667

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

Figure 17. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.3.2 Regression Results

The average difference in unplanned readmissions probability per 1,000 inpatient admission for all innovation quarters, weighted by the number of inpatient admissions in the quarter, equals 45, indicating that the probability of readmission increases by 4.5 percentage points for innovation participants (***Table 27***). The effect is not statistically significant (90% CI: −48; 138).

Table 27. Difference-In-Differences Linear Probability Model Regression Estimates for Probability that Participant Had Hospital Unplanned Readmission per 1,000 Inpatient Admissions: REMSA CP–30 Days

Quarter	Coefficient	Standard Error	P-Values
Overall average	45	57	0.428
Overall aggregate	12	15	0.428

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.4 Medicare Emergency Department Visits

2.5.4.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 28*** and ***Figure 18.*** Baseline ED utilization rates for participants and controls are comparable. Although the enrollment criterion for this innovation is inpatient admissions for MI, CHF, and COPD rather than ED visits, these conditions are associated with an increased ED utilization in the innovation quarter.

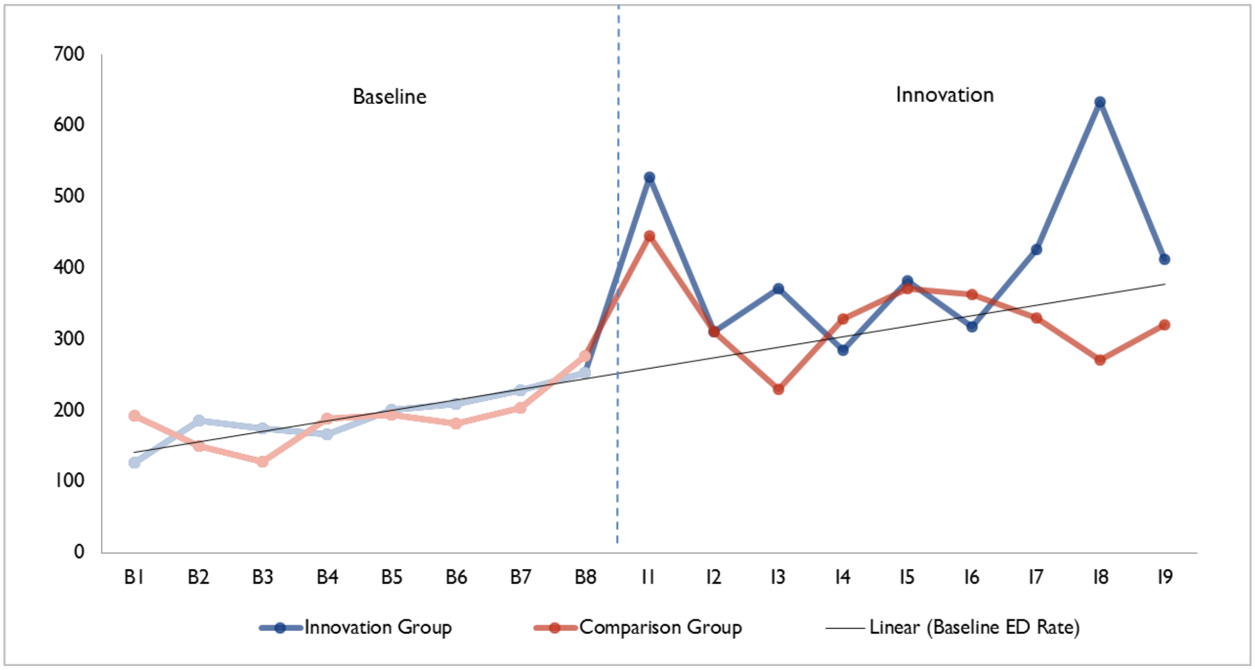
Table 28. ED Visits per 1,000 Participants: REMSA CP–30 Days

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters								
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9
Innovation Group																	
ED rate	126	185	175	167	200	209	228	253	527	310	371	284	382	317	426	633	412
Std dev	417	537	504	485	525	795	577	699	852	710	892	695	833	692	994	1938	870
Unique patients	159	162	166	168	175	177	180	182	182	174	151	116	89	63	47	30	17
Comparison Group																	
ED rate	192	150	127	188	194	181	203	277	445	310	230	328	371	362	329	271	321
Std dev	541	322	262	449	377	543	408	433	588	482	373	528	568	549	718	578	438
Weighted patients	163	164	164	167	170	172	180	182	182	181	158	128	98	71	53	36	18
Innovation − Comparison Rate																	
	−66	35	48	−22	6	28	25	−24	82	0	141	−44	11	−45	96	362	91

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

Figure 18. ED Visits per 1,000 Participants: REMSA CP–30 Days



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.4.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits per 1,000 participants is 28 visits per 1,000 participants higher during the innovation period. This is the average difference in ED visits per 1,000 participants for all innovation quarters, weighted by the number of participants in the quarter. The effect is not statistically significant (90% CI: −31, 86). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 29 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants.

Table 29. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Participants: REMSA CP–30 Days

Quarter	Coefficient	Standard Error	P-Values
I1	78	102	0.443
I2	−19	72	0.790
I3	148	72	0.041
I4	−134	93	0.153
I5	−47	109	0.667

(continued)

Table 29. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Participants: REMSA CP–30 Days (continued)

Quarter	Coefficient	Standard Error	P-Values
I6	−64	109	0.563
I7	56	143	0.701
I8	364	210	0.094
I9	57	242	0.818
I10	9	303	0.977
Overall average	28	36	0.442
Overall aggregate	24	31	0.442
Overall aggregate (IY1)	18	27	0.513
Overall aggregate (IY2)	5	15	0.723
Overall aggregate (IY3)	1	5	0.826

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; REMSA CP–30 Days = Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.5.5 Discussion: Medicare Results—REMSA CP (30 Days)

The innovation is associated with statistically significant reductions in Medicare spending and inpatient admissions. The evidence in favor of reduced spending is strongest in the first four quarters after enrollment. There are no statistically significant effects for ED utilization or readmissions rates for the innovation period.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 1 percent of the overall population reached by the innovation and 18 percent of the beneficiaries served by the 30-day CP enrollment program. In addition, we have a small sample size, which is particularly susceptible to outliers.

2.6 Medicare Comparison Group: Community Paramedics—Evaluate and Refer (CP-ER)

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 35 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. Because few fee-for-service beneficiaries were linked to claims data, we do not have enough participants to support a meaningful comparison group for Community Paramedics—Evaluate and Refer (CP-ER).

2.6.1 Medicare Spending

2.6.1.1 Descriptive Results

Table 30 reports Medicare spending per patient in the eight quarters before and eight quarters after enrolling in the innovation. Two more quarters of data are available but these have only four participants each. ***Figure 19*** illustrates the Medicare spending per participant beneficiary only.

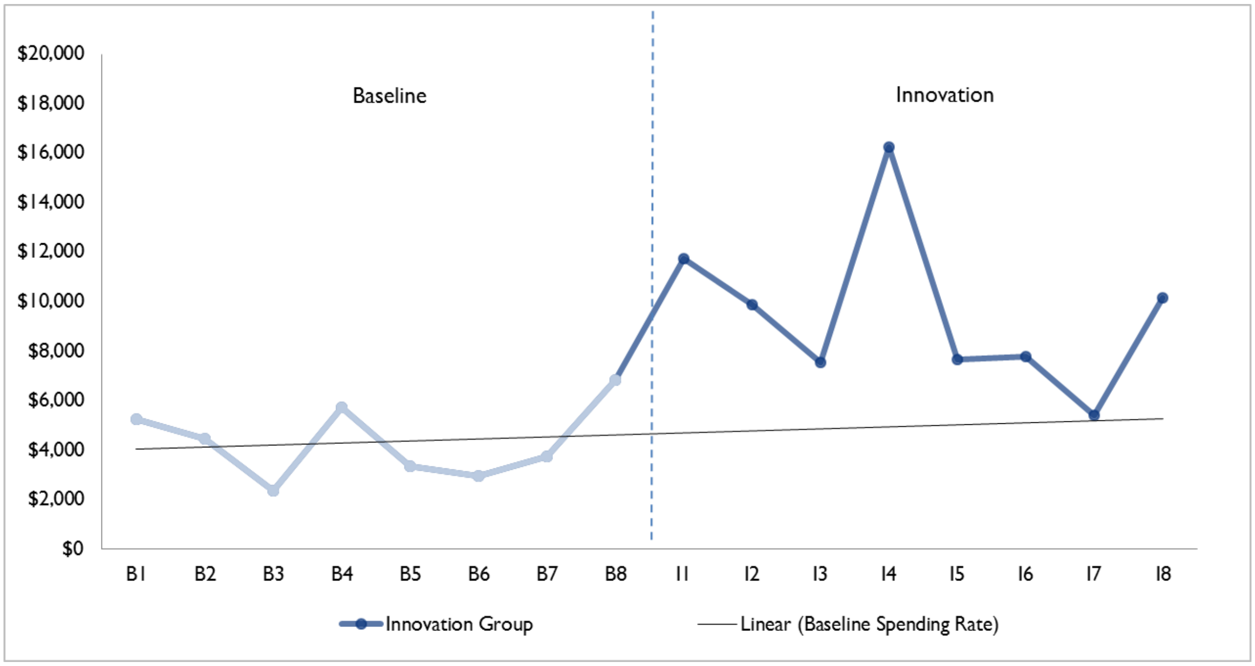
Table 30. Medicare Spending per Participant: REMSA CP–ER

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Spending rate	$5,254	$4,463	$2,345	$5,711	$3,346	$2,951	$3,734	$6,851	$11,729	$9,882	$7,552	$16,238	$7,654	$7,799	$5,411	$10,165
Std dev	$10,627	$8,707	$3,668	$12,024	$6,182	$4,407	$5,900	$11,159	$15,420	$14,765	$10,255	$44,998	$12,054	$9,963	$5,802	$19,396
Unique patients	32	32	32	33	34	34	34	35	35	33	29	25	22	21	18	11
Comparison Group																
Spending rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Savings per Patient																
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).
— Data not yet available.

Figure 19. Medicare Spending per Participant: REMSA CP–ER



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).

2.6.2 *Medicare Inpatient Admissions*

2.6.2.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 31*** and ***Figure 20***.

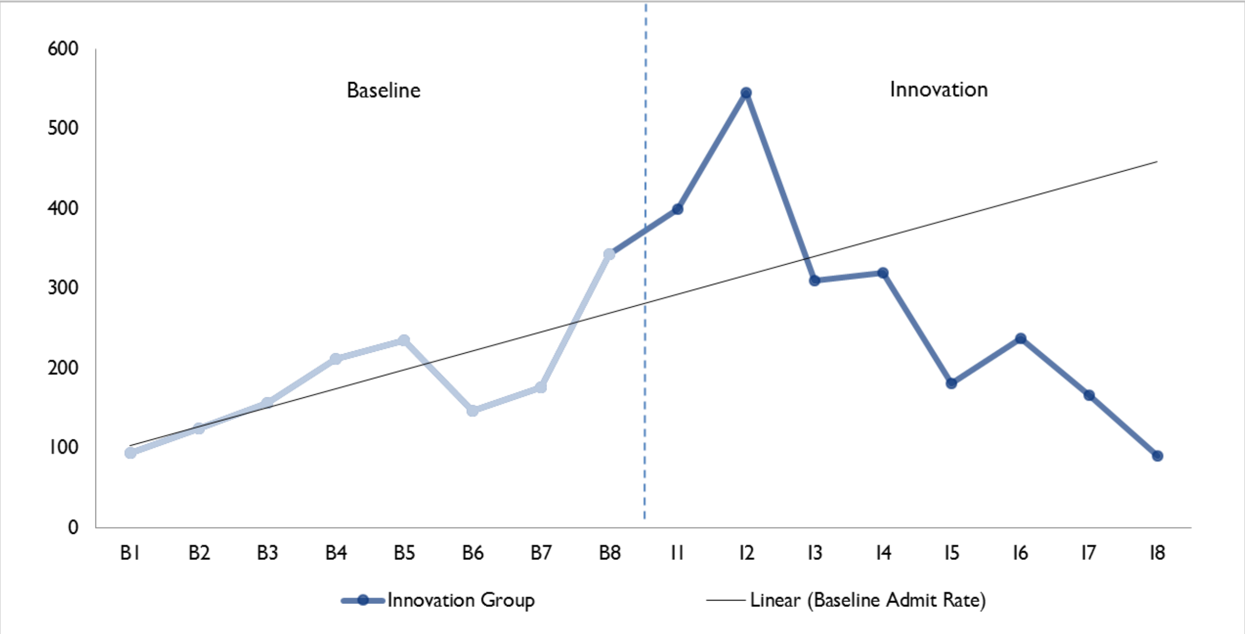
Table 31. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA CP–ER

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Admit rate	94	125	156	212	235	147	176	343	400	545	310	320	182	238	167	91
Std dev	291	415	363	591	730	354	452	674	545	924	593	546	490	426	373	287
Unique patients	32	32	32	33	34	34	34	35	35	33	29	25	22	21	18	11
Comparison Group																
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).
— Data not yet available.

Figure 20. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA CP–ER



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).

2.6.3 Medicare Unplanned Readmissions

2.6.3.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 32*** and ***Figure 21***.

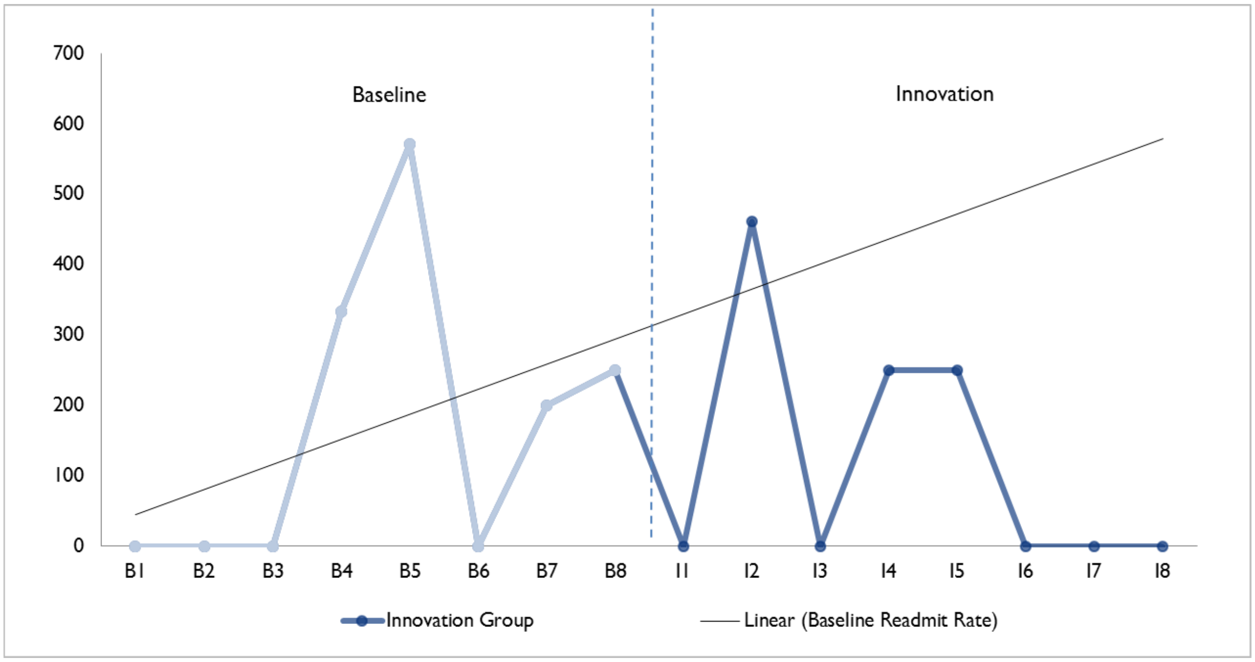
Table 32. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA CP–ER

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
Readmit rate	0	0	0	333	571	0	200	250	0	462	0	250	250	0	0	0
Std dev	0	0	0	471	495	0	400	433	0	499	0	433	433	0	0	0
Total admissions	3	4	5	6	7	4	5	8	12	13	5	4	4	5	1	1
Comparison Group																
Readmit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total admissions	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).
— Data not yet available.

Figure 21. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA CP–ER



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).

2.6.4 Medicare Emergency Department Visits

2.6.4.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 33*** and ***Figure 22.***

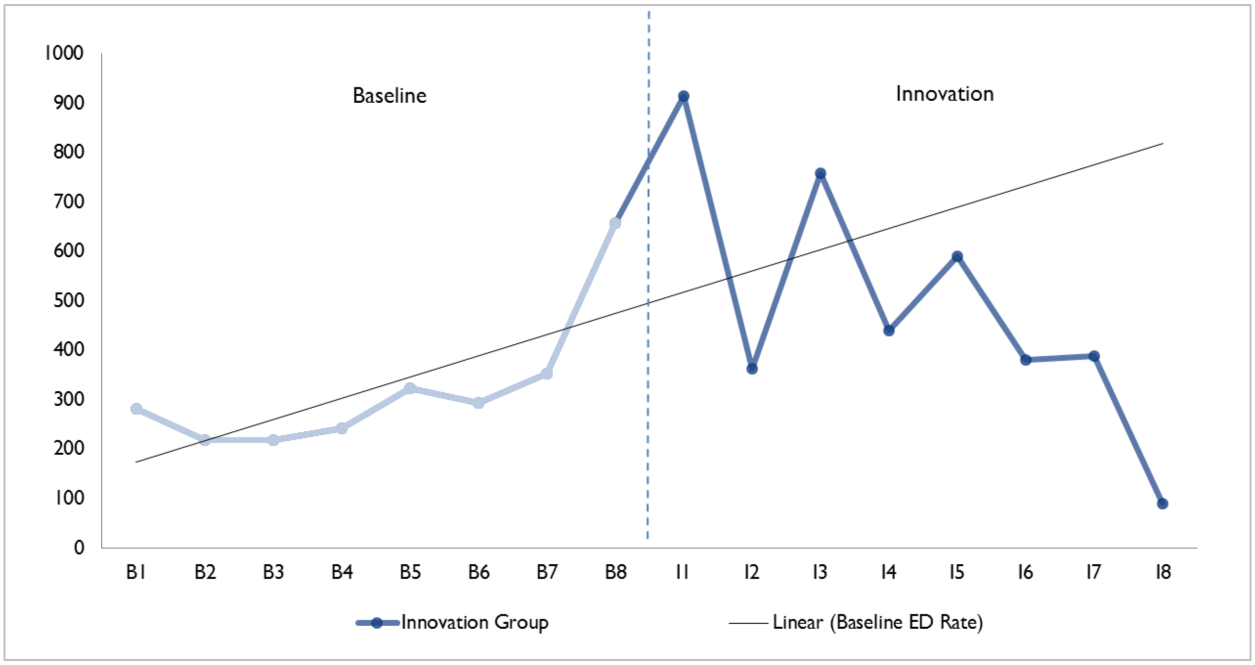
Table 33. ED Visits per 1,000 Participants: REMSA CP–ER

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters							
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group																
ED rate	281	219	219	242	324	294	353	657	914	364	759	440	591	381	389	91
Std dev	772	751	553	614	806	676	812	1626	1292	962	1300	1003	1141	805	850	302
Unique patients	32	32	32	33	34	34	34	35	35	33	29	25	22	21	18	11
Comparison Group																
ED rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).
— Data not yet available.

Figure 22. ED Visits per 1,000 Participants: REMSA CP–ER



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
REMSA CP–ER = Regional Emergency Medical Services Authority-Community Paramedics (ER).

2.6.5 Discussion: Medicare Results—REMSA CP-ER

ER visits are by construction higher for participants in the innovation during the enrollment quarter than in any other period. Inpatient admissions are above the baseline trend line for the first two quarters of the innovation. Spending is greatly volatile during the innovation, reflecting the small sample size and the different composition of participants present due to rolling enrollment. The participants in this analysis represent less than 1 percent of the total population of beneficiaries served by the innovation and 20 percent of the beneficiaries served by the CP E&R component.

2.7 Medicaid Analysis

We do not have identifying variables to link Medicaid beneficiaries to the NHL innovation. The CP-30 Days innovation has eight Medicaid FFS participants and three quarters of claims and the CP-ER innovation has five Medicaid FFS participants and two quarters of data. Here we present summary statistics for the ATA innovation only.

2.8 Medicaid Comparison Group: ATA

This section summarizes the outcomes of eligible participants and nonparticipants. Given the small number of fee-for-service beneficiaries we are able to link (27 participants and 82 nonparticipants), As with the Medicare ATA analysis, nonparticipants include fee-for-service beneficiaries (a) who were recommended for ATA transport but refused, or (b) for whom alternative transportation was deemed unsuitable based on REMSA's triage system. Because of small sample size, we do not have statistical power to identify differences between the treatment and comparison groups in a regression analysis. Medicaid participants are more likely to be white, male, and disabled compared to those who do not use the alternative location option (***Table 34***).

Table 34. Comparing Participant to Nonparticipant Characteristics in ATA Innovation

Population Characteristics	ATA Participants		Refused or Ineligible for ATA		Difference	P-Value
	Mean	SD	Mean	SD		
Age	47.44	16.26	46.77	18.50	0.68	0.857
Female	25.9%	44.7%	57.3%	49.8%	−31.4%	0.003
White	77.8%	42.4%	82.9%	37.9%	−5.1%	0.575
Black	11.1%	32.0%	6.1%	24.1%	5.0%	0.457
Other race	11.1%	32.0%	11.0%	31.5%	0.1%	0.985
Dual eligible	48.1%	50.9%	56.1%	49.9%	−7.9%	0.481
Disabled	81.5%	39.6%	70.7%	45.8%	10.7%	0.242
N	27		82			

ATA = Ambulance Transport Alternatives.

2.8.1 Medicaid Spending ATA

2.8.1.1 Descriptive Results

Table 35 reports Medicaid spending per patient in the eight quarters before and the three quarters after enrolling in the innovation. One more quarter of data is available but is not presented because only five participants were enrolled early enough to accrue four quarters of post-enrollment data. ***Figure 23*** illustrates the Medicaid spending per beneficiary in Table 35 for innovation participants and beneficiaries who were eligible but were not transported to an alternative location. REMSA did not collect information on those not transported to alternative locations in the first two quarters of the innovation; hence, summary statistics for the comparison group are available only for persons who were not transported in the third and fourth quarter after the innovation began. Because we define innovation quarters based on when a person enrolls (or could have enrolled), we only have data for the comparison group in I1 and I2. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Although this measure has a lot of variation given the small sample size, throughout the innovation period, spending is higher for those who participate compared to those who did not.

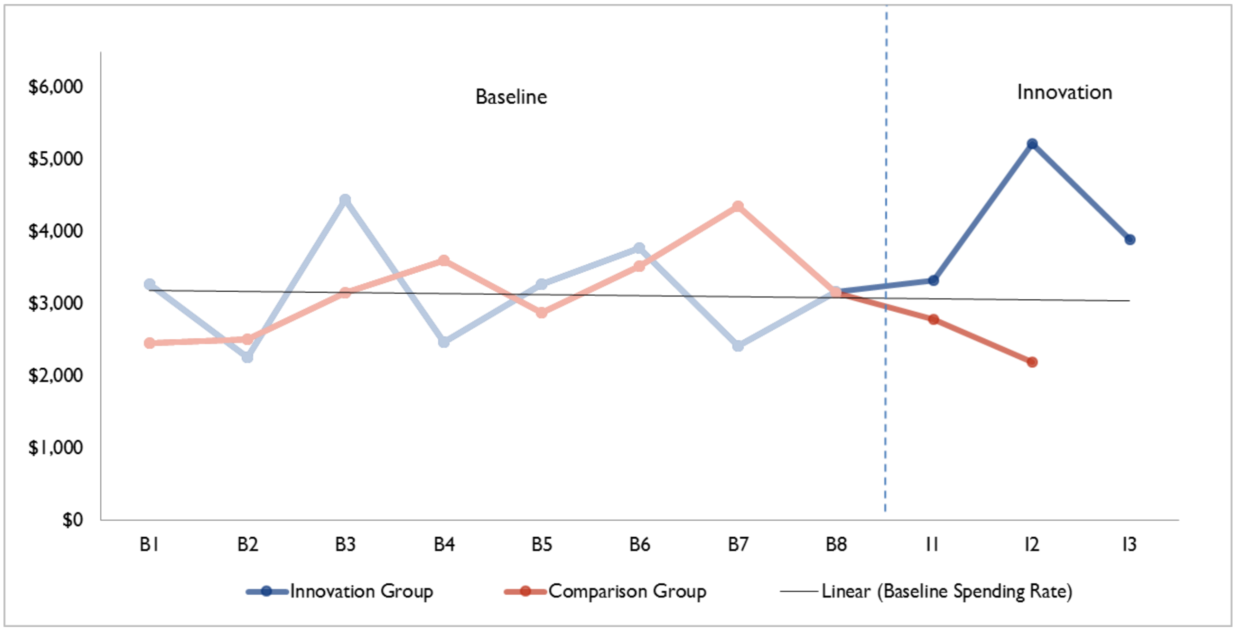
Table 35. Medicaid Spending per Participant: REMSA-ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Spending rate	$3,282	$2,255	$4,452	$2,468	$3,274	$3,772	$2,425	$3,172	$3,334	$5,221	$3,897
Std dev	$7,787	$7,077	$9,290	$6,887	$7,553	$7,877	$5,791	$6,602	$5,027	$8,178	$4,636
Unique patients	18	17	17	17	17	18	21	23	27	21	17
Comparison Group											
Spending rate	$2,465	$2,516	$3,153	$3,605	$2,876	$3,524	$4,351	$3,153	$2,792	$2,196	N/A
Std dev	$4,369	$5,049	$6,032	$6,758	$6,244	$7,648	$8,019	$5,863	$6,248	$3,792	N/A
Weighted patients	47	54	59	64	70	67	66	77	82	37	N/A
Savings per Patient											
	−$817	$261	−$1,299	$1,137	−$398	−$248	$1,926	−$19	−$542	−$3,025	N/A

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
N/A = data not applicable.

Figure 23. Medicaid Spending per Participant: REMSA-ATA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives

2.8.2 Medicaid Inpatient Admissions

2.8.2.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 36*** and ***Figure 24***.

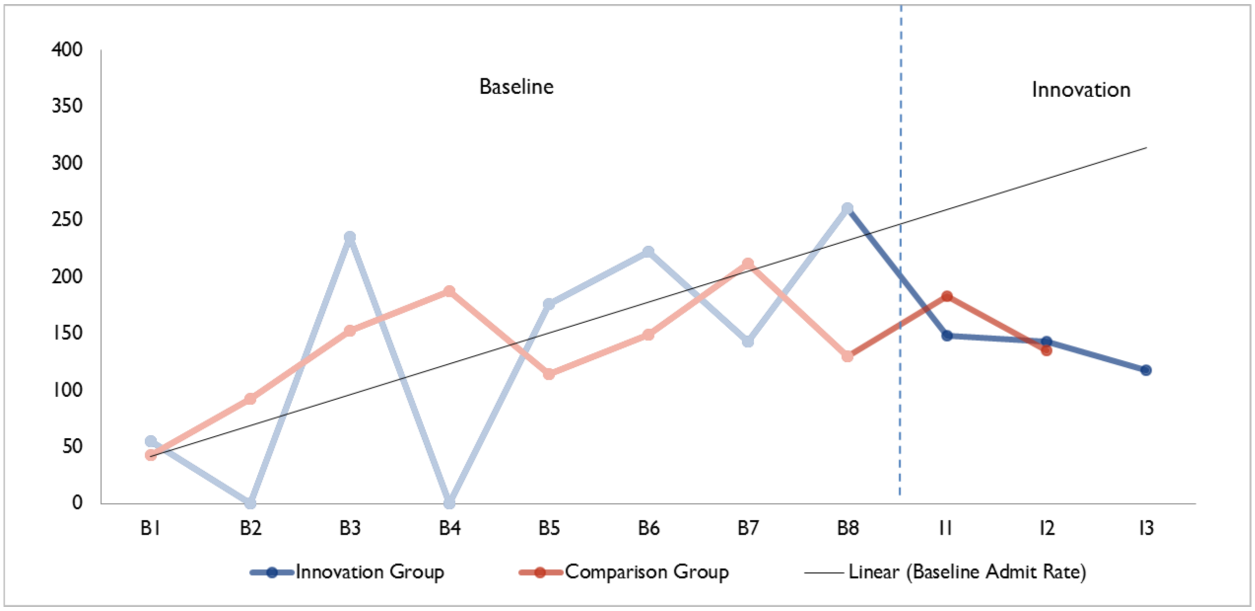
Table 36. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA-ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Admit rate	56	0	235	0	176	222	143	261	148	143	118
Std dev	236	0	752	0	393	428	359	619	456	359	485
Unique patients	18	17	17	17	17	18	21	23	27	21	17
Comparison Group											
Admit rate	43	93	153	188	114	149	212	130	183	135	—
Std dev	204	351	519	614	435	609	541	469	475	419	—
Weighted patients	47	54	59	64	70	67	66	77	82	37	—
Innovation − Comparison Rate											
	13	−93	83	−188	62	73	−69	131	−35	8	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
— Data not yet available.

Figure 24. All-Cause Inpatient Admissions Rate per 1,000 Participants: REMSA-ATA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.8.3 Medicaid Unplanned Readmissions

2.8.3.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 37*** and ***Figure 25***. The 27 participants in the innovation have no readmissions in seven out of eight baseline quarters.

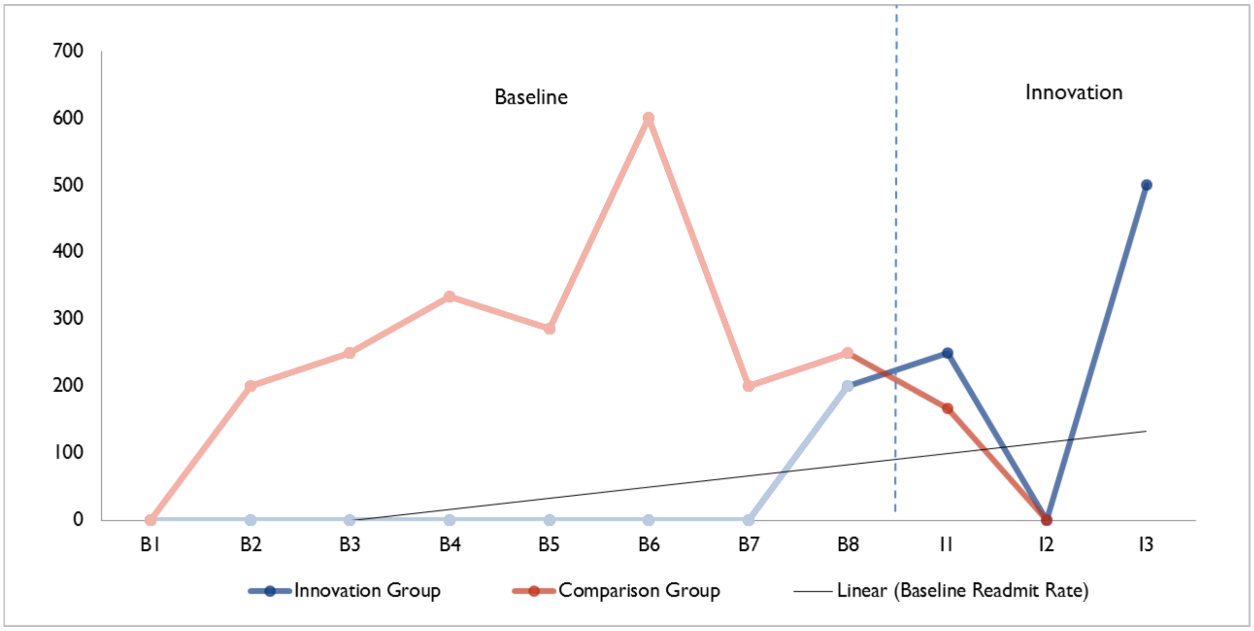
Table 37. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA-ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Readmit rate	0	0	0	0	0	0	0	200	250	0	500
Std dev	0	0	0	0	0	0	0	400	433	0	500
Total admissions	1	0	2	0	3	4	3	5	4	2	2
Comparison Group											
Readmit rate	0	200	250	333	286	600	200	250	167	0	—
Std dev	0	400	433	471	452	490	400	433	373	0	—
Total admissions	0	5	8	9	7	10	10	8	12	4	—
Innovation − Comparison Rate											
	0	−200	−250	−333	−286	−600	−200	−50	83	0	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
— Data not yet available

Figure 25. Hospital Unplanned Readmissions Rates per 1,000 Admissions: REMSA-ATA



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.8.4 Medicaid Emergency Department Visits

2.8.4.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 38*** and ***Figure 26.*** Individuals who did not participate had historically much higher ED visit rates than the Medicaid beneficiaries who were transported to alternative locations.

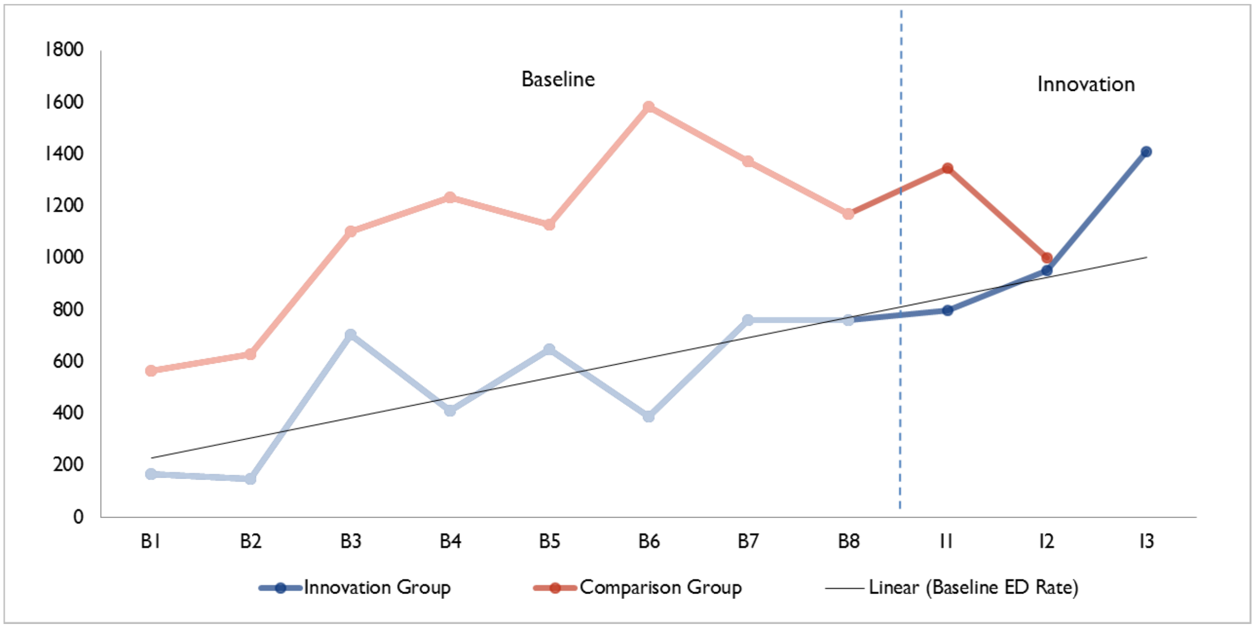
Table 38. ED Visits per 1,000 Participants: REMSA-ATA

Awardee Number: 1C1CMS330971
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
ED rate	167	147	706	412	647	389	762	761	796	952	1,412
Std dev	515	424	1,572	795	1,730	698	1,480	1,429	1,389	1,802	2,373
Unique patients	18	17	17	17	17	18	21	23	27	21	17
Comparison Group											
ED rate	564	630	1,102	1,234	1,129	1,582	1,371	1,169	1,348	1,000	—
Std dev	1,432	1,866	2,802	3,411	3,111	4,560	2,869	2,867	2,602	2,014	—
Weighted patients	47	54	59	64	70	67	66	77	82	37	—
Innovation − Comparison Rate											
	−397	−483	−396	−823	−482	−1,193	−609	−408	−551	−48	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
— Data not yet available.

Figure 26. ED Visits per 1,000 Participants: REMSA-ATA



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicaid fee-for-service claims.
ED = emergency department; REMSA ATA = Regional Emergency Medical Services Authority Ambulance Transport Alternatives.

2.8.5 Discussion: Medicaid Results—REMSA ATA

Using individuals who were screened, but not transported to an alternative location as a comparison group might be problematic for at least three reasons. First, possible selection effects may make participants and nonparticipants different across unobservable characteristics that are correlated with the outcomes of interest. Second, there is no distinction in the data for nonparticipants between those who refused to participate when deemed eligible and those who did not meet the triage criteria and did not qualify to be transported to an alternative location. The comparison group lumps together these two categories of people and thus might comprise individuals more at risk of serious events than the participating sample. And third, while there are more nonparticipants than participants, no data were collected on those who did not participate during the first 6 months of the innovation. Thus, comparing innovation and comparison groups across the same periods is not possible.

The small sample size did not allow us to construct an alternative comparison group. The summaries of the outcomes of interest (spending, inpatient admissions, readmissions, and ED visits) presented here are for Medicaid beneficiaries only, which represent only 3 percent of beneficiaries served by the ATA innovation. In addition, the small sample size does not allow control for potential confounding factors that might affect the trends in medical utilization or to construct a matched comparison sample.

2.9 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

REMSA submitted data to RTI current through December 2015. ***Table 39*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for all of these measures are included in this annual report.

Table 39. Awardee-Specific Outcome Measures

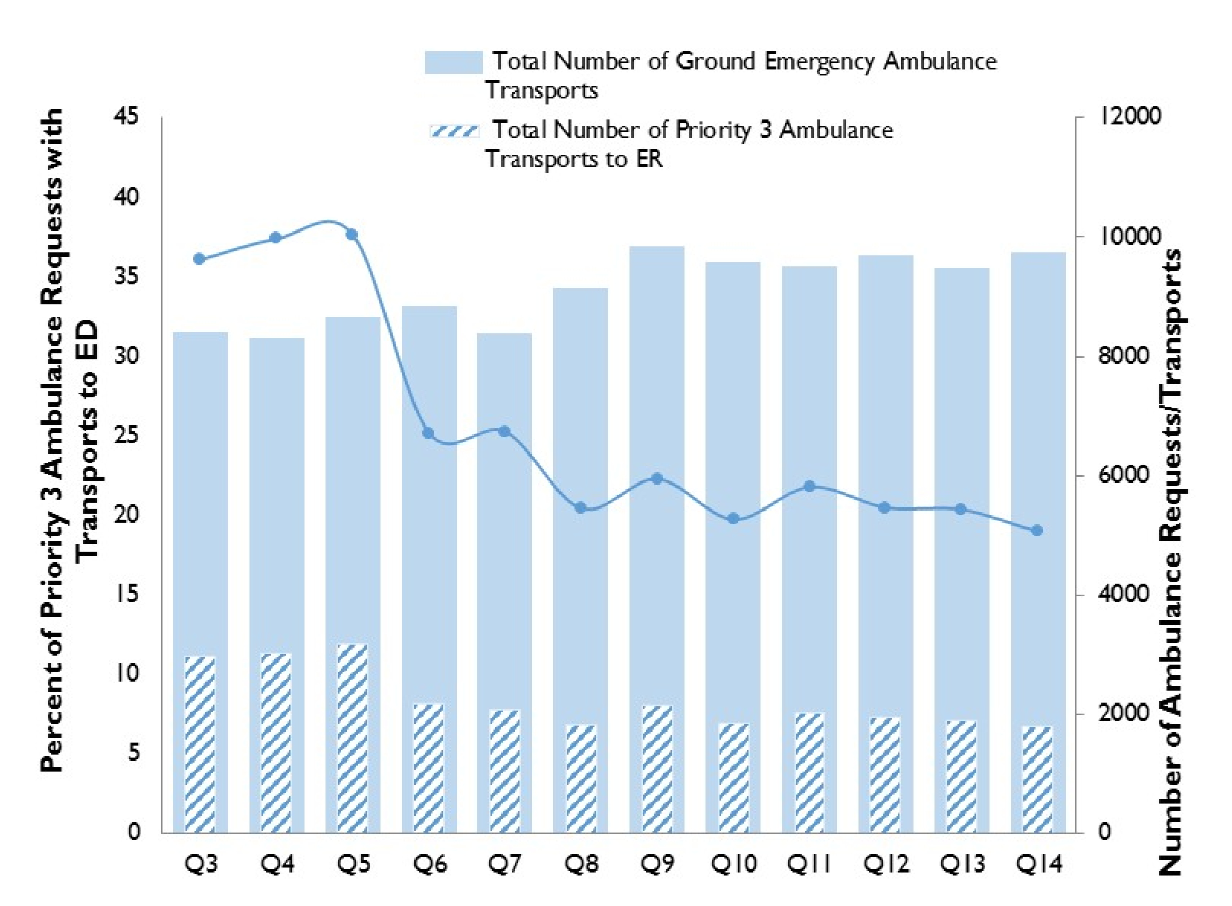
Evaluation Domains	Subdomains	Measure	Status
Health care outcomes	Utilization	Number/percentage of Priority 3/low-priority ambulance transports to ED	Data received from REMSA
		Hospital readmission rate	Data received from REMSA

ED = emergency department; REMSA ATA = Regional Emergency Medical Services Authority.

2.9.1 Health Care Outcomes: Utilization

REMSA provided health care utilization data to RTI related to REMSA's goals of improving appropriate care and reducing costs. The source is aggregated data provided in REMSA's self-monitoring plan. ***Figure 27*** *(Priority 3 transports to ED)* demonstrates a decrease in the amount of Priority 3/low priority transports to the ER; Q14 is the lowest thus far in the innovation with 19 percent of transports to the ED classified as nonemergency (Priority 3/low priority). Over time, if the ATA and NHL components of this innovation are successful, we expect to see a continuing decrease in the percentage of nonemergency ambulance transports to the ED.

Figure 27. Priority 3 Transports to ED—Percentage of Priority 3/Low-Priority Transports to the ED though Q14



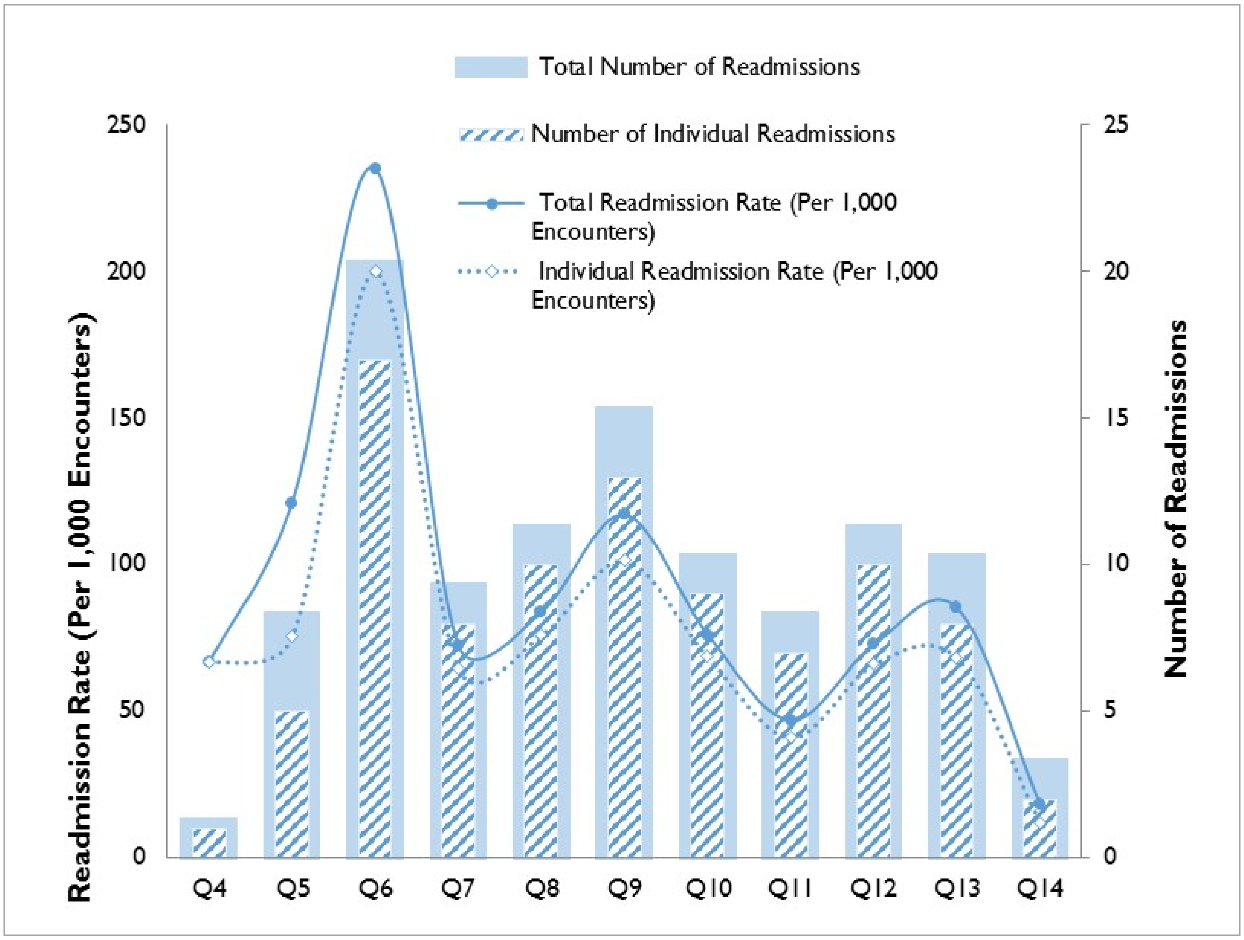
Quarter	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Percentage of Priority 3 ambulance transports to ED	36.1	37.4	37.7	25.2	25.3	20.4	22.3	19.8	21.8	20.5	20.4	19.0
Total number of emergency ground ambulance transports	8,212	8,098	8,456	8,650	8,176	8,945	9,641	9,378	9,294	9,473	9,290	9,525
Total number of Priority 3 ambulance transports to ED	2,962	3,028	3,184	2,180	2,068	1,829	2,150	1,853	2,026	1,942	1,893	1,807

Source: Aggregate data provided in self-monitoring plan.
ED = emergency department; Q = quarter.

REMSA provided patient-level data on the rate of total hospital readmissions for participants in the CP program by quarter through Q14, as well as the rate of individual hospital readmissions for participants enrolled in the 30-day enrollment program. These data are presented both ways: readmissions rates can be high because of the diseases for which people enroll in the 30-day program (e.g., CHF, COPD)—and if individuals are very ill, they may need to be readmitted multiple times. ***Figure 28*** shows that for every 1,000 participants enrolled in the program in Q14, 18.4 total participants are readmitted to the hospital during the course of their enrollment. This rate decreases to 12.3 readmissions for every 1,000 participants when unique individuals are considered rather than examining the total number of readmissions regardless of unique individuals. Overall, since the inception of the innovation in Q4, the total rate of readmission for individuals in the 30-day enrollment program is 82.7 for every 1,000 participants, and the individual rate of readmission for those in the 30-day enrollment program is 70.3 for every 1,000 participants.

These rates vary slightly from the 2015 second annual report because of corrections REMSA made in previously reported data.

Figure 28. 30-Day Enrollment Program Readmissions—Rate of Total and Individual Hospital Readmissions for Patients Enrolled in the CP Program



(continued)

Figure 28. 30-Day Enrollment Program Readmissions—Rate of Total and Individual Hospital Readmissions for Patients Enrolled in the CP Program (continued)

	Quarter	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
●	Total readmission rate (per 1,000 encounters)	66.7	121.2	235.3	72.6	84.0	117.2	76.3	47.1	72.8	85.5	18.4
◊	Individual readmission rate (per 1,000 encounters)	66.7	75.8	200.0	64.5	76.3	101.6	68.7	41.2	66.2	68.4	12.3
	Total number of readmissions	1	8	20	9	11	15	10	8	11	10	3
	Number of individual readmissions	1	5	17	8	10	13	9	7	10	8	2

Source: Patient-level data provided to RTI by REMSA.
CP = community paramedic; Q = quarter.

2.9.2 Discussion: Awardee-Specific Data

REMSA focused on decreasing the number of nonemergency calls to 911 (the NHL program), decreasing the number of nonemergency transports to the ED (the ATA program), and decreasing the number of hospital readmissions and nonemergency ED visits in the CP programs. Data indicate that, overall, the CP 30-day enrollment program may contribute to a decrease in readmission rates. The decrease in readmissions shown here (from 20% among CHF patients down to 8% among 30-day enrollment program participants), is consistent with reductions identified in other studies involving similar innovations and populations.

In Q13, REMSA reported an increase in CHF readmission rates. Speculation was that staff turnover at Renown Health and loss of the in-patient nurse navigator who steered the CPs to eligible patients resulted in fewer individuals recommended and recruited for the innovation. Since this issue, the CPs worked with the new staff at Renown, and readmission rates decreased in Q14.

2.10 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 40*** lists the quantifiable measures of implementation and their status as of December 31, 2015 that RTI obtained from REMSA's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q14 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 40. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q14	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11-Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11-Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	CP 30-day enrollment: Number/percentage of patients enrolled in the CP program	Data received from REMSA
		CP E&R: Number /percentage of patients visited by CPs	Data received from REMSA
		ATA: Number/percentage of patients transported to alternative location	Data received from REMSA
		NHL: Number/percentage of NHL callers	Data received from REMSA
	Dose	CP 30-day enrollment: Number of encounters/CP visits	Data received from REMSA
Coordinated care	Efficiency	ATA: Repatriation to ED in the ATA	Data received from REMSA
		CP E&R: Evaluate and Refer patients sent to ED by CP	Data received from REMSA
		NHL: Number of NHL protocols completed with callers	Data received from REMSA
		NHL: Rate of repatriation in the NHL	Data received from REMSA

ATA = Ambulance Transport Alternatives; CP = Community Paramedic; E&R = Evaluate and Refer; FTE = full-time equivalent; NHL = Nurse Health Line; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

2.10.1 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question
• What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.10.1.1 Hiring and Retention

At the end of Q14 (December 2015), the innovation was staffed with 16.0 full-time equivalent (FTE) staff members. Since these data were last reported in the 2015 annual report, six separations occurred.

REMSA faced challenges in staffing the CP (30-day enrollment program and E&R) and NHL components of the innovation throughout the innovation. For both CP components, REMSA initially recruited internally from existing paramedics; issues subsequently arose regarding the expectations for these paramedics about their role as part of the innovation. In the 30-day enrollment program and the E&R program, paramedics are accustomed to critical situations in which they quickly assess patients and take them to the hospital (i.e., "load and go"). Transitioning to this new role of providing follow-up care to patients who are no longer in an urgent medical situation was a big shift. As a result, several CPs left in 2014, but REMSA used these lessons to recruit more effectively for the CP positions. REMSA determined that it had to fully address candidates' expectations during the hiring process so that informed decisions could be made for both paramedics and REMSA.

Staffing and retention problems related to staffing expectations also occurred in the NHL component. Manning a call center is significantly different from a typical day of nursing. Because Nevada has a nursing shortage, finding staff who had the skills to answer questions and also wanted to work in a call center environment was very difficult. REMSA discovered that not all nurses were adept at transitioning from traditional nursing to an emergency dispatch/telephone nursing environment. Issues with this internal change in workflow led to turnover in the NHL. REMSA worked to alleviate this issue by asking all interviewees for the job to work in the NHL with a nurse navigator for 4 hours and listen to the process, as an opportunity to make sure the job was a good match.

2.10.1.2 Skills, Knowledge, and Training

REMSA has a well-organized in-house training program originally established for the paramedics; they are well versed in developing curriculum to educate staff and used that strength in preparing current staff to implement this innovation. Training curricula were expanded for the new aspects of the innovation, but the emphasis on training remained the same. By the end of Q14 (December 2015), REMSA provided 18,870 hours of training to 176 individuals (***Table 41***). This training includes the full-scale community health paramedic training for the CPs, as well as the community health paramedic condensed training developed based on an evaluation of the initial full-scale training, nurse navigator training for the nurses in the NHL, ambulance transport alternatives training for the ground ambulance paramedic crews, and monthly continuing education.

Table 41. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q14	2,576	8
Since inception	18,870	176

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter

The ATA innovation was a shift from the usual paramedic protocol, and was initially a challenge for paramedics who were used to taking all patients to the ED, regardless of condition. There was also concern about paramedics making medical decisions about patients without appropriate training and protocols. To ensure the new protocol was adopted and followed, REMSA conducted educational sessions for the paramedics and audits of each unit following their shifts to determine if patients were getting advanced assessments.

2.11 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

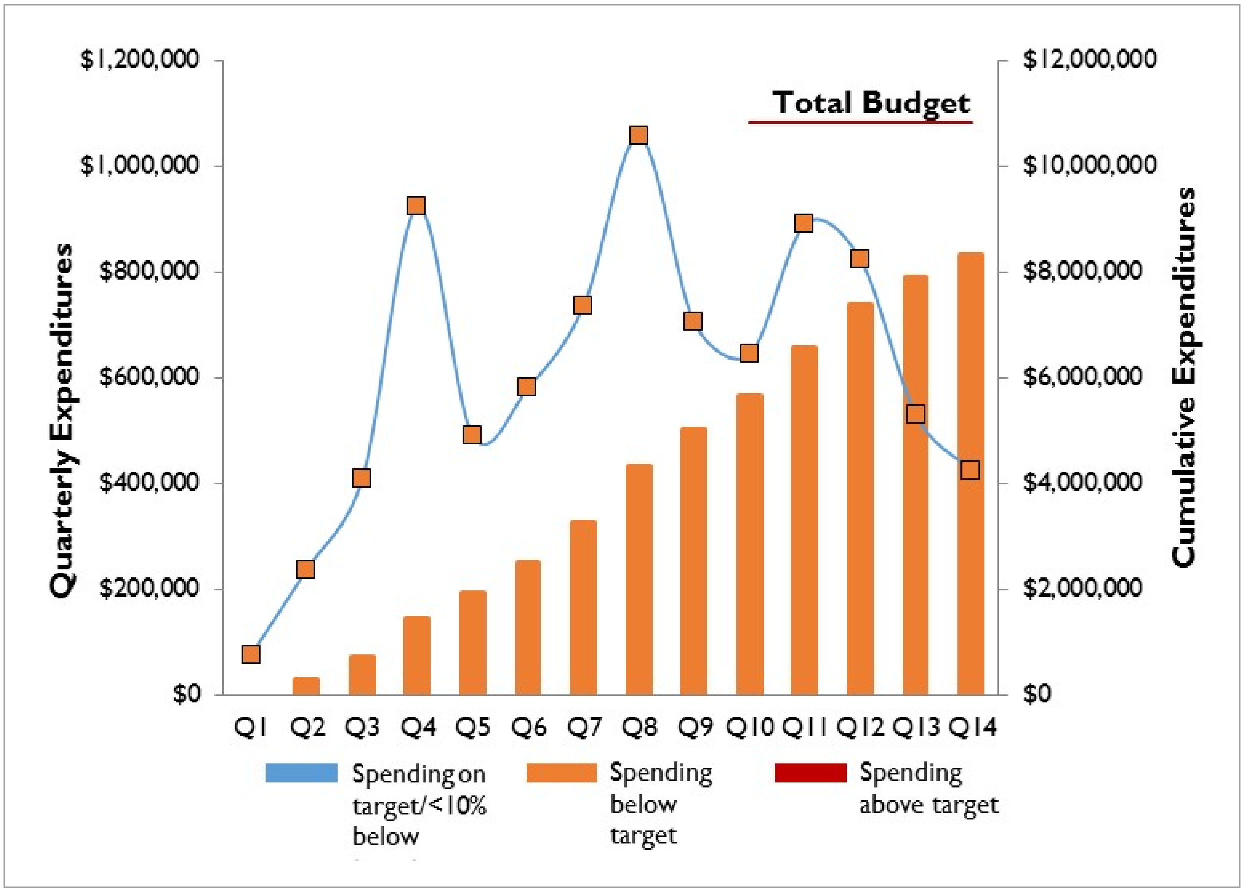
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.11.1 Award Execution

This annual report highlights the significance of REMSA's expenditure rates on implementation. As of December 2015 (Q14), REMSA spent 77.1 percent of its total budget, which is below the projected target (see ***Figure 29***). REMSA was awarded a 12 month no-cost extension to support its sustainability efforts, and that award provides limited funding toward program operation. They are expected to spend remaining funds in the last year of their grant.

Figure 29. Cumulative Spend Rate from Q1 (June 1, 2012) to Q14 (December 31, 2015)



2.11.2 Leadership

This innovation has a clearly designated leader with the requisite experience, skills, and authority to marshal resources and make decisions. The program director has significant experience working for ambulance companies, understands the billing and policy aspects, and has local and national perspectives on emergency medicine issues. REMSA has high organizational support across all levels of the organization; the chief executive officer (CEO), chief medical officer, managers, supervisors, and coordinators all understand the innovation and can articulate their direct involvement. Although some organizational leaders changed early in the innovation, organizational leadership turnover remains low.

2.11.3 Organizational Capacity

REMSA has adequate space, technology, and equipment to operate this innovation, as many aspects of the innovation built on the existing structure of paramedics and emergency medical dispatchers already in place at REMSA. REMSA faced some data collection and reporting challenges because of differences in the metrics that emergency medical providers collects versus those that a health care innovation aimed at reducing overall costs and improving care quality collects. REMSA, however, used internal resources to ensure that the data collected and provided adhered to evaluation expectations.

2.11.4 Innovation Adoption and Workflow Integration

The multiple components of REMSA's innovation (ATA, NHL, CP 30-day enrollment, and E&R) and each component's different stakeholders and partners led to issues about adopting components of the innovation and workflow integration. REMSA remediated any problems that arose.

Workflow integration was necessary for the NHL and CP components. The NHL was physically integrated into the Emergency Dispatch Center, and the nurse navigators needed to integrate with the emergency dispatchers. Although this setup allowed for easy transfers of nonemergency calls from 911 to the NHL (and vice versa), at the beginning of the innovation some were concerned whether nurses and emergency medical dispatchers (EMDs) would create a cohesive unit. During the 2014 site visit, RTI learned that this hesitancy was due to a previous bad experience REMSA EMDs had when they shared a call center with nurse navigators from another organization. However, no issues occurred with the integration of the nurse navigators for the NHL in the current innovation, probably because NHL nurse navigators are a part of REMSA, the nurse navigators trained with the existing EMDs to understand the job, and REMSA recognized the previous issue and worked with all involved to address the hesitancy.

The CPs were easily accepted into the largest health care system, Renown Health, at the beginning of the innovation, though it took time for physicians to become aware of their services and refer patients to this aftercare component. This easy integration is attributed to the existing relationships with Renown Health staff and including representatives from Renown in the innovation development process. The CPs work closely with the hospital to obtain daily rosters of those eligible for the program, and CPs then visit each patient to recruit them into the program.

Innovation adoption was an issue internally. For the CP, ATA, and NHL components this innovation is a shift in the usual scope of work for paramedics and nurses. These nontraditional roles and responsibilities led to a slower adoption of the innovation internally.

2.12 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.12.1 Innovation Reach

Reach is a critical dimension for determining the extent to which an innovation met its goals of affecting key health behaviors. REMSA's complex innovation has multiple components that must be assessed individually for reach. ***Figure 30*** shows reach by quarter since the launch of the innovation by each component of the innovation.

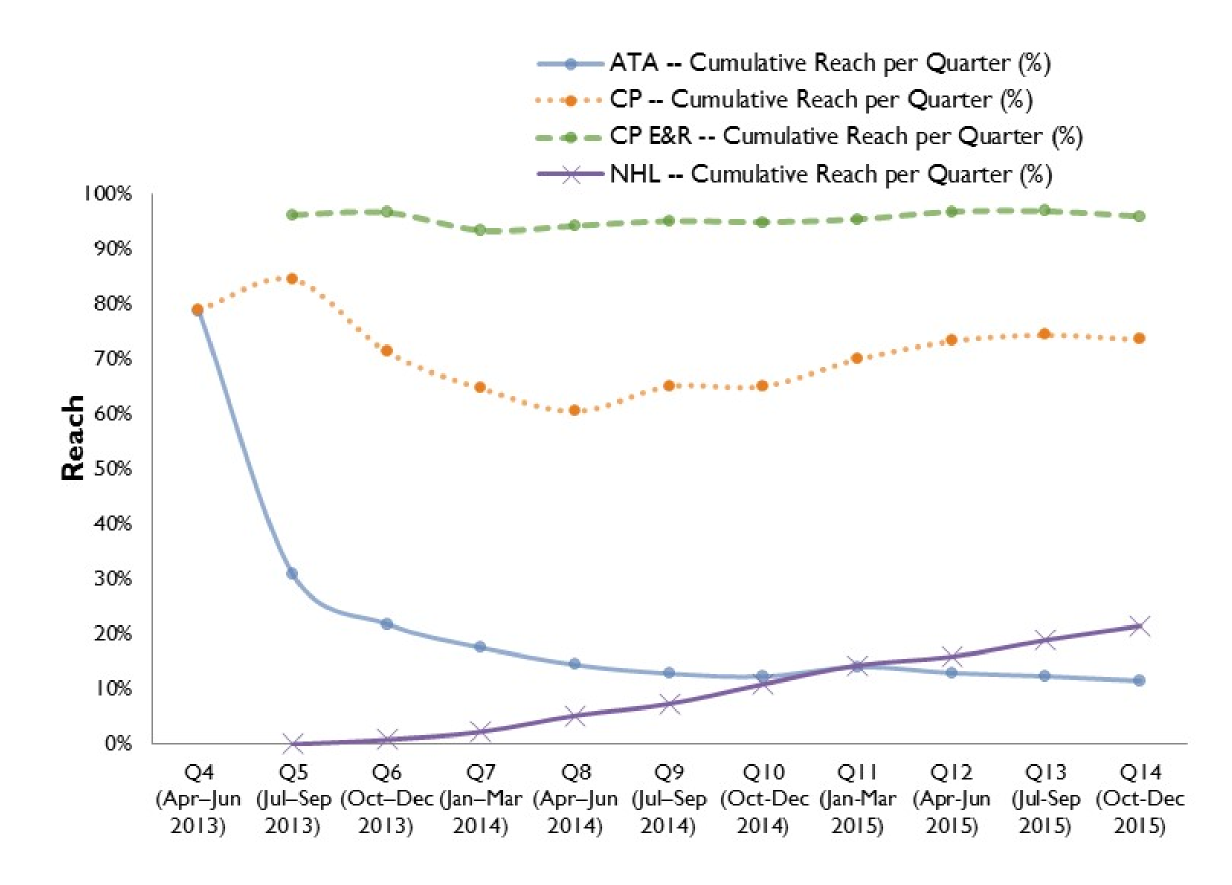
As of Q14, 1,281 patients enrolled in the CP 30-day enrollment program (including re-enrollment of patients), which is 73.4 percent of those referred to the CP 30-day enrollment program. Reach increased since the 2015 annual report.

As of Q14, in the CP E&R component, REMSA reached 95.8 percent of its target population, or 172 unique patients (293 E&R encounters). These participants were patients of primary care providers who engaged REMSA for help in assessing patients that the providers could not see. Overall reach remained consistently high across all quarters.

For the ATA component, REMSA completed 1,280 transports to alternative destinations other than the ED through Q14, which equates to 11.5 percent of its eligible target population. These transports occurred for 850 unique patients. Many external factors influence whether an alternative transport is possible; therefore, the explanation of reach for ATA is difficult. These factors include: determining an appropriate alternative location (e.g., urgent care center, community triage/detoxification center, and mental health hospital) with space available; finding an alternative location that accepts the patient's insurance or noninsurance status; and obtaining the patient's consent to transport him/her to the alternative location. If any of these factors is not aligned, the patient may refuse transport anywhere or be taken to the ED.

For the NHL component, we present the number of calls made to the NHL: the NHL fielded 35,001 calls through Q14. We do not provide a percentage of those reached for the NHL component because there is no appropriate denominator. In previous reports we provided the number of calls to the NHL as a percentage of the households in Washoe County. However, because any one household may have called the NHL multiple times—and we do not expect every household to need to call the NHL—we decided not to include this percentage in this annual report.

Figure 30. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q2 (Oct-Dec 2012)	Q3 (Jan-Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct-Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)	Q13 (Jul-Sep 2015)	Q14 (Oct-Dec 2015)
•	ATA—Cumulative reach per quarter (%)	—	—	78.6	30.8	21.8	17.5	14.4	12.8	12.2	14.0	12.9	12.3	11.5
	ATA—Cumulative number enrolled	12	56	132	244	337	424	537	636	773	900	1,020	1,172	1,280
•	CP 30-day enrollment program—Cumulative reach per quarter (%)	—	—	78.9	84.4	71.2	64.6	60.5	65.0	65.0	69.8	73.2	74.3	73.4
	CP 30-day enrollment program—Cumulative number enrolled	—	—	15	81	166	290	421	549	680	850	1,001	1,118	1,281

(continued)

Figure 30. Participant Enrollment and Reach for Each Quarter since Project Launch (continued)

	Quarter	Q2 (Oct-Dec 2012)	Q3 (Jan-Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct-Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)	Q13 (Jul-Sep 2015)	Q14 (Oct-Dec 2015)
•	CP E&R—Cumulative reach per quarter (%)	—	—	—	96.0	96.4	93.2	94.0	94.9	94.7	95.2	96.6	96.7	95.8
	CP E&R—Cumulative number enrolled	—	—	—	24	27	68	94	130	143	159	229	265	293
	NHL—Cumulative number enrolled	—	—	—	29	1,303	3,634	8,460	11,912	17,809	23,323	25,892	30,835	35,001

Source: Patient-level data provided to RTI by REMSA.

[1] REMSA did not provide the necessary denominator data (number of advanced assessments) used to calculate the reach percentage in Q2, Q3. REMSA noted these data were not collected at this stage of the innovation.

[2] Based on how data were provided, all calls prior to Q6 to the NHL are considered direct calls to the 858-1000 number.

— Data not available.

2.12.2 Innovation Dose

Table 42 provides the number of services provided across participants in the CP 30 day enrollment component of the innovation, the number of participants receiving services, and the average number of services per participant through Q14. Dose is not calculated for other components of the innovation as they are encounter based services, and each participant receives one encounter per visit.

We last reported dose in the 2015 annual report based on data through Q10. As expected, the number of services provided and the percentage of participants receiving those services increased from Q10 to Q14. As shown in the table, 100 percent of participants received home visits from CPs, but the number of visits is driven by the participant. Participants who need more attention and make more requests will be visited more often than those who do not request help. The CPs try to visit all patients at least once a week. The average number of home visits per participant is 4.4.

Table 42. Number and Types of Services Provided to CP Participants through Q14

Services	Number of Services Provided Across Patients	Number (Percentage) of Participants Receiving Service	Average Number of Services per Participant
Home Visits Made by CPs	5,660	1,281	4.4

Source: Patient-level data provided to RTI.
CP = community paramedic

2.12.3 Coordinated Care

For the CP component, RTI received data on the E&R program, which offers an alternative for physicians who (because of weekends, holidays, or lack of available appointments) would normally send patients who call their office to the ED. The goal of the program is to avoid unnecessary ED visits (and unnecessary 911 calls) among individuals who are not experiencing a medical emergency, while still confirming the patient's health and ensuring that he or she is not experiencing a medical emergency. The data show that paramedics sent only 20 patients to the ED (of 293 encounters with E&R patients; n=172 E&R patients); therefore, this program avoided 273 ED visits that otherwise would likely have occurred at this time (***Table 43***). However, a notable limitation is the lack of information after the E&R encounter and the individual's need for and use of the ED after the encounter.

Table 43. ED Visits by E&R Patient Encounters[1]

Quarter	Number of Encounters with E&R Patients	Number of ED Visits by E&R Patients	Percentage of Encounters Sent to ED
Q5 (Jul–Sep 2013)	24	2	8.3
Q6 (Oct–Dec 2013)	3	0	0.0
Q7 (Jan–Mar 2014)	41	5	12.2
Q8 (Apr–Jun 2014)	26	4	15.4
Q9 (Jul–Sep 2014)	36	3	8.3
Q10 (Oct-Dec 2014)	13	1	7.7
Q11 (Jan-Mar 2015)	16	1	6.3
Q12 (Apr-Jun 2015)	70	4	5.7
Q13 (Jul-Sep 2015)	36	0	0.0
Q14 (Oct-Dec 2015)	28	0	0.0
Total	293	20	6.8

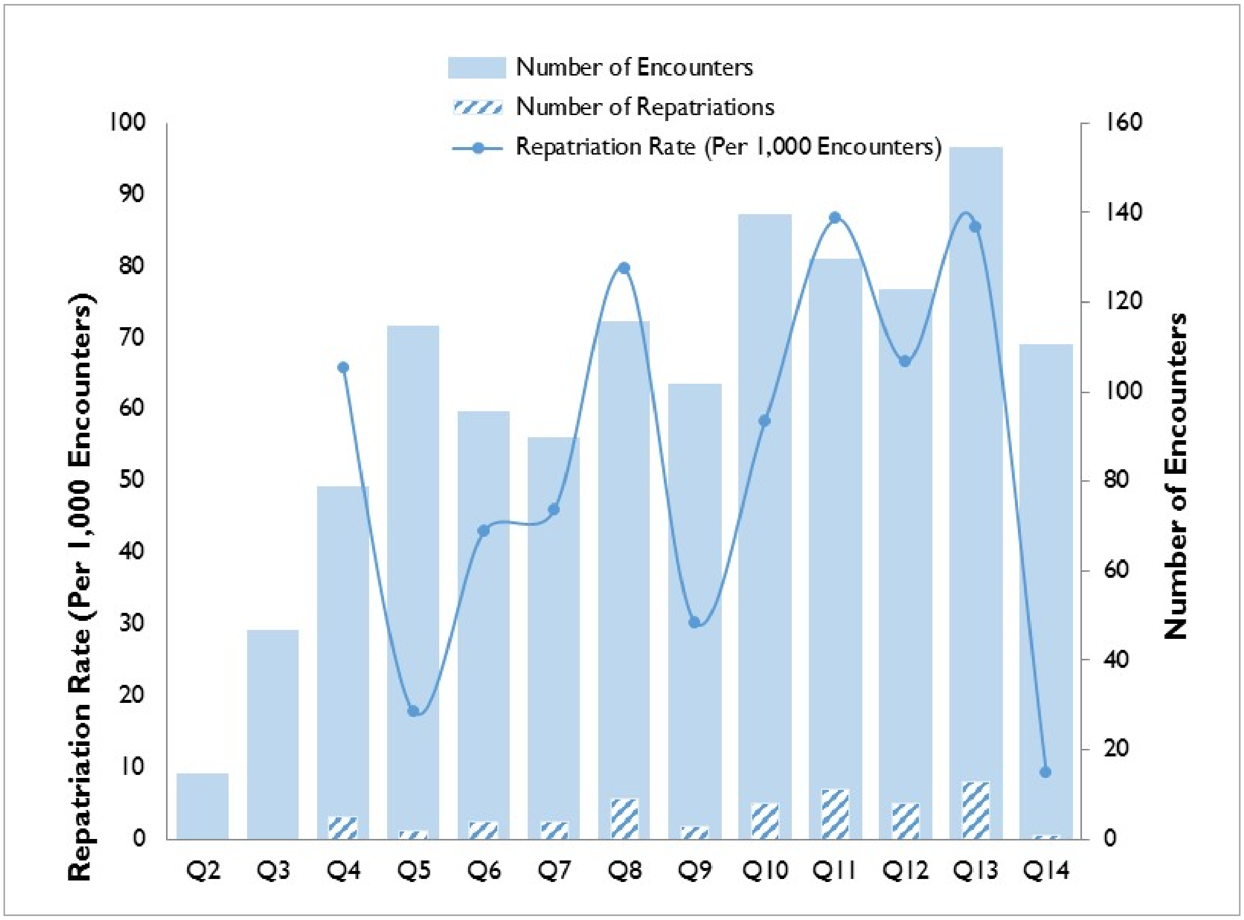
[1]These data represent 172 patients.
ED = emergency department; E&R = Evaluate and Refer.

For the ATA component of the innovation, repatriations are monitored to ensure that the component is providing appropriate care. REMSA originally defined a repatriation to be when an individual receives emergency services, is transported to an alternative location, but then has to be transported to an ED within 6 hours of the original transport because either the facility capacity or resources changed, the patient withdrew his/her consent, the patient's condition changed, or the initial assessment was inaccurate. In July 2015, REMSA redefined repatriation to include only the *transport of a patient by ambulance to an emergency department where the patient, within the previous 6 hours, had been transported to an alternative destination and the alternative destination was unable to provide definitive care.*[3] As shown in ***Figure 31,*** repatriations ranged from a high of 86.6 per 1,000 patients (8.6%) transported to an alternative location in Q11, to a low of 9.3 per 1,000 patients (0.9%) transported to an alternative location in Q14. The sharp decline seen in Q14 may be in part due to the narrowing of the repatriation definition (noted above) to include only patients sent to the ED (because the alternative destination could not provide appropriate care). The overall rate of repatriation was 53.1 per 1,000

[3] *Q13 Awardee Narrative Progress Report.*

patients (5.3%) transported to an alternative location. A total of 68 out of 1,280 ATA encounters who were transported to an alternative location were repatriated (5.3%).

Figure 31. ATA Repatriation Rate since Project Launch



	Quarter	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
	Repatriation rate (per 1,000 encounters)	0.0	0.0	65.8	17.9	43.0	46.0	79.6	30.3	58.4	86.6	66.7	85.5	9.3
	Number of encounters	12	44	76	112	93	87	113	99	137	127	120	152	108
	Number of repatriations	0	0	5	2	4	4	9	3	8	11	8	13	1

Source: Patient-level data provided to RTI by REMSA.
ATA = Ambulance Transport Alternatives; Q = quarter.

As shown in ***Table 44,*** approximately 56 percent of calls to the NHL had a protocol completed (a series of scripted questions used to match callers to the appropriate level of care). The remaining 44 percent of the calls to the NHL did not a complete a protocol for various reasons (e.g., wrong number/hang-ups, caller terminated the call).

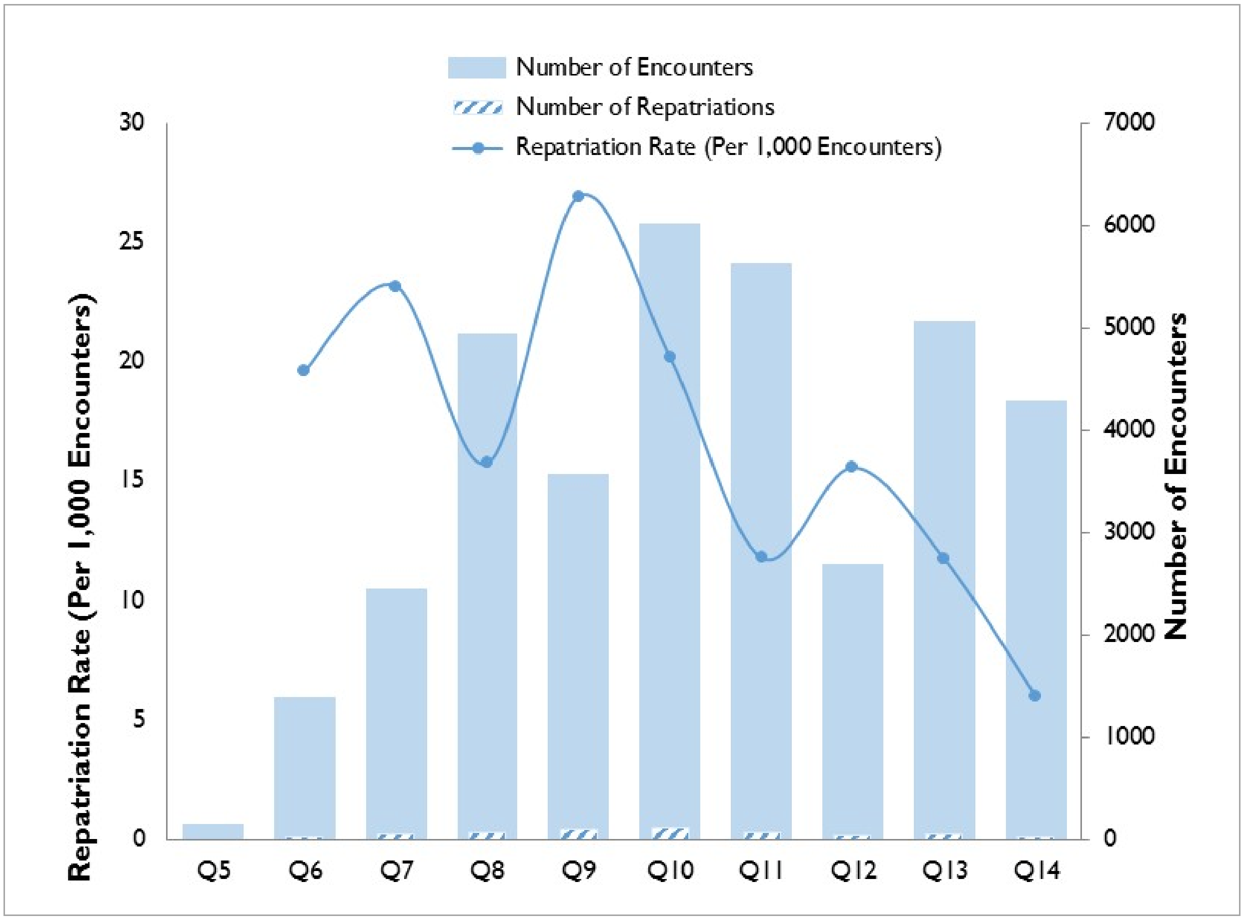
Table 44. Number and Percentage of NHL Protocols Completed

Quarter	Protocols Completed with Callers	Number of NEW NHL Encounters	Percentage of Protocols Completed
Q5 (Jul–Sep 2013)	—	29[1]	—
Q6 (Oct–Dec 2013)	921	1,274	72.3%
Q7 (Jan–Mar 2014)	1,619	2,331	69.5%
Q8 (Apr–Jun 2014)	2,576	4,826	53.4%
Q9 (Jul–Sep 2014)	3,092	3,452	89.6%
Q10 (Oct-Dec 2014)	3,194	5,897	54.2%
Q11 (Jan-Mar 2015)	2,170	5,514	39.4%
Q12 (Apr-Jun 2015)	2,538	2,569	98.8%
Q13 (Jul-Sep 2015)	2,026	4,943	41.0%
Q14 (Oct-Dec 2015)	1,460	4,166	35.0%
Total	19,596	34,972	56.0%

Source: Patient-level data provided to RTI by REMSA.
[1] Not included in the total because data regarding the number of protocols completed was not recorded at this stage of the innovation
NHL = Nurse Health Line; Q = quarter.
— Data not available.

The final coordinated care outcome measure for the NHL component is repatriation (a call transferred from the NHL to 911 for an emergency response). As shown in ***Figure 32***, repatriation ranged from a high of 26.9 per 1,000 patients (2.7%) transferred to 911 from the NHL in Q9, to a low of 6.0 per 1,000 patients (0.6%) transferred to 911 from the NHL in in Q14. The overall rate of repatriation was 15.9 per 1,000 patients (1.6%) transferred to 911 from the NHL. A total of 555 calls (out of 35,001 calls to the NHL were transferred to 911, and then transported to the ED) were repatriated—less than 2 percent of all calls to the NHL. These results show that the NHL is reaching the appropriate target population (individuals in nonemergency situations) and providing a useful service: for more than 35,000 encounters, an emergency call or dispatch was not required when the situation might have otherwise resulted in a call to 911.

Figure 32. Rate or Repatriation in the NHL (Calls Transferred from NHL to 911)



	Quarter	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
●	Repatriation rate (per 1,000 encounters)	0.0	19.6	23.2	15.7	26.9	20.2	11.8	15.6	11.7	6.0
	Number of encounters	29	1,274	2,331	4,826	3,452	5,897	5,514	2,569	4,943	4,166
	Number of repatriations	0	25	54	76	93	119	65	40	58	25

Source: Patient-level data provided to RTI by REMSA.
NHL = Nurse Health Line.

2.13 Qualitative Findings: Sustainability

Between Q11 and Q14, REMSA continued to work on the sustainability of all components of the innovation. They leveraged success of the current components to gain recognition from Nevada and from other emergency medical service providers. First, REMSA received recognition in the media for its efforts throughout the innovation, including national exposure in *USA Today,* which featured REMSA's innovation in an article published on May 10, 2015.[4] Second, in Year 3, Nevada's innovation team invited

[4] Gorman, A. (n.d.). Paramedics work to keep patients out of the E.R. USA Today.

REMSA to help develop a SIM driver diagram to improve Nevada's health status from 39^{th} to 34^{th} in the nation. The state expressed interest in including all of REMSA's innovations (CP, ATA, and NHL) in the driver diagram to make them available to all people in Nevada. Third, REMSA gained recognition for the program with the successful passage of legislation defining paramedics' roles. On May 26, 2015, the governor signed Assembly Bill 305, which authorizes and provides for the regulation of community paramedicine services in the state of Nevada. The act allows licensed ambulance services to obtain an endorsement to provide community paramedicine services, requires quarterly reports to the health department about the effect of providing community paramedicine services, and establishes personnel qualifications, training, and continuing education requirements.

Along with the successful legislation, in Q14, the Nevada Medicaid Administrator announced reimbursement for community paramedicine services beginning in July, 2016. REMSA also worked with local health system and key clinical partners in the community to ensure a smooth transition from grant funding at the end of June 2016, to funding from other sources (e.g., state, private, etc.).

2.14 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing REMSA as well as accomplishments to date. In this section we assess REMSA's progress on achieving HCIA goals to date:

- **Smarter spending.** Among Medicare beneficiaries, NHL showed no statistically significant savings or loses in the innovation period.

  CP 30-day enrollment had a statistically significant reduction in Medicare spending in the first four quarters after enrollment.

- **Better care.** The NHL showed no statistically significant difference in inpatient stays and readmissions. Participants using the service had significantly higher ED visits in the innovation period relative to the comparison sample. Although the stated goal of the NHL program was to reduce ED visits, in many cases the nurse advised the patient to seek emergency services—so this result is not surprising.

  For CP 30-day enrollment program, no statistically significant effects were found for ED utilization or readmission rates in the innovation period, but the innovations were responsible for a significant reduction in inpatient admissions among Medicare beneficiaries. These results are consistent with the goals of the CP 30-day enrollment program. CP home visits involved reviewing post-discharge instructions, identifying needs or problems, and this intense level of patient engagement may have reduced unplanned inpatient admissions.

  Based on data provided by REMSA, the total number of hospital readmission reached an all-time low in Q14, with only 1.8 percent of those enrolled in the CP program readmitted to the hospital in 30 days. Due to the medically fragile participants in this program, eliminating readmissions altogether is impossible, although readmission rates decreased. The E&R and ATA programs are working to divert nonemergent patients from the ED to more appropriate care: the E&R program resulted in 273 avoided ED visits, and the ATA program had 1,212 transports to alternative locations that were not repatriated to the ED both over the course of the innovation.

The NHL showed increasing participation/usage each quarter, with a continually increasing reach. The reach of the CP 30-day enrollment and CP E&R components remained relatively stable potentially because they have very specific target populations. Paramedics in the CP component of the innovation continued to provide home visits for enrolled participants; they performed 5,660 home visits since the program began, an average of 4.4 visits per patient during the 30-day enrollment.

- **Healthier people**. REMSA has not provided data on health outcomes to RTI.

REMSA received statewide and national attention for its innovation, and the organization can be credited with adoption of these components by stakeholders internal to the organization, the paramedics, clinical partners, health system administration partners, and community partners. REMSA leveraged this attention by working with the state to assure the sustainability of the innovation through community paramedic legislation, and by establishing contracts to ensure continued funding. REMSA worked with the Nevada legislature to recognize and regulate community paramedicine as well as obtain reimbursement for its services from the state Medicaid agency, private insurance companies who are currently negotiating contracts, and the Reno area's largest health system, Renown Health.

REMSA experienced challenges in changing the culture of emergency medical personnel (e.g., paramedics, clinical providers) as well as the general public, but acknowledged that culture shift can take time. In the interim, REMSA invested in marketing and training. Issues with staff retention in the CP and NHL components led REMSA to improve the interview process for CPs and nurse navigators by clearly demonstrating day-to-day responsibilities and expectations for each position. Through these improvements, REMSA hired quality practitioners who are a good fit for the positions.

Overall, REMSA achieved success with its programs, based on the quarterly increase in enrollment and encounters for each. The NHL component far exceeded all expectations: the original estimates assumed 2,400 calls a year, and they now exceed that number each quarter. The NHL has also been certified as an Accredited Center for Excellence (ACE) by the International Academies of Emergency Dispatch, a nonprofit standard-setting organization promoting safe and effective emergency dispatch services world-wide.[5] The ATA component successfully diverted over 1,200 911 callers (who normally would have been taken to the ED) to a more appropriate facility. REMSA is currently in negotiation with a local health system to accept both Medicaid and uninsured individuals at the urgent care clinics. The CP 30-day enrollment program and E&R components' success is evidenced by the providers' willingness to continually recommend their patients for program services.

[5] Welcome to the Academy. (n.d.). Retrieved June 08, 2016, from http://www.emergencydispatch.org/

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Regional Emergency Medical Services Authority (REMSA)

The Regional Emergency Medical Services Authority (REMSA) is a nonprofit emergency medical services (EMS) provider in Reno, Nevada, which is the exclusive provider of ground transport services for the cities of Reno and Sparks and for Washoe County. REMSA received an award of $10,824,025, beginning on December 10, 2012 to implement programs to promote the appropriate utilization of health care services.

Awardee Overview

Innovation dose:	Dose is only relevant to the community paramedic (CP) component. Patients enrolled in the CP program received, on average, 4.4 home visits during the 30 days of their enrollment.	***Innovation reach:***	The CP component reached 73.4% of the target population, CP E&R reached 95.8% of the target population, ATA reached 11.5% of the target population, and NHL enrolled a total of 35,001 people.
Components:	(1) Home visits by CPs within 30 days post-discharge (2) Examinations and referrals by community paramedics (CP E&R) (3) Ambulance transport alternatives (ATA) (4) Nurse health line (NHL)	***Participant demographics:***	Across the innovation's four components, 20,593 individuals enrolled or had an encounter. Almost one-third (29.8%) of participants were younger than 18 years of age; 60.5% were female, 9.7% were covered by Medicare, 24.6% were covered by Medicaid, and 33.2% were uninsured.
Sustainability:	REMSA worked with the Nevada legislature to successfully pass a bill that authorizes, regulates, and supports reimbursement for CP services beginning in July 2016. REMSA worked with local health systems and key clinical partners to identify funding from other sources (e.g., state, private, etc.).		
Innovation type:	Coordination of care	Process of care	Decision support

Key Findings

Smarter spending. Among Medicare beneficiaries, the average quarterly impact on spending per person was not statistically significant for the NHL innovation (−$12; 90% CI: −$418, $395). The average quarterly impact on spending per person for the CP 30-day enrollment innovation was statistically significant, indicating a reduction in Medicare spending (−$2,394; 90% CI: −$4,553, −$235).

Better care. Total changes in inpatient stays were also statistically significant over the entire innovation period for the CP 30-day enrollment innovation and amounted to 543 (90% CI: −648, −438) fewer inpatient stays per 1,000 participants per quarter. ED visits did not show a significant change (28; 90% CI: −31, 86) nor did readmissions (45; 90% CI: −48, 138). For the NHL innovation, total change in inpatient stays were not statistically significant at 3 (90% CI: −19, 13) fewer inpatient stays per 1,000 participants per quarter. ED visits increased significantly 64 (90% CI: 26, 103) per 1,000 participants per quarter. Unplanned readmissions did not change significantly (−35; 90% CI: −80, 11).

Healthier people. REMSA has not provided data on health outcomes to RTI.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

South County Community Health Center

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

South County Community Health Center

2.1 Introduction

South County Community Health Center[1] (South County) is a federally qualified health center (FQHC) in Palo Alto, California, that received an award of $7,302,843 to identify, prioritize, and manage high-risk patients. South County is located in a low-income area with a large local population of Hispanics. South County's innovation, which began enrolling patients in January 2013, sought to achieve the following HCIA goals.

1. **Smarter spending.** Reduce expenditures by 5 to 10 percent by better planning and managing care for complex patients, resulting in fewer ED visits and approximately $6.2 million in system savings.

2. **Better care.** Improve care by enhancing access to chronic disease services; successfully managing care and utilization of these services; and create and implement a workforce development and training coordination deployment plan.

3. **Healthier people**. Improve health outcomes for patients with chronic disease (e.g., hypertension and diabetes).

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter* (*Q)11-12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received from South County through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	South County continued to assign patients to a medical team for active management and care coordination of chronic conditions and intensified linkages within the community.
Program Participant Characteristics	
	Nearly half of participants (42.7%) were less than 18 years of age. More than half (60.6%) were female. The majority were Hispanic (83.6%) and Medicaid beneficiaries (84.7%).

(continued)

[1] Also referred to as Ravenswood in some documents, but South County is the organization's legal name.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Workforce Development	
Hiring and retention	No new hires during Year 3; staff numbers below projection by 1.00 FTE, at 33.49 total FTEs.
Skills, knowledge, and training	During Q11 and Q12, provided 841 hours of training to 184 staff members (mostly clinical personnel). Training topics included customer service, health coaching, boundaries and ethics, and screenings.
	Began developing systems to support training application and assessment based on Ken Blanchard's "Maximize Your Training Investment" model.
	Began collecting information through interviews with managers and staff to develop goals and improve service delivery through improved communication and documentation processes.
	Providers, medical assistants, health coaches, and panel managers attended a UCLA Integrated Substance Abuse Programs training facilitated by the Santa Clara Valley Medical Center.
	Created opportunity with collaborating agencies for nonclinical staff to receive medical assistant training and industry certification.
Context	
Award execution	Spending rate for Year 3 budget was at projected rate: 99.8%.
Leadership	Leadership remained unchanged and was highly involved in the innovation.
Organizational capacity	Opened a new building in May 2015, where entire staff is now colocated.
	Gradually addressed the challenge of reporting patient outcomes, although capacity to collect and analyze data remain limited.
Innovation adoption and workflow integration	Colocation of staff drove efficiencies in patient care. Newly hired nurse coordinated the care of patients who have been to the ED to better integrate them into primary care services. Improved efficiencies in appointments (i.e., more patients seen each day, fewer "no shows").
	Refined the EHR system, and put in place care coordination templates and patient and organizational dashboards to monitor specific conditions or care processes.
	Standardized structured panel management activities to provide weekly and monthly reports for health coaches, panel managers, and providers; contacted inactive patients for follow-up.
	Created a Performance and Quality Improvement (PQI) protocol, developing goals and objectives statements to improve services and clarify the process to identify team roles and expectations.
Implementation Effectiveness	
Innovation reach	54.1% of target population was enrolled (3,341 participants).
Innovation dose	Majority of all enrolled completed a comprehensive assessment (92.9%), initiated care plan (93.5%), and had contact with a health coach (44.8%). High-risk patients received an average of six contacts with health coaches. More than 25% of high-risk patients received an IBHS referral.
Sustainability	
	Plans to maintain new care model after project ended; some community partner services to be incorporated internally. New medical social worker to be hired, and activities planned to strengthen systems and processes.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 3, 2015.

ED = emergency department; EHR = electronic health record; FTE = full-time equivalent; IBHS = integrated behavioral health services; UCLA = University of California Los Angeles.

2.1.1 Innovation Components

South County's innovation entailed providing care coordination to treat or prevent complications of chronic diseases, such as diabetes, high blood pressure, heart disease, and asthma. Prior to the innovation, South County's patients went through a typical family practice care process: They made appointments, saw a provider, and received treatment for the issue at hand. The existing clinical structure did little to address South County's highest risk patients, who have multiple health problems commonly exacerbated by numerous social and economic barriers to health. Through its innovation, South County changed its entire patient flow such that all patient care was managed using population-based panel management, and patients with chronic diseases and complex patients received intensified care management services.

This innovation consisted of the following four program components that transformed South County's internal care coordination processes, staff roles, clinic flow, and increased linkages with community resources:

1. Comprehensive health assessments completed by patient navigators with new and returning patients that captured family medical history, current chronic conditions, prescribed medications, allergies, and patient barriers to care, which were entered into the EHR system (NextGen).

2. Panel management and family practice care teams that engaged providers (nurse practitioners, physician's assistants, or physicians), medical assistants, and health coaches/panel managers to collaboratively manage panels of high-risk patients.

3. A registered nurse (RN) care coordinator and health coaches assigned to frequent users of the Stanford University Medical Center ED (Stanford) to help patients access follow-up care and promote long-term changes to health risk.

4. Community resource referrals to three community organizations—Nuestra Casa, Voices of Recovery (VOR), and the San Mateo County Health System Behavioral Health & Recovery Services (BHRS)—to provide intensified and immediate referrals and linkages to behavioral health or substance abuse treatment, transportation, housing, and food assistance.

No changes to these components were made since implementation began.

The partners for this innovation remained the same since implementation started and are listed in ***Table 3***.

Table 3. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Nuestra Casa	Case management for those needing specialized services such as housing and transportation	East Palo Alto, CA
Voices of Recovery (VOR)	Substance abuse and recovery peer support	Belmont, CA
San Mateo County Health System Behavioral Health & Recovery Services (BHRS)	Clinical psychiatric medication management, mental health therapy, and counseling	San Mateo, CA

Source: RTI site visit, April 2014.
HCIA = Health Care Innovation Award.

2.1.2 *Program Participant Characteristics*

Table 4 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report, based on data through Q11. The distribution of patient characteristics is similar to the information reported in the 2015 annual report. More specifically, more than one-third of participants (42.7%) were less than 18 years of age and more than half (60.6%) were female. The majority of participants were Hispanic (83.6%) and covered by Medicaid (84.7%).

Table 4. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	3,341	100.0
Age		
< 18	1,427	42.7
18–24	243	7.3
25–44	735	22.0
45–64	688	20.6
65–74	148	4.5
75–84	68	2.0
85+	32	0.9
Missing	0	0.0
Sex		
Female	2,028	60.6
Male	1,313	39.4
Missing	0	0.0
Race/ethnicity		
White	78	2.3
Black	216	6.5
Hispanic	2,796	83.6
Asian	15	0.5
American Indian or Alaska Native	2	0.1

(continued)

Table 4. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015 (continued)

Characteristic	Number of Participants	Percentage of Participants
Race/ethnicity (continued)		
Native Hawaiian or other Pacific Islander	172	5.1
Other	17	0.5
Missing/refused	45	1.4
Payer category		
Dual	139	4.3
Medicaid	2,833	84.7
Medicare	0	0.0
Medicare Advantage	0	0.0
Other	369	11.0
Uninsured	0	0.0
Missing	0	0.0

Source: Patient-level data provided to RTI by South County.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 5 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 5. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	No	No

ED = emergency department.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 53 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. Most Medicare beneficiaries in South County's innovation were also enrolled in Medicaid. We present measures for beneficiaries enrolled in the innovation and for a group of statistically matched comparison beneficiaries with fee-for-service Medicare living near South County. When creating the comparison group, we excluded patients who visited South County since the innovation started enrolling patients in January 2013. In addition, comparison beneficiaries were required to have lived in California from 2010 to December 31, 2015, and in San Mateo County for at least 1 month while the innovation enrolled beneficiaries.

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of race, gender, number of chronic conditions, dual Medicare-Medicaid status months in the previous calendar year, and total Medicare payments in the calendar year prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 6 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 6. Mean Values and Standardized Differences of Variables in Propensity Score Model: South County

	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized	Treatment Group		Comparison Group		Standardized
Variable	Mean	SD	Mean	SD	Difference	Mean	SD	Mean	SD	Difference
Percentage white	9.43	29.23	71.70	45.04	1.64	9.43	29.23	10.06	30.08	0.02
Percentage male	43.40	49.56	43.30	49.55	0.00	43.40	49.56	41.51	49.27	0.04
Number of chronic conditions	4.58	3.65	5.10	3.75	0.14	4.58	3.65	4.42	3.77	0.05
Number of dual-eligible months in the previous calendar year	9.08	4.69	1.81	4.24	1.63	9.08	4.69	9.18	4.64	0.02
Total payments in calendar year prior to enrollment	13,529	32,435	7,571	20,700	0.22	13,529	32,435	9,650	21,108	0.14
Number of beneficiaries	53	—	108,892	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	14,562	—	—	53	—	157	—	—
Number of weighted beneficiaries	—	—	—	—	—	53	—	53	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

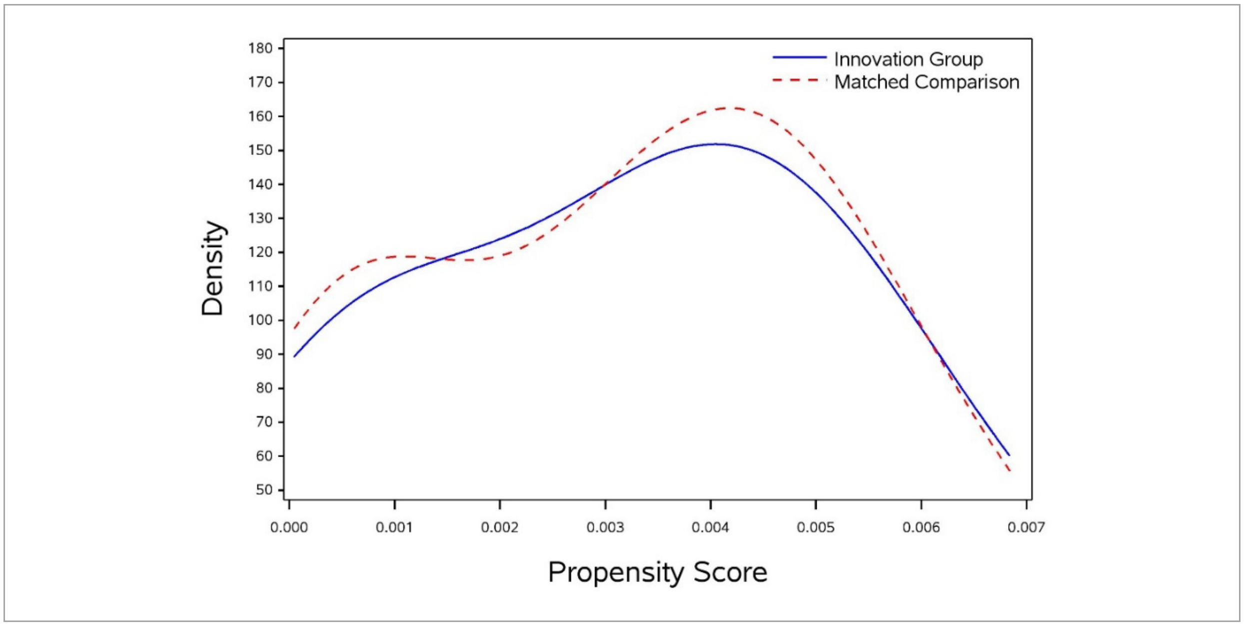
SD = standard deviation; South County = South County Community Health Center.

— Not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 6). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 6 show that matching reduced the absolute standardized differences for most variables and achieved adequate balance for four of the five variables. With the exception of percentage male, all variables have a significant effect in the propensity score model. Total Medicare payments in the calendar year prior to the innovation does not achieve adequate balance after matching. Before matching, this variable has a standardized difference of 0.22, which declines to 0.14 after matching. Based on observable characteristics, the comparison group selected is an acceptable match to patients in South County.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure demonstrates a close overlap between the treatment and comparison groups' propensity scores, indicating that matched comparison beneficiaries have similar propensity scores to treatment beneficiaries. Therefore, we present the Medicare claims analysis using both the treatment group and the matched comparison group.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
South County = South County Community Health Center.

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 7 reports Medicare spending per patient in the eight quarters before and the 12 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 7 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. The baseline period trend line for the innovation group shows spending decreases prior to enrollment. The time series for both the innovation and comparison groups varies widely, and high standard deviations are evident for all periods. After the start of the innovation, the spending pattern of the innovation group is higher than that of the comparison group for all innovation quarters, with noticeable peaks above the baseline trend line at I5 and I10.

Because of the small number of observations, we did not perform regression analysis on the Medicare sample for South County.

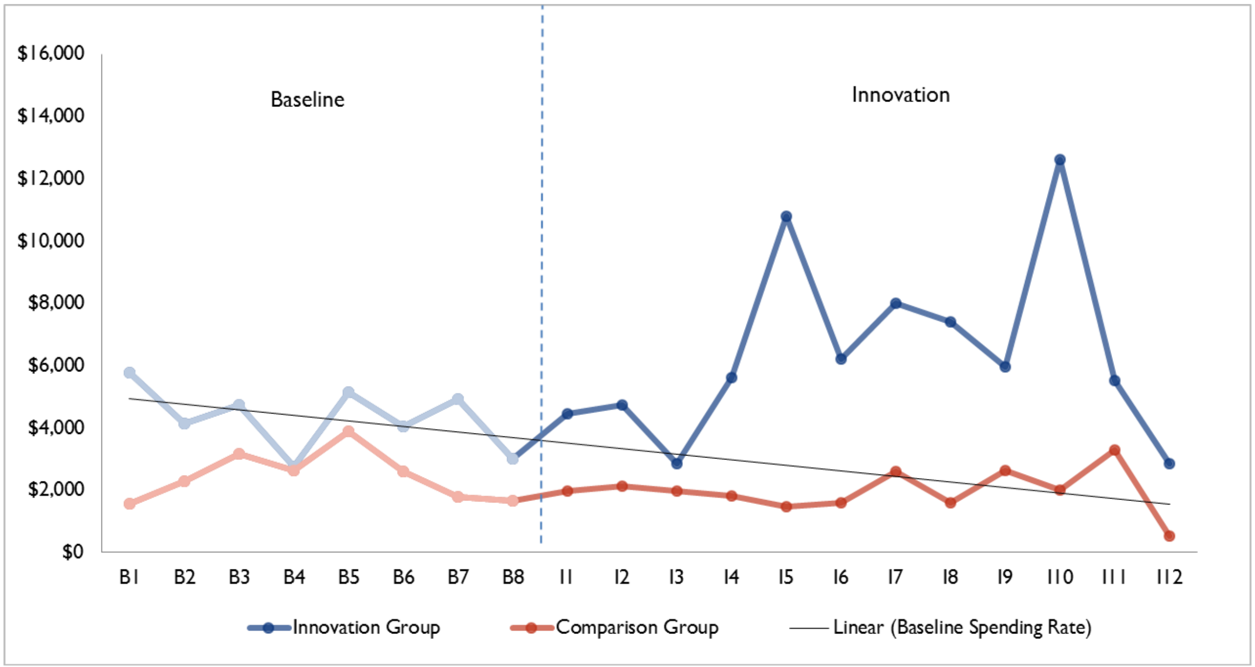
Table 7. Medicare Spending per Participant: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters											
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Spending rate	$5,759	$4,133	$4,736	$2,743	$5,155	$4,041	$4,921	$3,018	$4,442	$4,743	$2,842	$5,618	$10,785	$6,220	$8,011	$7,406	$5,963	$12,627	$5,516	$2,866
Std dev	$18,122	$8,748	$13,145	$5,925	$13,527	$10,123	$11,693	$7,203	$14,538	$9,549	$5,878	$21,041	$28,321	$15,263	$23,574	$19,089	$12,703	$24,349	$8,394	$4,325
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	24	19	14	11	11
Comparison Group																				
Spending rate	$1,555	$2,298	$3,171	$2,623	$3,873	$2,615	$1,777	$1,673	$1,972	$2,142	$1,966	$1,809	$1,460	$1,588	$2,608	$1,602	$2,619	$2,003	$3,307	$514
Std dev	$3,521	$8,936	$14,043	$7,241	$11,584	$6,934	$4,640	$5,080	$6,981	$5,484	$5,967	$5,429	$4,400	$4,790	$10,002	$4,783	$9,656	$7,580	$8,087	$868
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	34	24	20	16	13
Savings per Patient																				
	−$4,204	−$1,835	−$1,564	−$120	−$1,282	−$1,427	−$3,145	−$1,345	−$2,470	−$2,601	−$876	−$3,808	−$9,325	−$4,632	−$5,403	−$5,805	−$3,344	−$10,625	−$2,208	−$2,351

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.
.

Figure 2. Medicare Spending per Participant: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
South County = South County Community Health Center.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 8*** and ***Figure 3***. The baseline period trend line shows a stable inpatient admissions rate prior to enrollment. After the innovation begins, inpatient admissions for the innovation group increase after I3 with a spike at I6. However, as shown in Table 8, the standard deviation is high for all periods. The sample size is too small to support regression analysis.

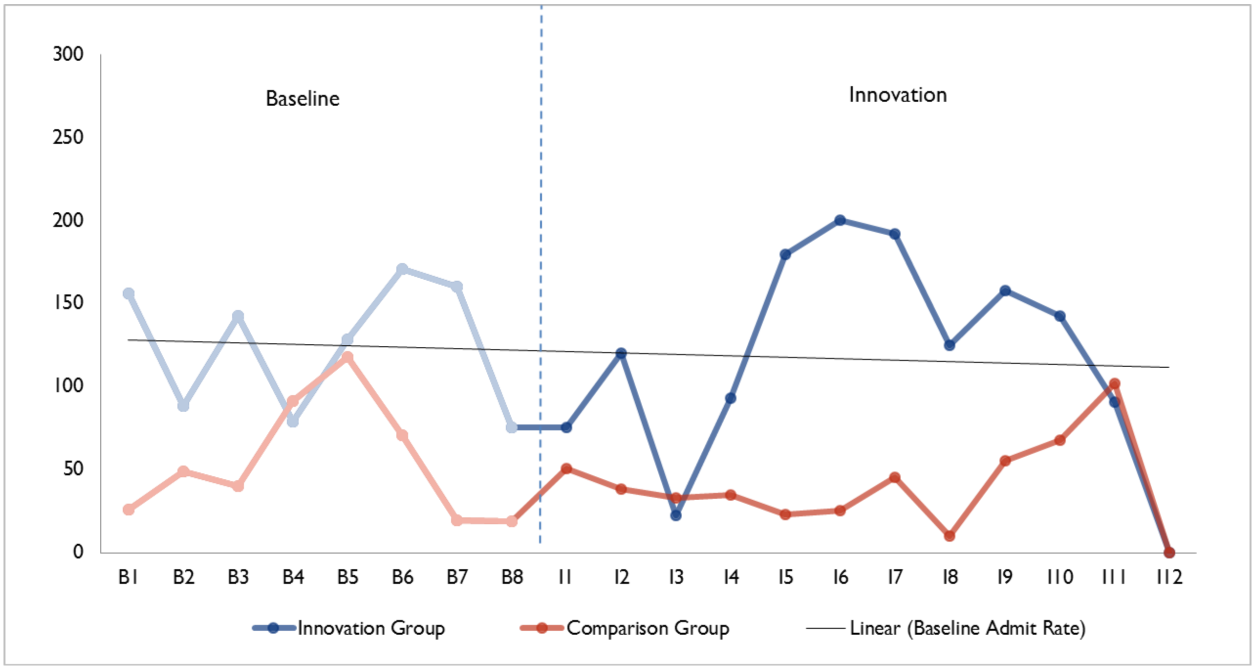
Table 8. All-Cause Inpatient Admissions Rate per 1,000 Participants: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I7	I8	I9
Innovation Group																				
Admit rate	156	88	143	79	128	171	160	75	75	120	22	93	179	200	192	125	158	143	91	0
Std dev	712	373	487	270	463	537	504	264	328	325	147	421	549	693	785	439	365	350	287	0
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	24	19	14	11	11
Comparison Group																				
Admit rate	26	49	40	92	118	71	19	19	51	38	33	35	23	26	45	10	56	68	102	0
Std dev	157	215	195	377	382	255	137	136	292	191	178	216	149	204	207	99	283	251	303	0
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	34	24	20	16	13
Innovation — Comparison Rate																				
	130	39	103	−13	11	100	141	56	25	82	−11	58	156	174	147	115	102	75	−11	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 3. All-Cause Inpatient Admissions Rate per 1,000 Participants: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
South County = South County Community Health Center.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 9*** and ***Figure 4***. Readmissions rates vary greatly before and after enrollment, reflecting the small number of hospital admissions during each quarter. With few admissions (the denominator in the readmissions rate) and a relatively low underlying percentage of readmissions, the rate varies widely over time.

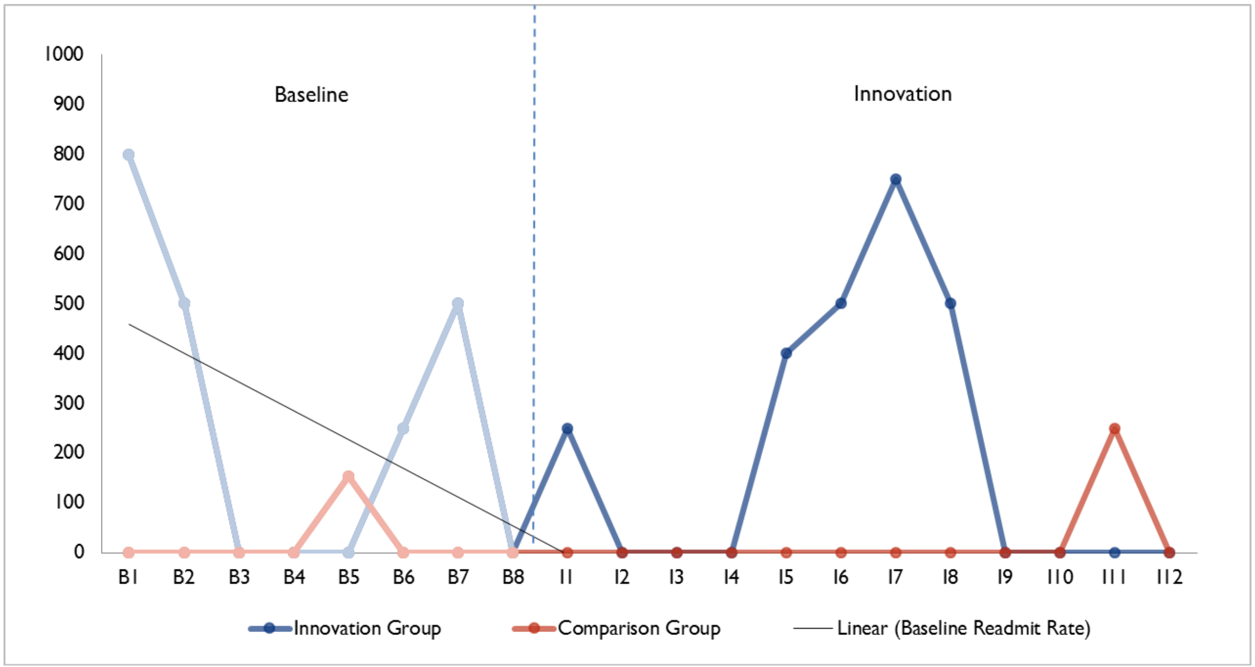
Table 9. Hospital Unplanned Readmissions Rates per 1,000 Admissions: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I7	I8	I9
Innovation Group																				
Readmit rate	800	500	0	0	0	250	500	0	250	0	0	0	400	500	750	500	0	0	0	0
Std dev	400	500	0	0	0	433	500	0	433	0	0	0	490	500	433	500	0	0	0	0
Total admissions	5	2	1	1	3	4	6	2	4	3	0	4	5	2	4	2	1	0	0	0
Comparison Group																				
Readmit rate	0	0	0	0	154	0	0	0	0	0	0	0	0	0	0	0	0	0	250	0
Std dev	0	0	0	0	361	0	0	0	0	0	0	0	0	0	0	0	0	0	433	0
Total admissions	1	1	1	2	4	2	1	0	1	1	1	1	1	0	1	0	1	1	1	0
Innovation – Comparison Rate																				
	800	500	0	0	−154	250	500	0	250	0	0	0	400	500	750	500	0	0	−250	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 4. Hospital Unplanned Readmissions Rates per 1,000 Admissions: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
South County = South County Community Health Center.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 10*** and ***Figure 5***. ED visits trend downward during the baseline period. The ED visit rate varies somewhat before and after patient enrollment in the innovation. The ED visit rate for the innovation group remains higher than the rate for the comparison group for all innovation quarters except I9. As with the other measures, ED visits have a high standard deviation. In spring 2015, which corresponds to innovation quarter I9 in the figure, South County allocated a nurse to begin working directly with patients who were seen at the ED at Stanford (i.e., the hospital that serves many of South County's patients). The nurse was to follow up with those patients to ensure that they were seen by a primary care medical team to prevent additional ED visits. Getting the ED to share medical records took time, but subsequently the nurse also followed up with patients at the other hospital's ED. The sample size is too small to support regression analysis.

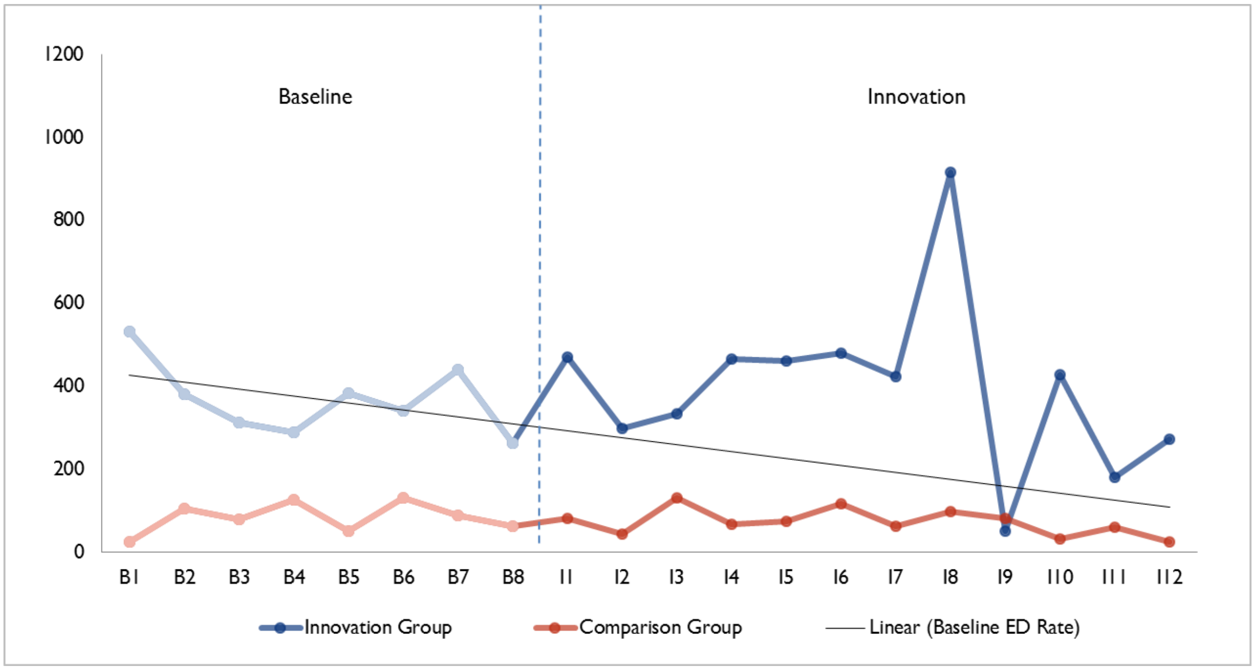
Table 10. ED Visits per 1,000 Participants: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I7	I8	I9
Innovation Group																				
ED rate	531	382	314	289	385	341	440	264	472	300	333	465	462	480	423	917	53	429	182	273
Std dev	1,319	1,074	1,078	768	877	911	1,373	684	1,103	974	929	1,351	1,315	1,123	2,157	1,976	229	646	603	647
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	24	19	14	11	11
Comparison Group																				
ED rate	25	105	79	128	51	133	90	63	82	44	132	68	76	119	63	99	83	34	61	25
Std dev	120	295	203	231	128	310	232	181	196	211	238	162	170	242	180	323	211	105	140	91
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	34	24	20	16	13
Innovation – Comparison Rate																				
	506	278	235	162	334	209	350	201	390	256	202	397	386	361	360	818	−31	395	121	248

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 5. ED Visits per 1,000 Participants: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; South County = South County Community Health Center.

2.8 Discussion: Medicare Results

The results presented here are only for dually eligible Medicare beneficiaries who we were able to match with the identifiers provided by the site. These beneficiaries represent 1.6 percent of the overall population reached by the innovation. Focusing only on a very small subset of the population served by the innovation likely does not capture the full impact on spending and health care utilization. For all four measures, we found considerable variability and high standard deviations accompanied by a very small sample size of Medicare beneficiaries. The sample size was too small to support regression analysis.

2.9 Medicaid Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicaid claims data available through December 31, 2015. As of December 31, 2015, South County Medicaid claims data in the Centers for Medicare & Medicaid Services (CMS) Alpha-MAX database were available up to October 31, 2013. The Medicaid claims analysis focuses on 93 Medicaid beneficiaries enrolled in fee-for-service during the innovation period. With limited innovation data (three quarters) and high managed care enrollment, we have a very small number of fee-for-service Medicaid beneficiaries we were able to match. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living near South County. When creating the comparison group, we excluded patients who visited South County since the innovation started enrolling patients in January 26, 2013. In addition, comparison beneficiaries were required to have lived in California from 2010 to December 31, 2015, and in San Mateo County for at least 1 month while the innovation enrolled beneficiaries.

We use PSM to select comparison group beneficiaries with characteristics similar to innovation group beneficiaries. From the 3,341 patients enrolled in the innovation, only 93 (3%) Medicaid fee-for service beneficiaries were matched in the Chronic Conditions Data Warehouse. The lack of fee-for-service Medicaid beneficiaries enrolled in the innovation and for whom we have claims data limits the number of variables available for use in the matching regression. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, total Medicaid payments in the calendar quarter prior to the innovation, and dual Medicare-Medicaid status. Fifty of the 93 beneficiaries were not enrolled in Medicaid fee-for-service in the calendar quarter prior to the innovation and, therefore, did not have Medicaid claims data for this quarter. These beneficiaries are matched based on age, gender, dual Medicare-Medicaid status, and disabled status. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 11 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 6*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. One treatment beneficiary who did not have Medicaid in the calendar quarter prior to enrollment was dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 11. Mean Values and Standardized Differences of Variables in Propensity Score Model: South County

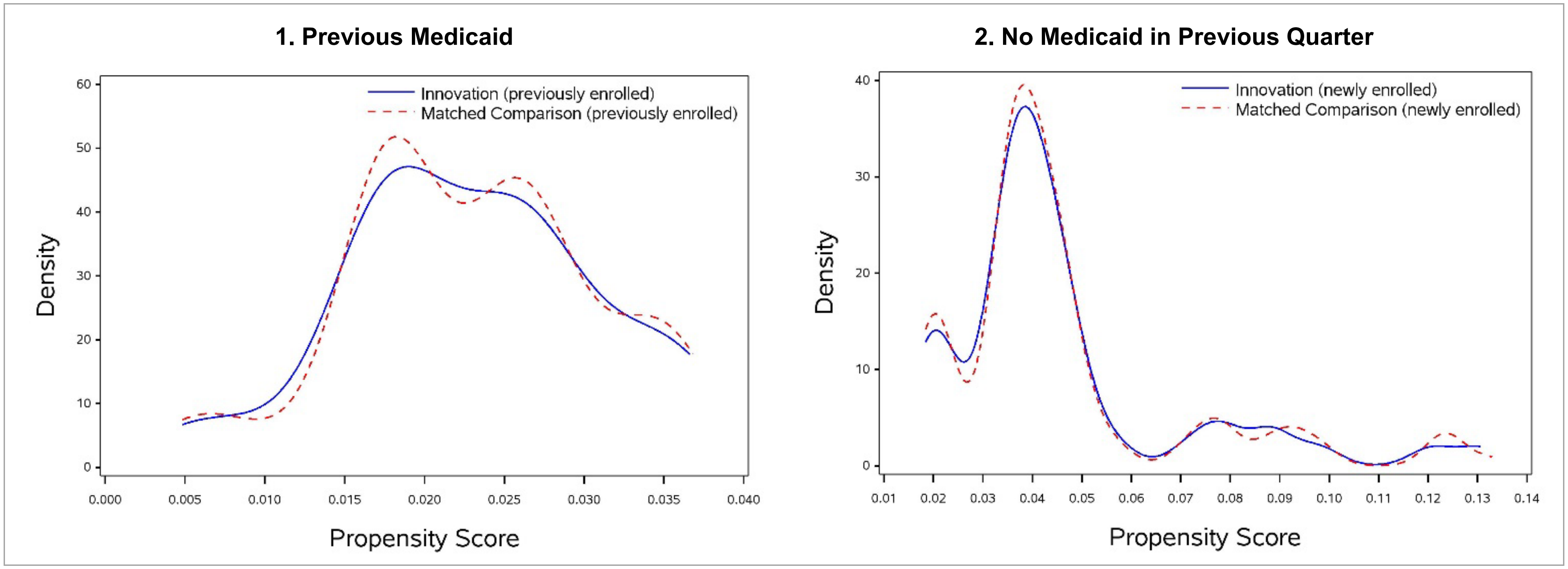
Variable	Before Matching: Treatment Group Mean	Before Matching: Treatment Group SD	Before Matching: Comparison Group Mean	Before Matching: Comparison Group SD	Before Matching: Standardized Difference	After Matching: Treatment Group Mean	After Matching: Treatment Group SD	After Matching: Comparison Group Mean	After Matching: Comparison Group SD	After Matching: Standardized Difference
Previous Medicaid										
Age	24.52	25.34	31.09	26.85	0.25	24.52	25.05	24.35	25.23	0.01
Percentage female	47.73	50.53	56.63	49.57	0.18	47.73	49.95	49.24	49.99	0.03
Payments in calendar quarter prior to enrollment	103	322	418	1,908	0.23	103	319	85	294	0.06
Percentage dual eligibility	6.82	25.50	21.97	41.41	0.44	6.82	25.21	6.82	25.21	0.00
Number of beneficiaries	44	—	2,299	—	—	44	—	132	—	—
Number of unique beneficiaries[1]	—	—	1,248	—	—	44	—	120	—	—
Number of weighted beneficiaries	—	—	—	—	—	44	—	44	—	—
No Medicaid in Previous Quarter										
Age	26.36	24.88	18.19	19.32	0.37	25.22	23.55	22.02	23.20	0.14
Percentage female	42.00	49.86	56.43	49.60	0.29	42.86	49.49	34.01	47.38	0.18
Percentage dual eligibility	16.00	37.03	7.72	26.70	0.26	16.33	36.96	12.93	33.55	0.10
Percentage disabled	6.00	23.99	3.66	18.79	0.11	6.12	23.97	8.16	27.38	0.08
Number of beneficiaries	50	—	1,283	—	—	49	—	147	—	—
Number of unique beneficiaries[1]	—	—	1,260	—	—	49	—	113	—	—
Number of weighted beneficiaries	—	—	—	—	—	49	—	49	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).
SD = standard deviation; South County = South County Community Health Center.
— Data not yet available;

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 11). The results in Table 11 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables in the group of beneficiaries with Medicaid in the quarter before enrollment. For the group without Medicaid in the quarter before enrollment, matching reduced the absolute standardized difference for all four variables, but standardized differences were slightly above 0.1 for age, percentage female, and percentage with dual eligibility. Only age and percentage female had a significant effect in the propensity score model. With a limited pool of comparison beneficiaries from which to draw, comparison beneficiaries that match treatment beneficiaries along every dimension may not exist. Lower balance on a particular variable does not imply lack of overall balance between the treatment and comparison groups.

Figure 6 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure demonstrates a considerable overlap between the treatment and comparison groups' propensity scores, indicating that matched comparison beneficiaries have similar propensity scores to treatment beneficiaries. Therefore, we present the Medicaid claims analysis using both the treatment group and the matched comparison group.

Figure 6. Distribution of Propensity Scores for Comparison and Innovation Groups: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Alpha-MAX Medicaid fee-for-service claims.
South County = South County Community Health Center.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 12 reports Medicaid spending per patient in the eight quarters before and the three quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 7*** illustrates the Medicaid spending per beneficiary in Table 12 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. As shown by the baseline period trend line for the innovation group, trends in spending follow a steep downward slope prior to enrollment. The time series for both the innovation and comparison groups varies widely, and high standard deviations are evident for all periods. The innovation group spending rate is above the comparison group rate for all innovation quarters. The extremely small sample size for both groups, particularly for baseline quarters 1 to 6 and innovation quarter 3, precludes a clear assessment of the spending trend. The higher spending for all quarters of the innovation group, when compared to baseline quarters 6, 7, and 8, might be related to South County's care coordination innovation focus on linking patients to preventive services. However, without statistical testing, it is premature to conclude that the innovation had any effect on spending. The current sample size is too small to support regression analysis. In the future, when additional Alpha-MAX claims data for the rest of the enrollment period are available, RTI plans to statistically compare spending trends and assess the impact of the innovation in the difference in spending between treatment and comparison groups.

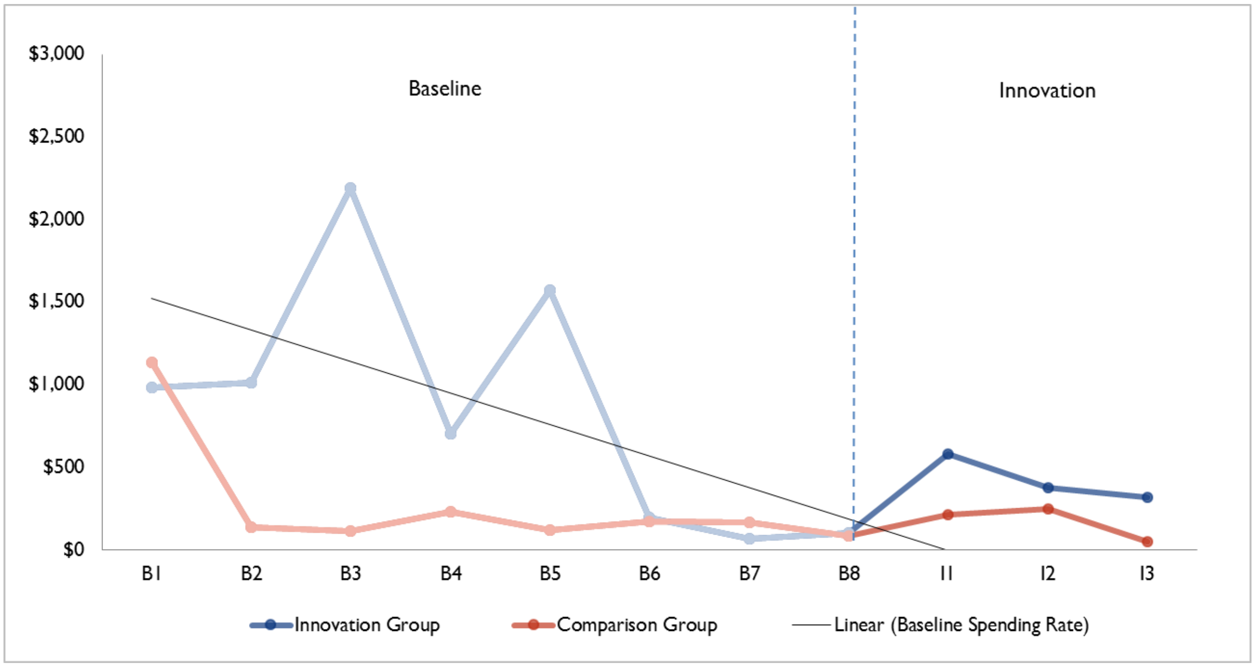
Table 12. Medicaid Spending per Participant: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Spending rate	$981	$1,012	$2,192	$703	$1,573	$193	$68	$103	$580	$378	$319
Std dev	$1,346	$1,239	$4,626	$1,928	$4,973	$437	$197	$322	$1,411	$1,437	$461
Unique patients	9	8	9	10	10	16	18	44	93	48	16
Comparison Group											
Spending rate	$1,136	$137	$115	$229	$122	$174	$167	$85	$210	$246	$52
Std dev	$3,025	$285	$232	$678	$229	$383	$258	$179	$693	$574	$234
Weighted patients	16	16	18	21	23	26	30	44	93	42	17
Savings per Patient											
	$155	−$875	−$2,077	−$474	−$1,451	−$20	$99	−$18	−$370	−$131	−$267

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 7. Medicaid Spending per Participant: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
South County = South County Community Health Center.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 13*** and ***Figure 8***. Before enrollment, admission rates are highly variable for the comparison group and, with the exception of baseline quarter B3, zero for the innovation group. After enrollment, the innovation group shows higher inpatient admission rates than the comparison group for I1 and I2. However, as presented in Table 13, the standard deviation is high for all periods. When sample size permits, we will compare inpatient admissions trends between the innovation and comparison groups, and assess whether differences are statistically significant.

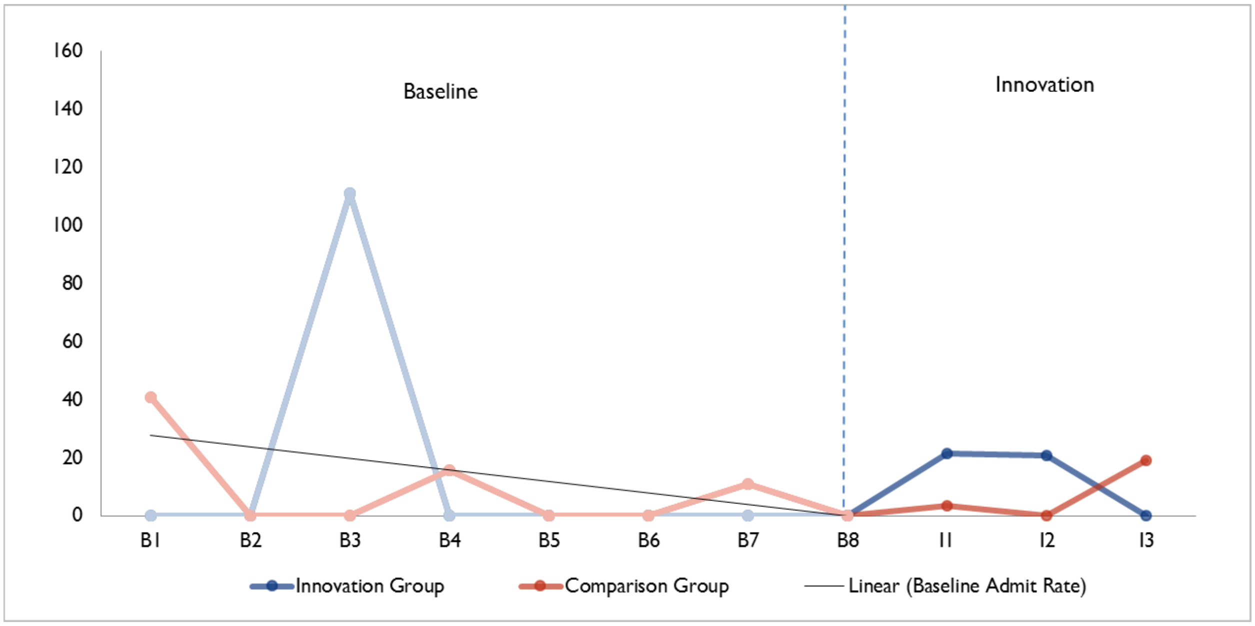
Table 13. All-Cause Inpatient Admissions Rate per 1,000 Participants: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Admit rate	0	0	111	0	0	0	0	0	22	21	0
Std dev	0	0	333	0	0	0	0	0	146	144	0
Unique patients	9	8	9	10	10	16	18	44	93	48	16
Comparison Group											
Admit rate	41	0	0	16	0	0	11	0	4	0	19
Std dev	126	0	0	80	0	0	66	0	38	0	86
Weighted patients	16	16	18	21	23	26	30	44	93	42	17
Innovation − Comparison Rate											
	−41	0	111	−16	0	0	−11	0	18	21	−19

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 8. All-Cause Inpatient Admissions Rate per 1,000 Participants: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
South County = South County Community Health Center

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 14***. The readmissions rate for all periods and both groups is zero, related to the very small to nonexistent number of hospital admissions during each quarter associated with the very small number of beneficiaries included in the claims analysis. Because the readmissions rate does not vary from zero, we do not include a figure showing the readmissions rate. As more beneficiaries enroll in the innovation and more claims data become available, the sample size may increase so that the readmissions measure can be reported with more precision.

Table 14. Hospital Unplanned Readmissions Rates per 1,000 Admissions: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Readmit rate	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	0	0	0	0	0	0	0	0
Total admissions	0	0	0	1	0	0	1	0	0	0	0
Comparison Group											
Readmit rate	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	0	0	0	0	0	0	0	0
Total admissions	0	0	0	0	1	0	0	0	0	0	0
Innovation − Comparison Rate											
	0	0	0	0	0	0	0	0	0	0	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 9*.** ED visits trend downward during the baseline period. The ED visit rate varies somewhat before and after patient enrollment in the innovation. For the innovation group, the ED visit rate is above the rate for the comparison group for innovation quarters I1 and I3. As with the other measures, ED visits have a high standard deviation. When sample size permits, we will compare the rate of ED visits between the two groups and assess whether the differences are statistically significant.

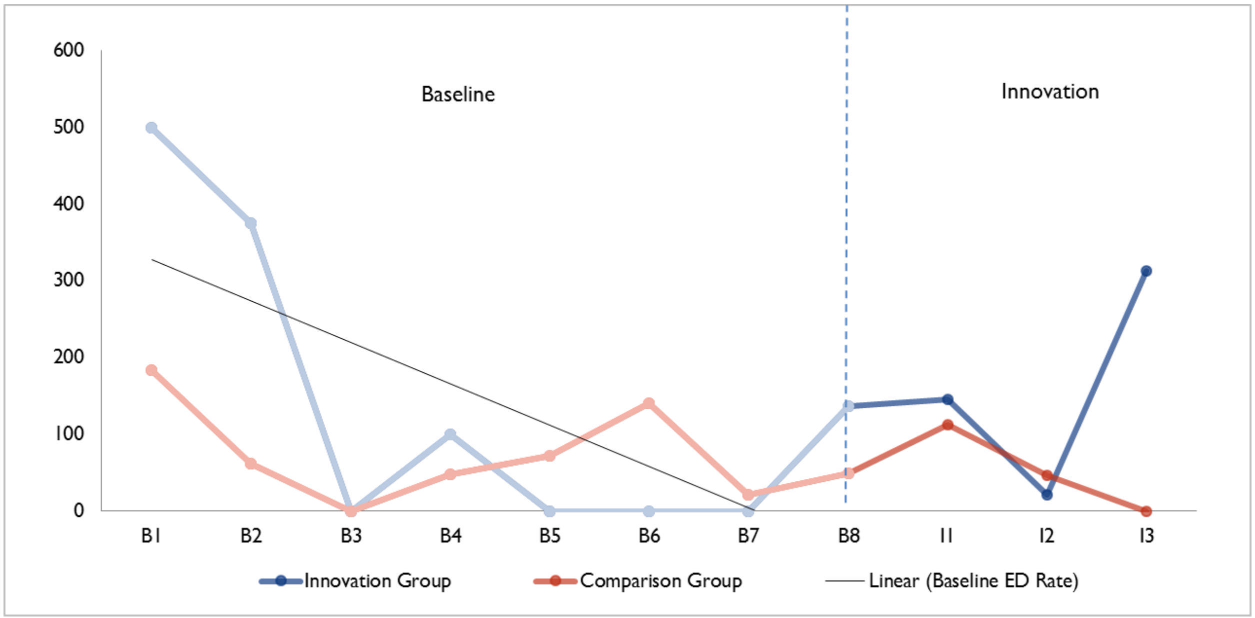
Table 15. ED Visits per 1,000 Participants: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
ED rate	500	375	0	100	0	0	0	136	145	21	313
Std dev	1,500	1,061	0	316	0	0	0	632	690	144	793
Unique patients	9	8	9	10	10	16	18	44	93	48	16
Comparison Group											
ED rate	184	63	0	48	72	141	22	49	113	47	0
Std dev	417	155	0	178	225	297	93	154	303	193	0
Weighted patients	16	16	18	21	23	26	30	44	93	42	17
Innovation − Comparison Rate											
	316	313	0	52	−72	−141	−22	87	32	−26	313

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 9. ED Visits per 1,000 Participants: South County



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ED = emergency department; South County = South County Community Health Center.

2.14 Discussion: Medicaid Results

For all four measures, we found considerable variation and high standard deviations accompanied by a very small sample size of Medicaid beneficiaries. Medicaid claims data were available only for the first three quarters after the innovation was launched on January 26, 2013, while the innovation ended June 30, 2016. If additional claims data become available we will perform regression analyses in the final report.

The results do not fully represent the overall population served by the innovation. The results presented here are only for Medicaid fee-for-service beneficiaries enrolled during the first three quarters of the innovation who we were able to match with the identifiers provided by the site. Although Medicaid beneficiaries represent 93 percent of the overall population reached by the innovation, many of these beneficiaries are enrolled in Medicaid managed care. In addition, the small sample size can hinder detection of changes in spending. Focusing on a very small subset of the population served by the innovation may not capture the full impact on spending and health care utilization.

In the South County innovation, patients are assigned a risk level from “low” to “super-high” based on diagnoses of multiple chronic diseases, medication use, ED utilization, and hospitalizations. Based on this risk stratification or a physician’s judgment, patients receive varying levels of the innovation. Therefore, although every South County patient receives services from the innovation, higher-risk patients receive more concentrated attention from health coaches than lower-risk patients. If sample size permits, in the next report we will assess if the results vary by risk group.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

South County submitted data to RTI that are current through June 2015. ***Table 16*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses for all of these measures are included in this annual report.

Table 16. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Diabetes	Percentage of patients with diabetes who received a foot exam	Data received from South County	Yes
		Percentage of patients with diabetes who received a hemoglobin A1c test	Data received from South County	Yes
		Percentage of patients with diabetes who received an LDL-C test	Data received from South County	Yes
	Hypertension	Percentage of patients with hypertension who received a blood pressure reading	Data received from South County	Yes
Health outcomes	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c > 9.0%	Data received from South County	Yes
	Hypertension	Percentage of patients with diabetes who had LDL-C control < 100 mg/dL	Data received from South County	Yes
		Percentage of patients with hypertension with blood pressure < 140/90 mm Hg	Data received from South County	Yes

LDL-C = low-density lipoprotein cholesterol; South County = South County Community Health Center.

We examined clinical effectiveness and health outcomes among patients with diabetes and hypertension. The following run charts take into account rolling enrollment. The innovation quarters (Is) are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation will have health outcome data in more innovation quarters over time than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tends to drop substantially as the number of quarters enrolled increases. We provide data when at least 20 patients had a test or reading within the innovation quarter.

We also conducted multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time, while controlling for repeated measures (i.e., within-subject covariance). More specifically, HbA1c and low-density lipoprotein cholesterol (LDL-C) values among those with diabetes and systolic and diastolic blood pressure values among those with hypertension were regressed onto dose (i.e., number of contacts with health coaches). We controlled for the baseline health outcome being examined in the regression (i.e., HbA1c, LDL-C, or blood pressure at innovation enrollment), age, sex, race, and insurance type. Changes over the innovation period for each health outcome measure were examined in separate regression analyses.

The sections below describe the results of each of the clinical effectiveness and health outcome measures.

2.16 Diabetes

We received data on whether patients with diabetes received an HbA1c test, an LDL-C test, or a foot exam during the innovation period. This allowed us to determine whether appropriate clinical services were provided to those with diabetes during the innovation. We also received outcome data for HbA1c and LDL-C among those with diabetes, which allowed us to determine whether the percentage of patients with poor HbA1c control decreased and whether the percentage of patients with LDL-C control increased among those with diabetes over the course of the innovation.

Evaluation Questions

- What percentage of patients with diabetes received an HbA1c test during the innovation period?
- What percentage of patients with diabetes received an LDL-C test during the innovation period?
- What percentage of patients with diabetes received a foot exam during the innovation period?
- Has the percentage of patients with diabetes with poor HbA1c control decreased over time?
- Has the percentage of patients with diabetes with LDL-C control increased over time?

2.16.1 Descriptive Results

Approximately 14 percent of patients overall and about 38 percent of high-risk patients had diabetes. ***Table 17*** shows the percentage of all patients with diabetes and the percentage of high-risk patients with diabetes who received an HbA1c test, LDL-C test, or foot exam during the innovation period. As shown in the table, among all patients with diabetes, nearly all (99.0%) received an HbA1c test, most (93.1%) received an LDL-C test, and nearly two-thirds (62.5%) received a foot exam. Among high-risk patients with diabetes, nearly all received an HbA1c test (99.0%) or LDL-C test (96.2%), and approximately two-thirds (66.9%) received a foot exam.

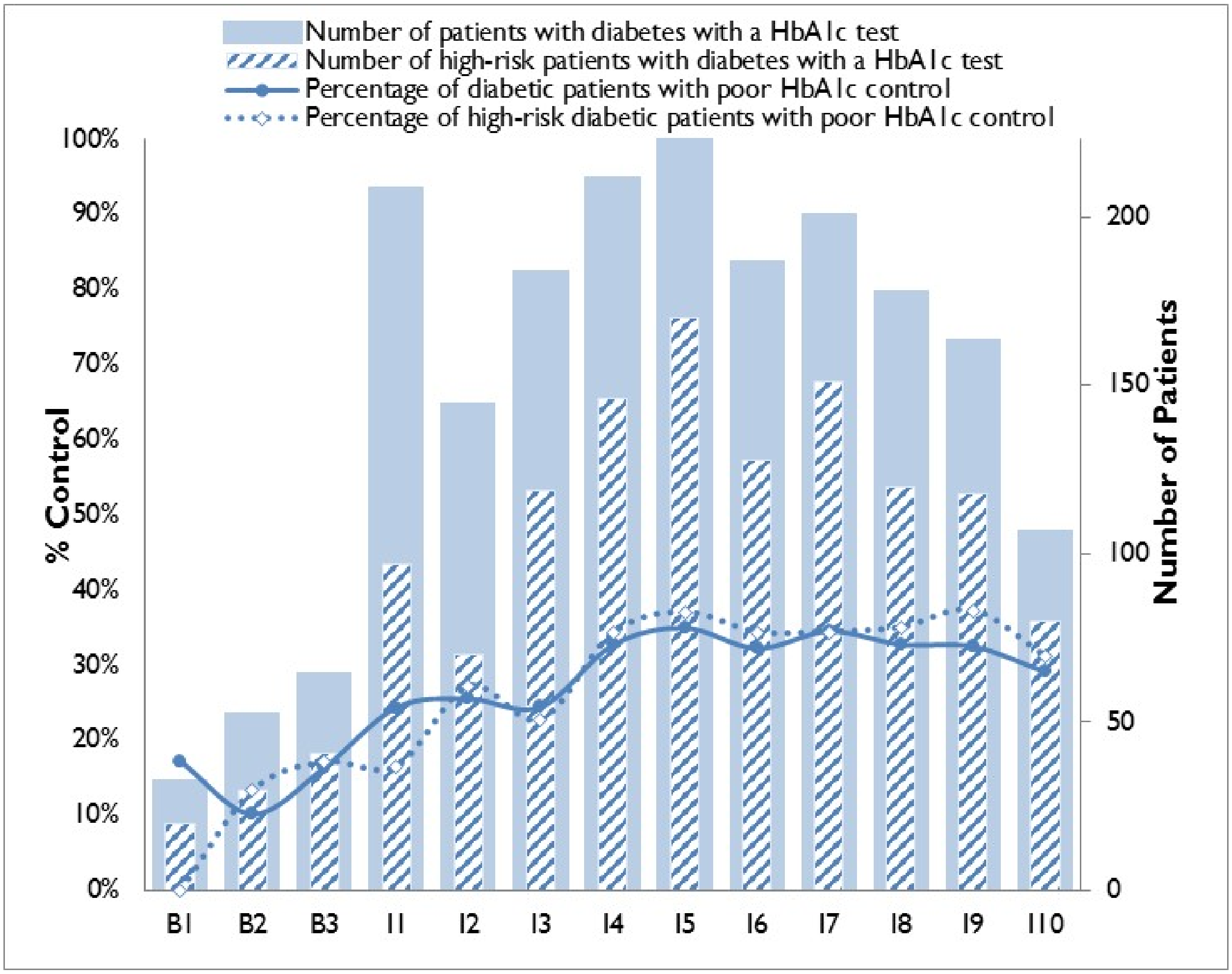
Table 17. Percentage of Patients with Diabetes Who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
All Patients with Diabetes (n = 480)	
Percentage of patients with diabetes who received an HbA1c test	99.0
Percentage of patients with diabetes who received an LDL-C test	93.1
Percentage of patients with diabetes who received a foot exam	62.5
High-risk Patients with Diabetes (n = 293)	
Percentage of patients with diabetes who received an HbA1c test	99.0
Percentage of patients with diabetes who received an LDL-C test	96.2
Percentage of patients with diabetes who received a foot exam	66.9

Source: Patient-level data provided to RTI by South County.
LDL-C = low-density lipoprotein cholesterol; n = number.

Figure 10 presents the percentage of participants, overall and high risk, with diabetes who had an HbA1c test indicating poor control (i.e., HbA1c > 9%) over time. The denominator represents the number of overall or high-risk patients with diabetes who received an HbA1c test for each quarter. The numerator represents the number of overall or high-risk patients with diabetes who received an HbA1c test that was > 9.0 percent. As shown in the figure, the percentage of patients with poor HbA1c control increased over time. About one-fourth of patients overall (24.4%) had poor HbA1c control at I1; this percentage increased to 35.0 percent in I5 and then dropped to 29.1 percent in I10. Among high-risk diabetic patients, the increase in the percentage with poor HbA1c control was more pronounced—specifically, the percentage increased from about 17 percent in I1 to 37.3 percent in I9 and remained close to that percentage through I10, dropping slightly to 31.3 percent. Thus, HbA1c control did not improve over time among those diabetic patients enrolled in the innovation.

Figure 10. Percentage of Patients with Diabetes with Poor HbA1c Control over Time

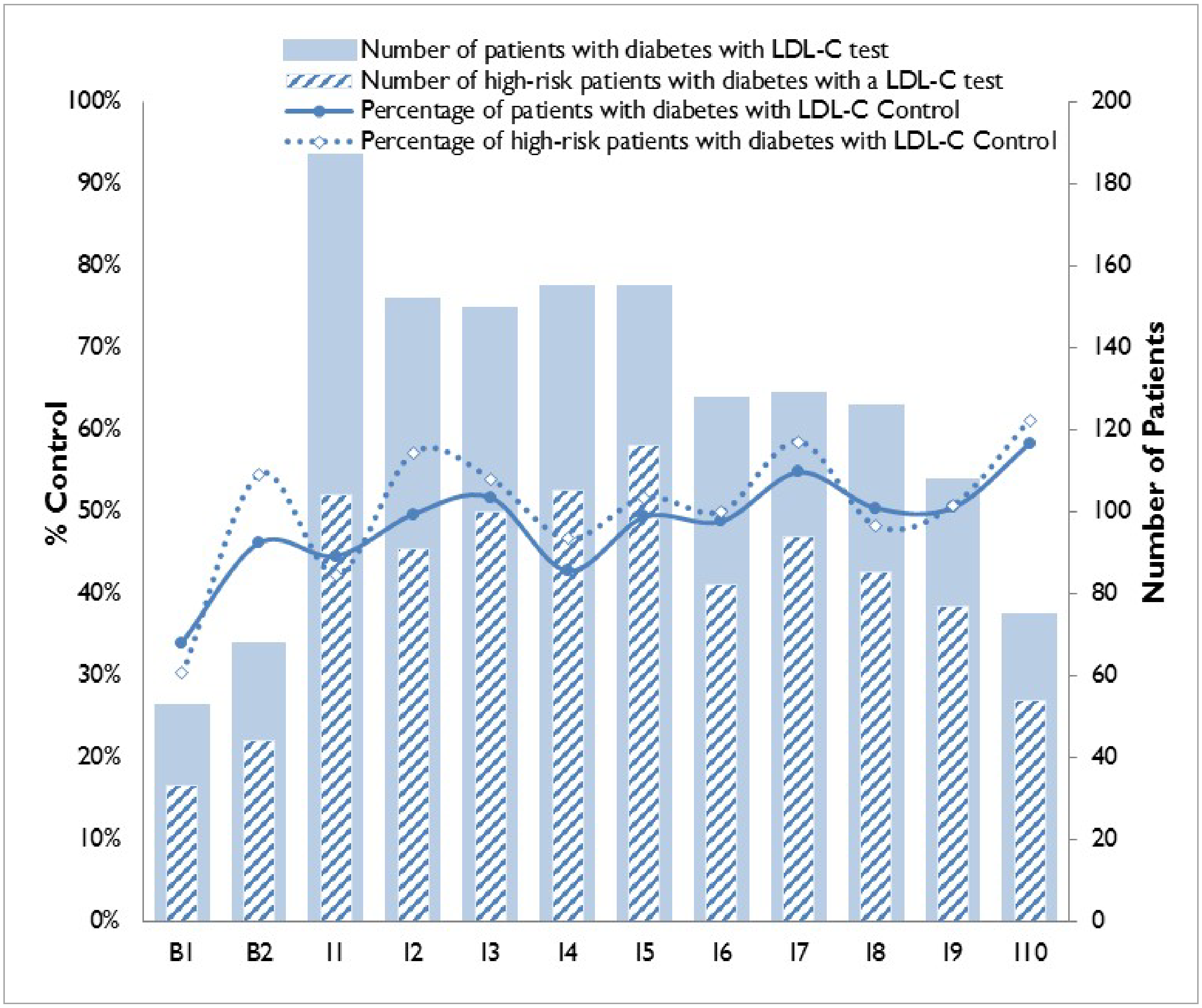


	Quarter	B1	B2	B3	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of diabetic patients with poor HbA1c control	17.2	10.2	16.4	24.4	25.5	24.4	32.7	35.0	32.6	34.5	32.8	32.5	29.1
◊	Percentage of high-risk diabetic patients with poor HbA1c control	0.0	13.3	17.1	16.5	27.1	22.7	34.3	37.1	34.4	34.4	35.0	37.3	31.3
	Number of patients with diabetes with an HbA1c test	29	49	61	205	141	180	208	223	181	197	174	160	103
	Number of high-risk patients with diabetes with an HbA1c test	20	30	41	97	70	119	146	170	128	151	120	118	80

Source: Patient-level data provided to RTI by South County.

Figure 11 presents the percentage of participants, overall and high risk, with diabetes with an LDL-C test indicating good control (i.e., < 100 mg/dL) over time. The denominator represents the number of overall or high-risk patients with diabetes who received an LDL-C test for each quarter. The numerator represents the number of overall or high-risk patients with diabetes who received an LDL-C test result that was < 100 mg/dL. As shown in the figure, the percentage of patients with LDL-C control fluctuated, but increased slightly, over time. Among all diabetic patients, the percentage with LDL-C control increased from approximately 45 percent in I1 to approximately 58 percent in I10. Among high-risk diabetic patients, the percentage with LDL-C control increased from approximately 42 percent in I1 to approximately 61 percent in I10. Thus, LDL-C control improved over time among diabetic patients enrolled in the innovation.

Figure 11. Percentage of Patients with Diabetes with LDL-C Control over Time



(continued)

Figure 11. Percentage of Patients with Diabetes with LDL-C Control over Time (continued)

	Quarter	B1	B2	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients with diabetes with LDL-C control	34.0	46.2	44.6	49.7	51.7	42.8	49.3	48.8	54.8	50.4	50.5	58.3
◊	Percentage of high-risk patients with diabetes with LDL-C control	30.3	54.5	42.3	57.1	54.0	46.7	51.7	50.0	58.5	48.2	50.7	61.1
	Number of patients with diabetes with an LDL-C test	28	24	184	149	147	152	152	125	126	123	105	72
	Number of high-risk patients with diabetes with an LDL-C test	16	15	104	91	100	105	116	82	94	85	77	54

Source: Patient-level data provided to RTI by South County.

2.16.2 Regression Results

Table 18 presents the results from the GEE assessing the impact of dose (i.e., number of contacts with health coaches) on HbA1c values over time among those with diabetes. The table shows a marginally significant effect for dose, with a positive association between number of contacts with health coaches and higher HbA1c values. This suggests that those with greater difficulty controlling their HbA1c likely had more contacts with health coaches over time.

Table 18. Impact of Dose on HbA1c Values among Those with Diabetes over Time

Predictor	Coefficient	Standard Error	P-Value
Contacts with health coaches	0.04	0.02	0.05

Source: Patient-level data provided to RTI by South County.

A GEE assessing the impact of dose (i.e., number of contacts with health coaches) on LDL-C values over time among those with diabetes was also conducted (***Table 19***). There was no statistically significant effect for dose.

Table 19. Impact of Dose on LDL-C Values among Those with Diabetes over Time

Predictor	Coefficient	Standard Error	P-Value
Contacts with health coaches	-0.23	0.37	0.54

Source: Patient-level data provided to RTI by South County.

2.17 Hypertension

South County provided data on whether patients with hypertension received a blood pressure reading, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation. Blood pressure data for those with hypertension allowed us to determine whether the percentage of patients with hypertension with blood pressure control increased over the course of the innovation.

Evaluation Questions

- What percentage of patients with hypertension received a blood pressure reading during the innovation period?
- Has the percentage of patients with hypertension with blood pressure control increased over time?

2.17.1 Descriptive Results

About 20 percent of patients overall, and about half of high-risk patients, had hypertension. ***Table 20*** shows that nearly all patients with hypertension (99.4%) and all high-risk patients with hypertension (100%) received a blood pressure reading during the innovation period.

Table 20. Percentage of Patients with Hypertension Who Received Clinical Services

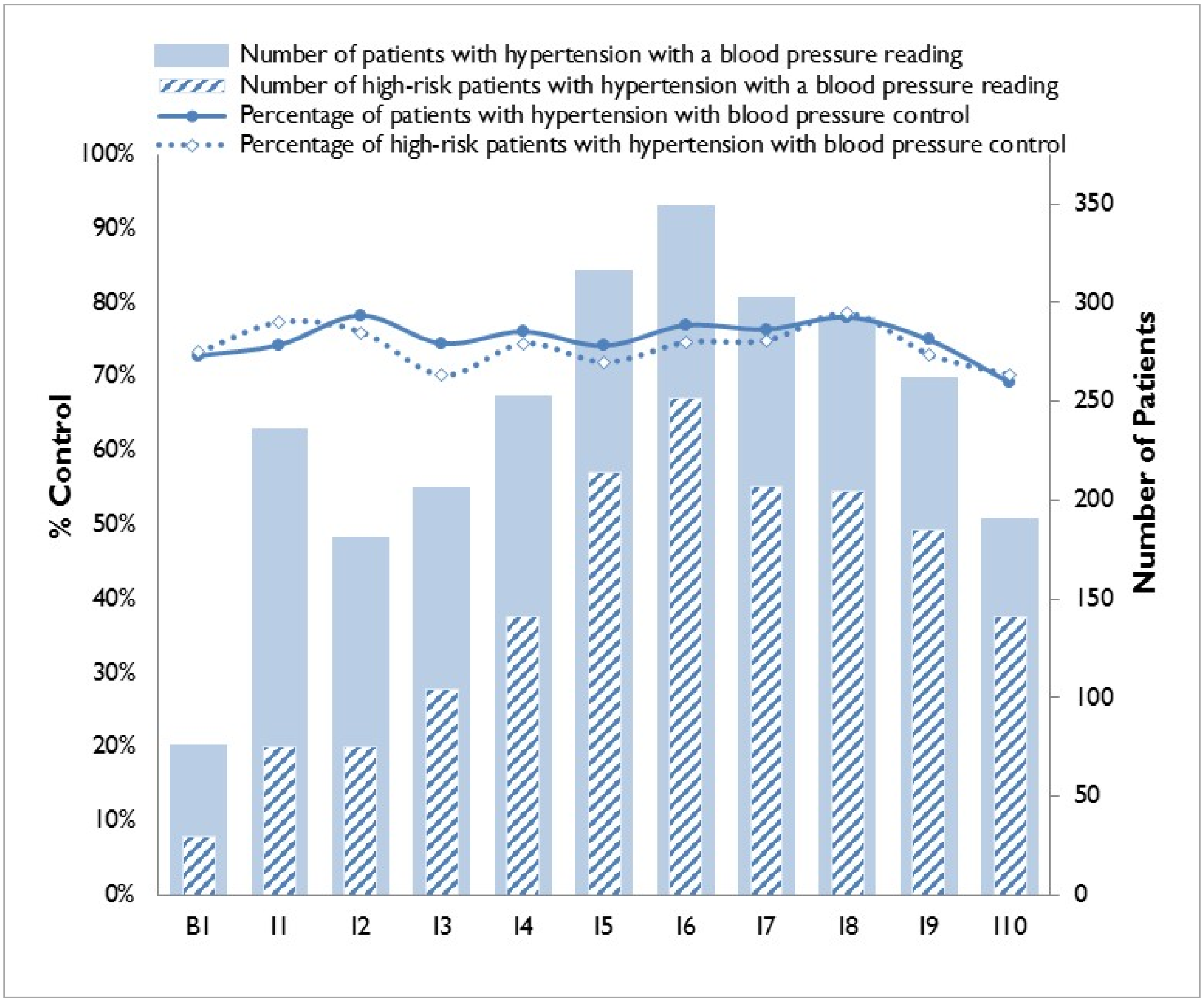
Measure	Percentage of Patients Receiving Clinical Services
All patients with hypertension (n = 664)	
Percentage of patients with hypertension who received a blood pressure reading	99.4
High-risk patients with hypertension (n = 393)	
Percentage of patients with hypertension who received a blood pressure reading	100.0

Source: Patient-level data provided to RTI by South County.

We used the blood pressure values from South County to calculate the percentage of patients overall and high-risk patients with hypertension with blood pressure control (i.e., < 140/90 mm Hg).

Figure 12 presents the percent of participants, overall and high risk, with hypertension with a blood pressure reading indicating control (< 140/90 mm Hg) over time. The denominator represents the number of hypertension patients, overall or high risk, who received a blood pressure reading for each quarter. The numerator represents the number of hypertension patients, overall or high risk, who received a blood pressure reading that was < 140/90 mm Hg. Across all hypertensive patients, the percentage of those with blood pressure control declined from approximately 74 percent in I1 to approximately 69 percent in I10. Among high-risk hypertensive patients, the percentage of those with blood pressure control declined from approximately 77 percent in I1 to approximately 70 percent in I10. Thus, blood pressure control did not improve over time among hypertensive patients enrolled in the innovation.

Figure 12. Percentage of Patients with Hypertension with Blood Pressure Control over Time



	Quarter	B1	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
●	Percentage of patients with hypertension with blood pressure control	72.9	74.4	78.3	74.5	76.1	74.2	77.0	76.4	78.1	75.0	69.2
◊	Percentage of high-risk patients with hypertension with blood pressure control	73.3	77.3	76.0	70.2	74.5	72.0	74.6	74.9	78.5	73.0	70.2
	Number of patients with hypertension with blood pressure reading	70	230	175	200	247	310	343	297	287	256	185
	Number of high-risk patients with hypertension with blood pressure reading	30	75	75	104	141	214	252	207	205	185	141

Source: Patient-level data provided to RTI by South County.

2.17.2 Regression Results

Results from the GEE assessing the impact of dose (i.e., number of contacts with health coaches) on systolic and diastolic blood pressure values over time among those with hypertension are shown in ***Table 21***. There was no statistically significant effect for dose among those with hypertension for systolic or diastolic blood pressure.

Table 21. Impact of Dose on Systolic and Diastolic Blood Pressure Values among Those with Hypertension over Time

Predictor	Coefficient	Standard Error	P-Value
Systolic blood pressure			
Contacts with health coaches	0.01	0.28	0.96
Diastolic blood pressure			
Contacts with health coaches	-0.01	0.14	0.94

Source: Patient-level data provided to RTI by South County.

2.18 Discussion: Awardee-Specific Data

South County provided necessary clinical services to enrollees with diabetes and hypertension. Most patients with diabetes had an HbA1c test, an LDL-C test, or foot exam. All patients with hypertension received a blood pressure reading. The results did not differ between all patients with diabetes or hypertension and high-risk patients with diabetes or hypertension.

Based on the run charts, the percentage of diabetes patients with LDL-C control increased over time. However, the percentage of diabetes patients with HbA1c control did not increase over time. Similarly, the percentage of hypertensive patients with blood pressure control did not change over time. Thus, the innovation seems to be effective in improving LDL-C, but not HbA1c control, among patients with diabetes. However, conclusions should be drawn with caution, as the denominators decreased substantially over time.

Dose, as measured by number of contacts with health coaches, was not related to decreases in health outcome values over time. However, dose was related to increases in HbA1c values over time, suggesting that dose was provided to diabetes patients who likely needed it most.

2.19 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 22*** lists the quantifiable measures of implementation and their status as of June 30, 2015 that RTI obtained from South County's

Narrative Progress Reports, Quarterly Awardee Performance Reports. Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 22. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of target population patients enrolled	Data received from South County
	Dose	Care plans initiated	Data received from South County
		Completed comprehensive assessments	Data received from South County
		Number of contacts with health coaches	Data received from South County
Coordinated care	Comprehensiveness	Number/percentage of patients referred to IBHS	Data received from South County

FTE = full-time equivalent; IBHS = integrated behavioral health services; South County = South County Community Health Center.

2.20 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.20.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation had 33.49 FTE staff members, below projection by 1.00 FTE. The majority of staff at the end of Q12 included 12 health educators/health coaches, 9 management/administrative staff, and 6 peer counselors. The number of individuals in these roles stayed consistent since Q7 (March 2014) except for health educators/health coaches. That role grew from 11 health educators/health coaches in Q5 (Sept. 2013) to 14 in Q8 (June 2014). However, in Q9 (Sept. 2014) the number of health educators/coaches dropped to 12, where it remained every quarter until the project concluded. No FTE new hires or staffing challenges were reported between Q11 (March 2015) and Q12; however, two community health workers (CHWs) left.

Workforce development was a critical component of the South County innovation. South County established new roles for several aspects of care coordination (i.e., health navigator, health coach, panel manager) to improve key health outcomes. Partners also employed innovation staff; Nuestra Casa's health promoters offered linkages to social and community services, and VOR's recovery coaches helped patients struggling with substance abuse. South County put major effort into hiring innovation staff who reflected the culture and first language (English, Tongan, Spanish) of its diverse patients.

Since the start of the innovation, South County invested resources to build up its training and staff development program. For example, expansion of the CHW roles provided opportunities for lay health worker staff members to grow professionally. CHWs provided more holistic care, streamlined the care coordination process, engaged patients with preventive care, and helped to ensure that patients were not lost in the system. Existing medical assistants and reorganized staff filled the panel manager and health coach roles.

As staff roles and duties changed to accommodate the innovation, South County responded by hiring a staff development director in 2013 and a curriculum developer in 2014. Perhaps as a result, South County maintained a high retention rate throughout the implementation period. The chief executive officer (CEO) noted that the people they attract were able to adapt quickly to change. She said reviewing the driver diagram with staff helped to get everyone aligned on the implementation plan.

2.20.2 Skills, Knowledge, and Training

Between Q11 and Q12, South County provided 841 hours of training to 184 clinical staff and administrative personnel. South County developed systems to support training application, assessment, and acquisition using the "Maximize Your Training Investment" model by author Ken Blanchard. Training modalities during Q11 and Q12 included classroom, discussion, and text, and represented courses on topics including health coaching, care management, wellness, boundaries and ethics, customer service, family planning health worker certification, and prevention of blindness screenings. Duration of training courses offered in Q11 and Q12 ranged from 2 hours to 24 hours. Customer service training was provided for the new front office and enrollment staff, and a training for Screening, Brief Intervention, and Referral to Treatment (SBIRT) was provided to both HCIA and community-based clinical and administrative personnel. Providers, medical assistants, health coaches, and panel managers attended a UCLA Integrated Substance Abuse Programs training facilitated by the Santa Clara Valley Medical Center.

Table 23 shows the number of trainees and training hours for Q11 and Q12 as well as cumulative hours through June 2015. In Q12, South County reported that the Health Coaching Curriculum, a first-draft comprehensive curriculum that included information on chronic disease physiology, care team roles, and quality improvement was ready to be reviewed by the innovation core group. This curriculum was developed with different levels to meet development needs of various clinical staff; for example, two of the courses are Advanced Coaching for Medical Assistants and Health Coaching for Registered Nurses. South County also completed a survey of health coaches during Q12 to garner feedback on most effective patient health education handouts, and will provide an in-service with health coaches to standardize the use of handouts. The staff development director assisted managers and staff with skills and goals development to improve service delivery, workflow process, and communications. She also collaborated with a local training school to offer classes for selected staff who wanted to become certified medical assistants.

Table 23. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	841	184
Cumulative (July 2012–June 2015)	6,725	788

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.21 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

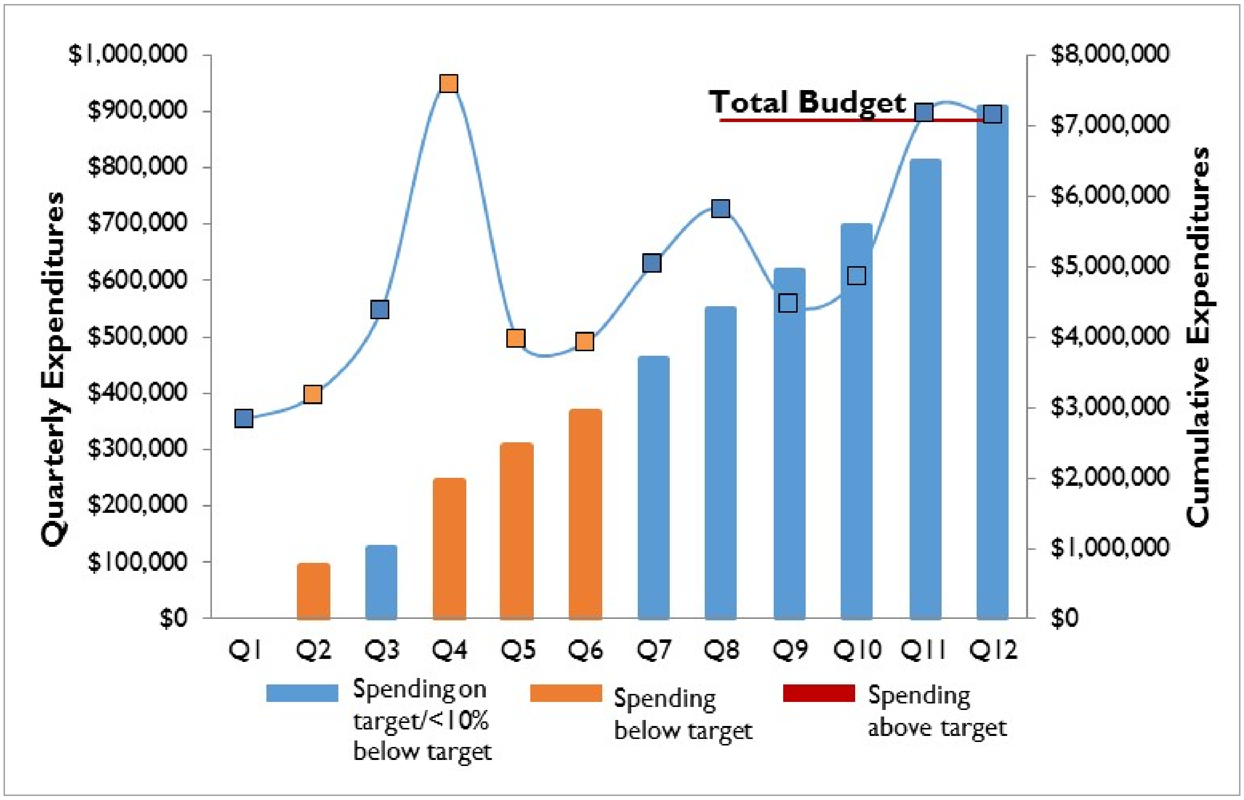
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.21.1 Award Execution

The annual report highlights the significance of South County's expenditure rates related to implementation. As of June 2015 (Q12), South County spent 102.9 percent of its total budget, which exceeds its projected target (see ***Figure 13***). The cumulative spending rate for the first eight quarters was consistently at target or less than 10 percent below target. Delays affected the awardee's ability to effectively use resources. It took South County longer than expected to get its innovation off the ground, as staff worked to get the innovation concept into practice and adjust to the new system of care. Concurrent to initial implementation was the kickoff of a new electronic health record (EHR) system, which also had a major impact on how staff spent their time (e.g., attending trainings specific to the EHR) and provided health services. South County was also conducting a pilot implementation phase of the care redesign process during Q3 and Q4, and began expanding the innovation to the other departments during Q5.

Figure 13. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.21.2 Leadership

Since the 2014 annual report, leadership staff at South County did not change; the CEO and all other leaders, including the medical director, remained highly involved in the implementation of the innovation.

South County's innovation transformed its entire process of care delivery; the CEO envisioned it as a means to provide more comprehensive and coordinated care to all patients. The CEO and medical director worked together to create the entire vision for the innovation and implement workflow process changes. Because this was such a dramatic change from the previous flow of patient care, staff in a few departments were more amenable to change than those in other departments. However, the CEO worked to engage providers across the organization to increasingly incorporate their patients into the new processes. South County hired a primary care development corporation at the start of the award, which broke down the grant into pieces and phases with a strategic plan, laying out all the work that needed to be done and putting timelines in place. Strategic planning workshops and retreats were held to unify staff at all levels around a single, coherent vision and to identify improvements needed to make the necessary changes. Also in preparation for project implementation, selected staff participated in trainings on patient coaching and self-management, motivational interviewing, and population management. The CEO shared her strong belief that this new process of care provides South County's patients with better outcomes, and expressed her personal commitment to seeing that the changes continue.

2.21.3 Organizational Capacity

During spring 2015, South County moved into a new building that now houses all staff. Previously, staff members were distributed among several buildings. The colocation of staff, with strategic placement of medical teams all within the same site, was intended to increase patient care efficiencies and coordination. At the same time, South County implemented a new EHR system (Epic) and continued to struggle with creating templates and interfaces that matched the workflow process and procedures. Staff had to learn to use the new EHR system and how to enter patient data. They entered patient data as new participants came in for care, while simultaneously working to enter all prior patient records into the new system. Compounding the work needed to get patient records into the system, South County needed to make significant improvements to the EHR to track and monitor innovation participants. For instance, health coaches lacked EHR templates needed to modify or document progress notes and reminders, and until a centralized page was constructed, care documentation required a great amount of manual data entry and toggling among windows on the screen. Given the challenges of the new system, South County had issues providing complete patient data to RTI during the first 2 years of the innovation. While the EHR was a primary barrier to reporting data for patients enrolled in the innovation, during Year 3 staff members could enter more patient data into the system.

Innovation partners continued to expand South County's services through the end of implementation. During Q11 and Q12, the BHRS Psychiatric Nurse Practitioner reported that patients were successfully connected to services and that hospital staff helped optimize the process of getting patients connected back with their appropriate providers. Neustra Casa increased the number of participants in its cooking and gardening classes so they could learn to grow their own fruits and vegetables and cook healthy meals, and continued collaboration with the Department of Motor Vehicles to assist immigrants with procuring drivers licenses. VOR continued quarterly celebrations to highlight recovery accomplishments and created instruments to track the mobility of patients throughout San Mateo County to continue supporting its efforts to help patients move from treatment programs back into the community.

2.21.4 Innovation Adoption and Workflow Integration

With the new building, medical teams were colocated; a clinician, medical assistant, and health coach worked at the same physical site. The goal of united medical teams was to enhance communication among team members on behalf of patients. Some teams adapted well to this new setup and used colocation to enhance patient care coordination; others were more resistant to sharing the same space. Because the workflow processes for South County changed drastically as a result of this innovation, the changes took time to evolve and diffuse across the organization and into all departments. Since the intention of the new setup is to enhance communication and collaboration—and departments that accepted the innovation first are seeing improvements now—outcomes from these efforts will likely improve beyond the funding period of this award.

For workflow integration, in early 2014, South County added a new role for a nurse to follow up with patients who visited the ED. The purpose was to better connect patients with their primary care providers and to prevent unnecessary future ED visits.

Other accomplishments in the implementation process include improved efficiencies in appointments (i.e., more patients seen each day, fewer “no shows”) and incorporating care coordination templates and patient and organizational dashboards into the EHR system to monitor specific conditions or care processes. Structured panel management activities were standardized in Year 3 to provide weekly and monthly reports for health coaches, panel managers, and providers; inactive patients are contacted for follow-up. Also in Year 3, South County created a Performance and Quality Improvement (PQI) protocol, developing goals and objectives statements to improve services and clarify the process of identifying team roles and expectations. The PQI Steering Committee made progress in ensuring data availability at various levels, including developing dashboards for organization key performance indicators and care teams.

In Q11, South County started using the Stages of Change (SOC) model to help improve health outcomes of subpopulations not showing improvements. In this model, interventions are tailored based on the patient’s state, and care is coordinated with IBHS. Also in this quarter, South County initiated a SBIRT project to improve care management for patients with anxiety, depression, and substance abuse; the project was intended to standardize the SOC model throughout the clinic.

2.22 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.22.1 Innovation Reach

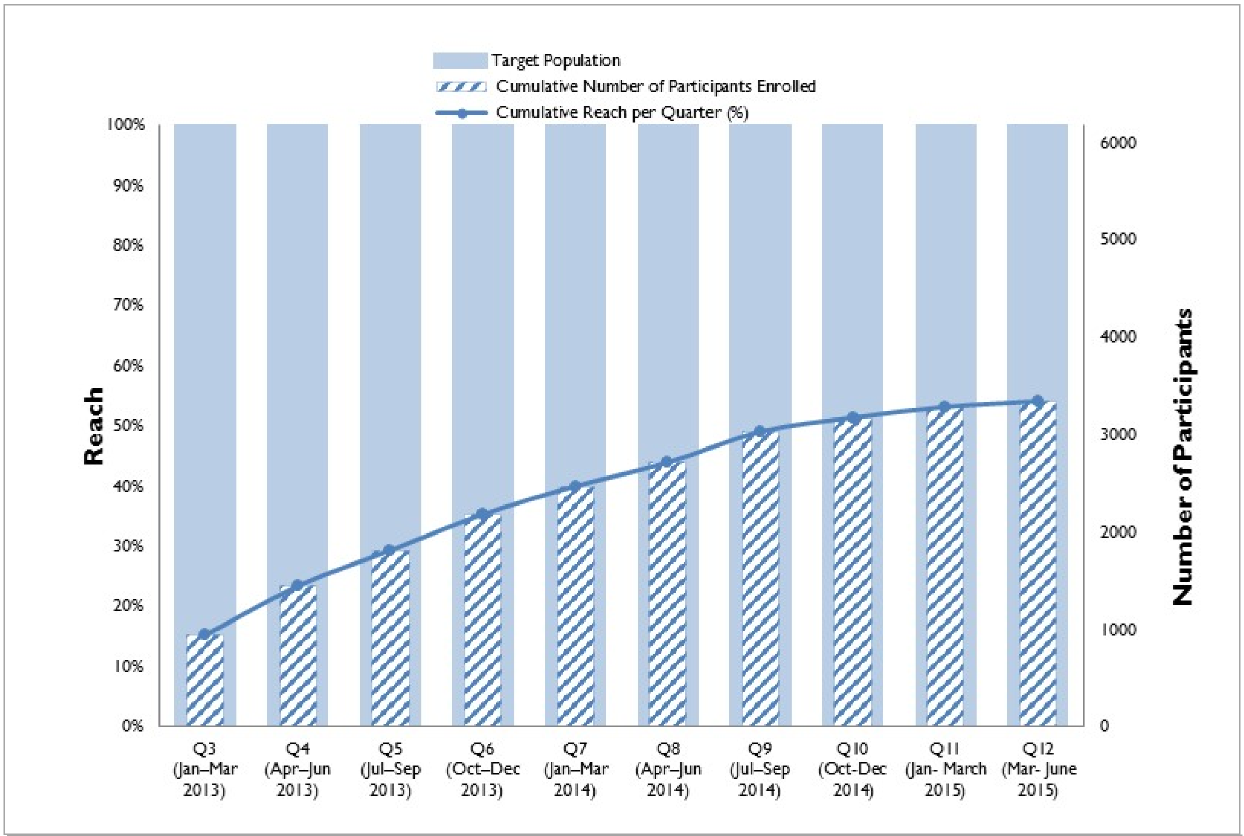
Reach is the extent to which the targeted number of patients are exposed to the innovation. South County's innovation is a complete transformation of its process of care delivery. Therefore, its target population is the 6,180 patients who were enrolled in the San Mateo Health Plan. To be considered as enrolled in the innovation, patients had to have spoken with a health coach or provider by telephone or in person about addressing their chronic health needs.

Figure 14 shows reach by quarter since the launch of the innovation. We last reported reach in the 2015 annual report, based on data through Q11. Overall, South County enrolled an additional 119 patients by the end of Q12, increasing reach from the 51.1 percent reported in the 2015 annual report to 54.1 percent. Note that new patient data were added to each new data set that South County provided to RTI, which changed the total number of patients enrolled by quarter reported in prior reports.

South County reported challenges in reaching its target population since the beginning of the award. First, at the same time the innovation began, South County was building a new health center. Ultimately, the transition to the new facility was smooth, but resources were impacted because of the time required to prepare for the opening: new and existing equipment and systems had to be configured, tested and implemented, and new workflows had to be planned, mapped, communicated, rehearsed, and then documented in policies. Implementing the new EHR system also caused problems with creating templates and interfaces that matched the workflow process and procedures and caused challenges with tracking and monitoring innovation participants.

Several additional challenges undermined South County's reach. First, South County struggled to keep patients in care because many moved or changed phone numbers, making it difficult for staff to contact patients for information. Second, because South County is a FQHC, health coaches' workload increased, and the staff lacked enough replacements to ensure clinical coverage when coaches were out sick. Finally, communication with providers was somewhat lacking, such that providers did not always know if the project was meeting their benchmarks, limiting their ability to make adjustments as needed.

Figure 14. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Mar–June 2015)
●	Cumulative reach per quarter (%)	15.2	23.4	29.3	35.3	39.9	43.9	49.0	51.3	53.1	54.1
	Target population	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180
	Cumulative number of participants enrolled	940	1,444	1,810	2,180	2,468	2,714	3,029	3,173	3,283	3,341

Source: Patient-level data provided to RTI from South County.

2.22.2 Innovation Dose

The central component of the innovation was to manage care for all patients, with intensified services for patients with chronic disease. Health navigators completed a comprehensive health assessment; patients were offered health coaching to help them set goals (e.g., lose weight, quit smoking), understand preventive health maintenance and provider instructions, and improve self-management of chronic conditions. High-risk patients received varying services and were contacted 2 weeks after the visit to follow up on their concerns, needs, and progress toward goals. Determining “dose” (i.e., the duration, length of time, and intensity of services received by each patient) for the innovation was thus challenging, as duration depended on the patient and his/her willingness to work with the health coach for the length of time needed to reach the patient's goals.

Table 24 shows the number of services provided across participants, the number of participants receiving services, and the average number of services per participant for the overall population and among those identified as high risk. High-risk participants (i.e., chronic conditions, high cost, high utilization based on an algorithm used by the medical care team) represent 23.4 percent of all those enrolled. We last reported dose in the 2015 annual report based on data through Q11. As expected, the number of these services provided and the percentage of participants receiving these services increased from Q11 to Q12. More specifically, 92.9 percent of all participants and 96.7 percent of high-risk participants completed a comprehensive assessment. Less than half of all participants and more than two-thirds of high-risk patients had contact with a health coach (44.8% and 67.6%, respectively).

Table 24. Number and Types of Services Provided to Participants

Services	Number of Services Provided to Participants	Number (Percentage) of Participants Receiving Service	Average Number of Services per Participant
All enrolled patients (3,341)			
Comprehensive assessment completed	3,105	3,105 (92.9)	1.0
Care plan initiated	3,125	3,125 (93.5)	1.0
Contact with health coaches	6,462	1,498 (44.8)	4.3
Referred to IBHS	593	512 (15.3)	1.2
High-risk patients (781[1])			
Comprehensive assessment completed	755	755 (96.7)	1.0
Care plan initiated	743	743 (95.1)	1.0
Contact with health coaches	3,471	528 (67.6)	6.6
Referred to IBHS	248	202 (25.9)	1.2

Source: Patient-level data provided to RTI.
[1] Patients identified as being at high or super-high risk (e.g., chronic conditions, high cost, high utilization).
IBHS = integrated behavioral health services.

South County identified several factors that may have adversely affected dose. First, some patients failed to follow their care plans or keep appointments. South County reported that patients occasionally put their medical care on hold because of other pressing issues such as lack of housing, child care, insurance, transportation, and food. South County attempted to address these needs by directing patients to community partner organizations for assistance.

Second, workflow at South County undermined the staff's ability to deliver services. Staff members struggled to document the care plan due to the new EHR structure and, initially, before the new building opened in May 2015, health coaches were located in a different building, which affected communication with patients.

Approximately 15 percent of all patients and more than a quarter of high-risk patients were referred to South County's IBHS program, but this was not the only behavioral health support available to patients. South County referred patients to community partners for assistance with behavioral health or substance abuse issues. South County's IBHS served patients with less acute mental health issues.

2.23 Qualitative Findings: Sustainability

The South County innovation involved a total transformation of care: Patients were assigned to and managed by a medical team that focused on ensuring comprehensive care, particularly for patients at greatest risk for experiencing complications resulting in ED visits, hospitalizations, or readmissions. As the CEO reported, while South County received the HCIA funding, it also finalized plans and funding to build a new facility and prepared to implement an EHR system. The new building opened in spring 2015 and all staff were moved. The new space was engineered to encourage coordination within teams: Each team had a shared space to facilitate conferring on treatment plans and improving care coordination for each patient. The innovation is regarded as the way care will be delivered at South County going forward, and South County reports that it will maintain the new care model after the project concludes. Some services that the community partners had been providing will be incorporated internally. South County plans to hire a medical social worker to help patients address barriers to care, and several activities such as patient surveys and health coaching enhancements are planned to help the organization move toward strengthening its systems and processes.

2.24 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing South County as well as accomplishments to date. In this section we assess South County's progress on achieving HCIA goals to date.

- **Smarter spending.** Limited claims data were available for assessing spending during the innovation. Medicare and Medicaid spending trends varied widely. Because of the small number of patients in the claims samples, RTI cannot form any conclusions on the impact of the innovation on spending at this time.

- **Better care.** Hospital inpatient admissions, hospital unplanned readmissions, and ED visits for Medicare and Medicaid patients varied widely. Because of the small number of patients in the claims samples, RTI cannot form any conclusions on the impact of the innovation on these measures at this time.

  As of Q12, reach was 54.1 percent, with a total of 3,341 participants enrolled in the innovation. Although reach increased over time, reach was just over half of South County's target population of 6,180.

  Nearly all participants completed the comprehensive assessment and had a care plan initiated. Less than half of all participants and approximately two-thirds of high-risk patients had at least one contact with a health coach. Findings indicate that patients who were categorized as high risk are more likely to receive health coaching and other services. Approximately 15 percent of all patients and 26 percent of high-risk patients were referred for IBHS.

- **Healthier people**. Based on the run charts assessing the percentage of patients in control over time, LDL-C control among those with diabetes increased. However, rates of HbA1c control and blood pressure control did not improve over time among the diabetic and hypertensive patients, regardless of whether they were high-risk patients.

  Based on the regressions, which assessed the impact of dose on health outcome values over time, dose—as measured by the number of contacts with health coaches—was related to increased HbA1c values over time. This finding suggests that greater dose was provided to diabetes patients who had greater difficulty in improving their HbA1c.

South County attempted to implement a comprehensive innovation that transformed patient care simultaneously with the implementation of a new EHR system, construction of a new building, and relocation of staff into the new building. As noted by site visit respondents, the timing of this innovation was not ideal because of the other organizational changes occurring, but was necessary to improve South County's patient care. Unfortunately, as the center began to roll out the innovation, South County recognized that the new EHR system needed significant improvements in its ability to track and monitor patients enrolled in the innovation. During the first 3 years, staff made substantial effort to learn the new EHR and create templates or interfaces so that work to assess and track patients could be documented.

RTI encountered challenges in obtaining data from South County, mostly because the data provided were inconsistent and difficult to interpret based on how the innovation was organized. Over time, South County's data improved, but many findings presented in this report are likely influenced by the quality and quantity of the data received to date and retrospectively entered into the new EHR system since the start of the innovation (i.e., South County has yet to enter all its patients into the system).

South County had some success in implementing its innovation. South County succeeded in setting up medical teams of multidisciplinary staff members, each with distinct roles in delivering patient care plans. The center hired and trained staff to fill new roles and held a major training program for the staff; the center also implemented changes to its workflow. South County instituted, and required all staff to complete, comprehensive training to learn about the new workflow processes and procedures. South County now has medical teams in place in most of its clinics to manage panels of patients and ensure comprehensive and coordinated care, particularly for those at highest risk. South County also identified key partners in the community that have the resources to fill gaps in the center's patient care services, and maintained relationships with those partners throughout the implementation.

South County steadily increased the number of patients enrolled in the innovation, but ultimately failed to enroll the number of patients targeted. The care redesign optimization phase started in the third year of the award; care teams began to focus on making interventions more effective by reviewing patients' progress toward meeting their health targets. South County feels that identifying and classifying patients based on meeting health targets has been a major achievement. Nevertheless, given the health outcomes data South County provided for all its enrolled patients, we determined that no improvements were documented for patients with diabetes or hypertension.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

South County Community Health Center (South County)

South County Community Health Center (South County) is a federally qualified health center (FQHC) in Palo Alto, California, that received an award of $7,302,843 to identify, prioritize, and manage high-risk patients. South County is located in a low-income area with a large local population of Hispanics. South County's innovation began enrolling patients in January 2013.

Awardee Overview

Innovation dose:	Majority of all enrollees completed a comprehensive assessment (92.9%), initiated care plan (93.5%), and had contact with a health coach (44.8%). High-risk patients had an average of six contacts with health coaches. More than 25% of high-risk patients received an Integrated Behavioral Health Services referral.	***Innovation reach:***	By the final innovation quarter, 54.1% of the target population was enrolled (3,341 participants out of a target population of 6,180).
Components:	(1) Comprehensive health assessments by patient navigators (2) High-risk patient panel management (3) Care coordination and health coaching for high emergency department (ED) users (4) Community resource referrals for behavioral or substance abuse needs	***Participant demographics:***	Nearly half of participants (42.7%) were younger than 18 years of age, and 60.6% were female. The majority were Hispanic (83.6%) and Medicaid beneficiaries (84.7%).
Sustainability:	Plans are to maintain the new care model after project conclusion; some community partner services are to be incorporated internally. A new medical social worker is to be hired, and activities are planned to strengthen systems and processes.		
Innovation type:	Coordination of care; Process of care	Direct health care/dental care	Health care workforce

Key Findings

Smarter spending. Limited claims data were available for assessing spending during the innovation. Medicare and Medicaid spending trends varied widely. Because of the small number of patients in the claims samples (Medicare n=53; Medicaid n=93), RTI cannot form any conclusions on the impact of the innovation on spending at this time.

Better care. Hospital inpatient admissions per 1,000 participants per quarter, hospital unplanned readmissions per 1,000 admissions per quarter, and ED visits per 1,000 participants per quarter for Medicare and Medicaid patients varied widely. Because of the small number of patients in the claims samples (Medicare n=53; Medicaid n=93), RTI cannot form any conclusions on the impact of the innovation on these measures. Approximately two-thirds (67.6%) of high-risk patients had at least one contact with a health coach. Findings indicate that patients who were categorized as high risk were more likely to receive health coaching and other services.

Healthier people. Based on run charts assessing the percentage of patients in control over time, LDL-C control among those with diabetes increased from 34.0 to 58.3. However, rates of HbA1c control and blood pressure control did not improve over time among diabetic and hypertensive patients, regardless of whether they were high-risk patients. Patients with poor HbA1c control increased from 24.4 percent to 29.1 percent, and patients with blood pressure control declined from 74.4 percent to 69.2 percent.

Based on the regressions that assessed the impact of dose on health outcome values over time, dose—as measured by the number of contacts with health coaches—was related to increased HbA1c values over time (0.04; p=0.05). This finding suggests that greater dose was provided to diabetes patients who had greater difficulty in improving their HbA1c.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Southeast Mental Health Services

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

Southeast Mental Health Services

2.1 Introduction

Southeast Mental Health Services (SEMHS) provides mental health care and substance abuse treatment in the rural, frontier southeast corner of Colorado. Awarded $1,405,924, SEMHS sought to provide health navigation to Medicaid patients living in Prowers County who are frequent users of the health care system. The innovation had the following HCIA goals:

1. **Smarter spending.** Decrease spending by reducing the health care expenditures for the highest users of Medicaid, Medicare, and Child Health Plan Plus (CHP+) by 15 percent from baseline (i.e., $1.875 million) by June 2015.

2. **Better care.** Increase access to primary and secondary prevention by connecting high-risk patients with primary care through patient navigation (i.e., health navigators) services.

3. **Healthier people**. Improve health status through care coordination and appropriate primary and follow-up care to high users of the system.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the *Quarter (Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports,* and secondary data submitted by SEMHS and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Focus was to provide care coordination through health navigation services and establish a formal HN training program through OJC.
Program Participant Characteristics	
	Most (56.7%) participants were 25 to 64 years of age; 67.0% were female. Over 20% were children (< 18 years of age). Slightly more than one-third (34.7%) were white and 9.1% were Hispanic; 85.0% were covered by Medicaid, 1.7% by Medicare, and 5% were dually eligible for Medicaid and Medicare.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Workforce Development	
Hiring and retention	Staffing remained at 8.25 FTEs throughout project period. At the end of Q12, three HNs remained.
Skills, knowledge, and training	For Q11 and Q12, OJC provided 1,520 hours of training to 73 people. OJC approved the second HN curriculum for the common course curriculum.
	Execution remained strong due to increased confidence of HN team, strong collaboration with partners to ensure appropriate care, and expansion of OJC training program.
Context	
Award execution	Expenditure rate was 97.99% in Year 3—on target.
Leadership	Leadership remained stable across the implementation period.
Organizational capacity	Continued to have challenges with data management, and analysis efforts underestimated the staff time needed to adequately perform these tasks.
Innovation adoption and workflow integration	Adoption of the innovation continued to improve. HNs more directly involved in follow-up care and better integrated into the workflow process at SEMHS.
Implementation Effectiveness	
Innovation reach	In Q11, 47 patients were enrolled for HN services. An additional 43 patients enrolled in Q12, bringing the total to 639 participants.
Innovation dose	Between Q11 and Q12, receipt of outreach services increased from 65.9% to 67.1%. Receipt of nonbillable services decreased slightly, from 47% in Q11 to 44.8% in Q12. An average of 9.9 services provided per participant.
Sustainability	
	SEMHS leadership will use monies received from the ACO to maintain the current services and expand to all six counties in the region using four HNs, the project manager, and the HN supervisor.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June 2015.

ACO = accountable care organization; FTE = full-time equivalent; HN = health navigator; OJC = Otero Junior College; Q = quarter; SEMHS = Southeast Mental Health Services.

Table 3 summarizes Medicare claims-based findings during the innovation period. The SEMHS innovation did not generate any statistically significant changes in spending or inpatient stays. The innovation group had significantly higher ED visits overall than the comparison group, and the annual differences were statistically significant in Year 2, but not in other years. The innovation group had significantly fewer unplanned readmissions than the comparison group. Changes in spending and utilization are difficult to detect with a small sample size of 106 fee-for-service Medicare innovation participants.

Table 3. Summary of Medicare Claims-Based Findings: SEMHS

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI	Year 4	90% CI
Aggregated results										
Total spending (in millions)	$0.507	−$0.278, $1.292	$0.314	−$0.123, $0.751	$0.108	−$0.186, $0.401	$0.052	−$0.277, $0.382	$0.033	−$0.097, $0.164
Acute care inpatient stays	15	-11, 41	4	-13, 22	8	-6, 22	3	-8, 13	0	-7, 7
Hospital-wide all-cause unplanned readmissions	-17	-29, -6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	108	44, 171	29	-14, 73	62	25, 98	19	-7, 45	-2	-13, 9
Average impact per quarter										
Spending per participant	$637	−$349, $1,624	$798	−$314, $1,911	$468	−$807, $1,743	$358	−$1,900, $2,616	$1,237	−$3,596, $6,070
Acute care inpatient stays (per 1,000 participants)	19	-13, 51	11	-34, 57	34	-26, 94	18	-53, 89	2.6	-272, 277
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	-345	-579, -111	—	—	—	—	—	—	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	136	56, 215	75	-36, 186	269	111, 427	129	-51, 310	-84	-499, 330

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. The SEMHS innovation did not have an impact on spending, inpatient stays, or ED visits for fee-for-service Medicaid patients enrolled in the innovation. There were not enough inpatient visits to allow separate yearly effects to be estimated. In Year 3, the change in ED visits is statistically significant; however, the innovation had a small number of participants that year and the small sample size skewed the ED visit rate during the year. With a sample size of 128 innovation participants matched to the data provided by Value Options, the number of hospital readmissions was insufficient to conduct a regression analysis for that outcome. Overall, the SEMHS innovation does not appear to have had an impact on these measures of spending and utilization among Medicaid fee-for-service beneficiaries.

Table 4. Summary of Medicaid Claims-Based Findings: SEMHS

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$0.093	−$0.321, $135	−$0.008	−$0.116, $0.100	−$0.040	−$0.144, $0.646	−$0.045	−$0.103, $0.013
Acute care inpatient stays	2	-22, 26	N/A	N/A	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	15	−32, 61	4	−32, 39	−16	−43, 10	28	13, 42
Average impact per quarter								
Spending per participant	−$281	−$970, $409	−$24	−$350, $302	−$120	−$435, $195	−$136	−$312, $39
Acute care inpatient stays (per 1,000 participants)	7	-64, 78	N/A	N/A	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	48	−102, 197	20	−174, 215	−159	−416, 98	1,058	512, 1,604

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the average quarterly effect from a simple difference in difference model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

SEMHS is in Prowers County, located near the Colorado-Oklahoma border, had an estimated population of 12,291 as of 2013. Some parts of this very rural area qualify as “frontier” designations, and the region’s residents must travel considerable distances to access services. SEMHS was one of only a few service agencies available to residents in the six-county region that includes Prowers, and was well known as a key provider of behavioral health services in the area. The intent of the health navigator (HN) innovation was to reduce health care costs for frequent health system users by integrating behavioral health services with primary care for high-risk patients and ensuring that people received comprehensive preventive care.

This innovation had two components: (1) the Community Health Worker Training Program conducted with Otero Junior College (OJC) that established a community health worker (CHW) certificate program with 31.5 hours of course- and fieldwork; and (2) HNs hired through SEMHS to increase patients’ access to behavioral care, primary care, and early intervention services, as well as team-based education and coaching to improve self-management of diseases. HNs performed many tasks beyond behavioral health needs, to include getting patients connected to primary care to reduce overuse of and reliance on the health system. Their duties included helping individuals with care coordination, scheduling appointments, sending reminders, arranging transportation, health coaching, informal counseling, and group and individual health education. They also offered health education classes to the local community and used media outreach to encourage healthier lifestyles in Prowers County. The CHW training component of the innovation focused on workforce development beyond the six HNs hired by SEMHS. This innovation component was intended not only to prepare HNs for the SEMHS program but also to train individuals in the region to serve in the HN role in other health care settings.

SEMHS planned for HNs to work from three locations: the SEMHS main office in Prowers County; the High Plains Community Health Center (HPCHC); and the Prowers Medical Center (PMC). During Year 3, HNs remained in the main office and PMC but left HPCHC when that partnership dissolved in Year 1. No changes to innovation components occurred during the final year of funding. The other partners (OJC and PMC) remained with the innovation.

Table 5. HCIA Partners, Roles, and Locations

Partner Name	Role in HCIA Project	Location
Otero Junior College	Trained incumbent health workers, future associate’s-level HNs, and future bachelor’s-level social workers	La Junta, CO
Prowers Medical Center	Provided access to patient identifiers and space for HNs	La Junta, CO

Source: Site visit, May 1–2, 2014.
HCIA = Health Care Innovation Award; HN = health navigator.

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants ever enrolled in the innovation. A majority of participants (56.7%) were 25 to 64 years of age, although over 20 percent were under age 18. More than half (67.0%) were female. Slightly more than one-third of participants (34.7%) were white, and approximately 9 percent were Hispanic. Most (85.0%) were covered by Medicaid, 1.7 percent were covered by Medicare or Medicare Advantage, and 5 percent were eligible for both Medicare and Medicaid. The distribution of patient characteristics is similar to the 2015 annual report. Insurance information presented in Table 6 is based on the awardee's categorization of patients into insurance categories. It appears that some of the Medicaid beneficiaries were in fact dually eligible based on the claims findings.

Table 6. Characteristics of All Participants Ever Enrolled in the SEMHS Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	639	100.0
Age		
< 18	130	20.3
18–24	73	11.4
25–44	198	31.0
45–64	164	25.7
65–74	44	6.9
75–84	23	3.6
85+	7	1.1
Missing	0	0.0
Sex		
Female	428	67.0
Male	207	32.4
Missing	4	0.6
Race/ethnicity		
White	222	34.7
Black	6	0.9
Hispanic	58	9.1
Asian	1	0.2
American Indian or Alaska Native	3	0.5
Native Hawaiian or other Pacific Islander	0	0.0
Other	29	4.5
Missing/refused	320	50.1
Payer category		
Dual eligibility	32	5.0
Medicaid	543	85.0
Medicare	11	1.7
Medicare Advantage	0	0.0
Other	53	8.3
Uninsured	0	0
Missing	0	0

Source: Patient-level data provided to RTI by SEMHS.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We included patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focused on 106 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in Prowers, Kiowa, Bent, or Baca Counties in southeastern Colorado.

We used propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits in the calendar quarter and calendar year prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 8 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. One innovation beneficiary was dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 8. Medicare Mean Values and Standardized Differences of Variables in Propensity Score Model: SEMHS

Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Payments in calendar quarter prior to enrollment	$2,991	$5,420	$1,952	$6,768	0.17	$2,856	$5,263	$3,323	$6,375	0.08
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$14,066	$19,959	$6,168	$14,703	0.45	$13,858	$19,938	$12,060	$24,117	0.08
Age	59.74	15.49	72.43	11.23	0.94	59.88	15.50	61.10	16.60	0.08
Percentage male	32.71	46.92	46.80	49.90	0.29	33.02	47.03	30.66	46.11	0.05
Percentage white	73.83	43.96	84.76	35.94	0.27	74.53	43.57	72.48	44.66	0.05
Percentage disabled	68.22	46.56	21.14	40.83	1.08	67.92	46.68	71.07	45.34	0.07
Percentage ESRD	2.80	16.51	0.77	8.76	0.15	2.83	16.58	2.99	17.02	0.01
Number of dual eligible months in the previous calendar year	9.30	4.66	2.27	4.59	1.52	9.28	4.68	9.75	4.46	0.10
Number of chronic conditions	6.93	4.08	6.04	4.00	0.22	6.92	4.09	7.06	4.01	0.04
Number of ED visits in calendar quarter prior to enrollment	0.60	1.15	0.14	0.52	0.51	0.55	1.03	0.50	1.46	0.04
Number of ED visits in calendar year prior to enrollment	2.06	2.94	0.52	1.33	0.67	1.96	2.79	1.32	2.56	0.24
Number of beneficiaries	107	—	43,015	—	—	106	—	295	—	—
Number of unique beneficiaries[1]	—	—	4,310	—	—	106	—	295	—	—
Number of weighted beneficiaries	—	—	—	—	—	106	—	106	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ED = emergency department; ESRD = end-stage renal disease; SD = standard deviation; SEMHS = Southeast Mental Health Services.

— Data not applicable.

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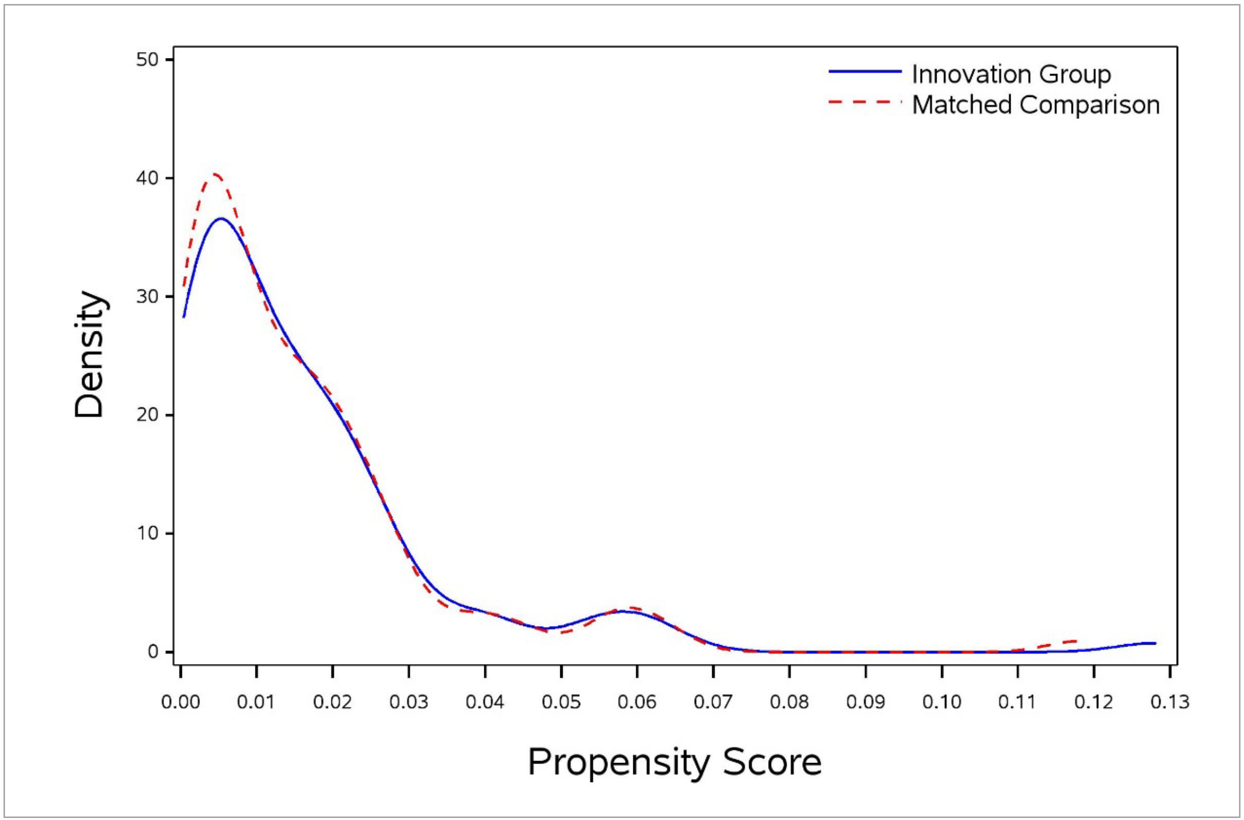
After performing PSM, we calculated absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 8). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[1] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 8 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables except the number of ED visits in the calendar year prior to enrollment.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The propensity score distributions for the innovation and matched comparison groups overlap substantially, indicating that matched comparison beneficiaries have similar propensity scores to innovation beneficiaries.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SEMHS = Southeast Mental Health Services.

[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the eight quarters before and the 14 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. During the baseline and innovation periods, spending is similar in the innovation and comparison group.

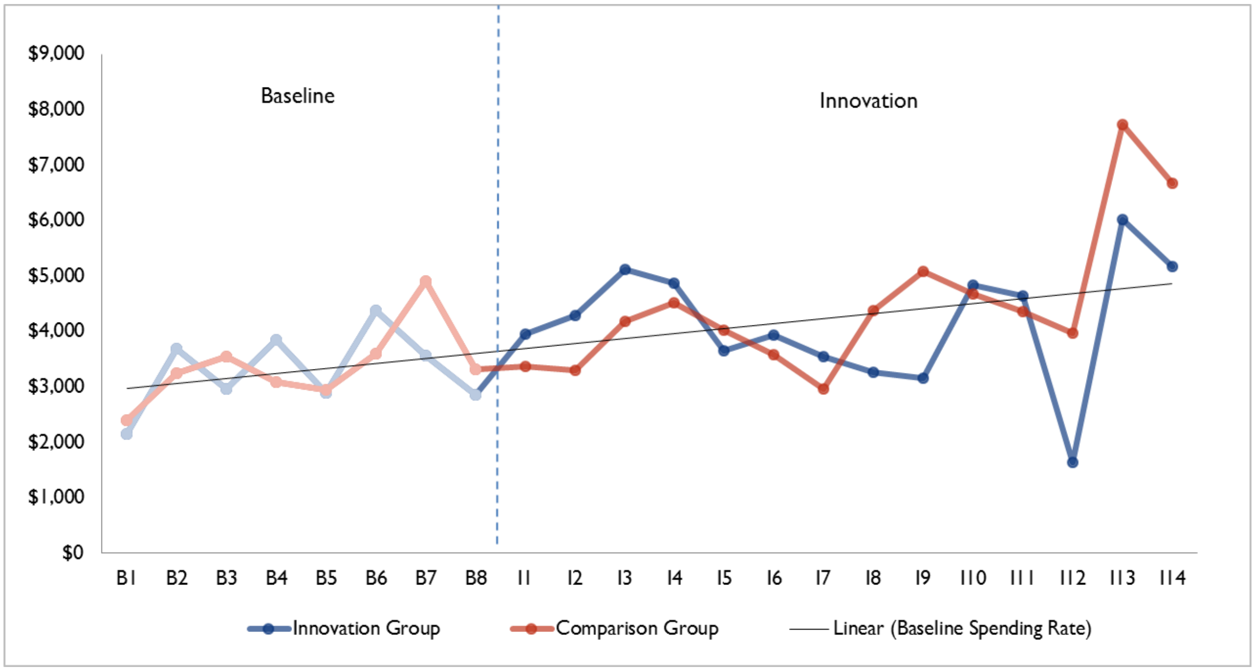
Table 9. Medicare Spending per Participant: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters													
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
Innovation Group																						
Spending rate	$2,147	$3,686	$2,970	$3,846	$2,899	$4,371	$3,558	$2,856	$3,959	$4,284	$5,112	$4,873	$3,652	$3,943	$3,555	$3,265	$3,149	$4,838	$4,641	$1,642	$6,024	$5,172
Std dev	$3,790	$7,130	$6,206	$7,535	$5,946	$8,475	$7,827	$5,263	$9,150	$8,124	$9,928	$10,853	$7,570	$7,574	$6,904	$5,668	$6,351	$12,266	$10,417	$1,973	$12,189	$9,575
Unique patients	93	94	96	95	99	103	103	106	106	106	106	75	69	61	53	47	43	39	35	29	17	10
Comparison Group																						
Spending rate	$2,405	$3,246	$3,539	$3,085	$2,952	$3,604	$4,907	$3,323	$3,369	$3,300	$4,189	$4,521	$4,024	$3,586	$2,958	$4,383	$5,077	$4,669	$4,366	$3,963	$7,736	$6,673
Std dev	$5,999	$8,731	$9,938	$8,317	$6,624	$13,044	$12,611	$6,375	$8,908	$6,820	$14,782	$10,538	$10,672	$7,688	$5,163	$11,442	$13,522	$8,618	$11,696	$7,326	$14,087	$6,099
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	75	70	63	53	44	42	36	32	26	15	8
Savings per Patient																						
	$259	−$440	$568	−$760	$53	−$767	$1,349	$468	−$590	−$983	−$923	−$352	$371	−$357	−$597	$1,118	$1,928	−$169	−$276	$2,321	$1,711	$1,502

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 2. Medicare Spending per Participant: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SEMHS = Southeast Mental Health Services.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period is $637 (90% CI: −$349, $1,624), indicating loss. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence. We also present estimates for savings and loses of the innovation as a whole during the entire innovation period, as well as Years 1 through 4 of the innovation.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. The quarterly estimates flip from positive to negative and are never statistically significant. Similarly, the overall estimates for the entire innovation period and the Year 1–Year 4 estimates are not statistically significant. Thus, there is not sufficient evidence to conclude that the innovation generated either a savings or loss.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	$623	$980	0.526
I2	$1,009	$888	0.257
I3	$984	$1,220	0.421
I4	$487	$1,349	0.718
I5	−$135	$1,061	0.899
I6	$771	$1,117	0.491
I7	$1,423	$1,137	0.212
I8	−$114	$1,370	0.934
I9	−$787	$1,817	0.665
I10	$1,430	$2,270	0.529
I11	$1,500	$2,569	0.560
I12	−$763	$1,108	0.492
I13	$774	$4,289	0.857
I14	$2,025	$3,090	0.513
Overall average	$637	$598	0.288
Overall aggregate	$507,140	$476,340	0.288
Overall aggregate (IY1)	$313,704	$265,156	0.238
Overall aggregate (IY2)	$107,719	$177,855	0.545
Overall aggregate (IY3)	$52,320	$199,954	0.794
Overall aggregate (IY4)	$33,397	$79,158	0.673

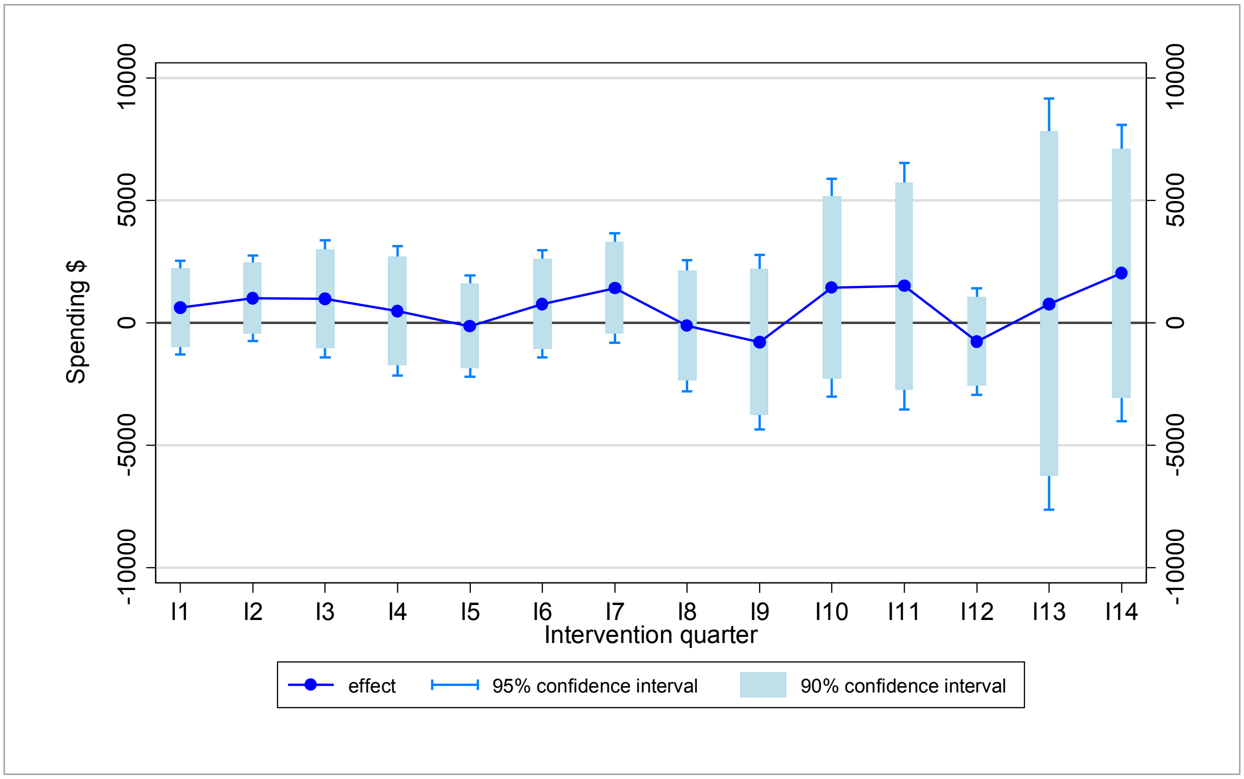
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; SEMHS = Southeast Mental Health Services.

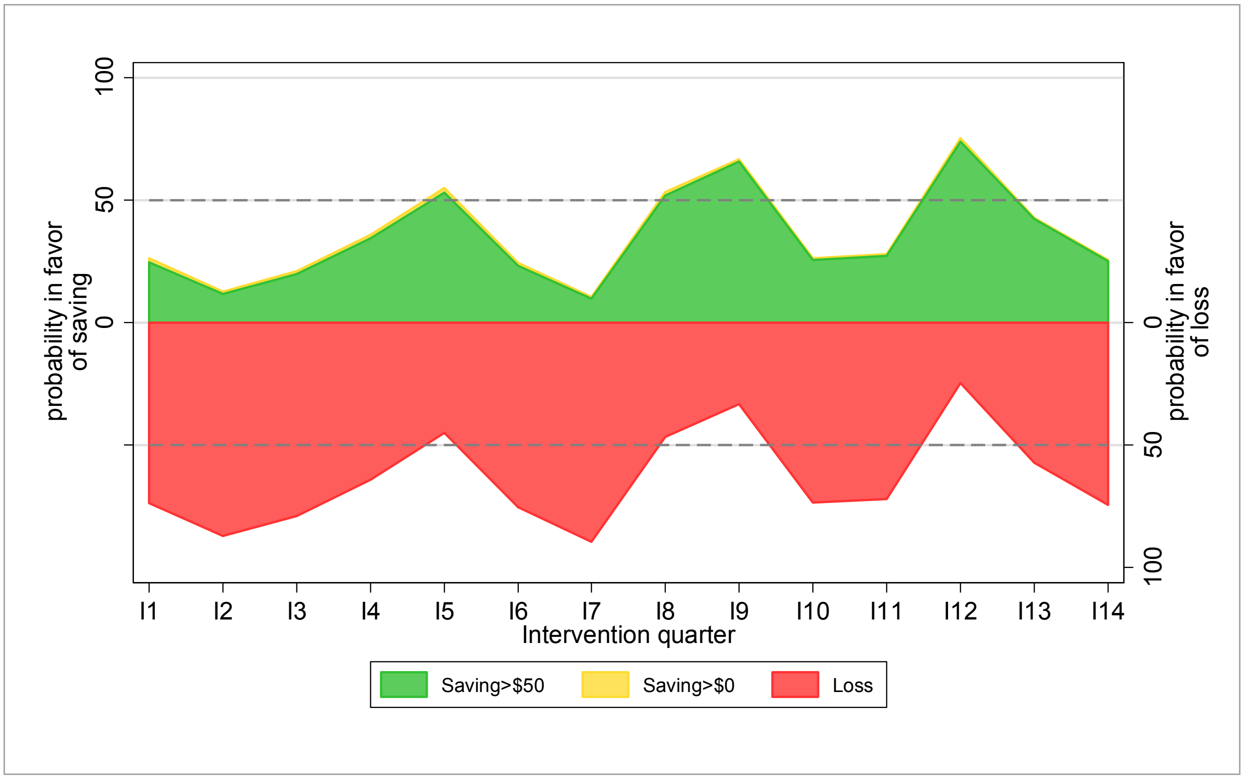
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; SEMHS = Southeast Mental Health Services.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The evidence supports the conclusion that the innovation generated losses in some quarters and savings in others. The sample size is not large enough to detect any differences (if they exist) in spending between the innovation and comparison groups.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SEMHS = Southeast Mental Health Services.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 5***. During the baseline period, the all-cause admissions rate is very similar for the innovation and comparison groups. Between I6 and I11, the innovation group's inpatient admissions are higher than those of the comparison group.

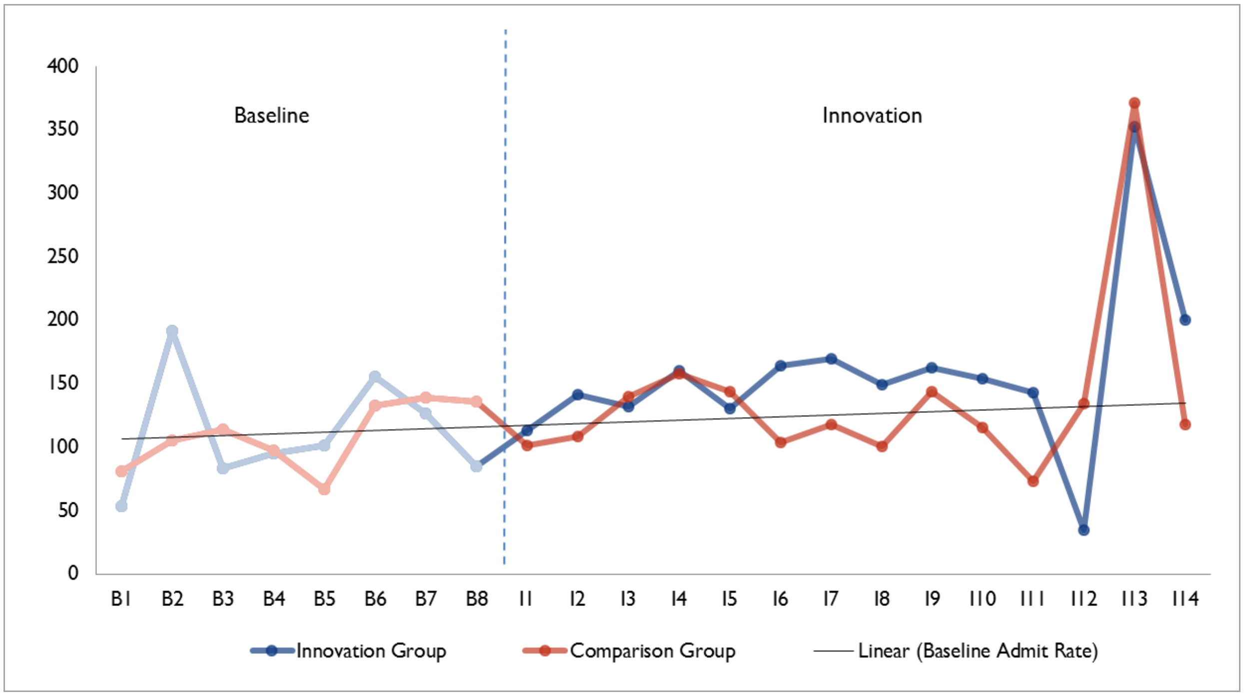
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters													
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
Innovation Group																						
Admit rate	54	191	83	95	101	155	126	85	113	142	132	160	130	164	170	149	163	154	143	34	353	200
Std dev	226	511	312	327	389	478	476	340	419	399	414	463	479	793	423	411	568	579	542	182	588	400
Unique patients	93	94	96	95	99	103	103	106	106	106	106	75	69	61	53	47	43	39	35	29	17	10
Comparison Group																						
Admit rate	81	106	114	97	67	133	139	136	102	108	139	158	144	104	118	101	144	116	73	134	371	118
Std dev	385	385	514	421	287	557	490	442	390	385	555	466	539	411	398	430	632	457	403	532	1413	367
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	75	70	63	53	44	42	36	32	26	15	8
Innovation − Comparison Rate																						
	−27	86	−30	−2	34	22	−13	−51	12	33	−7	2	−13	60	52	48	19	38	70	−100	−18	82

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter.
B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SEMHS = Southeast Mental Health Services.

2.5.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 19 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: -13, 51). In addition to the average effect over the innovation period, we present quarterly effects.

Table 12 represents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. None of the quarterly, yearly, or aggregate effects are statistically significant. Although the sample size is small, which makes changes to inpatient admissions difficult to statistically detect, there is no evidence that the innovation had any impact on inpatient admissions.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions, per 1,000 Medicare Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	16	47	0.730
I2	48	53	0.365
I3	-21	56	0.715
I4	-2	67	0.978
I5	-8	71	0.912
I6	58	63	0.363
I7	53	83	0.525
I8	45	76	0.562
I9	11	85	0.895
I10	34	98	0.728
I11	63	87	0.473
I12	-47	53	0.385
I13	-67	246	0.790
I14	120	167	0.490
Overall average	19	20	0.337
Overall aggregate	15	16	0.337
Overall aggregate (IY1)	4	11	0.678
Overall aggregate (IY2)	8	8	0.349
Overall aggregate (IY3)	3	6	0.672
Overall aggregate (IY4)	0	5	0.988

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; SEMHS = Southeast Mental Health Services.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 6***. Due to the small sample size, the number of inpatient admissions is small and the number of readmissions is even smaller. Thus, the readmissions measure for SEMHS is highly variable in both the innovation and comparison groups.

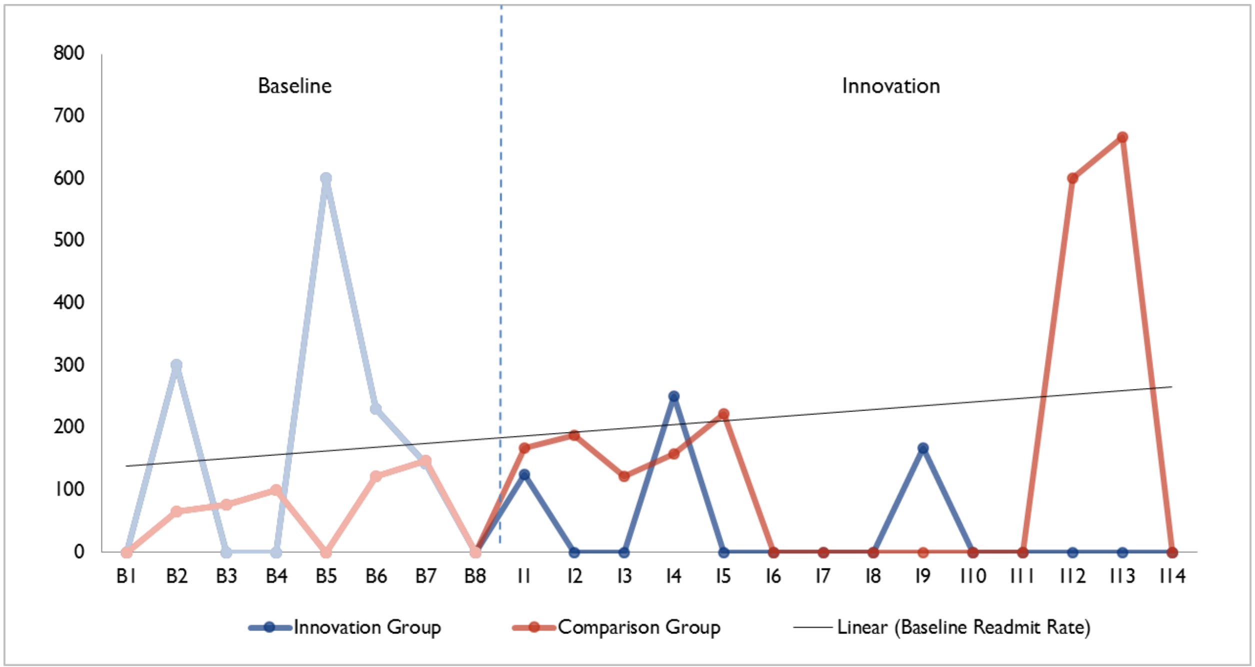
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters													
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
Innovation Group																						
Readmit rate	0	300	0	0	600	231	143	0	125	0	0	250	0	0	0	0	167	0	0	0	0	0
Std dev	0	458	0	0	490	421	350	0	331	0	0	433	0	0	0	0	373	0	0	0	0	0
Total admissions	3	10	2	6	5	13	7	5	8	7	8	4	2	2	3	5	6	1	2	0	2	0
Comparison Group																						
Readmit rate	0	65	77	100	0	121	147	0	167	188	121	158	222	0	0	0	0	0	0	600	667	0
Std dev	0	246	267	300	0	326	354	0	373	390	326	365	416	0	0	0	0	0	0	490	471	0
Total admissions	3	5	4	7	3	6	6	5	4	5	6	6	3	2	1	1	1	1	1	2	1	0
Innovation − Comparison Rate																						
	0	235	−77	−100	600	110	−4	0	−42	−188	−121	92	−222	0	0	0	167	0	0	−600	−667	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
SEMHS = Southeast Mental Health Services.

2.6.2 *Regression Results*

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −345 per 1,000 inpatient admissions (−3.45 percentage points), indicating that the innovation-comparison difference is 3.45 percentage points smaller during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −579, -110).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission, per 1,000 Medicare Inpatient Admissions: SEMHS

Quarter	Coefficient	Standard Error	P-Values
Overall average	-17	7	0.019
Overall aggregate	-345	142	0.019

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
SEMHS = Southeast Mental Health Services.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 7.*** During the baseline period, the ED visit rate trends upward for the innovation and comparison groups, and the innovation group's rate is higher than that of the comparison group. During the innovation period, the gap in the ED visit rate widens between the innovation and comparison groups.

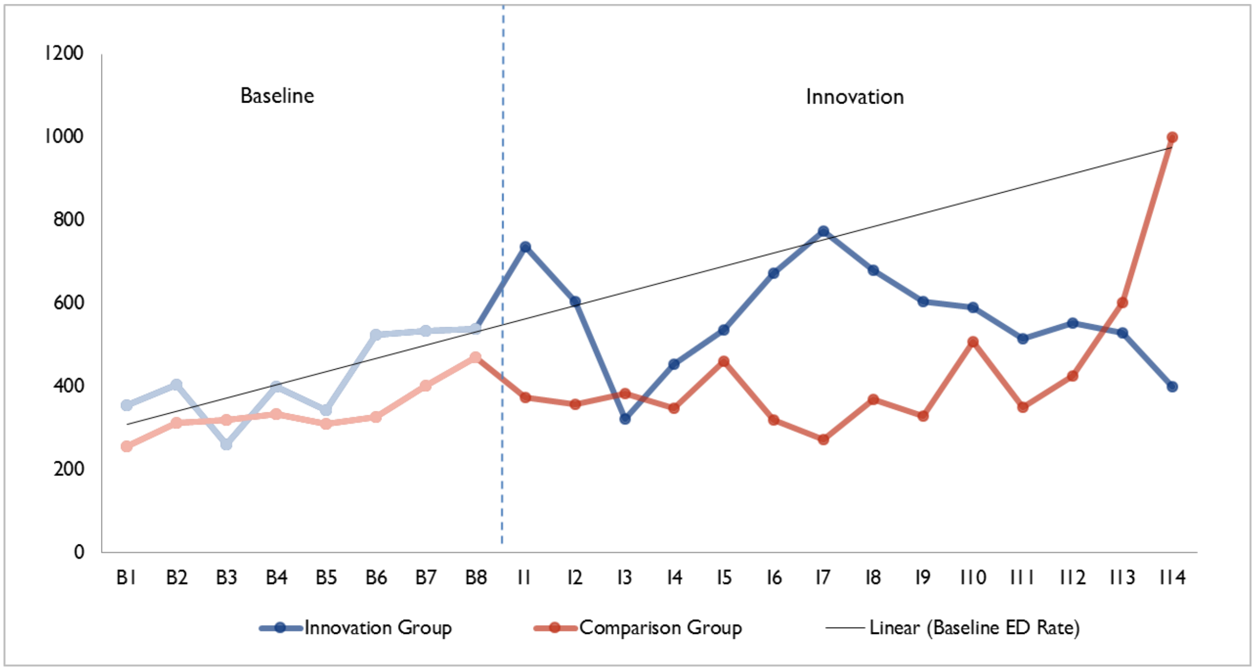
Table 15. ED Visits per 1,000 Medicare Participants: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters													
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
Innovation Group																						
ED rate	355	404	260	400	343	524	534	538	736	604	321	453	536	672	774	681	605	590	514	552	529	400
Std dev	829	1019	585	1046	758	1074	1127	1025	1260	1135	931	949	850	1221	1235	1105	1178	1517	1246	1121	717	843
Unique patients	93	94	96	95	99	103	103	106	106	106	106	75	69	61	53	47	43	39	35	29	17	10
Comparison Group																						
ED rate	255	311	320	334	309	327	401	470	373	357	383	347	460	320	272	370	329	507	349	426	602	1000
Std dev	378	446	478	437	430	557	676	798	760	661	648	472	665	506	503	689	619	784	597	573	866	1041
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	75	70	63	53	44	42	36	32	26	15	8
Innovation − Comparison Rate																						
	100	93	−59	66	34	197	133	68	363	247	−63	107	77	352	502	311	275	83	165	126	−73	−600

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; ED = emergency department; SEMHS = Southeast Mental Health Services.

Figure 7. ED Visits per 1,000 Medicare Participants: SEMHS



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; SEMHS = Southeast Mental Health Services.

2.7.2 *Regression Results*

The average quarterly difference-in-differences estimate for ED visits is an increase of 136 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 56, 215). In addition to the average effect over the innovation period, we present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. During most innovation quarters, the innovation-comparison difference in the ED visit rate is larger during the innovation period. Differences between the innovation and comparison groups are statistically significant in I1, I3, I6, and I7. The impact of the innovation is significant overall, and the largest difference in the ED visit rate is during Year 2 of the innovation.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits, per 1,000 Medicare Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	270	148	0.071
I2	192	137	0.164
I3	-192	109	0.082
I4	11	140	0.939
I5	-22	177	0.902
I6	315	178	0.082
I7	539	201	0.010
I8	330	220	0.140
I9	272	198	0.176
I10	-11	238	0.965
I11	121	207	0.563
I12	117	235	0.623
I13	4	331	0.989
I14	-235	383	0.555
Overall average	136	49	0.005
Overall aggregate	108	39	0.005
Overall aggregate (IY1)	29	27	0.268
Overall aggregate (IY2)	62	22	0.006
Overall aggregate (IY3)	19	16	0.241
Overall aggregate (IY4)	-2	7	0.741

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; SEMHS = Southeast Mental Health Services.

2.8 Discussion: Medicare Results

Overall, the SEMHS innovation did not impact spending or inpatient stays. Innovation participants had fewer unplanned readmissions but more ED visits than the comparison group during the innovation period.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 17 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending and utilization.

2.9 Medicaid Comparison Group

The Medicaid analysis uses claims data provided by ValueOptions and contains all Medicaid patients in Prowers County from July 2013 to December 2014. ValueOptions manages the behavioral health care services for Medicaid-eligible participants in Colorado, and provided data to RTI for SEMHS participants served in Prowers County. The sample includes Medicaid beneficiaries who were enrolled in the innovation and appeared in the 18 months of claims data provided by ValueOptions. Although RTI made a substantial effort to provide analyses using the claims data provided, the analysis has limitations, which are described below.

First, because RTI received a fixed 18 months of data (2013 Q3 to 2014 Q4), we observe each beneficiary over six calendar quarters. In contrast to the Medicare analysis, we do not observe a single beneficiary in all baseline and innovation quarters in the Medicaid claims data. Instead, beneficiary claims may be available before, after, or at the time of innovation enrollment because beneficiaries enroll between 2012 Q3 and 2014 Q4. For example, a beneficiary who enrolled in the innovation in 2014 Q1 would have claims data for the final three baseline quarters (B6 to B8) and the first three innovation quarters (I1 to I3). RTI pooled all beneficiaries to analyze 5 baseline and 10 innovation quarters; however, a beneficiary will only be present in a maximum of six consecutive quarters. The number of unique patients in each quarter is provided in Table 18.

Second, RTI did not receive Medicaid eligibility data. Thus, if a patient did not generate a claim in a quarter, we assume that the patient had zero spending and utilization during the quarter. Although this assumption is reasonable given the short time period of the data, other reasons for lack of a claim include death, switch of Medicaid plans, or loss of Medicaid eligibility. These variables are not observed in the claims data provided. As a result, the spending and utilization figures may be understated if zeros are inserted for some individuals whose spending and utilization are not observed for the aforementioned reasons.

Additionally, some Medicaid patients who enrolled in the innovation did not appear at all in the claims data; therefore, RTI was unable to include these beneficiaries in the analysis. Of the 639 innovation enrollees, 134 appeared in the claims data provided by ValueOptions. A Medicaid beneficiary who was enrolled in the innovation might not appear in the claims data for several reasons: (1) the Medicaid ID provided by SEMHS was incorrect, (2) the beneficiary did not generate any claims in the six-quarter period, or (3) the beneficiary lived outside of Prowers County.

We used PSM to select a comparison group of beneficiaries that appeared in the Medicaid data from ValueOptions but were not enrolled in the innovation. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age and gender. We were limited to using only age and gender in the propensity score model because these were the only patient characteristics included in the claims data provided by ValueOptions. We matched innovation and comparison beneficiaries using one-to one-variable matching within a caliper, allowing each innovation beneficiary to have up to three comparison beneficiaries.

Table 17 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 8*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Six innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 17. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: SEMHS

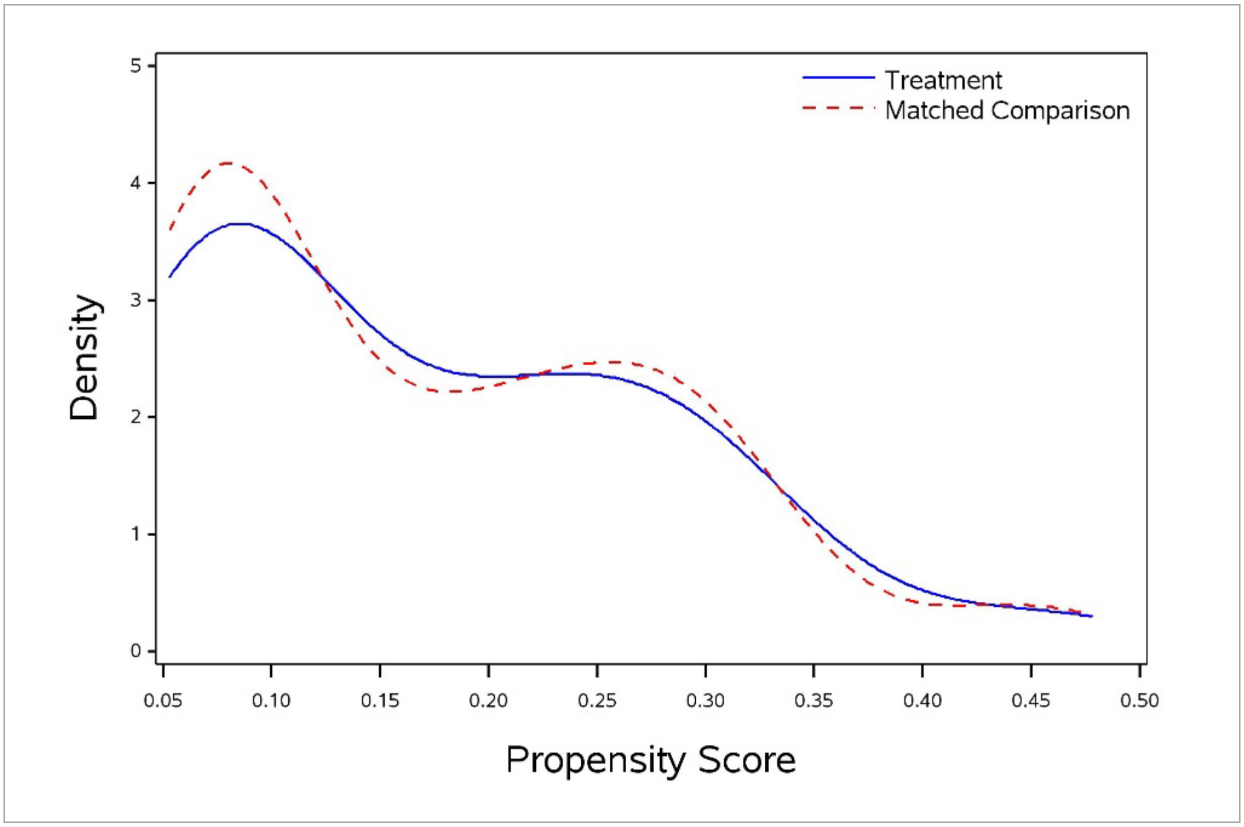
Variable	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized Difference	Treatment Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Age	21.13	21.06	9.87	16.14	0.600	19.77	20.43	16.13	18.69	0.252
Percentage male	34.33	47.48	45.30	49.78	0.226	32.03	46.66	33.01	47.03	0.028
Number of unique beneficiaries	134	—	958	—	—	128	—	310	—	—
Weighted number of beneficiaries	—	—	—	—	—	128	—	128	—	—

Source: RTI analysis of Medicaid claims provided by ValueOptions.
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).
SD = standard deviation; SEMHS = Southeast Mental Health Services.
— Data not yet available.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 17). The results in Table 17 show that matching reduced the absolute standardized differences for age and gender and achieved adequate balance for gender.

Figure 8 shows the distribution of the propensity scores for both the innovation and comparison groups. The distribution lines for the innovation and comparison groups trend close together, indicating a high degree of overlap in the propensity scores of both groups.

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: SEMHS



Source: RTI analysis of Medicaid claims provided by ValueOptions.
SEMHS = Southeast Mental Health Services.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 18 reports Medicaid spending per patient in the five quarters before and the 10 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 9*** illustrates the

Medicaid spending per beneficiary in Table 18 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

During the baseline period, the spending trends for the innovation and comparison groups are similar. During the innovation period, spending for the innovation and comparison groups remain similar and are just above the baseline trend. In I8 though I10, spending for the comparison group increases at a higher rate than the innovation group. As shown in Table 18, the standard deviation for spending among comparison group beneficiaries also increases during those quarters, implying that spending among comparison group beneficiaries is highly variable. The increase in spending in the comparison group is driven by a small number of beneficiaries with extremely high spending. As previously mentioned, caution should be used when interpreting the comparison group as the counterfactual for the innovation group, because only two matching variables were available in the claims file provided by ValueOptions.

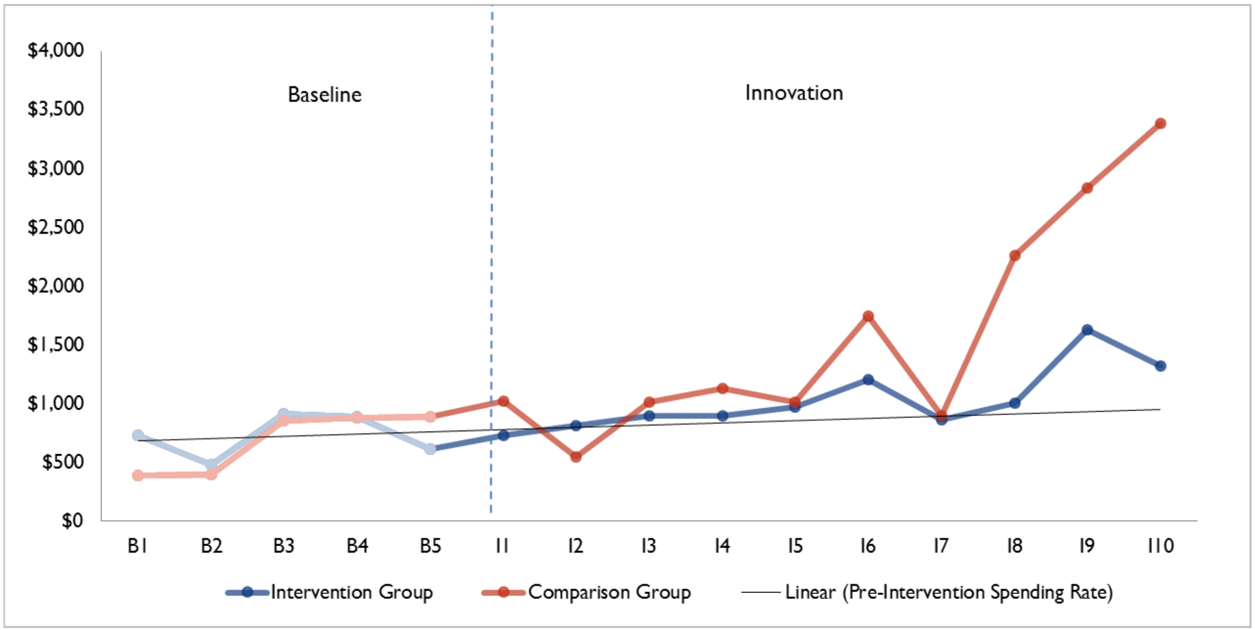
Table 18. Medicaid Spending per Participant: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters					Innovation Quarters									
	B1	B2	B3	B4	B5	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
Innovation Group															
Spending rate	$728	$481	$915	$890	$618	$728	$815	$899	$896	$970	$1,202	$860	$1,004	$1,631	$1,325
Std dev	$1,324	$924	$1,759	$1,392	$767	$1,112	$987	$1,621	$1,422	$1,512	$1,491	$972	$1,210	$1,680	$1,723
Unique patients	22	31	46	57	50	43	49	50	41	43	24	17	19	14	12
Comparison Group															
Spending rate	$392	$399	$855	$882	$889	$1,019	$552	$1,013	$1,130	$1,016	$1,747	$901	$2,260	$2,834	$3,389
Std dev	$701	$870	$2,783	$2,722	$2,800	$3,567	$1,202	$3,386	$3,920	$3,800	$4,925	$1,365	$5,212	$6,349	$6,985
Unique patients	22	31	46	57	48	42	48	50	42	44	24	18	20	14	12
Savings per Patient															
	−$336	−$82	−$60	−$8	$271	$291	−$263	$114	$234	$45	$545	$41	$1,257	$1,204	$2,064

Source: RTI analysis of Medicaid claims provided by ValueOptions.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 9. Medicaid Spending per Participant: SEMHS



Source: RTI analysis of Medicaid claims provided by ValueOptions.
SEMHS = Southeast Mental Health Services.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$281 (90% CI: −$970, $409). This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 19*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly difference-in-differences estimates. Quarterly differences in spending between the innovation and comparison groups alternate between positive and negative, and are never statistically significant. Thus, we cannot conclude that the SEMHS generated either a savings or a loss.

Table 19. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	−$414	$310	0.182
I2	$265	$338	0.434
I3	$99	$534	0.853
I4	−$195	$670	0.771
I5	$117	$618	0.850
I6	−$764	1,025	0.457
I7	$65	$360	0.857
I8	−1,263	$821	0.125
I9	−1,340	1,185	0.259
I10	−1,825	1,303	0.162
Overall average	−$281	$418	0.503
Overall aggregate	−$92,853	$138,461	0.503
Overall aggregate (IY1)	−$7,935	$65,415	0.904
Overall aggregate (IY2)	−$39,756	$63,283	0.530
Overall aggregate (IY3)	−$45,162	$35,188	0.200

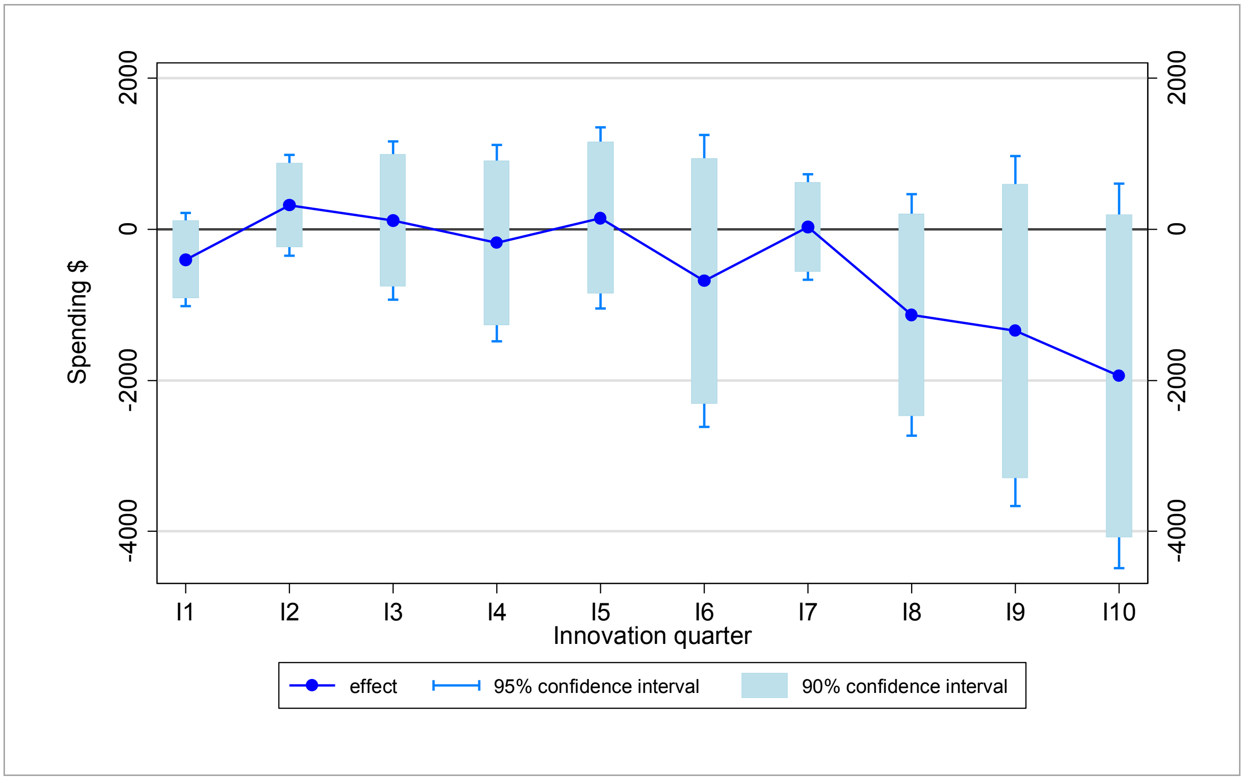
Source: RTI analysis of Medicaid claims provided by ValueOptions.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; SEMHS = Southeast Mental Health Services,

Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: SEMHS



Source: RTI analysis of Medicaid claims provided by ValueOptions.
OLS = ordinary least squares; SEMHS = Southeast Mental Health Services.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Quarterly differences in spending between the innovation and comparison groups have high standard errors and are not statistically different from zero. Obtaining precise estimates of differences in spending between the innovation and comparison groups is difficult with such a small sample size; therefore, we cannot draw conclusions about the innovation's impact on spending.

Figure 11. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: SEMHS

Source: RTI analysis of Medicaid claims provided by ValueOptions.
SEMHS= Southeast Mental Health Services.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 20*** and ***Figure 12***. Due to the small sample size (128 Medicaid beneficiaries) and the infrequency of inpatient stays, the inpatient admissions rates for the innovation and comparison groups are highly variable. The trends are similar for both groups.

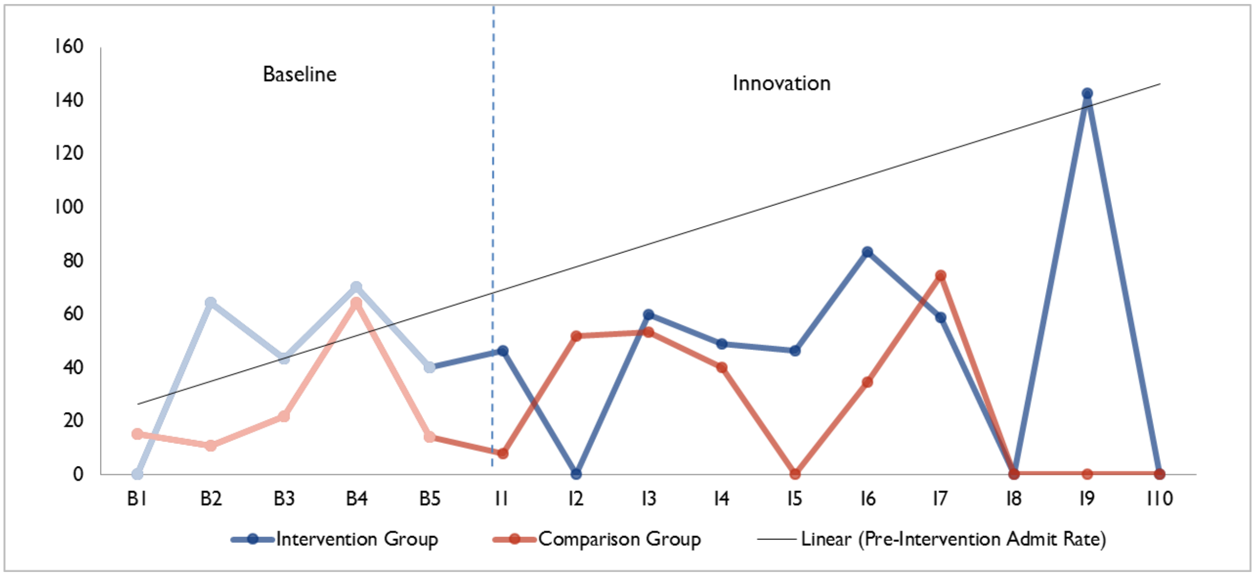
Table 20. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters B1	B2	B3	B4	B5	Innovation Quarters I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
Innovation Group															
Admit rate	0	65	43	70	40	47	0	60	49	47	83	59	0	143	0
Std dev	0	250	206	320	198	213	0	240	218	213	282	243	0	363	0
Unique patients	22	31	46	57	50	43	49	50	41	43	24	17	19	14	12
Comparison Group															
Admit rate	15	11	22	64	14	8	52	53	40	0	35	75	0	0	0
Std dev	124	104	147	346	118	89	222	226	197	0	185	266	0	0	0
Unique patients	22	31	46	57	48	42	48	50	42	44	24	18	20	14	12
Innovation − Comparison Rate															
	−15	54	22	6	26	39	−52	7	9	47	49	−16	0	143	0

Source: RTI analysis of Medicaid claims provided by ValueOptions.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: SEMHS



Source: RTI analysis of Medicaid claims provided by ValueOptions.
SEMHS = Southeast Mental Health Services.

2.11.2 Regression Results

Table 21 presents the results of a negative binomial model with the dependent variable set to one for patients equal to the number of hospital visits for each individual who had a hospital visit during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The data did not include enough hospital admissions to estimate separate effects for each innovation quarter; therefore, we present the average effect for all innovation quarters pooled. The average quarterly difference-in-differences estimate for inpatient admissions is 7 per 1,000 participants (0.7 percentage points), indicating that the innovation-comparison difference is 0.7 percentage points higher during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −64, 78).

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions, per 1,000 Medicaid Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
Overall average	7	36	0.852
Overall aggregate	2	12	0.852

Source: RTI analysis of Medicaid claims provided by ValueOptions.
Notes: The negative binomial coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age and gender. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
SEMHS = Southeast Mental Health Services.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 22*** and ***Figure 13***. The innovation group had no hospital readmissions during the observation period because of the small sample size. Hospital admissions (the denominator in the readmissions measure) are infrequent and, at most, four admissions are observed per quarter. With four or fewer hospital admissions per quarter in the innovation group, it is unlikely that a hospital readmission would be observed.

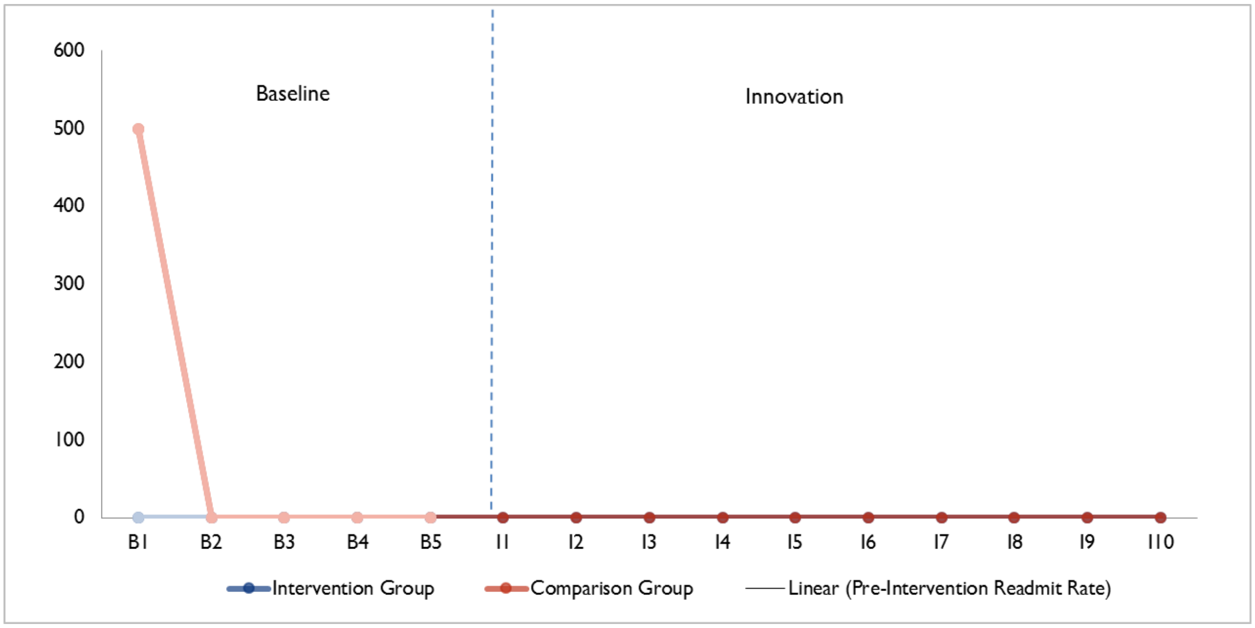
Table 22. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters					Innovation Quarters									
	B1	B2	B3	B4	B5	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
Innovation Group															
Readmit rate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total admissions	0	2	2	4	2	3	0	3	2	2	2	1	0	2	0
Comparison Group															
Readmit rate	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Std dev	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total admissions	4	0	2	1	2	0	2	1	2	0	1	0	0	0	0
Innovation − Comparison Rate															
	−500	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: RTI analysis of Medicaid claims provided by ValueOptions.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 13. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: SEMHS



Source: RTI analysis of Medicaid claims provided by ValueOptions.
SEMHS = Southeast Mental Health Services.

2.12.2 Regression Results

There are not enough unplanned readmissions to estimate a regression, therefore, we do not present regression results for this measure.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 23*** and ***Figure 14.*** The time series for ED visits trends slightly upward during the baseline period for the innovation group. During the innovation period, the innovation group's ED visit rate falls below the baseline trend. During the baseline and innovation periods, the trend lines in ED visits run parallel for both the innovation and comparison groups; however, the standard deviation of the ED visit rate is high for both groups. In I9, the ED visit rate spikes for the innovation group, but the sample size is small.

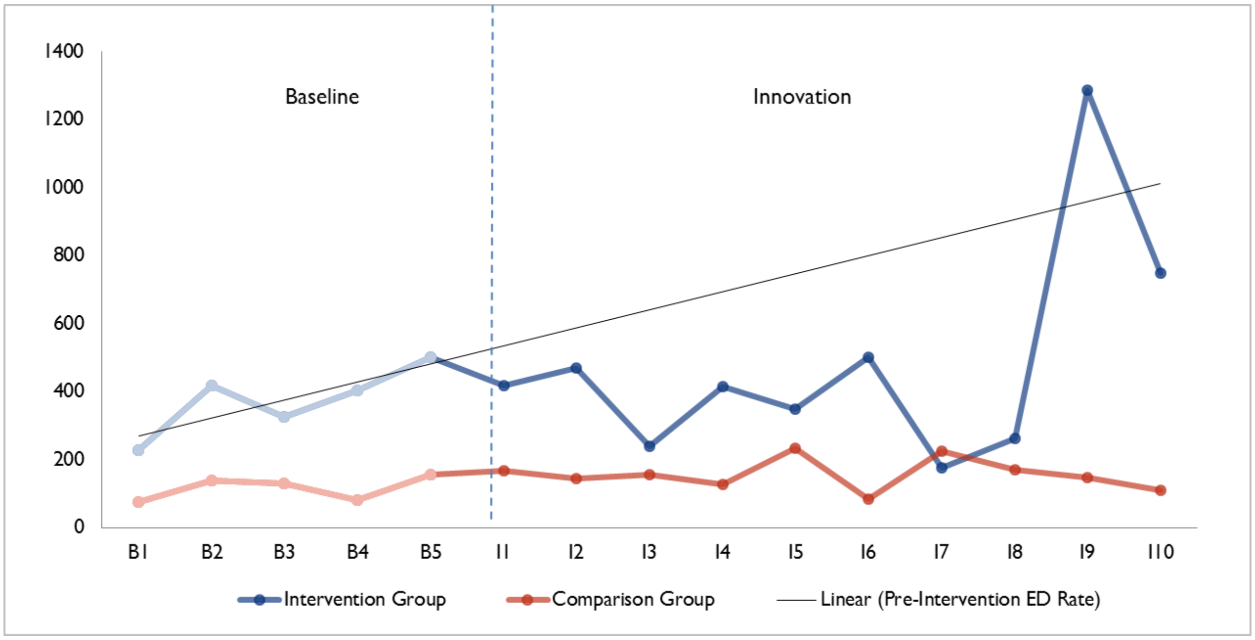
Table 23. ED Visits per 1,000 Medicaid Participants: SEMHS

Awardee Number: 1C1CMS330988
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters					Innovation Quarters									
	B1	B2	B3	B4	B5	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
Innovation Group															
ED rate	227	419	326	404	500	419	469	240	415	349	500	176	263	1,286	750
Std dev	528	923	668	753	931	879	892	591	706	686	722	393	562	1,541	1,055
Unique patients	22	31	46	57	50	43	49	50	41	43	24	17	19	14	12
Comparison Group															
ED rate	76	140	130	82	157	167	145	157	128	233	83	224	171	146	111
Std dev	268	433	379	333	384	434	408	432	402	500	385	422	463	423	399
Unique patients	22	31	46	57	48	42	48	50	42	44	24	18	20	14	12
Innovation − Comparison Rate															
	152	280	196	322	343	252	325	83	287	116	417	−48	92	1,139	639

Source: RTI analysis of Medicaid claims provided by ValueOptions.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 14. ED Visits per 1,000 Medicaid Participants: SEMHS



Source: RTI analysis of Medicaid claims provided by ValueOptions.
ED = emergency department; SEMHS = Southeast Mental Health Services.

2.13.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 48 per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: .−102, 197). In addition to the average effect over the innovation period, we present quarterly effects.

Table 24 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. During I1 through I8, the ED visit rate is not statistically different between the innovation and comparison groups. In I9 and I10 (Year 3), the innovation group's ED visits spike, and the measure then becomes statistically different from the comparison group's ED visit rate. The spike in ED visits should not be considered an effect of the innovation; rather, it is likely caused by the small number of innovation beneficiaries during those two quarters.

Table 24. Difference-In-Difference Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicaid Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	−83	254	0.743
I2	205	254	0.418
I3	−154	207	0.446
I4	120	227	0.597
I5	−278	297	0.349
I6	348	251	0.166
I7	−480	318	0.131
I8	−242	293	0.409
I9	1,348	501	0.007
I10	720	420	0.086
Overall average	48	91	0.600
Overall aggregate	15	28	0.600
Overall aggregate (IY1)	4	22	0.864
Overall aggregate (IY2)	−16	16	0.310
Overall aggregate (IY3)	28	9	0.002

Source: RTI analysis of Medicaid claims provided by ValueOptions.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = I Year; SEMHS = Southeast Mental Health Services.

2.14 Discussion: Medicaid Results

Overall, the SEMHS innovation does not appear to have an impact on spending, inpatient stays, readmissions, or ED visits of fee-for-service Medicaid patients participating in the innovation. This analysis has several limitations, which are discussed in Section 2.9.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 20 percent of the overall population reached by the innovation. In addition, the small sample size can hinder detection of changes in spending and utilization.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

SEMHS submitted data to RTI that are current through June 2015. ***Table 25*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. The results of analyses of this measure are not included in this annual report. Neither ValueOptions nor SEMHS keeps a record of participants and their associated Integrated Community Health Partners (ICHP) risk level over time.

Table 25. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	General health and wellness	Number of high-risk participants who step down to lower risk level during HN innovation	Data unavailable	No

HN = health navigator.

2.16 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 26*** lists the quantifiable measures of implementation, and their status as of June 30, 2015, that RTI obtained from SEMHS's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

Findings presented here are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 26. Measures of Implementation: SEMHS

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*

(continued)

Table 26. Measures of Implementation: SEMHS (continued)

Evaluation Domains	Subdomains	Measures	Source
Implementation effectiveness	Reach	Number of participants who receive services from HNs	Data received from SEMHS
	Dose	Number and types of services provided to participants	Data received from SEMHS
		Duration of of services provided to participants	Data received from SEMHS
		Number and types of HN contacts to participants	Data received from SEMHS

FTE = full-time equivalent; HN = health navigator; Q = quarter; SEMHS = Southeast Mental Health Services.

2.17 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.17.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was staffed with 8.25 full-time equivalent (FTE) staff members; three HNs left the organization in anticipation of the project's end. During the innovation, SEMHS successfully hired and retained several HNs. In Year 1, two HNs resigned soon after HN services were initiated because, these individuals were not a good fit for the position. Since that time, turnover remained relatively low. Innovation staff increasingly learned that not everyone can be an effective HN, and that key qualities, such as compassion, care, and strong communication and motivational interviewing skills, are essential to the role. In hindsight, staff members felt that they could have been more diligent during the interview process in identifying more qualified HN candidates and in finding replacements for unsuitable HN hires.

2.17.2 Skills, Knowledge, and Training

Between Q11 and Q12, SEMHS provided 1,520 hours of training to 73 individuals, predominantly community college students and HCIA-employed clinical personnel. These courses continued to support the innovation's objectives to prepare HNs and staff for their roles in the innovation and prepare a workforce of HNs. OJC provided the initial course for HNs (Introduction to Community Health Work) in fall 2012 and spring 2013, and expanded it with additional courses for a CHW certificate program requiring

31.5 hours of courses and fieldwork. HNs hired by SEMHS participated in the Introduction to Community Health Work course on their work time. They did not receive any formal continuing education following the course, which might have helped them with critical areas such as working with patients who had severe behavioral issues. In addition to HN certification courses, training topics included first aid, motivational interviewing, mental health first aid, and healthy living for diabetes.

HNs received the Healthier Living training, Colorado's version of the Stanford Model's Chronic Disease Self-Management Program (CDSMP), late in Year 1, when HNs already had significant patient loads. The Healthier Living course would have been more useful if given as part of, or soon after, completing the HN training, allowing HNs to be better prepared to treat and advise clients with complex chronic diseases.

As part of SEMHS's innovation goal to prepare a workforce of HNs, training for HNs increased dramatically during the innovation as the curriculum became more established and partnership with groups such as the Fort Lyon Facility expanded. In the last year of the award alone, OJC trained 44 of the total 100 HNs trained as part of the program. Since the last reporting period, the community college system approved the second HN curriculum, which is now listed on the common course curriculum. Plans are in place to offer an online version of the course beginning in fall 2018. Unfortunately, OJC's efforts to obtain matriculation agreements from 4-year colleges were not successful. SEMHS staff believe that the role of the CHW and efforts to standardize the approach will continue to evolve in Colorado.

Staffing resources are scarce in this region; therefore, many of the selected innovation staff had no prior experience or training in HN services. Almost all HNs were new bachelor's-level graduates with limited experience working with patients, particularly those with complex needs as served by SEMHS. Over time and with additional support from the HN supervisor and program manager, HNs became more familiar with the role and responsibilities and learned from their collective experience. HNs reported that, in particular, they improved their ability to identify individuals in need of behavioral health services because of the partnership between the hospital and the HN team.

Table 27. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12 (January–June, 2015)	1519.50	73
Since inception	9,520	426

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.18 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. In this annual report, RTI examines three contextual factors—award execution, leadership, and organizational capacity—to address the following evaluation questions.

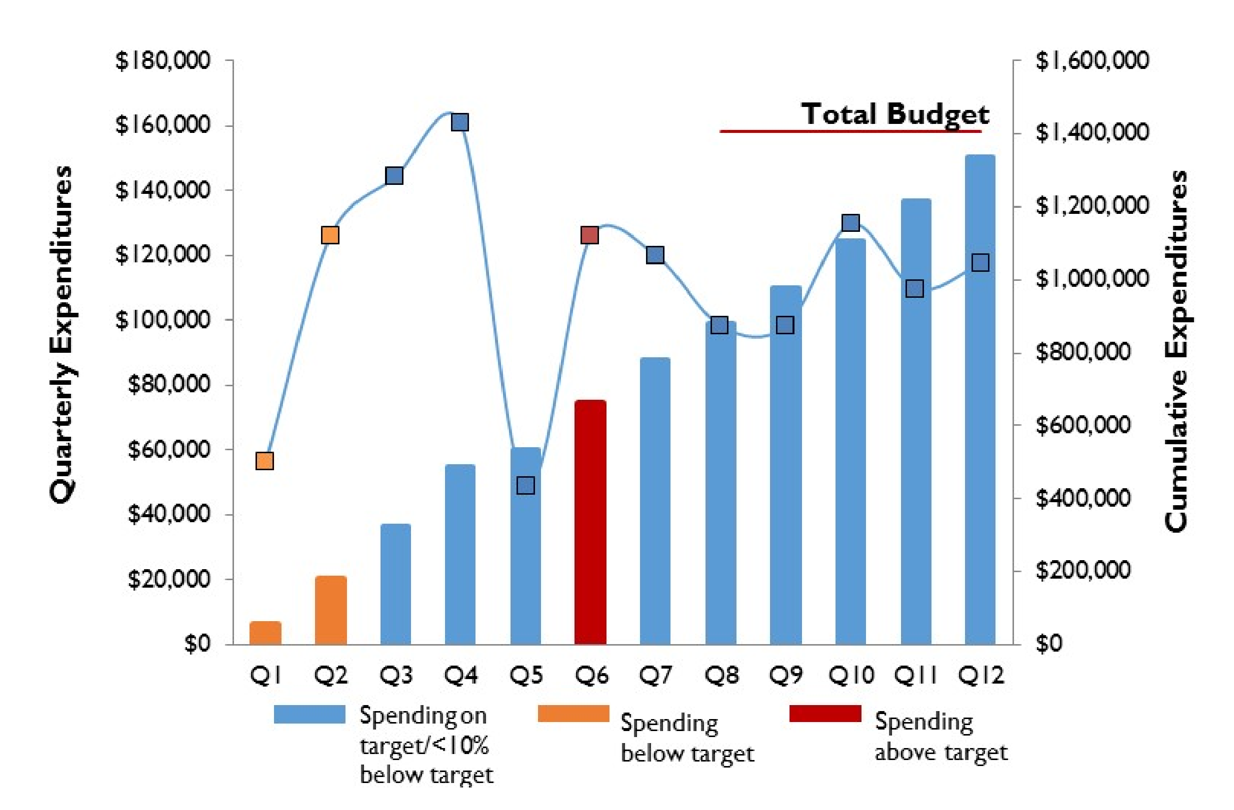
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.18.1 Award Execution

The annual report highlights the significance of SEMHS's expenditure rates on implementation. As of June 2015 (Q12), SEMHS spent 95 percent of its total budget, which is at the projected target (***Figure 15***).

Figure 15. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.18.2 Leadership

No changes in leadership occurred at SEMHS since the information provided in the 2015 annual report. The HN supervisor oversaw day-to-day operations of the HNs, met with them regularly, and served as their main point of contact. A program manager who oversaw the innovation worked closely with the HN supervisor as the liaison to partner organizations and the larger community to facilitate external communication and coordination.

Support from senior leadership within SEMHS remained strong throughout the project. The chief executive officer (CEO) was an avid champion of the program and promoted the program in the larger community in meetings with other CEOs and in media events to showcase the innovation. Leadership reported in hindsight that more in-depth conversations with partners at the beginning would have helped improve stakeholders' understanding of the HNs' work and how integrated health care could benefit their communities. Although SEMHS leaders had a vision of integrated care, they were unsure that their partners shared the same vision and wished they had spent more time getting partners onboard to avoid some of the challenges (e.g., lack of understanding of innovation goals, confusion over organization's role, no standard plan of operation) they encountered during the first year.

2.18.3 Organizational Capacity

This award is the first federally funded support SEMHS has received, which posed specific challenges with administration and data reporting. SEMHS's capacity to implement the innovation continued to improve during the project, even with challenges to data management and analysis efforts. They underestimated the staff time needed to adequately perform these tasks.

Prior to the award, SEMHS had limited experience with primary care integration for patients with substance abuse and/or mental health issues. The service did, however, have strong partners in the PMC and local community health center, HPCHC, which they hoped would be integral to engaging patients in HN services. Initially, SEMHS colocated an HN full time within the HPCHC to assist in the transition, as patients were referred and accepted from HPCHC for behavioral health services. However, challenges in collaboration and communication developed between HPCHC providers and the HN, and SEMHS decided in June[2] 2013 to remove the HN position from HPCHC. Because the organizational arrangements with the HPCHC changed, SEMHS had limited ability to reach its original goals. However, with the addition of an HN located in PMC in 2014, SEMHS accelerated efforts to integrate primary care within SEMHS and with external partners.

2.18.4 Innovation Adoption and Workflow Integration

Five of the six HNs have work space at SEMHS's office in Lamar, Colorado, with one HN located at PMC. SEMHS initially intended to establish a formal partnership with the HPCHC, located close to SEMHS's office in Lamar, that would house one of the HNs in the health center. The intent was to make the innovation part of the workflow process at HPCHC, and give the HN team direct access to primary care for patients enrolled in the innovation. However, the partnership faltered because the HN and the HPCHC providers were unable to form an effective working relationship. Instead, the SEMHS HNs worked directly with the patient navigator employed at the HPCHC on a case-by-case basis. Although this change reportedly worked for the most part, the objective of integrating HN services into the HPCHC was never achieved.

[2] Respondents during the site visit shared that this relationship was changed in June 2013.

Initially, all HNs focused on increasing access for all patients who qualified for behavioral care, primary care, and early intervention services through specific activities such as care coordination, transportation, and scheduling. They also provided individual and team-based education and coaching to improve self-management of disease. Two HNs changed their roles to focus on specific areas that better met their skill set and the needs of the program. One HN worked primarily with the SEMHS's Choices Recovery Program, in a case manager type of role, with severely and persistently mentally ill patients who had experienced multiple hospitalizations. The HN had contact with patients almost daily and helped manage medication, housing, links to community resources, and connections with other HNs for transportation services. The other HN, housed at PMC near SEMHS's office, coordinated care of identified patients there. With this HN located at PMC, SEMHS had more success in case management but not necessarily in primary care integration. The HN played a critical role in the ongoing care of patients who came to the ED.

2.19 Implementation Effectiveness

A major focus of the evaluation is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.19.1 Innovation Reach

RTI was unable to define a target population for SEMHS to serve as the denominator for a percent reached measure because SEMHS did not provide RTI with any usable data to calculate reach over time and/or with a target number of participants. The eligible population for HN services included frequent users of ED services who were on the ICHP[3] list from ValueOptions. Each month, HNs received a list of eligible participants (i.e., those who were on the ICHP list, had no designated PCP, or had SEMHS as designated PCPs) to call and offer services such as transportation or assistance making a medical appointment. Unfortunately, SEMHS did not maintain historic lists of frequent users of ICHP services from ValueOptions, so we had no data to establish an innovation baseline.

SEMHS also targeted all residents of Prowers County, including Medicaid recipients not on ICHP, Medicare beneficiaries, and the uninsured—and the number changed frequently. Therefore, we are only

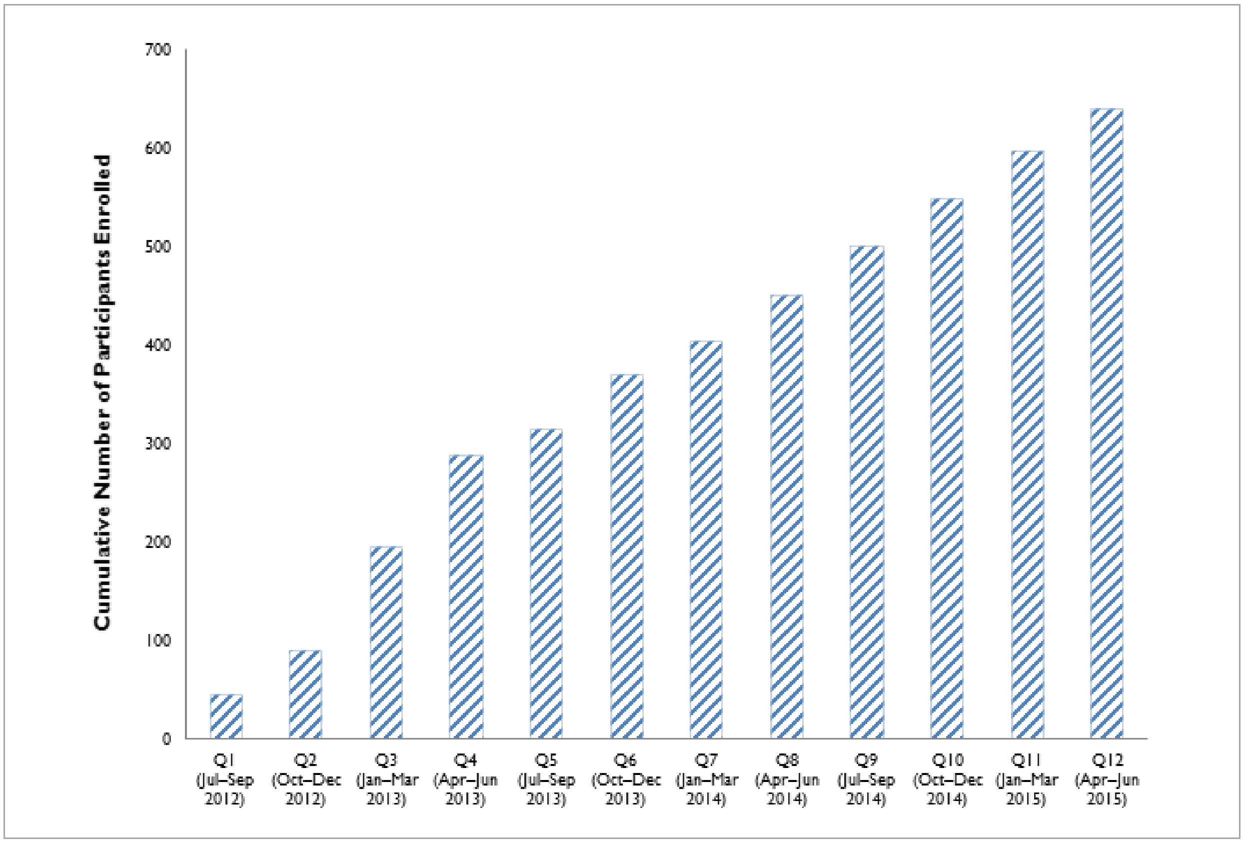
[3] ICHP is the regional care collaborative organization that manages the health care needs of all Medicaid Accountable Care Collaborative members who live in Region 4. ValueOptions manages the behavioral health care services for Medicaid-eligible people in Colorado.

able to present the number of participants enrolled in the innovation in a specific quarter, which limits us from evaluating the degree to which the innovation reached the population eligible for HN services. We tried numerous times to obtain usable data from SEMHS, but as discussed above, SEMHS struggled with data reporting.

Figure 16 shows cumulative participant enrollment by quarter since the launch of the innovation based on data provided by SEMHS. Enrolled participants were defined as those who were reported as served by HNs. We last reported enrollment in the 2015 annual report, based on data through Q11. Since that time, SEMHS enrolled an additional 43 participants in the innovation, for a total of 639 participants.

Enrollment of eligible participants increased steadily during the innovation, due in part to access to the ICHP list that HNs received in Year 1, which allowed them to reach out to eligible patients. With this list, HNs proactively identified potential participants for HN services routinely. Through community outreach and referral networks, SEMHS also targeted residents of Prowers County, including Medicaid recipients not on the ICHP, Medicare beneficiaries, and the uninsured, all of which contributed to increased enrollment over time.

Figure 16. Participant Enrollment for Each Quarter since Project Launch



(continued)

Figure 16. Participant Enrollment for Each Quarter since Project Launch (continued)

Quarter	Q1 (Jul–Sept 2012)	Q2 (Oct–Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
Cumulative number of participants enrolled	45	89	195	288	314	370	403	450	501	549	596	639

Source: Patient-level data provided to RTI by SEMHS.

2.19.2 Innovation Dose

Table 28 illustrates the number of services provided to participants, the number of participants receiving services, and the average number of services per participant through Q12. We last reported dose in the 2015 annual report, based on data through Q11. As expected, the number and percentage of services provided increased from Q11 to Q12. Table 28 shows that 67.1 percent of participants received outreach services, and 44.8 percent received nonbillable services. Only a small percentage received any individual skills counseling (2.2%) or group skills classes (4.4%). However, those who participated in these services had an average of 21.4 and32.5 classes, respectively. The number of individual skills counseling services per individual is high possibly because one HN was located in the SEMHS day program; this HN provided individual and group classes for SEMHS participants. An average of almost 10 services of all types were provided to participants.

Table 28. Number and Types of Services Provided to Participants

Services	Number of Services Provided to Participants	Number (Percentage) of Unique Participants Receiving Service[1]	Average Number of Services per Participant
Outreach	497	429 (67.1%)	1.2
Case management	801	125 (19.6%)	6.4
Individual skills counseling	299	14 (2.2%)	21.4
Group skills classes	910	28 (4.4%)	32.5
Transportation	1,241	64 (10.0%)	19.4
Nonbillable (scheduling, reminders)	2,427	286 (44.8%)	8.5
Other	181	91 (14.2%)	2.0
Total	6,356	639	9.9

[1] Because participants could receive more than one service, we only count participants once, even if they received more than one service.

Source: Patient-level data provided to RTI by SEMHS.

Table 29 provides the total duration of HN assistance. Most participants (59.0%) received services lasting less than 1 day in total. Therefore, the majority of participants received a low dose of the innovation services over time.

Table 29. Total Duration of Services Provided to Participants through Q12

Duration[1]	Number of Unique Participants	Percentage of Unique Participants
Less than 1 day	377	59.0
1 day to less than 1 week	21	3.3
1 week to less than 1 month	32	5.0
1 month to less than 3 months	35	5.5
3 months to less than 6 months	35	5.5
6 months to less than 1 year	50	7.8
1 year or more	89	13.9
Total	639	100.0

[1] Duration of assistance is considered the time between the first service and the most recent service provided. Patients with the first and most recent service occurring on the same day are included in the "less than 1 day" category.
Source: Patient-level data provided to RTI by SEMHS.

Table 30 lists the type of contacts made with the enrolled participants through Q12. Slightly more than one-third of the participants (34.7%) received in-person visits, 42.4 percent received telephone calls, and 22.2 percent received both in-person visits and telephone calls.

Table 30. Number of Participants Contacted by HNs through Q11

Type of HN Contact	Number of Participants Contacted	Percentage of Participants Contacted
In-person visit	222	34.7
Telephone call	271	42.4
Both types of contact	142	22.2
Other[1]	4	0.7
Total	639	100.0

Source: Patient-level data provided to RTI by SEMHS.
[1] Other types of contacts include written contact or video conferencing.
HN = health navigator.

The majority of participants received a relatively low dose of the innovation services. Although, on average, they received 10 services, the majority of the participants received less than a day of total services. Therefore, vast improvements in either health outcomes or cost savings are not expected; a more sustained effort over time would help lead to improved coordinated care and, perhaps, more meaningful improvements.

2.20 Qualitative Findings: Sustainability

SEMHS leadership planned to use monies received from an accountable care organization (ACO) to maintain the current services and expand to all six counties in the region. The organization plans to maintain funding for four HNs, the project manager, and the HN supervisor, including colocating an HN at Prowers Memorial Hospital. ACO funds will sustain HNs as long as they are not doing office work or traveling all over the state.

During this reporting period, SEMHS applied for funding from Colorado's Amendment 35 (funding from tobacco tax revenue) through the Colorado Department of Public Health Environment, which would have allowed SEMHS to expand the HN efforts. The organization was not awarded funds for direct services but did receive Amendment 35 funds to continue HN training at OJC for the next 3 years.

SEMHS leadership continued to refine the HNs' functions so their time can be used more efficiently when SEMHS expands to the six-county region. For example, SEMHS will leverage staff from its other behavioral health programs for transportation services to save costs and effort. Because Prowers County is a rural area, the region's residents must travel considerable distances to reach services, and SEMHS plans to shift transportation services provided directly by HNs (which consume much of the HNs' time because of the long distances involved in travel to other counties) to peers with experience in behavioral health care. HNs will likely continue to coordinate with peers on transportation issues, but will focus more time on core HN activities, especially given the state's newly expanded Medicaid population and the availability of patient navigation services for these participants.

SEMHS still faces the challenge of being able to bill HN services under the existing Medicaid rules in Colorado. Although SEMHS has the potential to earn significant revenue with the expansion of Medicaid in the state, the organization will not be reimbursed for HN services such as sending reminders and assisting with transportation. SEMHS continues to share its story around the state and nationally about the value of this innovation in hopes that changes to the reimbursement system will follow.

2.21 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing SEMHS as well as accomplishments to date. In this section we assess SEMHS's progress on achieving HCIA goals to date:

- **Smarter spending.** Among the sample of fee-for-service Medicare and Medicaid beneficiaries participating in the innovation, no statistically significant changes in spending were found relative to the comparison group. The evidence does not support a conclusion that the SEMHS innovation generated savings or a loss; however, changes in spending are difficult to detect with a small sample size.

- **Better care.** Medicare fee-for-service beneficiaries enrolled in the innovation had a higher rate of ED visits and a lower rate of unplanned readmissions than the comparison group. Differences between the innovation and comparison groups for inpatient admissions were not statistically significant. Among Medicaid fee-for-service beneficiaries, we found that that the innovation had no impact on utilization.

  SEMHS enrolled an additional 43 participants in Q12, bringing the total enrollment to 639. An average of almost 10 services were provided per participant; the majority of participants, however, received less than 1 day of total services. RTI did not receive clinical effectiveness data regarding the impact of the innovation on reducing the risk levels. Therefore, we do not present these data in this report.

- **Healthier people**. SEMHS informed RTI that health outcome data were not available, so they are not presented in this report.

SEMHS is one of only a few service agencies available to residents in the six-county region that includes Prowers, and is well known as a key provider in the area. SEHMS designed the HN innovation to integrate services so that patients could access more comprehensive preventive care. The SEMHS innovation had mixed success, however, in part because SEMHS's primary care provider left the innovation and SEMHS struggled to find effective alternative means for participants to receive primary care.

RTI has limited evidence to suggest that the SEMHS innovation achieved the goals of smarter spending, better care, or healthier people. The lack of evidence to support a savings or loss is likely due, in part, to the small sample size for the claims analysis (106 Medicare patients and 128 Medicaid patients). Statistically significant changes in health care utilization were not expected for this innovation, given its focus on increasing access to preventive care. Because SEMHS struggled with data reporting, reach could not be assessed because there were no data over time that could be used as the denominator. The dose data also suggest that the majority of participants received less than a day of services in total. This is a relatively low dose given that goal of the innovation is to integrate services for participants. We could not assess the goal of improving the health status of participants because no health outcomes were available.

The program succeeded in the development of a community health worker certificate program through OJC and the certification of its first group of students. This program component received both state and national recognition, and may become a degree program in the future. Therefore, some of the components of the innovation appear to be sustainable, although SEMHS faced some significant challenges that make a complete assessment of the innovation difficult.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Southeast Mental Health Services (SEMHS)

Southeast Mental Health Services (SEMHS) provides mental health care and substance abuse treatment in the rural, frontier southeast corner of Colorado. Awarded $1,405,924, SEMHS sought to provide health navigation to Medicaid patients living in Prowers County who are frequent users of the health care system.

Awardee Overview

Innovation dose:	Between Q11 and Q12, receipt of outreach services increased from 65.9% to 67.1%. Receipt of nonbillable services decreased slightly, from 47% in Q11 to 44.8% in Q12. An average of 9.9 services were provided per participant.	***Innovation reach:***	In Q11, 47 patients were enrolled for health navigator (HN) services. An additional 43 patients enrolled in Q12, bringing the total to 639 participants.
Components:	The innovation focused on providing care coordination through health navigation services and establishing a formal HN training program through Otero Junior College.	***Participant demographics:***	Most (56.7%) participants were 25 to 64 years of age; 67.0% were female. Over 20% were children under 18 years of age, 34.7% were white, and 9.1% were Hispanic; 85.0% were covered by Medicaid, 1.7% by Medicare, and 5% were dually eligible for Medicaid and Medicare.
Sustainability:	SEMHS leadership will use monies received from the accountable care organization to maintain current services and expand to all six counties in the region with four HNs, the project manager, and the HN supervisor.		
Innovation type:	Coordination of care		Health care workforce

Key Findings

Smarter spending. No statistically significant changes in average quarterly spending were found among the sample of fee-for-service Medicare ($637; 90% CI: −$349, $1,624) and Medicaid (−$281; 90% CI: −$970, $409) beneficiaries participating in the innovation, relative to the comparison group. However, changes in spending are difficult to detect in a small sample size.

Better care. Medicare fee-for-service beneficiaries enrolled in the innovation had a higher rate of emergency department (ED) visits per 1,000 participants per quarter (136; 90% CI: 56, 215) and a lower rate of unplanned readmissions per 1,000 admissions per quarter (−345; 90% CI: −579, −111) than the comparison group. Differences between the innovation and comparison groups for inpatient admissions per 1,000 patients per quarter were not statistically significant (19; 90% CI: −13, 51). Among Medicaid fee-for-service beneficiaries, the innovation had no significant impact on inpatient stays per 1,000 participants per quarter (7; 90% CI: −64, 78) or ED visits per 1,000 participants per quarter (48; 90% CI: −102, 197).

An average of almost 10 services were provided per participant; the majority of participants, however, received less than 1 day of total services. RTI did not receive clinical effectiveness data about the impact of the innovation on reducing the risk levels. Therefore, we do not present these data in this report.

Healthier people. SEMHS informed RTI that health outcome data were not available, so they are not presented in this report.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

University of Chicago

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Order HHS-500-T0010

Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

University of Chicago

2.1 Introduction

The University of Chicago (U-Chicago), an academic research organization located in the South Side of Chicago, received an award of $5,862,027 for an innovation called CommunityRx (CommRx). This innovation utilizes aggregate electronic health record (EHR) and community resource data to provide patient-centered e-prescriptions called HealtheRx, which include resources for community health and social services. The target population consists of residents living in one of the 16 zip codes in the South Side region of Chicago. Launched on March 21, 2013, the innovation aimed to achieve the following goals:

1. **Smarter spending.** Reduce spending by 0.5 percent per beneficiary per year by providing community resources that promote healthier lifestyles and self-care to decrease unnecessary ED visits.

2. **Better care.** Improve care by providing primary care and emergency care providers with community resources to promote healthy lifestyles, disease management, and social services in the neighborhoods where their patients live.

3. **Healthier people**. Improve health by providing information on local community programs and services available to residents for health maintenance and disease management.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11-12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by U-Chicago and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Updated current and existing disease ontologies to better align with clinical guidelines, decrease redundancy for colocated services, and include general wellness services in HealtheRxs. A total of 31 health conditions and behaviors are currently included.
	Launched pilot of CommRx as a tool for care coordinators at Chicago Family Health Center and Friend Family Health Center.
	Launched SMS messaging pilot to better connect program participants to the information specialists at the eight Near North Health Corporation clinical sites.
	Expanded target population by 5 zip codes in Year 3 to match the total of 16-zip code region for which MAPSCorps data were available.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Program Participant Characteristics	
	Majority of participants (36.8%) were less than 18 years of age or between 25 and 64 years of age (41.7%). Most were female (63.3%) and black (69.1%). About half (46.1%) were covered by Medicaid, and more than 10% were covered by Medicare or eligible for both Medicare and Medicaid.
Workforce Development	
Hiring and retention	16.5 FTE staff at the end of Q12, below projection by 1 FTE.
	One of two interview specialists left after 2 months when another position became available.
	Hired and trained manager to oversee information specialists and interview specialists in data collection and determine weekly outreach assignments.
	With the loss of the interview specialist in Q12, retention rate was 95% among staff and 100% among project director.
Skills, knowledge, and training	Provided 99 hours of training to 99 awardees in Q11 and 88 hours of training to 88 trainees in Q12. Continued to train providers on how to generate a HealtheRx.
	Trained and provided access to CommRx tools for 15 care coordinators at Chicago Family (3/10/15) and Friend Family (3/17/15). Conducted pretraining and posttraining observations and focus groups to assess impact of CommRx on care coordinator workflow efficiency.
	Completed iteration and incorporation of the final information specialist training module into the Brainshark online learning management system.
	Adapted online training modules to align with updates to functionality available in the service-level survey and the information specialist workspace.
	Created self-guided, online modules for training providers at clinical sites on HealtheRx workflow and for engaging patients in HealtheRx.
	Integrated MAPSCorps training videos into the Brainshark system.
Context	
Award execution	As of Q12, 97.3% of U-Chicago's Year 3 budget was expended, which was on target with CMS's approved plan.
Leadership	Leadership remained strong and engaged. A quarterly meeting for all CommRx collaborators was held on 1/21/15, including core operations team members and HIT, clinical, workforce development, and information specialist staff.
Organizational capacity	Maintained the organizational capacity to implement the innovation components and continue collaborating across working groups.
Innovation adoption and workflow integration	HIT Development Working Group scaled existing EHR interfaces to eight new clinical sites.
	Added field for information specialist to enter zip code in tracking interactions with program participants.
	Added feature to display MAPSCorps taxonomy in the service-level survey for tracking type of business or organization contacted and targeted probing.
	Created new functionality whereby information specialist can tailor HealtheRx to include specific service providers and filter services by eligibility requirements, health conditions, and behaviors.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Innovation adoption and workflow integration	Expanded ArcGIS data to the entire United States to allow for generation of geocodes outside of Chicago.
	Incorporated a pop-up message to notify user when HealtheRx request was sent, reducing the submission of duplicate requests.
Implementation Effectiveness	
Innovation reach	Total of 125,182 participants (count current as of June 2015); 73.6% of the target population received at least one HealtheRx, up from 52.5% in Q11. The awardee's innovation was projected to launch at 35 clinical sites. As of Q11, 30of the targeted clinical sites (88%) began implementing HealtheRx. As of Q12, 33 of the targeted clinical sites (94%) began implementing HealtheRx.
Innovation dose	More than half of participants (59.6%) received one HealtheRx report, and the other half received two or more reports.
Sustainability	
	U-Chicago transferred CommRx technology in its entirety to Care IT Health, LLC, which will do business as NowPow in partnership with a 501c3 organization (to be formed) called MAPSCorps to test a collective social impact for sustainability.

Sources: *Q11-Q12 Narrative Progress Report*.
Q11-Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted February–June 2015.

ArcGIS = Aeronautical Reconnaissance Coverage Geographic Information System; CMS = Centers for Medicare & Medicaid Services; CommRx = Community Rx; EHR = electronic health record; FTE = full-time equivalent; HIT = health information technology; MAPSCorps = Meaningful Active Productive Science in Service to Communities; SMS = short message service; U-Chicago = University of Chicago.

Table 3 summarizes Medicare claims-based findings during the innovation period. The innovation group incurred lower spending overall but the estimate is not statistically significant, indicating no significant difference between the innovation and comparison groups in Medicare spending. Overall, the innovation group has fewer inpatient admissions and unplanned readmissions than the comparison group, and the results are statistically significant. The overall impact of the innovation on ED visits was not statistically significant, but the innovation group had significantly more ED visits during the first year of the innovation.

Table 3. Summary of Medicare Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$2.301	−$11.300, $6.696	−$4.327	−$10.130, $1.476	$1.683	−$2.966, $6.332	$0.342	−$1.189, $1.874
Acute care inpatient stays	−961	−1186, −736	−679	−856, −502	−264	−393, −136	−18	−69, 34
Hospital-wide all-cause unplanned readmissions	−69	−128, −10	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	191	−107, 489	255	20, 490	−47	−218, 125	−18	−85, 49
Average impact per quarter								
Spending per participant	−$44	−$216, $128	−$142	−$333, $49	$91	−$160, $341	$103	−$357, $563
Acute care inpatient stays (per 1,000 participants)	−18	−23, −14	−22	−28, −17	−14	−21, −7	−18	−21, 10
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−19	−35, −3	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	4	−2, 9	8	1, 16	−3	−12, 7	−5	−25, 15

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares**.**
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

Table 4 summarizes Medicaid claims-based findings during the innovation period. The innovation group incurred higher spending in the first year after the innovation launch than the comparison group. The overall estimate for the difference in quarterly spending is positive, but not statistically significant, indicating no significant difference between the innovation and comparison groups in Medicaid spending. Overall, the innovation group has fewer ED visits than the comparison group, and the results are statistically significant, whereas the innovation group and the comparison group have similar rates for inpatient stays and unplanned readmissions.

Table 4. Summary of Medicaid Claims-Based Findings

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	$1.104	−$0.272, $2.479	$1.104	−$0.272, $2.479	N/A	N/A	N/A	N/A
Acute care inpatient stays	21	−21, 63	21.265	−20.626, 63.155	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−14	−32, 4	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−279	−366, −192	−279.250	−366.075, −192.426	N/A	N/A	N/A	N/A
Average impact per quarter								
Spending per participant	$202	−$50, $454	$202	−$50, $454	N/A	N/A	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	4	−4, 12	4	−4, 12	N/A	N/A	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−87	−196, 22	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−51	−67, −35	−51	−67, −35	N/A	N/A	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size.

2.1.1 Innovation Components

CommRx was a multisite, multifaceted innovation that included a range of educational, technological, and analytical components to provide patient-centered e-prescriptions for community-based health and social services (HealtheRx) to patients at the University of Chicago Medical Center (UCMC) and community health centers (CHCs) across 16 zip codes from Chicago's South Side, which encompasses 60 percent of the city's land area. The partners provided information technology (IT), training, implementation expertise, and clinical health services to link a patient's medical record data with the CommRx data system, which produced the HealtheRx. Several key partners supported the innovation (***Table 5***), which helped CommRx meet the following three objectives.

1. Aggregated EHR and CommRx referral data that inform program planning for community-based service providers (CBSPs) (referred to as CommRx Reports).
2. Provided patient-centered e-prescriptions for community health and social services (HealtheRx).
3. Deployed information specialists[1] to support recipients of the HealtheRx who seek more information or assistance with connecting to local health and social services for self-care.

This innovation had three components. The first component, HealtheRx, involved developing and using a health information technology (HIT) database that receives EHR data from the participating health care sites to produce a HealtheRx or patient-centered prescription for healthy lifestyle, disease management, and social services. The database tailored the HealtheRx to patients' conditions and the resources available in their communities. The second component identified, engaged, and prepared clinical sites to participate in the innovation. The third component deployed information specialists to support recipients of the HealtheRx who wanted more information or assistance with connecting to local health and social services for self-care.

Since we provided details on these components in the 2014 and 2015 annual reports, only a few minor changes to the components were made. During Q11, U-Chicago added 8 additional clinical sites—6 Alivio Medical Center sites, including 3 school-based clinics, the Esperanza Health Center on California Avenue, and the Chicago Family Health Center on 120 West 11th Street. With these additions, 14 total clinical sites were added in Year 3, for a total of 33 since project launch.

U-Chicago also launched a short message service (SMS) pilot at the 8 Near North Health Service Corporation clinic sites to facilitate communication between program participants and information specialists. Because the pilot test was launched at only 8 of the 33 sites, RTI did not include the pilot test as a new innovation component. The information specialist model also evolved to include interview specialists who focused on building the list of resources and services available in the target zip codes. Although the information specialists were always involved with identifying and gathering additional

[1] During the May site visit, we were told that "community health information specialist" (information specialist) was the preferred title. In the original application, this role was listed as "community health information expert," but it evolved over time. The preferred title is now "information specialist," which we use in this report.

information about the health resources in the community, the new interview specialist team members took on this work as their central focus.

Table 5. HCIA Partners, Roles, and Locations

Partner Name	Role in HCIA Project	Location
Northwestern University Chicago Health Information Technology Regional Extension Center (CHITREC)	HIT expertise and training	Chicago, IL
Alliance of Chicago Community Health Services, L3C	Training and HIT expertise	Chicago, IL
Centers for New Horizons	Implementation expertise and workforce development expertise	Chicago, IL
Chicago Family Health Center	Clinical health services	Chicago, IL
Friend Family Health Center	Clinical health services	Chicago, IL
Greater Auburn-Gresham Development Corporation	Implementation expertise and workforce development expertise	Chicago, IL
Near North Health Service Corporation	Clinical health services	Chicago, IL
University of Chicago	Project leadership and operations, management/ administration expertise, HIT training; workforce development expertise, clinical health services, and implementation and evaluation expertise	Chicago, IL
Alivio Medical Centers	Clinical health services	Chicago, IL
Esperanza Health Centers	Clinical health services	Chicago, IL

Source: *Q11-Q12 Narrative Progress Report*.
HCIA = Health Care Innovation Award; HIT = health information technology.

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants ever enrolled in the innovation. The majority of participants were either less than 18 years of age (36.8%) or between 25 and 64 years of age (41.7%); most were female (63.3%) and black (69.1%). About half (46.1%) were covered by Medicaid; more than 10 percent were covered by Medicare or dually eligible for both Medicare and Medicaid. The distribution of patient characteristics is similar to that reported in the 2015 annual report.

Table 6. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015

Characteristic	Number of Participants[1]	Percentage of Participants
Total	125,182	100.0
Age		
< 18	46,086	36.8
18–24	11,646	9.3
25–44	28,533	22.8
45–64	23,656	18.9
65–74	7,268	5.8
75–84	4,978	4.0
85+	2,219	1.8
Missing	796	0.6

(continued)

Table 6. Characteristics of All Participants Ever Enrolled in the Innovation through June 2015 (continued)

Characteristic	Number of Participants[1]	Percentage of Participants
Sex		
Female	79,299	63.3
Male	45,880	36.7
Missing	3	0.0
Race/ethnicity		
White	10,027	8.0
Black	86,542	69.1
Hispanic	4,539	3.6
Asian	1,583	1.3
American Indian or Alaska Native	103	0.1
Native Hawaiian or other Pacific Islander	119	0.1
Other	93	0.1
Missing/refused	22,176	17.7
Payer Category		
Dual	4,366	3.5
Medicaid	57,711	46.1
Medicare	11,800	9.4
Medicare Advantage	2	0.0
Other	36,953	29.5
Uninsured	8,547	6.8
Missing	5,803	4.7

Source: Patient-level data provided to RTI by U-Chicago.
[1] Based on data received from U-Chicago (n=80,117), Chicago Family (n=11,480), Friend Family (n=22,102), and Near North (n=11,483).

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced spending per patient?
- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
		ED visit rate	Yes	Yes
	Cost	Spending per patient	Yes	Yes
		Estimated cost savings	Yes	Yes

ED = emergency department.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 8,399 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare living in the 16 intervention zip code areas of the South Side of Chicago.

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits, and inpatient stays in the calendar quarter prior to the innovation, as well as outpatient, professional, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

In previous reports, we noticed that spending rises sharply for the innovation group in the first innovation quarter, whereas it remains stable for the comparison group. A likely reason for the initial spending spike in the innovation group is that a majority of beneficiaries were enrolled in the CommRx innovation when they visited an ED or a CHC. Therefore, beneficiaries in the first calendar quarter after innovation (I1) incur inpatient or outpatient costs. The result is an artifact of the enrollment dates coinciding with the ED or community health center visit date.

To better match this initial spike in spending and utilization among the innovation group, we added 3 months (one quarter) to each innovation beneficiary's original enrollment date (or visit date), so that the original first calendar quarter in the innovation period is now considered the last calendar quarter prior to the innovation. Since our PSM method uses spending and utilization variables in the calendar quarter prior to the innovation to match beneficiaries, we end up selecting comparison beneficiaries who had similar spending and utilization patterns in the calendar quarter when the spike appears, but who did not participate in the intervention.

Table 8 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology. Eighteen innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available.

Table 8. Mean Values and Standardized Differences of Variables in Propensity Score Model: U-Chicago

Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Total payments in calendar quarter prior to enrollment	$5,854	$12,897	$2,939	$9,032	0.26	$5,781	$12,772	$6,155	$15,561	0.03
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$16,480	$32,152	$10,268	$23,304	0.22	$16,355	$31,861	$16,581	$31,485	0.01
Outpatient payments in calendar quarter prior to enrollment	$1,309	$2,802	$487	$1,986	0.34	$1,286	$2,707	$1,213	$3,328	0.02
Outpatient payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$3,557	$8,881	$1,729	$6,164	0.24	$3,520	$8,713	$3,114	$9,620	0.04
Professional payments in calendar quarter prior to enrollment	$1,032	$1,822	$596	$1,577	0.26	$1,014	$1,745	$1,080	$1,930	0.04
Professional payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$2,861	$5,162	$2,149	$4,525	0.15	$2,827	$4,958	$2,908	$4,425	0.02
Age	68.55	15.19	69.00	13.61	0.03	68.58	15.17	68.40	14.88	0.01
Percentage male	31.02	46.26	43.13	49.53	0.25	30.94	46.22	29.36	45.54	0.03
Percentage white	10.47	30.61	14.81	35.52	0.13	10.44	30.58	10.35	30.47	0.00
Percentage disabled	39.06	48.79	33.41	47.17	0.12	39.02	48.78	40.67	49.12	0.03
Percentage ESRD	4.60	20.94	2.68	16.14	0.10	4.57	20.88	4.87	21.52	0.01
Number of dual-eligible months in the previous calendar year	5.16	5.75	3.87	5.43	0.23	5.15	5.74	5.68	5.79	0.09
Number of chronic conditions	7.54	4.12	6.13	4.28	0.34	7.53	4.12	7.86	4.27	0.08
Number of ED visits in calendar quarter prior to enrollment	0.77	1.48	0.11	0.45	0.60	0.73	1.11	0.68	1.13	0.05
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.24	3.86	0.65	1.66	0.20	1.19	3.53	1.01	2.52	0.06

(continued)

Table 8. Mean Values and Standardized Differences of Variables in Propensity Score Model: U-Chicago (continued)

	Before Matching					After Matching				
	Innovation Group		Comparison Group			Innovation Group		Comparison Group		
Variable	Mean	SD	Mean	SD	Standardized Difference	Mean	SD	Mean	SD	Standardized Difference
Number of inpatient stays in calendar quarter prior to enrollment	0.19	0.62	0.09	0.40	0.19	0.19	0.60	0.19	0.59	0.00
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.51	1.46	0.33	1.04	0.14	0.50	1.41	0.50	1.34	0.00
Number of beneficiaries	8,399	—	678,615	—	—	8,381	—	25,070	—	—
Number of unique beneficiaries[1]	8,399	—	93,213	—	—	8,381	—	21,455	—	—
Number of weighted beneficiaries	—	—	—	—	—	8,381	—	8,381	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

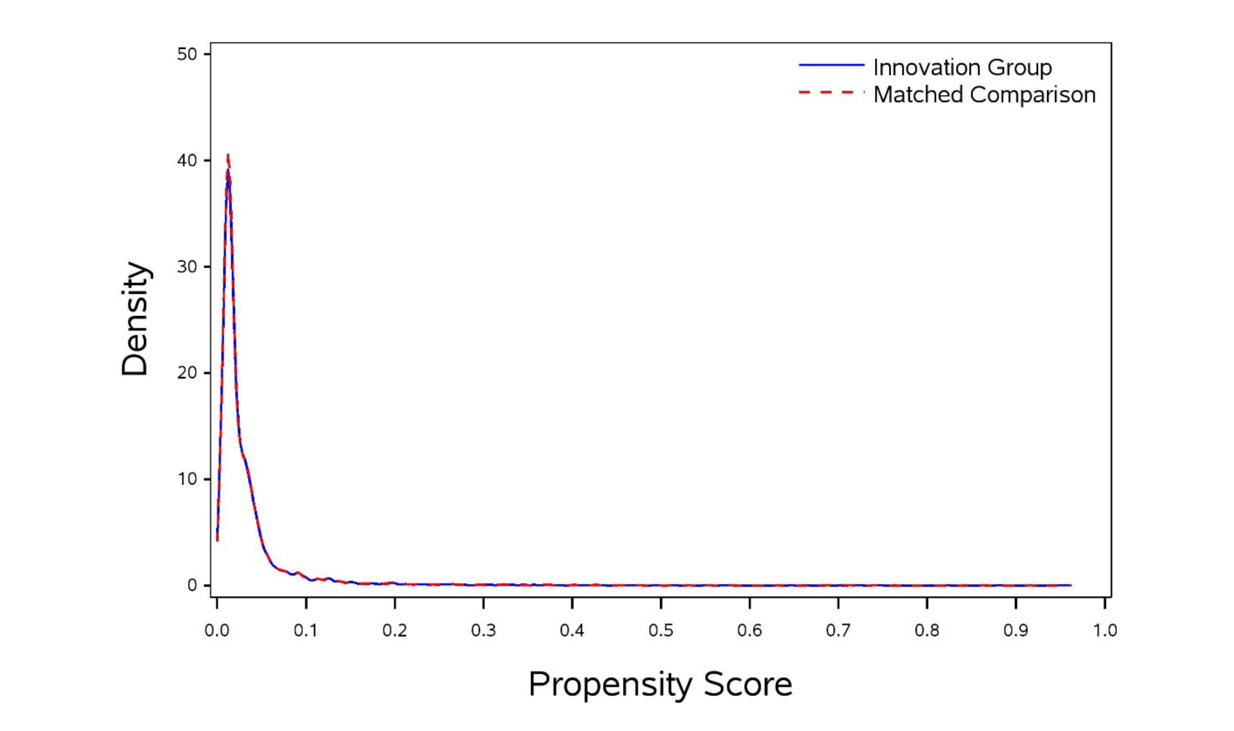
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ED = emergency department; ESRD = end-stage renal disease; — = not applicable; U-Chicago = University of Chicago.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 8). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into treatment (e.g., those with significant effects in the propensity score equation) should have greater balance, while indicators with minor importance in determining treatment selection do not require optimal balance. The results in Table 8 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figure demonstrates a very close overlap between the innovation and comparison groups' propensity scores. Therefore, we present the Medicare claims analysis using both the innovation group and the matched comparison group.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
U-Chicago = University of Chicago.

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 9 reports Medicare spending per patient in the 8 quarters before and the 11 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison group beneficiaries and is darker in the innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending trends upward in the baseline quarters for both the innovation and comparison beneficiaries. After the innovation launch, spending increases for both the innovation and comparison groups. The spending gap between the two groups remains stable during the innovation quarters. However, on this basis, it is premature to draw conclusions about the impact of the innovation on spending. As shown in Table 9, the standard deviation for spending is very high, representing the skewed nature of expenditures. We will estimate the statistical impact of the innovation in the difference-in-differences analyses that follow.

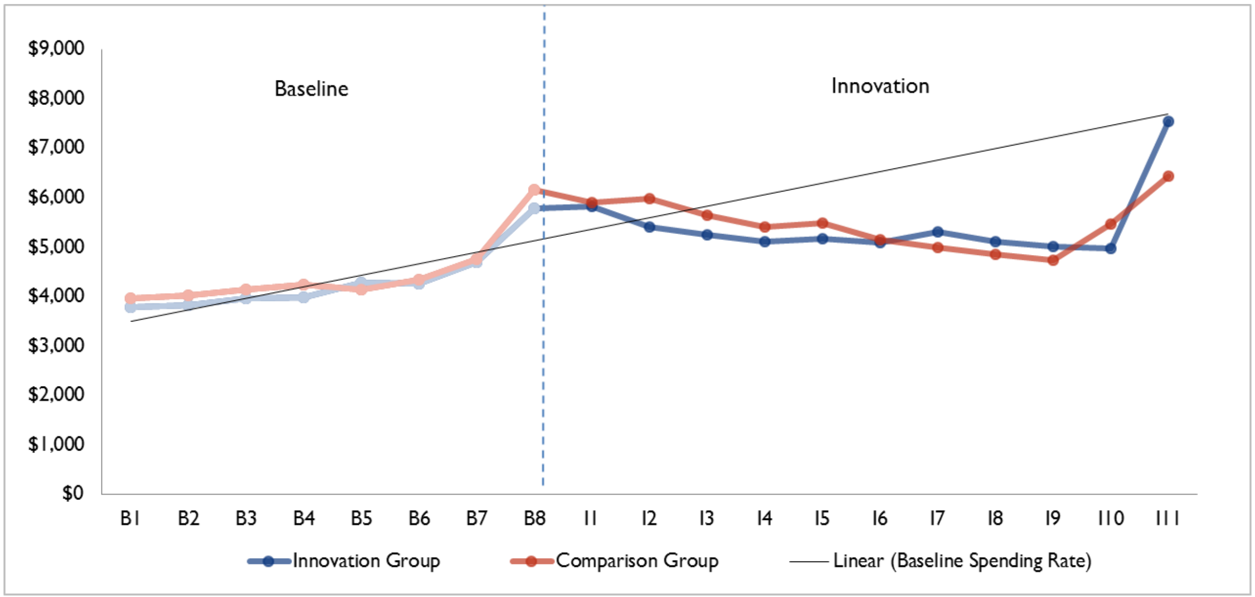
Table 9. Medicare Spending per Participant: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Spending rate	$3,780	$3,812	$3,961	$3,989	$4,267	$4,247	$4,692	$5,781	$5,815	$5,395	$5,249	$5,102	$5,168	$5,095	$5,302	$5,097	$5,013	$4,971	$7,546
Std dev	$9,792	$10,548	$13,262	$10,964	$11,419	$11,420	$12,286	$12,772	$14,476	$12,891	$12,564	$12,557	$12,077	$12,457	$13,499	$13,787	$11,889	$10,870	$12,820
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,363	6,514	5,651	4,922	4,279	3,704	2,636	647	44
Comparison Group																			
Spending rate	$3,961	$4,021	$4,142	$4,239	$4,144	$4,342	$4,744	$6,155	$5,897	$5,971	$5,646	$5,404	$5,483	$5,144	$4,982	$4,846	$4,724	$5,463	$6,441
Std dev	$9,574	$10,020	$10,055	$10,769	$10,398	$11,620	$12,384	$15,561	$14,283	$15,143	$14,271	$13,580	$13,890	$12,596	$11,930	$12,013	$12,091	$13,572	$10,740
Weighted patients	7,261	7,368	7,505	7,663	7,831	8,016	8,267	8,381	8,381	8,227	7,204	6,078	5,018	4,144	3,474	2,918	2,008	519	36
Savings per Patient																			
	$181	$209	$181	$251	−$123	$95	$53	$374	$82	$575	$397	$302	$316	$49	−$321	−$251	−$288	$492	−$1,105

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 2. Medicare Spending per Participant: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
U-Chicago = University of Chicago.

2.4.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period is −$44 (90% CI: −$216, $128), indicating savings. This effect is not statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 10*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly difference-in-differences estimates. The quarterly estimates fluctuate above and below zero over time, and most of them are not statistically significant.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	$130	$175	0.458
I2	−$330	$175	0.059
I3	−$219	$177	0.214
I4	−$172	$187	0.358
I5	−$181	$206	0.379
I6	$60	$213	0.779
I7	$350	$241	0.147
I8	$248	$261	0.343
I9	$211	$282	0.454
I10	−$393	$591	0.506
I11	$900	$2,164	0.678
Overall average	−$44	$105	0.674
Overall aggregate	−$2,301,313	$5,469,664	0.674
Overall aggregate (IY1)	−$4,326,738	$3,527,889	0.220
Overall aggregate (IY2)	$1,683,266	$2,826,327	0.552
Overall aggregate (IY3)	$342,159	$930,964	0.713

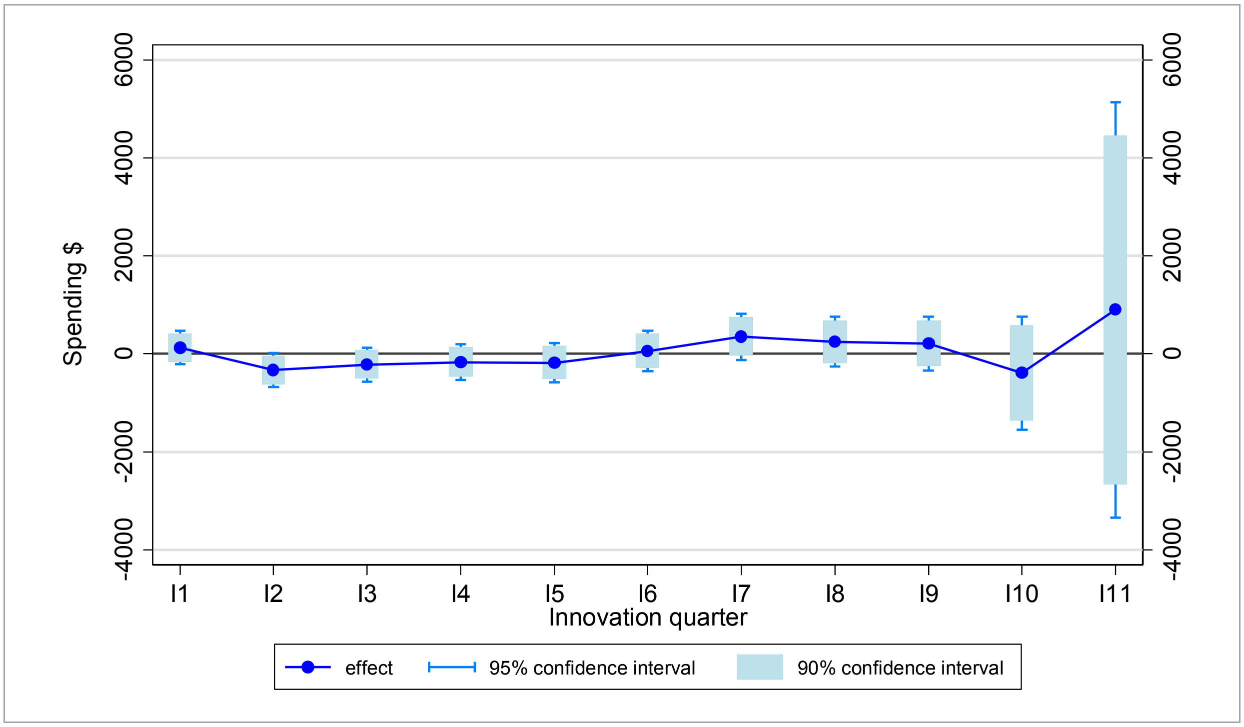
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; U-Chicago = University of Chicago.

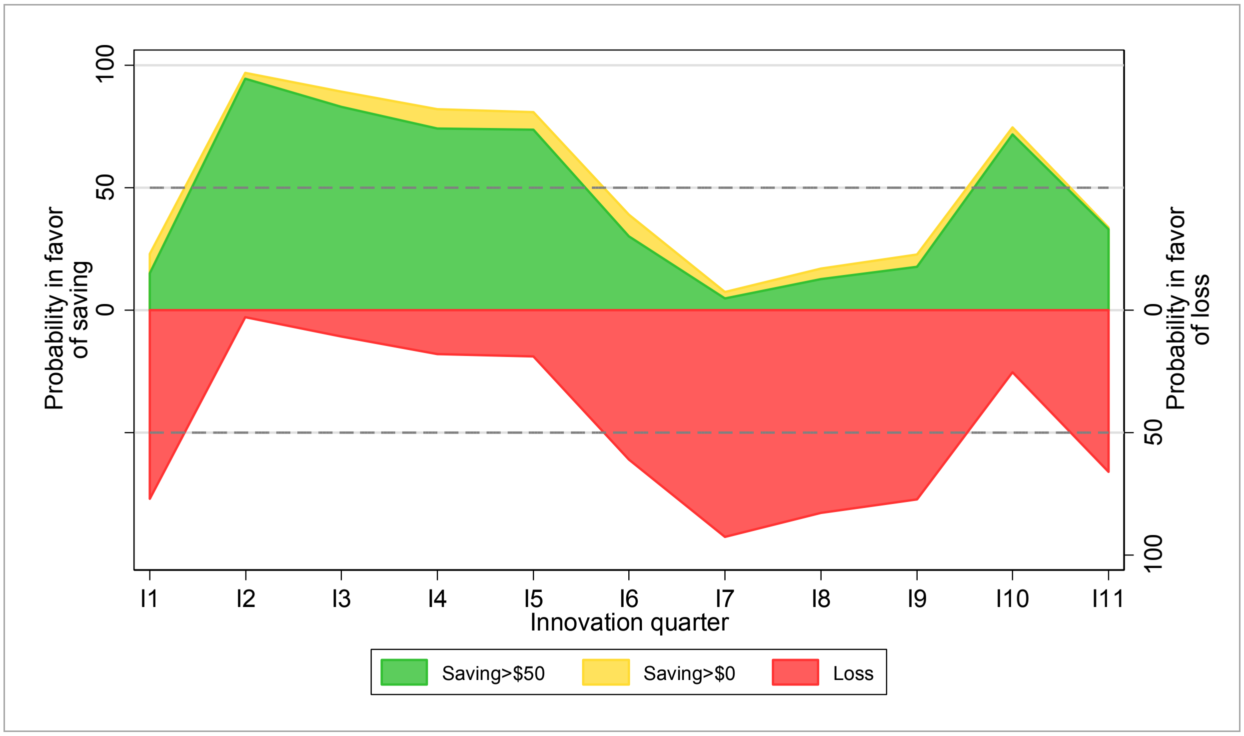
Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; U-Chicago = University of Chicago.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates are not statistically significant in the entire innovation period, we observe about a 50/50 chance of savings versus loss for the innovation period, with earlier innovation quarters demonstrating a higher probability of savings and later innovation quarters demonstrating a higher period of losses.

Figure 4. Quarterly Strength of Evidence in Favor of Savings/Loss: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
U-Chicago = University of Chicago.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 11*** and ***Figure 5***. Inpatient admissions trend slightly upward and are similar in the baseline period for both the innovation and comparison groups. Inpatient admissions decline for beneficiaries enrolled in the innovation during the innovation quarters, whereas inpatient admissions for the comparison beneficiaries remain higher than those of the innovation group. Without statistical testing, it is premature to conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

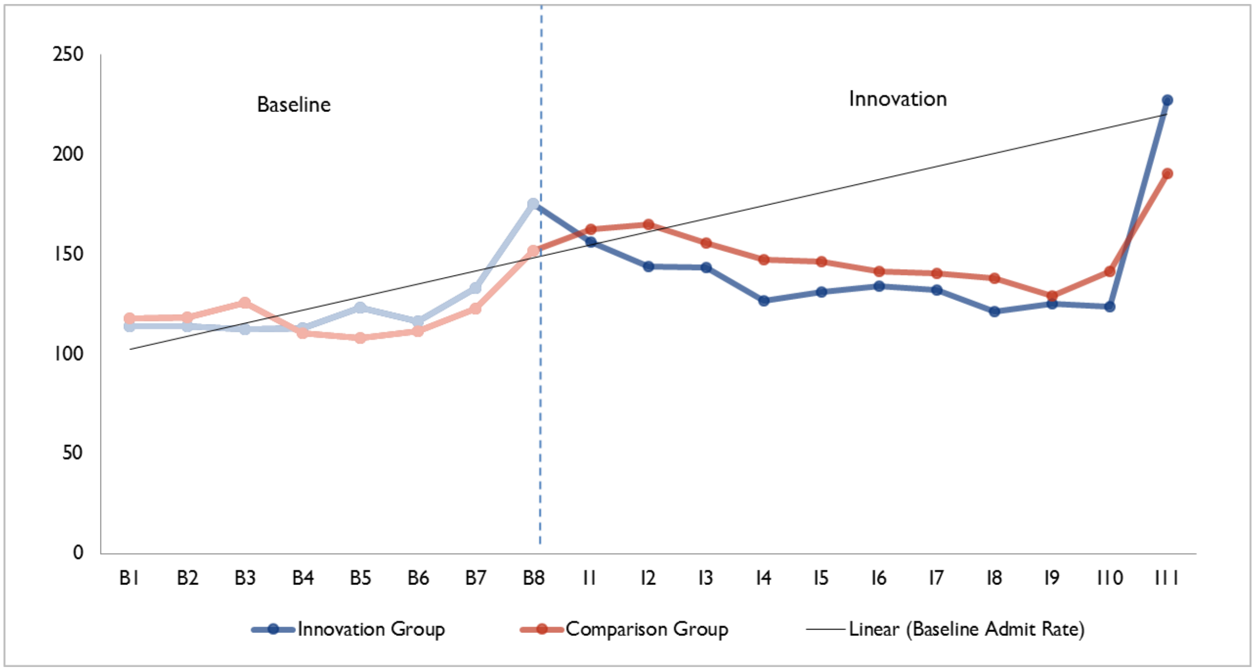
Table 11. All-Cause Inpatient Admissions Rate per 1,000 Participants: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Admit rate	114	114	112	113	123	117	133	176	156	144	144	127	131	134	132	121	125	124	227
Std dev	478	484	450	461	479	465	503	579	551	512	535	467	468	507	504	446	442	465	670
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,363	6,514	5,651	4,922	4,279	3,704	2,636	647	44
Comparison Group																			
Admit rate	118	118	126	111	108	111	123	152	162	165	156	147	146	141	140	138	129	142	190
Std dev	470	477	486	470	449	451	480	548	592	569	559	524	520	517	508	485	481	485	613
Weighted patients	7,261	7,368	7,505	7,663	7,831	8,016	8,267	8,381	8,381	8,227	7,204	6,078	5,018	4,144	3,474	2,918	2,008	519	36
Innovation − Comparison Rate																			
	−4	−4	−14	2	15	5	10	24	−6	−21	−12	−21	−15	−7	−8	−16	−4	−18	37

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Participants: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
U-Chicago = University of Chicago.

2.5.2 *Regression Results*

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 18 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: −23, −14).

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 12*** presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. Most of the quarterly estimates are negative and statistically significant.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	−20	7	0.006
I2	−24	7	< 0.001
I3	−23	7	0.001
I4	−22	7	0.001
I5	−14	8	0.071
I6	−14	8	0.089
I7	−11	9	0.223
I8	−19	9	0.036
I9	1	10	0.911
I10	−35	22	0.111
I11	41	110	0.710
Overall average	−18	3	< 0.001
Overall aggregate	−961	137	< 0.001
Overall aggregate (IY1)	−679	108	< 0.001
Overall aggregate (IY2)	−264	78	0.001
Overall aggregate (IY3)	−18	31	0.574

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; U-Chicago = University of Chicago.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 13*** and ***Figure 6***. Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch, and the trend line slopes slightly downward. The readmissions rates for the innovation group are lower than the comparison group for most of the innovation period until the eighth innovation quarter (I8). The sample size in the last two quarters (I10 and I11) is small because only a small number of index admissions are included. Without statistical testing, it is premature to conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

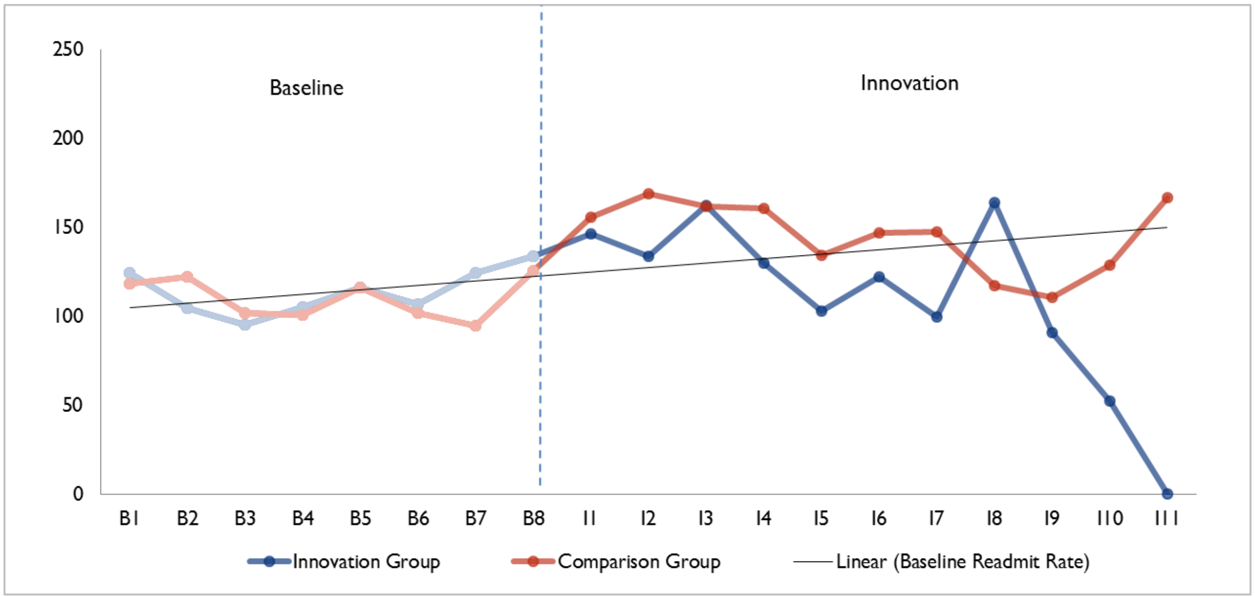
Table 13. Hospital Unplanned Readmissions Rates per 1,000 Admissions: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
Readmit rate	124	104	95	105	116	107	124	134	147	134	162	130	103	122	100	164	91	53	0
Std dev	330	306	294	307	321	309	330	340	354	340	369	336	304	328	300	370	288	223	0
Total admissions	378	402	420	408	473	468	547	794	689	561	517	431	389	343	301	232	154	38	2
Comparison Group																			
Readmit rate	118	122	102	101	116	102	95	126	156	169	162	160	134	147	147	117	110	129	167
Std dev	323	327	303	301	320	302	293	331	363	375	368	367	341	354	355	322	314	335	373
Total admissions	493	507	530	475	483	526	607	794	878	783	682	537	435	364	280	222	118	31	2
Innovation − Comparison Rate																			
	6	−17	−7	4	0	5	30	8	−9	−35	1	−31	−31	−24	−48	47	−20	−76	−167

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Admissions: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
U-Chicago = University of Chicago.

2.6.2 Regression Results

Table 14 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −19 per 1,000 inpatient admissions (−1.9 percentage points), indicating that the innovation−comparison difference is 1.9 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant at the 10 percent level (90% CI: −35, −3).

Table 14. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Inpatient Admissions: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
Overall average	−19	10	0.055
Overall aggregate	−69	36	0.055

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
U-Chicago = University of Chicago.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 7.*** The ED visit rate remains stable before launch and spikes upward during the last baseline quarter because of patient enrollment at ED visit, as mentioned previously. During the subsequent innovation quarters, the ED visit rate remains stable and is very similar between the innovation and comparison groups, although the gap between the two groups seems to shrink. As with the other variables, we will include statistical tests on the ED visit rate in the following section.

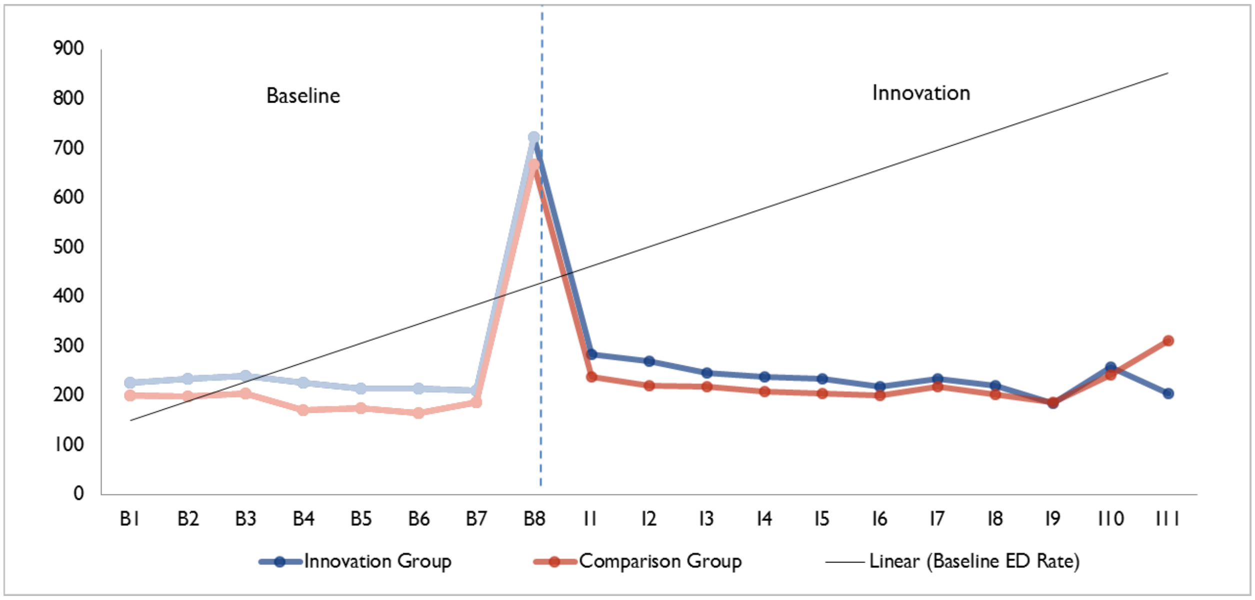
Table 15. ED Visits per 1,000 Participants: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters										
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Innovation Group																			
ED rate	226	233	240	225	213	215	210	723	284	269	246	237	234	218	233	220	185	258	205
Std dev	958	939	842	938	827	929	812	1120	962	925	811	835	840	719	811	764	601	763	594
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,363	6,514	5,651	4,922	4,279	3,704	2,636	647	44
Comparison Group																			
ED rate	201	198	205	170	175	165	186	668	237	219	218	209	205	201	218	202	187	241	312
Std dev	419	418	461	396	442	383	415	701	476	461	436	420	430	418	467	427	415	459	485
Weighted patients	7,261	7,368	7,505	7,663	7,831	8,016	8,267	8,381	8,381	8,227	7,204	6,078	5,018	4,144	3,474	2,918	2,008	519	36
Innovation − Comparison Rate																			
	25	36	35	55	39	50	24	55	47	50	29	28	29	17	16	18	−2	17	−107

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 7. ED Visits per 1,000 Participants: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; U-Chicago = University of Chicago.

2.7.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is an increase of 4 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant at the 10 percent level (90% CI: −2, 9). In addition to the average effect over the innovation period, we present quarterly effects.

Table 16 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. In the innovation period, the difference-in-differences estimate for ED visits fluctuates above and below zero, and most of the estimates are not statistically significant.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	15	9	0.125
I2	22	9	0.015
I3	−5	9	0.623
I4	−2	10	0.848
I5	2	10	0.809
I6	−4	11	0.735
I7	−12	12	0.302
I8	3	12	0.820
I9	−5	13	0.689
I10	1	32	0.978
I11	−106	121	0.385
Overall average	4	3	0.292
Overall aggregate	191	181	0.292
Overall aggregate (IY1)	255	143	0.074
Overall aggregate (IY2)	−47	104	0.655
Overall aggregate (IY3)	−18	41	0.659

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; U-Chicago = University of Chicago.

2.8 Discussion: Medicare Results

The claims measures provide descriptive data on a subset of Medicare beneficiaries enrolled in the CommRx innovation before and after their enrollment dates. Because a majority of these innovation beneficiaries were enrolled in the innovation on their ED visit or CHC visit, we added 3 months (one quarter) to each innovation beneficiary's original enrollment date (or visit date), so that their original first calendar quarter of the innovation is now considered the last calendar quarter prior to the innovation. In doing so, we were able to select comparison beneficiaries who had similar spending and utilization patterns in the calendar quarter where the ED or CHC visit appears. The Medicare claims analysis shows a statistically significant decrease in two of the four core measures after the innovation started: hospital inpatient admissions and unplanned readmissions. However, the core measures may not provide a complete evaluation of U-Chicago's CommRx innovation for several reasons.

First, the innovation was launched on March 21, 2013. The impact of receiving a tailored HealtheRx with community-based resources specific to the patient's diagnosis on these more distal outcomes would probably not be immediately evident. As discussed previously, the assumption is that the provider gave the HealtheRx to patients, and patients used those community resources listed on the HealtheRx and, as a result, learned how to better manage their chronic conditions and change their behaviors. Because U-Chicago did not track whether patients access and use the services on their tailored HealtheRx, we do not know which patients used the services. Although U-Chicago conducted a call-in participation satisfaction survey to track the number of participants who visited a place listed on their HealtheRx, the number of responses (24) from participants was too low to draw conclusions for the 226 individuals who were surveyed.

Second, although the U-Chicago CommRx innovation offered potential benefits to all enrollees, the benefits were likely to be most pronounced for patients with certain diseases or conditions. The claims measures listed previously are reported at the aggregate level for all Medicare fee-for-service patients, and the sample size is not adequate to examine different condition subsets.

Third, over 89 percent of the Medicare beneficiaries came from the U-Chicago clinical sites, and during the innovation there were several other health care innovations running simultaneously, such as the State Innovation Model and the University of Chicago community programs.[3] The effect of these simultaneous programs could have confounded our evaluation of the HCIA innovation, impeding the ability to isolate the impact of the U-Chicago CommRx innovation.

Finally, the results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries represent 6.7 percent of the overall population reached by the innovation.

2.9 Medicaid Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicaid claims data through Q4 2013. The Medicaid claims analysis focuses on 3,042 Medicaid beneficiaries enrolled in fee-for-service Medicaid during the innovation period. We present measures for beneficiaries enrolled in the innovation as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in the 16 innovation zip code areas of the South Side of Chicago.

We use PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, enrollee status, number of months of Medicaid eligibility during the calendar year prior to the innovation, number of ED visits, number of inpatient stays, other therapy payments, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid fee-for-service in the calendar quarter prior to the

[3] For more information, see http://www.idph.state.il.us/ship/icc/SIM.htm and http://www.uchospitals.edu/about/community/programs/index.html.

innovation did not have Medicaid claims data for this quarter, and were matched separately using demographic variables only. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score. Similar to Medicare analyses, we added 3 months (one quarter) to each innovation beneficiary's original enrollment date (or visit date), so that the original first calendar quarter in the innovation period is now considered the last calendar quarter before the innovation.

Table 17 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 8*** shows the distribution of the propensity scores for both the comparison and innovation groups. ***Appendix B.2*** provides technical details on the propensity score methodology.

Table 17. Mean Values and Standardized Differences of Variables in Propensity Score Model: U-Chicago

Variable	Before Matching					After Matching				
	Innovation Group		Comparison Group		Standardized Difference	Innovation Group		Comparison Group		Standardized Difference
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Previous Medicaid										
Total payments in calendar quarter prior to enrollment	$1,361	$7,568	$682	$5,412	0.10	$1,361	$7,567	$1,360	$14,660	0.00
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$3,918	$19,242	$2,556	$13,108	0.08	$3,918	$19,239	$4,832	$32,175	0.03
Other therapy payments in calendar quarter prior to enrollment	$752	$1,834	$448	$1,739	0.17	$752	$1,834	$773	$3,010	0.01
Other therapy payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$1,859	$5,626	$1,699	$5,931	0.03	$1,859	$5,626	$2,245	$12,357	0.04
Age	14.94	15.97	23.27	21.72	0.44	14.94	15.97	14.49	15.58	0.03
Percentage adult and nondisabled	18.27	38.65	25.83	43.77	0.18	18.27	38.65	17.12	37.67	0.03
Percentage blind, disabled, or aged	9.95	29.93	15.69	36.37	0.17	9.95	29.93	11.63	32.06	0.05
Percentage female	56.54	49.58	58.79	49.22	0.05	56.54	49.57	56.33	49.6	0.00
Percentage black	91.37	28.08	59.22	49.14	0.80	91.37	28.07	91.5	27.89	0.00
Percentage Hispanic	4.59	20.94	32.62	46.88	0.77	4.59	20.93	4.08	19.77	0.03
Percentage dual eligible	1.19	10.84	12.04	32.54	0.45	1.19	10.84	1.49	12.1	0.03
Number of months of Medicaid eligibility in lagged year prior to enrollment	11.16	2.48	11.55	1.92	0.17	11.16	2.48	11.07	2.62	0.04
Number of ED visits in calendar quarter prior to enrollment	1.04	1.09	0.13	0.55	1.05	1.04	1.09	0.92	1.17	0.10
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.09	2.79	0.5	1.58	0.26	1.09	2.79	0.82	2.07	0.11
Number of inpatient stays in calendar quarter prior to enrollment	0.06	0.46	0.03	0.22	0.10	0.06	0.46	0.04	0.28	0.06
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.2	1.28	0.11	0.77	0.09	0.2	1.28	0.16	0.88	0.04
Number of beneficiaries	3,026	—	1,162,494	—	—	3,026	—	9,077	—	—
Number of unique beneficiaries	3,026	—	317,782	—	—	3,026	—	8,051	—	—
Number of weighted beneficiaries	—	—	—	—	—	3,026	—	3,026	—	—

(continued)

Table 17. Mean Values and Standardized Differences of Variables in Propensity Score Model: U-Chicago (continued)

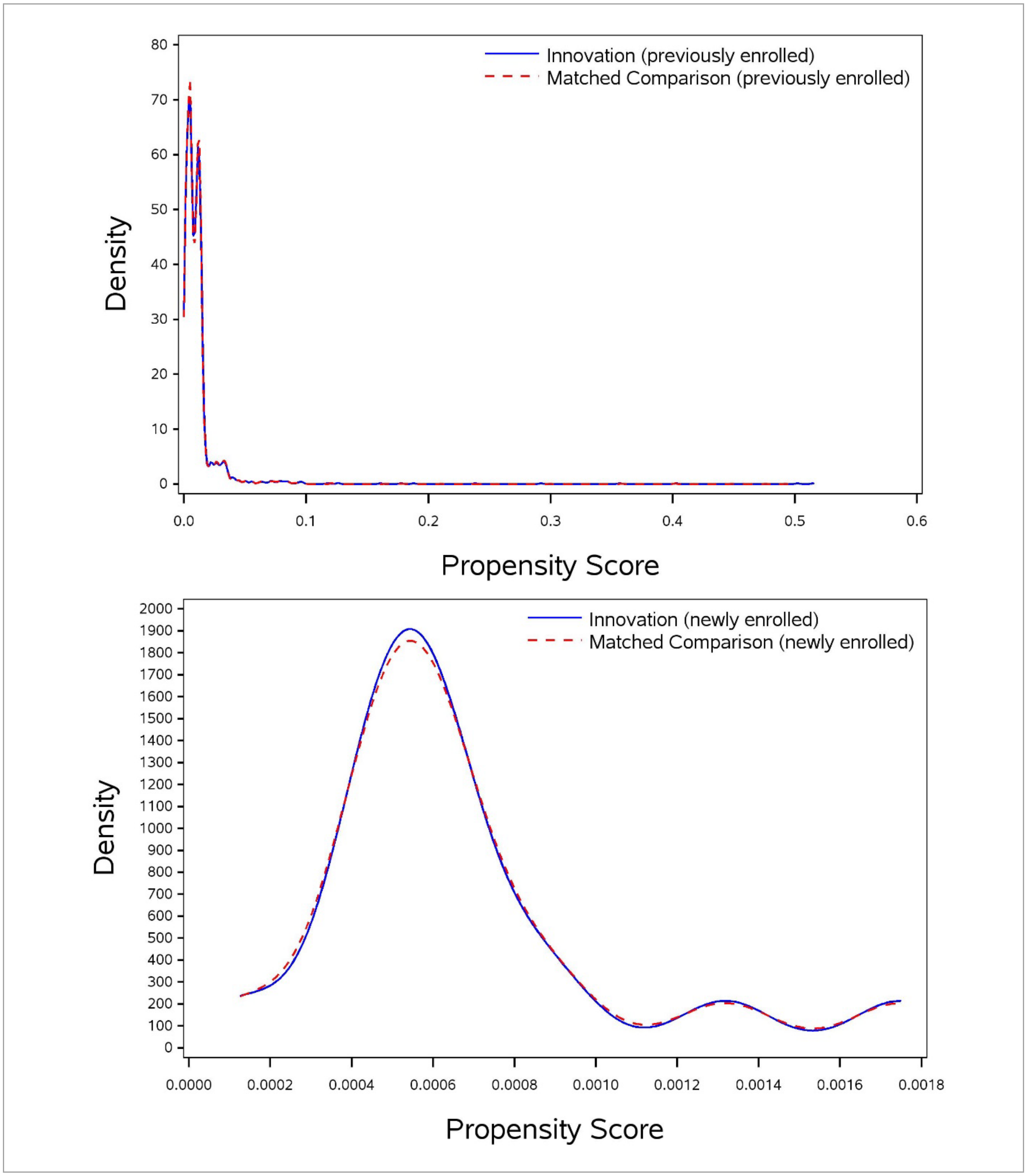
Variable	Before Matching: Innovation Group Mean	Before Matching: Innovation Group SD	Before Matching: Comparison Group Mean	Before Matching: Comparison Group SD	Standardized Difference	After Matching: Innovation Group Mean	After Matching: Innovation Group SD	After Matching: Comparison Group Mean	After Matching: Comparison Group SD	Standardized Difference
No Medicaid in Previous Quarter										
Age	12.88	17.33	11.24	13.65	0.10	12.88	16.78	10.83	13.60	0.13
Percentage adult and nondisabled	18.75	40.31	26.01	43.87	0.17	18.75	39.03	14.58	35.29	0.11
Percentage blind, disabled, or aged	0.00	0.00	0.93	9.58	0.14	0.00	0.00	0.00	0.00	
Percentage female	50.00	51.64	60.50	48.89	0.21	50.00	50.00	50.00	50.00	0.00
Percentage black	75.00	44.72	63.51	48.14	0.25	75.00	43.30	70.83	45.45	0.09
Percentage Hispanic	6.25	25.00	29.00	45.38	0.63	6.25	24.21	6.25	24.21	0.00
Percentage dual eligible	0.00	0.00	0.94	9.63	0.14	0.00	0.00	0.00	0.00	
Number of beneficiaries	16	—	36,416	—	—	16	—	48	—	—
Number of unique beneficiaries	16	—	36,124	—	—	16	—	48	—	—
Number of weighted beneficiaries	—	—	—	—	—	16	—	16	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).
ED = emergency department; SD = standard deviation; U-Chicago = University of Chicago.
— = not applicable.

After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups, and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 17). The results in Table 17 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables, except for the number of ED visits in the calendar year prior to enrollment for participants who were previously enrolled in Medicaid, and certain demographic variables for those who were not previously enrolled in Medicaid.

Figure 8 shows the distribution of the propensity scores for both the innovation and comparison groups. The figures demonstrate a very close overlap between the innovation and comparison groups' propensity scores for those previously enrolled in Medicaid as well as those newly enrolled in Medicaid. Therefore, we present the Medicaid claims analysis using both the innovation group and the matched comparison group.

Figure 8. Distribution of Propensity Scores for Comparison and Innovation Groups: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
U-Chicago = University of Chicago.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 18 reports Medicaid spending per patient in the eight quarters before and the three quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 9*** illustrates the Medicaid spending per beneficiary in Table 18 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in the innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

As shown by the baseline trend line for innovation enrollees, spending trends upward in the baseline quarters for the innovation beneficiaries. Innovation spending decreases in the first and second quarters for both the innovation and comparison groups. It is premature to draw conclusions about the impact of the innovation on spending among enrolled beneficiaries. As shown in Table 18, the standard deviation for spending is very high, representing the skewed nature of expenditures.

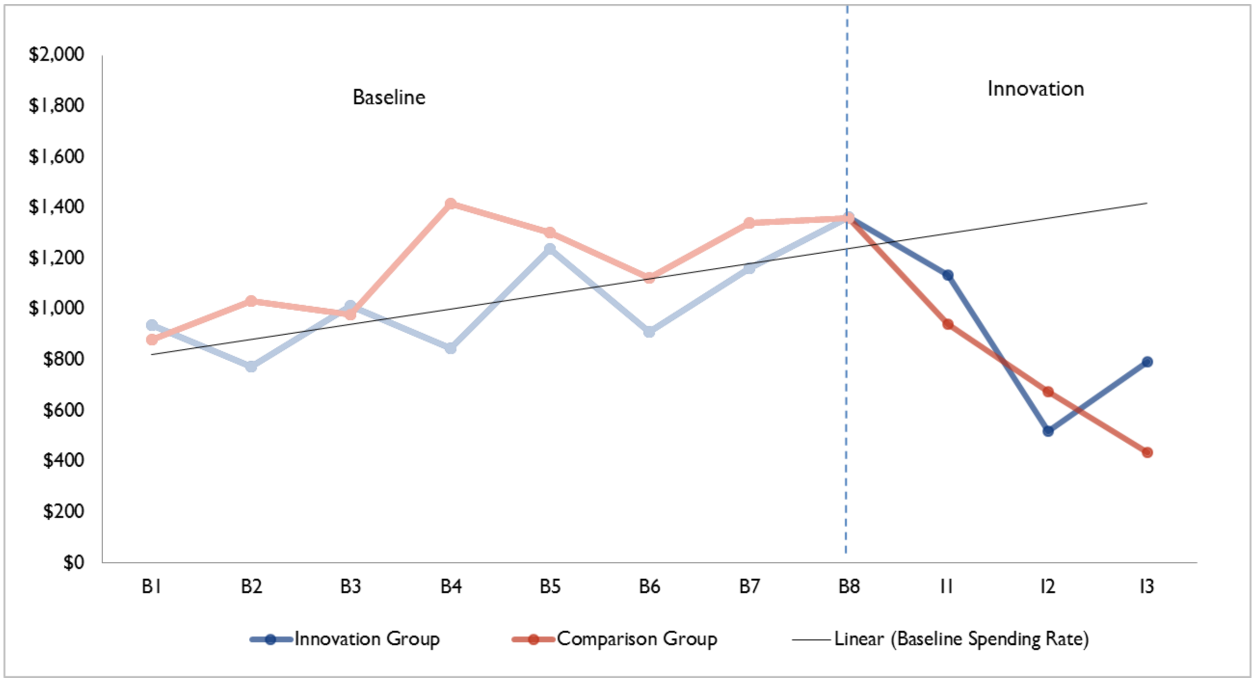
Table 18. Medicaid Spending per Participant: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Spending rate	$936	$774	$1,014	$847	$1,238	$910	$1,160	$1,361	$1,136	$521	$792
Std dev	$6,772	$4,193	$6,891	$5,383	$10,171	$4,675	$7,838	$7,568	$11,004	$2,782	$4,858
Unique patients	2,408	2,486	2,631	2,724	2,812	2,902	2,959	3,026	3,042	2,242	183
Comparison Group											
Spending rate	$879	$1,032	$980	$1,417	$1,300	$1,123	$1,341	$1,360	$939	$676	$434
Std dev	$2,779	$6,942	$3,732	$9,826	$8,030	$6,096	$8,709	$8,988	$5,715	$6,711	$1,344
Weighted patients	2,437	2,515	2,656	2,718	2,793	2,867	2,925	3,026	3,042	2,225	182
Savings per Patient											
	−$57	$258	−$34	$570	$63	$213	$181	−$1	−$197	$156	−$358

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 9. Medicaid Spending per Participant: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
U-Chicago = University of Chicago.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their matched comparison group. The weighted average quarterly spending differential in the innovation period is 202 (90% CI: –50, 454), indicating a loss. This effect is not statistically significant at the 10 percent level. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

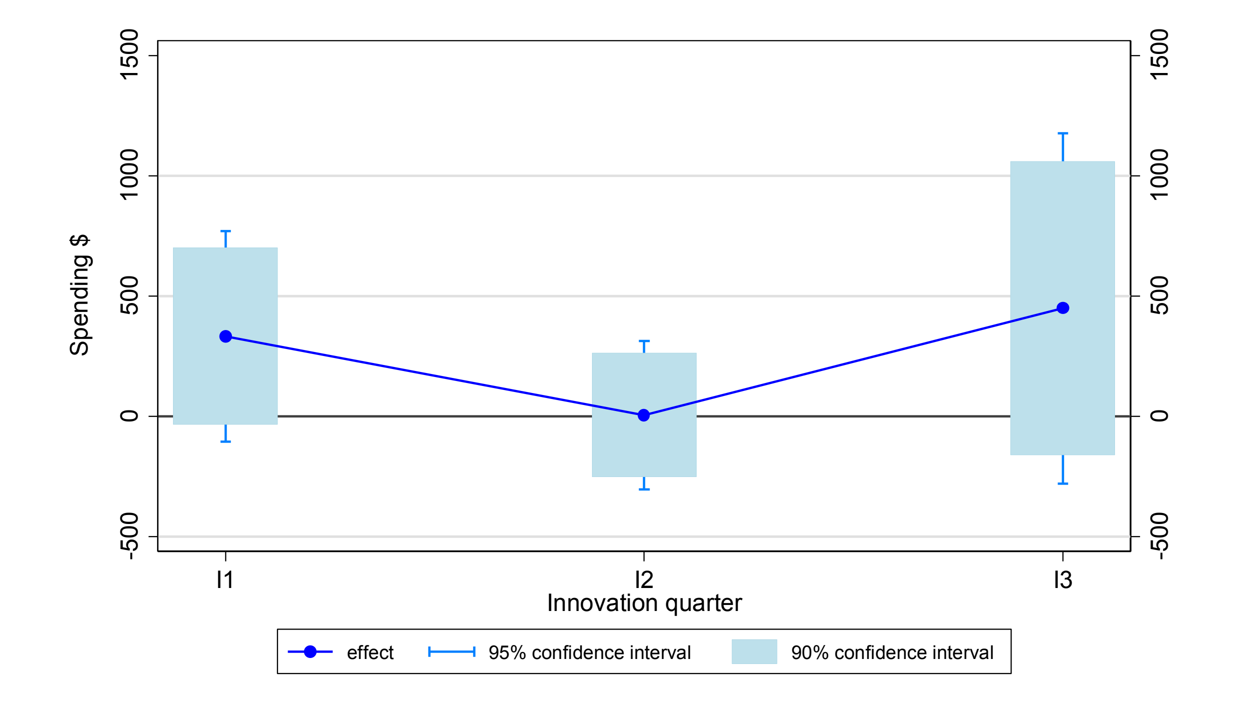
In addition to the average effect over the innovation period, we present quarterly effects. ***Table 19*** presents the results of an OLS regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly difference-in-differences estimates. In all three innovation quarters, spending among the innovation group is higher than that of the comparison group, although the estimates are not statistically significant.

Table 19. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	$333	$224	0.137
I2	$4	$158	0.978
I3	$449	$372	0.228
Overall average	$202	$153	0.187
Overall aggregate	$1,103,594	$836,332	0.187
Overall aggregate (IY1)	$1,103,594	$836,332	0.187

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; U-Chicago = University of Chicago.

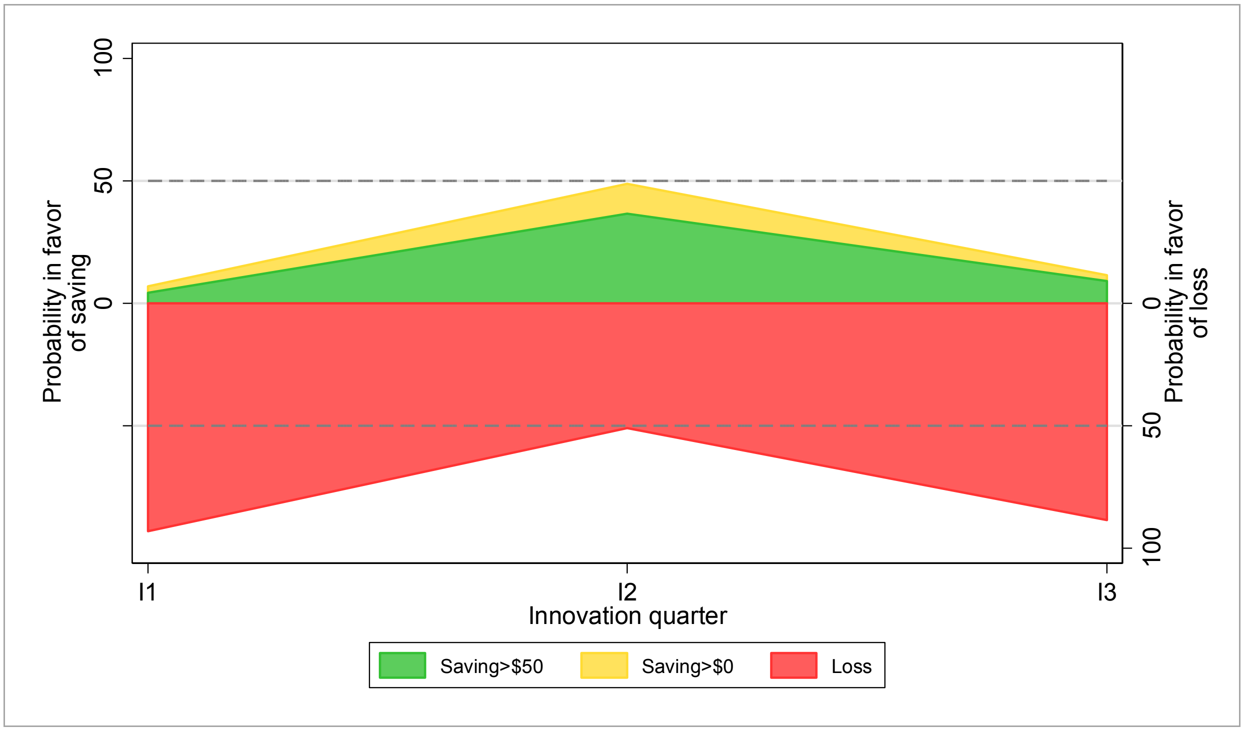
Figure 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
OLS = ordinary least squares; U-Chicago = University of Chicago.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates are higher for the innovation group than the comparison group in all three innovation quarters, we see a high probability of loss.

Figure 11. Quarterly Strength of Evidence in Favor of Savings/Loss: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
U-Chicago = University of Chicago.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 20*** and ***Figure 12***. Inpatient admissions fluctuate around the baseline trend line and trend upward in the baseline period for the innovation beneficiaries. Inpatient admissions fall during the first and second innovation quarters for the innovation group, and fall slightly for the comparison group.

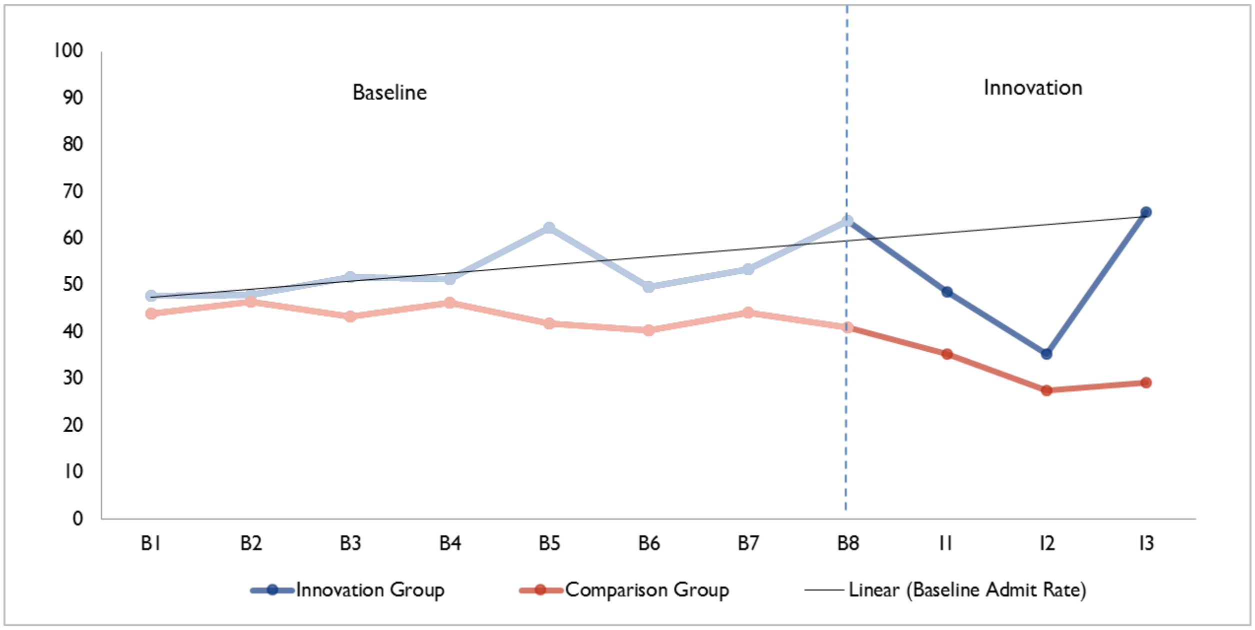
Table 20. All-Cause Inpatient Admissions Rate per 1,000 Participants: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Admit rate	48	48	52	51	62	50	53	64	49	35	66
Std dev	355	317	367	397	420	334	391	463	330	245	341
Unique patients	2,408	2,486	2,631	2,724	2,812	2,902	2,959	3,026	3,042	2,242	183
Comparison Group											
Admit rate	44	47	43	46	42	40	44	41	35	28	29
Std dev	226	253	236	233	178	157	162	172	172	143	122
Weighted patients	2,437	2,515	2,656	2,718	2,793	2,867	2,925	3,026	3,042	2,225	182
Innovation − Comparison Rate											
	4	1	8	5	20	9	9	23	13	8	36

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Participants: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
U-Chicago = University of Chicago.

2.11.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 4 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −4, 12). In addition to the average effect over the innovation period, we present quarterly effects.

Table 21 presents the results of a negative binomial count model with the dependent variable set to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. In all three innovation quarters, the number of inpatient admissions among the innovation group is higher than the comparison group, although the estimates are not statistically significant.

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	4	7	0.541
I2	2	6	0.806
I3	28	27	0.292
Overall average	4	5	0.404
Overall aggregate	21	25	0.404
Overall aggregate (IY1)	21	25	0.404

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; U-Chicago = University of Chicago.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 22*** and ***Figure 13***. Hospital unplanned readmission rates fluctuate around the trend line prior to the innovation's launch, although the trend is rising. The unplanned readmission rates fall below the trend line in the quarters after innovation launch for both innovation and comparison groups.

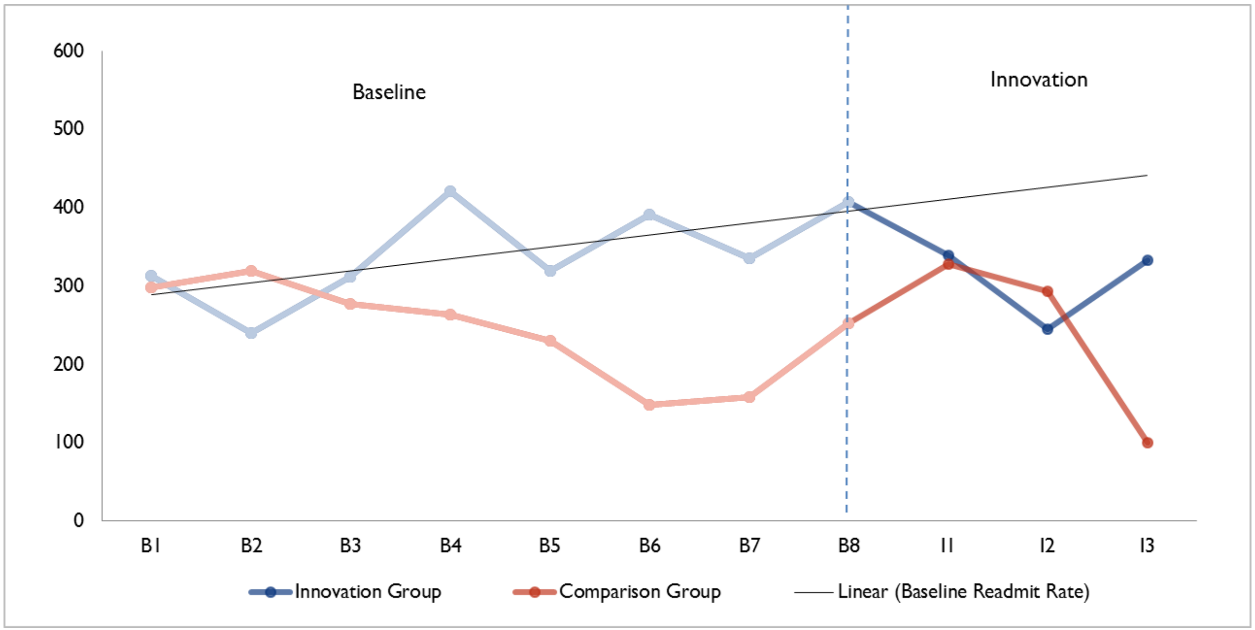
Table 22. Hospital Unplanned Readmissions Rates per 1,000 Admissions: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
Readmit rate	313	240	312	421	320	392	336	408	340	245	333
Std dev	464	427	463	494	466	488	472	491	474	430	471
Total admissions	83	96	109	114	147	120	131	152	106	49	9
Comparison Group											
Readmit rate	299	320	278	263	230	148	159	253	329	293	100
Std dev	458	466	448	440	421	355	365	435	470	455	300
Total admissions	83	89	91	100	92	95	107	97	83	42	3
Innovation − Comparison Rate											
	15	−80	34	158	90	244	177	155	11	−48	233

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 13. Hospital Unplanned Readmissions Rates per 1,000 Admissions: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
U-Chicago = University of Chicago.

2.12.2 Regression Results

Table 23 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −87 per 1,000 inpatient admissions (−8.7 percentage points), indicating that the innovation−comparison difference is 8.7 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant at the 10 percent level (90% CI: −196, 22).

Table 23. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Inpatient Admissions: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
Overall average	−87	66	0.191
Overall aggregate	−14	11	0.191

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
U-Chicago = University of Chicago.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 24*** and ***Figure 14.*** The ED visit rate remains stable before innovation launch and spikes upward during the last baseline quarter because of patient enrollment at ED visit, as mentioned previously. During the first three innovation quarters, the ED visit rate remains flat and almost identical for both the innovation group and the comparison group.

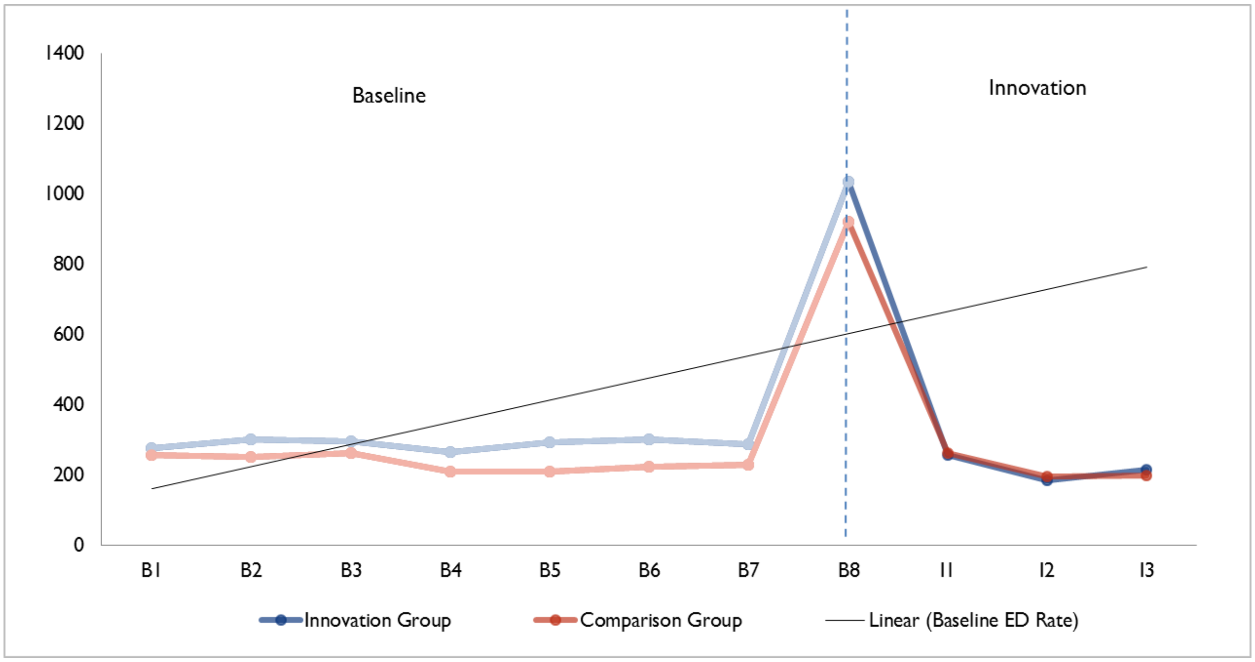
Table 24. ED Visits per 1,000 Participants: U-Chicago

Awardee Number: 1C1CMS330997
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Baseline Quarters								Innovation Quarters		
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3
Innovation Group											
ED rate	278	301	296	266	293	304	289	1037	258	185	216
Std dev	766	880	860	788	975	840	981	1086	774	639	592
Unique patients	2,408	2,486	2,631	2,724	2,812	2,902	2,959	3,026	3,042	2,242	183
Comparison Group											
ED rate	258	254	265	212	210	225	231	922	263	197	199
Std dev	473	440	470	469	437	399	464	717	563	419	421
Weighted patients	2,437	2,515	2,656	2,718	2,793	2,867	2,925	3,026	3,042	2,225	182
Innovation − Comparison Rate											
	19	48	31	54	83	79	58	115	−5	−12	17

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays/number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 14. ED Visits per 1,000 Participants: U-Chicago



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
ED = emergency department; U-Chicago = University of Chicago.

2.13.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 51 ED visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: −67, −35). In addition to the average effect over the innovation period, we present quarterly effects.

Table 25 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. In all three innovation quarters, the number of ED visits among the innovation group is lower than that of the comparison group, and the estimates are statistically significant, except for the last quarter, due to small sample size.

Table 25. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	−55	14	<0.001
I2	−48	13	<0.001
I3	−16	45	0.721
Overall average	−51	10	<0.001
Overall aggregate	−279	53	<0.001
Overall aggregate (IY1)	−279	53	<0.001

Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, dual eligibility, number of months of Medicaid eligibility status during the calendar year prior to the innovation, and whether the beneficiary was not enrolled in Medicaid in the quarter prior to enrollment. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; U-Chicago = University of Chicago.

2.14 Discussion: Medicaid Results

The four measures provide descriptive data on Medicaid patients enrolled in the U-Chicago innovation before, during, and after the launch of the innovation. These measures may not provide a complete evaluation picture of the U-Chicago innovation for reasons previously stated in the discussion under Medicare claims analysis. The four measures listed above are reported at the aggregate level for all Medicaid patients. The regression results indicate that the innovation group beneficiaries incurred higher spending, had more inpatient hospital admissions, and a lower probability of having an unplanned readmission, although the estimates are not statistically significant. The regression results also suggest that the innovation group beneficiaries had fewer ED visits than the comparison group, and the results are statistically significant. These findings are short-term effects of the innovation because there are only three quarters of innovation data. Conclusions about the long-term effectiveness of the innovation will be drawn as more data become available.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries who we were able to match with the identifiers provided by the site, and over 80 percent came from the U-Chicago clinical sites. These beneficiaries represent 2.4 percent of the overall population reached by the innovation.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

U-Chicago submitted data to RTI that are current through June 2015. ***Table 26*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. Results of analyses of all of the measures in the table are included in this annual report.

Table 26. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Diabetes	Percentage of patients with diabetes who received an HbA1c test	Data received from U-Chicago	Yes
	Hypertension	Percentage of patients with hypertension who had a blood pressure reading	Data received from U-Chicago	Yes
Health outcomes	Diabetes	Percentage of patients with diabetes who had HbA1c > 9.0%	Data received from U-Chicago	Yes
	Hypertension	Percentage of patients with hypertension with blood pressure < 140/90 mm Hg	Data received from U-Chicago	Yes
	Weight	Percentage of patients who are overweight (BMI 25.0–29.9) or obese (BMI > 30)	Data received from U-Chicago	Yes

BMI = body mass index; U-Chicago = University of Chicago.

Clinical effectiveness refers to the extent to which patients with certain health conditions are provided with appropriate clinical care. Clinical effectiveness measures for U-Chicago include the percentage of participants with diabetes who received an HbA1c test and the percentage of patients with hypertension who received a blood pressure reading. The subsections below describe the results of each of these measures.

We also examined health outcomes among patients with diabetes, hypertension, and those who were overweight or obese. The following run charts take into account rolling enrollment. The innovation quarters (Is) are based on individual enrollment dates. For example, I1 is equal to the first quarter of enrollment for all participants, regardless of their actual enrollment date. Patients enrolled early in the innovation will have health outcome data in more innovation quarters over time than those enrolled later in the innovation period. Therefore, the number of patients with health outcome data per innovation quarter tends to drop substantially as the number of quarters enrolled increases. We provide data when at least 20 patients had a test or reading within the innovation quarter.

For U-Chicago, the enrollment date reflects the date when a patient received a HealtheRx. The lab data for the results below were obtained during the first visit in which a patient received a HealtheRx, as well as any follow-up visits through Q12. Thus, the denominators are based on the number of patients who had a visit in which they received a test during each quarter following their first enrollment quarter.

Patients were unlikely to have a visit each quarter after they received a HealtheRx. Therefore, the patients included in the denominator for each quarter change over time, and the number of quarters in which patients were eligible to have a lab result is based on the quarter in which they were enrolled. For example, the 3,608 patients enrolled in Q4 (Apr–Jun 2013) may have data in any of the following eight quarters (i.e., Q5–Q12) reported in this annual report. The additional 10,329 patients enrolled in Q5 (Jul–Sep 2013) may have data in any of the following seven quarters (Q6–Q12). Thus, only 13,937 patients were eligible to have lab data for more than five quarters after enrollment. As such, over time the denominators in the results below drop, making it difficult to draw conclusive interpretations of the findings.

2.16 Diabetes

For clinical effectiveness, we received data on whether patients with diabetes received an HbA1c test during the innovation period. This allowed us to examine whether appropriate clinical services were provided to those with diabetes during the innovation.

Evaluation Question

- What percentage of patients with diabetes received an HbA1c test during the innovation period?

We received health outcome data for HbA1c among those with diabetes, which allowed us to address the question of whether the percentage of patients with diabetes with poor HbA1c control decreased over the course of the innovation.

Evaluation Question

- Has the percentage of patients with diabetes with poor HbA1c control decreased over time among those who received at least one HealtheRx?

2.16.1 Descriptive Results

Table 27 shows the percentage of patients with diabetes who received an HbA1c test during the innovation period. Less than one-third (32.4%) of patients with diabetes received an HbA1c test.

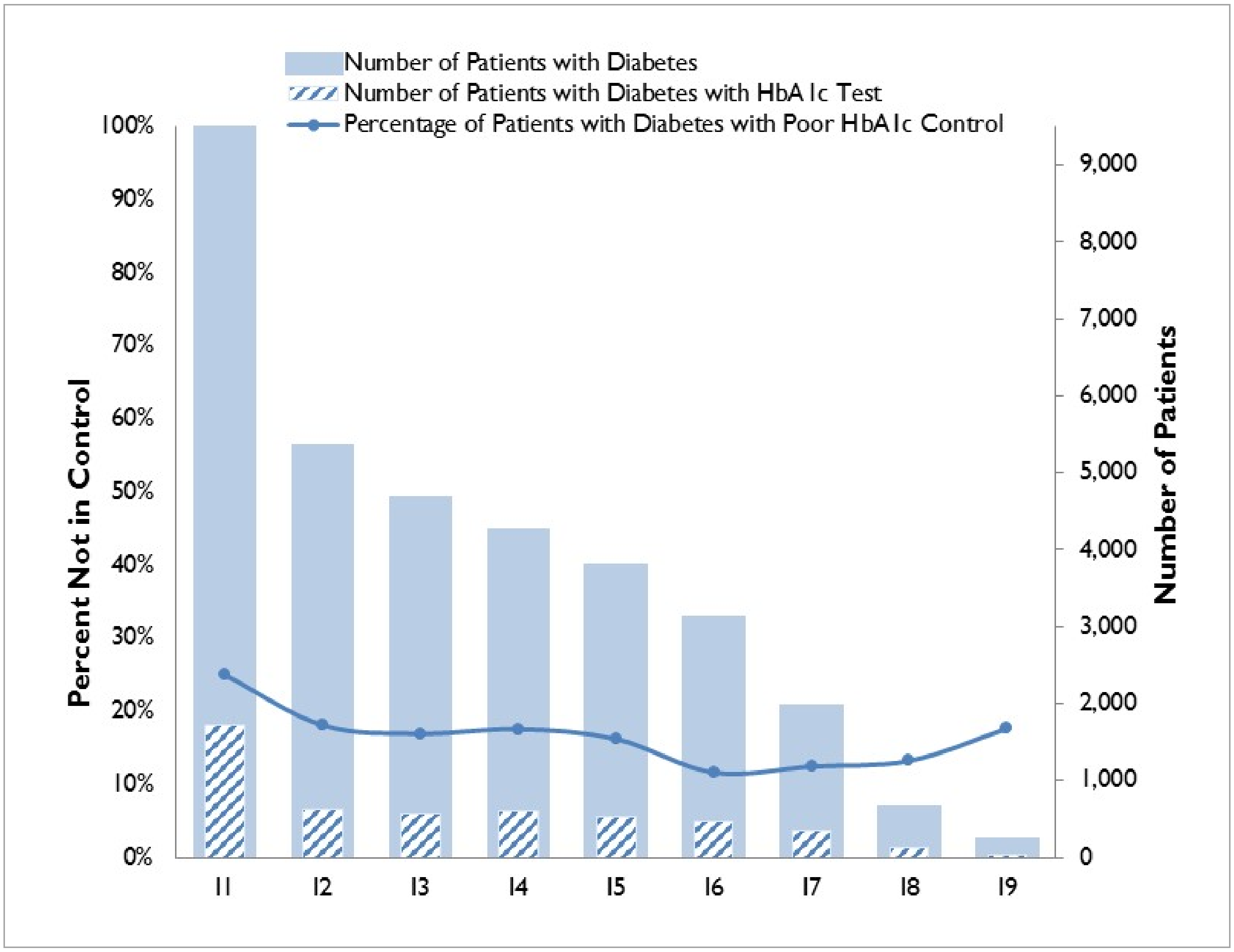
Table 27. Percentage of Patients with Diabetes Who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Diabetes (n=9,465)	
Percentage of patients with diabetes who received an HbA1c test	32.4

Source: Patient-level data provided to RTI by U-Chicago.
U-Chicago = University of Chicago.

Figure 15 presents the percentage of patients with diabetes with an HbA1c test indicating poor control (i.e., HbA1c > 9%) over time. The denominator represents the number of diabetes patients who received an HbA1c test for each quarter. The numerator represents the number of diabetes patients who received an HbA1c test that was > 9.0 percent. As shown in the figure, the percentage of patients with poor HbA1c control fluctuated somewhat, but declined over time between I1 and I8. More specifically, the percentage of patients with poor HbA1c control declined from approximately 25 percent in I1 to approximately 13 percent in I8. This finding suggests that the innovation may have helped reduce the percentage of patients with poor HbA1c control over time. However, as noted above, the denominator decreases substantially across the innovation quarters because fewer patients were eligible to have a test result in later quarters, making interpretation of the findings tentative.

Figure 15. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9
●	Percentage of patients with diabetes with poor HbA1c control	25.0	18.1	17.0	17.6	16.2	11.6	12.5	13.2	17.6
	Number of patients with diabetes	9,465	5,221	4,537	4,119	3,669	2,980	1,822	520	101
	Number of patients with diabetes with HbA1c test	1,718	619	566	603	537	465	353	136	34

Source: Patient-level data provided to RTI by U-Chicago.

2.17 Hypertension

U-Chicago provided data on whether patients with hypertension received a blood pressure reading, allowing us to address the question of whether appropriate clinical services were provided to those with hypertension during the innovation.

> ***Evaluation Question***
> - What percentage of patients with hypertension received a blood pressure reading during the innovation period?

Blood pressure data for those with hypertension allowed us to address the question of whether the percentage of patients with hypertension with blood pressure control increased over the course of the innovation.

> ***Evaluation Question***
> - Has the percentage of patients with hypertension with blood pressure control increased over time among those who received at least one HealtheRx?

2.17.1 Descriptive Results

Table 28 shows that nearly all patients with hypertension received a blood pressure reading during the innovation period. Nearly three-quarters (72.9%) of patients with hypertension received at least one blood pressure reading.

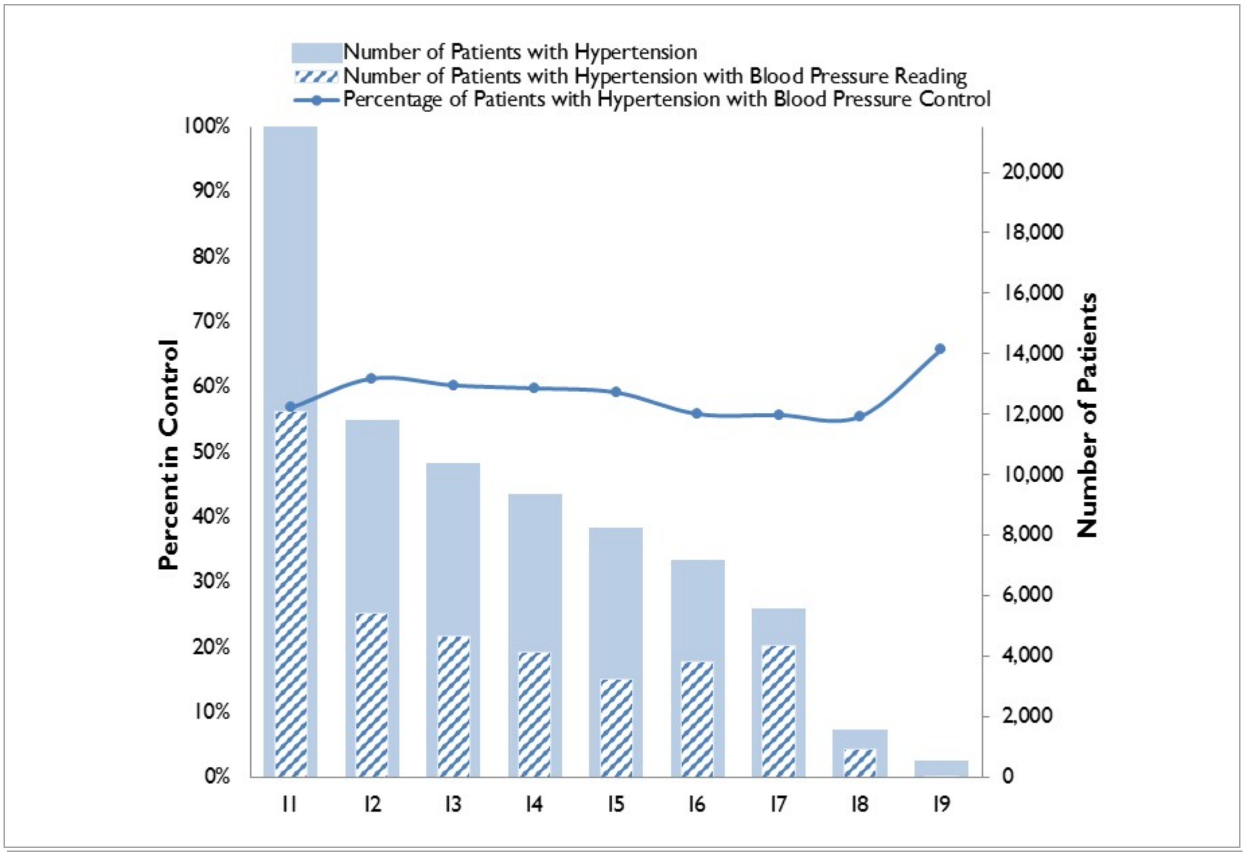
Table 28. Percentage of Patients with Hypertension Who Received Clinical Services

Measure	Percentage of Patients Receiving Clinical Services
Hypertension (n=21,374)	
Percentage of patients with hypertension who received a blood pressure reading	72.9

Source: Patient-level data provided to RTI by U-Chicago.

Figure 16 presents the percentage of patients with hypertension who had a blood pressure reading indicating good control (i.e., < 140/90 mm Hg) over time. The denominator is the number of hypertension patients who received a blood pressure reading for each quarter. The numerator is the number of hypertension patients who received a blood pressure reading of < 140/90 mm Hg. As shown in the figure, the percentage of patients with blood pressure control remained fairly consistent between I1 and I8. However, among those with blood pressure readings eight quarters after receiving their first HealtheRx, the percentage of those with blood pressure control increased from approximately 56 percent in I8 to approximately 66 percent in I9. Relatively few patients are in the quarters beyond I8. Therefore, the innovation does not appear to have increased the percentage of patients with blood pressure control over time. However, as noted above, the denominator decreases substantially across the innovation quarters because fewer patients are eligible to have a test result in later quarters, making interpretation of the findings tentative.

Figure 16. Percentage of Patients with Hypertension with Blood Pressure Control over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9
●	Percentage of patients with hypertension with blood pressure control	56.8	61.4	60.3	59.8	59.2	55.9	55.7	55.5	65.8
	Number of patients with hypertension	21,374	11,455	10,022	9,002	7,894	6,834	5,221	1,224	189
	Number of patients with hypertension with blood pressure reading	12,107	5,429	4,679	4,138	3,238	3,820	4,356	919	38

Source: Patient-level data provided to RTI by U-Chicago.

2.18 Body Mass Index

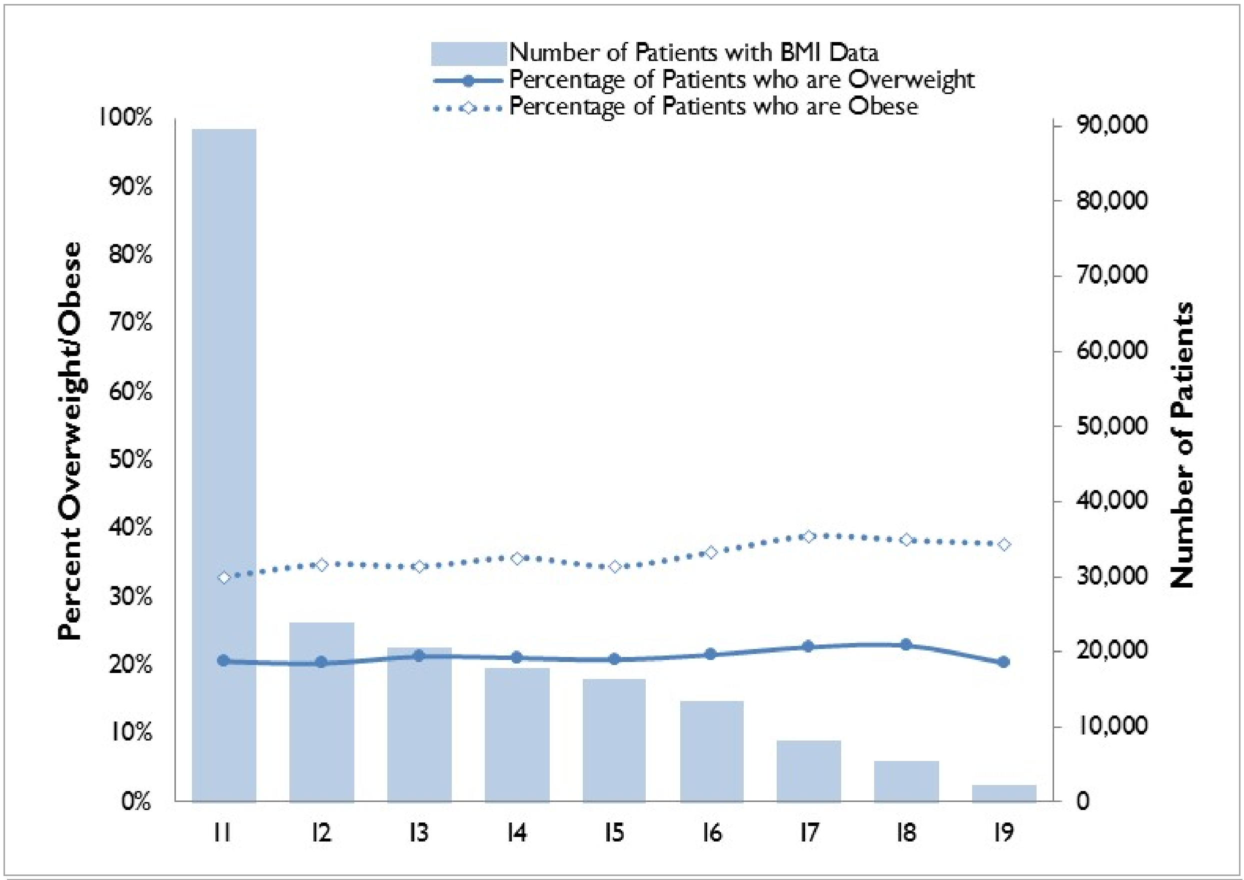
Body mass index (BMI) data provided by U-Chicago allowed us to address the question of whether the percentage of patients who were overweight or obese decreased over the course of the innovation.

Evaluation Question

- Has the percentage of overweight or obese patients decreased over time among those who received at least one HealtheRx?

Figure 17 presents the percentage of overweight and obese patients over time. The denominator represents the number of patients with height and weight data available to calculate BMI. The numerator represents the number of those patients who were overweight or obese. As shown in the figure, the percentage of overweight and obese patients remained relatively consistent over time. The percentage of overweight patients increased slightly from approximately 21 percent in I1 to approximately 23 percent in I8, and then declined slightly to approximately 20 percent in I9. The percentage of obese patients increased from approximately 33 percent in I1 to approximately 39 percent in I7, and then declined slightly to approximately 38 percent. Thus, the percentage of overweight and obese patients did not decrease over time among those who received a HealtheRx. However, as noted above, the denominator decreased substantially across the innovation quarters because fewer patients were eligible to have a test result in later quarters, making interpretation of the findings tentative.

Figure 17. Percentage of Overweight and Obese Patients over Time



	Quarter	I1	I2	I3	I4	I5	I6	I7	I8	I9
●	Percentage of patients who are overweight	20.6	20.3	21.3	21.1	20.9	21.6	22.7	22.9	20.4
◊	Percentage of patients who are obese	32.9	34.8	35.9	35.8	34.4	36.6	38.9	38.3	37.8
	Number of patients with BMI data	88,047	22,195	18,798	16,153	14,604	11,764	6,574	3,704	717

Source: Patient-level data provided to RTI by U-Chicago.
BMI = body mass index.

2.19 Discussion: Awardee-Specific Data

We report findings for health outcomes among patients with diabetes, hypertension, and weight-related issues. The percentage of diabetes patients with poor HbA1c control declined slightly over time, from approximately 25 percent in I1 to approximately 13 percent in I8. The percentage of patients with hypertension with blood pressure control remained fairly consistent over time. However, a 10 percent point increase occurred between I8 (55.5%) and I9 (65.8%). The percentage of obese patients increased slightly over time. Because the denominator decreased substantially across the innovation quarters as fewer patients were eligible to have a test result in later quarters, interpretation of the findings should be made with caution. Furthermore, because we have not conducted inferential analyses, we cannot determine whether any of the changes over time are significant.

2.20 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 29*** lists the quantifiable measures of implementation and their status as of June 30, 2015, that RTI obtained from U-Chicago's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following sections are based on data from Q11 and Q12 and, to provide context, may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation.

Table 29. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*

(continued)

Table 29. Measures of Implementation (continued)

Evaluation Domains	Subdomains	Measures	Source
Implementation effectiveness	Reach	Number/percentage of unique (unduplicated) participants who received a HealtheRx	Data received from U-Chicago
		Number/percentage of clinical sites that were approached regarding implementing this innovation	Data received from U-Chicago
	Dose	Number of tailored HealtheRx reports generated for each unique patient (unduplicated count)	Data received from U-Chicago
		Number of times information specialists were contacted by phone, text, e-mail, in person, or instant message	Data received from U-Chicago

FTE = full-time equivalent; U-Chicago = University of Chicago.

2.21 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.21.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation had 16.5 full-time equivalent (FTE) staff members, 1.0 FTE below projection. Between Q11 (June 2014) and Q12, U-Chicago lost about 1.0 FTE. During the innovation, U-Chicago hired 33.55 FTE staff. A majority of the staff provided part-time support for the MAPSCorps portion of the innovation to document, update, and expand community resources used to create the HealtheRx. Each summer college students served as supervisors to young adults (who were not paid from CMMI funds) to collect the MAPSCorps data. The role of the information specialist differed from MAPSCorps college students and young adults; information specialists conducted telephone interviews with community-based organizations to inventory the services each organization provided and helped to educate and connect patients to community resources that were listed on their tailored HealtheRx.

As described above, in Year 3, U-Chicago adapted the information specialist model to include two new interview specialists, who collected information from businesses and organizations that provide health-related services in the targeted zip codes. Although information specialists previously collected such information, hiring two part-time staff members to focus exclusively on phone interviews freed the information specialists to focus on increasing outreach in the target population and improving the accuracy of data in the CommRx. U-Chicago hired and trained a third person to manage the information specialists. With this new staffing model in place during Year 3, staff made 13,902 calls to community-based service providers, solicited the completion of 1,433 initial service-level surveys, and conducted 2,068 follow-up interviews with providers. The most commonly identified services included grocery stores (425 locations), dental providers (256 locations), individual counseling services (257 places), and public fitness facilities (243 places). The information specialists attempted to collect some service information via in-person visits; however, transportation, weather, and scheduling hindered this work. Thus, telephone data collection remained the primary mechanism for collecting those data. Retaining the interview specialists also impacted the new information specialist model. Although one interview specialist remained with the project and exceeded call volume expectations, the second interview specialist, hired on a part-time basis, left the project after only a few months.

Overall, U-Chicago experienced low turnover in project management staff. Turnover was highest among the information specialist staff. Despite the extensive training opportunities provided to staff and the revisions to the information specialist model, turnover continued to be high. Information specialists left the project when permanent or better-paying positions became available. In 2015, one interviewee suggested that retention may have been better if information specialists had been recruited from and physically worked at the CHCs involved in service delivery.

The project reported that at the end of Year 3, the Workforce Development Group began to provide information and resources to the information specialists as they prepared to find new jobs after HCIA funding ended. Information specialists participated in a workshop in April 2015 to help them review skills they developed and explored how these skills could be used for future employment. Although the information specialists helped connect patients to community resources and updated the community resources that the MAPSCorps summer staff identified, the technology for creating the HealtheRx is not dependent on information specialists. Updating the community resources in the database will need to be continued by MAPSCorps summer staff or additional staff.

2.21.2 Skills, Knowledge, and Training

Between Q11 and Q12, U-Chicago provided 187 hours of training to 187 community-based nonclinical personnel. A total of 1,608 trainees were trained over 3 years for a total of 5,017 hours (see ***Table 30***). Trainings included 19 different modules. The most common training was the 1-hour provider course for clinic staff who printed and disseminated the HealtheRxs. Others were trainings for information specialists (some offered through the Graham School) and trainings for MAPSCorps summer staff.

Table 30. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	187	187
Since inception	5,017	1,608

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

As RTI reported in 2015, U-Chicago had challenges in maintaining its initial information specialist training program, which was designed by the Graham School. Although the Graham School certificate program was created specifically for the information specialist staff, the intent was to design and offer the training to HealtheRx staff as well as others seeking the necessary skills to work in similar environments or roles. Through the virtual site visit interviews, we learned that the Graham School had tuition/revenue targets it had to meet to keep the program in place, and because of low enrollment, the training program closed. U-Chicago reported that meeting revenue targets through sufficient enrollment was a challenge in implementing such training programs at private organizations such as U-Chicago, which are not accustomed to providing training for students from diverse educational and training backgrounds (GED, associate's degree, bachelor's degree, or more advanced degree or training).

Although U-Chicago did not sustain the Graham School initial trainings, the management team transitioned training opportunities to a Web-based learning management system. The new system allowed the management team to offer trainings via Web, archive the training, and make them more widely accessible to new staff or staff who needed refresher training. In Year 3, the modules described below were entered into the Brainshark system.

- Modules 2, 3, and 4 of the information specialist training
- Self-guided training for providers at clinical sites on the HealtheRx workflow and engaging patients in the HealtheRx
- Modules for the care coordination pilots with Friend Family and Chicago Family health centers
- MAPSCorps training videos

2.22 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

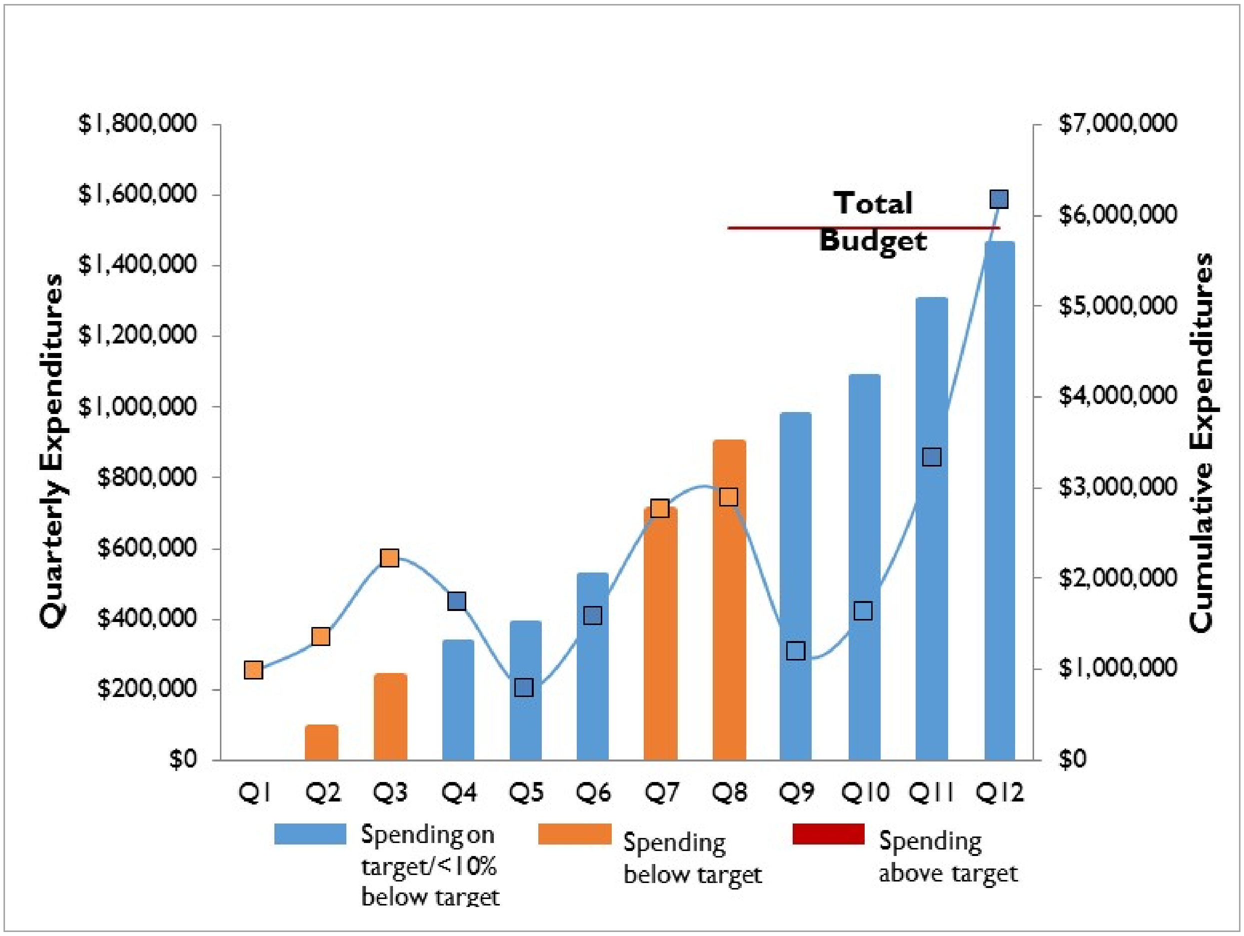
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.22.1 Award Execution

The annual report highlights the significance of U-Chicago's expenditure rates (***Figure 18***) on implementation. As of June 2015 (Q12), U-Chicago spent 97.3 percent of its total budget, which is at the projected target. The cost overrun may be due to the integration of SMS texting at a few sites. The original application discussed use of SMS texting by the information specialists, but did not include a pilot testing phase and necessary budgetary line items required to provide this service to a few sites. The slight overrun may also be due to U-Chicago's expansion of the target area from 10 to 16 zip codes, which required additional time and resources to identify community resources in the 6 additional zip codes.

Figure 18. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.22.2 Leadership

Throughout the evaluation, leadership and governance infrastructure remained clearly defined. For example, the leadership for different committees and working groups had well-defined channels for communication and for achieving specific implementation milestones. As the primary lead for the multisite innovation, U-Chicago's CommRx innovation is nested within the University of Chicago Biological Sciences Division. The designated primary leader of the innovation (project director) is principal investigator of the South Side Health and Vitality Studies and is also affiliated with the University of Chicago Medical Center Urban Health Initiative (UHI).

Since inception of the award, the steering committee, chaired by the project director, led the CommRx innovation. Other members of the steering committee included the leaders of the four working groups (technology, workforce, clinical partners, and research and evaluation), key consultants, and medical center legal counsel. In Year 3, six Steering Committee meetings took place as well as three meetings of all CommRx collaborators. These collaborators included the core operations team, clinical partners, health information technology (HIT) partners, workforce development partners, and information specialists.

In addition to these meetings, the implementation partners, through the working groups, developed key components of the innovation. Feedback from all working groups informed iterative revisions or redesigns of the key components. The core operations team supported the working groups and facilitated the flow of information among the groups. Program and organizational leadership and working groups addressed issues and challenges related to achieving the innovation's milestones.

U-Chicago's CommRx innovation also obtained commitment of designated leaders at each implementation site: three CHC corporations and UCMC, totaling 33 clinical sites. Ultimately, the site leaders determined the workflow and how the innovation was implemented at the site. RTI interviewed a few partner sites in May 2014 and learned that allowing clinical sites the flexibility to tailor the delivery of the HealtheRx, rather than forcing the sites into a procedure that does not align with the resources available (e.g., printer in the exam room) or staff availability (e.g., delivery of the HealtheRx by a nurse vs. a checkout person), minimized burden and facilitated greater buy-in by providers and practices.

2.22.3 Organizational Capacity

The University of Chicago Medicine existing Urban Health Initiative (UHI) helped support implementation of CommRx. Also with support of UHI, the University of Chicago South Side Health and Vitality Studies team had experience with implementing similar community-engaged innovations such as MAPSCorps. MAPSCorps engaged high school and college-aged students to collect information about community health resources used to populate the CommRx database. U-Chicago's core operation team continued a collaborative relationship with the University of Chicago Medicine Chicago Biomedicine Information Services (CBIS) and the University of Chicago Information Technology Services, which served as the internal technology development team. The proximity of CommRx's core operation with the University of Chicago and University of Chicago medical center's technology teams allowed the core operation team to leverage the expertise of faculty and administrative leadership across the institution.

U-Chicago also leveraged its strong internal technology expertise and created new HIT partners to manage different EHR systems across the 33 sites. This ability to adapt how CommRx communicates with the various EHR systems and workflows allowed U-Chicago to make progress in the generation of HealtheRxs. Despite occasional delays with sites changing EHR vendors and trying to achieve Meaningful Use standards, the technology partners remained invested in ensuring that the innovation remained compatible with and useful to all participating sites. Throughout the 3-year period, the CommRx innovation grew rapidly from one clinical site by Q3 to 33 clinical sites by Q12. This growth was driven by active recruitment of clinical sites and rapid onsite implementation.

The SMS texting pilots allowed the team to explore innovative ways for the information specialists to communicate with patients who received a HealtheRx. U-Chicago developed a workflow for communication with those who consented to be contacted via text message. This workflow allowed for patient follow-up, if desired, and options for follow-up if the patient chose not to reach out to the information specialists. Although more work must be done to fine-tune the SMS texting process, this pilot provided key lessons about how to work with a vendor to customize the system and optimize the usefulness of this technology (e.g., queuing automated messages to send at a specific time). The system was set up to allow multiple opportunities for consent to participate, and to determine what to expect from different populations that may use texting for communication. Initial findings showed similar rates of use by males and females but some differences by age group in willingness to use texting. Access to additional data was still needed to see if the differences observed were statistically significant.

2.22.4 Innovation Adoption and Workflow Integration

As mentioned previously, HealtheRx was launched at an additional 8 sites in Q11, for a total of 14 sites added in Year 3 and 33 sites during the entire period. Uptake at the Chicago Family Health Center and Esperanza Medical Center sites was initially slow because of staffing capacity issues and competing workflow priorities. To improve uptake, the Clinical Partners Working Group and Northwestern University Chicago Health Information Technology Regional Extension Center (CHITREC) conducted visits to each of the sites to identify and resolve any technical or workflow issues. Afterward, staff began to observe a noticeable increase in the number of HealtheRxs generated each week. The ability to remain flexible and work with the unique needs and workflow processes of different sites helped to improve adoption of the innovation in various clinical environments. For example, some clinical sites expressed interest in customizing the HealtheRx to their sites by including their care coordinators' photo and contact information instead of the information specialists, or by prioritizing partner service providers over those that may be closest to a patient's home.

In Q12, U-Chicago reported that it adapted the CommRx system so that the information specialist could tailor the HealtheRxs to the unique needs or requests of patients. Whereas CommRx previously autogenerated the HealtheRx, information specialists gained the ability to filter the services that appeared on the HealtheRx by eligibility requirements, including age, gender, language, cost, and geography. To make the HealtheRx more patient-centered, information specialists could also choose to include certain service providers and create HealtheRxs based on a patient's address, age, or certain health conditions or behaviors. In addition, information specialists could select specific services such as groceries or group exercise classes to be included on the HealtheRxs instead of the services being driven by a patient's diagnosis or characteristics alone.

Finally, in Q11, the team explored the possibility of care coordinators using CommRx in their work with patients at Chicago Family Health Center and Friend Family Health Center. U-Chicago implemented a pilot to determine if it would be beneficial to train care coordinators to search the CommRx database for patient services and generate HealtheRxs for their patients. The U-Chicago evaluator conducted focus groups and observations to collect feedback from the care coordinators; they reported that the tools were helpful and could assist them in finding services that could be tailored to patients' needs. Care coordinators at the Chicago Family Health Center found the CommRx database less helpful than care coordinators at Friend Family Health Center because the former primarily focused on providing patients with resources related to transportation and durable medical equipment, which the CommRx lacks. Because of the mismatch between the focus on care coordination at Chicago Family Health Center and the focus on CommRx, U-Chicago and the Chicago Family Health Center discontinued the pilot.

2.23 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

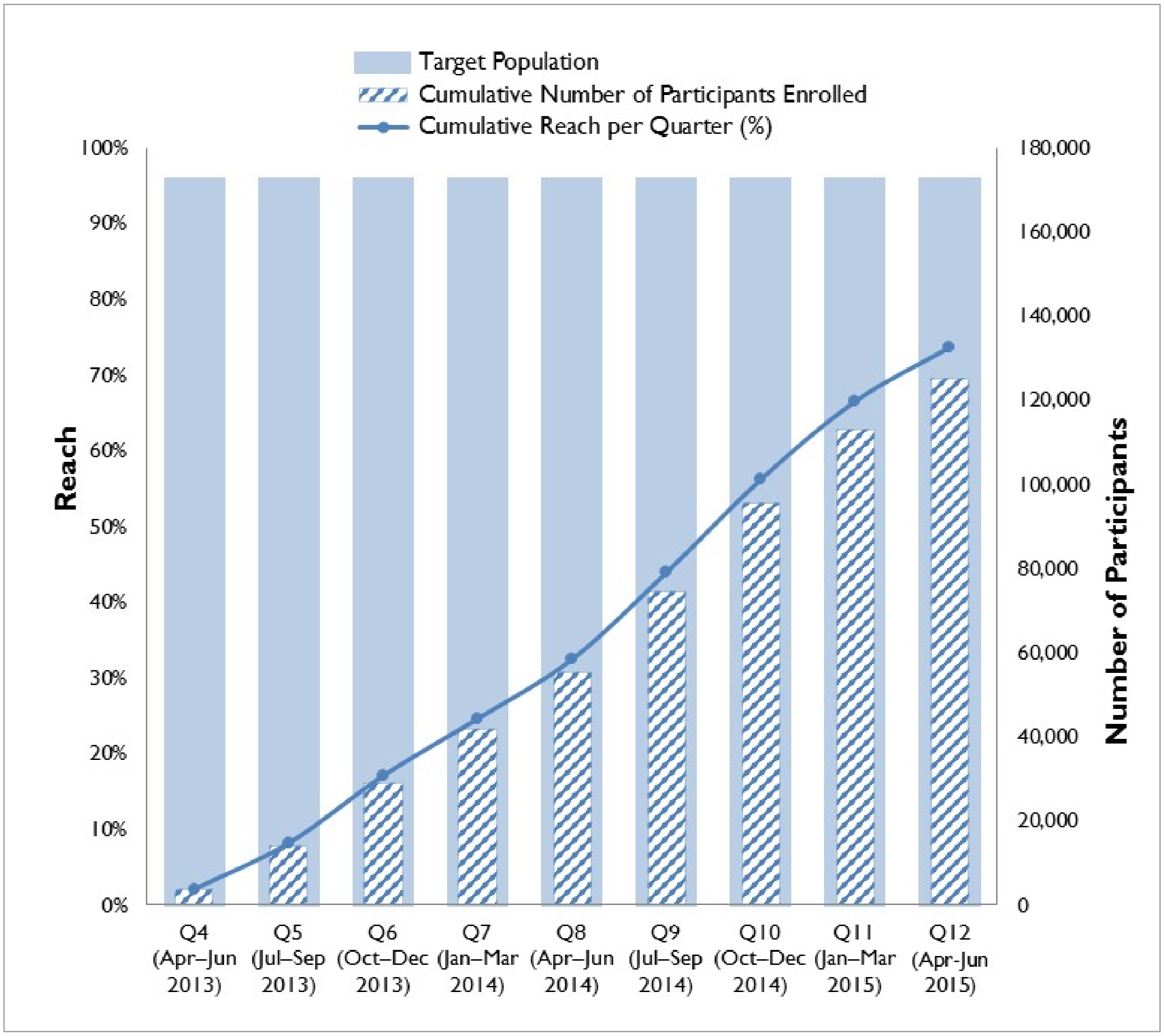
Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.23.1 Innovation Reach

Figure 19 shows reach by quarter since the launch of the innovation. U-Chicago aimed to enroll 170,000 of those living in one of the 16 zip codes on Chicago's South Side who received care at (1) a CommRx community health center site or (2) the adult or children's ED for low-acuity problems or (3) other ambulatory clinics at the UCMC. We last reported reach in the 2015 annual report, based on data for participants enrolled through Q11 (March 2015). We received data for an additional 34,796 participants for this report. These data included participants with enrollment dates prior to April 2015. Therefore, the numbers enrolled each quarter, shown in this annual report, do not match those reported in the 2015 annual report. With these additional participants, reach increased from 52.5 percent to 73.6 percent.

Figure 19. Participant Enrollment and Reach for Each Quarter since Project Launch



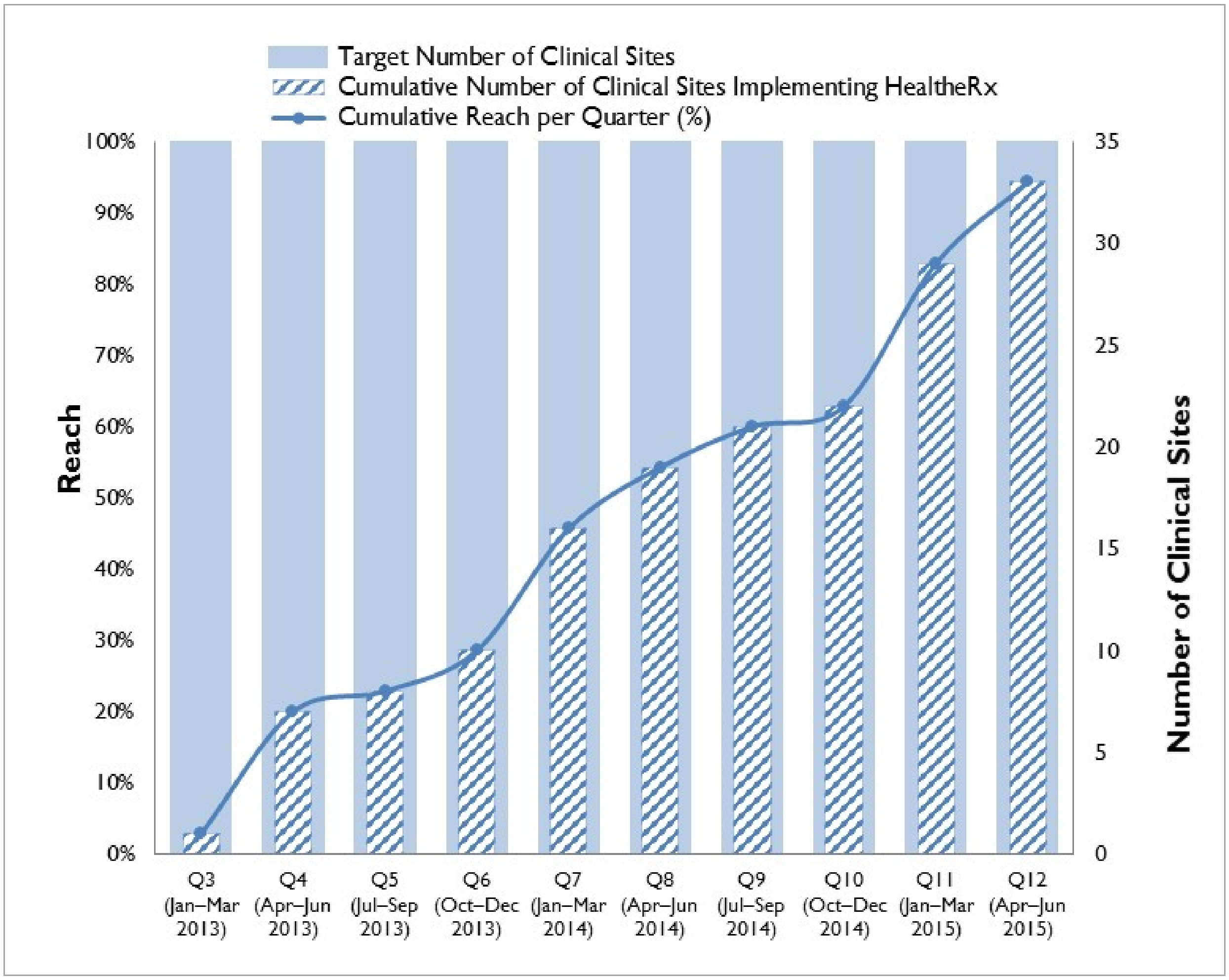
	Quarter	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
•	Percent cumulative reach per quarter	2.1	8.2	17.1	24.6	32.5	43.9	56.2	66.5	73.6
	Target population	170,000	170,000	170,000	170,000	170,000	170,000	170,000	170,000	170,000
	Cumulative number of participants enrolled	3,608	13,937	29,080	41,856	55,169	74,676	95,529	113,085	125,182

Source: Patient-level data provided to RTI by U-Chicago.

U-Chicago continued to add clinical sites to the innovation, increasing the number of residents who could receive a HealtheRx. The engagement of EDs significantly boosted the number of HealtheRxs distributed, but the expansion of the innovation to 33 clinical sites was slower than expected. U-Chicago did not meet the original projections for reaching 170,000 unique participants by the end of Year 3, mainly because of demands in the regulatory environment, including new HIT Meaningful Use and patient-centered medical home regulations that required EHR upgrades. U-Chicago reported that the technology and administrative teams at clinical sites were overwhelmed with regulatory environment demands. In response, internal HIT staff and partners became familiar with different EHR vendors and learned how to interface with them to produce the HealtheRx for all 33 clinical sites. The time and effort for customizing the innovation to different EHR systems and the unique processes of different clinical sites also slowed the timeline for bringing on additional sites.

Figure 20 presents reach at the clinical site level. No site reach data were received for Q12. As shown in the figure, about 83 percent of the targeted clinical sites began implementing HealtheRx by Q11.

Figure 20. Clinical Sites Implementing HealtheRx and Reach since Project Launch



(continued)

Figure 20. Clinical Sites Implementing HealtheRx and Reach since Project Launch (continued)

Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)
Percent cumulative reach per quarter	2.9	20.0	22.9	28.6	45.7	54.3	60.0	62.9	82.9	94.3
Target number of clinical sites	35	35	35	35	35	35	35	35	35	35
Cumulative number of clinical sites implementing HealtheRx	1	7	8	10	16	19	21	22	29	33

Source: Data provided to RTI by U-Chicago and *Q12 Narrative Progress Report*.

2.23.2 Innovation Dose

Table 31 provides number of HealtheRx reports generated for each patient, the number of participants receiving the reports, and the percentage of enrolled participants represented. We last reported dose in the 2015 annual report, based on data through Q11. Similar to that reported in the 2015 annual report, over half of participants (59.6%) received one HealtheRx report, and the other half received two or more reports. The number of reports likely mirrors the number of times a patient visited a provider, as they are automatically generated at each visit. Those who received a HealtheRx during an ED visit may have received one HealtheRx at that visit and then another HealtheRx if they visited a primary care provider who participated in the innovation, or if they were readmitted to the same ED.

The data presented on dose are limited in the sense that they do not reveal the extent to which participants actually received services appropriate for their medical and social needs. Although a participant may have received the HealtheRx, questions remained about what to do with the prescription. Also unclear is whether a participant who received more than one HealtheRx was more likely to follow up with the referrals compared with an individual who only received the HealtheRx once. For this reason, a measurement of dose for this innovation is of somewhat limited value.

Table 31. Number and Percentage of Participants by Number of HealtheRx Reports Received

Number of HealtheRx Reports Generated for Each Unique Patient	Number of Participants	Percentage of Enrolled Participants (N=125,182)
1 report	74,563	59.6
2 reports	24,672	19.7
3+ reports	25,947	20.7

Source: Patient-level data provided to RTI by U-Chicago.

Table 32 shows the number of contacts that information specialists had with participants by mode. No additional data were provided in Q12, so the number of contacts provided is through Q11. As shown in the table, a patient contacting an information specialist by phone was the most common mode

(77.2%). Contact via text was the second most likely method of contact (14.0%). E-mail was the least likely method for contacting an information specialist (2.9%), perhaps because many people in lower-income neighborhoods have access to a cell phone with text messaging capabilities but do not have access to a smart phone with e-mail or consistent access to the Internet to use e-mail. Because the SMS texting pilot was only fielded in Q10, and only at one site, this finding indicates that texting may be a feasible option for communication between patients and the information specialists.

In addition, RTI received data on the number of contacts made to the information specialist by mode, but not the number of unique patients who contacted the information specialists. It is possible that 685 unique patients contacted the information specialists, but it is just as likely that fewer than 685 patients contacted them, with some patients contacting the information specialists more than once. If the total number of contacts, at 685, is indeed unduplicated, then less than 1 percent of the 89,273 participants contacted an information specialist with questions about their HealtheRx. The low number of patients contacting the information specialist illustrates how CommRx was not dependent on the role of the information specialist and why this role is not part of U-Chicago's sustainability plan. Participant contact was only one of several responsibilities of the two information specialist staff members. Due to the low contact from participants, information specialists appeared to spend the majority of their time contacting new CBSPs to include in the CommRx database.

Table 32. Number and Types of Contacts from Participants through Q11

Type of Contact	Number of Contacts Across Patients	Percentage of Contacts Across Patients
Phone	529	77.2
E-mail	20	2.9
Text	96	14.0
In person	40	5.9
Total	685	N/A

Source: Patient-level data provided to RTI by U-Chicago.
N/A = not applicable.

2.24 Qualitative Findings: Sustainability

Sustainability of the CommRx technology and innovation was a central focus for the U-Chicago team. In Year 3, U-Chicago completed a technology transfer that moved the CommRx from U-Chicago to Care IT Health/NowPow LLC (dba NowPow) (http://www.nowpow.com/), founded and owned by CommRx Project Director, Stacy Lindau. NowPow will work with MAPSCorps, which will become a 501(c)3 organization, to explore opportunities for the implementation of CommRx moving forward.

The CommRx team sought additional funding to sustain certain elements of the innovation. The project director received funding (1R01AG047869-01) from NIH/National Institutes on Aging to examine the impact of the CommRx technology on adults 45–74 years of age. The U-Chicago Institute for Translational Medicine also funded a pilot project examining the use of CommRx as a tool for clinical trials recruitment. Funding from the Agency for Healthcare Research & Quality (AHRQ) to CHITREC (one of the CommRx technology teams) at Northwestern University will support small-scale implementation of CommRx within practices in Illinois, Indiana, and Wisconsin, specifically in heart health. Although this funding will expand the reach and evaluation of the CommRx technology, it will not support the ongoing implementation of the innovation within the community reached through HCIA. Finally, a collaboration between the CommRx team and the Mount Sinai Adolescent Health Center in New York City is examining the replication of the MAPSCorps work for East Harlem. This work will test whether the program can be replicated in other communities.

The technology that identifies and updates community resources in a database and produces a HealtheRx based on a patient's EHR will be sustained in its current form. The information specialist component will not continue in its current form; thus, members of the Workforce Development Group began to work with remaining information specialist staff to examine how their skills can be used in future employment (after HCIA funding). Although the information specialist played a vital role for the patients that contacted them with questions, the technology for creating the HealtheRx can exist without participation of information specialists. Additionally, as reported in Q11, the HIT Development Working Group is developing plans for "sunsetting" CommRx technology at participating providers that do not want to continue after the award ends. It is unclear if clinical sites will be allowed to continue their involvement with CommRx after HCIA funding ends, and if so, what that may involve now that the technology has been transferred to the for-profit Care IT Health, LLC/NowPow.

2.25 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing U-Chicago as well as accomplishments to date. In this section, we assess U-Chicago's progress on achieving HCIA goals to date:

- **Smarter spending.** The regression results suggest that Medicare and Medicaid beneficiaries incurred similar spending rates to their respective comparison groups in the innovation period.

- **Better care.** Medicare beneficiaries had significantly fewer inpatient stays and unplanned readmissions during the innovation, whereas Medicaid beneficiaries had significantly fewer ED visits. Medicare beneficiaries had notably more ED visits during Year 1, but the effect for the innovation period overall was not statistically significant.

  Nearly three-quarters (73.6%) of the target population was enrolled, and approximately 40 percent of those enrolled received two or more HealtheRx reports during the innovation. Approximately one-third of patients with diabetes (32.4%) received an HbA1c test, and approximately three-quarters of patients with hypertension (72.9%) had their blood pressure measured at least once during the innovation.

- **Healthier people.** For the diabetes-related health outcome, the percentage of diabetes patients with poor HbA1c control declined slightly over time. The percentage of patients with hypertension with blood pressure control remained consistent over time, with a 10 percentage point increase between I8 and I9. However, relatively few patients appeared in the quarters beyond I8; therefore, we do not have strong evidence to suggest that the innovation helped increase the percentage of patients with blood pressure control over time. The percentage of obese patients increased slightly over time. Because we did not conduct inferential analyses, we cannot determine if any of these differences are significant.

Overall, U-Chicago implemented its innovation as planned and reached over 70 percent of its target population. The U-Chicago team implemented the CommRx innovation by forming partnerships with key community-based health care organizations and clinical sites throughout the service area. The U-Chicago team engaged the EDs, which significantly boosted the number of HealtheRxs distributed. Keys to engaging clinical practices in this innovation appear to be the willingness to be flexible and adapt the process for distribution of the HealtheRxs to what works best for the practice. A noteworthy challenge was working with IT and administrative teams at the clinical sites already overwhelmed by new rules and regulations, including Affordable Care Act and Meaningful Use requirements and changing EHR needs. As U-Chicago reported in Q11, addressing these immediate needs and priorities often had to come before implementation of CommRx, complicating recruitment of new sites or requiring that they be moved quickly toward full implementation of CommRx.

Although staffing at the upper levels of innovation management remained constant, the greatest challenges were with the information specialist staff and model. Information specialist staff communicated with patients who received a HealtheRx and built and updated the list of community resources in the CommRx database. To better meet these needs, U-Chicago hired interview specialists to support the information specialists; the new interview specialists focused solely on identifying new resources and updating information on existing resources in the database. Thus, the existing information specialist staff were free to focus on engaging with patients. Although extensive training was offered to information specialists (some trainings were offered through a partnership with the Graham School earlier in the project), some turnover of information specialist staff occurred, particularly when permanent or better-paying positions became available.

Despite U-Chicago implemented the innovation as planned, the lack of data on how many patients actually accessed the services recommended to them in their HealtheRx made it difficult to ascribe declines in inpatient visits, readmissions, and ED visits to the innovation. Moreover, making patients aware of but not ensuring they received community services seemed insufficient for impacting these utilization measures or health outcomes. We cannot rule out that the improvements seen are due to other factors outside of the innovation.

The U-Chicago team is taking steps to sustain the CommRx technology; however, this effort will continue primarily through the new Care IT Health, LLC (NowPow). This new for-profit organization will leverage the technology and resources supported by HCIA to continue providing services to Chicago and presumably examine expansion beyond Chicago. It remains unclear what this technology transfer will mean for clinical practices that already adopted CommRx, and whether these practices will continue to receive the support needed to generate HealtheRxs for their patients.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

University of Chicago (U-Chicago)

The University of Chicago (U-Chicago), an academic research organization located in the South Side of Chicago, received an award of $5,862,027 for an innovation called CommunityRx (CommRx). This innovation, launched on March 21, 2013, utilizes aggregate electronic health record (EHR) and community resource data to provide patient-centered e-prescriptions called HealtheRx, which include resources for community health and social services.

Awardee Overview

Innovation dose:	More than half of participants (59.6%) received one HealtheRx report, and the other half received two or more reports.	***Innovation reach:***	Total of 125,182 participants; 73.6% of the target population received at least one HealtheRx, up from 52.5% in Q11. As of Q12, 33 of the targeted clinical sites (94%) began implementing HealtheRx.
Components:	(1) HealtheRx patient-centered prescriptions for healthy lifestyle, disease management, and social services (2) Engaging clinical sites (3) Information specialists to help HealtheRx recipients access care.	***Participant demographics:***	Majority of participants (36.8%) were younger than 18 years of age or between 25 and 64 years of age (41.7%). Most were female (63.3%) and black (69.1%). About half (46.1%) were covered by Medicaid, and more than 10% were covered by Medicare or eligible for both Medicare and Medicaid.
Sustainability:	U-Chicago transferred CommRx technology in its entirety to Care IT Health, LLC, which will do business as NowPow in partnership with a 501c3 organization (to be formed) called MAPSCorps to test a collective social impact for sustainability.		
Innovation type:	Coordination of care	Health IT	Decision support

Key Findings

Smarter spending. The regression results suggest that Medicare (−$44; 90% CI: −$216, $128) and Medicaid ($202; 90% CI: −$50, $454) beneficiaries incurred average quarterly spending rates similar to their respective comparison groups in the innovation period.

Better care. Medicare beneficiaries had significantly fewer inpatient stays per 1,000 patients per quarter (−18; 90% CI: −23, −14) and unplanned readmissions per 1,000 admissions per quarter (−19; 90% CI: −35, −3) during the innovation, whereas Medicaid beneficiaries had significantly fewer ED visits per 1,000 participants per quarter (−51; 90% CI: −67, −35). Medicare beneficiaries had more ED visits per 1,000 participants per quarter during Year 1 (8; 90% CI: 1, 16), but the effect for the innovation period overall (4; 90% CI: −2, 9) was not statistically significant. Similarly, the overall effect on inpatient stays per 1,000 participants per quarter (4; 90% CI: −4, 12) and readmissions per 1,000 admissions per quarter (−87; 90% CI: −196, 22) for Medicaid was not significant.

Approximately one-third of patients with diabetes (32.4%) received an HbA1c test, and approximately three-quarters of patients with hypertension (72.9%) had their blood pressure measured at least once during the innovation.

Healthier people. For the diabetes-related health outcome, the percentage of diabetes patients with poor HbA1c control declined slightly over time (25.0% to 17.6%). The percentage of patients with hypertension with blood pressure control remained consistent over time, with a 10 percentage point increase between I8 (55.5%) and I9 (65.8%). However, relatively few patients appeared in the quarters beyond I8; therefore, we do not have strong evidence to suggest that the innovation helped increase the percentage of patients with blood pressure control over time. The percentage of obese patients increased slightly over time (from approximately 21% in I1 to approximately 23% in I8). Because we did not conduct inferential analyses, we cannot determine if any of these differences are significant.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

University of Miami

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q12 (June 2015)
Quarterly Awardee Performance Report	Launch date–Q12 (June 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–June 2015

Q = quarter.

University of Miami

2.1 Introduction

The University of Miami (U-Miami) innovation expanded a longstanding network of school-based health centers (SBHCs) that provide comprehensive health care to school-aged students in Miami-Dade County. The Center for Medicare & Medicaid Innovation (CMMI) awarded the innovation $4,097,197 over 3 years to achieve the following HCIA goals:

1. **Smarter spending.** Reduce spending by approximately $1.8 million by providing the appropriate level of care and improving access to preventive services.

2. **Better care.** Give students access to medical screenings; immunizations; and nutrition, dermatology, and dental and mental health services; offered a medical home to children with coordinated care; and leveraged community health workers (CHWs) to supplement care and provide social services.

3. **Healthier people.** Make improvements in: control of chronic conditions such as asthma; dental and mental health; nutritional habits; and dermatology.

Table 2 provides a summary of changes that occurred during the final 6 months of operations. These updates are based on a review of the Quarter (*Q)11–12 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data submitted by U-Miami and received through June 30, 2015.

Table 2. Summary of Updates as of Quarter 12, June 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Innovation Components	
	Continued use of five components: CHWs for care coordination and Medicaid enrollment, dental service delivery, telemedicine, ED diversion clinic, and payment mechanism development.
Program Participant Characteristics	
	Nearly half of participants (46.5%) were 12 to 18 years of age. Data on race and sex were missing for most participants (80.5% and 77.1%, respectively). Less than half (46.8%) were covered by Medicaid.
Workforce Development	
Hiring and retention	Employed 9.75 total FTEs, below projection by 6.4 FTEs.
Skills, knowledge, and training	A total of 191 trainees received 8,346 cumulative training hours as of Q12, with no new trainings in Q11 or Q12.

(continued)

Table 2. Summary of Updates as of Quarter 12, June 30, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2015)
Context	
Award execution	Spending rates 10% to 20% below projection, related to understaffing of CHWs.
Leadership	Project director filled both clinical and administrative roles. Program manager hired in Year 1 to manage CHWs.
Organizational capacity	The CHW role was understaffed. There were no plans to replace CHWs who recently departed, resulting in more students per CHW, which hindered tracking and monitoring insurance continuity.
Innovation adoption and workflow integration	CHW caseloads greatly increased, and services needed to be triaged. Expanded services at the SBHCs were used, but difficulties were encountered using CHS as an ED diversion clinic.
Implementation Effectiveness	
Innovation reach	We received some data for 11,281 participants. However, only 14.8% received at least one service as part of the innovation.
Innovation dose	About 15% of those enrolled in the innovation received at least one dental, CHW, or telehealth service. Dental services represented 6.8%, with the rest split between CHW and telehealth services.
Sustainability	
	Leadership secured over $1.3 million, but it is not clear which services will remain and which will not be supported after HCIA funding ends. Agreements with MCOs will explore alternate payment models.

Sources: *Q11–Q12 Narrative Progress Report*.
Q11–Q12 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted March 2–13, 2015.
CHS = Center for Haitian Studies; CHW = community health worker; ED = emergency department; FTE = full-time equivalent; MCO = managed care organization; Q = quarter; SBHC = school-based health center.

2.1.1 Innovation Components

This innovation originally consisted of five components: (1) CHWs who coordinated services in the clinic, social services, and assistance with Medicaid enrollment; (2) a dental services expansion including oral exams and screenings, cleanings, fluoride varnish applications, placement of dental sealants, and fluoride rinses; (3) telemedicine intended to increase access to primary care, mental health care, nutritional counseling, and dermatology care, whereby patients can be seen by an offsite physician for a limited physical exam with the aid of a nurse or medical assistant; (4) an ED diversion clinic where students and families are referred to the Center for Haitian Studies (CHS) in lieu of ED visits; and (5) development of a new payment mechanism by which agreements are established with managed care organizations (MCOs) to explore payment models. Throughout implementation, these components changed in the following ways:

- CHWs: CHWs initially largely focused on Medicaid enrollment, with less of a focus on clinical and social services. After Florida went to a Medicaid Managed Care model, the CHWs focused more on social services with less of a focus on clinical services than planned. The CHW role was also professionalized; U-Miami supported them to obtain a newly developed state certification for care coordinators.

- ED diversion clinic: Amerigroup data from U-Miami indicated that very few ED visits and inpatient stays were in the zip codes of the participating schools. However, during the site visit, participants explained that the ED diversion clinic was not well attended because families preferred to go to hospitals near their homes. Thus, the CHW assigned to the clinic spent more time elsewhere.
- Payment mechanism: U-Miami contracted with the following health maintenance organizations (HMOs): Amerigroup, Inc., Sunshine, Inc., Molina, Coventry, and Wellcare. U-Miami planned to implement an alternative payment plan in collaboration with Amerigroup as soon as 500 beneficiaries were enrolled. As of June 2015, efforts were under way to meet that initial beneficiary goal. The alternative payment plan expected to save costs by replacing fee-for-service with a capitated rate.

As shown in ***Table 3***, U-Miami worked with four partners. Psychiatry resident physicians at Larkin Community Hospital provided psychiatry services at the nine target schools while supervised by attending physicians through telemedicine. CHS administered the ED diversion clinic for uninsured parents of school-aged children at the schools, and was involved initially in recruiting and employing CHWs before those staff were transferred to U-Miami in May 2014. Nova Southeastern University replaced the University of Florida as the partner providing dental services because of delays establishing a subcontract, and currently provides dental services. The University of Florida was involved in design and implementation of the Community & Child Health Outreach for Improving Clinical and Educational Success (CHOICES), a web-based data tracking system CHWs use to track and report patient referrals.

Table 3. Key U-Miami HCIA Partners, Roles, and Locations

Partner Name	Role in HCIA Project	Location
Larkin Community Hospital	Clinical, training	Miami, FL
Center for Haitian Studies	Administration of ED diversion clinic	Miami, FL
Nova Southeastern University	Clinical, training	Fort Lauderdale, FL
University of Florida	Design and implementation of CHOICES	Gainesville, FL

Source: Self-monitoring plan; site visit in April 2014.
CHOICES = Community & Child Health Outreach for Improving Clinical and Educational Success; ED = emergency department; HCIA = Health Care Innovation Award.

2.1.2 Program Participant Characteristics

Table 4 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report, based on data through Q10. The distribution of patient characteristics is similar to that in the second annual report. More specifically, nearly half of participants (46.5%) were between 12 and 18 years of age at enrollment. Data on race and sex were missing for most participants (80.5% and 77.1%, respectively). Less than half (46.8%) were covered by Medicaid. It is notable that these data are not complete, as evidenced by the large number of participants missing sex and race information.

Table 4. Characteristics of All Participants Ever Enrolled in the University of Miami Innovation through June 2015

Characteristic	Number of Participants	Percentage of Participants
Total	11,281	100.0
Age		
0–2	17	0.2
3–5	598	5.3
6–8	1,329	11.8
9–11	1,705	15.1
12–15	3,387	30.0
16–18	1,867	16.5
>18	618	5.5
Missing	1,760	15.6
Sex		
Female	1,366	12.1
Male	1,221	10.8
Missing	8,694	77.1
Race/ethnicity		
White	525	4.7
Black	1,093	9.8
Hispanic	409	3.6
Asian	24	0.2
American Indian or Alaska Native	2	0.0
Native Hawaiian or other Pacific Islander	1	0.0
Other	141	1.2
Missing/refused	9,086	80.5
Payer category		
Dual	264	2.4
Medicaid	5,281	46.8
Medicare	67	0.6
Medicare Advantage	38	0.3
Other	63	0.6
Uninsured	83	0.7
Missing	5,485	48.6

Source: Patient-level data provided to RTI by U-Miami.

2.2 Claims-Based Measures for Evaluation

Table 5 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report. U-Miami's innovation targeted school-aged children; therefore, we do not include a Medicare claims analysis in this report. Additionally, it was not possible to identify Medicaid beneficiaries participating in the innovation because the beneficiary IDs provided by U-Miami were not in a format that could be linked to Medicaid Alpha-MAX data. No claims-based measures are reported for Medicaid in this report.

Table 5. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	No
		Hospital unplanned readmissions rate	No	No
		ED visit rate	No	No
	Cost	Spending per patient	No	No
		Estimated cost savings	No	No

ED = emergency department.

2.3 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

U-Miami submitted data to RTI that are current through June 2015. ***Table 6*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report. We did not receive patient-level data from the awardee for most of these measures. Those measures for which we did receive data included only a small percentage of patients. Although we received some HbA1c and low-density lipoprotein cholesterol (LDL-C) test results, none of these were from diabetic patients. We received body mass index (BMI) data for only 5 percent of students. Therefore, clinical effectiveness and health outcomes findings are not included in this report.

Table 6. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Clinical effectiveness	Asthma	Percentage of children identified as having persistent asthma and dispensed appropriate medications	Dropped; data unavailable	No
	Diabetes	Percentage of children with diabetes who received a hemoglobin A1c test	Data received from U-Miami	Yes
		Percentage of children with diabetes who received a LDL-C test	Data received from U-Miami	Yes
		Percentage of parents/caregivers of pediatric patients with diabetes who received nutrition counselling	Dropped; data unavailable	No
		Percentage of children with diabetes who received an eye exam	Dropped; data unavailable	No
	Mental health	Percentage of children with a confirmed diagnosis of depression following a referral for psychiatric evaluation	Dropped; data unavailable	No

(continued)

Table 6. Awardee-Specific Outcome Measures (continued)

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Health outcomes	Asthma	Percentage of children with asthma who have FEV1 ≥ 80%	Dropped; data unavailable	No
	Diabetes	Percentage of children with diabetes with a hemoglobin A1c test > 9%	Data received from U-Miami	No
		Percentage of children with diabetes with LDL-C < 100 mg/dL	Data received from U-Miami	No
	Weight	BMI: (1) percentage of children overweight (BMI ≥ 25.0 and ≤ 29.9); (2) percentage of children obese (BMI > 30)	Data received from U-Miami	Yes

BMI = body mass index; FEV1 = Forced Expiratory Volume (1 second); LDL-C = low-density lipoprotein cholesterol.

2.4 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 7*** lists the quantifiable measures of implementation and their status as of June 30, 2015 that RTI obtained from U-Miami's *Narrative Progress Reports, Quarterly Awardee Performance Reports.* Qualitative interviews with key staff provide additional detail.

The findings presented in the following Sections 2.5–2.9 are based on data from Q11 and Q12 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 7. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q12	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11 and Q12	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*

(continued)

Table 7. Measures of Implementation (continued)

Evaluation Domains	Subdomains	Measures	Source
Implementation effectiveness	Reach	Number/percentage of participants eligible for services	Data received from U-Miami
		Number/percentage of participants who received at least one CHW service	Data received from U-Miami
	Dose	Number/percentage of enrolled participants receiving dental services	Data received from U-Miami
		Number and type of CHW encounters	Data received from U-Miami
		Number/percentage of participants receiving telehealth services by specialty (e.g., dermatology, nutrition, mental health)	Data received from U-Miami

CHW = community health workers; ED = emergency department; FTE = full-time equivalent; Q = quarter; U-Miami = University of Miami.

2.5 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.5.1 Hiring and Retention

At the end of Q12 (June 2015), the innovation was understaffed; it had 9.75 full-time equivalent (FTE) staff members. Between Q11 (March 2015 and Q12 (June 2015, staffing remained constant at 9.75 FTEs, below projection by 6.40 FTEs, primarily because of CHW turnover and unexpected maternity and medical leave. When CHWs left the program, they were not replaced. When CHWs moved to U-Miami, leaders indicated that they used that as an opportunity to weed out underperforming CHWs. CHWs themselves largely felt very positive about the position and appreciated the opportunity to work more in the community. One CHW said that she *"wouldn't make a lot of changes because what they're doing now works for them to gather information that they need to."* Leadership and line staff disagreed about the appropriate number of CHWs; leadership indicated that one CHW per school was appropriate and CHWs indicated that more resources were necessary.

2.5.2 Skills, Knowledge, and Training

Between Q11 and Q12, U-Miami did not provide training to any individuals. Prior training consisted of refreshers on system use (CHOICES), education on the Managed Medical Assistance (MMA) program as part of the Statewide Medicaid Managed Care (SMMC) program, and Health

Insurance Marketplace training. Site visit interviews indicated that earlier trainings were more intensive, and more recent trainings refreshed and updated that knowledge. Staff also mentioned that the trainings were helpful, but not long enough, and did not always answer all of their questions. Interviewed CHWs noted, "*If we still had questions we usually take the email of the trainer and reach out to them that way.*" Trainings primarily taught CHWs how to perform their job duties and use systems but did not focus on integrating CHWs into the workflow of the school-based clinics, or educating school staff on work the CHWs would do. CHWs noted that they see themselves as extensions of school social workers, so it was a challenge learning how to assist students and their families with issues such as insurance enrollment, daycare, and even providing basic technology education such as registering for an email account. These topics were not necessarily covered in training, and CHWs learned those skills on the job. Another interviewee assumed that eventually a trained "super user" of the CHOICES system would be available who could assist CHWs as needed—however, this high-skilled role was not implemented.

Table 8 provides a breakdown of training provided to staff in Q11 and Q12 (none), as well as since inception. Overall training projections were exceeded because only CHWs were slated to receive trainings, but many trainings included other school health Initiative staff, and CHWs were included in additional trainings that school health Initiative staff received. According to one interviewee, *"Because CHWs are part of the school health program, they are offered the same training as other staff to work effectively and in compliance with clinical services. That is why cumulative trainees exceed the projection target."*

Table 8. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11 & Q12	0	0
Since inception	8,346	191

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.6 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

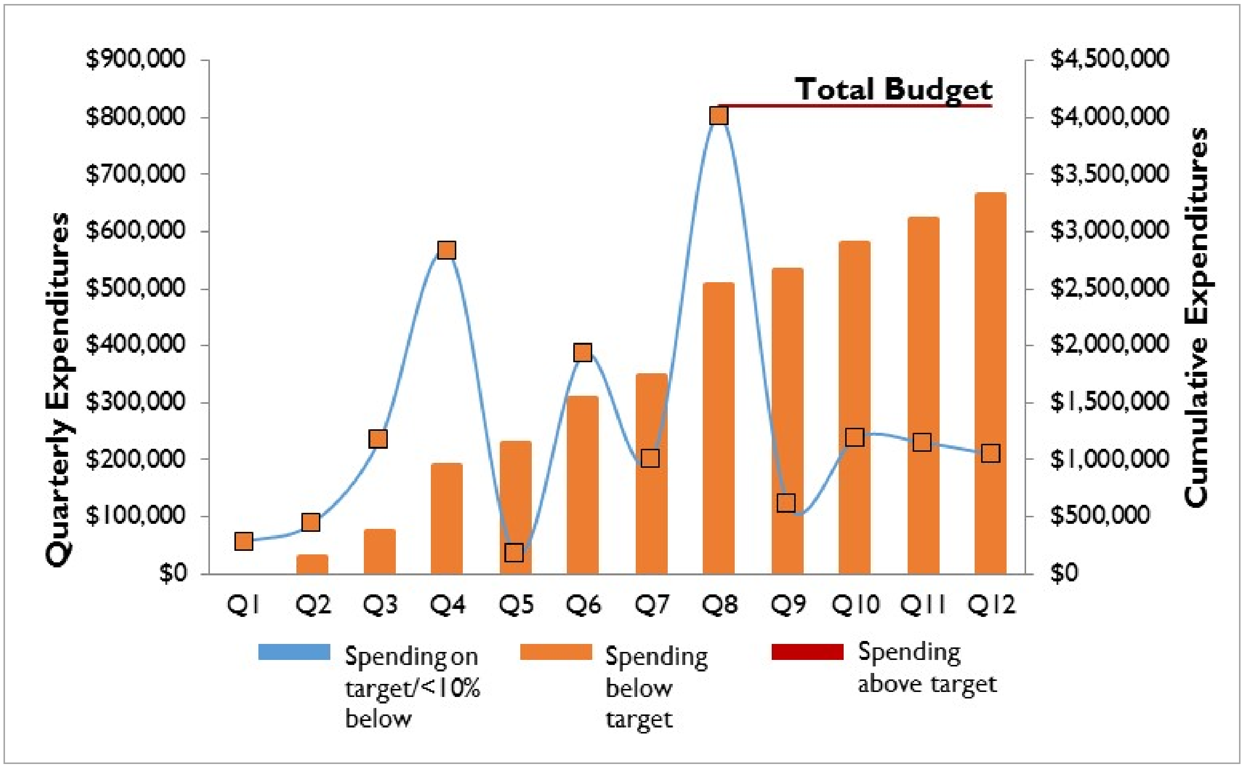
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.6.1 Award Execution

The annual report highlights the significance of U-Miami's expenditure rates on implementation. As of June 2015 (Q12), U-Miami spent 81.2 percent of its total budget, which was below the projected target (***Figure 1)***. U-Miami had no new hires since Q8. Understaffing, staff turnover, and unexpected maternity and medical leave all contributed to underspending. Issues with telemedicine infrastructure and delays in dental provision of services also contributed to underspending.

Figure 1. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.6.2 Leadership

Leadership was unstable early in the implementation of U-Miami's innovation. Because of initial turnover in the project director and project administrator roles, the medical director had to take on additional responsibilities during Year 1. Later, a project manager (PM) was hired and assumed increased administrative duties. The project director worked with the CMMI project officer to refine the original, ambitious goals of the program, focusing instead on shorter-term attainable goals, such as tracking and sustainability. Following the hiring, the PM supervised the CHWs and clinic staff, while the project director provided clinical oversight. One CHW noted that the PM position was helpful: *"Our manager provided a lot of structure to the program that helped with the flow of the program. When we have issues or dilemmas because of us being short staffed, I am comfortable with her and her helping us."* CHWs also felt meeting periodically was beneficial, saying, *"It's working very smoothly. If there are challenges or* *issues, we all discuss it and then we devise a plan about how to handle certain things. We talk about goals and how to meet them."*

Leaders at U-Miami were not directly involved in the management of the innovation, but increased their participation toward the end of the project, with particular interest in sustainability. The sustainability section of this report provides additional information.

2.6.3 Organizational Capacity

U-Miami had an ambitious program with a number of interrelated components. The initial pace of the project was swift, and participants indicated that they could have benefitted from an early focus on planning for the implementation and beyond. U-Miami had difficulties with contracting, as evidenced by the delay in executing subcontracts and receiving invoices. These difficulties led to shifting employment of CHWs from CHS to U-Miami, which took some time. In addition, problems occurred with MCOs because of the inability to contract with the clinics directly. U-Miami hired an HMO consultant to improve relations and resolve these issues. There were also delays in getting the dental partner on board, and the partner switched midway.

The innovation built on an existing school-based health clinic structure to add further components to expand services. U-Miami had a long-standing relationship with the schools in which the clinics were housed. Aside from dental services, which were expanded to include more people, U-Miami did not have previous significant experience with the innovation components. In addition to implementing these components, U-Miami did not have experience documenting the resulting work. Thus, U-Miami needed time and resources to become familiar with most innovation components, such as onboarding CHWs and incorporating telemedicine infrastructure.

U-Miami had multiple tracking systems to capture innovation activities which required manual reconciliation. Not all encounters were captured in the school-based system, CHEERS, the CHW system, CHOICES, or the electronic health record system, EPIC. Because several systems were involved in tracking, staff needed to manually consolidate information, which took time and created the possibility for additional human error. Consequently, difficulties occurred in attaining necessary information for tracking and monitoring. In addition, ED visits outside the U-Miami system could not be tracked, so it is difficult to determine if the innovation resulted in ED diversion. Finally, data from prior to the innovation were not available, meaning a baseline could not be developed.

2.6.4 Innovation Adoption and Workflow Integration

Provider and CHW feedback indicated buy-in and support of the program, and noted some areas of success, but also cited ways that overall workflow could have been improved. The CHW role and expansion of services into telemedicine and dentistry were seen as successful. Opportunities to improve included using CHS as an ED diversion clinic, supporting insurance continuity, and tracking and monitoring.

U-Miami partnered with CHS to help hire the CHWs and to provide medical services for parents. CHS was seen as a valuable partner because of strong ties to the local community. CHS had Spanish-speaking providers and was located where some of the target population lived. However, both location and insurance concerns impacted CHS's efficacy as an ED diversion clinic. The number of actual patients at CHS was not as high as expected; clinicians noted several reasons for this. One reason could be that CHS is not located at a school, which meant that the parent or student had to make a special effort to travel to CHS to receive services. One clinician said he was not sure if patients and their families understood that CHS was affiliated with the school-based health clinics. Thus, trust may have been an issue, since the target population was not familiar with CHS in and of itself.

Providers indicated that, despite CHW efforts to enroll patients in Medicaid, some patients still could not join due to lack of insurance continuity. Some patients were obtaining health insurance for the first time and faced difficulty with the administrative process and required paperwork, or avoided enrolling because they had concerns about their citizenship/immigration status. In addition, some families did not prioritize insurance and medical care. One provider indicated that, "*Patients come from a community with a lack of providers, and regular physician care is not the cultural norm."* Another provider indicated that, *"a lot of these kids have never received any dental services because it's not a priority for most families."*

Understaffing of the CHW position strained the project team and affected CHWs' ability to deliver services. The CHWs were originally intended to provide both medical and social services support, but ultimately provided more social services support. As the numbers of CHWs dwindled, each assumed responsibility for additional students, which meant that CHWs' activities were more tactical rather than forward-looking. The implications included lack of time to manage long-term caseloads, such as monitoring insurance continuity to address potential lapses in coverage before they occurred.

CHWs lacked work phones and computers, and periodically rotated from school to school. Thus, students and families sometimes had trouble contacting the CHWs. CHWs indicated that some students and their families *"fell through the cracks"* because they were unable to reach their assigned CHW. This situation was exacerbated because contact information for students and their families changed frequently. To improve service delivery, the program manager visited the clinics and interacted with students and their families to provide some continuity.

One CHW noted, *"We now have less time to do outreach and we focus more on immediate needs."* CHWs felt that, ideally, one CHW would be permanently stationed at each school, plus an additional floater who rotated from location to location. This staffing arrangement would provide continuity to students and assisted students and families in finding CHWs.

CHWs also said they enjoyed using the CHOICES system, noting its ease of use and that it was self-explanatory. However, use of the system did not always mirror the actual workflow of the CHWs. As one interviewee commented,

> ***"One glitch was: instead of putting our clients in by the getgo, we had to give it to our supervisor and then she put it in and we got assigned people. That's not how the flow of the job works. We're the first contact. But the system was set up so that the supervisor assigned us. We couldn't just go in and enter the initial contact with the client even though we were the initial person. We had to wait for the supervisor to put the name in and then we could input the information for that particular client."***

2.7 Implementation Effectiveness

A major focus of the evaluation is to assess the effectiveness of the implementation effort and determine if the innovation was implemented with sufficient rigor to change outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

Evaluation Question

- What is the implementation effectiveness as measured by reach and dose of the innovation?

2.7.1 Innovation Reach

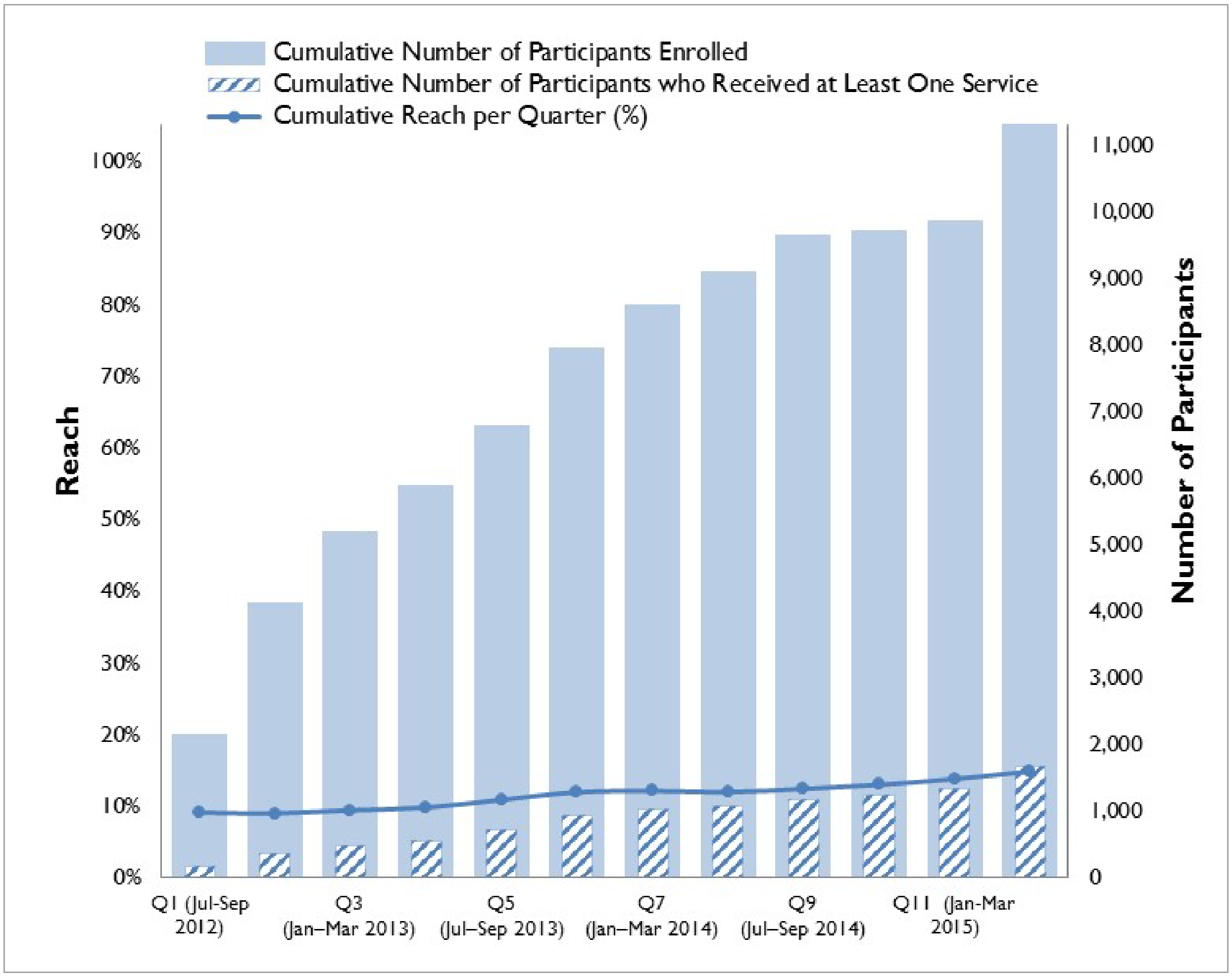
We last reported reach in the 2015 annual report based on data received through December 31, 2014 (Q10) for students for whom we received patient identifiers or secondary data as of June 30, 2015. However, not all these students received services as part of the innovation. In addition, the student body of the SBHCs changed every year, making tracking over time difficult. Therefore, in this annual report, we report reach as the number of students through Q12 who also received at least one innovation service (***Figure 2***). As shown in the figure, we received at least some data for 11,281 students. However, as of Q12, only 14.8 percent of those students were provided with at least one innovation service.

According to CHWs, issues involved in tracking and finding families to enroll them in Medicaid affected reach. The information provided to enroll students in the program at the beginning of the school year often changed during the year, which made it difficult for CHWs to find them and hindered provision of home services. Miami has a high population of undocumented immigrants, and some were reluctant to provide demographic information or to pursue any treatment at all if it involved Medicaid for fear of immigration consequences. Other patients worked multiple jobs and were difficult to reach, or were unwilling to follow up with treatment due to the costs.

Reach for dental services was challenged by changing providers and by consent. The dental provider changed midway through the project, which delayed dental service provision. In addition, consent forms for dental services were not sent home to parents with the initial paperwork at the beginning of the school year, but in a separate process, resulting in a lower return rate of consent forms.

Reach for telemedicine was influenced by technical difficulties. U-Miami reported a period of time in which the telemedicine infrastructure was not adequate to meet their needs. Leadership indicated that this problem was since rectified and service provision resumed.

Figure 2. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q1 (Jul-Sep 2012)	Q2 (Oct-Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan-Mar 2015)	Q12 (Apr-Jun 2015)
•	Cumulative reach per quarter (%)	9.1	9.0	9.4	9.8	10.9	11.9	12.1	12.0	12.4	13.0	13.8	14.8
	Cumulative number of participants enrolled	1,961	3,935	5,020	5,712	6,602	7,765	8,414	8,926	9,470	9,546	9,666	11,281
	Cumulative number of participants who received at least one service	178	353	472	559	717	926	1,018	1,067	1,173	1,237	1,332	1,673

Source: Patient-level data provided to RTI by U-Miami.

2.7.2 Innovation Dose

Table 9 lists the number of services provided to participants, the number and percentage of participants receiving services, and the average number of services per participant through Q12. We last reported dose in the 2015 annual report based on data through December 31, 2014 (Q10). A slightly greater percentage of participants received services through Q12 (14.8%) compared to Q10 (10.4%). As shown in the table, about 4 percent of those enrolled received assistance with the Affordable Care Act (ACA), Kidcare, or Medicaid application. More than 1 percent received assistance with food stamps, home visits, or other assistance. Less than 1 percent received behavioral health/counseling, community health resources, and health education. Less than 1 percent received dermatology or mental health telehealth services.

The number of participants who received services was minimal: dental services were the highest at 6.8 percent. Project leadership indicated that the intent of the innovation was not to provide all enrollees with each service in the table but to provide appropriate services given the student's needs. For example, not everyone enrolled would require telemedicine services. However, expectations were that the majority of those enrolled would receive some service as part of their enrollment in the innovation.

Table 9. Number and Types of Services Provided to Participants

Services	Number of Services Provided Across to Participants	Number (Percentage) of Participants Receiving Service	Average Number of Services per Participant
Dental services	2,832	771 (6.8)	3.7
CHW services			
Assistance with ACA, Kidcare, or Medicaid application	396	396 (3.5)	1.0
Behavioral health/counseling	7	7 (0.1)	1.0
Community health resources	25	25 (0.2)	1.0
Food stamps/SNAP/WIC assistance	163	163 (1.4)	1.0
Health education	98	98 (0.9)	1.0
Home visits	215	200 (1.8)	1.1
Other (e.g., legal, housing, fraud, financial assistance)	159	151 (1.3)	1.1
Telehealth			
Dermatology	92	92 (0.8)	1.0
Mental health	7	7 (0.1)	1.0
Nutrition	—	—	—
Total	3,994	1,673 (14.8)	2.5

Source: Patient-level data provided to RTI.
ACA = Affordable Care Act; CHW = community health worker; SNAP = Supplemental Nutrition Assistance Program; WIC = Women, Infants, and Children.
— Data not available.

2.8 Qualitative Findings: Sustainability

U-Miami needed new funding streams to continue services that were implemented through HCIA, including telehealth, oral health, mental health, and CHW services. Project leadership secured over $1.3 million to sustain basic services from the Children's Trust, the Dr. John T. Macdonald Foundation School Health Initiative, the Batchelor Foundation, the CVS Caremark Charitable Trust, and the Florida Medical Schools Quality Network. This funding was also used to expand a toolkit that other SBHCs could use for advocacy to help garner additional funding and to engage HMOs. It was not clear which services remained and were supported after the HCIA funding ended.

Leadership also concentrated on agreements with MCOs to explore alternate payment models and generate revenue. Leadership aimed to implement an alternative payment plan with Amerigroup. The alternative payment plan was a demonstration of cost savings via a capitation rate in lieu of fee-for-service. To implement this component, 500 beneficiaries were needed. As of the writing of this report, efforts were under way to assist with increasing member enrollment, but it is not clear if these efforts continued after HCIA funding. In addition, Medicaid MCOs and U-Miami made contracting progress so that MCOs could contract with the SBHCs without necessarily contracting with all of U-Miami under the same terms. The external HMO consultant retained by U-Miami was instrumental in developing contracting arrangements with Medicaid MCOs.

U-Miami developed a plan to offer reimbursable health care services to Miami Data County public school employees. While any school employee can use the school-based health clinic for primary care services, it is anticipated that employees at schools where clinics are housed will use those clinics. Employees may receive primary care services the school-based health clinics provide to students with additional telemedicine services available.

U-Miami reported that while sustainability efforts were under way, a key lesson learned was that sustainability efforts should have started with the implementation of the grant. U-Miami consistently underspent throughout the contract and did not spend the full amount of the award. Thus, funds were available to spend on sustainability planning from the outset. Because a plan was not already in place, and future funding was uncertain, some services provided through the award may not have continued.

2.9 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues faced by U-Miami and accomplishments to date. Here we assess U-Miami's progress in achieving HCIA goals to date:

- **Smarter spending.** RTI is unable to evaluate changes in spending because Medicaid claims data were not available for the Medicaid IDs we received from U-Miami.
- **Better care.** RTI is unable to evaluate changes in health care utilization because Medicaid claims data were not available for the Medicaid IDs we received from U-Miami. Approximately 15 percent of those enrolled received at least one dental, CHW, or telehealth service.

- **Healthier people**. RTI did not receive sufficient data over time for any of the outcomes (e.g., BMI, HbA1c control, asthma control). Thus, we cannot assess the innovation's impact on health outcomes.

U-Miami was a complex innovation with multiple components, locations, types of services, and types of staff. U-Miami is a large organization with long timeframes for hiring and making changes. Thus, implementing the innovation, making administrative changes to support the program, and hiring staff all occurred simultaneously. In addition, subcontracts took a long time to execute, which resulted in a delay of services.

Several key barriers affected the innovation. Workforce development was challenging because the CHW role was new. Although CHWs were trained in a variety of topics, other clinical staff on the care team were not entirely aware of their role. The CHW role was originally conceptualized as a clinical extender but in practice, became a social services extender. Much of CHWs' time was spent on Medicaid enrollment. A dedicated supervisor started working on the project midway through, providing much-needed structure and prioritization.

For adoption, staff worked to ensure that students and their families had continuous insurance coverage. That effort was often difficult because some families were obtaining health insurance for the first time or had difficulty with the administrative paperwork. Other families avoided enrolling entirely if they had concerns about their citizenship/immigration status. Further complications included difficulties related to tracking and monitoring insurance enrollment. CHWs did not have dedicated computers and phones, which was another challenge.

U-Miami had a positive working relationship with CHS, yet fewer patients than expected were seen, possibly because CHS was an offsite service and families did not want to make the additional effort. The dental partner changed midstream, delaying provision of dental services. The HMO consultant helped with developing partnerships with MCOs.

U-Miami continued to be challenged by data tracking and availability. Data before the innovation were not available, which hindered development of a baseline. SBHCs have a student body that changes from year to year, which complicated longitudinal tracking. Because of the number of systems involved in tracking (without an automated mechanism for information exchange), data were collated manually. In addition, the population of undocumented persons is high in Miami, which impaired tracking. There were also inconsistencies in how identifiers were tracked for Medicaid patients. These factors hindered initial and ongoing tracking and monitoring, which in turn hampered assessment of progress.

Despite these challenges, U-Miami made strides in sustainability. Project leaders made it an organizational priority to partner with MCOs and secure reimbursement for school-based services. This work will be supplemented by funding sources recently secured by the foundation. However, it is unclear if HCIA-funded services will be able to continue in their existing form. Nevertheless, U-Miami developed and implemented components to deliver services to students and their families and can share lessons learned with other SBHCs.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

University of Miami (U-Miami)

The University of Miami (U-Miami) innovation expanded a longstanding network of school-based health centers (SBHCs) that provide comprehensive health care to school-aged students in Miami-Dade County. U-Miami was awarded $4,097,197 over 3 years for the innovation, which launched in July 2012.

Awardee Overview

Innovation dose:	About 15% of those enrolled in the innovation received at least one dental, community health worker (CHW), or telehealth service. Dental care represented 6.8% of services, with the rest split between CHW and telehealth services.	***Innovation reach:***	RTI received some data for 11,281 participants. However, only 14.8% received at least one service as part of the innovation.
Components:	(1) CHWs for care coordination and Medicaid enrollment (2) Dental service delivery (3) Telemedicine (4) Emergency department (ED) diversion clinic (5) Payment mechanism development	***Participant demographics:***	Nearly half of participants (46.5%) were 12 to 18 years of age. Data on race and sex were missing for most participants (80.5% and 77.1%, respectively). Less than half (46.8%) were covered by Medicaid.
Sustainability:	Leadership secured over $1.3 million, but it is not clear which services will remain and which will not be supported after HCIA funding ends. Agreements with managed care organizations will explore alternate payment models.		
Innovation type:	Care coordination Health IT	Provider payment reform	Direct health care/dental care

Key Findings

Smarter spending. RTI is unable to evaluate changes in spending because Medicaid claims data were not available for the Medicaid IDs we received from U-Miami.

Better care. RTI is unable to evaluate changes in health care utilization because Medicaid claims data were not available for the Medicaid IDs we received from U-Miami.

Healthier people. RTI did not receive sufficient data over time for any of the outcomes (e.g., body mass index (BMI), HbA1c control, asthma control). Thus, we cannot assess the innovation's impact on health outcomes.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

Women and Infants Hospital of Rhode Island

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter (April 2015) for nonextended awardees and up to the 14th quarter (December 2015) of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q13 (September 2015)
Quarterly Awardee Performance Report	Launch date–Q13 (September 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–September 2015

Q = quarter.

Women and Infants Hospital of Rhode Island

2.1 Introduction

The Women and Infants Hospital of Rhode Island (W&I) is a nonprofit acute care hospital in Providence, RI. The W&I Neonatal Intensive Care Unit (NICU) provides state-of-the-art tertiary care to more than 1,200 high-risk infants annually. W&I received an award of $3,261,494 to implement its innovation, Partnering with Parents (PWP), to improve transition to home services for high-risk preterm and full-term infants in Rhode Island, Connecticut, and Massachusetts. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce health spending for families of high-risk preterm and full-term infants in Rhode Island by 25 percent.
2. **Better care.** Improve care for a diverse population of high-risk preterm and full-term infants and families by ensuring that more than 90 percent receive enhanced transition care education and support in the NICU, during a post-discharge home visit, and in the follow-up clinic, and that more than 90 percent express satisfaction with the innovation. Reduce 30-day readmissions rate by 10 percent, 3-month readmissions rate by 25 percent, and 30-day ED visits by 25 percent.
3. **Healthier people**. Reduce all-cause mortality among medically fragile infants.

Table 2 provides a summary of changes that occurred during the final 3 months of operations. These updates are based on a review of the *Quarter (Q) 11–13 Narrative Progress Reports, Quarterly Awardee Performance Reports*, from January 2015 to September 2015, and secondary data received through September 30, 2015.

Table 2. Summary of Updates as of Quarter 13, September 30, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 9/30/2015)
Innovation Components	
	Shortened the follow-up time from 3 months corrected age to 1 month post-discharge in preparation for project closeout.
Program Participant Characteristics	
	All participants (100%) were infants less than 1 year; 54.2% were male; 59% were white; 21.8% were Hispanic; 53.5% were enrolled in Medicaid.
Workforce Development	
Hiring and retention	Fully staffed through Q11; staffing for the innovation was highest in Q11 with 13.48 FTEs, but declined in Q12 (11.10 FTEs) through Q13 (5.85 FTEs) as the innovation neared the end of the funding cycle.
Skills, knowledge, and training	Provided 1,978 hours of training to 532 individuals over the course of the innovation through community partner workshops.
Context	
Award execution	Spent 93% percent of the total innovation budget.
Leadership	Continued to receive strong innovation and organizational leadership support.
Organizational capacity	No changes since the first and second annual reports.[1,2]; had prior experience with the innovation, and staff/funding resources to implement it.
Innovation adoption and workflow integration	Adopted innovation as planned and incorporated services into NICU workflow.
Implementation Effectiveness	
Innovation reach	1,391 cumulative participants enrolled: 75.3% of eligible early and moderate preterm infants and 68.7% of eligible late preterm and full-term infants enrolled.
Innovation dose	All infants enrolled after April 1, 2015, received a 1-month protocol, including post-discharge phone call (67.4–96% across the high-risk infant groups) and a 1-month assessment (75–96%). At least 70.8% of eligible mothers completed the Edinburgh Depression Scale.
	All infants enrolled before April 1, 2015 received the 3-month protocol, including a post-discharge phone call (98.5–100% across the high-risk infant groups), a 1-month assessment (73.2–91.6%), and a 3-month assessment (69.7–88%). At least 78.4% of eligible mothers completed the Edinburgh Depression Scale.
Sustainability	
	Continued education and support services to early preterm infants through THP.
	Exploring opportunities to sustain program for moderate/late preterm infants via Medicaid contracts and Care New England's Accountable Care Organization.
	Identifying opportunities to create positions for FRS on NICU research studies.

Sources: *Q11-Q13 Narrative Progress Report*.
Q11-Q13 Quarterly Awardee Performance Report.
Patient-level data provided to RTI. Key informant interviews conducted.

[1] Rojas Smith, L., Holden, D. J., Hoerger, T., et al.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report. 2014, October. Center for Medicare & Medicaid Innovation, Centers for Medicare & Medicaid Services. Available from: http://downloads.cms.gov/files/cmmi/HCIA-CommunityRPPM-FirstEvalRpt_4_9_15.pdf

[2] Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. 2015, Prepared for the Centers for Medicare & Medicaid Services.

FRS = Family Resource Specialists; NICU = neonatal intensive care unit; THP = Transition Home Plus.

Table 3 summarizes Medicaid claims-based findings during the innovation period. The innovation group incurred higher spending than the comparison group in the first year after the innovation launch (on the basis of claims data from all infants), but lower spending in the second year (among those infants who had claims data in the second year). The overall estimate for the difference in quarterly spending is positive, but not statistically significant, however, indicating no significant difference between the innovation and comparison groups in Medicaid spending. Overall, the innovation group had significantly fewer inpatient admissions, hospital readmissions, and ED visits than the comparison group.

Table 3. Summary of Medicaid Claims-Based Findings: W&I

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	0.902	(−0.497, 0.678)	2.414	(−3.460, 8.287)	−1.511	(−2.599, −0.423)	N/A	N/A
Acute care inpatient stays	−28	(−53, −4)	−23	(−46, −1)	−5	(−13, 3)	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−26	(−48, −4)	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−399	(−472, −327)	−324	(−392, −256)	−77	(−101, −51)	N/A	N/A
Average impact per quarter								
Spending per participant	740	(−4,080, 5,560)	1,980	(−2,838, 6,798)	−1,240	(−2,132, 347)	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−23	(−43, −3)	−19	(−38, −1)	−4	(−11, 2)	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−74	(−137, −10)	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−328	(−388, −269)	−266	(−322, −210)	−62	(−83, −42)	N/A	N/A

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size..

2.1.1 Innovation Components

The W&I innovation, PWP, was an expansion of the Transition Home Plus (THP) program, and offered support to newborns who spend 5 or more days in the NICU and their families. Newborns were placed in one of four enrollment groups, based on their gestational age at birth: Early/moderate preterm births are at or before 33.6 weeks of gestation; late preterm births are at or before 34 to 36.6 weeks of gestation; and, as of August 2013, full-term births are at or after 37 weeks of gestation. Enrolled infants and their families received four components: (1) peer support, (2) social worker support, (3) clinical support, and (4) patient navigation. The innovation also included community education and engagement efforts that consisted of periodic educational workshops with broad stakeholder participation and a health information technology partnership.

The innovation team provided services through April 1, 2016, assigning a family resource specialist (FRS) or licensed independent clinical social worker (LICSW) to deliver follow-up services for a family as an infant was discharged from the NICU and the family went home. The FRS or the LICSW was available to the family during the 3-month enrollment in the program to answer questions and to guide them through the activities that included a post-discharge phone call, a nurse practitioner home visit (for infants in the early and moderate preterm group), medical assessments at 1 and 3 month of age, and having mothers complete the Edinburgh Depression Scale.

W&I implemented the PWP innovation as planned, and even extended services to high-risk full-term infants in August 2013 and to families in Massachusetts and Connecticut in April 2014 to boost enrollment. In 2015, W&I shortened the follow-up time for PWP infants and families from 3 months corrected age to 1 month post-discharge for infants enrolled on or after April 1, 2016, in preparation for project closeout.

The partners for this innovation remained unchanged since the second annual report. Key partners through the PWP program are listed in ***Table 4***. The Rhode Island Parent Information Network (RIPIN) was a major partner in employing and training the FRS. RIPIN is a 501c3 nonprofit that provides the direct linkages for parents and children with special health care needs in Rhode Island to obtain the critical health care and education services and supports needed.[1] RIPIN trains and provides parent consultants to multiple programs in Rhode Island, including the Early Intervention program. The Rhode Island Department of Health: First Connections is a visiting nurse program (part of the Rhode Island Department of Health) that provides home visits to early and moderate preterm infants following discharge, and administers the Edinburgh Depression to mothers of infants enrolled. The Rhode Island Quality Institute/CurrentCare is the health information exchange that gave W&I providers up-to-the-minute information if a patient visited the ED or was admitted to the hospital. This is an opt-in program, and 885 out of the 1,391 enrolled in PWP were also enrolled in CurrentCare. The Massachusetts Welcome Family program is a home visiting program for Massachusetts newborns similar to First Connections in Rhode

[1] Rhode Island Parent Information Network. N.p., n.d. Web. (16 July 2014). www.ripin.org.

Island. Therefore, when a child, who is a resident of Massachusetts, enrolled in the PWP program, the Massachusetts Welcome Family program conducted a home visit. Kathleen Hawes, PhD, RN, a psychiatric clinical nurse specialist and member of the W&I NICU clinical team, also partnered with the PWP program informally. She provided subject matter expertise to the PWP program on perinatal depression and mood disorders, and was involved in the analyses of maternal health risk factors, the Edinburgh Depression Scale, and other measures of parental stress.

Table 4. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
RIPIN	Employs and provides training and support to FRS.	Cranston, RI
Kent Hospital	Hospital partner; only other NICU in Rhode Island.	Warwick, RI
Rhode Island Department of Health: First Connections	Supplies data on maternal depression for women enrolled in the program. Data are collected via independently conducted home visits to pregnant women and families statewide with young children who meet department criteria.	Providence, RI
Rhode Island Quality Institute/ CurrentCare	Health information exchange system with data about ED visits and hospitalizations.	Providence, RI
Massachusetts Welcome Family Program	Home visiting program that offers nurse home visits to parents of newborns residing in several large communities in Massachusetts.	Boston, MA
Kathleen Hawes, PhD, RN	Psychiatric Clinical Nurse specialist and member of the W&I NICU team.	Providence, RI

ED = emergency department; FRS = Family Resource Specialist; NICU = neonatal intensive care unit; W&I = Women and Infants Hospital of Rhode Island.

2.1.2 Program Participant Characteristics

Table 5 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the 2015 annual report, based on data through Q11. Since then, enrollment increased by 141 infants. The distribution of patient characteristics, however, is similar. More specifically, all of the participants (100%) were newborn infants and more than half (54.2%) were male. Most participants (59.0%) were white, and about 21.8% were Hispanic. About half (53.5%) were covered by Medicaid, while the other half (46.5%) were private insurance or self-pay.

Table 5. Characteristics of All Participants Ever Enrolled in the W&I Innovation through September 2015

Characteristic	Number of Participants	Percentage of Participants
Total	1,391	100.0
Age		
< 18	1,391	100.0
18–24	0	0.0
25–44	0	0.0
45–64	0	0.0
65–74	0	0.0
75–84	0	0.0
85+	0	0.0
Missing	0	0.0
Sex		
Female	637	45.8
Male	754	54.2
Missing	0	0.0
Race/ethnicity		
White	820	59.0
Black	141	10.1
Hispanic	303	21.8
Asian	50	3.6
American Indian or Alaska Native	10	0.7
Native Hawaiian or other Pacific Islander	0	0.0
Other	57	4.1
Missing/refused	10	0.7
Payer category		
Dual	0	0.0
Medicaid	744	53.5
Medicare	0	0.0
Medicare Advantage	0	0.0
Other[1]	647	46.5
Uninsured	0	0.0
Missing	0	0.0

Source: Patient-level data provided to RTI.
[1] Self pay and private insurance.

2.2 Claims-Based Measures for Evaluation

The following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?
- Has the innovation reduced spending per patient?

Table 6 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 6. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	Yes
		Hospital unplanned readmissions rate	No	Yes
		ED visit rate	No	Yes
	Cost	Spending per patient	No	Yes
		Estimated cost savings	No	Yes

ED = emergency department.

2.3 Medicare Claims Analysis

W&I provided services to high-risk newborns, therefore we do not perform Medicare claims analyses.

2.4 Medicaid Comparison Group

We originally planned to use Medicaid data from the Centers for Medicare & Medicaid Services (CMS) Alpha-MAX data files. However, currently, Medicaid claims for Rhode Island are only available in Alpha-MAX through Q3 2012. Because the W&I innovation was launched on October 15, 2012, and Alpha-MAX Medicaid claims data are not yet available for the period after the start of the innovation, we requested access from the state of Rhode Island. In August 2015, we obtained the Rhode Island Medicaid data through a data use and security agreement with one of RTI's current projects, the Multi-payer Advanced Primary Care Practice Demonstration, which had already obtained the Rhode Island Medicaid data for evaluation purposes. The Rhode Island Medicaid data cover 9 calendar years, from January 2006 to December 2014. In this report, we present the four core measures for Medicaid beneficiaries who enrolled before October 31, 2014.

Virtually all high-risk infants born in Rhode Island are treated in one of the two hospitals participating in the innovation: W&I or Kent Hospital NICU. Consequently, we cannot compare outcomes of W&I with other in-state hospitals in the period after W&I launched its innovation. We propose a before-and-after analysis in Rhode Island. Prior to the innovation, W&I treated high-risk infants through a similar program, THP. Babies were identified through provider identification codes, NICU codes, and diagnostic codes. The PWP innovation expanded the THP program to less high-risk babies, where risk is denoted by weight at birth and level of prematurity. W&I provided data for a group of similar high-risk infants born prior to the innovation's launch.

The Rhode Island Medicaid claims analysis focuses on 322 Medicaid beneficiaries enrolled in fee-for-service Medicaid during the innovation launch, although we use both the fee-for-service and/or managed care claims of the beneficiaries when calculating their spending and utilization measures. No baseline period is available to compare to newborns' experiences, because they entered the innovation shortly after birth. The comparison group consisted of 424 high-risk infants who were born and admitted to the W&I NICU during 2011. We present measures for newborns enrolled in the W&I innovation and for a group of comparison newborns with fee-for-service Medicaid in Rhode Island from a prior period. One difference between the two groups is that the innovation newborns had a higher percentage of births at less than 32 weeks of gestation than the comparison group (44% versus 39%).

To balance the demographic characteristics between the innovation and comparison groups, we estimate a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of gestational age, gender, and race. Then we use the predicted value of each comparison beneficiary's probability of being enrolled in the innovation, or propensity score, to construct corresponding weights. We ameliorate group disparities by weighting by the inverse of each comparison beneficiary's estimated propensity score. The inverse propensity treatment weight (IPTW) is PS/(1-PS) where PS is a comparison beneficiary's predicted propensity score. Weights are set to 1 for all members of the innovation group. In operationalizing the propensity score weighting, IPTWs are capped at a value of 5 to prevent any particular beneficiary from unduly influencing the results. Comparison beneficiary weights are also normalized to have a mean of 1 so that the weighted size of the comparison group is equal to the unweighted size.

In unweighted studies, all observations are implicitly assumed to have a weight of 1. When propensity score weights are applied, some comparison beneficiaries will have weights less than 1 (and will have less influence on study analyses), while others will have weights greater than 1 (and will have more influence on study analyses). These differential IPTWs, which produce different descriptive and multivariate results than unweighted data, are the key mechanism for creating greater equivalence between the innovation and comparison groups and for mitigating the potential for selection bias.

Table 7 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after weighting. ***Figure 1*** shows the distribution of the propensity scores for both the innovation and comparison groups.

Table 7. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: W&I

Variable	Before Weighting: Innovation Group Mean	Before Weighting: Innovation Group SD	Before Weighting: Comparison Group Mean	Before Weighting: Comparison Group SD	Standardized Difference	After Weighting: Innovation Group Mean	After Weighting: Innovation Group SD	After Weighting: Comparison Group Mean	After Weighting: Comparison Group SD	Standardized Difference
Female	0.46	0.50	0.45	0.50	0.03	0.46	0.50	0.47	0.50	0.02
White	0.16	0.36	0.19	0.40	0.10	0.16	0.36	0.16	0.37	0.01
Black	0.05	0.22	0.07	0.26	0.07	0.05	0.22	0.05	0.23	0.01
Race missing	0.77	0.42	0.70	0.46	0.15	0.77	0.42	0.76	0.42	0.01
Less than 32 weeks of gestation	0.27	0.44	0.19	0.40	0.18	0.27	0.44	0.27	0.44	0.00
Between 32 to 34 weeks of gestation	0.15	0.36	0.16	0.36	0.01	0.15	0.36	0.15	0.36	0.01
Between 34 to 36.6 weeks of gestation	0.37	0.48	0.27	0.45	0.22	0.37	0.48	0.37	0.48	0.00
Number of beneficiaries	322	—	424	—	—	322	—	424	—	—

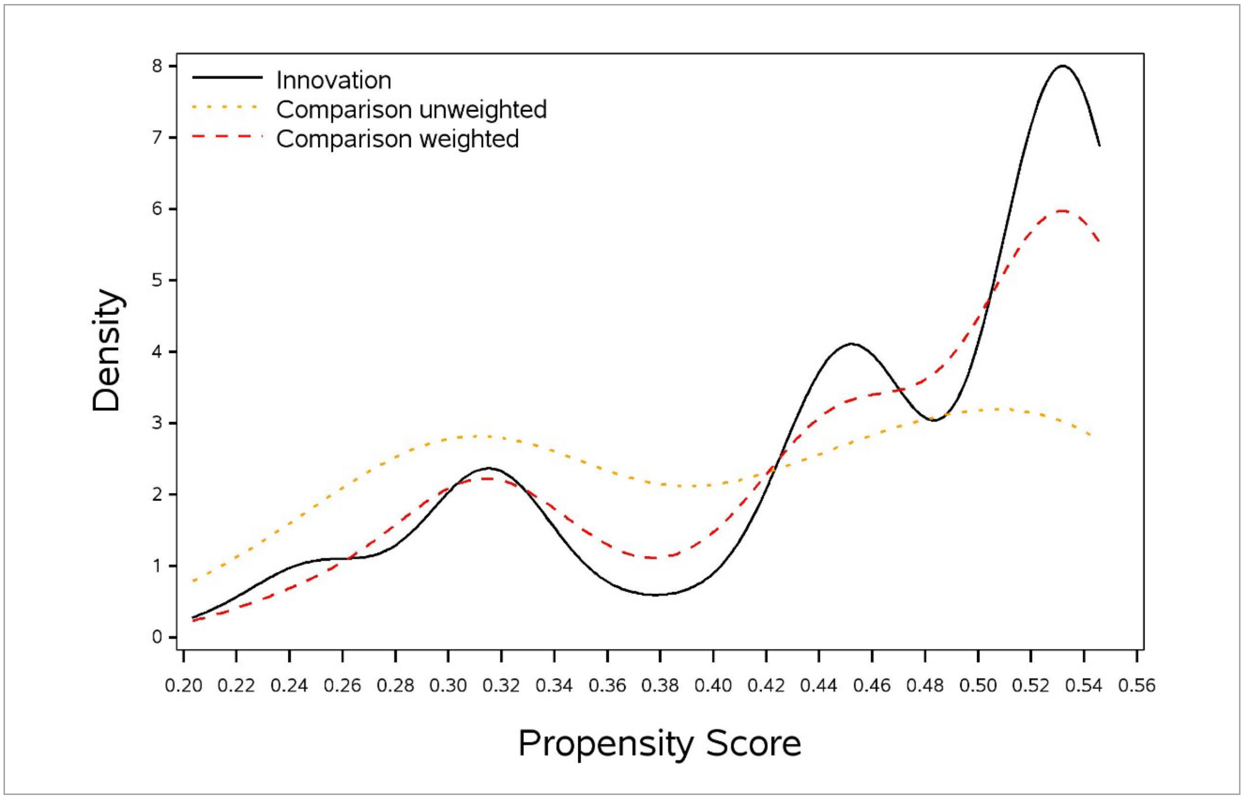
Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island; SD = standard deviation.
— Data not applicable.

After performing propensity score weighting, we calculate absolute standardized differences between the innovation and comparison groups and check whether the weights decrease the absolute standardized differences and achieve acceptable balance (Table 7). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[2] Researchers also point out that critical variables in determining selection into innovation (e.g., those with significant effects in the propensity score equation) should have greater balance, while minor indicators in determining innovation selection do not require optimal balance. The results in Table 7 show that propensity score weighting reduced the absolute standardized differences and achieved adequate balance for all included variables.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The figures demonstrate a very close overlap between the innovation and comparison groups' propensity scores after the weights are applied. Therefore, we present the Medicaid claims analysis using both the innovation group and the weighted comparison group.

[2] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

Figure 1. Distribution of Propensity Scores for Innovation and Comparison Groups: W&I



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.5 Medicaid Spending

2.5.1 Descriptive Results

This report includes claims through December 31, 2014. ***Table 8*** reports Medicaid spending per patient in the eight quarters after enrolling in the innovation (i.e., after birth) for the innovation group, as well as Medicaid spending per patient in the eight quarters after birth for the comparison group in a previous time period. Due to the difference in time periods, the spending numbers reported for both groups have been inflation-adjusted to reflect the equivalent value of 2014 U.S. dollars. Savings per patient reflect the spending differential between the comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicaid spending per beneficiary in Table 8 for innovation and comparison group beneficiaries, first using all eight innovation quarters, and then using quarters from the second innovation quarter onward. The blue line represents values for beneficiaries enrolled in the innovation. The red line represents values for comparison group beneficiaries.

We assigned each infant's quarter of inpatient admissions based on their admission date instead of the discharge date. As a result, all costs associated with the inpatient admissions are counted in the quarter of admissions based on their admission date. Spending is very high in the first quarter after birth for both the innovation and comparison groups, and quickly declines to a few thousand dollars per quarter for both groups in the subsequent quarters. Spending in the innovation group is higher than in the comparison group in the first quarter. As shown in Table 8, the standard deviation for spending is very high, representing the skewed nature of expenditures.

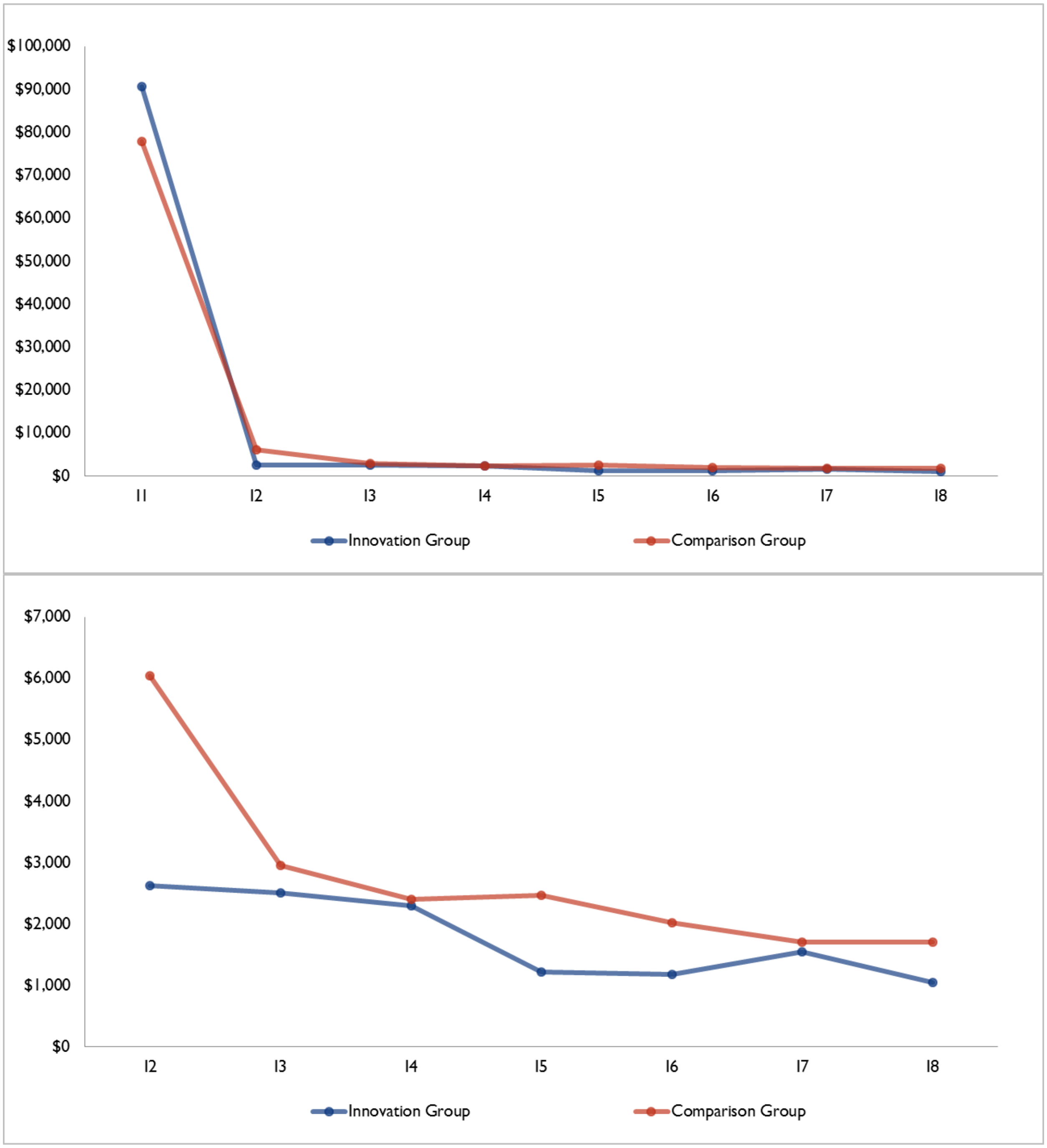
Table 8. Medicaid Spending per Patient: W&I

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
Spending rate	$90,594	$2,626	$2,511	$2,301	$1,220	$1,171	$1,541	$1,041
Std dev	$139,375	$5,303	$8,931	$7,657	$2,207	$2,084	$3,335	$1,581
Unique patients	322	256	187	157	122	94	56	24
Comparison Group								
Spending rate	$77,936	$6,040	$2,957	$2,395	$2,467	$2,019	$1,708	$1,705
Std dev	$114,871	$35,449	$12,796	$9,544	$14,152	$9,452	$6,838	$7,972
Unique patients	423	414	403	396	388	374	370	368
Savings per Patient								
	−$12,658	$3,414	$446	$94	$1,247	$848	$167	$664

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
Spending rate: Total quarterized payments/number of unique patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
I1 = Innovation Q1.
W&I = Women and Infants Hospital of Rhode Island.

Figure 2. Medicaid Spending per Participant (I1–I8 and I2–I8): W&I



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
W&I = Women and Infants Hospital of Rhode Island.

2.5.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their comparison group. The weighted average quarterly spending differential in the innovation period is $740 (90% CI: –$3,303, $4,784), indicating a loss. This effect is not statistically significant at the 10 percent level and is primarily driven by the loss in the first innovation quarter. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls with 90 percent confidence.

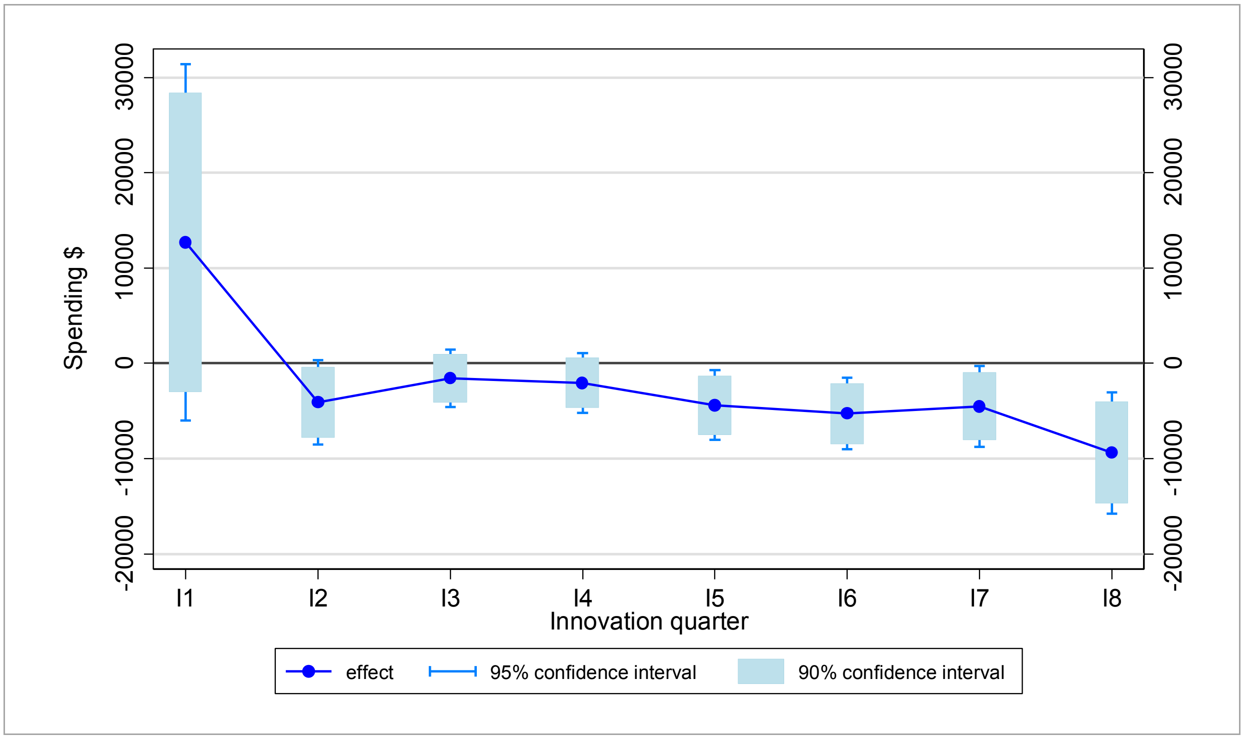
In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 9*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 3*** illustrates these quarterly estimates. The quarterly effects show savings in most of the innovation quarters after the first quarter.

Table 9. OLS Regression Estimates for Quarterly Medicare Spending per Participant: W&I

Quarter	Coefficient	Standard Error	P-Values
I1	12,693	9,533	0.184
I2	−4,104	2,267	0.071
I3	−1,586	1,539	0.303
I4	−2,066	1,613	0.201
I5	−4,388	1,862	0.019
I6	−5,279	1,923	0.006
I7	−4,536	2,161	0.036
I8	−9,409	3,253	0.004
Overall average	740	2,455	0.763
Overall aggregate	902,204	2,992,978	0.763
Overall aggregate (IY1)	2,413,555	2,991,702	0.420
Overall aggregate (IY2)	−1,511,350	554,149	0.007

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The regression coefficients are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups. The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their comparison group.
I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island; OLS = ordinary least squares.

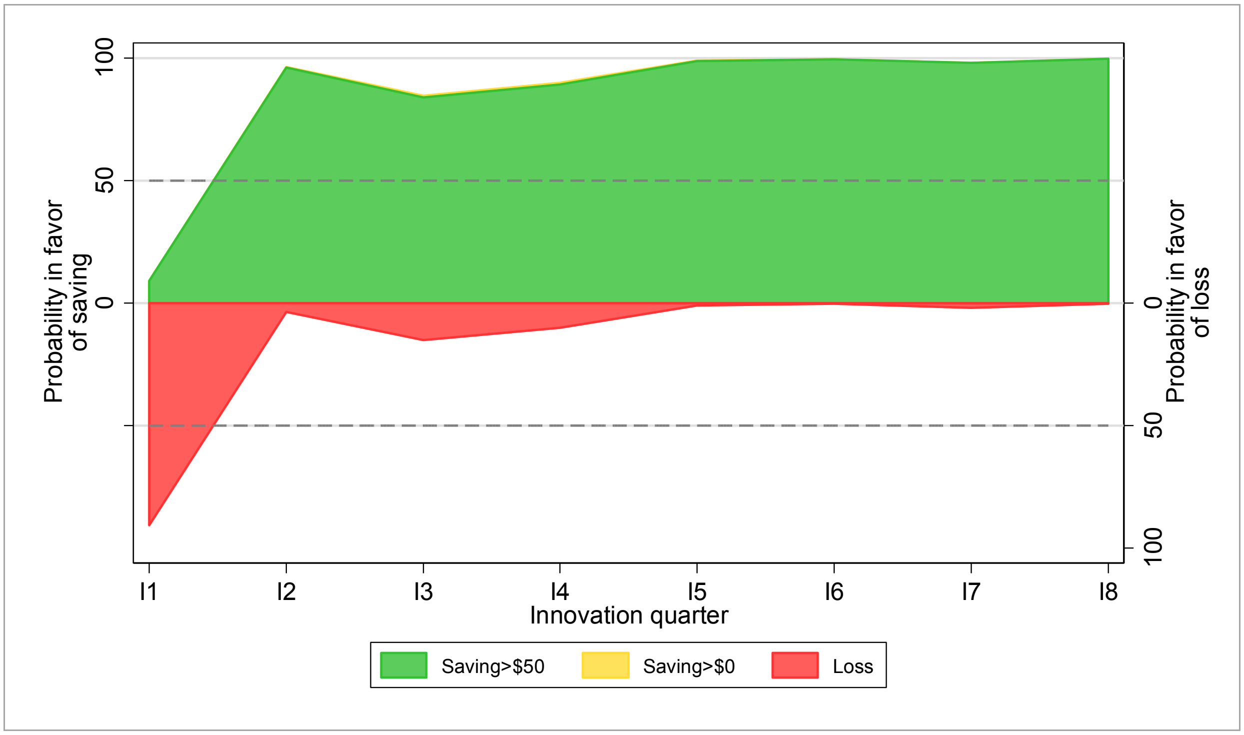
Figure 3. OLS Regression Estimates for Quarterly Medicaid Spending per Participant: W&I



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island; OLS = ordinary least squares.

Figure 4 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates are lower for the innovation group than for the comparison group from the second innovation quarter onward, the current result suggests that the innovation has a higher probability of generating savings in subsequent quarters after the first quarter. However, because the sample sizes are very small in later quarters, we may have low statistical power and imprecise regression estimates for these quarters.

Figure 4. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: W&I



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.6 Medicaid Inpatient Admissions

2.6.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 5***. Figure 5 illustrates the all-cause inpatient admissions rates first using all eight innovation quarters, and then using quarters from the second innovation quarter onward. As mentioned earlier, we assigned each infant's quarter of inpatient admissions based on admission date instead of discharge date. Inpatient admissions began at the same rate for both the innovation and comparison groups because almost every newborn was admitted to the W&I or Kent Hospital NICU. Inpatient admissions declined to below 100 per 1,000 for both groups in all subsequent quarters after birth. We examine the inpatient admissions rate further in the regression analysis section below.

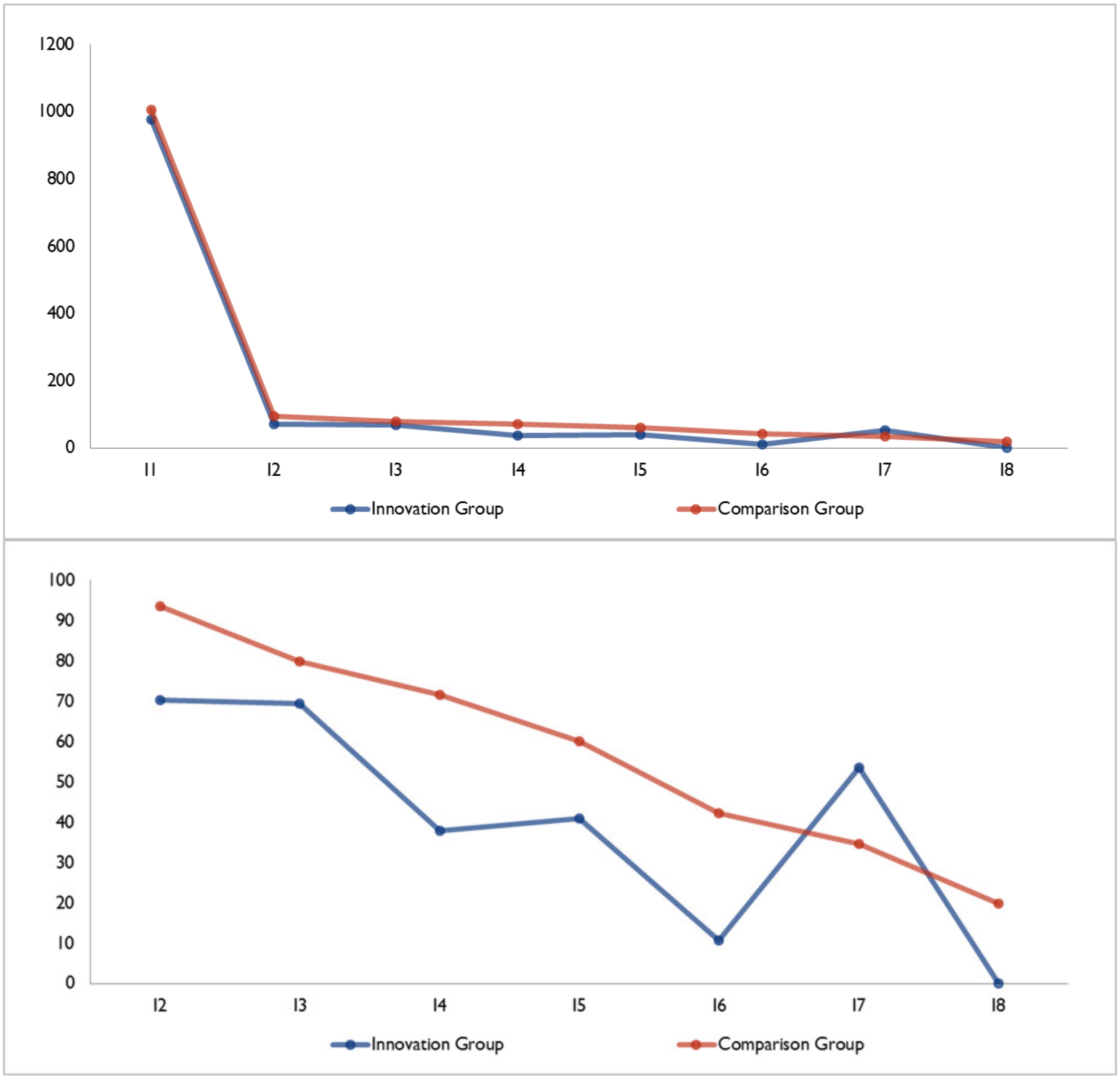
Table 10. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: W&I

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
Admit rate	978	70	70	38	41	11	54	0
Std dev	299	368	344	191	198	103	225	0
Unique patients	322	256	187	157	122	94	56	24
Comparison Group								
Admit rate	1,006	94	80	72	60	42	35	20
Std dev	393	340	406	399	436	299	241	211
Unique patients	423	414	403	396	388	374	370	368
Innovation − Comparison Rate								
	−28	−24	−10	−34	−19	−31	19	−20

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
Admit rate: (Total unquarterized admissions/unique patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants (I1–I8 and I2–I8): W&I



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.6.2 Regression Results

The average quarterly difference estimate for inpatient admissions is a decrease of 23 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in the number of inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −43, −3). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 11 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. All the quarterly coefficients are negative except for one, although none of them are statistically significant at the 10 percent level, possibly due to the small sample size in each quarter.

Table 11. Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: W&I

Quarter	Coefficient	Standard Error	P-Values
I1	−29	27	0.286
I2	−24	30	0.419
I3	−11	35	0.743
I4	−36	30	0.230
I5	−21	34	0.527
I6	−33	23	0.143
I7	18	34	0.606
I8	−21	14	0.138
Overall average	−23	12	0.058
Overall aggregate	−28	15	0.058
Overall aggregate (IY1)	−23	14	0.100
Overall aggregate (IY2)	−5	5	0.298

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The negative binomial coefficients are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their comparison group.
I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island.

2.7 Medicaid Unplanned Readmissions

2.7.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 12*** and ***Figure 6***. The unplanned readmissions rates are similar for the innovation and comparison groups during the first three quarters, but diverge widely in the rest of the quarters. Beginning in the fourth quarter, the number of total admissions is much lower for the innovation group than the comparison group, possibly due to incomplete Medicaid claims data for the innovation group instead of a true decline in the unplanned readmissions rates. As with the other variables, we include statistical tests on the unplanned readmissions rate in the regression analyses that follow.

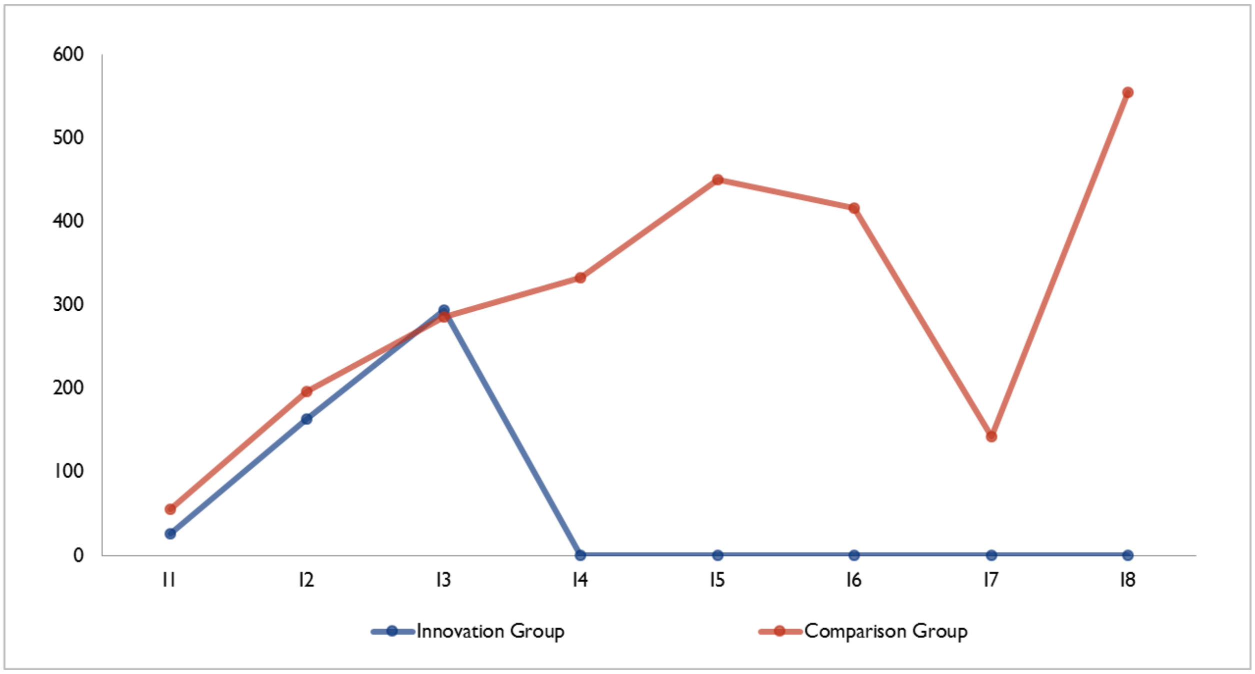
Table 12. Hospital Unplanned Readmissions Rate per 1,000 Medicaid Inpatient Admissions: W&I

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
Readmit rate	26	163	294	0	0	0	0	0
Std dev	158	370	456	0	0	0	0	0
Total admissions	272	49	17	6	5	1	2	1
Comparison Group								
Readmit rate	56	197	286	333	450	417	143	556
Std dev	229	398	452	471	497	493	350	497
Total admissions	395	61	28	21	20	12	7	9
Innovation − Comparison Rate								
	−30	−33	8	−333	−450	−417	−143	−556

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
Readmit rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 6. Hospital Unplanned Readmissions Rate per 1,000 Medicaid Inpatient Admissions: W&I



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.7.2 *Regression Results*

Table 13 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference estimate for unplanned readmissions is −74 per 1,000 inpatient admissions (−7.4 percentage points), indicating that the innovation-comparison difference is 7.4 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant at the 10 percent level (90% CI: −137, −10).

Table 13. Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicaid Participants: W&I

Coefficient	Coefficient	Standard Error	P-Values
Overall average	−74	38	0.055
Overall aggregate	−26	13	0.055

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The logistic regression coefficient is the simple difference estimate. Besides the innovation group indicator, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation.
W&I = Women and Infants Hospital of Rhode Island.

2.8 Medicaid Emergency Department Visits

2.8.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 14*** and ***Figure 7.*** The ED visit rate was less than 300 per 1,000 participants for the innovation group in the first six innovation quarters, whereas the ED visit rate for the comparison group starts at a rate above 400 and stay high during most of the quarters. As with the other variables, we will include statistical tests on the ED visit rate in the regression analysis section.

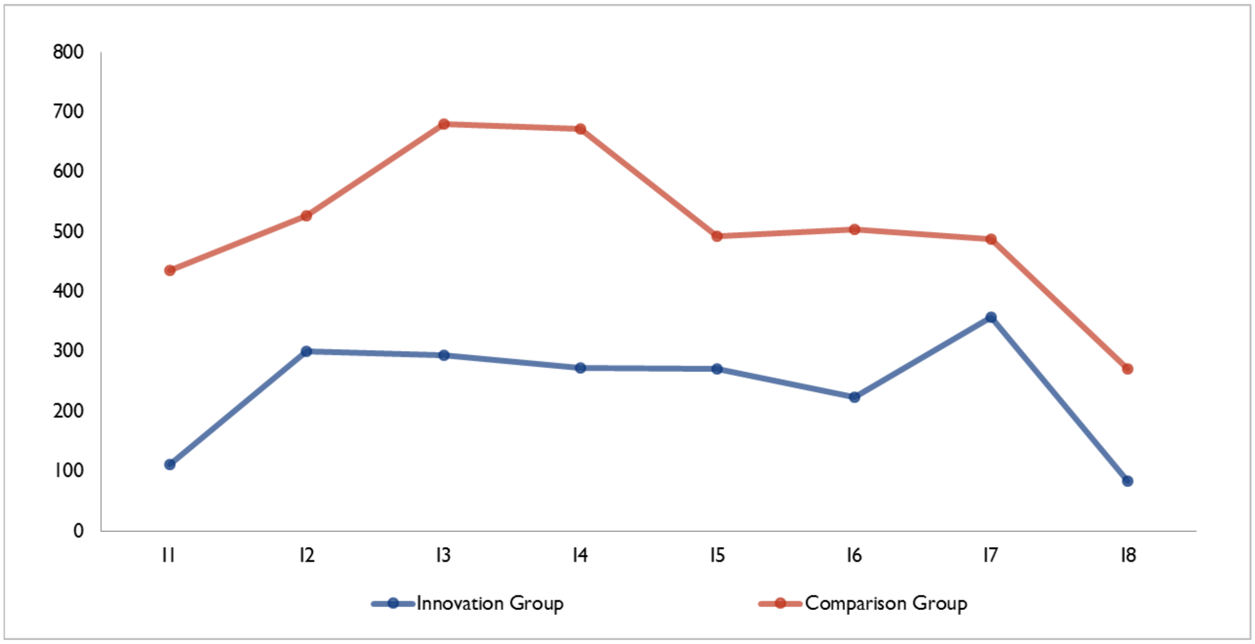
Table 14. ED Visits per 1,000 Medicaid Participants: W&I

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
ED rate	112	301	294	272	270	223	357	83
Std dev	459	861	674	559	587	509	666	276
Unique patients	322	256	187	157	122	94	56	24
Comparison Group								
ED rate	435	527	681	673	493	504	487	272
Std dev	1,077	1,168	1,355	1,352	978	1,231	1,081	763
Unique patients	423	414	403	396	388	374	370	368
Innovation−Comparison Rate								
	−323	−226	−387	−401	−223	−281	−130	−189

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /unique patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; ED = emergency department; W&I = Women and Infants Hospital of Rhode Island.

Figure 7. ED Visits per 1,000 Medicaid Participants: W&I



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
ED = emergency department; W&I = Women and Infants Hospital of Rhode Island.

2.8.2 Regression Results

The average quarterly difference estimate for ED visits is a decrease of 328 visits per 1,000 participants relative to the comparison group. This is the average difference in the number of ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: −388, −269). In addition to the average effect over the innovation period, we present quarterly effects.

Table 15 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000 so that the adjusted estimates show ED visits per 1,000 participants. All the quarterly coefficients are negative and all but one are statistically significant at the 10 percent level.

Table 15. Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: W&I

Quarter	Coefficient	Standard Error	P-Values
I1	−342	75	<0.001
I2	−260	87	0.003
I3	−411	102	<0.001
I4	−445	104	<0.001

(continued)

Table 15. Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: W&I (continued)

Quarter	Coefficient	Standard Error	P-Values
I5	−258	84	0.002
I6	−323	98	0.001
I7	−160	110	0.146
I8	−209	82	0.011
Overall average	−328	36	<0.001
Overall aggregate	−400	44	<0.001
Overall aggregate (IY1)	−324	41	<0.001
Overall aggregate (IY2)	−76	15	<0.001

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The negative binomial coefficients are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups. The overall average is the weighted average treatment effect per quarter during innovation period for beneficiaries enrolled in the innovation compared with the comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island.

2.9 Medicaid Subgroup Analysis

We also perform a subgroup analysis focusing on late preterm and full-term infants who had more than 34 weeks of gestation. The subgroup analysis will help examine the differential impact of the HCIA PWP innovation versus the preexisting THP program. We briefly present the comparison group, core four summary statistics, and corresponding regressions for the subgroup analysis.

Table 16 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after weighting.

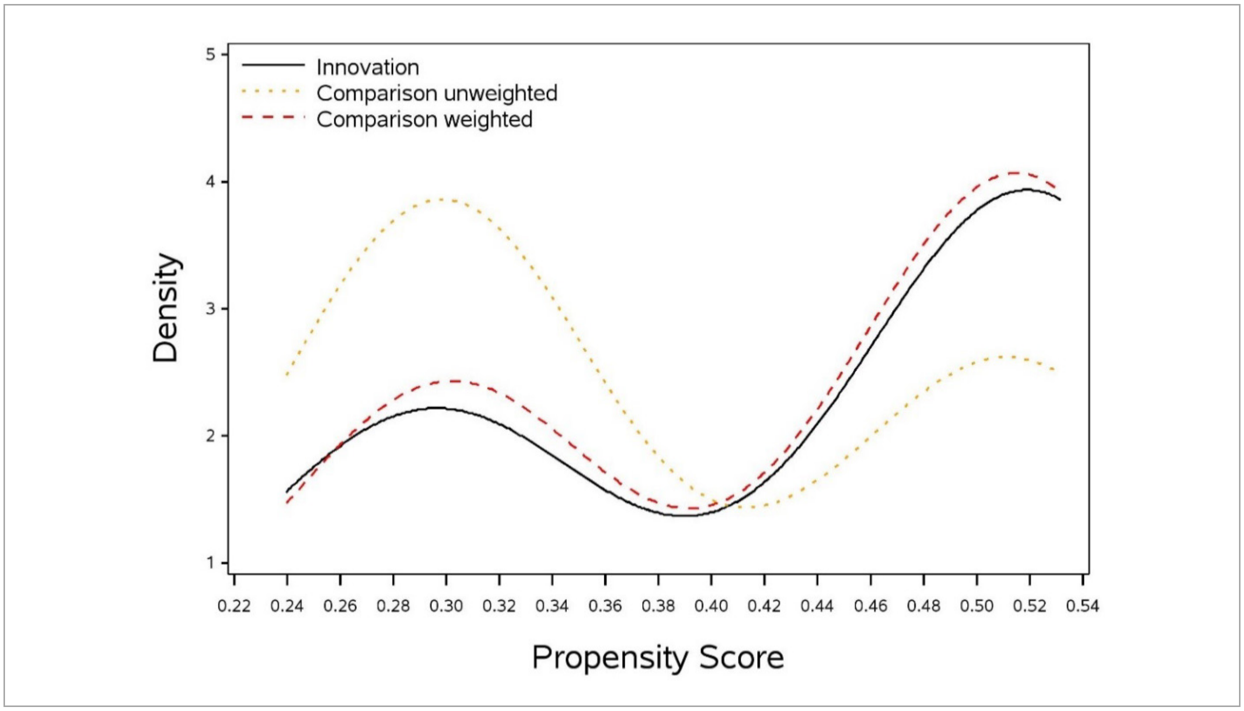
Table 16. Medicaid Mean Values and Standardized Differences of Variables in Propensity Score Model: W&I Subgroup (More than 34 Weeks Gestation)

Variable	Before Weighting: Innovation Group Mean	Before Weighting: Innovation Group SD	Before Weighting: Comparison Group Mean	Before Weighting: Comparison Group SD	Standardized Difference	After Weighting: Innovation Group Mean	After Weighting: Innovation Group SD	After Weighting: Comparison Group Mean	After Weighting: Comparison Group SD	Standardized Difference
Female	0.43	0.50	0.45	0.50	0.04	0.43	0.49	0.44	0.50	0.02
White	0.18	0.38	0.21	0.41	0.09	0.18	0.38	0.19	0.39	0.03
Black	0.04	0.19	0.06	0.23	0.10	0.04	0.19	0.04	0.20	0.01
Race missing	0.76	0.43	0.71	0.46	0.13	0.76	0.42	0.75	0.43	0.03
Between 34 to 36.6 weeks of gestation	0.64	0.48	0.42	0.49	0.46	0.64	0.48	0.64	0.48	0.01
Number of beneficiaries	187	—	276	—	—	187	—	276	—	—

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
SD = standard deviation; W&I = Women and Infants Hospital of Rhode Island.
— Data not applicable.

Figure 8 shows the distribution of the propensity scores for both the innovation and comparison groups. The figures demonstrate a very close overlap between the innovation and comparison groups' propensity scores after the weights are applied. We present the Medicaid claims analysis using both the innovation group and the weighted comparison group in the subgroup analysis.

Figure 8. Distribution of Propensity Scores for Innovation and Comparison Groups: W&I Subgroup (More than 34 Weeks Gestation)



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.10 Medicaid Spending in Subgroup

2.10.1 Descriptive Results

Figure 9 illustrates the Medicaid spending per beneficiary in ***Table 17*** for innovation and comparison group beneficiaries from the subgroup.

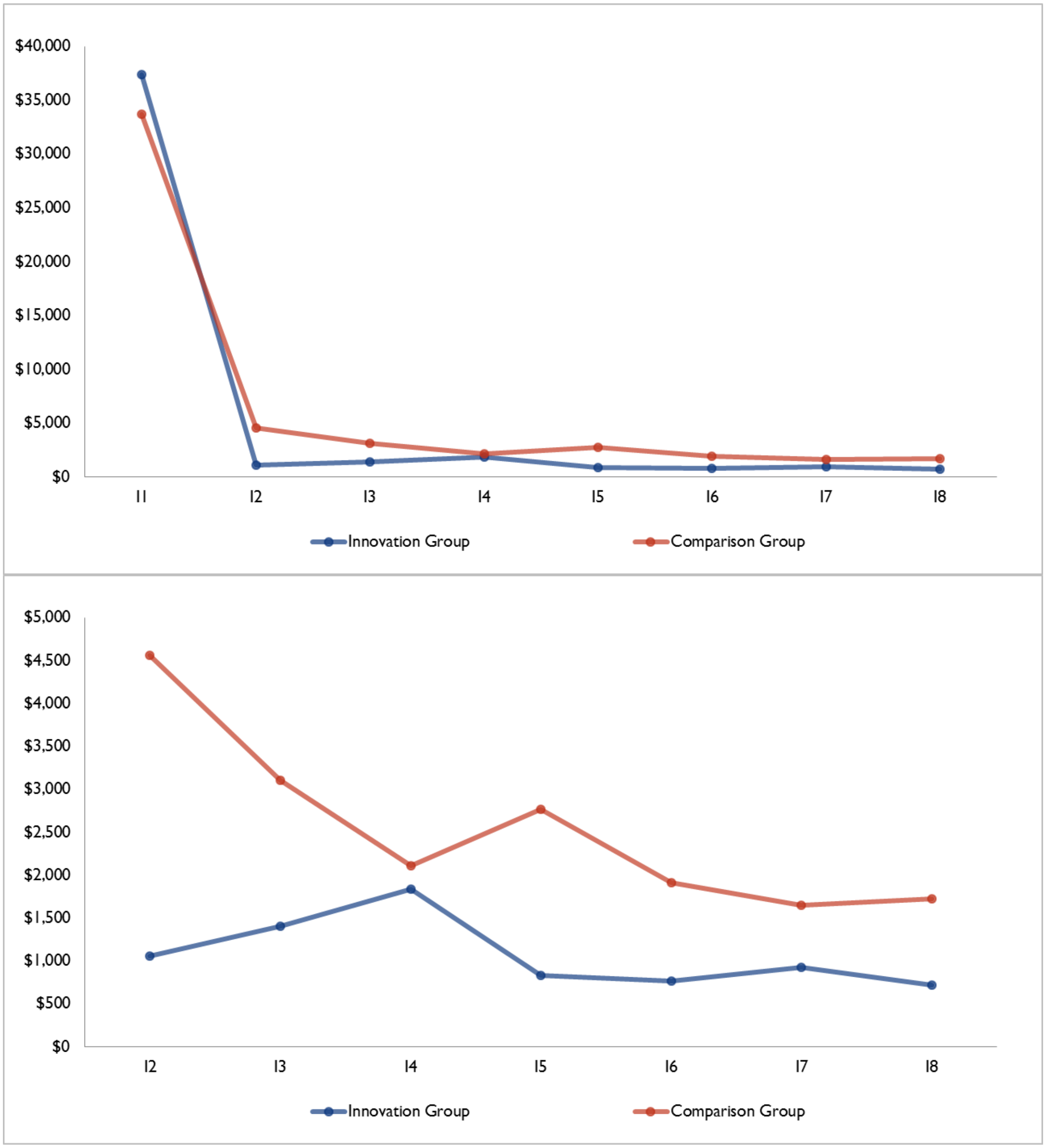
Table 17. Medicaid Spending per Patient: W&I Subgroup (More than 34 Weeks Gestation)

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
Spending rate	$37,374	$1,057	$1,404	$1,834	$835	$769	$927	$723
Std dev	$71,174	$2,176	$3,596	$8,553	$1,332	$933	$1,165	$1,248
Unique patients	187	142	99	82	60	41	23	9
Comparison Group								
Spending rate	$33,732	$4,559	$3,102	$2,110	$2,764	$1,915	$1,653	$1,725
Std dev	$53,785	$29,457	$15,978	$11,853	$17,823	$11,253	$8,480	$9,996
Unique patients	275	271	262	256	249	241	236	237
Savings per Patient								
	−$3,642	$3,503	$1,698	$276	$1,929	$1,146	$727	$1,002

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
Spending rate: Total quarterized payments/number of unique patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 9. Medicaid Spending per Participant (I1–I8 and I2–I8): W&I Subgroup (More than 34 Weeks Gestation)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
W&I = Women and Infants Hospital of Rhode Island.

2.10.2 Regression Results

We present the weighted average treatment effect per quarter during the innovation period for the subgroup of beneficiaries enrolled in the innovation compared with their comparison group. The weighted average quarterly spending differential in the innovation period is −$774 (90% CI: −$4,622, $3,075), indicating savings. This effect is not statistically significant at the 10 percent level. This estimate represents the differential spending per quarter in the baseline period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we present quarterly effects. ***Table 18*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 10*** illustrates these quarterly estimates. The quarterly effects, however, do show savings in most of the innovation quarters after the first quarter.

Table 18. OLS Regression Estimates for Quarterly Medicare Spending per Participant: W&I Subgroup (More than 34 Weeks Gestation)

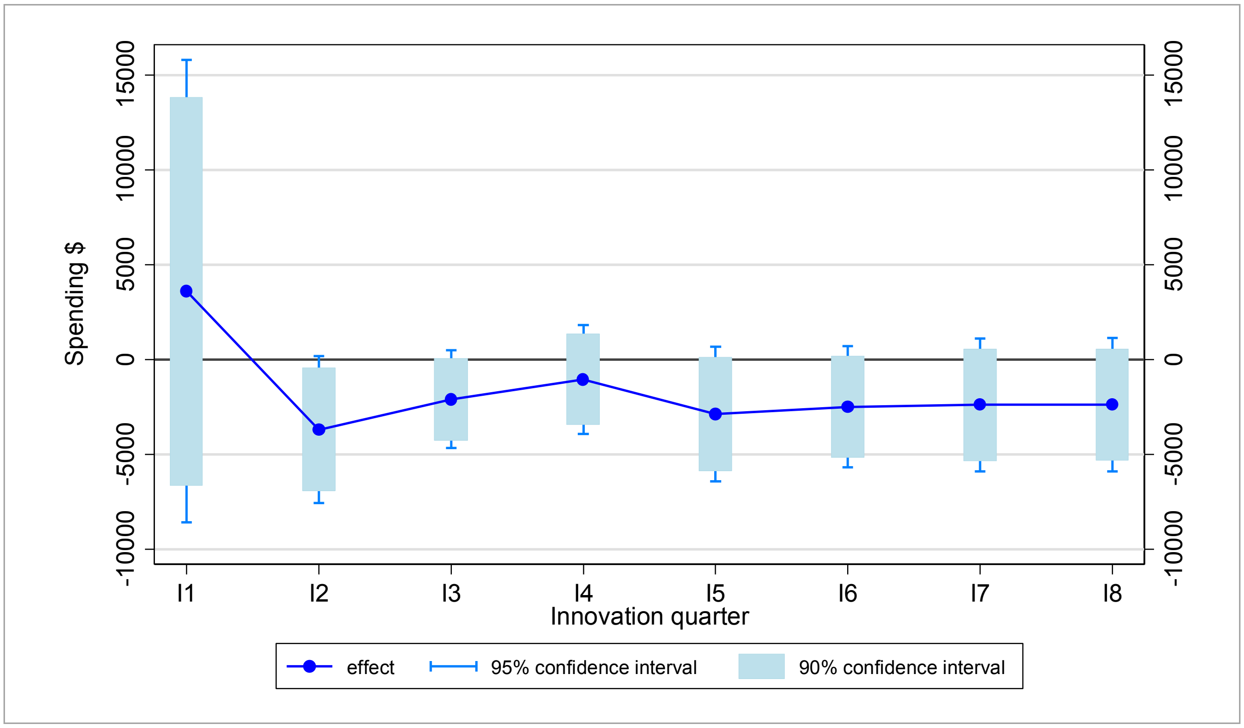
Quarter	Coefficient	Standard Error	P-Values
I1	3,605	6,226	0.563
I2	−3,704	1,982	0.062
I3	−2,097	1,319	0.113
I4	−1,060	1,466	0.470
I5	−2,872	1,818	0.115
I6	−2,495	1,631	0.127
I7	−2,392	1,794	0.183
I8	−2,381	1,793	0.185
Overall average	−774	2,335	0.741
Overall aggregate	−497,442	1,501,333	0.741
Overall aggregate (IY1)	−146,394	1,395,042	0.916
Overall aggregate (IY2)	−351,048	228,426	0.125

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.

Notes: The regression coefficients are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups. The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; W&I = Women and Infants Hospital of Rhode Island.

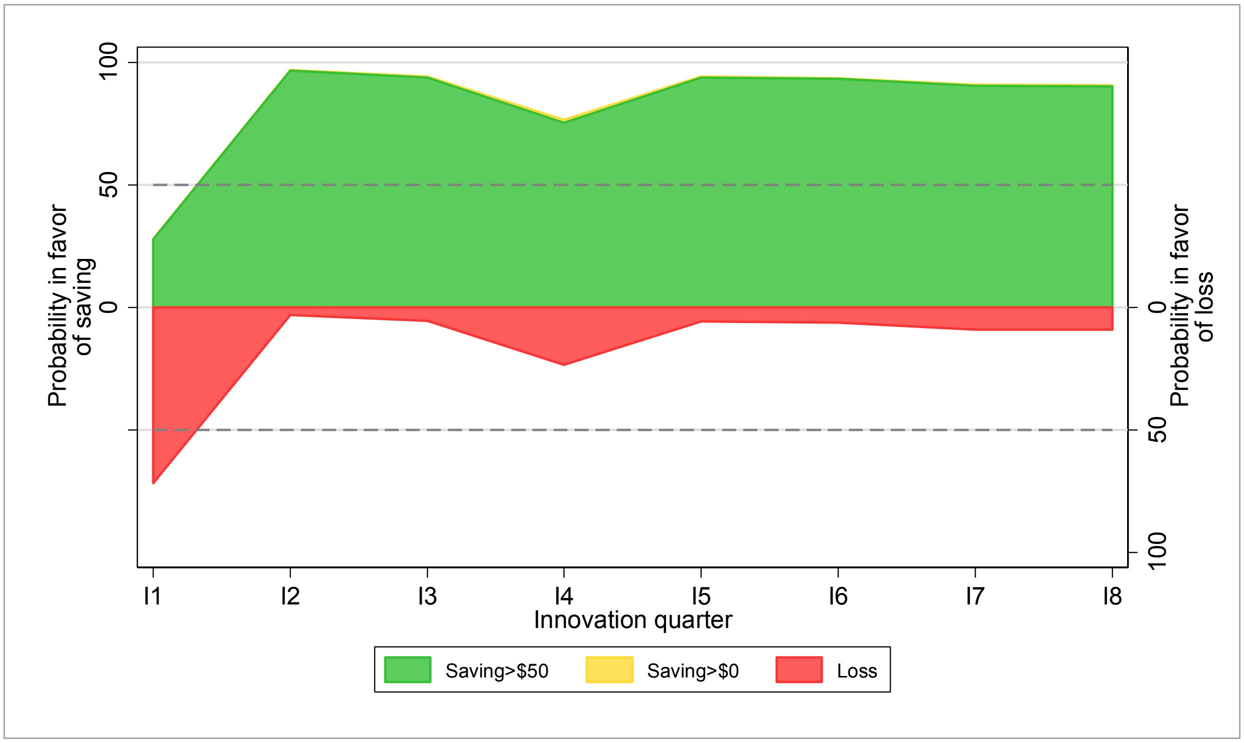
Figure 10. OLS Regression Estimates for Quarterly Medicaid Spending per Participant: W&I Subgroup (More than 34 Weeks Gestation)



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
OLS = ordinary least squares; W&I = Women and Infants Hospital of Rhode Island.

Figure 11 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Because the quarterly spending estimates are lower for the innovation group than for the comparison group from the second innovation quarter onward, the current result suggests that the innovation has a higher probability of generating savings in subsequent quarters after the first quarter. However, because the sample sizes were very small in later quarters, we may have low statistical power and imprecise regression estimates for these quarters.

Figure 11. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: W&I Subgroup (More than 34 Weeks Gestation)



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.11 Medicaid Inpatient Admissions in Subgroup

2.11.1 Descriptive Results

Figure 12 illustrates the all-cause inpatient admissions rate in ***Table 19*** for innovation and comparison group beneficiaries from the subgroup.

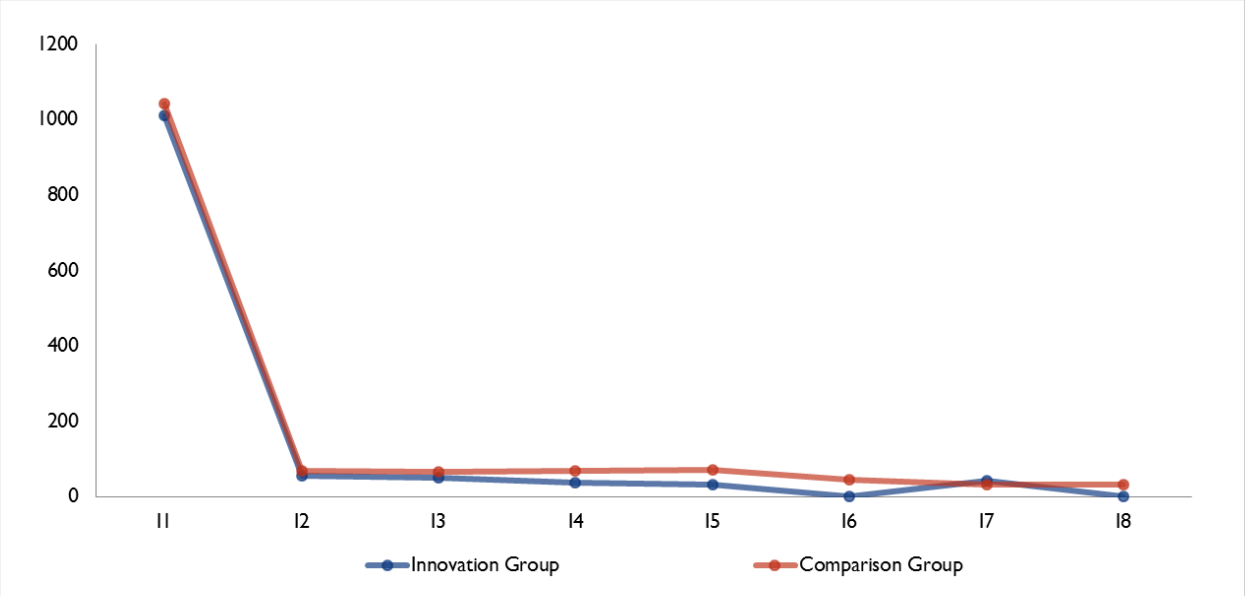
Table 19. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: W&I Subgroup (More than 34 Weeks Gestation)

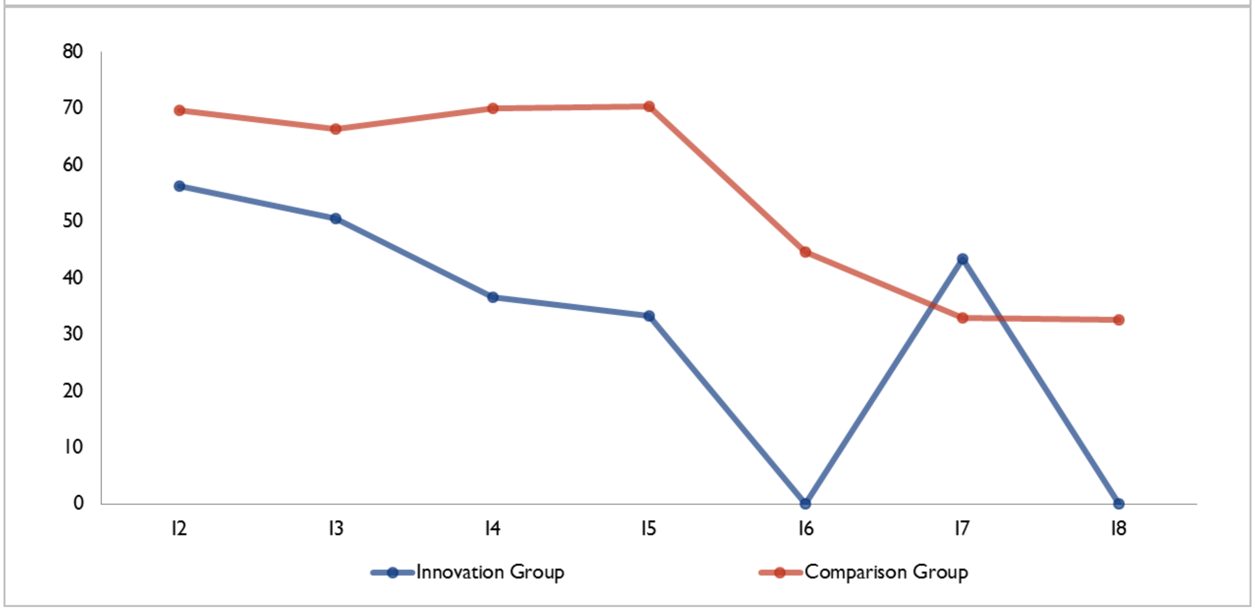
Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
Admit rate	1,011	56	51	37	33	0	43	0
Std dev	292	371	261	188	180	0	204	0
Unique patients	187	142	99	82	60	41	23	9
Comparison Group								
Admit rate	1,043	70	66	70	70	45	33	33
Std dev	397	303	434	463	519	348	269	269
Unique patients	275	271	262	256	249	241	236	237
Innovation − Comparison Rate								
	−32	−13	−16	−33	−37	−45	10	−33

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
Admit rate: (Total unquarterized admissions /unique patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants (I1–I8 and I2–I8): W&I Subgroup (More than 34 Weeks Gestation)





Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.11.2 Regression Results

Due to the small sample size and the lack of variation in inpatient admissions in the second innovation year, we use only the first four innovation quarters in our subgroup regression analysis for inpatient admissions. The average quarterly difference estimate for inpatient admissions decreases by 26 inpatient admissions per 1,000 participants relative to the comparison group. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant at the 10 percent level (90% CI: −57, 6). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 20 presents the results of a negative binomial model with the dependent variable equal to the number of hospital visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. All the quarterly coefficients are negative, although none of them are statistically significant at the 10 percent level, possibly due to the small sample size in each quarter.

Table 20. Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: W&I Subgroup (More than 34 Weeks Gestation)

Quarter	Coefficient	Standard Error	P-Values
I1	−35	33	0.291
I2	−14	37	0.708
I3	−17	43	0.690
I4	−36	43	0.405
Overall average (IY1)	−26	19	0.182
Overall aggregate (IY1)	−13	10	0.182

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The negative binomial coefficients are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their comparison group.
I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island.

2.12 Medicaid Unplanned Readmissions in Subgroup

2.12.1 Descriptive Results

Figure 13 illustrates the hospital unplanned readmissions rates in ***Table 21*** for innovation and comparison group beneficiaries from the subgroup. We observe a similar data pattern in the full sample analysis in Section 2.7.1.

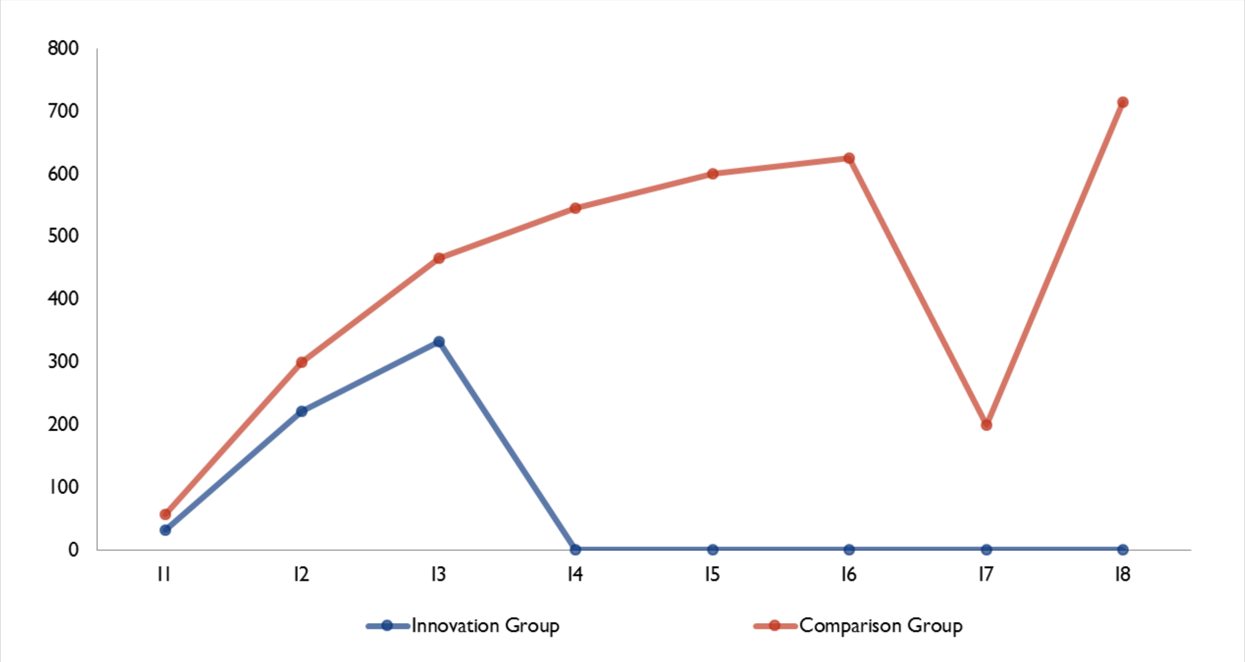
Table 21. Hospital Unplanned Readmissions Rate per 1,000 Medicaid Inpatient Admissions: W&I Subgroup (More than 34 Weeks Gestation)

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
Readmit rate	32	222	333	0	0	0	0	0
Std dev	176	416	471	0	0	0	0	0
Total admissions	187	9	6	3	2	0	1	0
Comparison Group								
Readmit rate	57	300	467	545	600	625	200	714
Std dev	231	458	499	498	490	484	400	452
Total admissions	282	20	15	11	15	8	5	7
Innovation − Comparison Rate								
	−25	−78	−133	−545	−600	−625	−200	−714

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
Readmit rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 13. Hospital Unplanned Readmissions Rate per 1,000 Medicaid Inpatient Admissions: W&I Subgroup (More than 34 Weeks Gestation)



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
W&I = Women and Infants Hospital of Rhode Island.

2.12.2 Regression Results

Table 22 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference estimate for unplanned readmissions is −116 per 1,000 inpatient admissions (−11.6 percentage points), indicating that the innovation−comparison difference is 11.6 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant at the 10 percent level (90% CI: −200, −32).

Table 22. Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicaid Inpatient Admissions: W&I Subgroup (More than 34 Weeks Gestation)

Coefficient	Coefficient	Standard Error	P-Values
Overall average	−116	51	0.024
Overall aggregate	−24	11	0.024

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The logistic regression coefficient is the simple difference estimate. Besides the innovation group indicator, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation.
W&I = Women and Infants Hospital of Rhode Island.

2.13 Medicaid Emergency Department Visits in Subgroup

2.13.1 Descriptive Results

Figure 14 illustrates the ED visits in ***Table 23*** for innovation and comparison group beneficiaries from the subgroup. The ED visit rate begins with a gap between the innovation and comparison groups, and the gap gradually shrinks as the innovation continued.

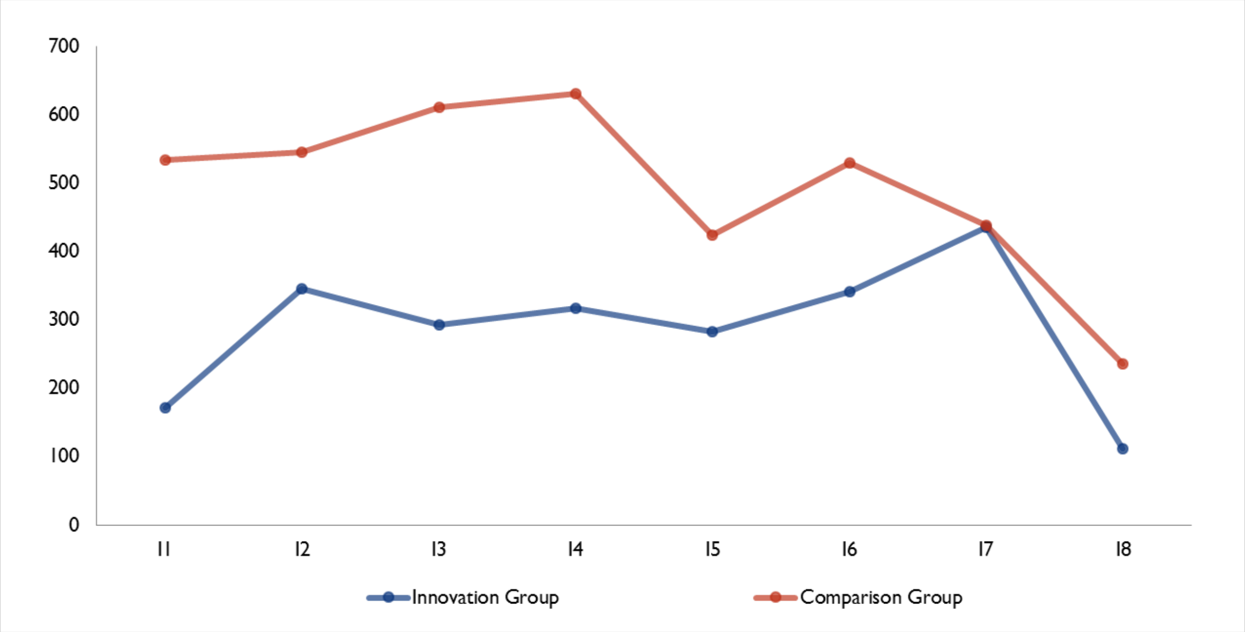
Table 23. ED Visits per 1,000 Medicaid Participants: W&I Subgroup (More than 34 Weeks Gestation)

Awardee Number: 1C1CMS330993
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

Description	Innovation Quarters							
	I1	I2	I3	I4	I5	I6	I7	I8
Innovation Group								
ED rate	171	345	293	317	283	341	435	111
Std dev	569	950	700	602	580	609	770	314
Unique patients	187	142	99	82	60	41	23	9
Comparison Group								
ED rate	534	545	611	631	424	530	439	235
Std dev	1,202	1,215	1,363	1,320	915	1,318	1,064	656
Unique patients	275	271	262	256	249	241	236	237
Innovation − Comparison Rate								
	−363	−200	−318	−314	−141	−188	−4	−124

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /unique patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
ED = emergency department; I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 14. ED Visits per 1,000 Medicaid Participants: W&I Subgroup (More than 34 Weeks Gestation)



Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
ED = emergency department; W&I = Women and Infants Hospital of Rhode Island.

2.13.2 Regression Results

The average quarterly difference estimate for ED visits is a decrease of 314 visits per 1,000 participants relative to the comparison group. This is the average difference in ED visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant at the 10 percent level (90% CI: −396, −231). In addition to the average effect over the innovation period, we also present quarterly effects.

Table 24 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. All the quarterly coefficients are negative, most of which are statistically significant at the 10 percent level.

Table 24. Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicaid Participants: W&I Subgroup (More than 34 Weeks Gestation)

Quarter	Coefficient	Standard Error	P-Values
I1	−393	106	<0.001
I2	−257	115	0.027
I3	−350	126	0.006
I4	−396	133	0.003
I5	−198	107	0.065
I6	−243	152	0.111
I7	−58	179	0.747
I8	−150	128	0.241
Overall average	−314	50	<0.001
Overall aggregate	−202	32	<0.001
Overall aggregate (IY1)	−177	31	<0.001
Overall aggregate (IY2)	−25	10	0.014

Source: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
Notes: The negative binomial coefficients are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, and number of weeks of gestation prior to the innovation. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared with their comparison group.
ED = emergency department; I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island.

2.14 Discussion: Medicaid Results

This report describes findings drawn from claims-based measures for Medicaid beneficiaries. In this section, we assess W&I's progress in achieving HCIA goals to date. The regression results suggest that the innovation group incurred higher spending in the first quarter after the innovation launch than the comparison group, but lower spending in all subsequent quarters. The overall estimate for the difference in quarterly spending is not statistically significant, however, indicating no significant difference between the innovation and comparison groups in Medicaid spending. Overall, the regression results suggest that the innovation group has fewer inpatient admissions, hospital readmissions, and ED visits than the comparison group. The subgroup analysis that focuses on late preterm and full-term infants who had more than 34 weeks of gestation shows similar results. The comparison group consisted of high-risk infants born and admitted to the W&I NICU during 2011, whereas the innovation group consisted of infants born in years 2012 and beyond. Thus, fewer complete claims data were available for the innovation group than the comparison group for certain measures. Therefore, the results could be due to incomplete Medicaid claims data for the innovation group instead of a true decline in the claims measures.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicaid beneficiaries who we were able to match with the identifiers provided by the site. These beneficiaries represent 23 percent of the overall population reached by the innovation. In addition, we have a small sample size, which can hinder detection of changes in spending.

2.15 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

W&I submitted the utilization data to RTI that are current through September 2015. ***Table 25*** lists the awardee-specific outcome measures, with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 25. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status	Reported in Annual Report
Health care outcomes	Utilization	ED visit rate	Yes	Yes
		Hospital unplanned readmissions rate	Yes	Yes
Health outcomes	Mortality	Participant all-cause mortality rate	Yes	Yes

ED = emergency department.

The ED visit and unplanned hospital admission data submitted by W&I are a supplement to the to the claims-based utilization data presented in the previous section. As discussed earlier in this report, Medicaid recipients were more than half of the population enrolled (53.5%); the remainder (46.5% of infants enrolled) were either self-pay or insured by private insurance agencies. We have no comparison group for these awardee data as we do for the claims-based data and, therefore, could not conduct regression analyses. Nonetheless, these supplemental data from W&I provide a cross-sectional descriptive view of the ED and hospital readmission rates across the entire population served, not just the infants covered under Medicaid.

2.16 Health Care Utilization

W&I provided data on ED visits and unplanned hospital readmissions, which allowed us to determine if these decreased over the course of the innovation.

Evaluation Questions

- Have ED visits decreased for those participating in the PWP program?
- Have unplanned readmissions decreased for those participating in the PWP program?

2.16.1 Descriptive Results

Figure 15 displays the ED visit rate (per 1,000) by enrollment group. The rates for the early and moderate preterm enrollment groups range from a low of 49 visits for every 1,000 patients enrolled in Q13 to a high of 507 visits for every 1,000 patients enrolled in Q8. In Q12 and Q13, the ED visit rates were 109 and 49 visits, respectively, for every 1,000 patients enrolled. For the late preterm and full-term enrollment group, the ED visit rate ranges from a low of 74 visits for every 1,000 patients enrolled in Q12 to a high of 400 visits for every 1,000 patients enrolled in in Q2. As previously stated in this report, this enrollment group (late preterm and full term) did not continue after Q12.

It is important to note that patients enrolled on April 1, 2015 and after were only enrolled for 1 month of services, whereas all patients prior to April 1, 2015, received 3 months of services from the PWP program.

Figure 15. Hospital ED Visit Rate (per 1,000) by Enrollment Group (n=1,391)

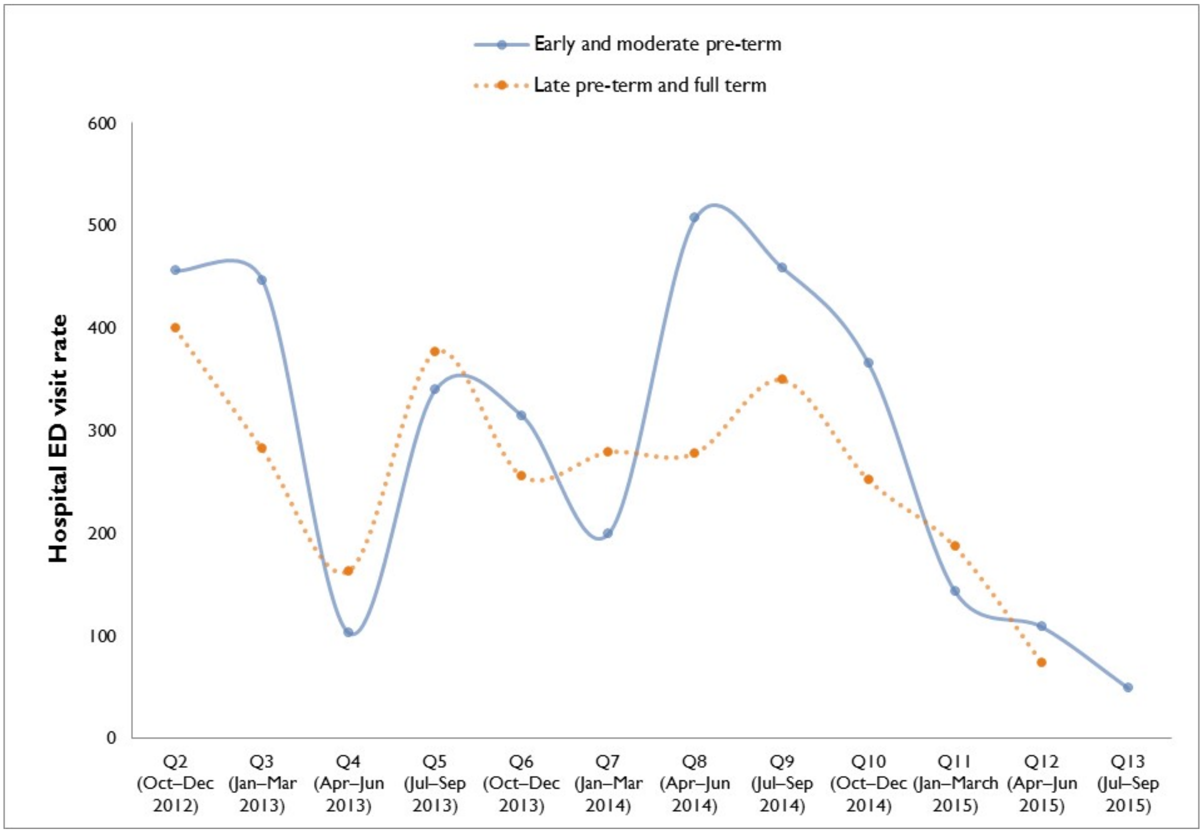
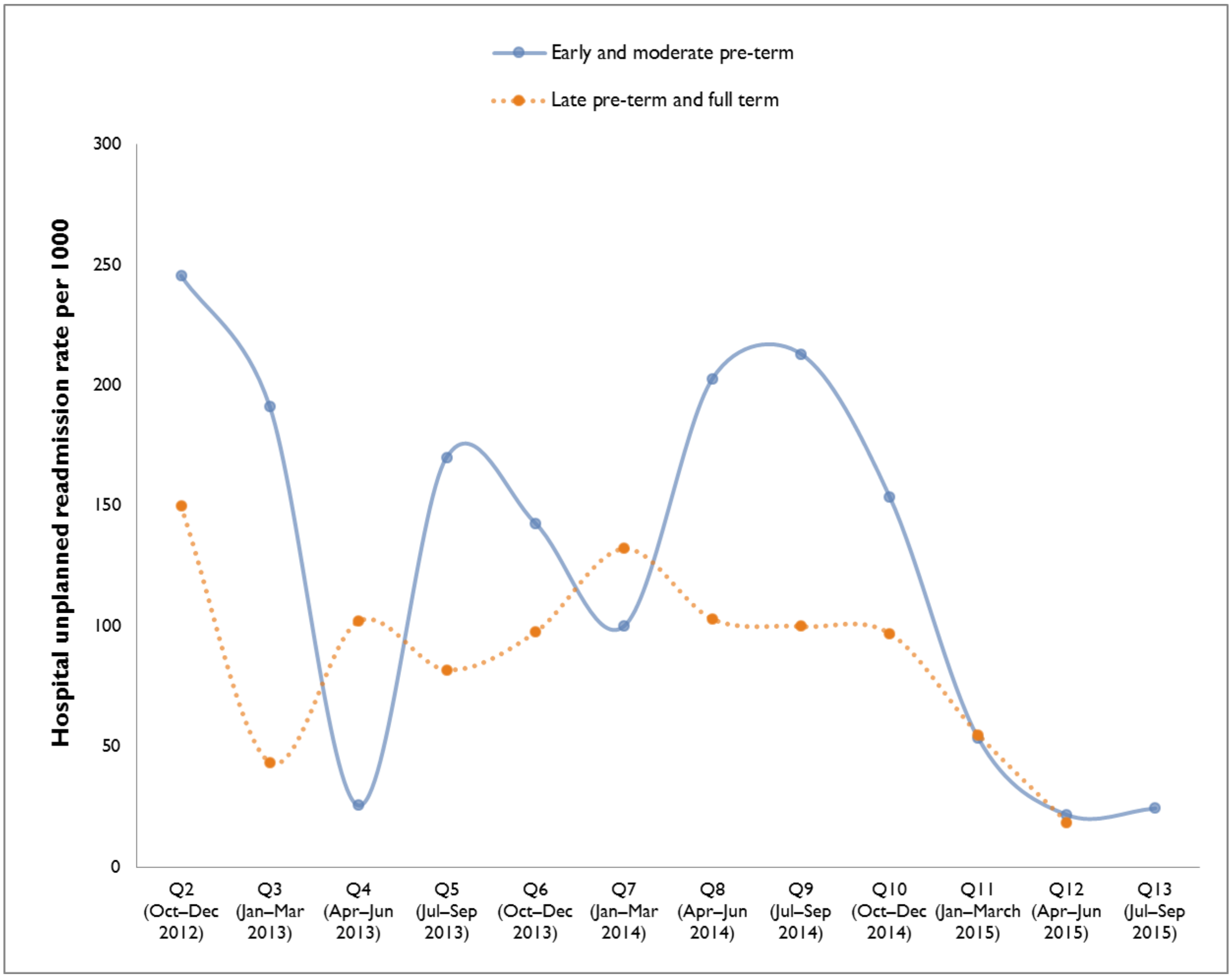


Figure 16 displays the unplanned readmissions rate (per 1,000) by enrollment group. The rates for the early and moderate preterm enrollment groups range from a low of 22 unplanned readmissions for every 1,000 patients enrolled in Q12 to a high of 245 unplanned hospitalizations for every 1,000 patients enrolled in Q2. In Q12 and Q13, the unplanned readmissions rates are 52 and 24 unplanned readmissions per 1,000 early and moderate preterm patients enrolled, respectively. For the late preterm

and full-term enrollment group, the unplanned readmissions rate range from a low of 19 unplanned readmissions for every 1,000 patients enrolled in in Q12 to a high of 150 unplanned readmission for every 1,000 patients enrolled in Q2. Enrollment in this group did not continue after Q12.

As previously noted, patients enrolled on and after April 1, 2015 were only enrolled for 1 month of services, whereas all patients prior to April 1, 2015, received 3 months of services from the PWP program.

Figure 16. Hospital Unplanned Readmissions Rate (per 1,000) by Enrollment Group (n=1,391)



2.17 Mortality

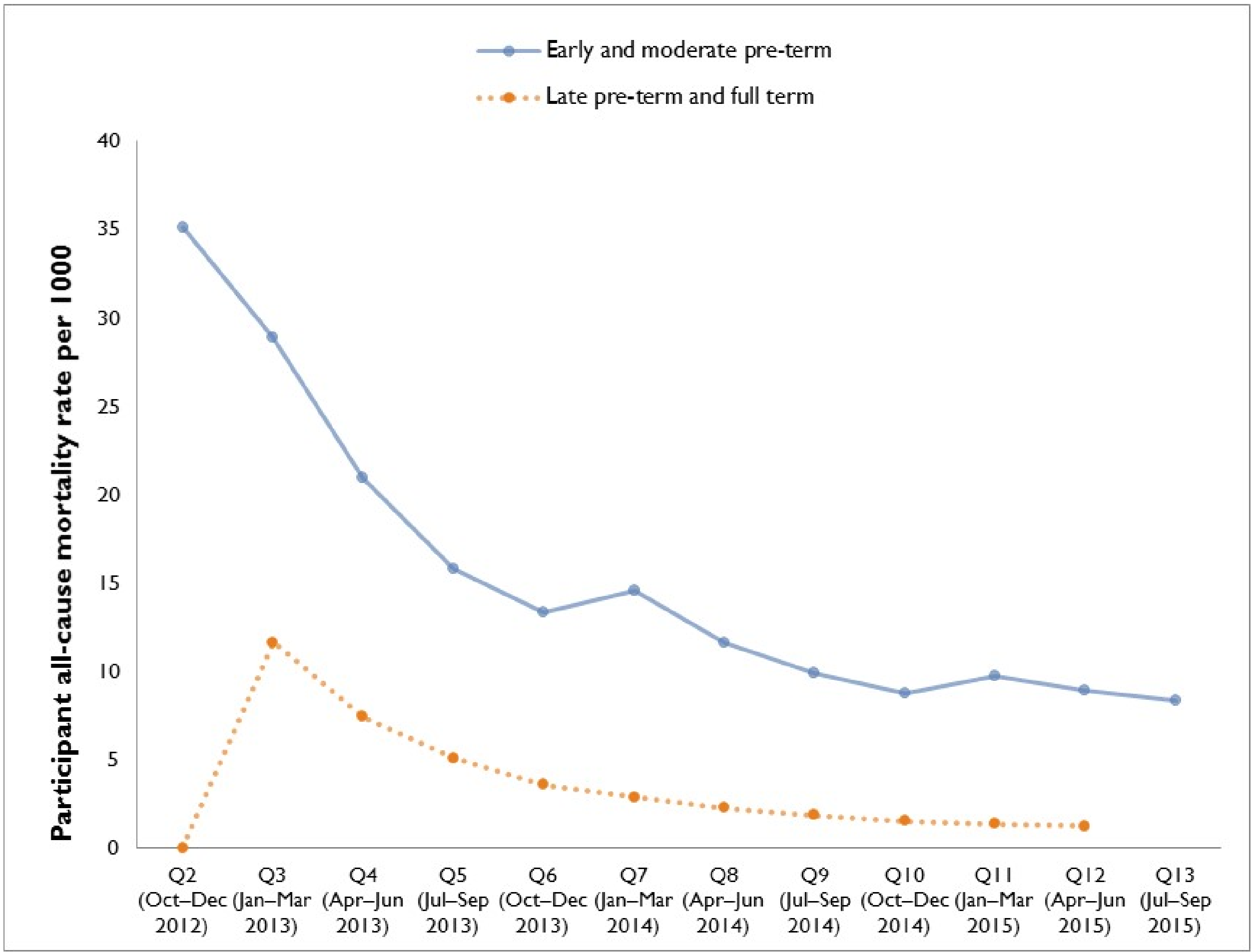
Mortality data provided by W&I was used to determine whether the mortality rate decreased over the course of the innovation.

Evaluation Question
• Has mortality rate decreased below expected levels for those participating in the PWP program?

2.17.1 Descriptive Results

Figure 17 displays cumulative mortality rates (per 1,000) for all enrollment groups. According to the National Center for Health Statistics, National Vital Statistics Report *Deaths: Final Data for 2013,*[3] the overall infant mortality rate in 2013 was 5.96 per 1,000. The mortality rate for the early and moderate preterm infants exceeds the national 2013 rate in each of the quarters of the innovation, ranging from 35.1 per 1,000 in Q2 to 8.3 per 1,000 in Q13; however, the rate for late preterm and full-term infants drops and stays below 5.96 as of Q5.

Figure 17. Mortality Rate (per 1,000) by Enrollment Group



2.18 Discussion: Awardee-Specific Data

W&I focused on decreasing the number of unplanned hospital readmissions, ED visits, and mortality among its target population. The unplanned hospital readmissions and ED visits data obtained from W&I (presented in Section 2.16) represent outcomes for all infants enrolled in the innovation, not just

[3] Xu, J.Q., Murphy, S.L., Kochanek, K.D., et al.: Deaths: Final data for 2013. National vital statistics reports (64)2. National Center for Health Statistics. 2016.

those covered under Medicaid. These data are representation of the innovation's progression over time, unlike the claims data, which followed individuals from enrollment in the innovation and used a comparison group.

As expected, rates of unplanned hospital readmissions and ED visits for the innovation over time varied by infant group: early and moderate preterm infants had the highest overall rates of both unplanned hospital admissions and ED visits. Most visits were for respiratory issues (57.2%). Other major issues included gastrointestinal problems (13.8%) and infection and fever (13.3%). The patterns of unplanned hospital admissions and ED visits fluctuated greatly in the first half of the innovation period. However, sustained declines occurred in the period between Q7 and Q10 through the end of the innovation period. These declines over time are consistent with the statistically significant reductions in ED visits and unplanned hospital readmissions seen in the claims analysis. One potential reason for the decline may be that the FRS and social workers refined the service delivery protocols to focus more intensively on preventing readmissions and ED visits.

The all-cause mortality rate for all enrollment groups exceeded the national 2013 rate of 5.96 per 1,000 at some point in the innovation. As expected, the rate for early and moderate preterm infants exceeded the rate throughout the innovation (with the lowest rate at 8.3 per 1,000), while the rate for late preterm and full-term infants dropped and stayed below 5.96 per 1,000 as of Q5. A criterion for inclusion in this innovation is a minimum 5-day stay in the NICU following birth—so all infants included in this innovation are medically fragile to some degree, which contributes to the higher than average mortality rates.

2.19 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. RTI evaluates these components through W&I *Narrative Progress Reports, Quarterly Awardee Performance Reports,* and qualitative interviews with key staff that provide additional context and detail. The findings presented in the following sections include W&I reports from Q11 through Q13 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient overall organizational capacity and leadership to implement the innovation effectively?

Table 26 lists the quantifiable measures obtained through awardee reports and secondary data provided to RTI by W&I, and its status as of September 30, 2015.

Table 26. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q13	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11-Q13	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11-Q13	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of eligible early and moderate preterm infants enrolled in the study	Data received from W&I
		Number/percentage of eligible late preterm and full-term infants enrolled in the study	Data received from W&I
	Dose	Number of families who received post-discharge phone calls within 24 hours of infant's discharge	Data received from W&I
		Number of nurse practitioner home visits	Data received from W&I
		Number of 1-month follow-up assessments	Data received from W&I
		Number of 3-month follow-up assessments	Data received from W&I
		Number of phone calls to enrolled families during first month after discharge	Data received from W&I
		Number of phone calls to enrolled families during first 3 months after discharge	Data received from W&I
		Number of mothers of enrolled infants screened for clinical depression	Data received from W&I

FTE = full-time equivalent.

2.20 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.20.1 Hiring and Retention

At the end of Q13 (September 2015), the innovation was staffed with 5.85 full-time equivalent (FTE) staff members, down from a high of 13.48 FTE staff members in Q11. W&I began to reduce staff in Q12 given that there would be only one additional quarter of programming funded under the no cost extension (NCE). Fewer staff resources were required as the innovation transitioned to a 1-month follow-up protocol and stopped enrolling late preterm and full-term infants (at the end of May 2015).

Throughout implementation, W&I retained the majority of its staff, with only four separations in the 18 months from July 2013 to March 2015. This success was attributed to factors that included the purposeful recruitment of PWP's medical staff who had worked in the NICU and would be accepted by the staff already working there. Also, to be hired as an FRS, applicants had to have relevant experience as a parent of an infant who had spent time in the NICU. That meant that very specific individuals were targeted for the position of FRS, and their hiring and training was done by an organization, RIPIN. RIPIN specializes in connecting parents and children with special health care needs to the critical health care and education services and supports they need in Rhode Island.[4]

2.20.2 Skills, Knowledge, and Training

By the end of Q13 (September 2015), W&I provided 1,978 hours of training to 532 internal and external stakeholders through six community partner workshops. The awardee exceeded its target to train 500 individuals over the course of the HCIA award. The community workshops cover topics relevant to the care of preterm and other medically fragile infants, such as those with prenatal opiate exposure.

RIPIN developed and conducted all of the formal trainings for the FRS. RIPIN's trainings were staggered throughout the year to accommodate FRS' work schedules. In addition to the RIPIN trainings, PWP staff provided guidance on documenting services, navigating the NICU, and connecting PWP families to needed services.

Table 27. Training Provided through Community Partner Workshops

Time Frame	Number of Training Hours	Number of Trainees
Q11-Q13	408	102
Since inception	1,978	532

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

[4] Rhode Island Parent Information Network. N.p., n.d. Web. 18 May 2016. <www.ripin.org>.

2.21 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

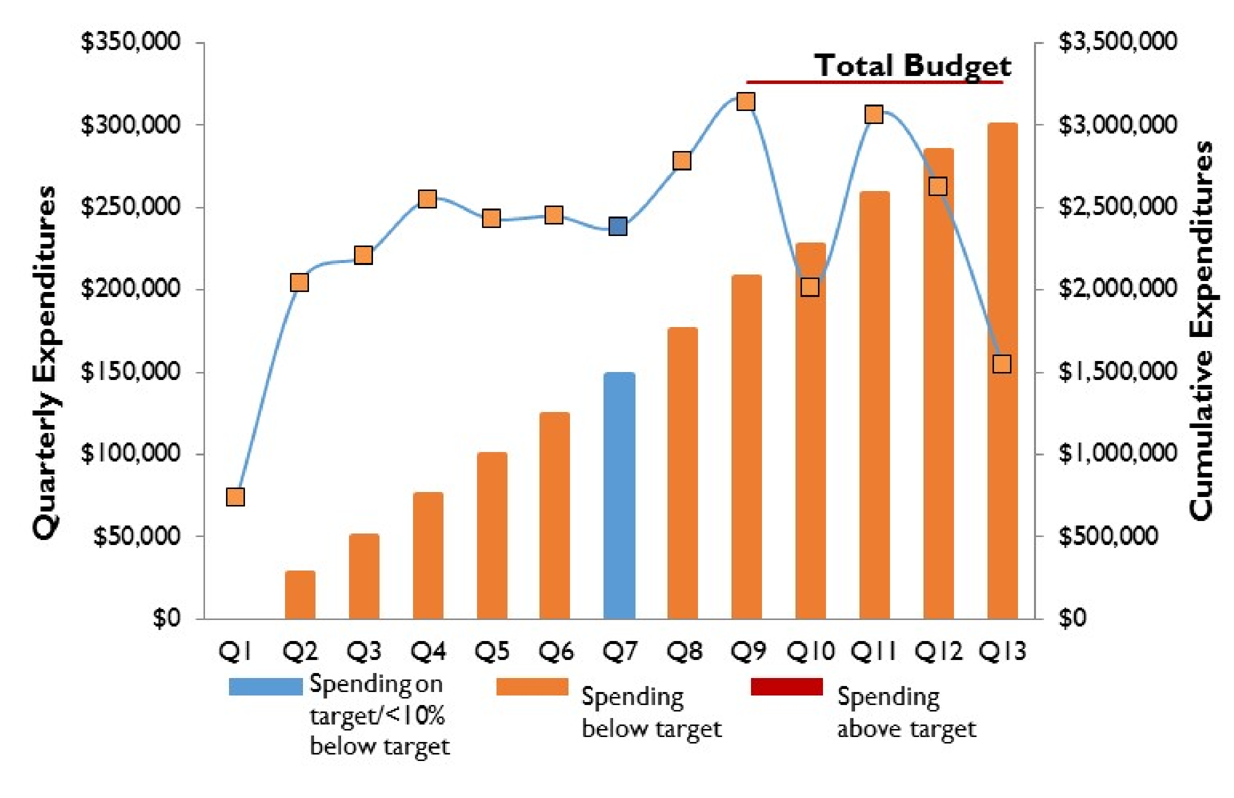
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.21.1 Award Execution

The annual report highlights the significance of W&I expenditure rates on implementation. As of September 2015 (Q13), W&I spent 93 percent of its total budget, which is below the projected target (see ***Figure 18***). As noted in the Reach section, W&I enrollment numbers were below those projected in its application. The below-target spend rate may reflect this difference between the projected amount of effort and services W&I planned to provide and the amount W&I actually provided.

Figure 18. Cumulative Spend Rate from Q1 (June 1, 2012) to Q12 (June 30, 2015)



2.21.2 Leadership

The PWP leadership and staff have extensive experience implementing different innovations and projects, mainly because W&I in Rhode Island is the primary teaching hospital in obstetrics, gynecology, and newborn pediatrics of the Warren Alpert Medical School at Brown University. W&I has multiple studies ongoing with this population at any point in time.

Strong organizational leadership support for this innovation extends back almost a decade. The PWP program is an expansion of the Transition Home Plus (THP) program, developed in 2007 with funding from the CVS Caremark Charitable Trust, and program services are now covered by Medicaid in the State of Rhode Island. Under THP, families of the most vulnerable early and moderate premature infants (born at ≤ 33.6 weeks with a birth weight of less than 1,500 grams and a NICU hospitalization of more than 5 days) receive support services tailored to their individual needs for up to 7 months. The PWP program expanded the same services to late preterm and full-term infants to follow the protocol for 3 months. Senior hospital leadership recognize the value of the innovation and have engaged innovation leaders in discussions about rolling the PWP program into bundling agreements with payers as the end of the contract approaches.

2.21.3 Organizational Capacity

As noted in previous annual reports, W&I began with the organizational capacity necessary to implement the innovation effectively, and maintained strong organizational capacity throughout the award. Key aspects of W&I's organizational capacity included: (1) experience with receiving and managing research grants, including measures development and data collection and reporting; (2) expertise in providing care to preterm and medically fragile infants; and (3) experience providing education and support services to preterm and medically fragile infants through the THP program, on which PWP was based. To expand its capacity to track ED visits and unplanned hospital readmissions among PWP infants, W&I enrolled participants in CurrentCare, Rhode Island's health information exchange. Over the course of the award, W&I enrolled 64 percent of PWP infants in CurrentCare.

2.21.4 Innovation Adoption and Workflow Integration

Adoption of the PWP innovation and integration into clinical workflow can be assessed at two levels—within the hospital and outside the hospital. Internally, NICU staff serve as gatekeepers to parents of infants in the NICU. To facilitate innovation adoption and integration into the NICU workflow, PWP made strategic hiring decisions. Because PWP's staff included individuals who had worked in the NICU (and thus were more readily accepted by the NICU staff) and the FRS were parents of infants who had spent time in the NICU, PWP staff was knowledgeable about the workflow of the NICU and the protocols and process that were in place to run a unit for medically fragile infants. PWP staff also began attending grand rounds in the NICU to introduce themselves and the program to clinical staff, and established meetings with the NICU social workers and case managers to assist the inpatient teams to provide seamless support to families' transition out of the NICU to home. Finally, the PWP innovation staff educated NICU staff about the transition to home programs available.

Externally, PWP staff worked with partners to develop various strategies for increasing the adoption of innovation services and tracking participants. First, PWP staff informed all enrolled infants' primary care providers of their participation in PWP and the services available through the innovation. CurrentCare partnered with PWP to help integrate the innovation into the health care workflow. When infants were enrolled in the PWP innovation, they could also be enrolled in CurrentCare (64% of enrolled PWP infants were also enrolled in CurrentCare). CurrentCare sent real-time alerts to the PWP program when an infant visited the ED or was admitted to the hospital. The FRS or licensed independent clinical social worker (LICSW) assigned to that infant could then reach out to the family to determine the reason for the visit and provide any needed support. For infants not enrolled in the CurrentCare program, FRS or social workers tracked ER visits and hospital admissions through self-report during 1-month and 3-month assessments.

2.22 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort because the evaluation cannot make conclusive assessments about the innovation's impact without first determining if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

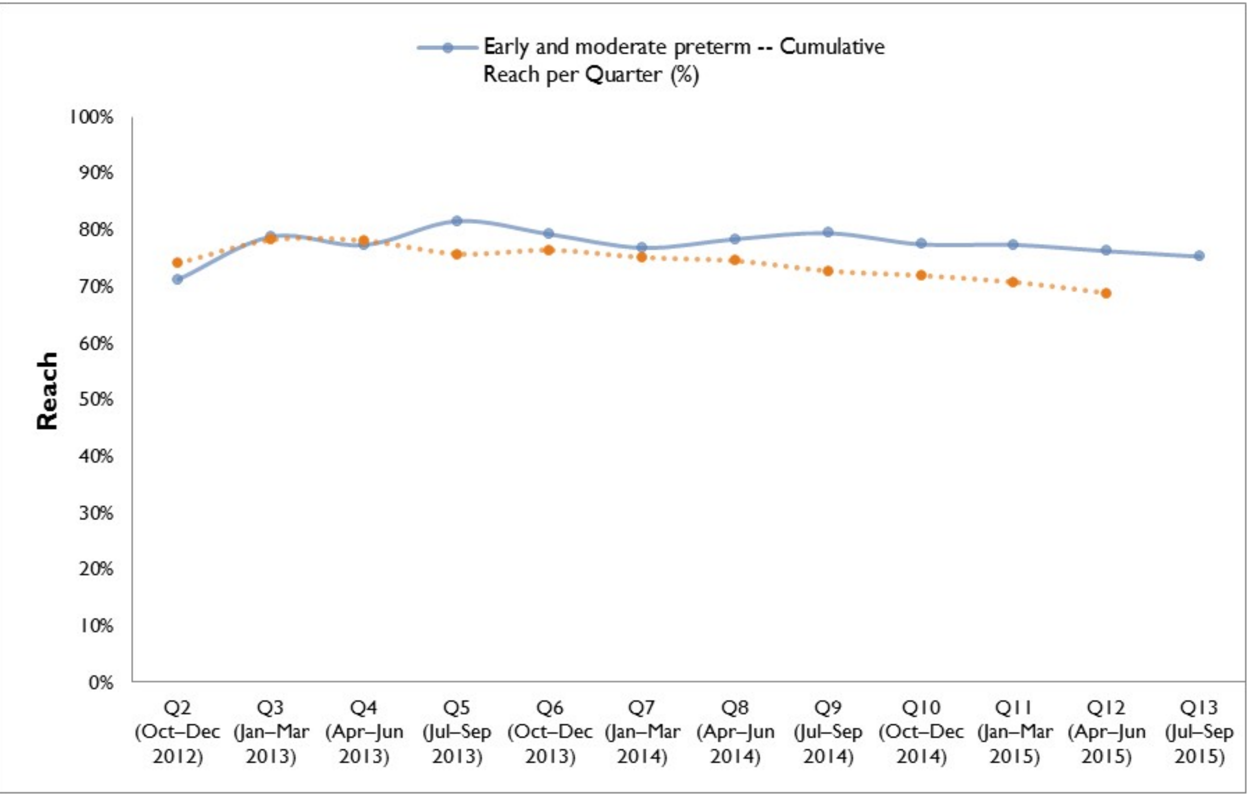
Evaluation Question

- What is the implementation effectiveness, including reach, and dose of the innovation thus far?

2.22.1 Innovation Reach

W&I worked to reach early, moderate, late preterm, and full-term infants residing in Rhode Island, Connecticut, and Massachusetts who spent 5 or more days in the W&I or Kent Hospital NICU. Reach is defined at the proportion of eligible infants in a quarter who are enrolled in the innovation. ***Figure 19*** shows reach by quarter since the launch of the innovation. We last reported reach in the 2015 annual report, based on data through Q11. Given that funding ended on September 30, 2015, W&I enrolled late preterm and full-term infants through May 31, 2015, allowing them to complete the 1-month protocol by June 30, 2015. W&I continued to enroll early- and moderate-preterm infants through August 31, 2015, allowing them to complete the 1-month protocol by September 30, 2015.

Figure 19. Participant Enrollment and Reach for Each Quarter since Project Launch



	Quarter	Q2 (Oct–Dec 2012)	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)	Q13 (Jul–Sep 2015)
●	Early and moderate preterm—cumulative reach per quarter (%)	71.3	78.8	77.3	81.5	79.2	76.8	78.4	79.4	77.4	77.3	76.2	75.3
	Early and moderate preterm—cumulative # enrolled	57	104	143	190	225	275	344	405	456	512	558	599
●	Late preterm and full-term—cumulative reach per quarter (%)	74.1	78.2	78.0	75.7	76.4	75.1	74.5	72.6	71.8	70.7	68.7	—
	Late preterm and full-term—cumulative number enrolled	40	86	135	196	278	346	443	543	648	738	792	—

— Data not applicable.

Reach remained fairly steady over time, ranging from 71.3 percent in Q2 to 81.5 percent in Q5 for early preterm and moderate preterm infants, and ranging from 68.7 percent in Q11 to 78.2 percent in Q13 for late preterm and full-term infants. Through Q13, the awardee enrolled an additional 141 participants, changing the total reach for the innovation from 77.3 percent to 75.3 percent for the early and moderate preterm infant group, and from 70.7 percent to 68.7 percent for the late preterm and full-term infant group.

Although W&I has a fairly high overall reach within its eligible population, enrollment numbers are below those projected at the time of the application. Factors that led to success in enrollment included the relationships FRS and social workers established with families while they were in the NICU and the FRS' firsthand knowledge of what it is like to have a child in the NICU. W&I leadership hypothesized that a decrease in the number of all infants eligible for enrollment resulted from a decrease in overall birth rates and NICU admissions. Anecdotally, PWP staff members said that they did not have as much time to establish relationships with late preterm and full-term infants as they do with early preterm infants prior to discharge (because early preterm infants typically have a longer NICU stay), so parents with later-term infants may not have felt comfortable enrolling in the innovation. Additionally, PWP staff heard from some parents whose infants are not as critically ill as early preterm infants that they did not need support services.

2.22.2 Innovation Dose

As discussed in the Innovation Components section, the original enrollment and protocol from Q2 through Q11 was 3 months long. In an effort to ensure that as many infants as possible could receive at least some of the services prior to project closeout, W&I shortened the protocol to 1 month for all infants enrolled after April 1, 2015. All participants across all enrollment groups (e.g., early-, mid-, and late-preterm and full-term) who enrolled prior to April 1, 2015 received the 3-month protocol. Services provided under both the 1- and 3-month protocols include a post-discharge phone call, a nurse practitioner home visit (for Rhode Island residents enrolled in the early or moderate preterm group), a 1-month assessment, an Edinburgh Depression Scale assessment, and availability of FRS or social workers to answer any participant questions through phone calls. Additional services delivered under the 3-month protocol include the 3-month assessment and additional phone calls past 1 month.

Tables 28 through ***31*** provide the number of services provided to participants, the number of participants receiving services, and the average number of services per participant through Q13. We last reported dose in the 2015 annual report based on data through Q11. As would be expected, the number of services provided and the percentage of participants receiving those services increased from Q11 to Q13. Many of the services were not appropriate for, or offered to, all participants. Therefore, in each table, the number of participants eligible to receive each service (i.e., the denominator) varies based on the PWP protocol, as well as whether the infant was enrolled on or before March 31, 2015, or on April 1, 2015 or later.

Tables 28 through ***31*** show the number and types of services provided for patients in the 3-month protocol group and the 1-month protocol group by respective enrollment group. The average number of services per patient through Q11 remained consistent since we began reporting dose over the last several quarters. In the early preterm participant group, at least 82 percent of participants received the services for which they were eligible. That number declined slightly in the moderate preterm participant group, in which at least 78 percent of infants received services for which they were eligible. In the late preterm and full-term participant groups, 72 percent and 69 percent of participants, respectively, received services for which they were eligible.

Participants enrolled during the last two quarters of the funded innovation cannot be compared with earlier participants because of the protocol change, which was done to ensure that the maximum number of infants who were eligible had the opportunity to be enrolled and complete the program. Although W&I intended for the "project closeout" protocol to last only for 1 month, a number of participants in each enrollment group received services beyond that 1-month time period (e.g., 3-month assessment, additional phone calls during 3 months).

For those participating in the 1-month protocol in the early preterm participant group, at least 65 percent of participants received the services for which they were eligible. That number increased slightly in the moderate preterm participant group, in which at least 67 percent of infants received services for which they were eligible. In the late preterm and full-term participant groups, 69 percent and 76 percent of participants, respectively, received services for which they were eligible.

Overall, the services offered seemed to meet the needs of the infants and families enrolled. An anonymous satisfaction survey administered to enrolled families by the PWP program showed that 96 percent of participants would recommend the program to another family in a similar situation, and 90 percent agreed or strongly agreed that the time spent with PWP staff helped them feel more comfortable bringing their infant(s) home. There were no overall barriers to providing services at the intended dose level, although the percentage of participants at each enrollment level receiving services shows that families with the most medically fragile infants (early and moderate preterm) received a slightly higher percentage of all the services than the late preterm and full-term infants.

Table 28. Number and Types of Services Provided to Early Preterm Participants through Q13

	Number of Services Provided across Preterm Participants Enrolled before 4/1 (Average per Participant) N = 299	Number (Percentage) of Preterm Participants Enrolled before 4/1 Receiving Services N = 299	Number of Services Provided across Preterm Participants Enrolled after 4/1 (Average per Participant) N = 44	Number (Percentage) of Preterm Participants Enrolled after 4/1 Receiving Services N = 44
Receive 1-month assessment	274 (0.92)	274 (91.6%)	33 (0.75)	33 (75.0%)
Receive 3-month assessment	263 (0.88)	263 (88.0%)	12 (0.27)	12 (27.3%)
Complete Edinburgh Depression Scale	232 (0.89)[1]	232 (89.2%)[1]	32 (0.80)[2]	32 (80.0%)[2]
Additional calls during first month after discharge	602 (2.01)	248 (82.9%)	64 (1.45)	29 (65.9%)
Additional calls during 3 months after discharge	975 (3.26)	267 (89.3%)	82 (1.86)	30 (68.2%)
Receive a post-discharge phone call	297 (0.99)	297 (99.3%)	40 (0.91)	40 (90.9%)
Receive a nurse practitioner home visit	253 (0.95)[3]	253 (95.1%)[3]	27 (0.87)[4]	27 (87.1%)[4]

1 Denominator is 260. This denominator includes all of the mothers of infants in this enrollment group.
2 Denominator is 40. This denominator includes all of the mothers of infants in this enrollment group.
3 Denominator is 266. This denominator includes only participants who live in Rhode Island.
4 Denominator is 31. This denominator includes only participants who live in Rhode Island.

Table 29. Number and Types of Services Provided to Moderate Preterm Participants through Q13

	Number of Services Provided across Preterm Participants Enrolled before 4/1 (Average per Participant) N = 214	Number (Percentage) of Preterm Participants Enrolled before 4/1 Receiving Services N = 214	Number of Services Provided across Preterm Participants Enrolled after 4/1 (Average per Participant) N = 43	Number (Percentage) of Preterm Participants Enrolled after 4/1 Receiving Services N = 43
Receive 1-month assessment	189 (0.88)	189 (88.3%)	29 (0.67)	29 (67.4%)
Receive 3-month assessment	179 (0.84)	179 (83.6%)	7 (0.16)	7 (16.3%)
Complete Edinburgh Depression Scale	152 (0.86)[1]	152 (85.9%)[1]	28 (0.82)[2]	28 (82.4%)[2]
Additional calls during first month after discharge	410 (1.92)	167 (78.0%)	58 (1.35)	34 (79.1%)
Additional calls during 3 months after discharge	668 (3.12)	185 (86.4%)	70 (1.63)	35 (81.4%)
Receive a post-discharge phone call	214 (1.00)	214 (100.0%)	39 (0.91)	39 (90.7%)
Receive a nurse practitioner home visit	163 (0.91)[3]	163 (90.6%)[3]	22 (0.76)[4]	22 (75.9%)[4]

Source: Patient-level data provided to RTI by W&I.
1 Denominator is 177. This denominator includes all of the mothers of infants in this enrollment group.
2 Denominator is 34. This denominator includes all of the mothers of infants in this enrollment group.
3 Denominator is 180. This denominator includes only participants who live in Rhode Island.
4 Denominator is 29. This denominator includes only participants who live in Rhode Island.

Table 30. Number and Types of Services Provided to Late Preterm Participants through Q13

	Number of Services Provided across Preterm Participants Enrolled before 4/1 (Average per Participant) N = 476	Number (Percentage) of Preterm Participants Enrolled before 4/1 Receiving Services N = 476	Number of Services Provided across Preterm Participants Enrolled after 4/1 (Average per Participant) N = 29	Number (Percentage) of Preterm Participants Enrolled after 4/1 Receiving Services N = 29
Receive 1-month assessment	397 (0.83)	397 (83.4%)	20 (0.69)	20 (69.0%)
Receive 3-month assessment[3]	346 (0.73)	346 (72.7%)	3 (0.10)	3 (10.3%)
Complete Edinburgh Depression Scale	331 (0.82)[1]	331 (82.3%)[1]	17 (0.71)[2]	17 (70.8%)[2]
Additional calls during first month after discharge	772 (1.62)	407 (85.5%)	46 (1.59)	24 (82.8%)
Additional calls during 3 months after discharge[3]	1492 (3.13)	463 (97.3%)	70 (2.41)	26 (89.7%)
Receive a post-discharge phone call	473 (0.99)	473 (99.4%)	28 (0.97)	28 (96.6%)
Receive a nurse practitioner home visit	—	—	—	—

Source: Patient-level data provided to RTI by W&I.
1 Denominator is 402. This denominator includes all of the mothers of infants in this enrollment group.
2 Denominator is 24. This denominator includes all of the mothers of infants in this enrollment group.
3 These services are additional to what would be done in the 1-month protocol.
— Data not applicable.

Table 31. Number and Types of Services Provided to Full-term Participants through Q13

	Number of Services Provided across Full-Term Participants Enrolled before 4/1 (Average per Participant) N = 261	Number (Percentage) of Full-Term Participants Enrolled before 4/1 Receiving Services N = 261	Number of Services Provided across Full-Term Participants Enrolled after 4/1 (Average per Participant) N = 25	Number (Percentage) of Full-Term Participants Enrolled after 4/1 Receiving Services N = 25
Receive 1-month assessment	191 (0.73)	191 (73.2%)	24 (0.96)	24 (96.0%)
Receive 3-month assessment[3]	182 (0.70)	182 (69.7%)	5 (0.20)	5 (20.0%)
Complete Edinburgh Depression Scale	200 (0.78)	200 (78.4%)[1]	22 (0.96)	22 (95.7%)[2]
Additional calls during first month after discharge	451 (1.73)	220 (84.3%)	30 (1.20)	19 (76.0%)
Additional calls during 3 months after discharge[3]	850 (3.26)	241 (92.3%)	61 (2.44)	24 (96.0%)
Receive a post-discharge phone call	257 (0.98)	257 (98.5%)	25 (1.0)	25 (100.0%)
Receive a nurse practitioner home visit	—	—	—	—

Source: Patient-level data provided to RTI by W&I.
1 Denominator is 255. This denominator includes all of the mothers of infants in this enrollment group.
2 Denominator is 23. This denominator includes all of the mothers of infants in this enrollment group.
3 These services are additional to what would be done in the 1-month protocol.
— Data not applicable.

2.23 Qualitative Findings: Sustainability

W&I will continue providing all support services to early preterm infants and their families who are publicly insured through the THP program. W&I reports strong support across the organization for sustaining support services for moderate, late-term, and full-term infants who spend 5 days or more in the NICU. However, at the time of this report, W&I and PWP leadership have not been able to obtain funding for the innovation. Lengthy negotiation processes with private payers are ongoing. W&I and innovation leaders are attempting to fit PWP into the new accountable care organization (ACO) model with W&I's biggest private payer, Blue Cross, and to negotiate with Rhode Island Medicaid for an extension on the contract for the THP program (currently serving infants with a birth weight of less than 1,500 g). W&I's efforts to fund the program have been challenged by conflicting timelines—the time required for funding negotiations does not line up with the end of CMS funding. Hospital negotiations are a complicated process that involve multiple programs and services that are all negotiated at the same time. Thus, the PWP program ended on September 30, 2015.

In Q13, W&I indicated that one of the most important lessons learned from the HCIA project is, "*the important role that a trained parent resource specialist can offer [in supporting NICU families during their NICU stay and post-discharge]*." W&I is working with the Department of Research to create new FRS positions, and requesting that FRS positions be added to the Department of Pediatrics. Potential opportunities will include working alongside research staff to assist them in enrolling NICU families in various studies and providing continued support to those families during enrollment. PWP staff also requested that several FRS positions be added to the Department of Pediatrics' fiscal year 2016 budget so that they can assist families returning home from the NICU and help them navigate follow-up medical treatment.

2.24 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing W&I as well as accomplishments to date. In this section, we assess W&I progress on achieving HCIA goals to date:

- **Smarter spending.** The innovation group incurred higher spending in the first quarter after the innovation launch than the comparison group did, but had lower spending in all subsequent quarters. To qualify for this innovation, infants were required to spend a minimum of 5 days in the NICU, and enrollment began at the time of their discharge. The overall estimate for the difference in quarterly spending is not statistically significant, however, indicating no significant difference between the innovation and comparison groups in Medicaid spending.

- **Better care.** Overall, the regression results for the Medicaid recipients indicate that the infants in the innovation group had fewer inpatient admissions, hospital readmissions, and ED visits than the comparison group and, these decreases were statistically significant. The cross-sectional analysis of ED and unplanned hospital readmissions data provided directly by W&I also showed sustained declines in both rates beginning in the period between Q7 and Q10.

  The W&I PWP had an overall reach of 71.3 percent, enrollment group-specific reaches of 75.3 percent for early preterm and moderate preterm infants, and a cumulative reach of 68.7 percent for late preterm and full-term infants.

  Across the four infant groups, the W&I PWP program provided consistently high levels of dose to enrollees. Nearly all enrollees received a post-discharge phone call; most received a 1-month assessment and a 3-month assessment. Nearly three-quarters of eligible mothers completed the Edinburgh Depression Scale.

  The high reach and intense level of dose make it plausible that the W&I innovation may have improved utilization outcomes for fragile infants although we cannot entirely rule out other factors that may have contributed to these improvements.

- **Healthier people**. Mortality rates (per 1,000) for late and full-term infants were below the national rate; six infants died following their enrollment in the innovation. Whether the innovation itself impacted mortality rates is difficult to ascertain without a control group because many other factors unrelated to the innovation may have influenced mortality.

W&I implemented the PWP innovation as planned, maintaining key staff and partnerships over the course of the HCIA award. To boost enrollment, W&I extended services to high-risk full-term infants in August 2013 and to families in Massachusetts and Connecticut in April 2014. Over the course of the innovation, W&I provided education and support services to a total of 1,391 infants. By the end of Q13 (September 2015), W&I also exceeded their training target by providing 1,978 hours of training to 532 internal and external stakeholders through six community partner workshops.

W&I started with the organizational capacity necessary to implement the innovation effectively, including expertise in providing health care for medically fragile infants and managing research grants that involve measures development and data collection and reporting. PWP leadership maintains that FRS played a critical role in helping family's transition home from the NICU, then navigate a complex system of follow-up care. The FRS and social workers also refined the protocol over time to improve delivery of the innovation and focus on preventing hospital readmissions and ED visits. The change in focus may have been one factor in the declines in utilization during the second half of the innovation period.

Overall, the services provided seemed to meet the needs of the infants and families enrolled. An anonymous satisfaction survey administered to enrolled families by the PWP program showed that 96 percent of participants would recommend the program to another family in a similar situation, and 90 percent agreed or strongly agreed that the time spent with PWP staff helped them feel more comfortable bringing their infants home.

Efforts are under way in the PWP program, in coordination with internal and external partners, to sustain the FRS workforce by creating FRS positions in the hospital's Division of Research and Department of Pediatrics. The THP program, which PWP was modeled after, will continue to serve early preterm infants and families who are publicly insured. THP is covered through existing Medicaid contracts with Neighborhood Health Plan of Rhode Island and United Healthcare RIteCare. Plans to sustain the full PWP through contracts with private insurers and Care New England's ACO had not yet come to fruition at the time of this report. However, PWP leadership noted in their final reporting that they will continue to pursue opportunities to sustain the innovation and provide services to all preterm and medically fragile infants in Rhode Island, Massachusetts, and Connecticut with a NICU stay of at least 5 days.

Collectively, the evaluation evidence suggests strong execution, capable leadership and staff, and an intensive protocol refined over time resulted in a positive impact on the infants enrolled in the W&I innovation.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

Women and Infants Hospital of Rhode Island (W&I)

The Women and Infants Hospital of Rhode Island (W&I) is a nonprofit acute care hospital in Providence, RI. The W&I neonatal intensive care unit (NICU) provides state-of-the-art tertiary care to more than 1,200 high-risk infants annually. W&I received an award of $3,261,494 to implement its innovation, Partnering with Parents (PWP), to improve transition to home services for high-risk preterm and full-term infants in Rhode Island, Connecticut, and Massachusetts. The innovation launched on October 15, 2012.

Awardee Overview

Innovation dose:	All infants enrolled after April 1, 2015, received a 1-month protocol, including post-discharge phone call (67.4–96% across high-risk infant groups) and a 1-month assessment (75–96%). At least 70.8% of eligible mothers completed the Edinburgh Depression Scale. All infants enrolled before April 1, 2015 received the 3-month protocol, including a post-discharge phone call (98.5–100% across high-risk infant groups), a 1-month assessment (73.2–91.6%), and a 3-month assessment (69.7–88%). At least 78.4% of eligible mothers completed the Edinburgh Depression Scale.	***Innovation reach:***	1,391 cumulative participants enrolled: 75.3% of eligible early and moderate preterm infants and 68.7% of eligible late preterm and full-term infants enrolled.
Components:	Enrolled infants and their families received (1) peer support, (2) social worker support, (3) clinical support, and (4) patient navigation.	***Participant demographics:***	All participants were infants less than 1 year; 54.2% were male; 59% were white; 21.8% were Hispanic; 53.5% were enrolled in Medicaid.
Sustainability:	W& I continued education and support services to early preterm infants through Transition Home Plus and is exploring opportunities to sustain the program for moderate/late preterm infants via Medicaid contracts and Care New England's Accountable Care Organization. W&I is also identifying opportunities to create positions for family resource specialists on NICU research studies.		
Innovation type:	Coordination of care		

Key Findings

Smarter spending. To qualify for this innovation, infants were required to spend a minimum of 5 days in the NICU, and enrollment began at the time of their discharge. The overall estimate for the difference in average quarterly spending ($740; 90% CI: −$4,080, $5,560) is not statistically significant, however, indicating no significant difference between the innovation and comparison groups in Medicaid spending.

Better care. Overall, the regression results for the Medicaid recipients indicate that the infants in the innovation group had fewer inpatient admissions per 1,000 participants per quarter (−23; 90% CI: −43, −3), fewer hospital readmissions per 1,000 admissions per quarter (−74; 90% CI: −137, −10), and fewer emergency department (ED) visits per 1,000 participants per quarter (−328; 90% CI: −388, −269) than the comparison group. The cross−sectional analysis of ED and unplanned hospital readmissions data provided directly by W&I also showed sustained declines in both rates between Q7 and Q10.

Healthier people. Mortality rates (per 1,000) for late and full-term infants were below the national rate of 5.96 per 1,000; six infants died following their enrollment in the innovation. Whether the innovation itself impacted mortality rates is difficult to ascertain without a control group because many other factors unrelated to the innovation may have influenced mortality.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report 2016

Awardee-Level Findings:

YMCA of the USA

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Overall Evaluation Summary

RTI International was selected to lead an independent evaluation of the 24 Health Care Innovation Award (HCIA) awardees categorized as Community Resource Planning, Prevention, and Monitoring (Community Resource). In this role, RTI is responsible for an in-depth evaluation of each innovation, as well as a cross-site evaluation that includes similar innovations targeting the same priority outcomes (e.g., emergency department [ED] visits). The evaluation methods vary by awardee innovation and are tailored to the type of innovation and availability of data. RTI's annual reporting includes a review, coding, and analysis of each awardee's *Narrative Progress Reports* and the *Quarterly Awardee Performance Reports*. In addition, RTI collected qualitative data through virtual site visits and end-of-year (EOY) interviews through the 12th quarter for nonextended awardees and up to the 14th quarter of operations for extended awardees. Each awardee's report incorporates this knowledge.

RTI presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. To date, RTI obtained patient identifiers for 23 of the 24 awardees. This report also presents secondary data received directly from awardees that quantify the impact of the innovation on clinical effectiveness and health outcomes. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report

Data Source	Period Covered
Awardee Narrative Progress Report	Launch date–Q14 (December 2015)
Quarterly Awardee Performance Report	Launch date–Q14 (December 2015)
Medicare	Launch date–December 2015
Medicaid	Launch date–December 2015
Awardee-specific data	Launch date–December 2015

Q = quarter.

YMCA of the USA (Y-USA)

2.1 Introduction

The YMCA of the USA (Y-USA), a nonprofit community-based organization headquartered in Chicago, received an award of $11,885,134 to expand a prevention program for prediabetic Medicare beneficiaries in 17 participating YMCAs across the nation. Y-USA began enrolling participants on February 15, 2013, and stopped enrolling on July 31, 2015. The innovation sought to achieve the following HCIA goals:

1. **Smarter spending.** Reduce health care expenditures by $3.3 million by June 2015. This goal was revised from a previous target of $1.8 million.
2. **Better care.** Improve care through diabetes-related preventive services in at least 500 community- and primary care-based settings by offering the National Diabetes Prevention Program (National DPP) in community or clinical settings.
3. **Healthier people.** Achieve better health through changes in nutrition and physical activity, resulting in an approximately 5 percent weight loss, and reduced risks for diabetes, hypertension, and hypercholesterolemia for at least 50 percent of the 10,000 expected Medicare participants.

Table 2 provides a summary of changes that occurred during the previous 12 months of operations. These updates are based on a review of the Quarter (*Q) 11–14 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through December 31, 2015.

Table 2. Summary of Updates as of Quarter 14, December 31, 2015

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 12/31/2015)
Innovation Components	
	Hired and trained lifestyle coaches to conduct diabetes prevention trainings for eligible participants.
Program Participant Characteristics	
	Majority (77.7%) of participants were from 65 to 74 years of age; 70.0% were female and 100% were covered by either Medicare FFS or Medicare Advantage.
Workforce Development	
Hiring and retention	No new hires or separations occurred between Q11 - Q14. As of Q14, at projection with 2.85 FTEs.
Skills, knowledge, and training	As of Q14, innovation had a cumulative 4,382 trainees and 39,148 training hours (since inception).

(continued)

Table 2. Summary of Updates as of Quarter 14, December 31, 2015 (continued)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 12/31/2015)
Context	
Award Execution	Expended 94.2% of budget by the end of Q14, which is on target.
	Enrollment ended on July 31, 2015.
	No-cost extension granted through June 30, 2016. All participants are in maintenance phase of the intervention.
Leadership	Y-USA leadership remains committed to the innovation beyond the end of the grant period.
Organizational capacity	Various internal and external strategies at each local YMCA were used to increase recruitment capacity, such as further engaging YMCA members and partnering with health care providers.
Innovation adoption and workflow integration	National DPP is integrated as part of Y-USA's strategic plan implemented at all 17 participating YMCAs to serve prediabetic Medicare beneficiaries.
Implementation Effectiveness	
Innovation reach	1,250 participants enrolled since 2015 annual report (6,946 cumulative total enrolled); overall 88.7% of recruited participants enrolled in the program.
Innovation dose	36.7% of participants completed between 9 and 16 sessions, 42.4% completed 17 or more sessions, and 20.9% completed fewer than 9 sessions.
Sustainability	
	New CPT code in July 2015 will allow providers to submit for reimbursement of the National DPP and help eliminate out-of-pocket expense for participants.
	The Community Guide and U.S. Preventive Task Force found sufficient evidence to recommend the National DPP intervention as a routine, reimbursable preventive service, which will encourage reimbursement of the National DPP.

Sources: *Q11-Q14 Narrative Progress Report*.
Q11-Q14 Quarterly Awardee Performance Report.
Patient-level data provided to RTI.
Key informant interviews conducted June, 2015.

CPT = current procedural terminology; CHW = community health worker; National DPP = National Diabetes Prevention Program; FFS = fee for service; FTE = full-time equivalent.

Table 3 summarizes Medicare claims-based findings during the innovation period. The weighted average quarterly saving differential over 3 years of the innovation period was $278 (90% CI: $159, $396) per member per quarter. This effect is statistically significant and translates into savings of $5,048,449 generated by the program over 3 years of the program. Savings are highest in the first year, and equal to $364 (90% CI: $241, $488) per participant per quarter. The impact of the program decreases thereafter. Total decreases in inpatient stays and ED visits are also statistically significant over the entire innovation period and amount to 9 fewer inpatient stays and 9 fewer ED visits per 1,000 participants per quarter. The impact on inpatient stays and ED visits was also highest in the first year (12 and 11 fewer inpatient and ED visits in the innovation sample per 1,000 participants per quarter, respectively). The innovation did not show a statistically significant effect on readmissions.

Table 3. Summary of Medicare Claims-Based Findings (Full Sample)

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$5.048	−$7.200, −$2.897	−$4.466	−$5.979, −$2.952	−$0.453	−$1.506, $0.599	−$0.129	−$0.568, $0.310
Acute care inpatient stays	−167	−224, −110	−149	−193, −105	−3	−35, 30	−15	−30, 0
Hospital-wide all-cause unplanned readmissions	0	−13, 13	—	—	—	—	—	—
ED visits not leading to a hospitalization	−168	−250, −86	−137	−202, −72	−3	−48, 42	−28	−48, −8
Average impact per quarter								
Spending per participant	−$278	−$396, −$159	−$364	−$488, −$241	−$92	−$307, $122	−$126	−$555, $302
Acute care inpatient stays (per 1,000 participants)	−9	−12, −6	−12	−16, −9	−1	−7, 6	−15	−29, 0
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	0	−24, 24	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	−9	−14, −5	−11	−16, −6	−1	−10, 9	−27	−47, −8

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; — = not applicable due to small sample size.

Table 4 summarizes Medicare claims-based findings during the innovation period for a subset of individuals without diabetes at baseline; this reduces the sample by approximately 30 percent. For this subset of healthier individuals, the National DPP program translates into bigger savings compared to the full sample. The program for individuals not flagged as having diabetes-related claims, generated $303 in savings (90% CI: $176, $430) per member per quarter. Inpatient stays and ED visits decreased over the entire innovation period by 8 and 9, respectively, per 1,000 participants per quarter. The innovation had no statistically significant effects on readmissions.

Table 4. Summary of Medicare Claims-Based Findings (Subsample Analysis)

Outcome	Total	90% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results								
Total spending (in millions)	−$3.699	−$5.249, −$2.148	−$3.085	−$4.121, −$2.050	−$0.681	−$1.497, $0.135	$0.068	−$0.276, $0.412
Acute care inpatient stays	−97	−141, −53	−74	−109, −40	−21	−46, 4	−2	−13, 8
Hospital-wide all-cause unplanned readmissions	−5	−14, 5	—	—	—	—	—	—
ED visits not leading to a hospitalization	−106	−168, −43	−90	−140, −39	−6	−40, 28	−10	−23, 4
Average impact per quarter								
Spending per participant	−$303	−$430, −$176	−$365	−$487, −$243	−$217	−$477, $43	$110	−$449, $670
Acute care inpatient stays (per 1,000 participants)	−8	−12, −4	−9	−13, −5	−7	−15, 1	−2	−21, 14
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−14	−45, 17	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	−9	−14, −4	−11	−17, −5	−2	−13, 9	−16	−38, 7

Note: Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.

Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending in the innovation group against the comparison group. Total spending is the product of spending per participant and the number of person quarters. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays are the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** are the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization in the innovation group against the comparison group. Hospital-wide all-cause unplanned readmissions are the product of hospital-wide all-cause unplanned readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model.
- **ED visits not leading to a hospitalization (per 1,000 participants)** are the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits not leading to a hospitalization are the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters Estimates are derived using a negative binomial count model.
- CI = confidence interval; ED = emergency department; — = not applicable due to small sample size.

2.1.1 Innovation Components

The HCIA innovation at Y-USA implemented the National DPP lifestyle intervention in 17 YMCA facilities across the country. The National DPP is an evidence-based lifestyle change program recognized by the Centers for Disease Control and Prevention (CDC) to help reduce the risk of Type 2 diabetes and improve population health. The National DPP is implemented through public and private partnerships with the goal of delivering the lifestyle change program at community organizations across the country. Y-USA began offering the National DPP to members before the HCIA innovation and successfully implemented the program in 75 YMCAs. The target population for these programs was working and young adults. For HCIA, the innovation expanded the National DPP to prediabetic Medicare beneficiaries. Only one of the 17 YMCA implementation sites had previously targeted this population. The Y-USA innovation included two program components: hiring and training YMCA lifestyle coaches to teach the program's curricula, and conducting community-based National DPP sessions among eligible participants. The overarching goals of Y-USA's HCIA innovation were to get participants to lose 5 percent or more of their body weight and gradually increase their physical activity to 150 minutes per week.

No changes were made to these components since their initial presentation in the 2014 annual report. The partners for this innovation remain unchanged and included the Diabetes Prevention and Control Alliance (a subsidiary of United Health Group's Optum Solutions), seven national nonprofits, and 17 local YMCAs. ***Table 5*** lists the partners involved in the innovation as of Q14.

Table 5. HCIA Partners, Role, and Location

Partner Name	Role in HCIA Project	Location
Diabetes Prevention Control Alliance	Project management/administration	Minnetonka, MN
American Diabetes Association	Tool/communication development	Alexandria, VA
American Heart Association	Tool/communication development	Dallas, TX
American Medical Association	Tool/communication development	Chicago, IL
National Council on Aging	Tool/communication development	Washington, DC
National Council of La Raza	Tool/communication development	Washington, DC
National Association of County and City Health Officials	Tool/communication development	Washington, DC
South County Family YMCA	Implementation of the community-based prevention program	Venice, FL
Tampa Metropolitan Area YMCA	Implementation of the community-based prevention program	Tampa, FL
Valley of the Sun YMCA	Implementation of the community-based prevention program	Phoenix, AZ
YMCA of Arlington	Implementation of the community-based prevention program	Arlington, TX
YMCA of Central Ohio	Implementation of the community-based prevention program	Columbus, OH
YMCA of Delaware	Implementation of the community-based prevention program	Wilmington, DE

(continued)

Table 5. HCIA Partners, Role, and Location (continued)

Partner Name	Role in HCIA Project	Location
YMCA of Greater Cincinnati	Implementation of the community-based prevention program	Cincinnati, OH
YMCA of Greater Cleveland	Implementation of the community-based prevention program	Cleveland, OH
YMCA of Greater Dayton	Implementation of the community-based prevention program	Dayton, OH
YMCA of Greater Indianapolis	Implementation of the community-based prevention program	Indianapolis, IN
YMCA of Greater New York	Implementation of the community-based prevention program	New York, NY
YMCA of Greater St. Petersburg	Implementation of the community-based prevention program	St. Petersburg, FL
YMCA of Metropolitan Dallas	Implementation of the community-based prevention program	Dallas, TX
YMCA of Metropolitan Fort Worth	Implementation of the community-based prevention program	Fort Worth, TX
YMCA of Southern Arizona	Implementation of the community-based prevention program	Tucson, AZ
YMCA of the Greater Twin Cities	Implementation of the community-based prevention program	Minneapolis, MN
YMCA of the Suncoast	Implementation of the community-based prevention program	Clearwater, FL

2.1.2 Program Participant Characteristics

Table 6 provides the demographic characteristics of all participants ever enrolled in the innovation (i.e., attended at least four sessions). We reported patient demographic characteristics in the 2015 annual report, based on data through Q11, and the distribution of patient characteristics is similar. The majority of participants (77.7%) were 65 to 74 years of age at enrollment, and more than two-thirds (70.0%) were female. Slightly more than half of participants (52.4%) were non-Hispanic white, 9.4 percent were black, and 2.1 percent were Hispanic. Over one-third (35.1%) did not report race/ethnicity. Two-thirds (66.1%) of enrollees were covered by Medicare fee-for-service and one-third (33.9%) covered by Medicare Advantage.

Table 6. Characteristics of All Participants Ever Enrolled in Innovation through December 2015

Characteristic	Number of Participants	Percentage of Participants
Total	**6,946**	**100**
Age		
< 18	0	0.0%
18–24	1	0.0%
25–44	9	0.1%
45–64	195	2.8%
65–74	5,396	77.7%
75–84	1,223	17.6%
85+	122	1.8%
Missing	0	0.0%
Sex		
Female	4,865	70.0%
Male	2,053	29.6%
Missing	28	0.4%
Race/ethnicity		
White	3,643	52.4%
Black	653	9.4%
Hispanic	149	2.1%
Asian	40	0.6%
American Indian or Alaska Native	15	0.2%
Native Hawaiian or Other Pacific Islander	6	0.1%
Other	0	0.0%
Missing/refused	2,440	35.2%
Payer category		
Dual	—	—
Medicaid	0	0
Medicare	4,594	66.1%
Medicare Advantage	2,352	33.9%
Other	0	0
Uninsured	0	0
Missing	0	0

Source: Patient-level data provided to RTI.
— Data not available
[1] Data provided by the Y-USA does not contain indication of Medicaid status so we are unable to determine dual eligibility.

2.2 Claims-Based Measures for Evaluation

This following sections describe the innovation's impact on health care spending per patient, hospital inpatient admissions, hospital unplanned readmissions, and ED visits that do not lead to a hospitalization. These claims-based measures are described in more detail in ***Appendix B.1***. A key concern of the evaluation is to address the following cost and utilization questions.

Evaluation Questions

- Has the innovation reduced inpatient admissions, ED visits, or unplanned readmissions?
- Has the innovation reduced spending per patient?

Table 7 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 7. Claims-Based Outcome Measures

Evaluation Domain	Subdomains	Measure	Medicare Reported in Annual Report	Medicaid Reported in Annual Report
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	N/A
		Hospital unplanned readmissions rate	Yes	N/A
		ED visit rate	Yes	N/A
	Cost	Spending per patient	Yes	N/A
		Estimated cost savings	Yes	N/A

ED = emergency department; N/A = not applicable.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. The Medicare claims analysis focuses on 3,336 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period as well as a group of statistically matched comparison beneficiaries with fee-for-service Medicare. The program stopped enrollment July 31, 2015. Although estimated impacts will continue to evolve as we analyze an additional two quarters of claims data through June 2016 in a supplemental report, no new individuals will enter the sample.

We use propensity score matching (PSM) to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary is enrolled in the innovation as a function of age, gender, race, disability, end-stage renal disease status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, total Medicare payments in the calendar quarter and calendar year prior to the innovation and whether an individual lives in the same zip code of a YMCA. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Table 8 describes the mean values and standardized differences of the variables of interest that are included in the propensity score model before and after matching. ***Figure 1*** shows the distribution of the propensity scores for both the comparison and innovation groups. The two distributions overlap substantially, indicating that the propensity scores for the matched comparison beneficiaries are similar to those of the treatment beneficiaries. ***Appendix B.2*** provides technical details on the propensity score methodology. Seventeen innovation beneficiaries were dropped from the subsequent analyses because an appropriately matched comparison beneficiary was not available. PSM reduced the absolute standardized differences and achieved adequate balance for all variables (the standardized difference is less than 0.1[1] throughout). Note that the indicator variable denoting diabetes status was not included in the propensity score model because by construction we selected the comparison group to include only individuals with prediabetes (ICD-9 codes: 790.29 (abnormal glucose); 277.7 (metabolic syndrome); 790.21 (impaired fasting glucose levels, but not yet diagnosed with diabetes); and 790.22 (failed glucose tolerance test)) while excluding those diagnosed with diabetes.

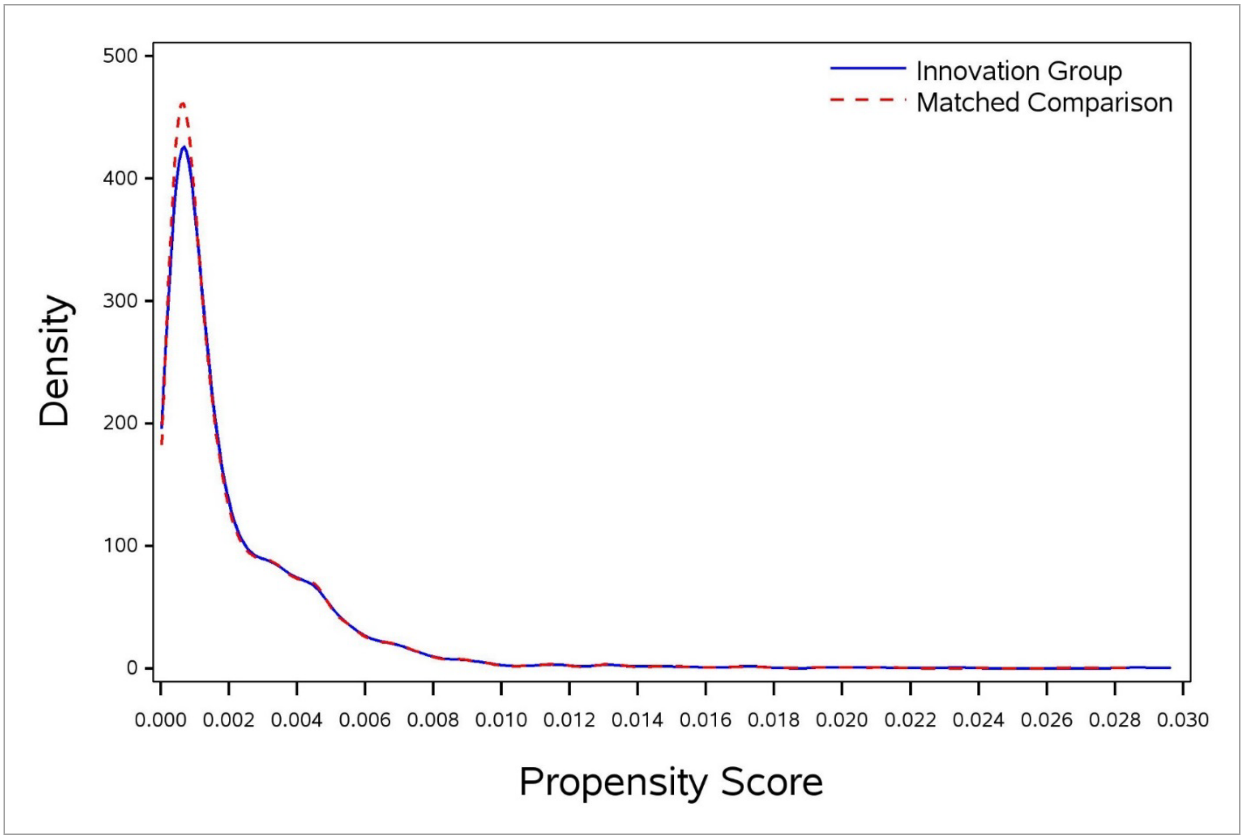
[1] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behav Res. 46(3):399-424, 2011.

Table 8. Mean Values and Standardized Differences of Variables in Propensity Score Model: Y-USA (Full Sample)

	Before Matching					After Matching				
	Treatment Group		Comparison Group			Treatment Group		Comparison Group		
Variable	Mean	SD	Mean	SD	Standardized Difference	Mean	SD	Mean	SD	Standardized Difference
Payments in calendar quarter prior to enrollment	$1,345	$3,466	$1,888	$5,930	0.11	$1,346	$3,473	$1,404	$4,143	0.02
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$5,832	$11,503	$6,707	$13,935	0.07	$5,829	$11,510	$6,048	$11,798	0.02
Age	70.18	5.78	74.47	7.38	0.65	70.29	5.54	70.25	5.14	0.01
Percentage male	31.15	46.31	41.99	49.35	0.32	31.24	46.35	31.86	46.59	0.02
Percentage white	81.98	38.43	87.3	33.3	0.21	82.1	38.33	81.17	39.1	0.03
Percentage ESRD	0.21	4.58	0.19	4.35	0.01	0.21	4.59	0.26	5.1	0.01
Percentage living in the same ZIP as a YMCA	44.3	49.67	15.19	35.89	0.95	44.14	49.66	43.94	49.63	0.01
Number of dual eligible months in the previous calendar year	0.49	2.31	0.84	3	0.13	0.49	2.3	0.47	2.25	0.01
Number of chronic conditions	5.73	3.14	6.25	3.28	0.16	5.74	3.14	5.71	3.18	0.01
Number of ED visits in calendar quarter prior to enrollment	0.07	0.32	0.07	0.32	0.03	0.06	0.32	0.07	0.3	0.01
Number of inpatient stays in calendar quarter prior to enrollment	0.02	0.17	0.05	0.26	0.13	0.02	0.17	0.02	0.17	0.00
Percentage with diabetes ever	29.77	45.72	0	0	1.30	29.8	45.74	0	0	1.30
Number of beneficiaries	3,336	—	4,387,776	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	457,774	—	—	3,319	—	9,861	—	—
Number of weighted beneficiaries	—	—	—	—	—	3,319	—	3,319	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).
ED = emergency department; ESRD = end-stage renal disease; Y-USA = YMCA of the USA.
— Data not applicable.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: Y-USA (Full Sample)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.3.1 No-Diabetes Subsample Analysis

Although all enrollees should have prediabetes at the time of enrollment in the program, some enrollees may also have received a formal diabetes diagnosis before entering the program. Cost savings may be higher among the subgroup of "healthier" individuals who never received a diabetes diagnosis compared to those that received a diabetes diagnosis. Therefore, using the same criteria as for comparison group 1, based on geographical location, prediabetes status, and Medicare fee-for-service coverage, we define a new comparison group based on propensity score matches to individuals who did not receive a diabetes diagnosis prior to enrollment. This sub-analysis analysis focuses on 2,322 participating beneficiaries in the innovation group who never had diabetes (based on claims history in the Chronic Conditions Data Warehouse). Twenty treatment beneficiaries were dropped from the analyses because an appropriately matched comparison beneficiary was not available. ***Table 9*** shows that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Table 9. Mean Values and Standardized Differences of Variables in Propensity Score Model: Y-USA (No-Diabetes Subsample Analysis)

	Before Matching					After Matching				
	Treatment Group		Comparison Group		Standardized	Treatment Group		Comparison Group		Standardized
Variable	Mean	SD	Mean	SD	Difference	Mean	SD	Mean	SD	Difference
Payments in calendar quarter prior to enrollment	$1,219	$3,265	$1,888	$5,930	0.14	$1,214	$3,255	$1,218	$3,525	0.00
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$5,129	$11,363	$6,707	$13,935	0.12	$5,131	$11,389	$4,989	$10,319	0.01
Age	69.79	5.76	74.47	7.38	0.71	69.98	5.36	70.1	4.96	0.02
Percentage male	30.84	46.18	41.99	49.35	0.33	30.93	46.22	30.25	45.93	0.02
Percentage white	83.03	37.54	87.3	33.3	0.17	83.32	37.28	82.9	37.65	0.02
Percentage ESRD	0.09	2.93	0.19	4.35	0.04	0.09	2.95	0.04	2.08	0.09
Percentage living in the same ZIP as a YMCA	43.37	49.56	15.19	35.89	0.92	43.09	49.52	43.85	49.62	0.02
Number of dual eligible months in the previous calendar year	0.4	2.07	0.84	3	0.17	0.39	2.04	0.41	2.1	0.01
Number of chronic conditions	4.82	2.8	6.25	3.28	0.47	4.84	2.8	4.86	2.94	0.01
Number of ED visits in calendar quarter prior to enrollment	0.05	0.25	0.07	0.32	0.07	0.05	0.25	0.05	0.28	0.01
Number of inpatient stays in calendar quarter prior to enrollment	0.02	0.14	0.05	0.26	0.16	0.02	0.14	0.02	0.13	0.00
Number of beneficiaries	2,322	—	4,387,776	—	—	—	—	—	—	—
Number of unique beneficiaries[1]	—	—	457,774	—	—	2,302	—	6,852	—	—
Number of weighted beneficiaries	—	—		—	—	2,302	—	2,302	—	—

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

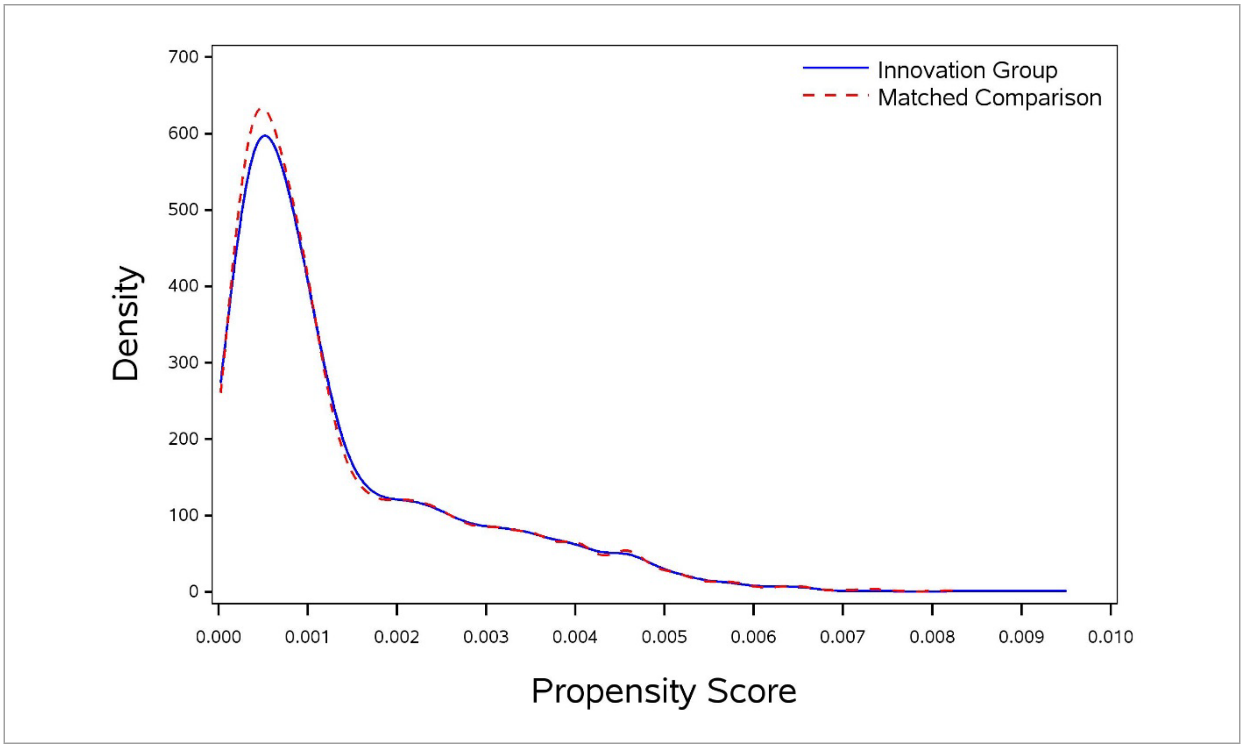
[1] Before matching, differences in the number of beneficiaries and the number of unique beneficiaries in the comparison group are due to multiple observations of each comparison beneficiary (clones). After matching, differences in the number of beneficiaries and the number of unique beneficiaries are due to weighting (see Appendix B for discussion of weights).

ED = emergency department; ESRD = end-stage renal disease; SD = standard deviation; Y-USA = YMCA of the USA; ZIP = zip code.

— Data not applicable.

Figure 2 shows the distribution of the propensity scores for both the innovation and comparison groups.

Figure 2. Distribution of Propensity Scores for Comparison and Innovation Groups: Y-USA (No-Diabetes Subsample Analysis)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.4 Medicare Spending

2.4.1 Descriptive Results (Using the Full Treatment Sample)

Table 10 reports Medicare spending per patient in the eight quarters before and the 12 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 3*** illustrates the Medicare spending per beneficiary in Table 10 for innovation and comparison group beneficiaries. The blue line represents values for beneficiaries enrolled in the innovation and is darker in innovation quarters. The red line represents values for comparison group beneficiaries and is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters.

Innovation participants have lower spending than comparison group members throughout the first six innovation quarters. Thereafter, variability increases as the number of participants declines reflecting the lower recruitment in the first quarters of the program relative to subsequent quarters.

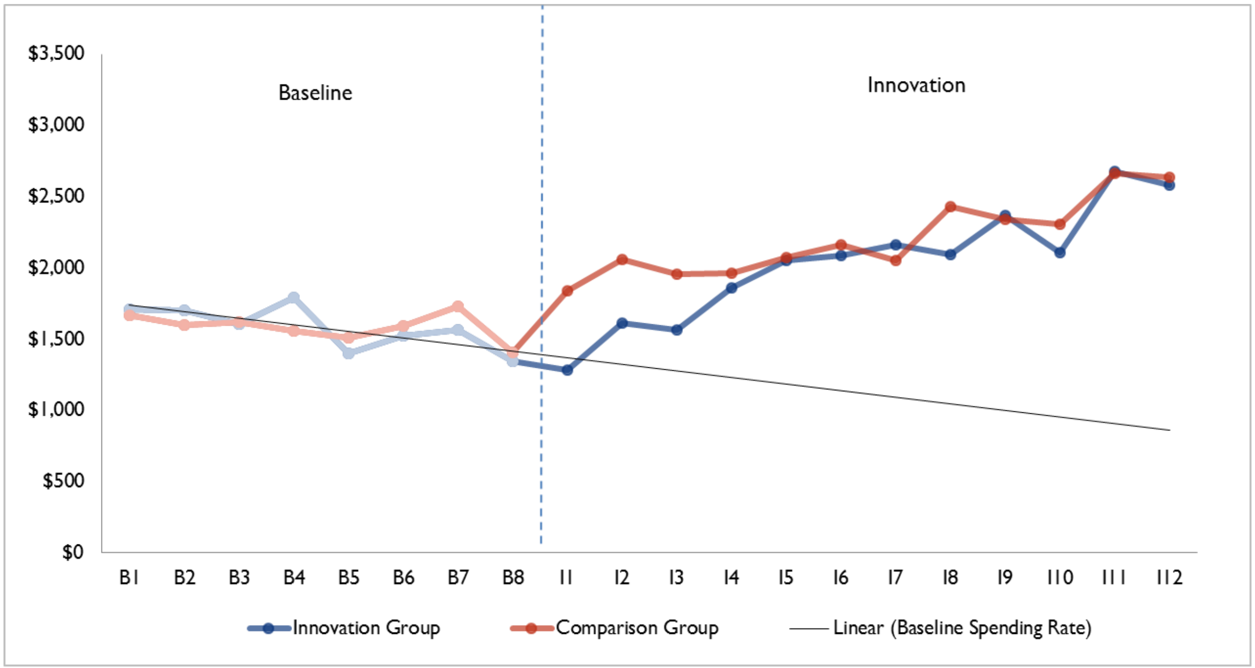
Table 10. Medicare Spending per Participant: Y-USA (Full Sample)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters											
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Spending rate	$1,712	$1,703	$1,608	$1,789	$1,403	$1,525	$1,563	$1,346	$1,284	$1,612	$1,563	$1,859	$2,055	$2,088	$2,165	$2,091	$2,368	$2,109	$2,678	$2,585
Std dev	$5,365	$5,503	$4,127	$5,407	$3,614	$4,234	$5,416	$3,473	$3,477	$7,047	$4,448	$5,739	$7,253	$5,696	$6,017	$6,597	$7,301	$4,658	$6,597	$5,415
Unique patients	2,653	2,750	2,836	2,924	3,040	3,141	3,237	3,319	3,319	3,303	3,098	2,537	1,650	1,403	1,107	749	498	345	128	54
Comparison Group																				
Spending rate	$1,667	$1,598	$1,620	$1,561	$1,511	$1,594	$1,730	$1,404	$1,840	$2,057	$1,954	$1,963	$2,071	$2,165	$2,052	$2,431	$2,339	$2,309	$2,663	$2,640
Std dev	$5,659	$4,807	$5,056	$4,598	$4,526	$4,696	$5,183	$4,143	$5,286	$6,207	$5,919	$6,349	$6,152	$6,376	$5,990	$7,681	$5,930	$6,128	$6,949	$7,378
Unique patients	2,693	2,796	2,888	2,993	3,088	3,184	3,274	3,319	3,319	3,303	3,084	2,518	1,647	1,396	1,109	749	500	350	124	56
Savings per Patient																				
	−$46	−$104	$12	−$228	$107	$69	$167	$58	$556	$445	$391	$104	$16	$77	−$112	$340	−$29	$200	−$15	$55

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 3. Medicare Spending per Participant: Y-USA (Full Sample)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Awardee abbreviation = Awardee Full Name.

2.4.2 Descriptive Results (No-Diabetes Subsample Analysis)

In the subsample of individuals without a diabetes diagnosis, comparison individuals have significantly higher spending in the first four innovation quarters.

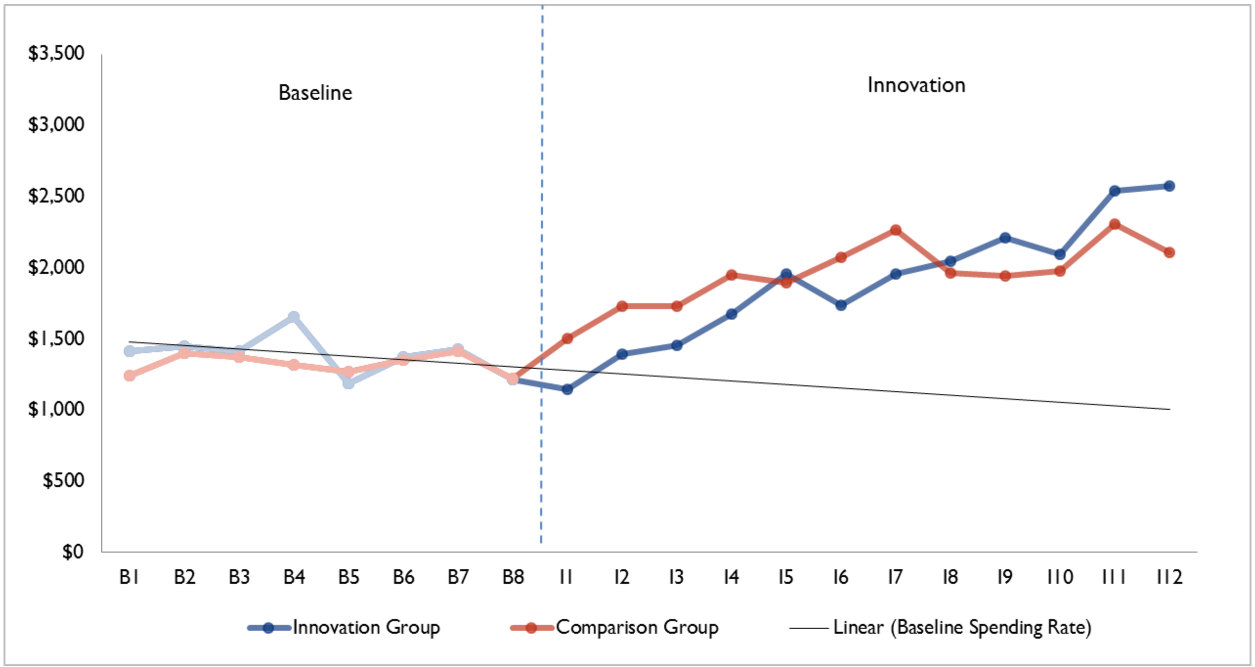
Table 11. Medicare Spending per Participant: Y-USA (No-Diabetes Subsample Analysis)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters											
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Spending rate	$1,414	$1,449	$1,411	$1,654	$1,187	$1,370	$1,428	$1,214	$1,147	$1,394	$1,453	$1,675	$1,958	$1,739	$1,960	$2,044	$2,211	$2,093	$2,541	$2,578
Std dev	$4,884	$3,946	$3,917	$5,286	$2,858	$4,049	$5,921	$3,255	$2,596	$3,836	$3,876	$5,370	$7,739	$4,158	$5,942	$7,408	$7,483	$4,794	$6,491	$5,497
Unique patients	1,761	1,835	1,895	1,971	2,058	2,142	2,224	2,302	2,302	2,290	2,135	1,727	1,070	898	696	472	289	213	80	33
Comparison Group																				
Spending rate	$1,242	$1,402	$1,371	$1,315	$1,272	$1,355	$1,413	$1,218	$1,504	$1,730	$1,729	$1,950	$1,895	$2,074	$2,263	$1,964	$1,942	$1,977	$2,305	$2,105
Std dev	$3,835	$4,800	$4,489	$3,914	$3,985	$4,037	$4,386	$3,525	$4,822	$5,696	$5,517	$6,669	$5,637	$7,140	$7,748	$5,903	$6,211	$5,274	$6,516	$4,745
Unique patients	1,822	1,883	1,957	2,034	2,104	2,176	2,254	2,302	2,302	2,296	2,134	1,723	1,073	897	701	477	295	218	77	33
Savings per Patient																				
	−$172	−$46	−$39	−$339	$86	−$16	−$15	$4	$357	$336	$276	$275	−$63	$335	$303	−$80	−$269	−$115	−$236	−$473

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique or weighted patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 4. Medicare Spending per Participant: Y-USA (No-Diabetes Subsample Analysis)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.4.3 Regression Results (Using the Full Treatment Sample)

We present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating saving, is −$278 (90% CI: −$159, −$396). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 12*** presents the results of an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 5*** illustrates these quarterly difference-in-differences estimates.

Table 12. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
I1	−$521	$82	<.0001
I2	−$406	$139	0.004
I3	−$370	$104	0.000
I4	−$98	$136	0.470
I5	−$37	$199	0.851
I6	−$122	$178	0.491
I7	$68	$205	0.741
I8	−$394	$285	0.168
I9	−$91	$356	0.798
I10	−$241	$311	0.440
I11	$9	$688	0.990
I12	−$43	$938	0.964
Overall average	−278	72	0.000
Overall aggregate	−$5,048,449	$1,307,895	0.000
Overall aggregate (IY1)	−$4,465,658	$920,182	<.0001
Overall aggregate (IY2)	−$453,338	$639,986	0.479
Overall aggregate (IY3)	−$129,453	$266,851	0.628

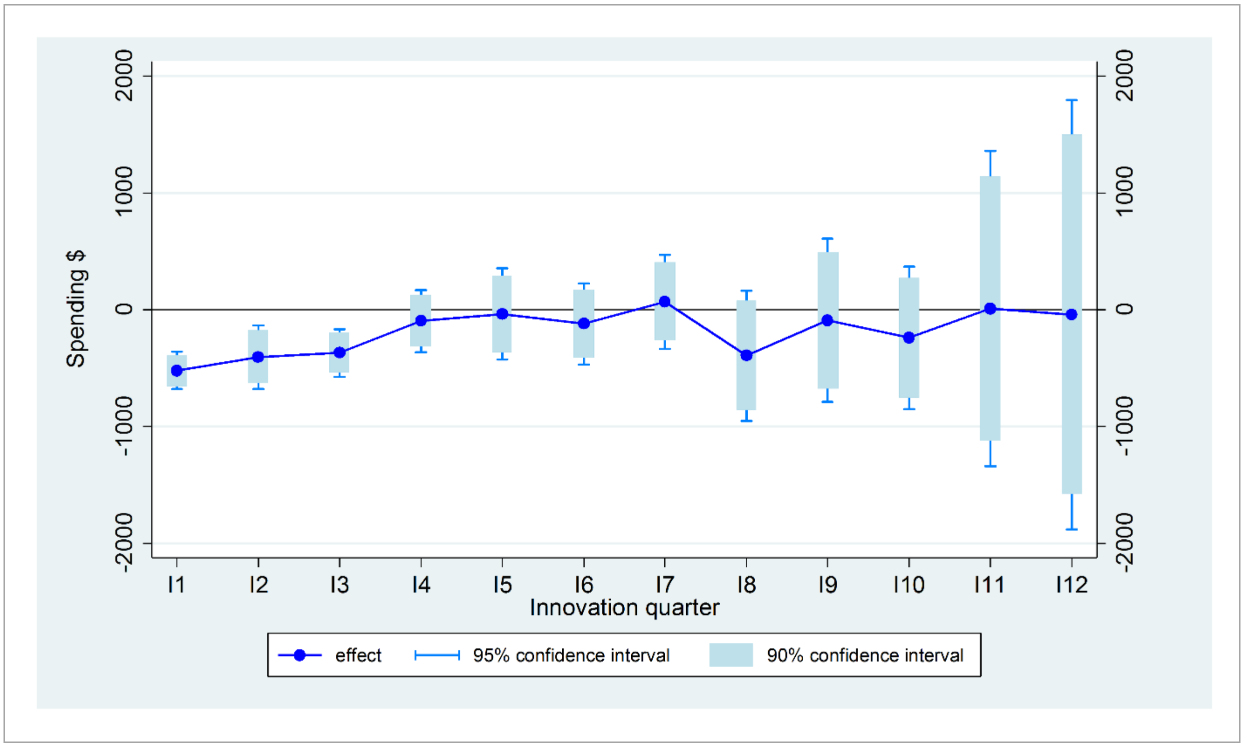
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Y-USA = YMCA of the USA.

Figure 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Y-USA (Full Sample)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; Y-USA = YMCA of the USA.

Figure 6 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Evidence of savings persists through the initial three innovation quarters. In subsequent quarters, savings remain more likely than losses; however, the impact of the program is not significant at the conventional levels.

Figure 6. Quarterly Strength of Evidence in Favor of Savings/Loss: Y-USA (Full Sample)

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.4.4 Regression Results (No-Diabetes Subsample Analysis)

Table 13 presents the results of an OLS regression with quarterly spending as the dependent variable for individuals without diabetes. The coefficients represent the difference in quarterly spending in innovation quarters between the subsample and its matched comparison group. ***Figure 7*** illustrates these quarterly difference-in-differences estimates. We find statistically significant differences in spending in the first four quarters of the innovation. These savings become insignificant in subsequent quarters, with the exception of I6.

The weighted average quarterly spending differential in the innovation period, indicating savings, is −$303 (90% CI: −$176, −$430). This effect is statistically significant. This estimate represents the differential spending per quarter in the innovation period between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

Table 13. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Y-USA (No-Diabetes Subsample Analysis)

Quarter	Coefficient	Standard Error	P-Values
I1	−$399	$82	<.0001
I2	−$381	$108	0.000
I3	−$334	$110	0.003
I4	−$337	$161	0.036
I5	−$11	$258	0.965
I6	−$429	$193	0.027
I7	−$404	$275	0.141
I8	−$5	$365	0.990
I9	$173	$478	0.718
I10	$9	$384	0.981
I11	$65	$844	0.938
I12	$322	$1,079	0.765
Overall average	−$303	$77	<.0001
Overall aggregate	−$3,698,665	$942,532	<.0001
Overall aggregate (IY1)	−$3,085,383	$629,278	<.0001
Overall aggregate (IY2)	−$680,965	$495,945	0.170
Overall aggregate (IY3)	$67,684	$209,177	0.746

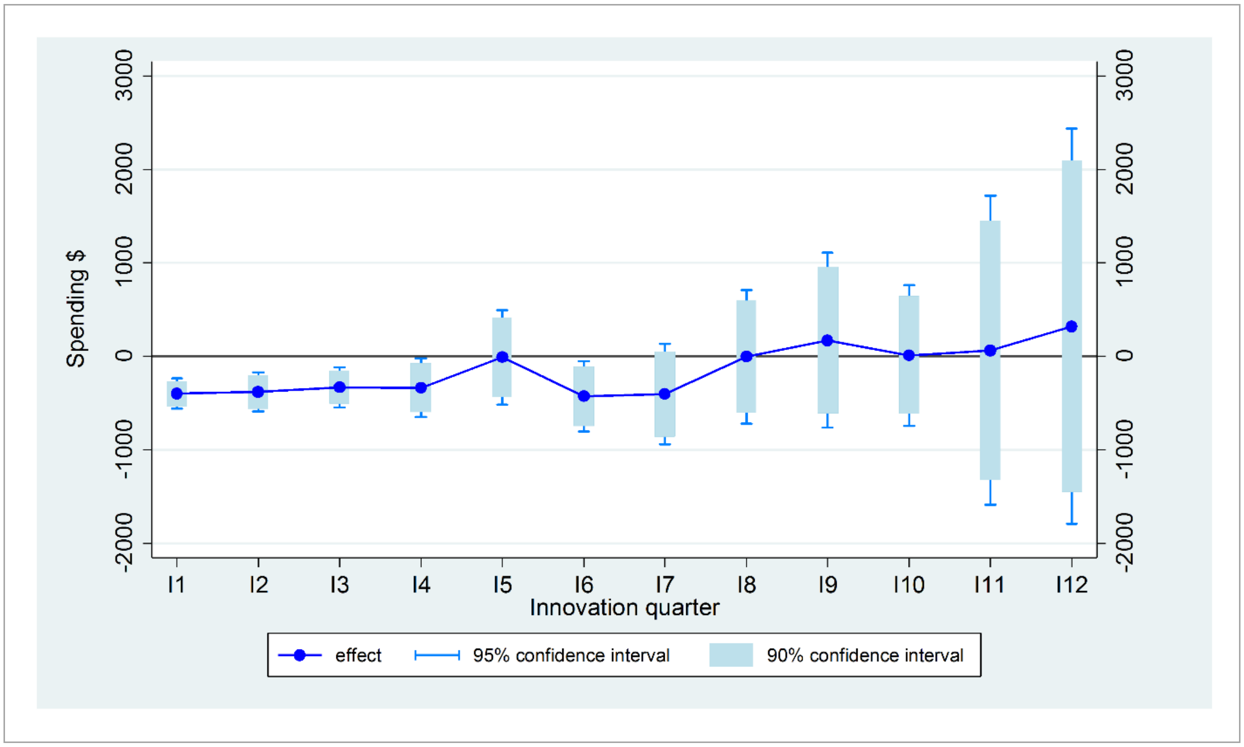
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The regression coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Y-USA = YMCA of the USA.

Figure 7. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Y-USA (No-Diabetes Subsample Analysis)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
OLS = ordinary least squares; Y-USA = YMCA of the USA.

Figure 8 shows that the strength of evidence shows savings for the first 2 years of the innovation. Thereafter, the innovation shown no impact on savings.

Figure 8. Quarterly Strength of Evidence in Favor of Savings/Loss: Y-USA (No-Diabetes Subsample Analysis)

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results (Using the Full Treatment Sample)

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 14*** and ***Figure 9***. The comparison group has slightly higher inpatient admission rates than the innovation group in several baseline quarters; this difference widens during all but two innovation quarters.

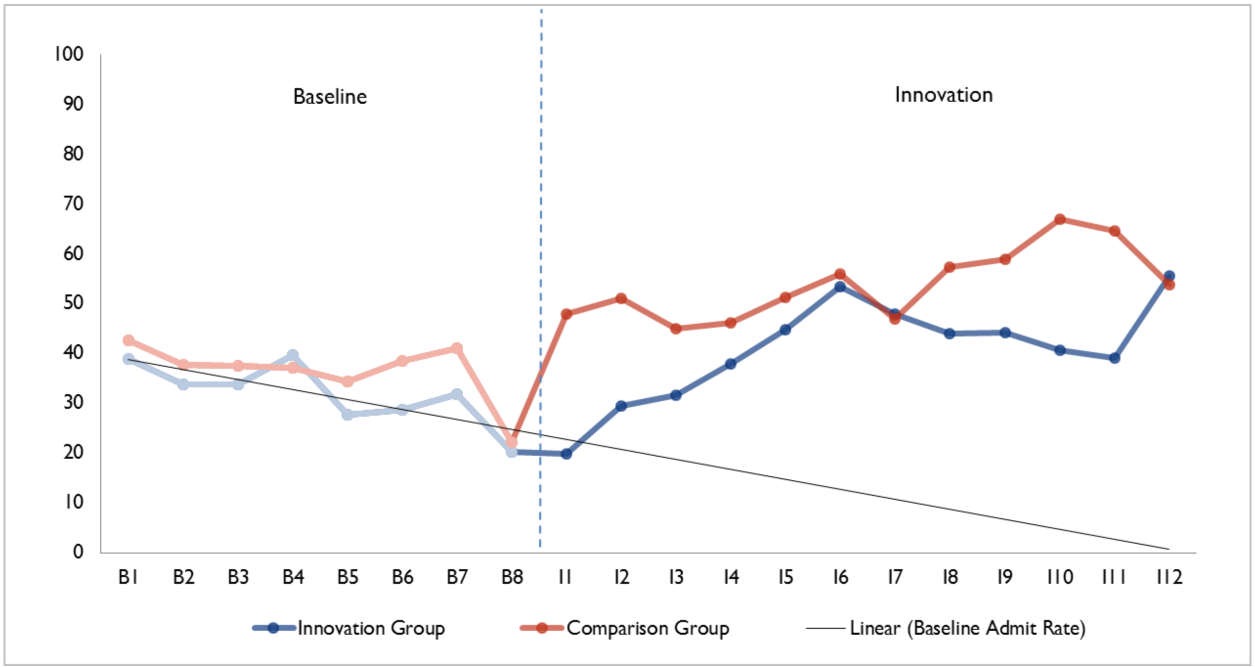
Table 14. All-Cause Inpatient Admissions Rate per 1,000 Participants: Y-USA (Full Sample)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters											
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**	**I11**	**I12**
Admit rate	39	34	34	40	28	29	32	20	20	29	32	38	45	53	48	44	44	41	39	56
Std dev	224	196	192	220	174	176	202	157	150	181	186	218	237	294	234	230	250	237	194	229
Unique patients	2,653	2,750	2,836	2,924	3,040	3,141	3,237	3,319	3,319	3,303	3,098	2,537	1,650	1,403	1,107	749	498	345	128	54
Comparison Group																				
Admit rate	43	38	38	37	34	39	41	22	48	51	45	46	51	56	47	57	59	67	65	54
Std dev	224	212	223	217	212	220	222	164	244	263	241	254	279	282	258	278	279	320	340	251
Weighted patients	2,693	2,796	2,888	2,993	3,088	3,184	3,274	3,319	3,319	3,303	3,084	2,518	1,647	1,396	1,109	749	500	350	124	56
Innovation – Comparison Rate																				
	−4	−4	−4	3	−7	−10	−9	−2	−28	−22	−13	−8	−6	−2	1	−13	−15	−26	−26	2

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 9. All-Cause Inpatient Admissions Rate per 1,000 Participants: Y-USA (Full Sample)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.5.2 Descriptive Results (No-Diabetes Subsample Analysis)

All-cause inpatient admissions rates per 1,000 participants for individuals without diabetes in the treatment and comparison group are shown in ***Table 15*** and ***Figure 10***. The pattern for the subsample is similar to that of the full sample but the differences in admission rates between innovation and comparison groups are smaller.

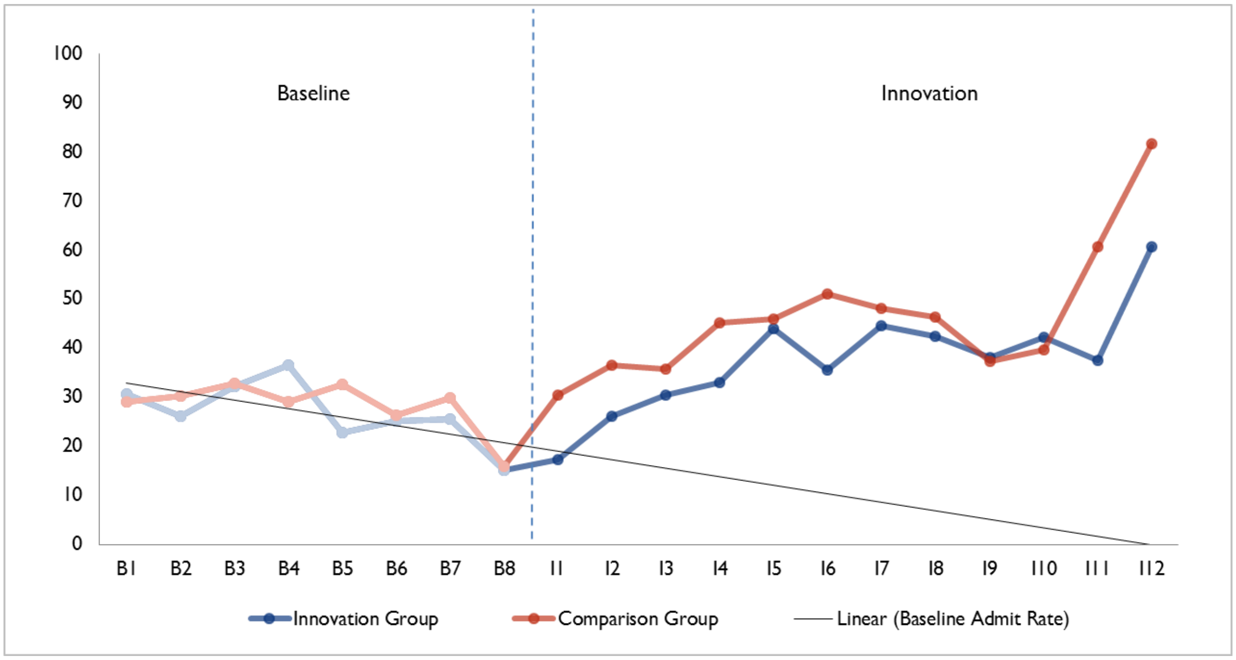
Table 15. All-Cause Inpatient Admissions Rate per 1,000 Participants: Y-USA (No-Diabetes Subsample Analysis)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Admit rate	31	26	32	37	23	25	26	15	17	26	30	33	44	36	45	42	38	42	38	61
Std dev	200	166	188	213	153	171	189	133	137	168	185	194	235	203	226	231	240	243	190	239
Unique patients	1,761	1,835	1,895	1,971	2,058	2,142	2,224	2,302	2,302	2,290	2,135	1,727	1,070	898	696	472	289	213	80	33
Comparison Group																				
Admit rate	29	30	33	29	33	26	30	16	30	36	36	45	46	51	48	46	37	40	61	82
Std dev	183	192	205	192	206	171	195	129	191	221	215	247	244	267	256	258	222	231	317	309
Weighted patients	1,822	1,883	1,957	2,034	2,104	2,176	2,254	2,302	2,302	2,296	2,134	1,723	1,073	897	701	477	295	218	77	33
Innovation – Comparison Rate																				
	2	−4	−1	8	−10	−1	−4	−1	−13	−10	−5	−12	−2	−15	−4	−4	1	3	−23	−21

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Admit rate: (Total unquarterized admissions /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Participants: Y-USA (No-Diabetes Subsample Analysis)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.5.3 Regression Results (Using the Full Treatment Sample)

Table 16 represents the results of a negative binomial count model with the dependent variable equal to the number of inpatient visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show inpatient admissions per 1,000 participants. The average quarterly difference-in-differences estimate is 9 inpatient admissions per 1,000 lower during the innovation period. This is the average difference in inpatient admissions for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant.

Table 16. Difference-In-Differences Negative Binomial Count Model Estimates for Inpatient Hospital Admissions, per 1,000 Participants: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
I1	−22	4	0.000
I2	−14	4	0.001
I3	−7	4	0.087
I4	−2	5	0.682
I5	−1	7	0.854
I6	0	8	0.987
I7	5	8	0.538
I8	−8	10	0.406
I9	−14	13	0.264
I10	−16	15	0.267
I11	−20	24	0.415
I12	4	45	0.924
Overall average	−9	2	0.000
Overall aggregate	−167	35	0.000
Overall aggregate (IY1)	−149	27	0.000
Overall aggregate (IY2)	−3	20	0.883
Overall aggregate (IY3)	−15	9	0.096

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Y-USA = YMCA of the USA.

2.5.4 Regression Results (No-Diabetes Subsample Analysis)

Table 17 represents the difference-in-difference inpatient admissions per 1,000 participants without diabetes. The average quarterly difference-in-differences estimate is 8 inpatient admissions per 1,000 lower during the 3 years following participation in the program. This finding is statistically significant.

Table 17. Difference-In-Differences Negative Binomial Count Model Estimates for Inpatient Hospital Admissions, per 1,000 Participants: Y-USA (Subsample Analysis)

Quarter	Coefficient	Standard Error	P-Values
I1	−11	4	0.004
I2	−9	5	0.060
I3	−4	5	0.402
I4	−11	6	0.093
I5	−1	9	0.874
I6	−16	9	0.070
I7	−7	11	0.530
I8	0	12	0.979
I9	1	14	0.925
I10	4	18	0.823
I11	−28	31	0.367
I12	−42	67	0.532
Overall average	−8	2	0.000
Overall aggregate	−97	27	0.000
Overall aggregate (IY1)	−74	21	0.000
Overall aggregate (IY2)	−21	15	0.176
Overall aggregate (IY3)	−2	7	0.712

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Y-USA = YMCA of the USA.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results (Using the Full Treatment Sample)

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 18*** and ***Figure 11***. Index admissions are low in this population; consequently, the unplanned readmissions rate is highly variable for both innovation and comparison groups.

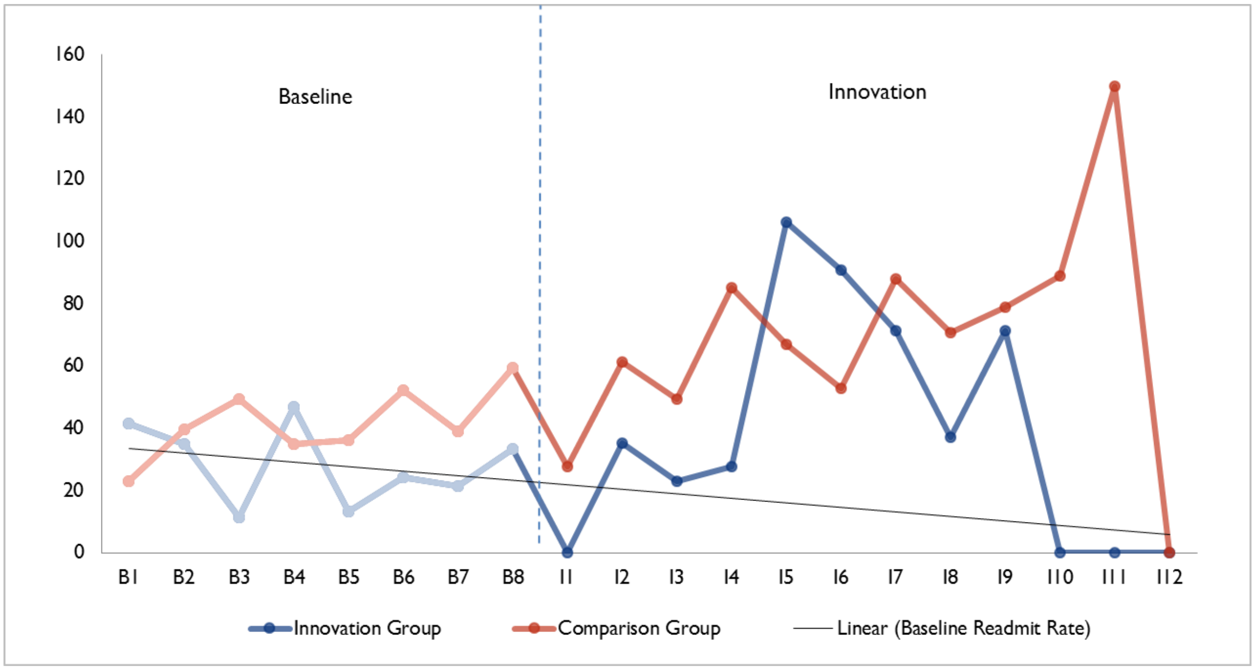
Table 18. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Y-USA (Full Sample)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Readmit rate	42	35	11	47	13	24	21	33	0	35	23	28	106	91	71	37	71	0	0	0
Std dev	200	184	105	211	115	153	144	180	0	185	150	164	308	288	258	189	258	0	0	0
Total admissions	96	86	89	107	75	83	94	60	62	85	87	72	66	66	42	27	14	7	5	2
Comparison Group																				
Readmit rate	23	40	49	35	36	52	39	59	28	61	49	85	67	53	88	71	79	89	150	0
Std dev	150	195	217	183	187	223	194	236	164	240	217	279	250	224	283	257	270	285	357	0
Total admissions	102	92	94	96	92	108	120	67	144	147	108	88	70	63	42	38	25	15	7	2
Innovation – Comparison Rate																				
	19	−5	−38	12	−23	−28	−18	−26	−28	−26	−26	−57	39	38	−17	−34	−8	−89	−150	0

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Y-USA (Full Sample)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.6.2 Descriptive Results (No-Diabetes Subsample Analysis)

Hospital unplanned readmissions rates per 1,000 admissions for individuals without diabetes are shown in ***Table 19*** and ***Figure 12***.

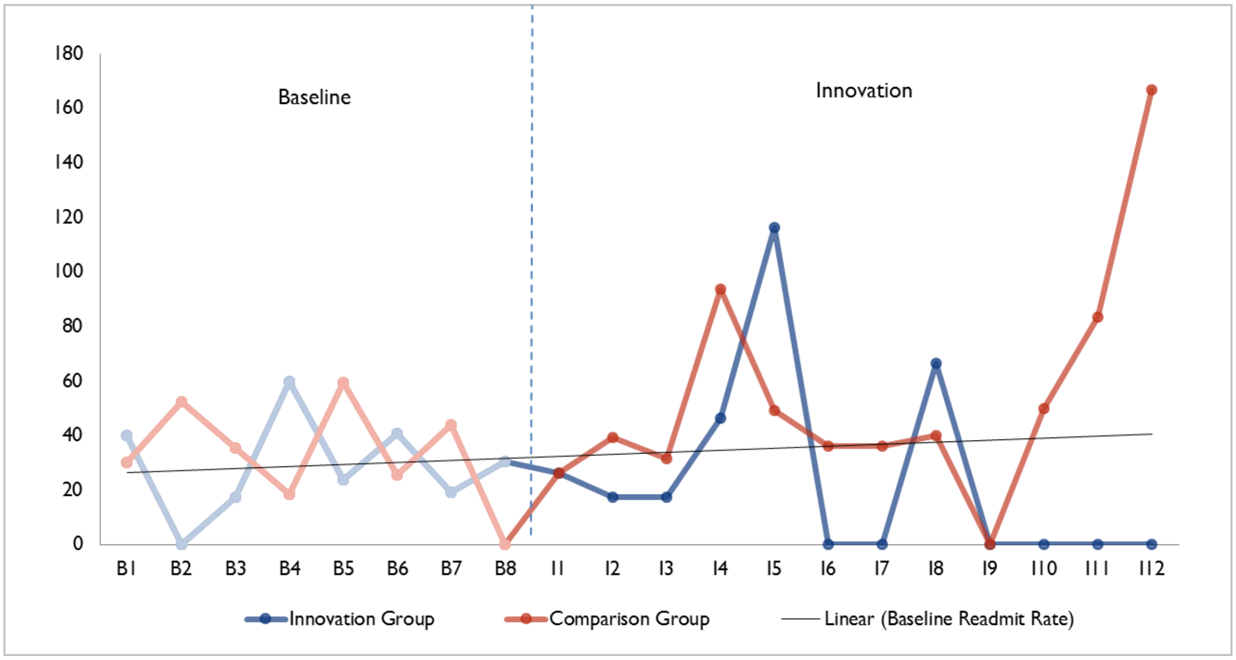
Table 19. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Y-USA (No-Diabetes Subsample Analysis)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Innovation Group																				
Readmit rate	40	0	18	60	24	41	19	30	26	18	18	47	116	0	0	67	0	0	0	0
Std dev	196	0	131	237	153	198	137	171	160	131	131	211	321	0	0	249	0	0	0	0
Total admissions	50	47	57	67	42	49	52	33	38	57	57	43	43	27	22	15	8	3	3	2
Comparison Group																				
Readmit rate	30	52	36	18	59	25	44	0	26	39	31	94	49	36	36	40	0	50	83	167
Std dev	171	223	185	134	237	158	205	0	160	194	174	292	216	186	187	196	0	218	276	373
Total admissions	44	51	56	55	62	52	61	34	64	77	64	64	41	37	28	17	9	7	4	2
Innovation – Comparison Rate																				
	10	−52	−18	41	−36	15	−24	30	0	−22	−14	−47	67	−36	−36	27	0	−50	−83	−167

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Readmissions rate: (Sum all eligible readmits to eligible hospital within 30 days/all eligible admissions in quarter)*1,000.
Total admissions: All eligible admissions in quarter.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 12. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Y-USA (No-Diabetes Subsample Analysis)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Y-USA = YMCA of the USA.

2.6.3 Regression Results (Using the Full Treatment Sample)

Table 20 presents the results of a logistic regression model with the dependent variable set to one for hospitalized patients who had an unplanned readmission within 30 days. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show readmissions per 1,000 admissions. The average quarterly difference-in-differences estimate for unplanned readmissions is 0.003 percentage points, indicating that the innovation-comparison difference is 0.003 percentage points lower during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −12, 12).

Table 20. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission, per 1,000 Inpatient Admissions: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−0.003	14.543	1.000
Overall aggregate	−0.002	7.780	1.000

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Y-USA = YMCA of the USA.

2.6.4 Regression Results (No-Diabetes Subsample Analysis)

The average quarterly difference-in-differences estimates for unplanned readmissions for the subsample, weighted by the number of beneficiaries in the quarter, is 14 percentage points lower during the innovation period for participants compared to nonparticipants. The effect is still not statistically significant (90% CI: −29, 9).

Table 21. Difference-In-Differences Logistic Regression Estimates for Probability that Participant Had Hospital Unplanned Readmission, per 1,000 Inpatient Admissions: Y-USA (Subsample)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−14.186	18.847	0.452
Overall aggregate	−4.511	5.993	0.452

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The logistic regression coefficient is the simple difference-in-differences estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
Y-USA = YMCA of the USA.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results (Using the Full Treatment Sample)

ED visits per 1,000 participants are shown in ***Table 22*** and ***Figure 13.*** Throughout the baseline period, the ED visit rate is similar in the treatment and comparison groups. In the first four innovation periods, the ED visit rate is higher in the comparison group than in the treatment group.

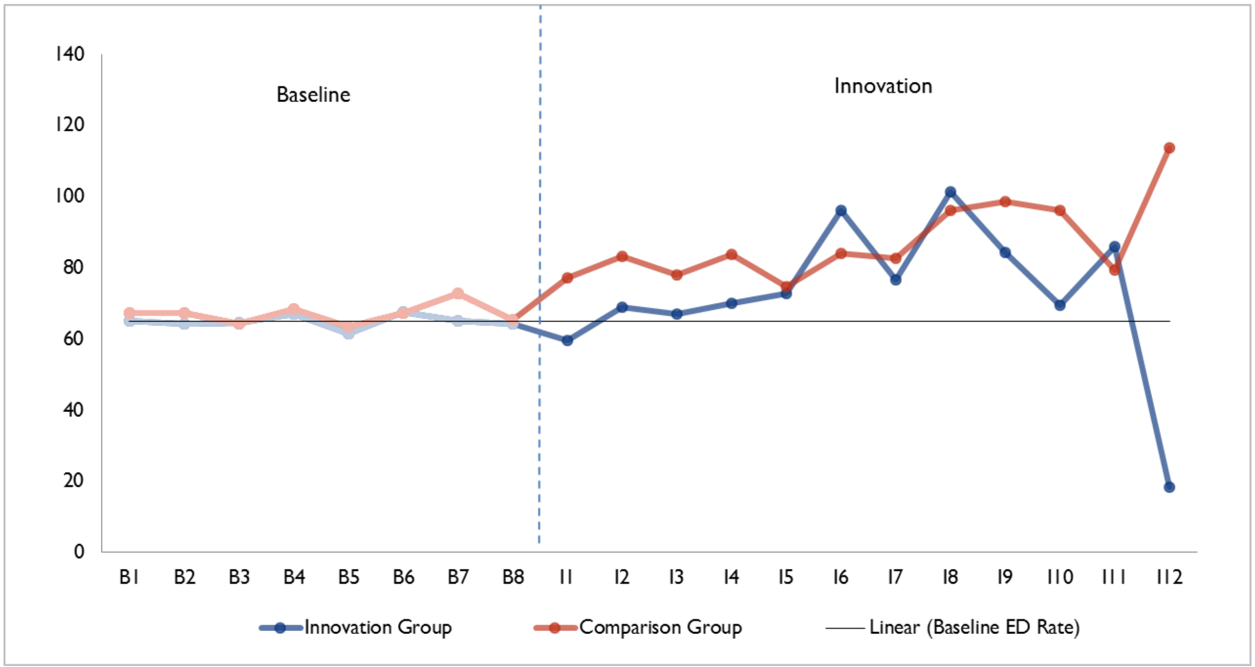
Table 22. ED Visits per 1,000 Participants: Y-USA (Full Sample)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I6	I7	I8	I9	I10	I11	I12	I6
Innovation Group																				
ED rate	65	64	65	67	62	67	65	64	60	69	67	70	73	96	77	101	84	70	86	19
Std dev	292	312	279	294	284	306	287	312	279	301	275	302	291	344	301	381	392	359	308	136
Unique patients	2,653	2,750	2,836	2,924	3,040	3,141	3,237	3,319	3,319	3,303	3,098	2,537	1,650	1,403	1,107	749	498	345	128	54
Comparison Group																				
ED rate	67	67	64	68	64	67	73	65	77	83	78	84	75	84	83	96	99	96	79	114
Std dev	177	185	170	174	167	172	183	174	198	197	196	215	182	201	199	220	227	220	183	214
Weighted patients	2,693	2,796	2,888	2,993	3,088	3,184	3,274	3,319	3,319	3,303	3,084	2,518	1,647	1,396	1,109	749	500	350	124	56
Innovation – Comparison Rate																				
	−2	−3	0	−1	−2	0	−8	−1	−18	−14	−11	−14	−2	12	−6	5	−14	−27	7	−95

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 13. ED Visits per 1,000 Participants: Y-USA (Full Sample)



Source: RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
ED = emergency department; Y-USA = YMCA of the USA.

2.7.2 Descriptive Results (No-Diabetes Subsample Analysis)

ED visits per 1,000 participants for individuals without diabetes are shown in ***Table 23*** and ***Figure 14.*** Throughout the baseline and innovation periods, the ED visit rate varies among the treatment and comparison groups. The biggest differences occur in innovation quarter 9 where the ED rate is higher among the innovation group and in innovation quarter 6 where the ED rate is higher among the comparison group.

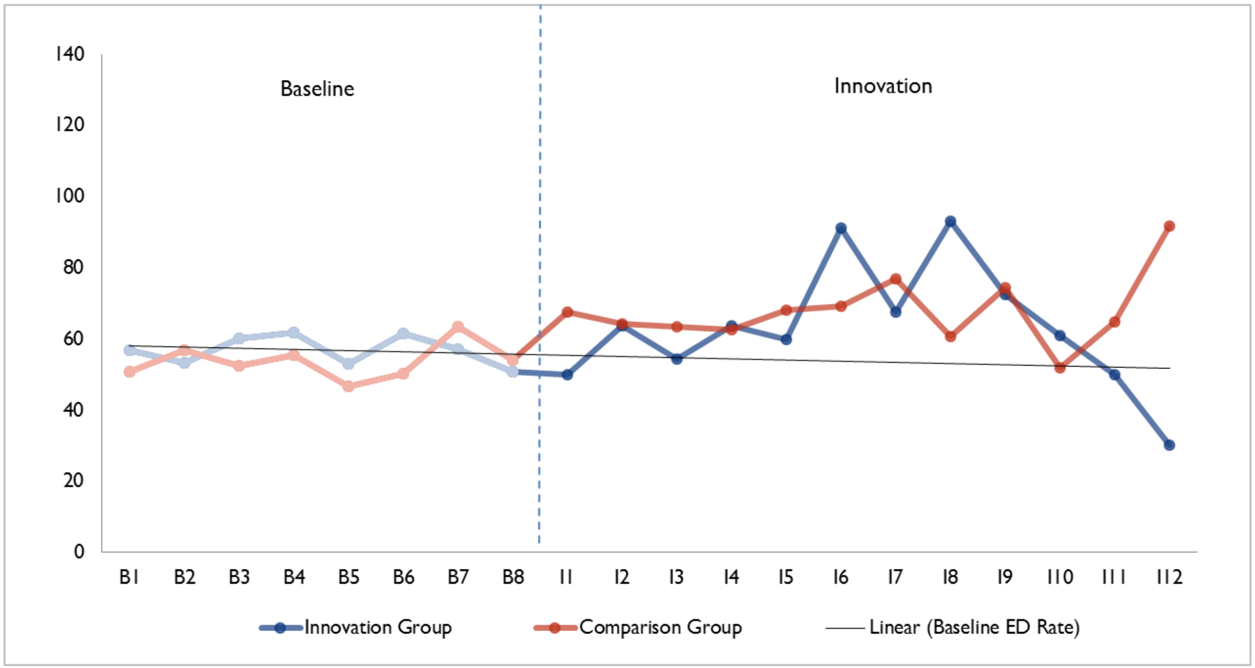
Table 23. ED Visits per 1,000 Participants: Y-USA (No-Diabetes Subsample Analysis)

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

	Baseline Quarters								Innovation Quarters											
Description	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I6	I7	I8	I9	I10	I11	I12	I6
Innovation Group																				
ED rate	57	53	60	62	53	62	57	51	50	64	54	64	60	91	68	93	73	61	50	30
Std dev	270	250	275	292	243	270	273	235	244	290	245	298	263	335	283	396	415	365	271	174
Unique patients	1,761	1,835	1,895	1,971	2,058	2,142	2,224	2,302	2,302	2,290	2,135	1,727	1,070	898	696	472	289	213	80	33
Comparison Group																				
ED rate	51	57	52	55	47	50	63	54	68	64	63	63	68	69	77	61	75	52	65	92
Std dev	149	149	150	153	134	144	167	161	185	170	168	163	167	177	192	165	197	143	162	187
Weighted patients	1,822	1,883	1,957	2,034	2,104	2,176	2,254	2,302	2,302	2,296	2,134	1,723	1,073	897	701	477	295	218	77	33
Innovation – Comparison Rate																				
	6	−3	8	6	6	11	−6	−3	−18	0	−9	1	−8	22	−10	32	−2	9	−15	−62

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
ED rate: (Total quarterized ED visits and observation stays /number of unique or weighted patients)*1,000.
Innovation – comparison group is calculated by subtracting the comparison group rate from the innovation group rate in each quarter. Innovation – comparison rate may not add up exactly due to rounding.
B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 14. ED Visits per 1,000 Participants: Y-USA (No-Diabetes Subsample Analysis)



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
ED = emergency department; Y-USA = YMCA of the USA.

2.7.3 Regression Results (Using the Full Treatment Sample)

Table 24 presents results of a negative binomial count model with the dependent variable set to the number of ED visits for each individual during the quarter. We estimated the equations using data on individual patients. To interpret these results in a standardized form, we multiplied the coefficients and standard errors by 1,000, so that the adjusted estimates show ED visits per 1,000 participants. Participants in the innovation had on average 9 fewer ED visits per 1,000 than the comparison group. This effect is statistically significant (90% CI: 6, 12).

Table 24. Difference-In-Differences Negative Binomial Count Model Estimates for ED Visits, per 1,000 Participants: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
I1	−14	6	0.016
I2	−11	6	0.097
I3	−8	6	0.183
I4	−11	7	0.133
I5	−3	9	0.754
I6	8	11	0.470
I7	−10	11	0.354
I8	2	16	0.877
I9	−25	18	0.171

(continued)

Table 24. Difference-In-Differences Negative Binomial Count Model Estimates for ED Visits, per 1,000 Participants: Y-USA (Full Sample) (continued)

Quarter	Coefficient	Standard Error	P-Values
I10	−32	20	0.105
I11	5	32	0.880
I12	−98	38	0.012
Overall average	−9	3	0.001
Overall aggregate	−168	50	0.001
Overall aggregate (IY1)	−137	40	0.001
Overall aggregate (IY2)	−3	27	0.911
Overall aggregate (IY3)	−28	12	0.022

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.
I = Innovation Quarter; IY = Innovation Year; Y-USA = YMCA of the USA.

2.7.4 Regression Results (No-Diabetes Subsample Analysis)

Table 25 presents results for the subsample of individuals without diabetes. Participants in the innovation had on average 9 fewer ED visits per 1,000 than the comparison group. This effect is statistically significant (90% CI: 4, 14).

Table 25. Difference-In-Differences Negative Binomial Count Model Estimates for ED Visits: Y-USA (Subsample Analysis)

Quarter	Coefficient	Standard Error	P-Values
I1	−21	7	0.003
I2	−3	7	0.646
I3	−14	7	0.054
I4	−4	8	0.667
I5	−14	10	0.176
I6	14	13	0.284
I7	−22	14	0.113
I8	24	18	0.164
I9	−14	21	0.498
I10	0	21	1.000
I11	−39	37	0.292
I12	−21	7	0.003

(continued)

Table 25. Difference-In-Differences Negative Binomial Count Model Estimates for ED Visits: Y-USA (Subsample Analysis) (continued)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−9	3	0.005
Overall aggregate	−106	38	0.005
Overall aggregate (IY1)	−90	31	0.003
Overall aggregate (IY2)	−6	21	0.772
Overall aggregate (IY3)	−10	8	0.251

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Notes: The negative binomial coefficients are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.

The overall average is the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their matched comparison group.

I = Innovation Quarter; IY = Innovation Year; Y-USA = YMCA of the USA.

2.8 Differences in Spending and Utilization by Innovation Dose

Dose is defined as the number of National DPP sessions completed during the program. This section examines whether full completion of the program results in better outcomes for participants than partial compliance. According to the 2015 CDC Diabetes Prevention Recognition Program (DPRP) standards and operation procedures,[2] on average participants should attend at least nine sessions in months 1–6 of the program. We define completers as participants who completed at least nine sessions. To conduct a fair comparison between completers and noncompleters (those with less than nine sessions), we considered only people in the sample for at least 20 weeks, which reduced the sample from 3,336 to 2,735 participants. Completers' participation might be correlated with other patient-specific characteristics that affect the outcomes. For example, healthier individuals may be more likely to complete, and may incur lower costs and have lower utilization rates than less healthy individuals.

Attendance levels are not randomly assigned across participants; individuals make their own attendance choices. Thus, differences in outcomes (medical spending and utilization) between people with different levels of attendance may overstate or understate the true impact of attending a program like the National DPP. The final report will analyze the impact of dose taking into account the endogeneity issue by using an appropriate instrumental variable that explains the differing levels of utilization among individuals that were selected into the National DPP. ***Table 26*** shows summary statistics to illustrate the differences in mean spending per quarter for completers and noncompleters. On average, noncompleters incur overall higher costs than completers, not controlling for other factors; this difference is evident in both the baseline and innovation periods, but the difference may be larger after the innovation begins.

[2] Centers for Disease Control and Prevention Diabetes Prevention Recognition Program, Standards and Operating Procedures. 2015, January. Available from: http://www.cdc.gov/diabetes/prevention/pdf/dprp-standards.pdf

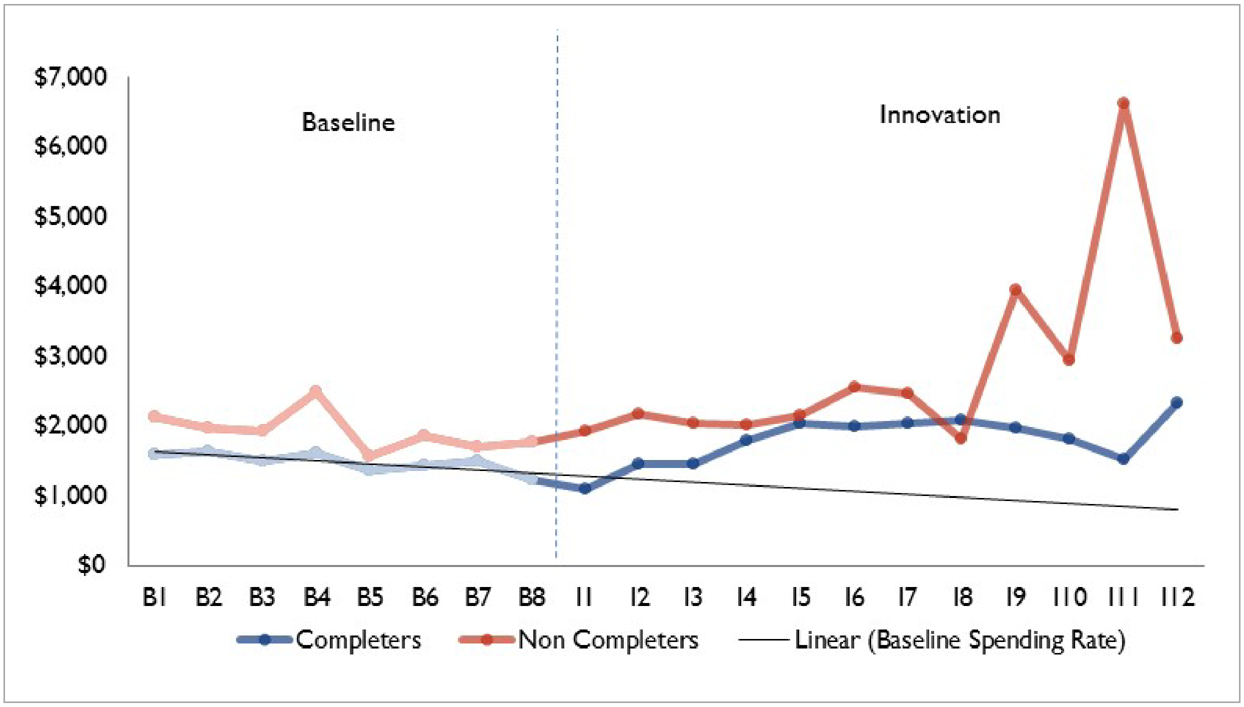
Table 26. Medicare Spending per Patient for Completers and Noncompleters: Y-USA

Awardee Number: 1C1CMS330965
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicare

Description	Baseline Quarters								Innovation Quarters											
	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
Completers																				
Spending rate	$1,596	$1,647	$1,514	$1,608	$1,375	$1,428	$1,516	$1,232	$1,111	$1,461	$1,454	$1,808	$2,055	$2,000	$2,047	$2,100	$1,983	$1,819	$1,535	$2,326
Std dev	$4,750	$4,876	$4,052	$4,864	$3,661	$3,877	$5,731	$3,202	$2,490	$7,259	$4,233	$5,779	$7,707	$5,699	$6,043	$6,932	$5,686	$4,290	$4,396	$5,110
Unique patients	2,142	2,219	2,286	2,361	2,447	2,527	2,610	2,684	2,735	2,734	2,554	2,106	1,404	1,215	954	641	430	298	115	49
Noncompleters																				
Spending rate	$2,131	$1,974	$1,938	$2,491	$1,564	$1,871	$1,711	$1,776	$1,927	$2,168	$2,035	$2,023	$2,153	$2,553	$2,468	$1,813	$3,951	$2,946	$6,616	$3,250
Std dev	$7,151	$7,620	$4,312	$6,985	$3,492	$5,289	$3,731	$4,260	$5,793	$5,543	$5,360	$5,309	$4,558	$5,810	$5,175	$3,712	$11,459	$5,330	$10,262	$6,338
Unique patients	556	575	597	611	639	660	677	694	708	709	680	555	338	270	218	154	97	70	27	8
Savings per Patient																				
	$534	$327	$424	$884	$189	$443	$195	$544	$816	$707	$581	$214	$98	$553	$421	−$287	$1,969	$1,127	$5,081	$923

Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
Notes:
Spending rate: Total quarterized payments/number of unique patients.
Savings per patient: Difference in comparison minus innovation average spending rates. Savings may not add up exactly due to rounding.
B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 15. Medicare Spending per Patient for Completers and Noncompleters: Y-USA



Y-USA = YMCA of the USA.

2.9 Discussion: Medicare Results

Analysis of currently available data for all individuals enrolled in the sample shows that the innovation is associated with statistically significant reductions in Medicare spending, inpatient admissions, and ED visits. The evidence in favor of a reduction in spending is strongest in the first three quarters after enrollment. This may be because maximum weight loss occurs during the first 3 to 6 months in the program and initial weight loss predicts longer-term weight maintenance.[3,4,5,6] Cost savings may also occur initially due to a reduction in outpatient spending and/or an increase in participants' physical activity. On average, noncompleters incur overall higher costs than completers, not controlling for other factors; this difference is evident in both the baseline and innovation periods, but the difference may be larger after the innovation begins.

[3] Ali, M.K., Echouffo-Tcheugui, J.B., and Williamson, D.F.: How effective were lifestyle interventions in real-world settings that were modeled on the Diabetes Prevention Program? Health Aff. 31(1):67-75, 2012.
[4] Jeffery, R.W., and Wing, R.R.: Frequency of therapist contact in the treatment of obesity. Behavior Ther. 10(2):186–92, 1979.
[5] Family Heart Study Group: Randomised controlled trial evaluating cardiovascular screening and intervention in general practice: Principal results of British Family Heart Study. BMJ. 308(6924):313–20, 1994.
[6] Jeffery, R.W., Wing, R.R., and Mayer, R.R.: Are smaller weight losses or more achievable weight loss goals better in the long term for obese patients? J Consult Clin Psychol. 66(4):641–5, 1998.

The significant average quarterly reduction in spending for the full sample ($278) is lower than the average quarterly savings we reported in the 2015 annual report ($455), but is still statistically significant. The reduction is due to three factors. First, the new estimate includes more observations in later quarters when smaller reductions in spending occurred. For example, this report includes 3 years of innovation data, whereas the 2015 report included 2 years of data; the average reduction in spending was only $126 per quarter in the added third year. This additional year pulled down the average for all innovation quarters. Second, the additional enrollments included in the data for this report may have had smaller estimated savings than those persons included in the 2015 annual report. The estimated reductions in spending for the first two innovation quarters are similar in the two reports ($521 vs $411 in I1 and $406 vs. $495 in I2 in this report and the 2015 report, respectively), but the estimated reductions are smaller in the next three innovation quarters ($370 vs. $636 in I3, $98 vs. $517 in I4, and $37 vs. $591 in I5). Third, the geographical area used to generate a possible comparison group is now larger than in the 2015 annual report, to reflect the background of the most recently enrolled participants. This translates into a bigger pool of comparisons for all beneficiaries.

The 2015 annual report spending estimates were cited in CMS's policy determination that diabetes prevention programs were eligible for coverage as preventive services under Medicare.[7] Because of the policy importance of the spending results, it is worth noting the limitations of our analysis. First, Medicare beneficiaries were not randomly assigned to the innovation and comparison groups. Participants in the innovation group chose to participate in the Y-USA program and were healthier with lower baseline spending and utilization than the average Medicare beneficiary. Participants were also likely to be more motivated to avoid diabetes than nonparticipants. We used PSM to select members of the comparison group with prediabetes. Although PSM selected healthier persons with lower spending, fewer hospitalizations, and fewer ED visits than the average Medicare beneficiary, it could not control for any unobservable differences in motivation. Second, we do not have claims data on the large share of participants enrolled in Medicare managed care programs, and we were unable to match some fee-for-service participant patient identifiers to the claims data. The results presented here are only for fee-for-service Medicare beneficiaries we were able to match with the identifiers provided by the site. These beneficiaries are approximately 40 percent of the overall population reached by the innovation.

2.10 Medicaid

Y-USA does not serve Medicaid beneficiaries (unless the beneficiary is eligible for both Medicare and Medicaid). Therefore, we do not present Medicaid claims analyses.

[7] Department of Health Human Services: Independent experts confirm that diabetes prevention model supported by the Affordable Care Act saves money and improves health. Press release, March 23, 2016. Accessed June 16, 2016; available at http://www.hhs.gov/about/news/2016/03/23/independent-experts-confirm-diabetes-prevention-model-supported-affordable-care-act-saves-money.html#

2.11 Awardee-Specific Measures of Clinical Effectiveness and Health Outcomes

The following sections present awardee-specific, patient-level data on the innovation's impact on clinical effectiveness and the health outcomes to address the following evaluation question.

Evaluation Question

- Has the percentage of obese and overweight patients decreased over time among those enrolled in the innovation?

Y-USA submitted data to RTI that are current through December 2015. ***Table 27*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested and whether the data are presented in this annual report.

Table 27. Awardee-Specific Outcome Measures

Evaluation Domains	Subdomains	Measure	Status
Health outcomes	Diabetes	Blood sugar levels at the onset of the program (HbA1c, fasting glucose, other risk factors)	Data received from Y-USA
	Weight management	Average weight loss for Medicare participants	Data received from Y-USA
		Percentage of patients who are overweight (25<BMI<29.9)	Data received from Y-USA
		Percentage of patients who are obese (BMI>30)	Data received from Y-USA

BMI = body mass index; HbA1c = glycated hemoglobin; Y-USA = YMCA of the USA.

2.12 Diabetes

The National DPP requires a minimum of 50 percent of participants be eligible for the lifestyle intervention on the basis of a blood test, such a hemoglobin A1c (HbA1c), a fasting plasma glucose (FPG), or an oral glucose tolerance test (OGTT), indicating prediabetes or a history of gestational diabetes mellitus (GDM). The remainder (maximum of 50% of participants) must be eligible on the basis of the CDC Prediabetes Screening Test, the American Diabetes Association Type 2 Diabetes Risk Test, or a claims-based risk test. For the HCIA project, however, Y-USA required all participants to complete a blood test: an HbA1c, FPG, or an OGTT indicating prediabetes.

2.12.1 Descriptive Results

As shown in ***Table 28***, on average, blood glucose levels were similar among those attending at least 1 session, those attending at least 4 sessions, and those attending 9 or more sessions. Among participants with a glycated HbA1c test, levels were on average 6 percent for the three groups, which is in the prediabetic range (5.7% to 6.4 %) according to the American Diabetes Association.[8] The results for the other tests used to identify prediabetes indicate that on the FPG test, participants had an average level of 108.7 mg/dL, which is in the prediabetic range (100 mg/dL to 125 mg/dL).[9] For the OGTT, participants attending at least 1 session had an average level of 160.9 mg/dL, and participants attending 4 or more sessions and attending at least 9 sessions had an average level of 159.8 mg/dL, which also falls in the prediabetic range (140 mg/dL to 199 mg/dL).[10] These results are not surprising, because the innovation targets prediabetics and encourages weight loss throughout its duration. We are not able, however, to track these values over time as the National DPP does not require that this information be collected at the conclusion of the program but rather only at the onset of the program to determine program eligibility.

Table 28. Average Blood Glucose Results for Participants through December 2015

Health Outcome	Number of Sessions: 1+ Sessions (Recruited) (Avg (Min, Max)) n=7,832	4+ Sessions (Enrolled) (Avg (Min, Max)) n=6,946	9+ Sessions (Completers) (Avg (Min, Max)) n=6,196
Starting HbA1c	6.0 (5.7, 7.1)	6.0 (5.7, 7.1)	6.0 (5.7, 7.1)
Starting FPG	108.8 (82.0, 165.0)	108.8 (82.0, 165.0)	108.8 (82.0, 165.0)
Starting OGTT	160.9 (140.0, 197.0)	159.8 (140.0, 197.0)	159.8 (140.0, 197.0)

Source: Patient-level data provided to RTI by Y-USA.
FPG = fasting plasma glucose; OGTT = oral glucose tolerance test.

2.13 Weight Loss

2.13.1 Descriptive Results

Table 29 provides data on average starting and ending weight, starting and ending body mass index (BMI), average weight loss for participants through December 2015. As shown in the table, on average, participants who attended at least 1 session in months 1-6 lost 9.3 pounds on average (4.7% of starting weight) at one year whereas participants attending at least four sessions in months 1-6 lost 10.4 pounds on average (5.2% of starting weight), and those attending at least 9 sessions lost 11.3 pounds (5.6% of starting weight) on average at one year. The initial BMI was 32.8 for all participants. The final BMI for those attending at least 1 session was 31.3, compared with 31.1 for those attending at least 4 sessions, and 31.0 for those attending at least 9 sessions.

Table 30 provides the percentages of obese and overweight participants (pre- and post-program) for those attending 1 or more sessions (i.e., recruited), 4 or more sessions (i.e., enrolled), or 9 or more sessions (i.e., completers). For all groups, the percentage of participants who were obese post-

[8] American Diabetes Association: Diagnosing Diabetes and Learning about Prediabetes. 2014, September 22. Available at: http://www.diabetes.org/diabetes-basics/diagnosis.
[9] Ibid.
[10] Ibid.

intervention was less than pre-intervention. For example, for participants attending at least 9 sessions less than half were obese post-intervention (49.5%) compared to the 63.9% pre-intervention. The percentage of participants post-intervention who were overweight increased from pre-intevention levels as expected, given a significant propotion of paticipants lost weight and went from obese to overweight.

Table 29. Weight Management Outcomes for Recruited, Enrolled, and Completer Participants through December 2015

Health Outcome	1+ Sessions (Recruited)) (Avg (Min, Max)) n=7,832	4+ Sessions (Enrolled) (Avg (Min, Max)) n=6,946	9+ Sessions (Completers) (Avg (Min, Max)) n=6,196
Weight Management			
Starting weight (lbs)	200.3 (95.4, 463.0)	200.7 (95.4, 463.0)	200.6 (95.4, 463.0)
Ending weight at 1 year (lbs)	191.0 (93.8, 449.4)	190.2 (93.8, 449.4)	189.3 (93.8, 449.4)
Weight loss at 1 year (lbs)	9.3 (−27.4, 85.4)	10.4 (−27.5, 85.4)	11.3 (−27.5, 85.4)
Starting BMI (kg/m^2)	32.8 (17.8, 72.4)	32.8 (17.8, 67.8)	32.8 (19.3–65.5)
Ending BMI at 1 year (kg/m^2)	31.3 (17.8, 72.4)	31.1 (17.8, 67.0)	31.0 (18.9–62.7)

Source: Patient-level data provided to RTI by Y-USA.
BMI = body mass index.

Table 30. Frequencies of Obese or Overweight Participants Attending At Least 1 Session, 4 Sessions, and 9 Sesions through December 2015

Health Outcome	1+ Sessions (Recruited) Freq (number) n=7,832	4+ Sessions (Enrolled) Freq (number) n=6,946	9+ Sessions (Completers) Freq (number) n=6,196
Obesity and Overweight Intervention			
Obese[1] pre-intervention	63.8% (4998)	65.9% (4575)	63.9% (3959)
Obese[1] post-intervention	51.9% (4062)	52.1% (3623)	49.5% (3066)
Overweight[2] pre-intervention	33.8% (2646)	34.8% (2415)	33.9% (2101)
Overweight[2] post-intervention	38.8% (3040)	40.4% (2809)	40.0% (2476)

Source: Patient-level data provided to RTI by Y-USA.
[1] Obesity: body mass index (BMI) =>30.
[2] Overweight: BMI = 25–29.9.
BMI = body mass index.

2.13.2 Regression Results

To assess the effectiveness of Y-USA's intervention, we examined the percent weight loss among participants by dose of the intervention using OLS regressions. We examined percent weight loss change in two separate regression analyses. The first examined the marginal effect of the number of DPP sessions on percent weight loss and the second examined the differences in percent weight loss between participants who completed nine or more sessions (completers) and those that completed fewer than nine sessions (noncompleters). We controlled for age, sex, race, insurance type, and diabetic condition in each regression.

Table 31 presents the results from both regressions. As shown in the first row of Table 31, the number of DPP sessions attended has a statistically significant marginal effect on percent weight loss. Specifically, the average effect of attending one additional session is a 0.43 percentage point increase in weight loss. The second row in Table 31 shows a statistically significant effect for completers (compared to noncompleters) on percent weight loss. The results show that a participant who attends nine or more sessions will on average experience a 6.24 percentage point increase in weight loss compared to participants attending fewer than nine sessions.

Table 31. Impact of Innovation Dose on Percent Weight Loss

Predictor	Coefficient	Standard Error	P-Value
Number of sessions	0.43	0.03	0.00
Completers: (9+ sessions)	6.24	1.71	0.00

2.14 Discussion: Awardee-Specific Data

Our results highlight the importance of retention on key outcomes such as percent weight loss. The regression results not only indicate the importance of attending each session, but also demonstrate the impact on percent loss is greatest for those participants who complete at least nine sessions. Therefore, if YMCA sites want to achieve recognition through the Centers for Disease Control and Prevention Diabetes Prevention Recognition Program (DPRP), retaining participants for at least nine sessions on average is critical. These results are also important because they that demonstrate percent weight loss, a key National DPP programmatic outcome, can be achieved with an older Medicare-based population.

2.15 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. RTI evaluates these components through Y-USA's *Narrative Progress Reports, Quarterly Awardee Performance Reports,* and qualitative interviews with key staff that provide additional context and detail. The findings presented in the following sections include the Y-USA's reports from Q11 through Q14 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient overall organizational capacity and leadership to implement the innovation effectively?

Table 32 lists the quantifiable measures obtained through awardee reports and secondary data provided to RTI by Y-USA and their status as of December 31, 2015.

Table 32. Measures of Implementation

Evaluation Domains	Subdomains	Measures	Source
Award execution	Year 3 expenditures	Direct and indirect expenditures during Year 3	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of FTE staff in Q14	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q11-Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q11-Q14	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participants recruited (i.e., attended at least one session in months 1-6)	Data received from Y-USA
		Number/percentage of participants who enrolled in the National DPP (i.e., completed at least four sessions in months 1-6)	Data received from Y-USA
	Dose	Number of sessions attended by each participant	Data received from Y-USA

DPP = diabetes prevention program; FTE = full-time equivalent; Q = quarter; Y-USA = YMCA of the USA.

2.16 Qualitative Findings: Workforce Development

The HCIA innovations seek to improve the quality of care of by ensuring that a workforce of sufficient size, capacity, and skill is in place to carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation.

Evaluation Question

- What accomplishments specific to hiring or training staff improved the organization's capacity to implement the innovation effectively?

2.16.1 Hiring and Retention

At the end of Q14 (December 2015), the innovation was staffed with 2.85 full-time equivalent (FTE) staff members, all serving in managerial or administrative roles at the national office in Chicago. This number does not include the lifestyle coaches that led the innovation activities at each YMCA affiliate. Lifestyle coaches were hired and supervised by each YMCA branch's executive director and received ongoing monitoring and assistance from each branch's chronic disease coordinator. Each chronic disease coordinator scheduled classes, ensured lifestyle coaches had all materials they needed, observed classes to ensure they were implemented with high quality and fidelity, and coordinated substitute lifestyle coaches when needed. Between Q11 (March 2015) and Q14, no new hires or separations took place and no staffing changes were made.

During our site visit at the YMCA of Central Ohio (located in Columbus, OH) in Year 1, we learned that this site alone employed 27 lifestyle coaches to implement their program at all 12 branches. The lifestyle coaches were mostly part-time employees who also worked for YMCA Central Ohio in other roles, including reception staff, wellness coaches, and chronic disease coordinators. Sites varied in the number and type of lifestyle coach hired. Though all of the lifestyle coaches had experience with the YMCA before the innovation, interviewees suggested that participating YMCAs sometimes encountered challenges in finding coaches with daytime availability to support the program. Turnover among the lifestyle coaches was an ongoing challenge, and some turnover occurred at the coordinator level, which did not affect enrollment because each site also had a program lead and, thus, had redundancies in their staffing capacity.

2.16.2 Skills, Knowledge, and Training

All lifestyle coaches were required to complete a standardized 16-hour training led by Y-USA-certified master trainers to be able to teach the National DPP curriculum. Coaches also completed one 12-hour group training session to develop facilitation skills. Y-USA further developed a medical community partnerships training to help program managers at the 17 participating local YMCAs to partner with local health care providers and the medical community to better recruit Medicare beneficiaries as well as an executive and manager operational training. Anyone who had contact with participants in the innovation (e.g., coordinators, coaches) must complete the Health Insurance Portability and Accountability Act training. A less traditional training included media training held in June 2014 to build local YMCA capacity in obtaining earned media as a strategy to advertise local DPP programs to their target population. A senior public relations manager at Y-USA and an outside public relations agency led the training and sought to provide YMCA staff with the skills needed to "*communicate key messages related to the YMCA's DPP and the Center for Medicare & Medicaid Innovation (CMMI) project across all media platforms and in various situations*."

Since the 2014 annual report, no additional changes were made to training efforts and routine trainings were held through Q12. Since enrollment ended in July 2015, no additional trainings were provided to staff in Q13 and Q14. By the end of Q14 (December 2015), Y-USA provided a cumulative total of 39,148 hours of training to 4,382 administrative and community-based nonclinical personnel, including local YMCA personnel and lifestyle coaches (see ***Table 33***).

Table 33. Training Provided to Staff

Time Frame	Number of Training Hours	Number of Trainees
Q11–Q14	7,472	1,390
Since inception	39,148	4,382

Note: Trainees are counted more than once if they participated in more than one HCIA training course.
Q = quarter.

2.17 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. RTI examines three contextual factors—award execution, leadership, and organizational capacity—in this annual report to address the following evaluation questions.

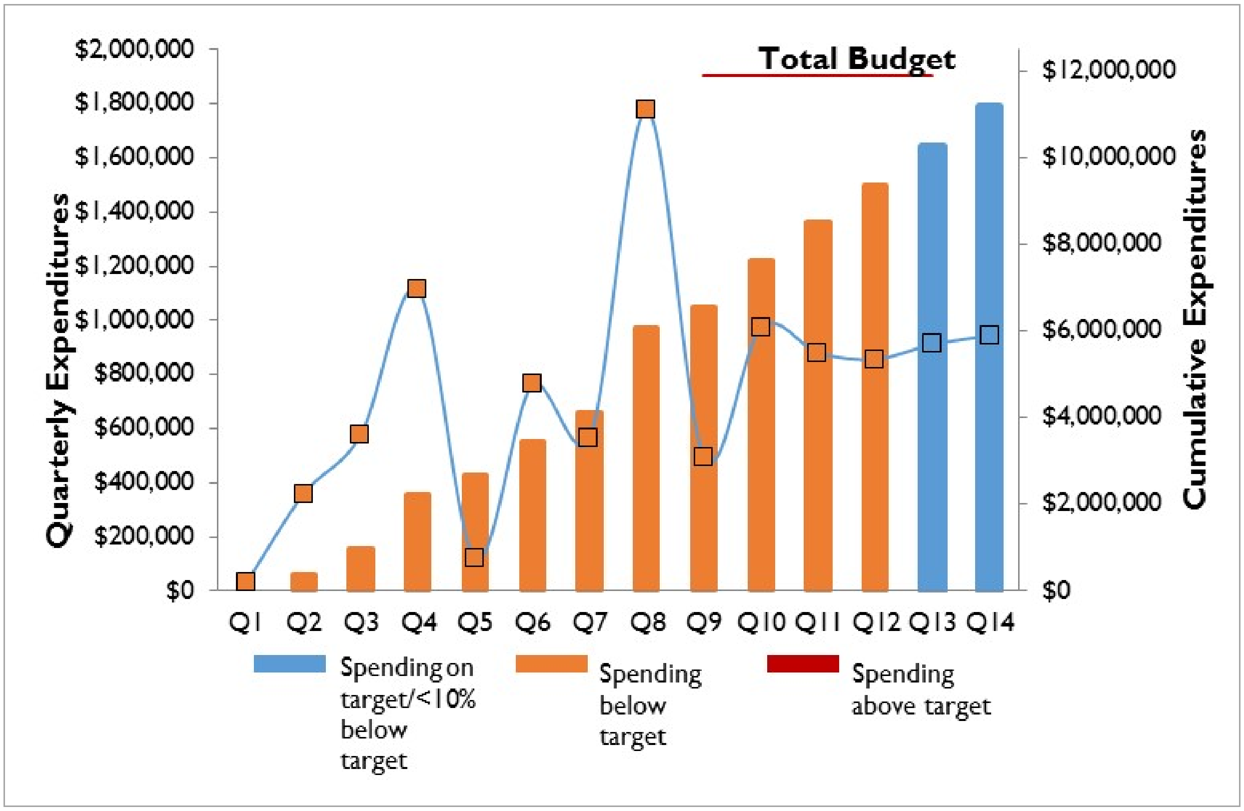
Evaluation Questions

- What is the overall execution of the innovation award in terms of the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation effectively?

2.17.1 Award Execution

The annual report highlights the significance of Y-USA's expenditure rates on implementation. As of December 2015 (Q14), Y-USA spent 94.2 percent of its cumulative budget, which was at projection (see ***Figure 16***). The spend rate was unusually high in Q14 because a large number of payments had to be made to cover participants who enrolled in the program by the July 31, 2015 deadline. These participants achieved their specific session attendance milestones in August and September; therefore, payments were due for them in October 2015. Y-USA had lower than expected spending rates until Q14, which reflected the initial enrollment challenges and timing of participant reimbursement for the National DPP through its partner, the Diabetes Prevention and Control Alliance (DPCA).

Figure 16. Cumulative Spend Rate from Q1 (June 1, 2012) to Q14 (December 30, 2015)



2.17.2 Leadership

During the site visit in June 2015, RTI learned that the innovation is a high priority for the Y-USA leadership and the organization. Y-USA designated the National DPP as the first "signature program" in Y-USA's Healthy Living initiative, which includes other programs such as fall prevention and cancer support groups. This designation from Y-USA leadership translated into a significant investment of resources in the program and a high level of accountability for the 17 YMCAs that participated. The champion and recognized leader for the innovation reports directly to the Vice President of Health Strategy and Innovation who reports to the chief executive officer (CEO) which further strengthens the involvement of Y-USA leadership. When the YMCAs initially struggled with recruitment, Y-USA leadership worked with CMMI to get approval to expand eligibility to include Medicare Advantage beneficiaries, which greatly aided enrollment. To respond to the recruitment challenge, the Y-USA CEO met with the local CEOs of the 17 innovation sites (independently governed YMCAs) to communicate the strategic focus of the innovation project. Leadership also set aside resources to fund and empower the 17 YMCA sites to adjust how they recruited participants when their traditional recruitment strategies did not work. These projects included a direct mail campaign, new physician engagement efforts, promotion of screenings with pharmacy partners, and various marketing strategies and events.

During the key informant interviews, respondents reiterated that this project remains a high priority for Y-USA, and the accountability for its success is shared throughout all levels of leadership. The session), but because enrollment is defined as attending at least four sessions, Y-USA's final reach will be unknown until RTI analyzes data through the end of the innovation, Q16.

Additional factors that facilitated reach were numerous internal and external efforts to increase enrollment, as discussed in detail in Section 2.17.4.

2.18.2 Innovation Dose

Participants received varying doses of the program, depending on the number of sessions attended. The recommended National DPP dose from CDC is 22 one-hour sessions (16 weekly sessions in the first 6 months plus 6 monthly maintenance sessions for months 7–12). Dose for this analysis is defined as attending between 1 and 3 sessions, attending at least 4 but fewer than 9 sessions, attending at least 9 of the 16 sessions, and attending at least 1 maintenance session (at least 17 sessions in total). ***Table 34*** provides the number of sessions participants attended.

As shown in the table, 36.7 percent of recruited participants attended 9 to 16 sessions as of December 2015, whereas almost 10 percent (9.6%) attended 4 to 8 sessions and 42.4 percent attended 17 or more sessions. Less than 15 percent (11.3%) attended only 1 to 3 sessions. Programs that engage participants on average for at least 9 sessions in months 1–6 meet the DPRP standard, as discussed earlier. These data show that Y-USA effectively kept participants engaged with the innovation. Because this innovation uses rolling enrollment, tracking those individuals who participated in fewer than 9 sessions will be helpful to determine if they attend more than 9 sessions by the end of the innovation.

Table 34. Number and Types of Services Provided to Participants

Number of Sessions	Number of Participants	Percentage of Total Recruited Participants (n=7,832)
1–3 sessions	885	11.3
4–8 sessions	748	9.6
9–16 sessions	2,876	36.7
17+ sessions	3,323	42.4
Total	7,832	100.0

[1] Recruited participants include those who have attended at least one session.

One interview respondent reported that having access to the group process and collective learning that occurs through the innovation kept many participants enrolled and engaged. This may help to explain why the majority of those enrolled in the innovation attended nine or more sessions. The respondents also reported that participants wanted the group to continue to meet without their lifestyle coaches after the innovation ends.

HCIA project focus and outcomes are reported up to the national board, as it is tied to all of the leadership performance goals (CEO, chief operating officer, president, and technical advisor). The project director is involved in all aspects of communication, and leads calls with the project officer and partner organizations.

2.17.3 Organizational Capacity

Y-USA had experience with implementing the evidence-based National DPP with 75 YMCAs before the HCIA program was launched. However, many aspects of the innovation, including targeting older adults to enroll in the program, understanding different Medicare plans, and working with health care providers to recruit program participants, were new to Y-USA and most participating YMCAs. YMCAs typically conduct outreach and deliver programs targeted to children and working adults, and only one of the 17 innovation sites had specifically targeted and enrolled older adults into a similar program before the HCIA innovation. YMCA staff were also not accustomed to screening participants' Medicare plans to determine program eligibility. YMCA of Delaware already had established relationships with local health care providers, which facilitated their ability to recruit higher numbers of Medicare participants. Other YMCAs also established relationships with local health care providers, community organizations, and local public health agencies to increase their enrollment. Y-USA continues to build organizational capacity to recruit and provide services to the Medicare population.

Furthermore, the organizational capacity of Y-USA depends largely on its partnerships and ability to leverage various resources. During the key informant interviews, Y-USA reported the need for additional support and resources to increase capacity. Gaining buy-in from all partners, which includes organizations like the American Medical Association (AMA), American Diabetes Association (ADA) and the American Heart Association (AHA), was not easy; although they all agreed to support the program, it took time to build shared communication strategies and determine the best way to share information with the ADA and AMA's local affiliates. Some partners could require involvement of local affiliates, while others could not and were limited to only national-level communication strategies. These efforts to engage the partners and their affiliates led to supplementary blood pressure monitoring projects with the AMA and AHA. The strategy of building these partnerships began with building trust and then demonstrating the value of the project through local affiliate testimony. This work helped to motivate additional changes and build buy-in.

Y-USA helped the local YMCA affiliates develop their capacity by linking them to ADA and AMA local affiliates in their respective communities. The initial plan to partner with physician champions was not sufficient to meet the recruitment demands and volume required of the HCIA innovation. One respondent reported that, "*we needed to partner with health system[s] to get more impact, which is a slow growing process."* Each health care system added a layer of complexity because of the need to navigate numerous medical records systems and different processes required to reach and recruit patients. Some health care systems identified participants and asked that YMCA staff contact patients directly; however, local YMCA staff did not have this capacity. One respondent reported that while the AMA was a facilitator in bridging the clinic-to-community gap, some challenges remain in getting health systems engaged.

2.17.4 Innovation Adoption and Workflow Integration

As already discussed, the HCIA innovation was adopted at the national level and was already somewhat integrated into the workflow of the local YMCA implementation sites prior to the award, but with a different population. For HCIA, the YMCAs expanded the intervention to recruit and enroll prediabetic Medicare beneficiaries. At the national level the innovation was adopted into the Y-USA strategic plan as a high priority in its Healthy Living initiative. Local YMCAs varied in their approach to recruiting participants. Some sites might receive referrals through local medical providers or through member outreach. To help move participants from recruitment to participation, however, staff developed a short orientation so individuals referred to the program by their providers could review the curriculum, understand what it offered to them, and get answers to their questions.

Throughout the implementation period Y-USA identified recruitment as a challenge, and at the national and local levels effective internal and external recruitment strategies were developed to assist local YMCAs in increasing their reach and enrolment. Internal recruitment strategies included:

1. Increasing awareness about the National DPP by educating branch staff;
2. Holding in-person meetings such as lunch-n-learns;
3. Marketing the value of the program to current YMCA senior members and Silver Sneakers (a national fitness program geared to older adults) members by visiting senior-focused classes and programs;
4. Using “Refer-a-friend” campaign with built-in incentives for Y community members.

External recruitment strategies focused on engaging health systems and providers, partnering with local affiliates of national collaborating organizations, and community-wide efforts. In Q11 (March 2015), Y-USA reported that among the most significant improvements during the HCIA innovation was that *“we became more effective in our marketing and enrollment procedures for older adults and built stronger referral processes with primary care providers.”* External strategies included:

1. In-services and lunch-n-learns designed to increase awareness of the program among providers and health systems. Standardized referral letters and secure eFax and electronic health record point-of-care referrals sent to patients who qualified proved to be successful recruitment methods.
2. Partnerships between local YMCAs and local senior centers, offering screening events and classes onsite, and marketed the program specifically to existing groups such as walking groups within the senior centers.
3. Community-wide recruitment strategies: collaborating with local public health stakeholders to promote increased awareness of prediabetes; offering screening events; and using local media, such as radio and newspaper, and social media to raise awareness of the program.

In addition to developing strategies for increasing recruitment, Y-USA identified approaches for understanding the participants' motivation to enroll and to remain involved with the multisession innovation. One interview respondent indicated that while the YMCA started with engagement strategies that successfully recruited a working-age population, these strategies were not as effective in recruiting and engaging the older population targeted by the HCIA project. YMCA staff learned that they had to build on the connection between Medicare patients and their physicians by engaging physicians in referrals, and then ensuring that providers had the right information to share with their patients about prediabetes and the importance of addressing it. This respondent further reported that ensuring doctors were actively involved in, and aware of, the innovation added a step to the recruitment process. Staff developed a short orientation so individuals referred to the program by their providers could review the curriculum, understand what it offered to them, and get answers to their questions.

CDC also published new DPRP standards in January 2015, thus requiring Y-USA to convert their self-monitoring measurement plans and entire system to collect data for these new standards by January 2016. This effort illustrates their dedication to this program and they plan to continue measuring program outcomes after the grant.

2.18 Implementation Effectiveness

A major focus is to assess the effectiveness of the implementation effort because the evaluation cannot make conclusive assessments about the innovation's impact without first determining if the innovation was implemented with sufficient rigor to effect a change in outcomes. Effectiveness is measured as the extent to which: (1) the innovation reached the number of targeted patients or participants (reach) and (2) patients or participants were exposed to the services provided (dose). To better understand the role of implementation effectiveness, the evaluation addresses the following question.

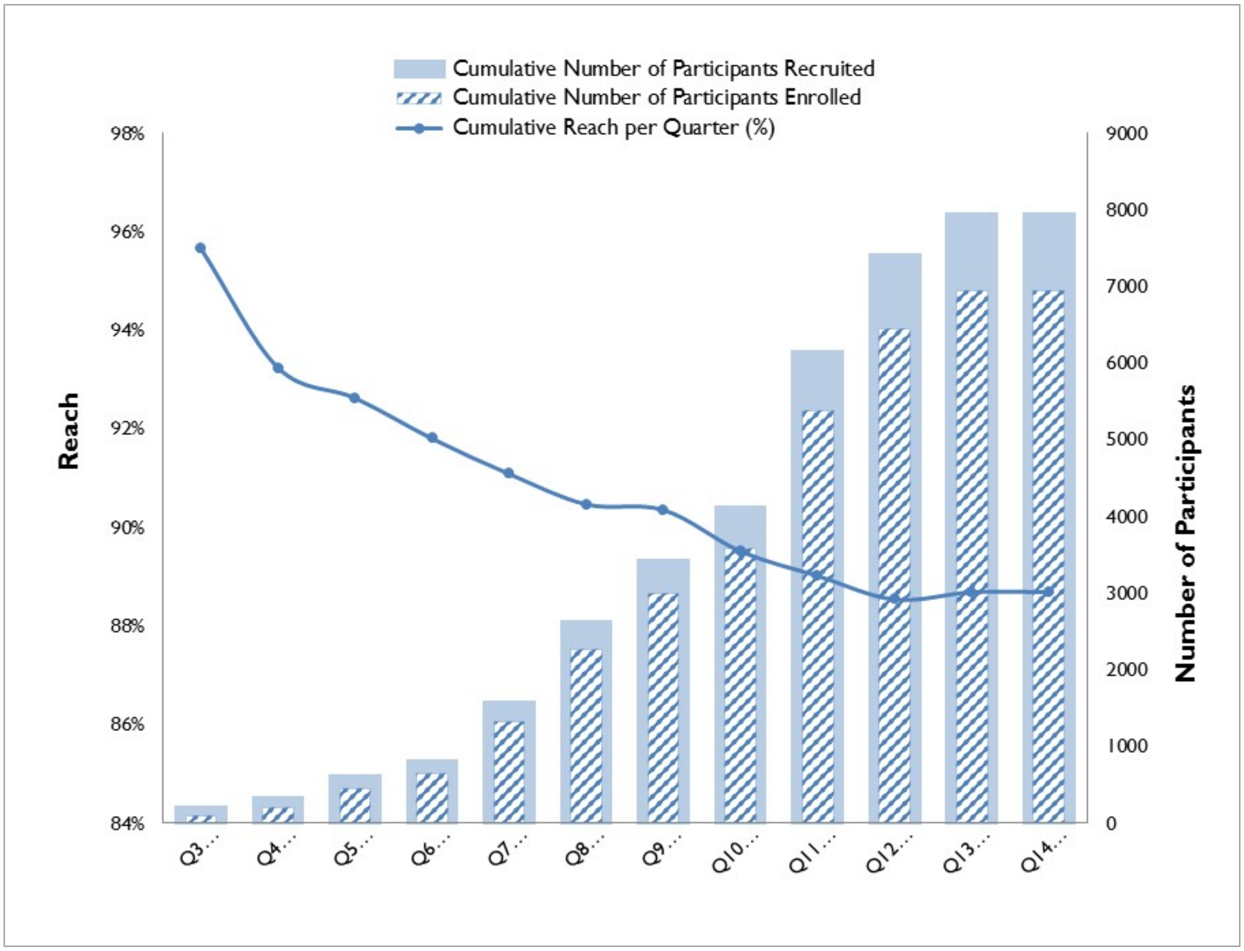
Evaluation Question

- What is the implementation effectiveness, including reach, and dose of the innovation thus far?

2.18.1 Innovation Reach

Figure 17 shows reach by quarter since the launch of the innovation. Reach is calculated as the number of participants who enrolled (i.e., attended at least four National DPP sessions) as a percentage of the number of participants recruited (i.e., attended at least one National DPP session). Since the 2015 annual report, Y-USA enrolled an additional 1,250 people, increasing enrollment from 5,696 to 6,946. Y-USA stopped enrollment in July 2015. Overall reach varies slightly from what was reported in the 2015 annual report, because Y-USA provided additional data for participants in previously reported quarters (i.e., Q1–Q11). Reach dropped slightly over time, ranging from 95.7 percent in Q3 to 88.7 percent in Q14. The overall decline in calculated reach may reflect the increased efforts to enroll anyone who qualifies and may benefit from the innovation (i.e., a larger denominator).

Figure 17. Participant Enrollment and Reach for Each Quarter since Project Launch



Quarter	Q3 (Jan–Mar 2013)	Q4 (Apr–Jun 2013)	Q5 (Jul–Sep 2013)	Q6 (Oct–Dec 2013)	Q7 (Jan–Mar 2014)	Q8 (Apr–Jun 2014)	Q9 (Jul–Sep 2014)	Q10 (Oct–Dec 2014)	Q11 (Jan–Mar 2015)	Q12 (Apr–Jun 2015)	Q13 (Jul–Sep 2015)	Q14 (Oct–Dec 2015)
Cumulative reach per quarter (%)	95.7	93.2	92.6	91.8	91.2	90.5	90.4	89.5	89.0	88.5	88.7	88.7
Cumulative number of participants recruited	92	207	488	695	1458	2507	3307	3996	6035	7285	7832	7832
Cumulative number of participants enrolled	88	193	452	638	1328	2268	2988	3577	5372	6450	6946	6946

Source: Patient-level data provided to RTI by Y-USA.
1 Participants recruited attended at least one National DPP session.
2 Participants enrolled completed at least four National DPP sessions.

Y-USA focused much of its efforts in the final quarters of implementation on a recruitment surge. Of the 17 YMCA associations, 16 submitted applications to Y-USA for funding to continue enrollment until in July 2015. Y-USA reported that focus on recruitment helped 6 of the 16 YMCAs meet their aggressive enrollment goals and another 4 YMCAs came within 15 percent of meeting their goal by the end of the recruitment period. This recruitment push successfully identified new participants (i.e., attended at least 1

2.19 Qualitative Findings: Sustainability

The National DPP innovation is a longstanding priority for Y-USA, which demonstrated a clear commitment to sustaining the innovation after the award ends, with a continued focus on the Medicare population. Y-USA developed a sustainability plan that will guide future scaling and dissemination activities through 2017. This focus on sustainability includes developing a community profile for the 17 markets it serves, to document information on the key partners engaged (including health care partners) and recruitment activities used. Y-USA hopes that this information will facilitate the work of other YMCA affiliates who want to implement the National DPP in their community stating, *"We will be 'digging in' to the data specific to our 17 markets. There will be an incredible learning opportunity to explore variations in program performance, community to clinic linkages, and cost savings at the local level*". Y-USA plans to add guidance to existing program materials about engaging a more senior population. In addition, CMS's policy determination that diabetes prevention programs were eligible for coverage as preventive services under Medicare will aid in sustainability efforts. The Y-USA also leveraged its experience with the HCIA effort to obtain funding from the John A. Hartford Association, which is interested in Medicaid and diabetes prevention, and is exploring the potential to communicate lessons learned for specific topics like electronic medical records (EMR) integration.

To address the priority of providing patients free or inexpensive access to prediabetes resources like the National DPP, the Y-USA applied for a CPT code for reimbursement for participation in the National DPP innovation and for sustaining the innovation. The CPT code would make the program more financially viable by eliminating out-of-pocket expenses for participation and sustainable for Y-USA as they would be able to recruit more participants. Y-USA reported that the AMA approved and published the new CPT in July 2015. In addition, the Guide to Community Preventive Services and the United States Preventive Task Force found that sufficient evidence to recommend the National DPP intervention as a routine, reimbursable preventive service.

Y-USA reported that concern for sustainability of the National DPP intervention came mainly from health care providers *"who have become aware of the value of the intervention to their patients, and who had begun to integrate program referrals into their clinical pathways*." Providers feel that if their patients will have significant out-of-pocket costs, they will no longer be able to refer them to the program, and Y-USA affirms that:

> ***"While this type of story was always anticipated to be the by-product of the end of a successful demonstration project, it is very difficult for all parties involved to see such a proven opportunity for better health, better quality preventive care, and for cost savings to evaporate just after it became viable in these communities."***

2.20 Overall Program Effectiveness to Date

This annual report described various implementation challenges and issues facing the Y-USA as well as accomplishments to date. In this section we assess Y-USA's progress on achieving HCIA goals to date:

- **Smarter spending.** The innovation is associated with a statistically significant reduction in Medicare spending for the initial three innovation quarters. The innovation does not have statistically significant effects on spending in later periods. However, over 3 years, the average quarterly reduction in spending per person is statistically significant and equal to $278 per person per quarter in the full sample and $303 for the subset of innovation group beneficiaries who were never diagnosed with diabetes. This may be because maximum weight loss often occurs in the first 3 to 6 months of the program. Also, participants may specifically be reducing outpatient visits (and thus spending) during this period as they are receiving weekly lifestyle coaching sessions.

- **Better care.** Innovation participants were significantly less likely to be hospitalized or have an ED visit during the innovation period. The innovation does not have an impact on readmissions, as this outcome is relatively rare in this population. These reductions are highest in the first year of the innovation.

  As of Q14, reach is 88.7 percent, a decrease of 0.3 percentage points from 89.0 percent in Q11, with a total of 6,946 participants enrolled in the innovation through Q14. In addition, Y-USA appears to be keeping participants engaged with the innovation; for example, over forty percent of participants attended at least 1 maintenance session (at least 17 sessions) (42.4%) and over one-third (36.7%) attended between 9 and 16 DPP sessions. Dose will change because enrollment of new participants ended and those recruited have an opportunity to engage in more sessions.

- **Healthier people.** The innovation is associated with participants' weight loss. Each additional DPP session attended was associated with an increase of 0.42 percent weight loss. In addition, those who attended at least nine sessions achieved significantly more weight loss (6.24%) than those who attended fewer than nine sessions. The Y-USA also stated its goal was to reduce the risks for diabetes, hypertension, and hypercholesterolemia for at least 50 percent of the 10,000 expected Medicare participants. We are unable to assess this goal, however, as glucose assessments were only completed prior to enrollment to determine program eligibility and no clinical data were collected to assess reductions in hypertension and/or hypercholesterolemia.

Y-USA successfully built on the preexisting evidence-based National DPP and expanded its capacity and knowledge of how to engage individuals older than 65 years in an innovation designed to address prediabetes. Although the preexisting National DPP provided some organizational infrastructure for the innovation, the most significant challenges were identifying the most efficient, effective ways to recruit a senior population. Staff reported one of their greatest achievements was becoming effective in the marketing and enrollment procedures for older adults, which was partly achieved through strong referral processes with primary care providers. As of December 2015, Y-USA recruited over 8,000 Medicare beneficiaries (i.e., participants that attended at least one session). The Y-USA also reports by increasing the number of participants in the program, they lowered the costs of delivery the intervention at the local level (i.e., achieved economies of scale), although we are not able to independently verify this assertion.

To help move participants from recruitment to participation, staff developed a short orientation so individuals referred to the program by their providers could review the curriculum, understand what it offered to them, and get answers to their questions. Examination of the program data indicates that the YMCA was very successful in getting participants to complete at least nine DPP classes (79.1% of participants attended nine or more classes), meeting or exceeding CDC's recommendation for program participation in the first 6 months.

Y-USA maintains a strong organizational commitment to the National DPP innovation and meeting the needs of a senior, Medicare-enrolled population. With a sustainability plan in place that will lead Y-USA through 2017, Y-USA is developing community profiles to serve as a new resource for local affiliates looking to implement the DPP in their communities. Y-USA also plans to update its existing DPP resources and tools with information and lessons learned for local YMCAs to successfully implement the DPP with individuals 65 years of age and older.

A multicomponent program like the National DPP requires financial resources and staffing to ensure that the innovation maintains programmatic fidelity. Y-USA received a 12-month extension of funding from CMS, and also secured additional funding from the John A. Hartford Association. Y-USA successfully obtained a CPT code that allows providers to bill for reimbursement for participation in the DPP innovation, which would sustain the innovation while minimizing or reducing the financial burden on participants. In addition, the policy determination that DPPs are eligible for coverage as a preventive services under the Medicare benefit will certainly add to the sustainability of the National DPP for the Y-USA sites.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring

YMCA of the USA (Y-USA)

The YMCA of the USA (Y-USA), a nonprofit community-based organization headquartered in Chicago, received an award of $11,885,134 to expand a prevention program for prediabetic Medicare beneficiaries in 17 participating YMCAs across the nation. Y-USA began enrolling participants on February 15, 2013, and stopped enrolling on July 31, 2015.

Awardee Overview

Innovation dose:	36.7% of participants completed between 9 and 16 sessions, 42.4% completed 17 or more sessions, and 20.9% completed fewer than 9 sessions.	***Innovation reach:***	6,946 cumulative total participants enrolled (attended at least 4 sessions) and 7,832 were recruited (attended at least 1 session); overall 88.7 % of recruited participants enrolled in the program.
Components:	Hired and trained lifestyle coaches to conduct diabetes prevention trainings for eligible participants.	***Participant demographics:***	Majority (77.7%) of participants were 65 to 74 years of age; 70.0% were female and 100% were covered by either Medicare fee for service or Medicare Advantage.
Sustainability:	New Current Procedural Terminology (CPT) code in July 2015 allows providers to submit for reimbursement of the National Diabetes Prevention Program (DPP) and helps eliminate out-of-pocket expense for participants. The Community Guide and U.S. Preventive Task Force found sufficient evidence to recommend the National DPP intervention as a routine, reimbursable preventive service, which will encourage reimbursement of the National DPP.		
Innovation type:	Coordination of care		Health care workforce

Key Findings

Smarter spending. Over 3 years, the average quarterly reduction in spending per person was statistically significant and equal to $278 (90% CI: −$396, −$159) per person per quarter in the full sample and $303 (90% CI: −$430, −$176) for the subset of innovation group beneficiaries who were never diagnosed with diabetes. Savings were highest in the first year, and equal to $364 (90% CI: −$488, −$241) per participant per quarter. This may be because maximum weight loss often occurs in the first 3 to 6 months of the program.

Better care. Total decreases in inpatient stays and ED visits were also statistically significant over the entire innovation period and amounted to 9 (90% CI: −12, −6) fewer inpatient stays and 9 (90% CI: −14, −5) fewer ED visits per 1,000 participants per quarter. The impact on inpatient stays and ED visits was also highest in the first year (12 and 11 fewer inpatient and ED visits in the innovation sample per 1,000 participants per quarter, respectively). The innovation did not show a statistically significant effect on readmissions (0; 90% CI: −24, 24).

Healthier people. Each additional DPP session attended was associated with an increase of 0.42 percentage points of weight loss. In addition, those who completed at least nine sessions achieved significantly more weight loss (6.24%) than those who attended fewer than nine sessions.

Section 3 Cross-Awardee Findings

3.1 Introduction

This chapter focuses on the HCIA awardees' experiences in implementing their innovations and their progress toward achieving smarter spending, better care, and healthier populations. The cross-awardee findings presented here draw upon quantitative, qualitative, and mixed-method analyses across the 24 HCIA Community Resource awardees. The main sources for these analyses are claims and performance reporting data obtained through December 2015, awardee secondary data, and key informant data obtained through March 2016.

Section 3 is organized as follows: ***Section 3.2*** presents an overview of cross-awardee spending and utilization results from the claims analyses. ***Section 3.3*** presents descriptive results for diabetes and hypertension outcomes. ***Section 3.4*** discusses the context of implementation and more specifically the influence of leadership and organizational capacity. ***Section 3.5*** examines the progress achieved in workforce development and efforts to integrate new work roles and engage providers. ***Section 3.6*** looks at the extent to which awardees reached their intended populations and the quality of the innovation dose provided to participants. This section also examines multiple pathways to achieving implementation effectiveness. ***Section 3.7*** assesses the prospects for sustaining the innovations and the features and characteristics necessary for achieving sustainability. In all these sections, we have distilled the key insights program staff, providers, and policymakers can use to shape and inform health care transformation.

3.2 Spending and Utilization

The goal of the cross-site spending and utilization analysis is to document similar quantitative data across sites to assess overall trends. We report multivariate regression analysis results derived from Medicare and Medicaid claims data for specific awardees. These awardees (or sites) were included in these analyses if they had an adequate sample size as well as a comparison group. In this section, we provide an overall update on the status of these awardees and any impacts of the innovations on spending, inpatient admissions, unplanned readmissions and emergency department (ED) visits. We present Medicare claims data through December 31, 2015 and Medicaid claims through the latest date available.

3.2.1 Claims Data Summary

RTI focused on two sources of claims data for each awardee: Medicare or Medicaid claims, as relevant to each innovation. This section describes the data and the comparison groups for 21 of the 24 awardees (NHCHC, Mary's Center, and U-Miami did not have comparison groups) in this annual report.

Most innovation sites served both Medicare and Medicaid beneficiaries. However, some sites, such as Delta Dental and Finity, focused only on Medicaid, and others (Intermountain, Y-USA) focused exclusively on Medicare beneficiaries. We matched patient identifiers with claims eligibility files or received Medicaid files directly from the awardees for all eligible awardees with Medicare beneficiaries (17) and all awardees with available Medicaid data (19).

In this report, we analyze Medicare claims through December 31, 2015. In selecting this cutoff, we assume that nearly all claims were submitted and processed within 6 months after services were provided. For this report, we performed descriptive Medicare analyses for the 17 eligible awardees: AACI, Altarum, BAHC, Bronx RHIO, Curators, ECCHC, IA, Intermountain, MPHI, Mineral Regional, NEU, Prosser, REMSA, South County, SEMHS, U-Chicago, and Y-USA.

Availability of Medicaid claims in the Chronic Conditions Data Warehouse depends on when a state submits its Alpha-MAX files. As shown in ***Table 3-1***, the availability of Alpha-MAX data varies widely among awardees depending upon the state in which they operate, ranging from the third quarter 2012 to complete 2014 data. Timing and acceptance of state submission of Medicaid data are complex issues largely beyond the control of the individual sites. Since timing and availability of Medicaid data are also beyond RTI's control, we are inherently limited in our analyses by the data available in the Chronic Conditions Data Warehouse. The lack of availability of up-to-date Alpha-MAX data slowed analysis of Medicaid claims, although many awardees' innovations target Medicaid beneficiaries (n=22). In a few cases where Alpha-MAX data were not available, awardees provided Medicaid claims data directly to RTI or RTI obtained reuse agreements to obtain state Medicaid data (Finity, Mary's Center, SEMHS, and W&I.). As discussed in the individual awardee sections, these data lack the detail and uniformity of Alpha-MAX data. For this report, we were able to perform descriptive Medicaid analyses for 19 awardees: Altarum, BAHC, Bronx, Children's Hospital, Curators, Delta Dental, ECCHC, Finity, IA, Mary's Center, MPHI, Mineral Regional, NEU, Prosser, REMSA, SEMHS, South County, U-Chicago, and W&I.

We calculated all four priority measures for the awardees that submitted patient or provider identifiers: spending per patient, inpatient admissions, unplanned readmissions, and ED visit rates. RTI relies on utilization and payment data from claims data for Medicare and Medicaid beneficiaries to independently calculate these rates.

Table 3-1. Payer Shares for HCIA Community Resource Program Participants through December 31, 2015

Awardee	Number of Unique Patients in Data File Received	Percentage of Participants Insured by Medicare[1]	Percentage of Participants Insured by Medicaid[1]	Number of Unique Patients in Medicare Claims Analysis for AR3	Number of Unique Patients in Medicaid Claims Analyses for AR3	Medicaid Data in Alpha-MAX
AACI	3,113	27.5	42.7	603	—	13Q4
Altarum	N/A/-NPIs	—	—	45,007 [2]	53	14Q2
BAHC	601	64.4	29.0	180	98	13Q4
Bronx RHIO	28,844	28.8	24.8	6,623	1,606	14Q6
Children's Hospital	1,722	0.0	100.0	N/A	535	13Q4
Curators	9,932	72.2	18.1	6,476	2,397	14Q4
Delta Dental	7,781	0.0	73.0	N/A	4,446	14Q4
ECCHC	1,653	1.8	19.1	76	274	14Q2
Finity	13,517	0.0	100.0	N/A	5457	14Q5
IA	172,073	—	—	3,799 [2]	3,088 [2]	13Q4
Intermountain	42,018	99.4	0.06	29,454	—	13Q2
Mary's Center	2,963	3.0	78.6	N/A	2,489	13Q4
MPHI	8,301	35.1	46.7	2,264	170	14Q2
Mineral Regional	N/A-NPIs	—	—	13,822 [2]	6,591 [2]	14Q1
NHCHC	N/A	—	—	N/A	N/A	N/A
NEU	14,153	7.4	58.0	1,138	771	13Q3
Prosser	1,016	31.3	30.1	254	130	14Q4
REMSA	20,593	9.7	24.6	2,204	27	13Q4
SEMHS	639	6.7	85.0	106	128	12Q2
South County	3,341	4.3	84.7	53	93	13Q4

(continued)

Table 3-1. Payer Shares for HCIA Community Resource Program Participants through December 31, 2015 (continued)

Awardee	Number of Unique Patients in Data File Received	Percentage of Participants Insured by Medicare[1]	Percentage of Participants Insured by Medicaid[1]	Number of Unique Patients in Medicare Claims Analysis for AR3	Number of Unique Patients in Medicaid Claims Analyses for AR3	Medicaid Data in Alpha-MAX
U-Chicago	125,182	12.9	46.1	8,381	3,042	13Q4
U-Miami	11,281	3.0	46.8	N/A	—	13Q3
W&I	1,391	0.0	53.5	N/A	322	12Q3
Y-USA	7,145	100.0	0.0	3,319	N/A	N/A
Total	477,259	N/A	N/A	123,760	31,717	N/A

[1] As reported in patient identifiers uploaded by the awardees.
[2] Number of patients is derived from provider identifiers.
— Data not available.
AR3 = 2016 annual report, including data through December 2015; N/A = not applicable; NPI = National Provider Identifier; Q = quarter.
Notes:
Percentage of participants insured by Medicare includes those beneficiaries identified by the site as being covered by Medicare fee-for-service or both Medicare and Medicaid.
Percentage of participants insured by Medicaid only includes those beneficiaries identified by the site as being covered by Medicaid alone (does not include Medicare/Medicaid (e.g., dual eligible beneficiaries) to avoid double counting).
The percentage of participants insured by Medicaid and Medicare will not add up to 100 percent in those cases where the innovation site submitted identifiers for beneficiaries who are covered by commercial or another type of insurance, including uninsured.

3.2.2 Strategy for Comparison Groups, Descriptive Analyses, and Regression Analyses

Comparison groups constructed for this evaluation are described in the individual awardee sections of this annual report. Technical details are summarized in ***Appendix B.2***. In the awardee sections, we present claims-based descriptive Medicare data for 18 awardees and claims-based descriptive Medicaid data for 19 awardees. In addition, we present multivariate regression analyses for 15 Medicare sites and 15 Medicaid sites. These sites had at least 100 treatment observations in the innovation period and an identified comparison group.

We constructed relevant comparison groups of Medicare and Medicaid fee-for-service beneficiaries who are similar to the patients in each innovation group but not participating in the innovations. These data were drawn from within-state geographic locations similar to the innovation, and we used propensity score matching, where appropriate, to create a comparison group with similar characteristics to participating beneficiaries, such as age, risk score, and other characteristics relevant to the innovation site. For awardees with direct program participants or with explicit eligibility criteria (e.g., five ED visits in the past 6 months), we identified the type of patient they targeted, and we used this information to select similar nonparticipating patients for comparison. For awardees serving participants indirectly through providers, we identified similar providers who were not part of the innovation. Descriptive and multivariate regression results on the variables of interest are presented quarterly. In addition, we also present visual depictions of the probability of savings or losses for those sites with comparison groups and at least 100 treatment observations. Appendix B.2 describes in detail the refined comparison group selection process overall and for each awardee who has a comparison group to date.

The following section provides an overview of the results of the multivariate difference-in-differences analyses for 15 Medicare awardees and 15 Medicaid awardees. All regressions controlled for an array of factors such as age, gender, race, disability, end-stage renal disease, dual eligibility, number of months of dual-eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The regression specification assumed the same quarterly fixed effect for treatment and comparison individuals in the baseline period and allowed for a separate quarterly effect for treatment individuals after enrolling in the innovation. The following section presents the weighted average treatment effect during the innovation period for beneficiaries enrolled in the awardee-specific innovation compared to their matched comparison group. Full results, including the quarterly estimates, are presented in the individual awardee sections.

3.2.3 Medicare Claims Data Findings

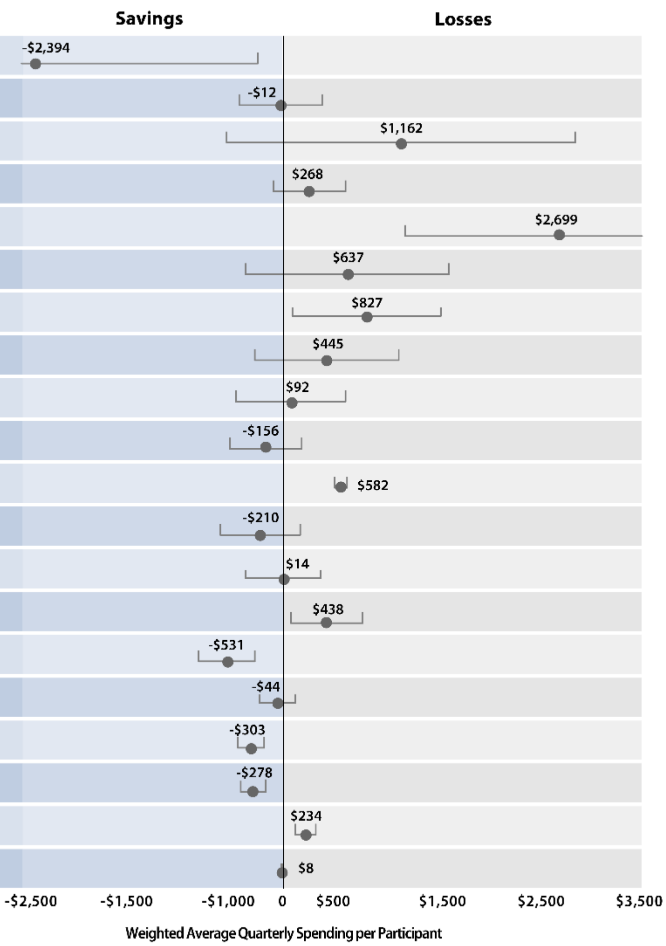
This section provides a high-level summary of Medicare spending and utilization across the 15 awardees with data available to conduct a regression analysis. Full results with quarterly effects are presented in the awardee-specific sections. The claims-based measures in this report include spending per patient, inpatient admissions, unplanned readmissions, and ED visits.

Figure 3-1 presents the weighted average quarterly spending coefficients in the innovation period. The coefficients in Figure 3-1 represent the differential spending per quarter between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval, shown by the lines extending from the point estimate, is the range in which the true parameter estimate falls, with 90 percent confidence. In some cases, the range falls outside of the viewable area because of wide confidence intervals. If this range is both greater than and less than 0, we conclude that the innovation did not significantly impact spending. However, if the point estimate and the range are less than 0, we conclude that the innovation yields savings. Finally, if the point estimate and range are greater than 0, we conclude that the innovation yields negative savings or losses. For example, U-Chicago has a point estimate of −$44, but the confidence interval falls on both the left and right sides of the zero cutoff, indicating that the finding is not significant.

Three innovations (REMSA-CP, Bronx RHIO, and Y-USA) showed statistically significant savings in the innovation period. Six awardees showed statistically significant losses during the innovation period (NEU-Lahey, IA, REMSA-ATA, MPHI, Curators and Intermountain-C3). The others showed neither statistically significant savings nor statistically significant losses.

Figure 3-1. Difference-in-Differences OLS Regression Estimates for Weighted Average Quarterly Medicare Spending per Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
REMSA-CP	182	-$4,553	-$235	0.07
REMSA-NHL	1,157	-$418	$395	0.96
Prosser	268	-$537	$2,860	0.26
NEU-CHA	950	-$81	$616	0.21
NEU-Lahey	188	$1,203	$4,195	0.00
SEMHS	106	-$349	$1,624	0.29
Imaging Advantage	3,799	$98	$1,555	0.07
BAHC	180	-$254	$1,144	0.30
Intermountain-C1	192	-$436	$619	0.78
Intermountain-C2	434	-$503	$191	0.46
Intermountain-C3	28,783	$522	$642	0.00
AACI	603	-$602	$183	0.38
Altarum	45,007	-$347	$376	0.95
MPHI	2,116	$90	$785	0.04
Bronx RHIO	6,623	-$804	-$258	0.00
U-Chicago	8,381	-$216	$128	0.67
Y-USA	3,319	-$430	-$176	0.00
Y-USA (no diab. dx)	2,302	-$396	-$159	0.00
Curators	6,474	$134	$334	0.00
Mineral Regional	13,822	-$2	$18	0.19



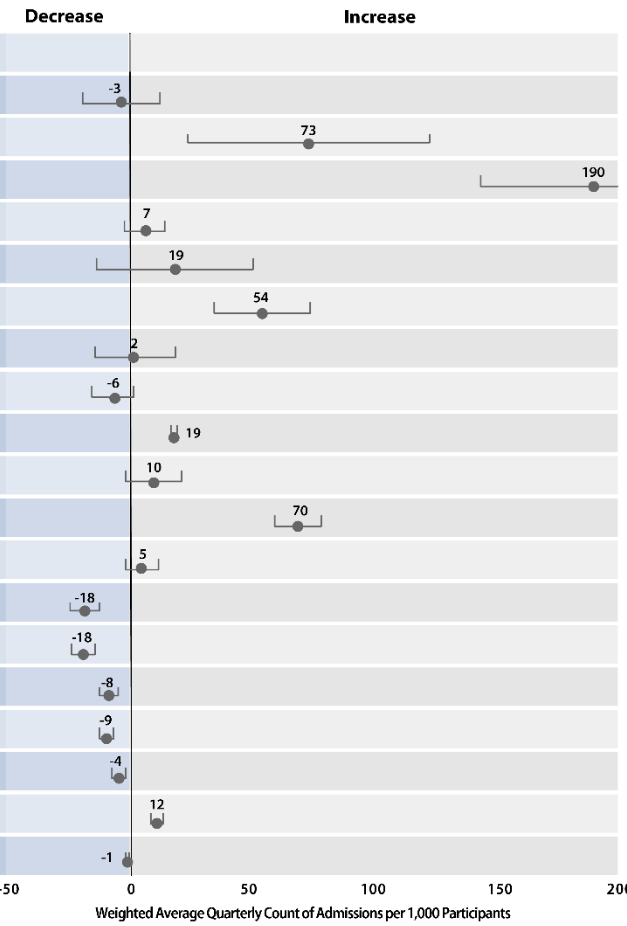
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of December 2015.
OLS = ordinary least squares.
Sample size is the unique number of treatment beneficiaries with matched claims data.

Figure 3-2 presents the findings for the weighted average quarterly difference-in-differences estimate for inpatient admissions in the innovation period from the count regression models. A positive coefficient indicates a statistically significant increased number of inpatient hospitalizations compared to the comparison group in the innovation period. A negative coefficient indicates a statistically significant decreased number of inpatient hospitalizations in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, REMSA-NHL has a point estimate of −3, but the confidence interval falls on both the left and right sides of the zero cutoff, indicating that the finding is not significant.

For inpatient admissions (Figure 3-2), the number of inpatient hospitalization in the innovation period significantly decreased for six awardees (REMSA-CP, Bronx RHIO, U-Chicago, Altarum, Y-USA, and Mineral Regional). The number of inpatient hospitalizations in the innovation period significantly increased for six awardees (Prosser, NEU-Lahey, BAHC, IA, Curators, and Intermountain-C3). The others had no significant change.

Figure 3-2. Difference-in-Differences Counts for Weighted Average Quarterly Inpatient Admissions per Medicare Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
REMSA-CP*	182	-648	-438	0.00
REMSA-NHL	1,157	-19	13	0.73
Prosser	268	24	123	0.02
NEU-Lahey	188	144	235	0.00
NEU-CHA	950	-2	15	0.19
SEMHS	106	-13	51	0.34
BAHC	180	35	74	0.00
Intermountain-C1	192	-14	19	0.84
Intermountain-C2	434	-15	2	0.22
Intermountain-C3	28,783	17	20	0.00
MPHI	2,116	-1	22	0.15
Imaging Advantage	3,799	60	79	0.00
AACI	603	-1	12	0.17
Bronx RHIO	6,623	-24	-12	0.00
U-Chicago	8,381	-23	-14	0.00
Y-USA (no diab. dx)	2,302	-12	-4	0.00
Y-USA	3,319	-12	-6	0.00
Altarum	45,007	-7	-1	0.02
Curators	6,476	9	14	0.00
Mineral	13,822	-1	0	0.01



*The estimate for REMSA-CP is -543 with a 90% confidence interval of -648 to -438.

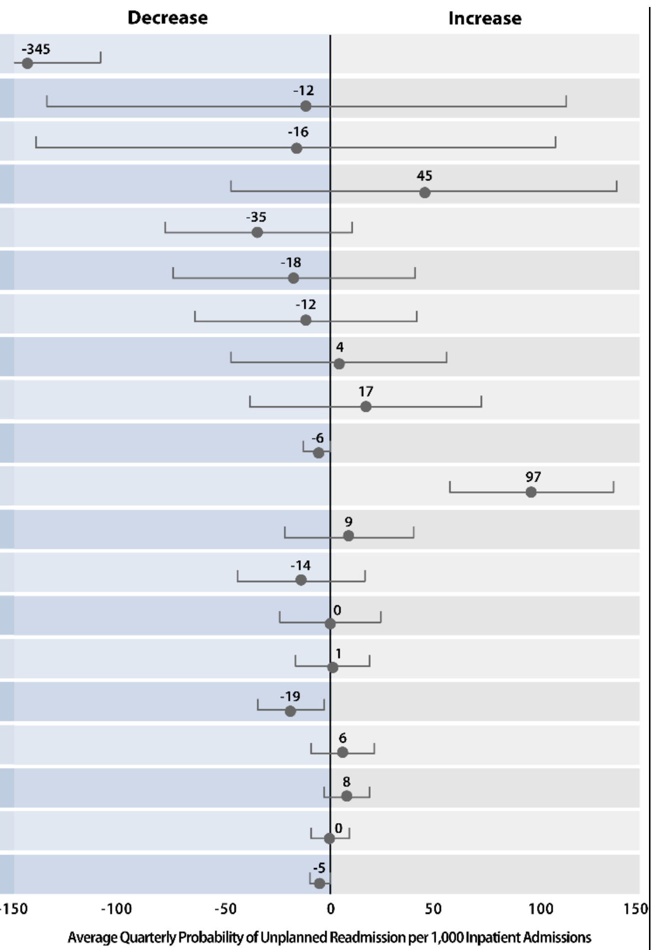
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of December 2015. Sample size is the unique number of treatment beneficiaries with matched claims data.

Figure 3-3 presents the findings for the weighted average quarterly difference-in-differences estimate for unplanned readmissions in the innovation period from the count regression model. A positive coefficient indicates a statistically significant increased number of unplanned readmissions compared to the comparison group in the innovation period. A negative coefficient indicates a statistically significant decreased number of ED visits in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, Intermountain C-1 has a point estimate of 4, but the confidence interval falls on both the left and right sides of the zero cutoff, indicating that the finding is not significant.

For unplanned readmissions (Figure 3-3), the rate of readmissions in the innovation period decreased significantly for two awardees (SEMHS and U-Chicago) and increased significantly for one awardee (Prosser). The others were not statistically significant.

Figure 3-3. Difference-in-Differences Counts for Average Quarterly Unplanned Readmissions per Medicare Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
SEMHS*	106	-579	-111	0.02
AACI	603	-137	114	0.88
BAHC	180	-142	109	0.83
REMSA-CP	182	-48	138	0.43
REMSA-NHL	1, 157	-80	11	0.21
NEU-CHA	950	-76	41	0.62
NEU-Lahey	188	-65	42	0.72
Intermountain-C1	192	-48	56	0.89
Intermountain-C2	434	-39	73	0.62
Intermountain-C3	28,783	-13	0	0.11
Prosser	268	58	137	0.00
MPHI	2,116	-22	40	0.65
Y-USA (no diab. dx)	2,302	-45	17	0.45
Y-USA	3,319	-24	24	1.00
Bronx RHIO	6,623	-17	19	0.93
U-Chicago	8,381	-35	-3	0.06
Curators	6,476	-9	21	0.53
Mineral Regional	13,822	-3	19	0.23
Altarum	45,007	-9	9	1.00
Imaging Advantage	3,799	-10	0	0.08



*The estimate for SEMHS is -345 with a 90% confidence interval of -579 to -111.

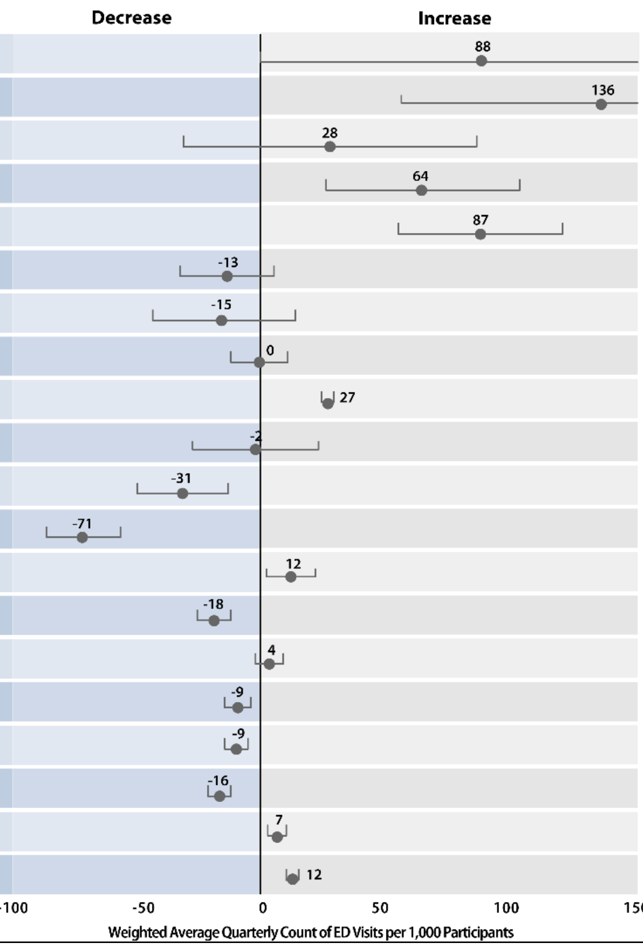
Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of December 2015. Sample size is the unique number of treatment beneficiaries with matched claims data.

Figure 3-4 presents the findings for the weighted average quarterly difference-in-differences estimate for ED visits in the innovation period from the count regression models. A positive coefficient indicates a statistically significant increased number of ED visits compared to the comparison group in the innovation period. A negative coefficient indicates a statistically significant decreased number of ED visits in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, Y-USA has a point estimate of −9, and the confidence interval falls on the left side of the zero cutoff, indicating that the finding is significant.

For ED visits (Figure 3-4), the number of ED visits in the innovation period decreased significantly for five awardees (BAHC, IA, Bronx RHIO, Y-USA, and Curators). For seven awardees the number of ED visits in the innovation period increased significantly (SEMHS, REMSA-NHL, NEU-Lahey, AACI, Altarum, Intermountain-C3, and Mineral Regional). The others had no significant change.

Figure 3-4. Difference-in-Differences Counts for Weighted Average Quarterly ED Visits per Medicare Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
Prosser	268	0	177	0.10
SEMHS	106	56	215	0.01
REMSA-CP	182	-31	86	0.44
REMSA-NHL	1,157	26	103	0.01
NEU-Lahey	188	55	120	0.00
NEU-CHA	950	-32	5	0.24
Intermountain-C1	192	-43	14	0.39
Intermountain-C2	434	-12	11	0.94
Intermountain-C3	28,783	24	29	0.00
MPHI	2,116	-27	23	0.87
BAHC	180	-49	-13	0.00
Imaging Advantage	3,799	-85	-56	0.00
AACI	603	2	22	0.05
Bronx RHIO	6,623	-25	-12	0.00
U-Chicago	8,381	-2	9	0.29
Y-USA (no diab. dx)	2,302	-14	-4	0.01
Y-USA	3,319	-14	-5	0.00
Curators	6,476	-21	-12	0.00
Altarum	45,007	3	10	0.00
Mineral Regional	13,822	10	15	0.00



Source: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of December 2015.
ED = emergency department.
Sample size is the unique number of treatment beneficiaries with matched claims data.

Three awardees showed savings and 12 awardees did not show Medicare savings in the innovation period. Additionally, there is limited evidence that the innovations significantly decreased the number of unplanned readmissions. Six of the 15 awardees showed reductions in inpatient visits and five showed significant reductions in ED visits. Many awardees focused specifically on avoiding ED visits and several were successful in these efforts. Conversely, seven awardees showed significant increases in ED visits. These findings span the full 3 years of the innovation plus 6 months for an examination of any residual effects after the innovation ended An additional 6 months of claims data will be included in the final addendum report, but we do not expect to see extreme variation in the results presented. Some awardees that received extensions continued to enroll new patients after the initial 3-year period and may have more substantial changes because new enrollees were added. These results will also be included in the final addendum report. Further details about the specific awardees that showed positive findings are presented in the individual awardee sections.

3.2.4 Medicaid Claims Data Findings

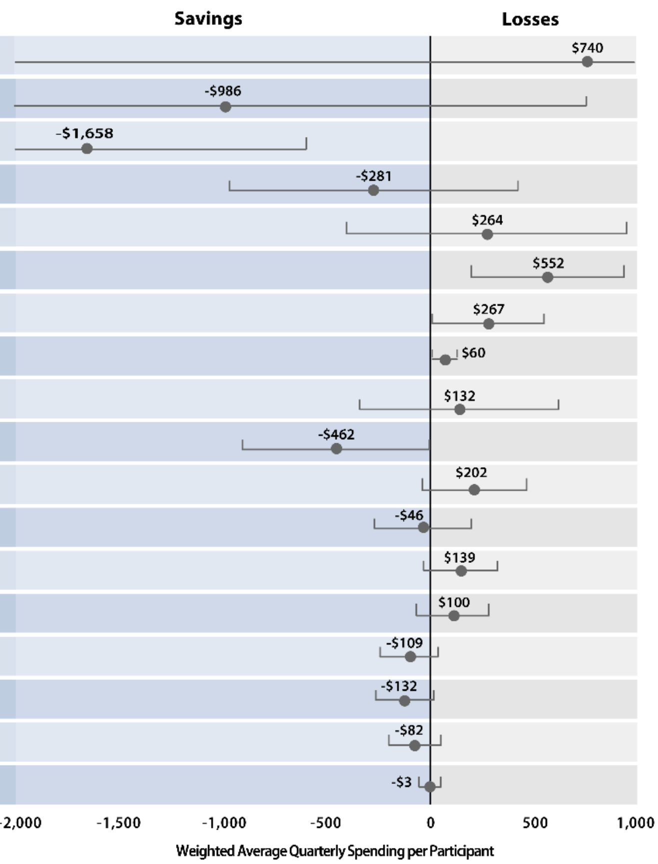
This section provides a high-level summary of Medicaid spending and utilization across 15 awardees with data available to conduct a regression analysis. Results should be treated as preliminary because they do not cover the entire innovation period; awardees often had regression analyses for only two or three innovation quarters because Medicaid data were either not available or were extremely delayed. The claims-based measures in this report include spending per patient, inpatient admissions, unplanned readmissions, and ED visits.

Figure 3-5 presents the weighted average quarterly spending coefficients during the innovation period. The coefficients in Figure 3-5 represent the differential spending per quarter between individuals enrolled in the innovation and comparison group individuals, on average, weighted by the number of innovation beneficiaries in each quarter. The 90 percent confidence interval, shown by the lines extending from the point estimate, is the range in which the true parameter estimate falls, with 90 percent confidence. In some cases, the range falls outside of the viewable area because of wide confidence intervals. If this range is both greater than and less than 0, we conclude that the innovation did not significantly impact spending. However, if the point estimate and the range are less than 0, we conclude that the innovation yields savings. Finally, if the point estimate and range are greater than 0, we conclude that the innovation yields negative savings or losses. For example, SEMHS has a point estimate of −$281, but the confidence interval falls on both the left and right sides of the zero cutoff, indicating that the finding is not significant.

Two innovations (MPHI and IA) showed statistically significant savings in the innovation period. One awardee showed statistically significant losses during the innovation period (Finity-Diabetes/Finity-BP: Mothers). The remainder showed neither significant savings nor significant losses. This is likely due to small sample sizes and lack of claims data available through the entire innovation period.

Figure 3-5. Difference-in-Differences OLS Regression Estimates for Weighted Average Quarterly Medicaid Spending per Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
Women and Infants	322	-$4,080	$5,560	0.76
Prosser	130	-$2,707	$735	0.35
MPHI	170	-$2,709	-$606	0.01
SEMHS	128	-$970	$409	0.50
Finity-BP: Babies	4,620	-$408	$936	0.52
Finity-Diabetes	418	$189	$918	0.01
Finity-Heart Health	419	-$2	$534	0.10
Finity-BP: Mothers	4,620	$1	$120	0.09
ECCHC	274	-$346	$609	0.45
Imaging Advantage	3,088	-$910	-$14	0.09
U-Chicago	3,042	-$50	$454	0.19
Bronx RHIO	1,606	-$280	$189	0.75
Curators	2,397	-$37	$315	0.19
Mineral Regional	6,591	-$75	$275	0.34
Children's Hospital	518	-$247	$28	0.19
NEU-CHA	771	-$269	$5	0.11
BAHC	98	-$206	$41	0.27
Delta Dental	4,446	-$57	$51	0.92



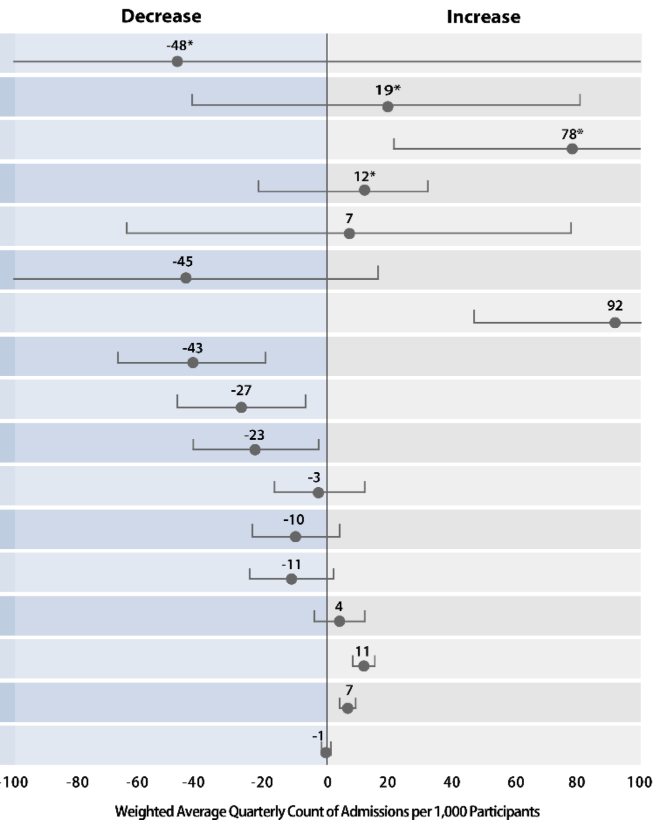
Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims available as of December 2015.
OLS = ordinary least squares.
Sample size is the unique number of treatment beneficiaries with matched claims data.

Figure 3-6 presents the findings for the weighted average quarterly difference-in-differences estimate for inpatient admissions in the innovation period from the count regression model. A positive coefficient indicates a statistically significant increased number of inpatient hospitalizations compared to the comparison group in the innovation period. A negative coefficient indicates a statistically significant decreased number of inpatient hospitalizations in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, NEU-CHA has a point estimate of −27, and the confidence interval falls on the left side of the zero cutoff, indicating that the finding is significant.

For inpatient admissions (Figure 3-6), the number of inpatient hospitalization significantly decreased for three awardees (IA, NEU-CHA, and W&I). The number of hospitalizations increased significantly during the innovation period for four awardees (Finity-BP: Baby Partners, Prosser, Curators, and Mineral Regional). For the remainder, we found no statistically significant change.

Figure 3-6. Difference-in-Differences Counts for Weighted Average Quarterly Inpatient Admissions per Medicaid Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
Finity-Diabetes	418	-236	140	0.67
Finity-BP: Mothers	4,620	-44	81	0.62
Finity-BP: Babies	4,620	21	135	0.02
Finity-Heart Health	419	-22	32	0.76
SEMHS	128	-64	78	0.85
MPHI	170	-107	16	0.23
Prosser	130	47	138	0.00
Imaging Advantage	3,088	-67	-20	0.00
NEU-CHA	771	-48	-7	0.03
Women and Infants	322	-43	-3	0.06
Bronx RHIO	1,606	-17	12	0.77
ECCHC	274	-24	4	0.26
Children's Hospital	518	-25	2	0.18
U-Chicago	3,042	-4	12	0.40
Curators	2,397	8	15	0.00
Mineral Regional	6,591	4	9	0.00
Delta Dental	4,446	-2	1	0.36



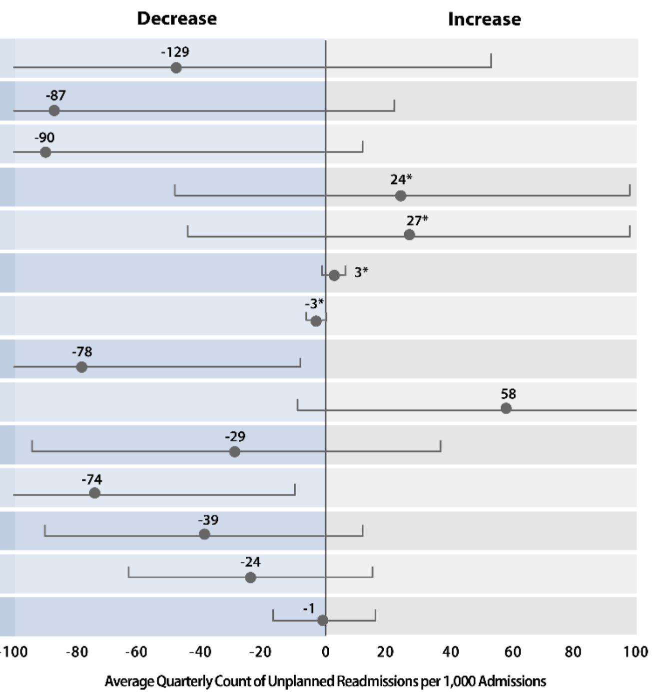
RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims available as of December 2015.
*Estimates are for the entire period (9-12 months for mothers and approximately 3 months for babies).
Sample size is the unique number of treatment beneficiaries with matched claims data.

Figure 3-7 presents the findings for the weighted average quarterly difference-in-differences estimate for unplanned readmissions in the innovation period from the count regression model. A positive coefficient indicates a statistically significant increased number of unplanned readmissions compared to the comparison group in the innovation period. A negative coefficient indicates a statistically significant decreased number of ED visits in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, NEU-CHA has a point estimate of −27, and the confidence interval falls on the left side of the zero cutoff, indicating that the finding is significant.

For unplanned readmissions (Figure 3-7), the rate of readmissions during the innovation period decreased significantly for two awardees (Children's Hospital, W&I) and was not significant for the rest.

Figure 3-7. Difference-in-Differences Counts for Average Quarterly Unplanned Readmissions per Medicaid Participant HCIA Community Resource

Site	Sample Size	90% CI		p-value
MPHI	170	-311	53	0.26
U-Chicago	3,042	-196	22	0.19
NEU-CHA	771	-191	12	0.15
Finity-Heart Health	419	-48	98	0.58
Finity-Diabetes	418	-44	98	0.53
Finity-BP: Babies	4,620	-1	6	0.28
Finity-BP: Mothers	4,620	-6	0	0.14
Children's Hospital	518	-148	-8	0.07
Curators	2,397	-9	126	0.16
Imaging Advantage	3,088	-94	37	0.47
Women and Infants	322	-137	-10	0.06
Bronx RHIO	1,606	-90	12	0.21
Delta Dental	4,446	-63	15	0.31
Mineral Regional	6,591	-17	161	0.96



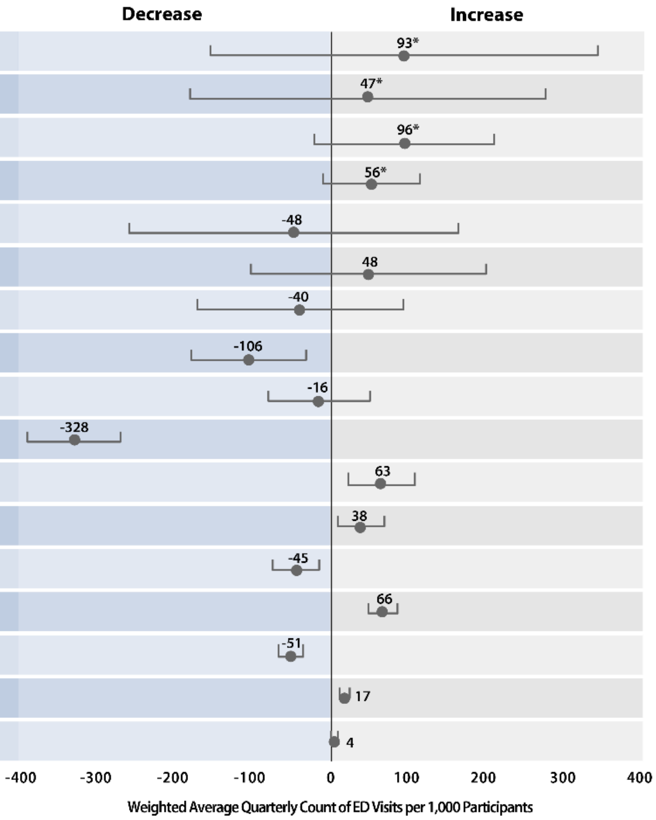
RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims, available as of December 2015...
*Estimates are for the entire period (9-12 months for mothers and approximately 3 months for babies).
Sample size is the unique number of treatment beneficiaries with matched claims data.

Figure 3-8 presents the findings for the weighted average quarterly difference-in-differences estimate for ED visits in the innovation period from the count regression model. A positive coefficient indicates a statistically significant increased number of ED visits compared to the comparison group in the innovation period. A negative coefficient indicates a statistically significant decreased number of ED visits in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, MPHI has a point estimate of −48, and the confidence interval falls on the left and right sides of the zero cutoff, indicating that the finding is not significant.

For ED visits (Figure 3-8), four awardees significantly decreased the number of ED visits in the innovation period (ECCHC, W&I, NEU-CHA, and U-Chicago). The number of visits increased significantly during the innovation period for four awardees (IA, Bronx RHIO, Curators, and Delta Dental). For the remainder, we found no significant change.

Figure 3-8. Difference-in-Differences Counts for Weighted Average Quarterly ED Visits per Medicaid Participant, HCIA Community Resource

Site	Sample Size	90% CI		p-value
Finity-Heart Health	419	-154	340	0.54
Finity-Diabetes	418	-180	273	0.73
Finity-BP: Mothers	4,620	-18	211	0.17
Finity-BP: Babies	4,620	-6	118	0.14
MPHI	170	-259	163	0.71
SEMHS	128	-102	197	0.60
Prosser	130	-172	92	0.62
ECCHC	274	-179	-33	0.02
Children's Hospital	518	-81	49	0.69
Women and Infants	322	-388	-269	0.00
Imaging Advantage	3,088	21	106	0.01
Bronx RHIO	1,606	8	68	0.04
NEU-CHA	771	-74	-16	0.01
Curators	2,397	47	85	0.00
U-Chicago	3,042	-67	-35	0.00
Delta Dental	4,446	10	23	0.00
Mineral Regional	6,591	-1	8	0.21



RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims, available as of December 2015.
*Estimates are for the entire period (9-12 months for mothers and approximately 3 months for babies).
Sample size is the unique number of treatment beneficiaries with matched claims data.

The majority of the HCIA Community Resource awardees do not show savings in the innovation period. In addition, preliminary evidence shows that some innovations decrease the likelihood of inpatient admissions or ED visits. Other nonsignificant findings may be due to the limited innovation periods, which cover only part of the award period. As we obtain additional data, the sample size of the innovation group in the innovation quarters will increase due to rolling treatment quarters—and we may be able to draw firmer conclusions. The final addendum report will examine additional innovation periods based on data received through December 2016, and we will continue to examine the impact on spending, inpatient admissions, ED visits, and hospital unplanned readmissions over time. However, we do not expect extreme variation in these outcomes for awardees that currently have complete or nearly complete data.

3.3 Clinical Effectiveness and Health Outcomes across Awardees

The following subsections summarize the diabetes and hypertension findings across awardees, for all patients enrolled in the innovations, regardless of payer category. Clinical effectiveness measures assess the process of care (e.g., percentage of diabetes patients receiving an HbA1c test) and health outcomes measures represent clinical outcomes (e.g., percentage of patients with poor HbA1c control). More specifically, we include the percentage of patients with diabetes and hypertension who received relevant clinical effectiveness services, as well as the percentage of patients who experienced improvements in diabetes-related and hypertension-related health outcomes, by awardee and combined across awardees.

3.3.1 Diabetes

Nine awardees provided data for diabetes-related clinical effectiveness measures. ***Table 3-2*** shows the percentage of patients with diabetes who received an HbA1c test, an LDL-C test, a foot exam, and an eye exam during the innovation period. More than two-thirds of patients with diabetes (69.1%) received an HbA1c test. Nearly three-quarters of patients with diabetes (72.5%) across five awardees received an LDL-C test. Less than two-thirds of patients with diabetes (62.0%) across four awardees received a foot exam, and less than one-half of the patients with diabetes (46.8%) across the two awardees received an eye exam. Some of the differences among these awardees may be due to differences in innovation design. MPHI, NHCHC, and U-Chicago focused on coordinating care provided by other entities or providing information on local community programs and services available to residents for health maintenance and disease management, rather than on providing direct health care services to the enrollees. Thus, they had less control over the clinical services provided to their enrollees than health centers (BAHC, ECCHC, Curators).

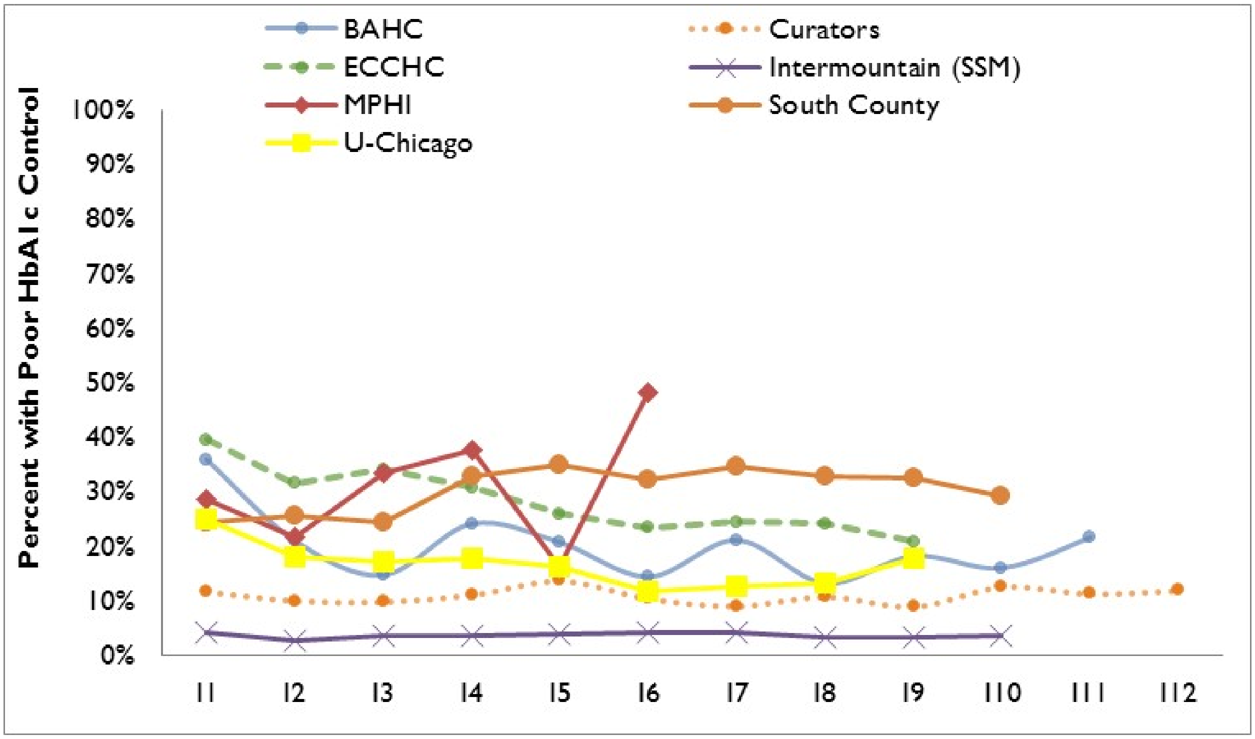
Table 3-2. Percentage of Patients with Diabetes Who Received Clinical Services

Awardee	Percentage of Patients with Diabetes who Received an HbA1c Test	Percentage of Patients with Diabetes who Received an LDL-C Test	Percentage of Patients with Diabetes who Received a Foot Exam	Percentage of Patients with Diabetes who Received an Eye Exam
BAHC (n=374)	95.2	69.3	91.7	65.5
Curators (n=2,005)	90.9	88.2		
ECCHC (n=273)	78.7		70.3	
Finity (n=418)	95.9	90.9		28.0
Intermountain (n=6,094 SSM)	68.0			
MPHI (2,122)	31.6	20.8		
NHCHC (n=90)	30.0		23.3	
South County (n=475)	99.0	93.1	62.5	
U-Chicago (n=9,465)	32.4			
Total (n=21,316)	69.1	72.5	62.0	46.8

Source: Patient-level data provided to RTI by the awardee.

Figure 3-9 displays the percentage of patients with diabetes with poor HbA1c control (i.e., > 9%) over time for seven of the nine awardees that provided HbA1c test results. It is important to note that the number of innovation quarters by awardee varies. For example, Curators had enrollees remain in the program through 12 quarters, while MPHI had enrollees remain in the program through 6 quarters. As shown in the figure, the percentage of patients with poor HbA1c control dropped over time for three (i.e., BAHC, ECCHC, and U-Chicago) of the seven awardees. The percentage remained stable over time for two awardees (i.e., Curators and Intermountain). However, both Curators and Intermountain had a relatively low percentage of patients with poor HbA1c control at the first innovation quarter. The percentage of those with poor HbA1c control increased slightly for one awardee (i.e., South County) and dramatically for the other awardee (i.e., MPHI).

Figure 3-9. Percentage of Patients with Diabetes with Poor HbA1c Control over Time

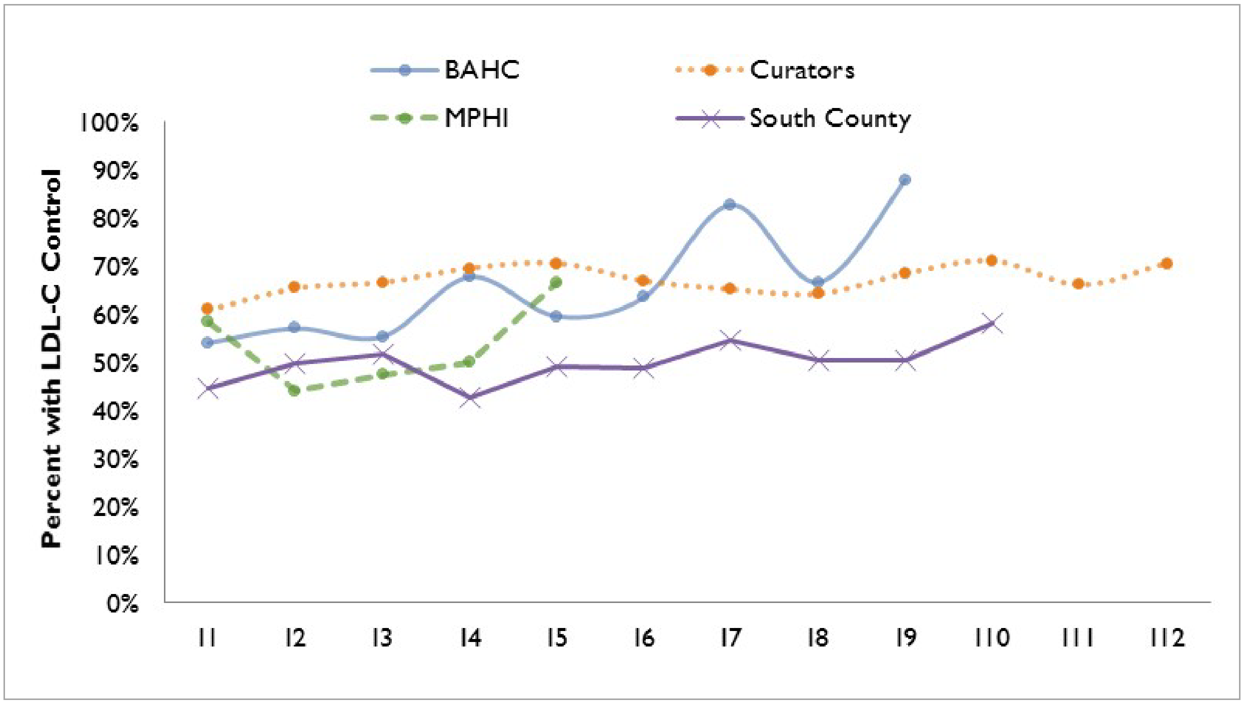


Awardee	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
BAHC	35.9	21.0	14.7	24.1	20.7	14.4	21.1	13.2	18.2	16.0	21.6	
Curators	11.7	10.0	9.8	11.1	13.7	10.4	9.0	10.8	8.9	12.6	11.3	11.9
ECCHC	39.5	31.5	34.1	30.8	26.0	23.4	24.4	24.2	20.8			
Intermountain (SSM)	4.1	2.7	3.7	3.6	4.0	4.3	4.3	3.4	3.3	3.7		
MPHI	28.5	21.6	33.3	37.5	16.3	48.0						
South County	24.4	25.5	24.4	32.7	35.0	32.2	34.5	32.8	32.5	29.1		
U-Chicago	25.0	18.1	17.0	17.6	16.2	11.6	12.5	13.2	17.6			

Source: Patient-level data provided to RTI by the awardee.

Figure 3-10 provides the percentage of patients with diabetes with LDL-C control (i.e., <100 mg/dL) over time for four awardees. As shown in the figure, the percentage of patients with LDL-C control increased over time for all four awardees.

Figure 3-10. Percentage of Patients with Diabetes with LDL-C Control over Time



Awardee	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
BAHC	54.1	57.1	55.4	67.8	59.6	63.6	82.8	66.7	88.0			
Curators	61.1	65.5	66.7	69.6	70.6	67.0	65.3	64.4	68.5	71.1	66.2	70.6
MPHI	58.4	44.0	47.4	50.0	66.7							
South County	44.6	49.7	51.7	42.8	49.3	48.8	54.8	50.4	50.5	58.3		

Source: Patient-level data provided to RTI by the awardee.
LDL-C = low-density lipoprotein cholesterol.

In summary, at least two-thirds of patients with diabetes across nine awardees received an HbA1c test and/or a LDL-C test. Fewer patients with diabetes a received a foot exam and an eye exam. Results were largely mixed for awardees reporting both HbA1c and LDL-C measures. Curators, MPHI, and South County improved on one measure but showed no change or worsened on the other measure. Only BAHC improved on both measures. Overall, we saw consistent improvements in LDL-C control among the four awardees reporting this measure. Improvements in HbA1c control were less consistent yet, on the whole, positive. The percentage of those with poor HbA1c control decreased over time for three awardees and remained relatively stable over time for two awardees whose enrollees were largely in good control at the beginning of the innovation. These results suggest there may be an association between receipt of appropriate diabetes-related clinical services and improvements in diabetes-related health outcomes over time.

3.3.2 Hypertension

Eight awardees provided data for hypertension-related clinical effectiveness measures. The percentages of patients with hypertension who received a blood pressure screening are shown in ***Table 3-3***. For four of the awardees, nearly all patients with hypertension received a blood pressure screening. Three other awardees provided blood pressure screenings to more than 70 percent of enrollees with hypertension. Less than half of MPHI's patients with hypertension received a blood pressure screening.

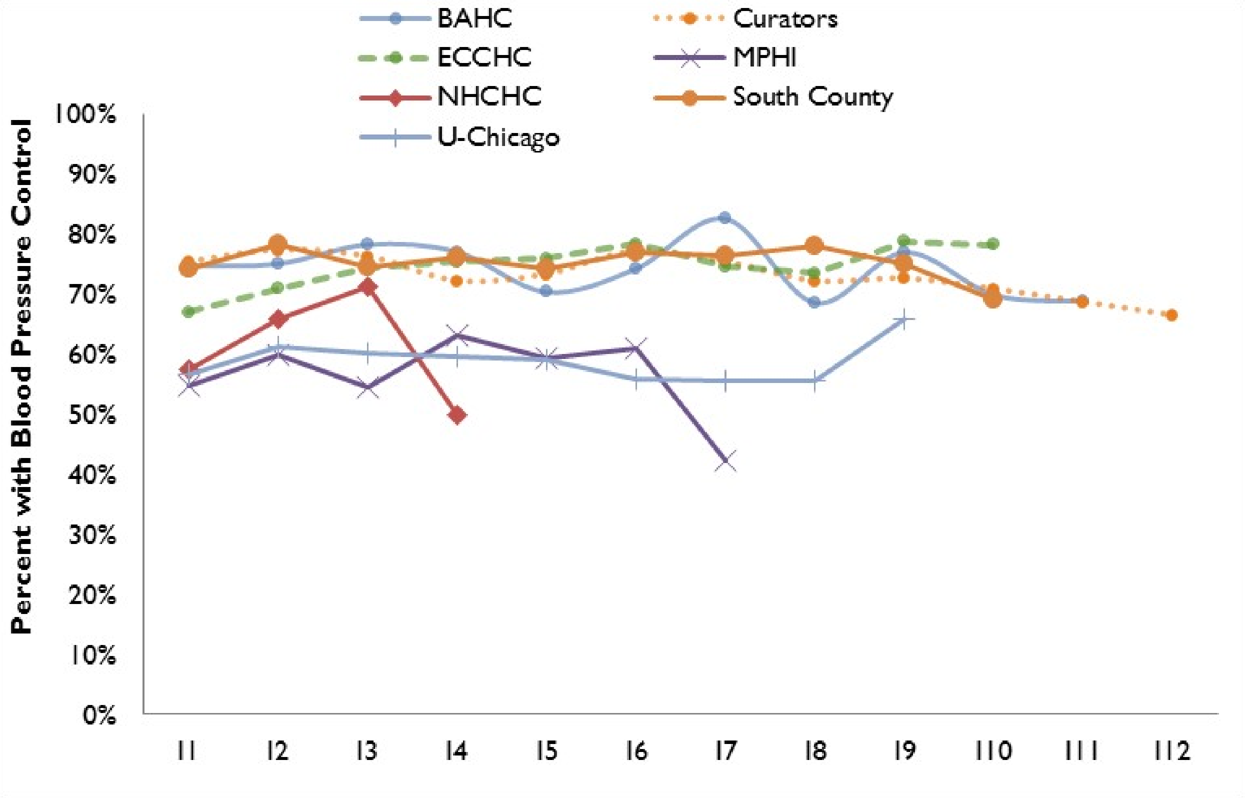
Table 3-3. Percentage of Patients with Hypertension Who Received Blood Pressure Screening

Awardee	Percentage of Patients with Hypertension who Received a BP Screening
BAHC (n=343)	99.1
Curators (n=3,936)	96.6
ECCHC (n=553)	98.2
Mary's Center (n=668)	73.1
MPHI (n=3,532)	42.8
NHCHC (n=198)	70.2
South County (n=664)	99.4
U-Chicago (n=21,374)	72.7
Total (n=31,268)	73.6

Source: Patient-level data provided to RTI by the awardee.
BP = blood pressure.

Figure 3-11 provides the percentage of patients with hypertension with blood pressure control (i.e., <140/90 mm Hg) over time for seven of eight awardees. Mary's Center's participants were enrolled for a maximum of 3 months; therefore, Mary's Center is not included in the figure. As shown, the percentage of patients with blood pressure control increased slightly over time for ECCHC and U-Chicago. The percentage dropped slightly over time for the other five awardees. The percentages with blood pressure control were relatively high at the first innovation quarter for three of these awardees, and the percentage dropped less than 10 percentage points over time. NHCHC and MPHI started with approximately half of enrollees with hypertension with blood pressure control, and the percentage dropped over time. However, these enrollees were in the innovation fewer quarters as compared with the other five awardees.

Figure 3-11. Percentage of Patients with Hypertension with Blood Pressure Control over Time



Awardee	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
BAHC	74.8	75.1	78.3	77.1	70.4	74.3	82.6	68.6	77.0	69.9	68.9	
Curators	75.4	77.4	76.3	72.2	73.3	77.2	75.4	72.2	72.6	70.8	68.7	66.5
ECCHC	67.0	71.0	74.5	75.4	76.0	78.4	74.6	73.5	78.8	78.3		
MPHI	54.8	60.0	54.6	63.2	59.4	61.0	42.3					
NHCHC	57.6	65.9	71.4	50.0								
South County	74.3	78.3	74.5	76.1	74.2	77.0	76.4	78.0	75.0	69.2		
U-Chicago	56.8	61.4	60.3	59.8	59.2	55.9	55.7	55.5	65.8			

Source: Patient-level data provided to RTI by the awardee.

In summary, a majority of patients with hypertension received a blood pressure screening in all but one of the nine awardees. Blood pressure control improved for enrollees in ECCHC and U-Chicago and declined most sharply for NHCHC and MPHI, whose enrollees had less control at the innovation's onset (less than 60%) and were in the innovation for less than 9 quarters. Thus, the percentage of enrollees with blood pressure control might improve further if a moderate percentage of them had control at baseline and at least nine innovation quarters of enrollment. However, other factors may affect changes in blood pressure control and these cannot be accounted for in this descriptive analysis.

3.3.3 Limitations

The clinical effectiveness and health outcome findings presented have several limitations. The sample sizes included for some awardee analyses are somewhat limited. More importantly, the findings are descriptive; we have not conducted significance tests to determine if any changes over time are statistically significant because of the sample size limitations.

The figures showing changes in measures over time (Figures 3-9, 3-10, and 3-11) account for rolling enrollment. That is, the intervention quarters (Is) are based on individual enrollment date and reflect the number of quarters in which a patient is enrolled or exposed to the innovation. For example, I1 is equal to the first quarter of enrollment for all participants. We present findings when at least 20 patients have a test or reading within the quarter. Since patients do not have test results for every quarter in which they are enrolled over time, the patients included in each quarter vary (although all patients are included in I1). For instance, a patient may be included in I1, I5, and I9. Finally, since fewer patients are enrolled over longer periods of time, the denominators used in these analyses decrease substantially between the first and last intervention quarters in many instances. And those enrolled in the innovation for a longer time may be those who were in worse health when they were enrolled. For instance, MPHI patients with more conditions to be addressed may be enrolled longer because they are more likely to need a variety of services.

Finally, MPHI, NHCHC, and U-Chicago did not provide clinical services to enrollees and did not have direct access to their medical records. Rather, they relied on health care providers to provide clinical data. Thus, these data may not have been as complete or timely as data from awardees that were health centers or systems.

3.4 Context of Implementation

3.4.1 Leadership

In the words of one interviewee from South County, *"leadership is everything."* Project directors and managers implement innovations as planned, oversee administrative and clinical operations, manage staff, engage partners, acquire funding and other resources to support the innovation, and work to evaluate and improve the innovation over time. We reviewed and analyzed data from interviews with various awardees and their *Q11–Q12 Narrative Progress Quarterly Awardee Performance Reports* to identify key insights about innovation leadership that can inform future health care innovation efforts. We present these insights in this section.

Leadership Requires Significant Upfront Planning

Health care innovations are large, complex projects. Many innovation leaders acknowledged that they could have been more prepared for implementation. Some underestimated the level of resources (time and staff) required to implement their innovations. A leader at Children's Hospital commented,

> ***"As the person responsible for reporting and managing front-line staff implementing activities, it would have been helpful to know upfront how much of my time would be occupied by activities such as reporting and on webinars and conference calls, etc." (Children's Hospital)***

Some innovation leaders struggled to obtain necessary resources, including funding, to sustain their innovations (see the Sustainability chapter). Investing in planning early on can help leaders better implement their innovations and maintain them when HCIA funding is no longer available. A staff member at South County said, *"One lesson learned is that we had many infrastructures to set up. We had to build infrastructure at the same time the innovation took place."*

Beyond planning for the *level* of resources required to implement and sustain their innovations, leaders also emphasized planning for data collection based on the reporting requirements for their awards. Data access and technology issues posed significant challenges for some awardees engaged in these planning efforts. Upfront planning—including developing protocols and systems for regularly collecting and reviewing data, analyzing data, and sharing and using data to improve the innovation—can help innovation leaders avoid these challenges.

Some awardees wished they could have started the grant-writing phase again and scaled back their plans. More realistic plans might have allowed them to accomplish everything they wanted in the 3-year timeframe (which many said was not enough time to demonstrate outcomes). During the planning phase, awardees should thoughtfully consider what work can feasibly be achieved in the award period.

Strong Leaders Engage Other Leaders, Champions, and Stakeholders

Innovation leaders recognized the value in engaging and educating as many potential stakeholders as possible. A Finity leader recommended, "*Begin the project with strong, binding commitments from potential partners. Select your partners carefully."* One leader from U-Chicago explained that, *"strong relationships and frequent meetings with invested clinical and community partners who share our vision were critical. Our relationships sustained us through challenges and gave us critical insights for continuous quality improvement."* Engaging stakeholders allowed leaders to integrate other perspectives and use those to inform program improvement. Conversely, turnover among key leaders, champions, and stakeholders can delay innovation implementation, as a staffer at Finity pointed out: *"Change in leadership at the partner organizations has been a struggle. Leadership champions have all changed and Finity had to educate the new leaders."* Related to the first key finding on importance of planning, leaders should be prepared to deal with turnover among champions and stakeholders.

Supportive Leaders Leverage Resources

Most awardees said their supportive leaders played a key role in ensuring adequate resources for project implementation. These leaders helped access and mobilize resources in the organization for start-up resources, IT support and staffing, purchase of equipment, and securing office space on the open market. Leaders' ability to maintain these resources during the innovation was equally as important.

Several awardees also noted that supportive leaders were crucial for communicating the values of the innovation to key stakeholders and ensuring these stakeholders help strengthen administrative processes and technology systems and address other infrastructure needs. Alternatively, turnover in leadership also impacted awardees' capacity to implement the innovation and ensure the maintenance and use of adequate resources. One awardee reported that new leadership needed time to get up to speed and avoided making big decisions, especially with funding, resulting in delays in necessary resources particularly for research activities that affected innovation implementation. One awardee noted: *"She sees her role (as CEO) is to remove barriers, remove resources as needed to get things done."* Another said: *"The leadership team has always supported financing positions and that we maintained the resources we needed to continue the project. They provided financial support within the project and start-up resources."*

Significance for Policy and Practice

KEY INSIGHTS

- Have Memoranda of Understanding or letters of commitment outlining how champions and stakeholders will participate in the innovation and describing plans for succession of key personnel.
- Explore successful strategies and tools from other innovations or organizations for engaging champions.
- Understand needs for accessing and analyzing data and the support that their project staff and organization may provide (or require).
- Allow ample time for comprehensive planning, implementation, and demonstrating outcomes; seek real-world examples from other innovation leaders to inform planning decisions.

3.4.2 Organizational Capacity

Awardees reported that adequate resources, particularly administrative systems for program development and management, were critical to implementing the innovation and were often overlooked in the development phase. Leadership support was key in attaining resources. Awardees also found other strategies for using resources outside their organizations to fill gaps where internal resources fell short.

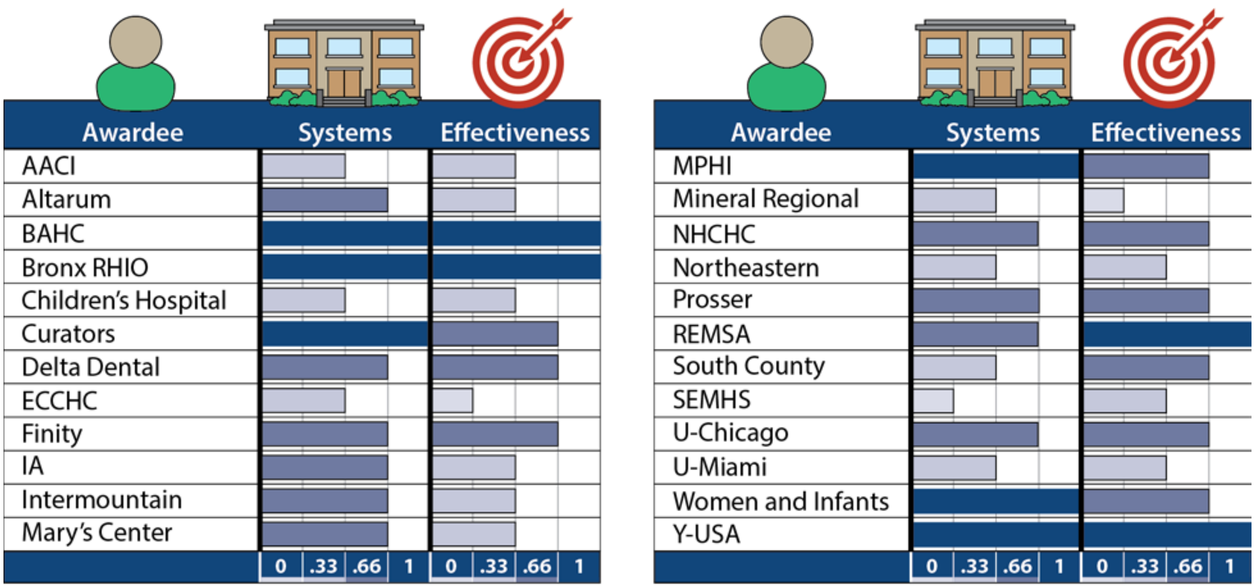
Lack of Anticipation Caused Setbacks

Awardees did not anticipate the need for administrative systems during the program development phase, which caused setbacks in implementation. Resources needed to implement HCIA innovations included information and technology systems, education and training systems, equipment, and physical space. Across awardees, especially important for program implementation was having adequate systems in place to address administrative and data management tasks. For instance, several awardees found administrative tasks were burdensome in both the development and implementation phases of the innovation; they had to develop and track reporting, process and manage legal and other nondisclosure agreements, orient and manage staffing, and carry out IT processes. In the program development phase, several awardees said they were unprepared to handle the increased amount of work involved in the innovation start-up and did not have systems in place to manage these development tasks. One awardee noted it needed more time to develop IT and data access processes. Another awardee reported it did not plan for a system to track operating costs, which became increasingly important as the innovation developed: *"We went in under the assumption that the amount and types of resources we would need and we underestimated how much it would take."*

Administrative Systems Were Key

RTI analyzed data from a structured form containing evaluators' assessments of different aspects of implementation to further understand the role of resources such as administrative structures in increasing the awardee's capacity to effectively implement the innovation. Using the evaluators' ratings for the 24 HCIA sites, we examined whether those sites that scored higher for having processes and/or systems in place to document and monitor innovation implementation (to ensure the innovation is on course to meet its goals) also scored higher on overall implementation effectiveness. ***Figure 3-12*** shows these ratings and how they cluster on the rating continuum. Almost half (11) of awardees had the same ratings for processes and/or systems in place and implementation effectiveness. Three sites that were rated highly successful in implementation effectiveness also rated highest for having systems in place. The one other site rated highly successful in implementation effectiveness had a slightly lower rating for having systems in place. This pattern is similar for sites that scored lower on implementation effectiveness in that the extent to which they had processes/systems in place aligned closely with their rating on overall implementation effectiveness. The alignment of ratings suggests the important role of organizational capacity in having processes/systems and implementation effectiveness.

Figure 3-12. Evaluators' Ratings for HCIA Sites



Overcoming Inadequate Resources

Organizational capacity not only includes the extent to which awardees had the resources necessary to implement the innovation but also the extent to which they could garner additional resources. Awardees reported several ways they overcame challenges involving lack of administrative systems and inadequate resources in other areas. These strategies included conducting a gap analysis aligned with project work plans to identify the resources needed to meet overall objectives. For example, several awardees could not completely upgrade or implement new IT capabilities for electronic health record (EHR) in areas like care coordination and data analytics systems. They found solutions such as additional organizational support and in-kind contributions for deployment of IT processes. Another awardee in a busy academic center had to step back and generate standardized processes and procedures to manage administrative tasks impacting implementation such as processing legal agreements and onboarding medical students.

Awardees also found that leveraging resources from partners helped them to fill gaps and ensure effective implementation. For example, W&I received a grant from the March of Dimes of Rhode Island for patient educational materials for the NICU. Another awardee sought resources on health care reform, reporting, and quality improvement methods from the state's hospital association, which strengthened its ability to address educational needs of critical access hospitals implementing the innovation. Finally, awardees noted the importance of keeping apprised of resources available in the larger community to address gaps both in providing services to patients and finding resources such as office space and training and educational materials.

Significance for Policy and Practice

KEY INSIGHTS

- Plan for administrative systems in the development phase to cover start-up activities and prevent administrative burden during implementation.
- Conduct a gap analysis to determine where resources are missing.
- Seek in-kind contributions such as clinical space, staffing and equipment within the organization.
- Engage partners in filling the gaps.
- Stagger resources across the timeline of the innovation, keeping in mind the need for start-up resources.
- Develop a system for assessing resources in the community to meet organizational needs in addition to patient needs.

3.4.3 The Role of Context in Clinical Decision Support (CDS) Innovation Adoption

The success of health information technology (HIT) adoption in clinical settings and by health care providers depends largely on the contexts in which such innovations are implemented. Contexts differ by the number of EHR systems and implementation sites involved, key stakeholders' experience, and the diversity of clinical settings. In this chapter, we use data from stakeholder interviews and a survey of health care providers to describe how contextual factors influence the adoption of clinical decision support (CDS) tools used in radiology. Our data come from two awardees (Altarum and Imaging Advantage-IA) that designed CDS software tools linked to EHR systems. The tools give health care providers specific recommendations on the optimal order for selecting and running images, such as X-rays or MRIs. Detailed explanation of our methods is provided in ***Appendix F***.

Multiple Sites and Systems Complicate Adoption

Altarum and IA developed similar CDS tools, but implemented them in contexts that differed considerably in complexity. IA prepared a tool to work in a group of four EDs under the same organizational umbrella, all using one EHR system. Altarum built a tool to work across multiple outpatient clinical practices, which were loosely affiliated with one another and used a variety of EHR systems. The relative complexity of the second environment introduced adoption challenges because the CDS tool had to be agile enough to function effectively in different workflows and with existing technical systems that collected and output patient data in different ways. Multiple EHRs interfered with automation and required data standardization, compared with clincial settings with one uniform EHR and tighter controls on quality and use. Ultimately, Altarum had to use an intermediary system that regulated data sharing between participating EHR systems and the tool. The necessity of this intermediary system was likely the largest contributor to poor adoption of the tool.

CDS tools designed for relatively few implementation sites and EHR systems can be more tightly coupled with existing workflow and technology, thereby improving users' experiences and increasing the likelihood of adoption. When tools must be designed to accommodate complex environments, users' experience often suffers. More than 27 percent of the Altarum providers who responded to the 2015 provider survey described the tool as "somewhat hard to use," and 4 percent described it as "very hard to use. [1]" In contrast, none of the IA providers (in the less complex environment with a single EHR and four EDs) described their tool as hard to use.

Provider: *"Using the product is unbelievably easy... We went live just after Thanksgiving last year, and it was the smoothest go-live I've ever been a part of in terms of technology. Just because the program is fairly small in terms of what we do on a daily basis… but also because it was a really well thought-out implementation plan. MedCPU (the technology vendor) and IA had tons of people here for support once it went up… To be perfectly honest, this really doesn't affect our workflow that much. That's the beauty of this particular design. For us, anything that affects our workflow is a huge dis-satisfier. This program, by design, was made to minimally affect our workflow."* (Imaging Advantage)

Experience Matters

Experience of the awardees and their partners was key to laying the groundwork for adoption. Although neither Altarum nor IA had experience implementing CDS tools in the sites selected for the HCIA project, IA had previously set up teleradiology services in the hospitals where their CDS was deployed. This experience and familiarity helped project leaders better anticipate both challenges and facilitators of adoption, including dealing with time constraints, altering workflows, mandating use, and connecting users with developers. By comparison, providers affiliated with Altarum, the inexperienced

[1] Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. Prepared for the Centers for Medicare & Medicaid Services, 2015, December.

awardee, were unlikely to adopt their CDS tool owing to some preventable barriers, including the option to decline use of the tool and multiple login screens required to access it. IA's avoidance of these obstacles facilitated CDS adoption, even though they had a more complicated process. Experience with CDS tools and related innovations is particularly important in complex clinical settings with diverse technological systems and in multiple locations with more challenges.

Experienced vendors can also facilitate adoption by helping organizations both avoid and address barriers to use. IA's seasoned technical vendor developed a CDS tool that worked seamlessly with the EHR system, allowing easier movement between the application and the patient record, and thereby encouraging providers' use of the tool. The experienced vendor also provided an onsite support person who answered questions and concerns, provided training, and did problem troubleshooting at all sites using the tool. Altarum and its less experienced partners used a "train the trainer" model with, at best, mixed results.

Practice Guidelines Require Tailoring to the Clinical Context

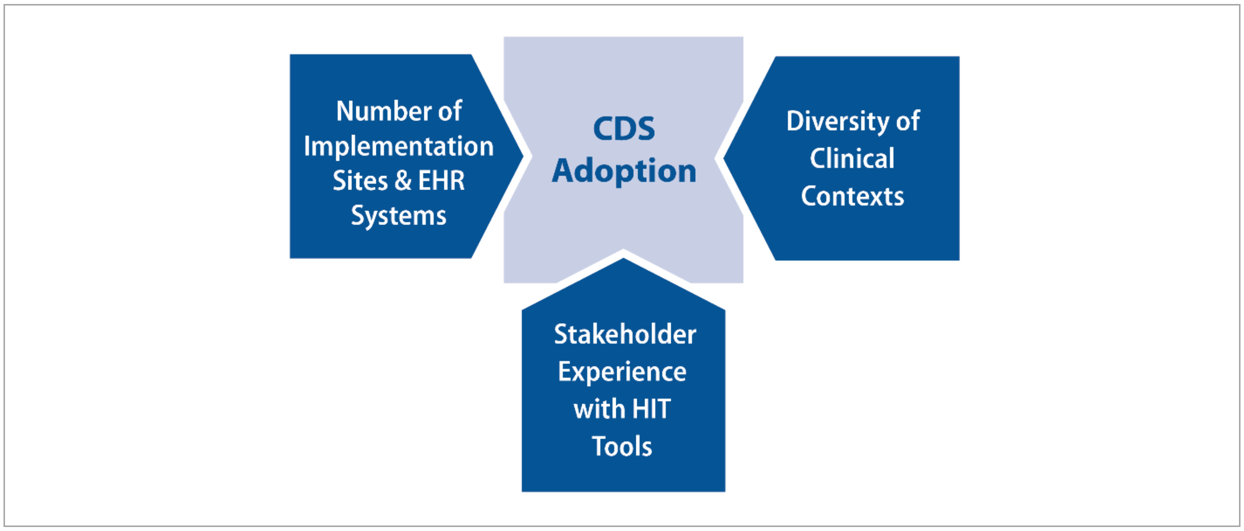
CDS tools are designed to help health care providers deliver the most appropriate care, but moving from clinical practice guidelines to evidence-based CDS tools remains complicated. Guidelines may not be written in ways that can be practically implemented during clinical encounters. Organizations designing CDS tools must take certain liberties in interpreting professional guidance and making it relevant for provider use, especially when tools are used in both generalist and specialty outpatient settings. Generalist and specialty providers serve different types of patients with varying needs, making it difficult to accommodate everyone with a single interpretation and implementation of the guidelines. Altarum's patients reflected such diversity, whereas IA's patients were relatively homogenous. Because Altarum's providers needed a tool suitable for a wide range of clinical encounters, Altarum had to invest more time in interpreting and tailoring than IA did. Altarum also enhanced the application search functionality to improve efficiency.

Progress report: *"Based on feedback from the user community physicians accessing the CDS tool report 20-25% of the time, the specific clinical situation is not present for selection. In particular, we found (through direct user feedback) that key barriers to adoption of the CDS tool were: the clinical content that professional societies provided was not robust enough to cover the majority of the pertinent reasons for requesting an imaging exam and the content provided can be redundant or provide conflicting recommendations to the ordering practitioner. Although we enhanced the application search functionality to be more dynamic and user-friendly, we are continuing to address where clinical content from the professional organizations is missing or may be ambiguous."* (Altarum)

Significance for Policy and Practice

Key contextual factors, including the number of implementation sites and EHR systems, experience with similar innovations, and the diversity of clinical settings, work together to influence provider adoption of CDS tools (see ***Figure 3-13***). Health care professionals aiming to improve adoption should consider how the implementation context might increase their salience.

Figure 3-13. Contextual Considerations for CDS Adoption



Note: CDS = clinical decision support; EHR = electronic health record; HIT = health information technology.

KEY INSIGHTS

- Complex implementation contexts, defined as the number of implementation sites and EHR systems, create barriers to adoption and ease of tool use.
- Stakeholders' experience with developing and implementing HIT tools supports adoption.
- The diversity of clinical contexts in which CDS tools will be used influences the extent to which they must be tailored to facilitate adoption.

3.5 Workforce Development

3.5.1 Staffing, Hiring, and Retention

Innovation staff members reported that they were generally satisfied and were advancing patient care with their new roles and responsibilities. However, awardees painted a picture of workplaces that struggled with burnout and turnover, including in positions so integral to innovations that programs slowed or became immobilized.

Building Organizational Capacity through New Roles

Awardees described capacity benefits from new team compositions. Specifically, awardees reported that new roles created a workplace with a more diverse, more capable staff. As a result, awardees described an improved ability to see more patients in a shorter timeframe *("we now have same-day or next-day appointments").* When staff with different jobs worked together, the combination seemed to push programs closer to their health care delivery and patient care goals.

For example, one awardee benefited from social workers who identified *"not just community resources, but resources in the system,"* (e.g., a financial counselor provided through a university to a clinic) that freed up provider time. Another awardee saw improved capacity from the combined expertise and responsibilities of a nurse and community health worker (CHW). As a diverse yet complementary team, nurses and CHWs may efficiently transfer and share trust and legitimacy for better patient care. One project leader described the value of the CHW to their team:

> ***The nurse educators leveraged their partnership with the CHW so they would be introduced by the CHW, which presented a level of trust in the community. Being able to see their patients at home and in the clinic and having the medical provider refer the nurse educator helped. (BAHC)***

Complexity, High Caseloads, and Unstable Funding Strained Organizational Capacity

Burnout and turnover. Complex organizational policies contributed to staff stress and exhaustion on the job. For both CHWs and nurses, burnout was linked to navigating health and related systems that connected patients with resources. CHWs specifically were stressed because they felt unprepared for certain tasks, especially field visits to manage severe clinical cases such as severely mentally ill and substance-abusing patients. Awardees that had to integrate and engage new staff also suggested that burnout occurred because of mismatches between people hired and the position's demands, especially for CHWs. According to these participants, this disconnect was rooted in poorly defined position requirements and expectations.

In contrast to burnout, awardees experienced turnover for reasons that had nothing to do with the innovation, such as leaving for maternity leave, wishing to go into practice, getting married and moving out of town, pursuing graduate school, retiring and obtaining better paying jobs. Some awardees noted that many vacated positions required exceptional traits and complex duties, so these staff and roles were the most difficult to identify and replace. Examples of these critical positions included analytical staff (e.g., health IT analysts, skilled programmers, *"industrial engineers that know about health care"*), support staff, and CHWs.

Staff numbers and funding. Many awardees said that grant funding and timelines shaped their approach to hiring and managing turnover. Some staff were hired only on a temporary or part-time basis. When budgeting for positions, awardees mentioned doing so only "through the end of the grant," not rehiring near the end of the project; for example, *"ECCHC will not pursue further recruiting efforts, given* *the grant period is near completion"*. In their hesitance to replace staff, some awardees said they used existing staff to *"make up the slack in the interim,"* thus reducing capacity to meet program goals.

New Work Policies and Conditions Improved Hiring and Retention

To build up staff numbers and availability and to reduce burnout and turnover, awardees suggested new models for their staffing policies, interview procedures, and working conditions.

Staffing policies. After facing turnover that slowed program implementation, some awardees describe a need for redundancy in key roles, including CHWs and health promoters (especially with relevant language skills), analysts, supervisors, and nurse practitioners. By having at least one person waiting in the wings, innovations may be more flexible and avoid the long delays caused by hiring, training, and integrating new staff.

Interview procedures. To fill key roles with the right people, awardees realized that they needed more rigorous interview processes. These steps included clearer, more detailed job descriptions, longer and more thoughtful vetting (e.g., written applications, tests, interviews, mandatory orientation sessions), and more explicit information about how new roles differ from more established health care positions. By describing in detail the good, the challenging, and the everyday work experience, awardees envision a system that could find and better retain appropriate candidates.

Working conditions. To protect against burnout and turnover, and especially to prevent key staff from leaving, awardees concentrated on improving working conditions and opportunities. Some awardees said positions that were short-term, temporary, and simply "a job" worked against keeping uniquely skilled staff. Participants argued that new roles, instead, should be marketed as careers, offer opportunities to move up/get promoted, focus on self-care, and pay good, competitive salaries. As a part of this rethinking for CHWs, awardees suggested developing support groups, comparing current pay with the going rate, considering where staff live and their cost of living, and asking whether wages are enough for what employees are asked to do.

Significance for Policy and Practice

KEY INSIGHTS

- Adopt staffing policies that promote redundancy in key roles.
- Create clear, comprehensive job descriptions.
- Include the everyday realities of the job in job descriptions.
- Use multiple recruitment activities (applications, tests, interviews) to vet eligibility and fit.
- Instead of jobs, offer careers: opportunities to move up, competitive salaries, support groups.

3.5.2 Training

Training develops staff who can implement new health care payment and service delivery models. Across many innovations, health IT professionals, patient navigators and CHWs, and patient providers experienced varied training processes, including training venue and mode of delivery.

We explored awardees' discussions of participants' experiences to identify if and how their chosen education models affected training. Based on opportunities and barriers for training venue (physical or virtual location), mode (training format or educational approach), and scheduling (duration and frequency), awardees recommended some improved processes. Results indicate that balancing new and varied training structures while allowing training to be flexible and integrated in existing institutional models may be a promising approach.

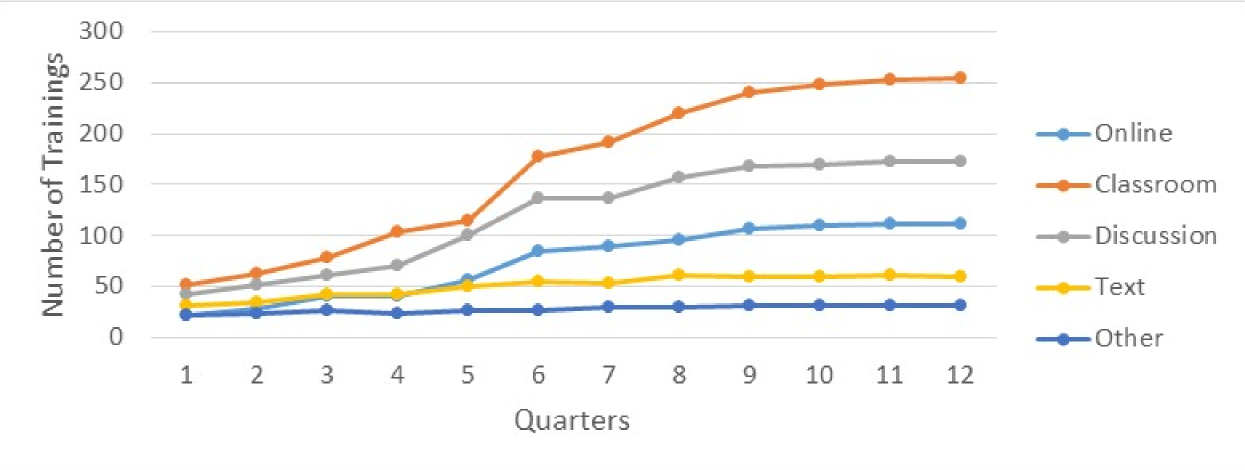
Effective Training Uses a Variety of Approaches

Training via various venues (classrooms, conference calls, hallways; virtually [video conferencing, webinars], in-person), modes (lectures, discussions, text) and on different schedules (e.g., informal and regular communication, month-long classes, quarterly seminars) helped improve program implementation. By giving staff many options to learn, overall communication about program needs increased. Trained staff could also get feedback regularly, which helped them improve service delivery.

Some awardees also said that different types of training and schedules helped reach even the busiest staff, such as CHWs and providers: *"Since the webinars were recorded and available on our website, CHWs who could not attend live webinars due to conflicts were still able to receive the training they needed."*

Figure 3-14 displays cross-awardee data for the number of planned, ongoing, and completed training sessions, by mode and/or venue, over time. These data reveal how awardees incorporated these lessons into their training schedules, so that trainings were available more frequently in a variety of modes and formats during the innovation.

Figure 3-14. Awardees' Growth in Training Regularity and Diversity over Time



(continued)

Figure 3-14. Awardees' Growth in Training Regularity and Diversity over Time (continued)

Cross-Awardee Findings													
Quarters	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Total**
Total number of trainings	168	199	249	281	348	481	500	563	607	618	629	631	5274

Training Advanced Through Organizational Networks

Some awardees folded training into existing organizational structures, such as current staff meetings, education systems, and even professional relationships or networks. By using colleagues and peers to conduct training, trainers may have preexisting goodwill and face time with trainees, and understand trainees' needs, experiences, and skills, two factors considered to be important for training implementation and uptake. For some innovations, folding HCIA training into existing organizational structures was a challenge. In academic settings, awardees said they had difficulty implementing and assessing student training because faculty (or trainers) did not collaborate *("faculty did not get together")*. In a clinical setting physicians had difficulty leaving their offices, so training in place was more effective.

Training Slowed by Inaccessible Online Systems

For many innovations, integrating training took time and tinkering, which in turn caused delays. Often these challenges related to institutional systems (especially online tools) that were *"antiquated," "difficult to manage,"* and not easily manipulated to include new training. As one awardee explained:

> ***"One challenge that we experienced with training was the need to align current, existing versions of the online training modules with the updates to the functionality availability in the service-level survey and the CHIS workspace."***
> **(U-Chicago)**

Even in cases where online venues could be adapted for training, however, some awardees warned that online training alone was not a solution for all necessary training. For CHWs specifically, one awardee clarified, *"…webinars are not ideal for conversation and practice. A cornerstone of CHW training is practice and participation."*

Training Essential to Preparing Community Health Workers

Several of the 13 awardees that employed CHWs reported that training was pivotal to implementation: it helped CHWs understand specific roles and responsibilities, strengthened their core skills and competencies, and provided opportunities to learn about health concepts and the health care setting. In addition, training increased CHWs' ability to perform organizational tasks such as using EHRs and other software for reporting and tracking implementation activities and learn about how to work professionally in a team environment and avoid burnout.

Awardees reported that the cornerstones of CHW training are "*practice and participation."* Yet, despite the breadth and depth of training offered in most sites, awardees recognized gaps existed in

CHW training. For example, they recommended ensuring that training curricula balance content with skills building. At one site CHWs wanted to have more training on what they needed to know to conduct productive interactions with clients and less emphasis on content (human anatomy, physiology).

Awardees also recommended training on how to supervise CHWs and clearly define CHWs' roles and competencies. They suggested (1) offering professional development, continuing education, and refresher courses that provide access to social support and other resources, and (2) developing a certification program to *"ensure consistent processes across all CHWs."*

Significance for Policy and Practice

KEY INSIGHTS

- Provide training where communication already happens (existing meetings, relationships, hallways).
- Offer diverse options for training venues, modes/formats, and schedules.
- Budget additional resources for integration and delays.
- Consider staff composition and workflow and how training can enhance moral and increase team building.

3.5.3 Integrating CHWs in Health Care Organizations

Despite the significant promise that CHWs hold for increasing care access, inclusiveness, continuity, and cultural competency, the nonclinical CHW role can create much confusion when new CHWs are integrated into an organization. Health care delivery is typically defined by clear industry-wide credentials, job titles, and work processes, and many organizations struggle to determine where and how CHWs might fit in. In this chapter we use qualitative interview and report data as well as provider survey findings to identify factors that help and hinder the integration of CHWs in health care organizations, so that patients and providers can better realize their benefits.

Organizations Must Prepare for CHWs

Awardees that effectively integrated CHWs first prepared their staff, including CHWs and other health care professionals, for CHWs' involvement in care. First, these awardees adopted thoughtful recruitment and training practices, so they could identify CHW candidates well-suited for their positions—in knowledge, skills, personality, and/or personal attributes (e.g., part of the patient population served). Thoughtful training and recruitment helped to ensure CHWs could provide the services planned and their skillset could also be standardized and described to other health care professionals to build awareness of and confidence in CHWs. Second, awardees prepared existing health care professionals for CHWs' arrival by offering information and education explaining how and why the CHWs would become part of the organization. This preparation laid the foundation for involving CHWs in care and collaborating across roles.

> **CHW:** *"They [providers] know that I am there. We did a presentation about what we do and how we can better assist the physicians and nurses. We have the freedom to go beyond the doctor's appointment. They don't have the time to call and we do. We can do home visits to make sure you are taking your medicine after you are discharged, doing the exercises, making the PT appointments and do those follow-up actions that doctors and nurses don't have time for."* (SEMHS)

Awardees further eased CHW integration by preparing the organization for CHWs' involvement in care: aligning work processes, tools, and technology with CHWs' responsibilities. For instance, a few awardees stated that CHWs must be physically located in high-traffic, visible clinical areas to remind their colleagues about CHW services and to facilitate direct interactions between CHWs and targeted patients. Tools such as EHR systems were also designed to help CHWs access and enter patient data; without them, organizations were forced to waste resources manually developing workarounds. Awardees struggled to monitor service delivery and facilitate communication between CHWs and other health care professionals when incompatible tools had been put into place.

CHW Staff Roles Must Be Defined and Valued

Staff roles and responsibilities must be clearly defined to prevent uncertainty and territorial conflicts when CHWs are introduced. We found that providers did not always understand CHWs' role and responsibilities. Likewise, some CHWs were not familiar with clinical roles, which affected their ability to work well with other members of the clinical team. Some providers said they were reluctant to work with CHWs because they thought CHWs' responsibilities, such as delivering home- or community-based care, psychosocial assessment, and linkages to community and social services, fell outside the boundaries of medical treatment. These clinicians did not see the value in nonclinical services or perceived that nonclinical services interfered with their own roles.

> ***CHW: "****We are still trying to get through to some of the providers. One provider doesn't see [the] point of why we are here, why we are doing this, and why we are going to their homes to see THEIR patients? We are not trying to take away your patients or give them diagnosis; we're going to educate, to tell them when they need to see the doctor. That's been a barrier with some of the providers."* (BAHC)

Awardees managed ambiguity by more clearly defining the roles of CHWs and other health care professionals, and how individuals in different positions should contribute to patient care. Some awardees used targeted communications and staff education methods to reduce ambiguity. Alternative strategies included developing clear job descriptions and protocols, creating informal divisions of labor between staff members, and hiring staff to liaise between clinical and nonclinical staff. When awardees took no action to reduce ambiguity, CHWs were often forced to explain and justify their role to other staff. CHWs described this process as time consuming and frustrating, and it detracted from their ability to deliver services.

CHWs, When Properly Supported, Reduce Clinician Burden

The prospect of reducing burden on existing staff encouraged CHW integration into care teams. Where existing staff had more work than they could manage, CHWs alleviated their burden by taking on non-medical tasks, including assessment, education, and addressing psychosocial needs and other barriers to care. ***Table 3-4*** shows findings from a survey that RTI administered to providers at 10 awardees. Providers involved in innovations with CHWs were significantly more likely to report that the program reduced the time they spent on care coordination, arranging clinical and social service referrals, and patient follow-up than providers without CHWs. By doing non-medical tasks, CHWs gave existing staff time to focus on clinical care and other productive activities.

To reduce the burden on existing staff, awardees likewise had to alleviate the burden on CHWs. In some innovations, CHWs had a limited understanding of how many patients they could realistically serve or how many services they could provide. Compounding these workload issues, several awardees did not initially hire staff to supervise or support the CHWs, which ultimately undermined CHWs' ability to manage patients and work effectively with other professionals. As awardees developed their programs, they eventually realized they needed to enlist senior staff to help CHWs manage their work more effectively. Beyond task management, these senior clinicians, frequently nurses or social workers, mentored and supervised CHWs, and delivered services that CHWs could not because of their limited medical training. Whereas CHWs were underqualified to deliver some services, they were overqualified for other work; to integrate CHWs, awardees often hired additional nonclinicians to complete basic tasks (e.g., patient paperwork, patient transport).

Table 3-4. Percentage of Providers Reporting That They Spend Less Time on Care Activities since Innovation Began, By Awardee Type[a]

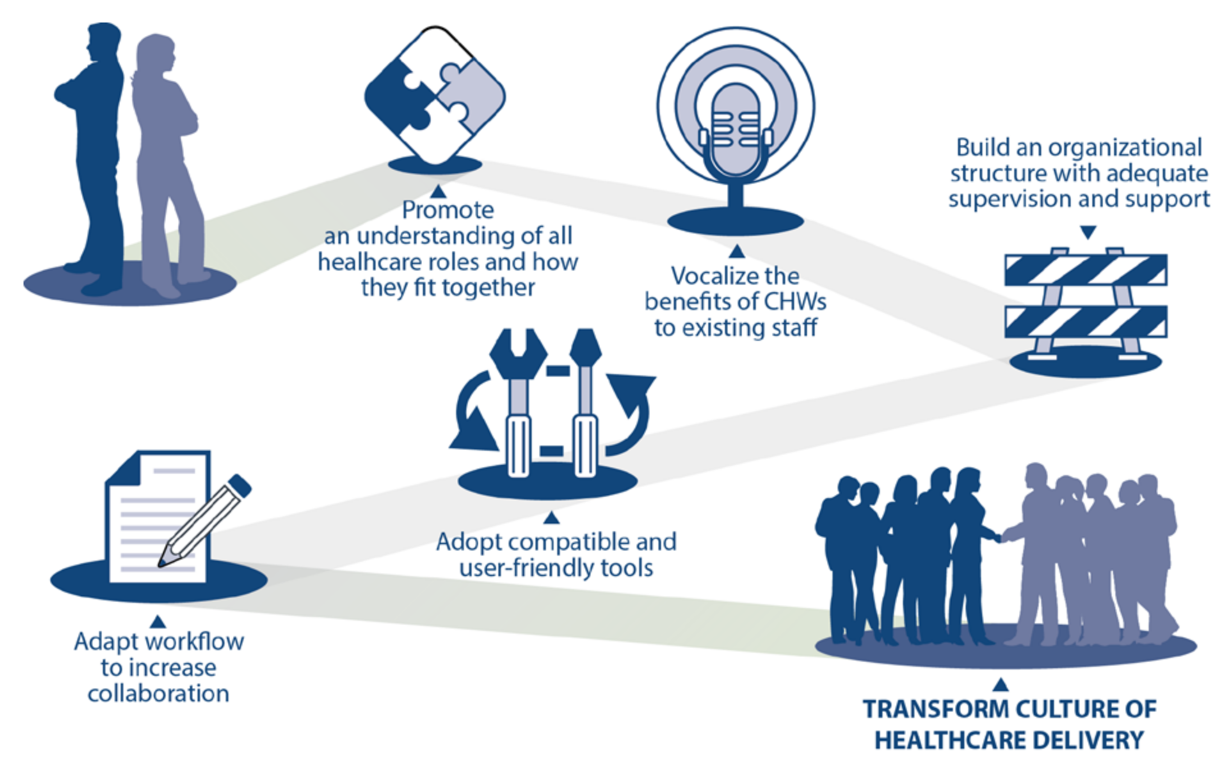
Activity	CHW Awardees	Non-CHW Awardees
Arranging clinical referrals and follow-up for patients	35% (n=74)	22% (n=34)
Arranging social service referrals for patients	52% (n=114)	23% (n=33)
Engaging in other care coordination activities	35% (n=77)	19% (n=29)

[a] Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. Prepared for the Centers for Medicare & Medicaid Services, 2015, December.

Significance for Policy and Practice

Figure 3-15 identifies steps health care organizations can take to effectively integrate CHWs and thereby transform health care delivery. These steps can be undertaken sequentially as shown, or occur simultaneously depending on organizational capacity. Organizations that follow these steps will have more clearly defined and valued roles for all staff, a team primed to work together effectively, and a culture conducive to cooperation and understanding.

Figure 3-15. Strategies for Facilitating CHW Integration



3.5.4 Provider Engagement Factors That Impact Provider Satisfaction

Engaging providers is critical for successful implementation of provider-based health care innovations. If providers are not engaged, they may feel overwhelmed, threatened, and frustrated, which lowers job satisfaction and impacts quality of patient care.[2,3] Research shows that "thoughtful[lly] engag[ing]" providers in organizational decisions and leadership roles is fundamental to a satisfied provider team.[4] This analysis examines how provider engagement influences provider satisfaction. When providers are satisfied with their work, patients benefit, and health care organizations may see economic benefits and more positive staff morale.[5]

To understand how provider engagement influences provider satisfaction, this analysis assesses provider engagement through four factors:

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[2] Binney, I.: Registered nurses' perceptions of work engagement and turnover intentions in a long-term care facility: A case study, Northcentral University Dissertation.177, 2014.

[3] Rosenstein, A.H.: Strategies to enhance physician engagement. J Med Pract Manage 31(2):113-116, 2015.

[4] Friedberg, M.W.: Factors Affecting Physician Professional Satisfaction and Their Implications for Patient Care, Health Systems, and Health Policy, RAND, 2013. Available at: http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR439/RAND_RR439.pdf

[5] Linn, L.S., Brook, R.H., Clark, V.A., Davies, A.R., Fink, A., and Kosecoff, J.: Physician and patient satisfaction as factors related to the organization of internal medicine group practices, Medical Care 23(10): 1171-1178,1985, Oct.

- provider involvement in the innovation (i.e., was leader, directly involved or indirectly involved) ;
- perceived patient benefit of the innovation;
- integration of the innovation into clinical workflow;
- sufficient resources to implement the innovation.

We examined how these factors individually and in combination influence provider satisfaction through a QCA. The main data sources for this analysis are the RTI-administered provider survey (administered in spring 2015).[6] The outcome of interest—provider satisfaction—was determined by asking providers how satisfied they were with the innovation. Providers that met the criteria for the outcome indicated that they were "extremely satisfied" with the innovation. For more information about the QCA methods used in this analysis see *Appendix F*.

Two Combinations of Engagement Factors Lead to Provider Satisfaction

Our analysis found that no one factor led to provider satisfaction; rather, combinations of factors produced that satisfaction. We identified two combinations that led to provider satisfaction among awardees:

1. A high level of provider involvement and perceived patient benefit, or alternately,
2. Provider access to resources, enhanced clinical workflow, and perception that the innovation benefitted their patients

These combinations generated greater satisfaction and ultimately encouraged greater adoption and maintenance of the innovation (see ***Figure 3-16***). These two combinations accounted for most of the providers who reported high levels of satisfaction with the innovation.

Figure 3-16. Two Pathways for Provider Satisfaction

[6] Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. Prepared for the Centers for Medicare & Medicaid Services, 2015, December.

Together, Provider Involvement and Perceived Patient Benefit Produce Satisfaction with the Innovation

Provider involvement is defined in this analysis as the provider's investment of time, energy, and resources, and the level of provider leadership and decision-making capacity in the innovation; perceived patient benefit refers to the provider's perception that the innovation was beneficial to the patient's overall health and/or health care. Taken together, these factors generated a perception that the innovation was a worthwhile endeavor for providers. For example, a subset of providers with high provider satisfaction reported that the innovation benefitted their patients and that their patients played an important role in the innovation. In some cases, innovations used CHWs to increase patients' access to nonclinical care resources, such as social services, allowing providers to focus on dispensing clinical judgment, which likely increased provider perception that the innovation benefitted their patients. One provider illustrated this effect when he said the network involving CHWs *"is a tool that has been useful for a group of patients" as it "has referred more patients" and "understands the value of home visits."* Another common theme of this subset of providers was the utilization of health information technology (HIT) tools that maximized providers' time spent with patients. More time allowed providers to better focus on their patients' acute health care needs. Involved providers had the opportunity to see how their work translated into better patient care, which, in turn, reaffirmed that they are doing meaningful work.

Together, Clinical Workflow Integration, Perceived Patient Benefit, and Adequate Resources Also Generate Provider Satisfaction

The second combination for producing provider satisfaction was an innovation well-integrated into clinical workflow, high levels of perceived patient benefit, and access to adequate resources. Integration of an innovation into clinical workflow made implementation easier because it reduced staff mental and administrative burden; simultaneously, perceived patient benefit further reinforced that the innovation had positive results. Adequate resources ensured that implementing providers feel supported in their new work. Taken together, these three factors fostered more seamless implementation and cultivated positive, emotionally rewarding work conditions. For example, one awardee offered accessible online training for providers with inconsistent schedules, multiple in-person platforms that promoted informal discussion of the innovation, and technical assistance as needed. The team-based training integrated the innovation into clinical workflow and helped providers feel empowered to provide better care to their patients. A nurse involved in the innovation remarked that *"now we are talking to patients one-on-one and saying 'this is the kind of doctor you need to see.' We never had time to work one-on-one with them; now we do."* When providers receive resources, such as critical training in a flexible format along with seamless workflow integration and understand the value of the innovation on patients' health care, they have high provider satisfaction.

Significance for Policy and Practice

Engaging providers through a combination of specific factors influences them to lead, collaborate, and deliver quality patient care. Giving providers access to tangible and intangible resources empowers them and generates greater satisfaction. Research shows that the more satisfied providers are with an innovation, the more successful innovations are in reaching their goals and influencing health outcomes. To increase provider satisfaction with an innovation:

KEY INSIGHTS

- Target specific combinations of provider engagement factors; no single factor is effective on its own.
- Involve providers in the innovation but also ensure :
  - providers understand the benefits of the innovation on their patients.
  - providers have sufficient tangible and intangible resources.
  - the innovation is effectively integrated into their workflow.

3.6 Implementation Effectiveness

3.6.1 Innovation Reach

Reach is a critical measure to determine whether innovations are implemented effectively and helps evaluators assess the potential impact of scaling innovations to various settings and populations.[7] For the evaluation, we define reach as the proportion of patients, providers, practices or health care systems participating in an innovation in whole or in part (i.e., they receive or participate in some service provided through the innovation). Measuring reach requires an in-depth understanding of the innovation's goals, its target population(s), and its recruitment and enrollment protocols. Each innovation has a unique measure of reach and, therefore, direct comparisons across awardees are not appropriate. However, reach is a useful metric by which to evaluate implementation effectiveness along with the factors that hinder and facilitate reach.

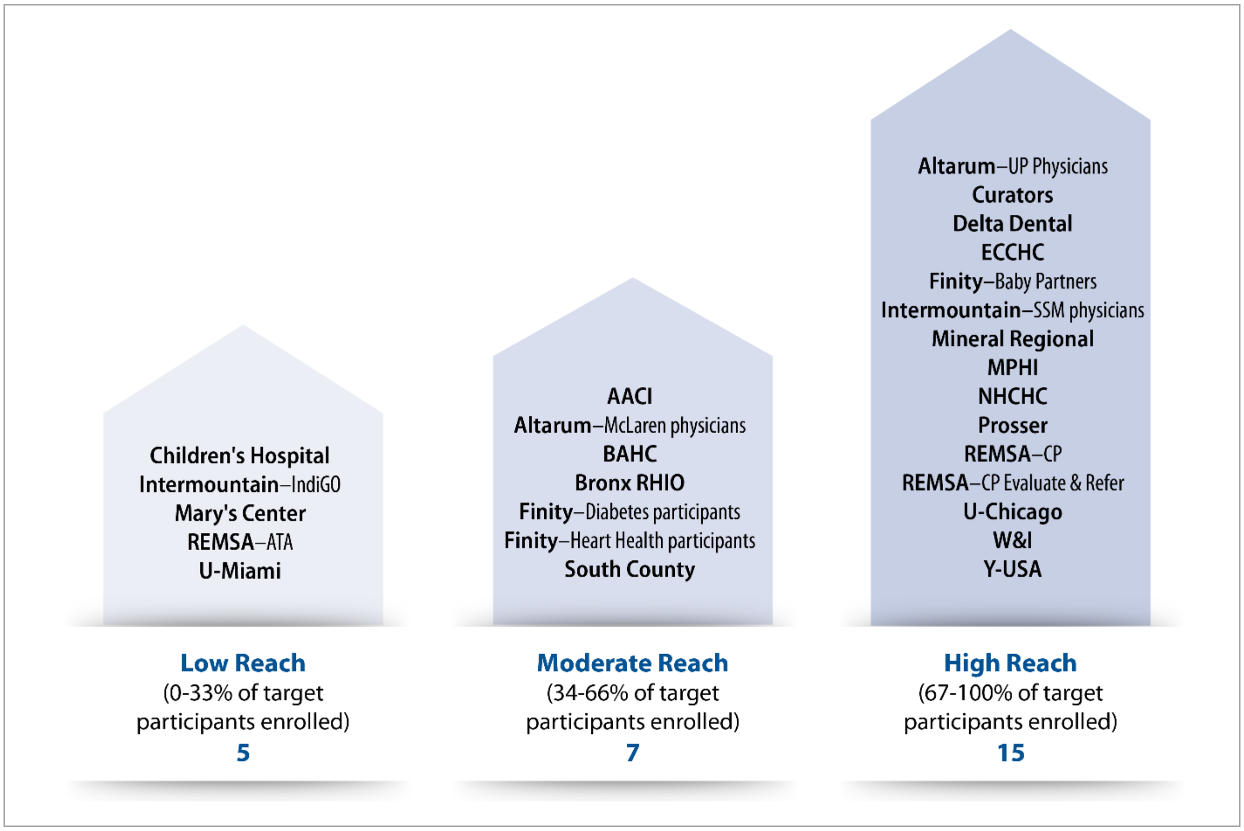
Over Two-Thirds of Awardees Achieved High Reach

Figure 3-17 shows the cumulative reach for all 24 awardees based on secondary data received through Q12. Over two-thirds of the awardees achieved a high-level reach (67% of higher)—reaching 67 percent or more of targeted participants for one or more components of their innovation efforts. A total of 171,200 participants were enrolled across awardees with high reach; 37,417 were enrolled across awardees with moderate reach; and 8,087 were enrolled across awardees with low reach. A total of 216,704 participants were enrolled across all awardees reflected in the figure. As indicated, not all target

[7] Estabrooks, P. A., and Allen, K. C.: Updating, employing, and adapting: a commentary on What does it mean to "employ" the RE-AIM model. Eval Health Prof, 36(1), 67-72, 2013. doi:10.1177/0163278712460546.
Proctor, E., Silmere, H., Raghavan, R., Hovmand, P., Aarons, G., Bunger, A., . . . Hensley, M.: Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda. Administration and Policy in Mental Health, 38(2), 65-76, 2011. doi:10.1007/s10488-010-0319-7.
Rojas Smith, L., Ashok, M., & Morss Dy, S., Wines, R. C., and Teixeira-Poit, S.: Contextual Frameworks for Research on the Implementation of Complex System Interventions. Rockville, MD: Agency for Healthcare Research and Quality, 2014. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK196199/.
Stetler, C. B., Legro, M. W., Wallace, C. M., Bowman, C., Guihan, M., Hagedorn, H., . . . Smith, J. L.: (2006). The role of formative evaluation in implementation research and the QUERI experience. J Gen Intern Med, 21 Suppl 2, S1-8, 2011. doi:10.1111/j.1525-1497.2006.00355.x

participants were patients. Two awardees' reach targets included physicians (IA and Altarum), and one included critical access hospitals (Mineral Regional). Evaluation findings suggest that identifying a specific and stable target population based on innovation components helped awardees achieve their reach targets (e.g., Curators and NHCHC).

Figure 3-17. Cumulative Reach for All Awardees



Trust is Essential to Successful Reach

Our findings show that to achieve successful innovation reach, programs must develop trust, knowledge, and support with those they serve. For several awardees, improving outreach and recruitment efforts meant going into the surrounding community, gaining their trust, and encouraging participation in the program innovation. For others, a central, common element may explain some implementation challenges these awardees faced: a breakdown of trust, or more specifically, knowledge-based trust. Mayer et al. (2005)[8] describes this notion of trust as "a function of individual perceptions of the competence, benevolence and integrity of a product, service, or person." This knowledge develops over time primarily when experience and knowledge gained from working with an individual or community supports a foundation of mutual trust, respect and understanding.

The key challenges awardees identified are participant enrollment and follow-up, staff (e.g., CHWs) and provider engagement, and leveraging partnerships. At the core of these challenges, mutual

[8] Mayer, R. C., Davis, J. H., & Schoorman, F. D.: An integrative model of organizational trust. Academy of Management Review, 20(3), 709–734, 1995.

lack of knowledge-based trust seemed to be lacking both from programs and the community. Factors that undermine knowledge-based trust and, in turn, innovation reach include:

- inaccurate assumptions about patient eligibility and catchment areas (i.e., lack of program awareness of the defined target population)
- lack of knowledge about the motivations of the target population to participate
- reliance on passive (rather than active) recruitment to enroll patients
- limited engagement of physicians and partners in the referral process

These challenges point to opportunities for to build the “trust factor” through needs assessments, focus groups, and surveys of participants, presenting data back to stakeholders (e.g., community forums, grand rounds, news outlets, and bulletins). Additionally, health entities can bring stakeholders to the table by diversifying their executive boards and/or advisory groups to include participants and providers (e.g., physician and nurse champions, community health workers, patients, caregivers, etc.).

Reach Is Not Simple to Define or Capture

Reach can be defined at the patient, provider organizational and system levels and, ideally, reach is directly aligned to the innovation’s intended target(s) of change. The main difficulty with conceptualizing reach at the patient level is distinguishing among the eligible, enrolled, and “exposed” patients (i.e., patients receiving some kind of service through the innovation). At a minimum, the evaluation requires data to estimate proportion of eligible patients who received a service so who was actually exposed or treated can be determined.

For Altarum, we defined reach at the provider-level as the number of providers trained to use HIT-enabled clinical decision support and data analytics tools as well the proportion of eligible providers trained and the proportion of trained providers using the tool.

Two organizational-level reach measure for workflow and process improvement/redesign innovations included the percentage of hospitals implementing workforce improvement projects (NEU) and the percentage of eligible critical access hospitals participating in an improvement partnership (Mineral Regional). Although neither of these innovations had specific patient reach targets, we sought to identify the number of patients who may have been exposed to the workflow and process improvements. This is a case of measuring reach at multiple levels within a single innovation.

Planning for Reach Measurement

The use of HIT (e.g., EHRs, mHealth solutions, patient portals, analytical capabilities, etc.) was an integral component of HCIA innovations. Successful participant reach and enrollment relied on HIT to more accurately capture and monitor participant data to identify (1) those eligible/targeted for the innovation (the denominator); 2) those enrolled and served by the innovation (the numerator); and 3) those potential opportunities for improving recruitment and reach.

Many awardees launched project data systems rapidly, which tested their capacity for capturing critical data elements for reach. For many awardees, the time and effort devoted to customizing the innovation to their EHR system(s) and the unique processes of different providers slowed the timeline for bringing on new clinical sites and referrals.

Some awardees did not understand the value of measuring reach and had not considered the necessary data requirements for reach in developing or modifying their data systems. These awardees received assistance from RTI, after which all but one successfully captured reach for one or more components of their innovation. The driver diagrams, a requirement of awardees' self-monitoring plans, were useful in identifying stages in the innovation where participant enrollment and reach could be maximized and captured. Even so, awardees wanted clearer guidance in the application stage about the evaluation data requirements. If awardees know (more precisely) what they intend to measure, the important groundwork is laid for capturing meaningful data to improve program- and patient-level impact.

Significance for Policy and Practice

KEY INSIGHTS

- Engage the community in ways that build trust: needs assessments, diversification of executive boards and advisory groups, presenting data to the community.
- Consider the various levels of reach (patient, provider, organizational, system) appropriate to the innovation; there is no one size fits all.
- Establish reach measures early on so data systems can be developed and adapted accordingly.

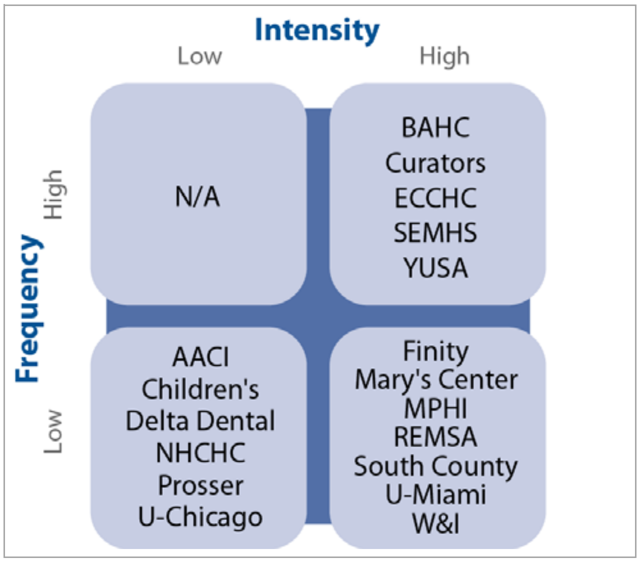
3.6.2 Innovation Dose

Effectiveness of an innovation is based both on enrolling a large proportion of the target population and on providing services to those enrolled. Although some awardees enrolled nearly all of their target population, not all of those enrollees received innovation services. Participants must get a sufficient dose of the innovation (i.e., intensity and frequency of services)—and dose can range from low to high. Intensity captures the degree of contact or engagement with participants; we examine it relative to frequency to better understand the potential impact of dose on patient outcomes. High-intensity services (i.e., health coaching, home visits, and telehealth services) are expected to affect participants' current health concerns more directly than low-intensity services (i.e., referrals to community resources, language services, and transportation). Low-intensity services involve less contact and, if provided with sufficient frequency, may reduce critical barriers to care. However, the impact of these services on health outcomes would not be as direct as that of higher-intensity services.

Half of Awardees Provided a High-Intensity Dose

We received dose data from 18 awardees, and we reviewed, categorized, and assigned an intensity score to each service that awardees provided to participants on a scale of low (1), moderate (2), or high (3) intensity based on the expected impact on participant outcomes. We categorized the frequency of each service as low (1-2), moderate (3-7), or high (8+). To arrive at awardee-level dose intensity and frequency, we averaged the intensity and frequency scores across all services provided by an awardee. Additional details on the methods used to standardize dose are in ***Appendix F***. The average awardee-level intensity score ranged from 1 to 3, with a mean of 1.9. The average awardee-level frequency score ranged from 1 to 3, with a mean of 1.6. We collapsed the awardee-level intensity and frequency scores into low (1–1.5) and high (1.6–3.0) for ease of interpretation.

Figure 3-18. Dose Frequency by Intensity



The results in ***Figure 3-18*** show that 12 awardees provided high-intensity dose and these were split between high and low frequency. For instance, BAHC provided a high frequency of primary care and intensive case management visits (i.e., high-intensity services). South County provided health coaching, a high-intensity service, at a relatively low frequency. Six awardees provided low-intensity, low-frequency services. For instance, AACI provided relatively low-intensity services (e.g., appointment assistance, assistance filling out forms, language assistance) at a low frequency. No awardees provided services that were low intensity, but high frequency.

Significance for Policy and Practice

KEY INSIGHTS	• Rate the intensity of services at the beginning of innovation and adjust the frequency as needed over time to increase the likelihood of affecting health outcomes.

3.6.3 *Pathways to Implementation Effectiveness: The Role of Organizational Characteristics*

For awardees to achieve better health and care and to reduce costs (i.e., achieve program effectiveness), they first must implement innovations effectively. That step depends on multiple awardee characteristics, such as organizational readiness for change, alignment of the innovation with the organizational values, and resources for change. An awardee may not have all of these characteristics, but can still implement the innovation effectively. Because we were interested in the different combinations of organizational characteristics that facilitated implementation effectiveness, we used QCA to capture the many pathways to achieve implementation effectiveness. QCA uses formal logic, a branch of mathematics, to examine combinations of factors (here, organizational characteristics) that lead to outcomes. This analysis examines three organizational characteristics: high-level leadership support, awardee priority for the innovation, and awardee history of the innovation. The methods used for the QCA and definitions of these constructs appear in ***Appendix E***.

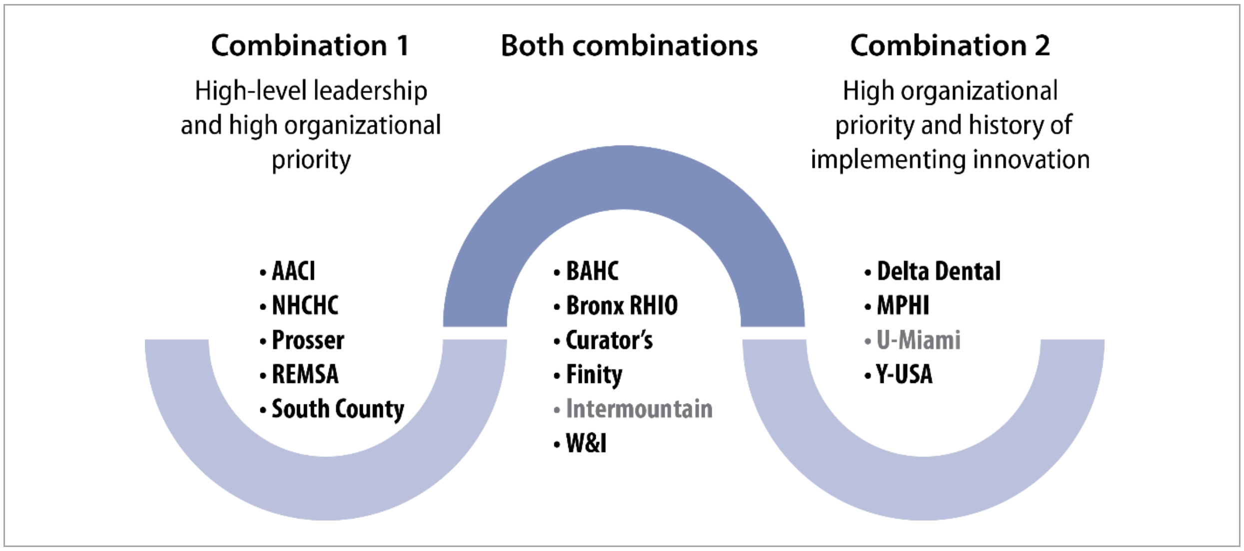
What Combinations of Organizational Characteristics Lead to Implementation Effectiveness?

Implementation effectiveness means that staff delivered the innovation as intended (or with modifications based on monitoring) to a substantial proportion of the targeted population in doses that were effective. Our analysis revealed two key combinations of factors that lead to implementation effectiveness most of the time:

1. Having high-level leadership support and a high organizational priority, and
2. Having a high organizational priority and a history of implementing the innovation.

We describe these combinations below. ***Figure 3-19*** displays the awardees who exhibited the combination of factors associated with implementation effectiveness; grayed-out awardees did not achieve the threshold rating for implementation effectiveness.

Figure 3-19. Awardees in Each Combination



Note: Awardees in grey demonstrated the combination(s) indicated but did not achieve high levels of implementation effectiveness.

Pathway 1: High-level Leadership Support and High Organizational Priority

Awardees in the first combination (strong leadership engagement and a high organizational priority) tended to have leaders who were directly involved in implementation, responded to the innovation's emerging needs, and had expertise or experience with the innovation (e.g., experience working with community health centers or knowledge of pediatrics). These awardees had organizational mandates to support implementation and defined HCIA activities as part of a longer-term change. Having high-level leadership and organizational priority for innovations can help staff see that the innovation is important to the organization and may also encourage longer-term changes in practice among staff.

REMSA's Path to Implementation Effectiveness

When strong leaders believe in a goal and support it, implementation effectiveness is likely. Regional Emergency Medical Services Authority (REMSA) wanted to improve care for patients with urgent medical needs by better connecting the emergency ambulance system to doctors, nurses, and other medical staff. They wanted to improve the health of people with congestive heart failure, chronic obstructive pulmonary disease, myocardial infarction, and other urgent conditions. REMSA's chief executive officer and chief medical officer believed in the project so much they even found money for the first 6 months of the innovation (before the award funding kicked in). Throughout, these leaders teamed up with their own staff (managers, supervisors, coordinators, and paramedics) and with medical partners in Washoe County, NV make the changes happen. They worked with local fire departments and the local health system to make the innovation part of everyday work. And REMSA leaders are keeping the improvements going by working with the state of Nevada to pass laws that sustain community paramedicine. They are also working to get reimbursement from Nevada Medicaid and private insurers to help pay for these new services. The innovation achieved high levels of implementation effectiveness because REMSA leaders believed in it, supported it, and made it a high priority.

Pathway 2: Organizational Priority and History with the Innovation

Awardees with high organizational priority and history with the innovation implemented innovations that aligned with their organizational mission or were consistent with ongoing activities and strategic plans. History with implementing similar innovations also meant that awardees had resources and partners to implement the HCIA innovation. Like the awardees in the first combination, this group of awardees' innovations matched well with long-term organizational commitments and priorities, making the innovation a part of existing priorities. Aligning innovation activities with existing organizational priorities also meant that implementation leaders did not need to generate new organizational support or create a culture change, but could rely on established missions and goals. Similarly, building on previous work meant that the awardee could rely on proven relationships and resources.

Y-USA's Path to Implementation Effectiveness

Y-USA's National Diabetes Prevention Program wants to help Medicare patients who are prone to develop diabetes (known as prediabetics). Y-USA and other YMCAs have a lot of experience with diabetes control programs and they made the innovation a priority—two reasons for high implementation effectiveness. One challenge was getting the innovation's new features—targeting older adults, understanding different Medicare plans, and working with health care providers to recruit participants—to be part of the existing program. The organization's leaders reached out to the community and to interested parties to recruit new prediabetic participants. Leaders told the 17 YMCAs that implemented the innovation they were responsible for its success. These top people, including the project director, were involved in all aspects of the project. When YMCAs struggled to get patients to participate, leaders worked with CMMI to allow Medicare Advantage beneficiaries to be eligible, which helped get more patients enrolled. The Y-USA CEO helped the local YMCAs develop new recruitment approaches tailored to their community. And the leaders got buy-in from partners like the American Medical Association, American Diabetes Association, and the American Heart Association. Because diabetes prevention has a long history at YMCAs and because top management made it a priority, this innovation reached a substantial number of patients who may now avoid developing diabetes.

Significance for Policy and Practice

KEY INSIGHTS

- Awardees need at least two organizational characteristics simultaneously to achieve implementation effectiveness:
  - High-level leadership support AND an organizational priority for the innovation
  - Organizational priority for the innovation AND a history of implementing similar innovations
- Awardees should consider implementing pilots to test innovations; these assess organizational support for a project and to identify potential challenges to rollout and maintenance of an innovation.

3.7 Innovation Sustainability

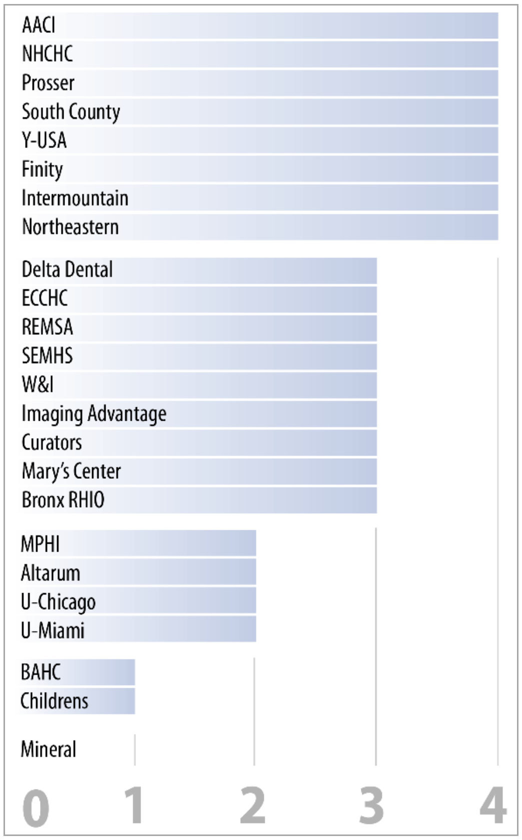
In the prior section, we discuss two successful pathways to implementation effectiveness that awardees used. This section assesses awardee sustainability: continually supporting and even expanding an innovation within an organization and across organizations. To one extent or another, all awardees shared the goal of sustainability. This section examines the extent to which all 24 awardees achieved this goal and the characteristics believed to play a role in sustainability. RTI relied on different methods and multiple sources of data from our evaluation—including a sustainability checklist, site visit interviews, *Narrative Progress Reports*, *Quarterly Awardee Performance Reports*, and findings from a qualitative comparative analysis (QCA)—to assess sustainability across awardees

3.7.1 Majority of Innovations Are Highly Sustainable

RTI developed a sustainability checklist (Appendix F) that captures the presence or absence of selected efforts associated with sustainable innovations, including planning, funding, partnering, workforce development, and other system-level changes. We scored all awardees using this checklist on a 5-point scale (0-4), where 0 indicated a low likelihood of sustainability and 4 a high likelihood (***Figure 3-20***). ***Table 3-5*** presents the factors assessed to determine sustainability scores for each awardee. The scores correlate to the number of sustainability factors present for each awardee. Our methods and data sources are fully described in Appendix F.

Two-thirds of awardees scored a 3 or a 4. Most (23) will maintain some of their current HCIA-related employees; 16 secured public or private funding, 5 secured reimbursement of services, and 2 sites sold their products/services. About half of all awardees developed formal sustainability plans, maintained partners, and had system-level changes—including adapting their organizational cultures and changing existing workflows. Mineral Regional, the awardee with the lowest sustainability score, created a nonprofit to seek funding for innovation activities after HCIA, but had not successfully secured funding, partners, staff, or system-level changes when the evaluation period ended.

Figure 3-20. HCIA CRP Awardees Sustainability Scores*



* Sustainability scores were fairly proportional across community health worker (CHW), health information technology (HIT), and CHW and HIT innovations.

Table 3-5. HCIA Awardee Sustainability Factors and Scores

HCIA Awardees	Funding	Partner-ships	Workforce Develop-ment	Integration/ Adoption	Sustain-ability Score	Notes
AACI	●	●	●	●	4	Innovation programs have been integrated and institutionalized at community colleges
NHCHC	●	●	●	●	4	10 of 12 sites made arrangements to continue CHW services through supplemental funding and/or partnerships
Prosser	●	●	●	●	4	Budget approved to continue essential elements of the innovation beyond funding period
South County	●	●	●	●	4	Awardee plans to maintain care coordination model beyond funding period

(continued)

Table 3-5. HCIA Awardee Sustainability Factors and Scores (continued)

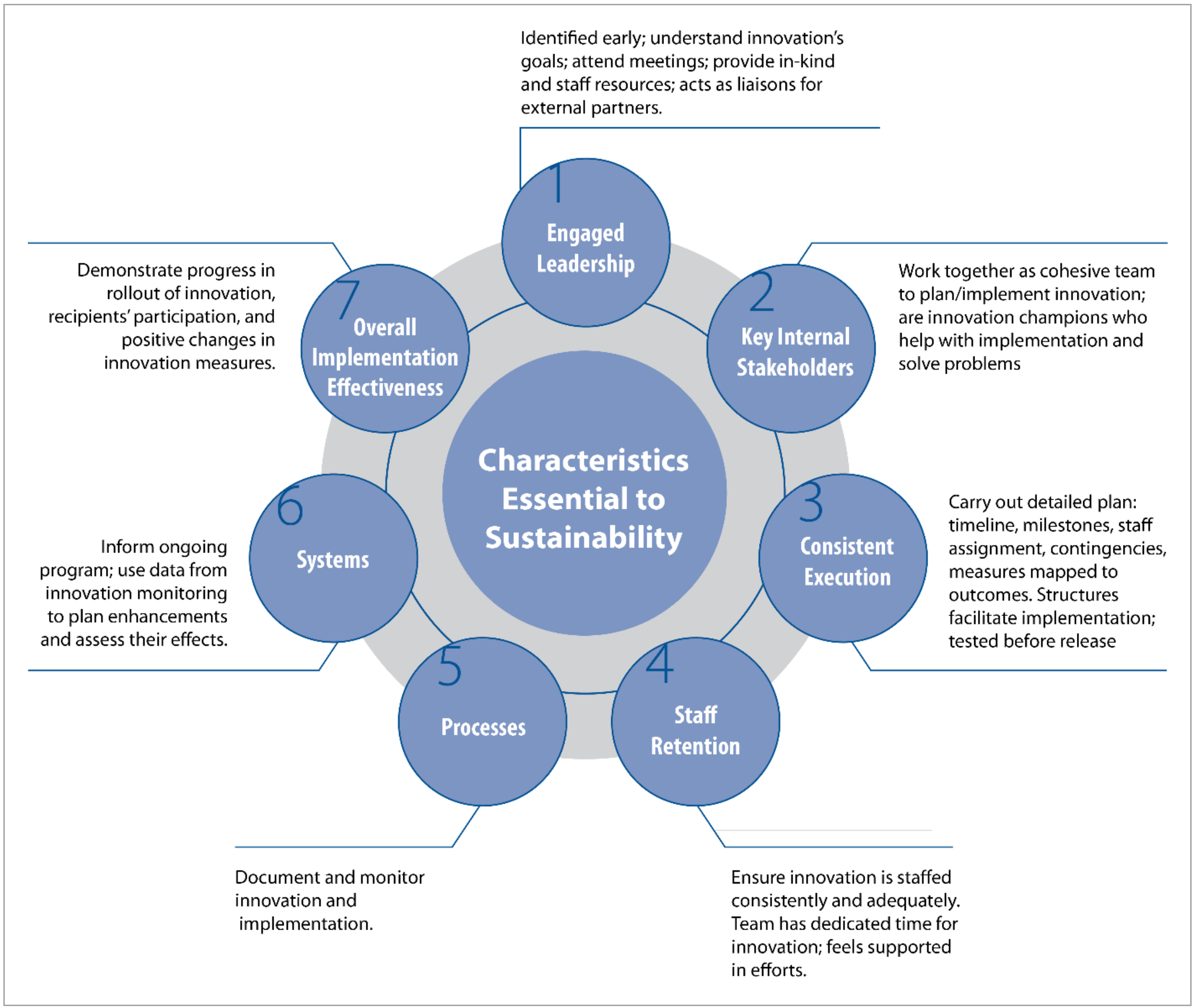
HCIA Awardees	Funding	Partner-ships	Workforce Develop-ment	Integration/ Adoption	Sustain-ability Score	Notes
Y-USA	●	●	●	●	4	Strong continuing partnership with community colleges
Finity	●	●	●	●	4	Partners valued innovation and continued to fund after HCIA award ended
Intermountain	●	●	●	●	4	Close integration of innovation with organizational strategy
NEU	●	●	●	●	4	Additional funding, new partnerships, and continued programs with partners
Delta Dental	●		●	●	3	Diverse sources of funding to support innovation
ECCHC	●		●	●	3	Continue to modify and develop microclinic model
REMSA	●		●	●	3	Identified additional funding sources for paramedicine services beyond funding period
SEMHS	●	●	●		3	Leadership identified ways to offset costs for service delivery by leveraging other staff to provide services
W&I		●	●	●	3	Strong organizational commitment and integration of program; additional funding uncertain as of August 2016
IA	●	●	●		3	Commitment from commercial partners to scale innovation to other markets
Curators	●		●	●	3	Success integrating LIGHT[2] permanently into workflow
Mary's Center	●	●	●		3	Lost and could not replace important Medicaid MCO partners
Bronx RHIO	●		●	●	3	Strong funding streams and continued workforce support
U-Chicago	●		●		2	Certain elements of CommRX will be sustained, but not in target HCIA population
MPHI		●	●		2	Key innovation components lack continued funding and payment model component was ineffective
Altarum	●		●		2	Workflow integration inconsistent across diverse EHR user base
U-Miami	●		●		2	Unclear which services remained and were supported after the HCIA funding ended
BAHC			●		1	Not able to achieve reimbursement for CHWs under existing payment models
Children's Hospital			●		1	Current staff maintained, but target population likely to change
Mineral Regional					0	No parts of innovation sustained

CHW = community health worker; EHR = electronic health record; MCO = managed care organization.

3.7.2 Seven Awardee Characteristics Essential to Sustainability

Our analysis revealed that awardees who scored as highly sustainable had a combination of seven characteristics described in ***Figure 3-21*** that distinguished them from awardees with lower sustainability scores. Awardees represented diverse innovations across care settings. These innovations focused on testing new approaches to care improvement from coordination of care to staffing and workforce development, to use of health IT, to redesign of workflow and care processes, and to decision support. The most significant finding from the sustainability analysis, then, is the consistency of these characteristics across all awardees, despite their heterogeneity.

Figure 3-21. Seven Characteristics Highly Correlated With Sustainability Scores



3.7.3 Strategies and Actions that Lead to Higher Sustainability

To better understand these characteristics, we analyzed coded data from awardee site visits. Analysis revealed differences in the strategies and actions that the higher-scoring (3-4) and lower-scoring (0-2) awardees took related to these characteristics; i.e., how engaged leaders differed in higher versus lower scoring awardees. Here we discuss selected examples of awardee strategies for involving key internal stakeholders, processes to document and monitor innovation implementation, and overall implementation effectiveness.

Although securing funds tended to drive awardees' ability to sustain innovations, awardees recognized that other strategies, such as involving key internal stakeholders, help offset costs and modify organizational infrastructures to better accommodate innovations. For instance, higher-scoring CHW awardees who engaged early with internal stakeholders had better CHW integration. NHCHC partnered with other programs that found funds to integrate CHWs into existing programming and hospitals who supplemented the cost of the CHWs. Awardees with lower sustainability scores also recognized the importance of engaging key internal stakeholders; however, some employed this strategy later in innovation implementation. A lower-scoring CHW awardee, BAHC, started discussions with key internal stakeholders near the end of the award and only later realized that internal partnerships were necessary to integrate and sustain CHWs.

Awardees often encountered obstacles that required modifying their approach to innovation implementation. Clear processes for documenting and monitoring innovation implementation helped awardees adjust innovations and improve their effectiveness. For example, Curators, a higher-scoring awardee, discovered it was not correctly identifying patients who might benefit from the innovation. Working with physicians and leaders, Curators altered its documentation and reporting processes to improve the match rate between patient needs and provider services. Although low-scoring awardees also had documentation and monitoring processes, they could not always react quickly enough to monitoring information. One HIT awardee thoroughly documented the processes of their innovation; however, they did not realize until later in implementation that low use of HIT was limiting innovation reach and that they should have responded sooner. Responding quickly to monitoring information is an important aspect of documentation and monitoring processes.

Awardees stressed the importance of demonstrating overall implementation effectiveness; that their innovations were cost-effective and improved processes and outcomes in target populations. One high-scoring awardee was able to show leadership how the innovation reduced high-cost events such as admissions, readmissions, observation stays, and ED visits. As a result, leadership decided to support the innovation beyond HCIA funding. In contrast, some lower-scoring awardees struggled to reach their target population and demonstrate impact. For example, Altarum implemented its innovation as intended but did not attain goals for reaching the target population. As one awardee commented,

> ***"We did everything we were supposed to do from the contractual and implementation standpoints. We reached out to the doctors and sent patients to their offices to show them how to use the tool. (In) the quarterly meetings I have with physicians we discussed utilization. From that standpoint we've done everything. The only thing we have not been able to meet is usage of the tool. The makeup of our organization is not unique but hinder progress. The majority are private physicians, not hospitals alone. Nothing mandates that they use the tool. To improve engagement, I think they should have to use the tool to have membership in the organization."***

The factor analysis and supporting qualitative data review revealed clear sustainability characteristics that apply to all awardees. Not surprisingly, the combination of strong leadership, active partners, capable and empowered team members, consistent execution, processes and systems to track progress, effective implementation, and reliable funding increase awardees' ability to sustain innovations. In addition, the qualitative data further suggest that higher-scoring sites (and thus more likely to be sustainable) are more agile and responsive to internal and external changes effecting their innovation.

Awardees represent diverse innovations across care settings. These innovations focus on testing new approaches to care improvement from coordination of care to staffing and workforce development, to use of HIT, to redesign of workflow and care processes, and to decision support. The most significant finding from this analysis, then, is consistency of sustainability characteristics, despite this heterogeneity.

Sustainability is critical for several reasons. As the results of the first 3 years of the HCIA evaluation show,[9] many awardees were not able to demonstrate significant changes to key outcomes of interest to CMS: total costs, changes to ED visits, hospitalization and rehospitalizations. By sustaining these innovations, CMS may have the opportunity to support longer-term follow-up analysis, and better understand the extent to which certain innovations may improve cost, quality, and patient experience.

3.7.4 Significance for Policy and Practice

KEY INSIGHTS

- Understand that seven characteristics were consistently associated with greater sustainability across diverse innovations.
- Use the seven characteristics to assess the prospects for sustaining an innovation early in the design and planning phases.
- Look for evidence of agility in future awardees; support innovations in organizations that are able to track progress and quickly adapt their innovation.

3.8 Summary Cross-Awardee Conclusions

Overall, 14 HCIA Community Resource awardees met one or more goals of smarter spending and better care. Most awardees reached over two-thirds or more of their targeted participants, and half provided high-intensity services. When delivered more frequently, these high-intensity services appear to be more effective in controlling blood pressure in hypertensive patients over time. Many patients enrolled

[9] Rojas Smith, L., Amico, P., Goode, S., Hoerger, T., Jacobs, S. and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2015. Prepared for the Centers for Medicare & Medicaid Services, 2015, December.
Holden, D. J., Rojas Smith, L., Hoerger, T., Renaud, J., and Council, M.: (2014, October). Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2014. Prepared for the Centers for Medicare & Medicaid Services, 2014, October. https://downloads.cms.gov/files/cmmi/HCIA-CommunityRPPM-FirstEvalRpt_4_9_15.pdf

in the innovations received recommended care. However, the overall effect on the goal of achieving healthier people remains inconclusive because minimal health outcomes data were available.

The awardees' workforce development and implementation experiences offer useful lessons and insights for future health care transformation initiatives. Health care personnel such as CHWs, data analysts, and systems engineers can drive innovation with careful attention to staffing policies, hiring procedures, and workplace conditions. Engaging providers is critical to any health care innovation; however, involvement alone is insufficient—they must be given adequate resources, see a benefit to their patients, and experience minimal disruption to their workflow. A fair number of awardees encountered initial and ongoing difficulties because they had not anticipated the types of administrative infrastructures and the time required to implement the innovation, so the importance of upfront planning cannot be overstated.

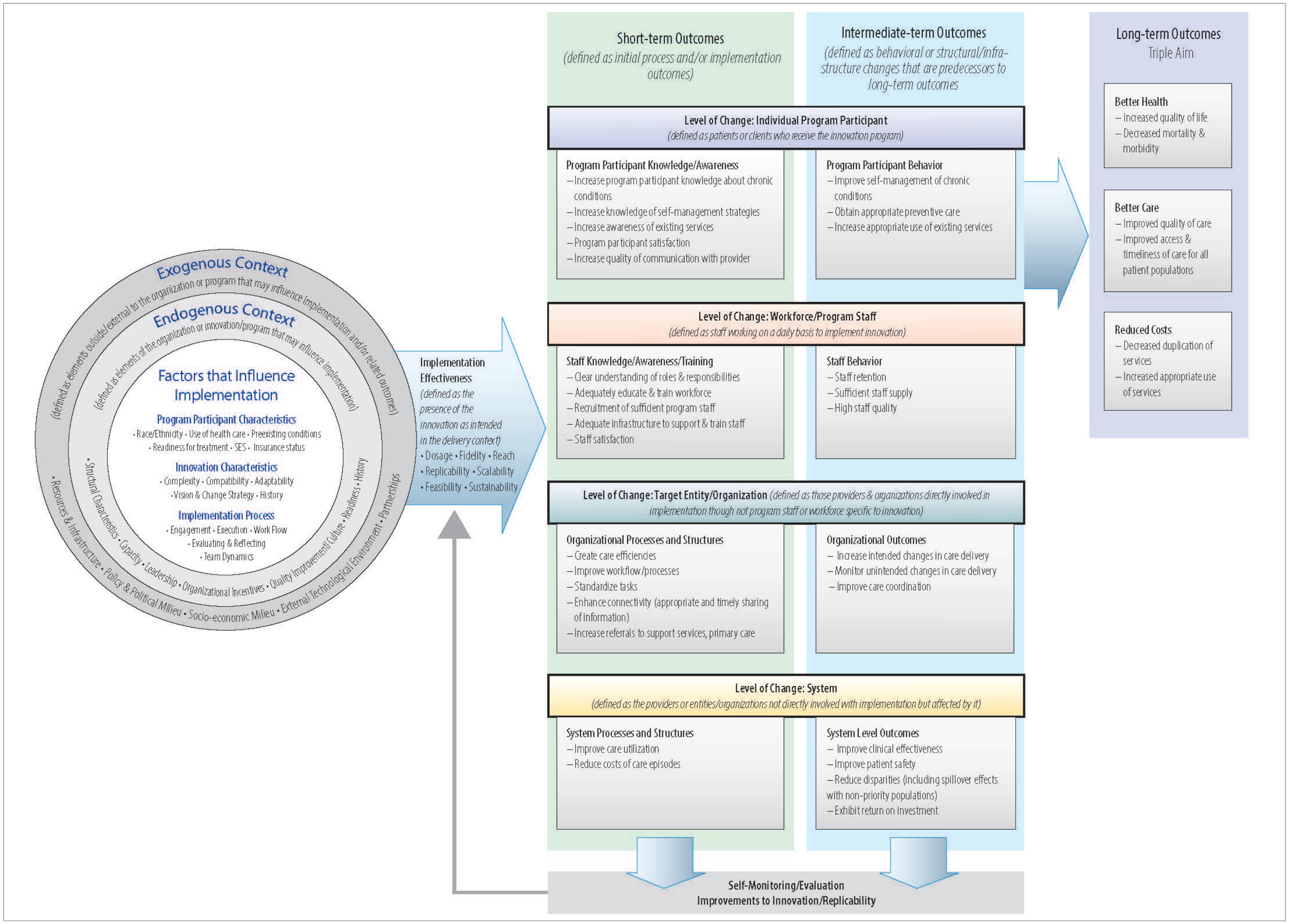
Likewise, the impact of leadership was evident both in the effectiveness of implementation and sustainability of the innovation. Awardees with strong leadership obtained the necessary resources for start-up and maintenance, engaged key partners and stakeholders, and ensured the innovation was an organizational priority. The majority of innovations were highly sustainable and had secured additional funding, reimbursement for services or were able to expand a product to a new market.

Appendix A

HCIA Community Resource Evaluation Framework

Figure A-1 presents the conceptual framework that articulates how the HCIA innovations may produce intended impacts on spending and utilization. The number of elements is large because of the diversity and complexity of the innovations evaluated. This framework suggests that exogenous and endogenous context of the awardee influences key aspects of the intervention and its implementation. These contextual and implementation factors may in turn influence the quality or effectiveness of implementation. The degree of implementation effectiveness can produce short and intermediate term outcomes for patients, providers, organizations and systems that may ultimately lead to changes in spending and utilization. We used this framework to guide the evaluation of each awardee recognizing that some elements would be more relevant or feasible to capture than others.

Figure A-1. HCIA Community Resource Evaluation Framework



Source: Rojas Smith L, Amico P, Goode S, Hoerger T, Jacobs S, Renaud J. Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Second Annual Report. Research Triangle Park, NC: Prepared for the Centers for Medicare & Medicaid Services, 2016.

Appendix B

Technical Methods

Technical Appendix B.1: Calculation of the Four Core Measures

Changes in This Report

We have continued to update the analyses as additional data become available. For Medicare analyses, we included patients who were enrolled prior to December 31, 2015, and we present Medicare claims data through December 31, 2015. We updated Medicaid analyses for awardees that had new data available in Alpha-MAX files or directly from awardees. Since the previous annual report, we added Medicaid analyses for the following awardees: Bronx RHIO, ECCHC, Mineral Regional, NEU, REMSA, and South County. Previously, Medicaid analyses for these awardees were not possible because the sample size was too small or sufficient Medicaid Alpha-MAX files were not available in the Chronic Conditions Data Warehouse until now.

We have also implemented a procedure to find additional Medicare beneficiaries in the Chronic Conditions Data Warehouse by name, date of birth, and gender. Previously, we identified innovation participants in the Chronic Conditions Data Warehouse using Health Insurance Claim Numbers (HICNs) and social security numbers (SSNs) provided by the awardee. For awardees with a high fraction of missing or invalid HICNs and SSNs in their finder file, we looked for an exact match in the CCW Medicare names database based on the participant's name, date of birth, and gender in the county(ies) or zip code(s) of the innovation. This was implemented for AACI, BAHC, Bronx RHIO, NEU-CHA, REMSA-NHL, SEMHS, and South County.

Core Measures

As part of a broad assessment of health care innovations, the Center for Medicare & Medicaid Innovation (CMMI) is assessing the impact of its programs, including those funded specifically by HCIA, on four core measures. The four core measures are

- health care spending per patient,
- hospital inpatient admissions,
- hospital unplanned readmissions, and
- emergency department (ED) visits not leading to a hospitalization.

We anticipate that CMMI programs will slow the increase in health care spending, reduce hospital admissions, reduce avoidable hospital readmissions, and prevent unnecessary ED visits. We report these measures for all awardees so that the collective impact of the awards can be assessed. As discussed in the individual awardee chapters, some innovations did not focus on these measures. Other awardees' innovations targeted specific conditions (e.g., imaging, diabetes) and may have significant impacts on spending, admissions, unplanned readmissions, and ED visits for the targeted conditions, but no statistically detectable impact at the aggregate level because the targeted conditions represent only a small fraction of total spending, inpatient admissions, and ED visits.

Measures were calculated through analysis of Medicare and Medicaid fee-for-service (FFS) claims. Because of differences between Medicare and Medicaid patients in age, other demographic variables, and disease status, we report results separately as follows.

- **Health care spending per patient**. For Medicare beneficiaries, health care spending per patient included expenditures for persons enrolled in the Part A and Part B FFS program in at least one of the post-enrollment quarters. The variable focused on Medicare FFS spending, so Medicare managed care (Part C) services were excluded, as were beneficiary copayments. Medicare Part D prescription spending was also excluded due to the large number of Medicare beneficiaries that do not have Part D coverage with available claims data. Spending was reported on a per-person per-quarter basis. If a beneficiary was not enrolled for every month in a quarter, spending (except for hospital inpatient spending) was prorated to a quarterly basis based on the number of days enrolled during the quarter. Because hospital inpatient admissions were both rare and expensive, spending was not prorated for hospital inpatient spending. Prorating was also not performed for beneficiaries who died during a quarter.

  For Medicaid beneficiaries, health care spending per patient was reported for FFS beneficiaries. Beneficiaries are only included in the analysis for spending (and the other measures) during periods when they are enrolled in Medicaid.

- **Hospital inpatient admissions**. This variable measures hospitalization, the single most expensive component of health care spending. Patients kept overnight in observation beds are excluded from this measure. Inclusion criteria for the analysis are the same as for spending. Hospital inpatient admissions are not prorated based on the number of days eligible during the quarter. The mean quarterly admission rate per 1,000 patients is reported.

- **Hospital unplanned readmissions**. Hospital unplanned readmission rates serve a dual purpose in evaluating HCIA impacts. Readmissions add to the costs of a prior hospitalization, and they often reflect a problem in the care provided during the first admission. All-cause readmissions are defined as follow-up admissions to any short-term acute general or long-term care hospital within 30 days of a discharge from another hospital of the same type. We ignore multiple admissions within 1 day of an initial admission because they often represent transfers between hospitals. We define index hospitalizations that begin during the quarter and follow each index admission for 30 days, even when the follow-up period extends beyond the end of the quarter. For Medicare analyses, we exclude patients under age 65 to be consistent with the Medicare Readmissions Reduction Program. We also exclude patients who died during hospitalization, were admitted to a prospective payment system (PPS)-exempt cancer hospital, who left against medical advice, were admitted for primary psychiatric diagnosis, rehabilitation, or medical treatment of cancer. Planned admissions (e.g., transplants) are not counted in the measure. Inclusion criteria for the analysis are the same as for spending. The unplanned readmissions rate equals the number of unplanned readmissions divided by the number of index hospitalizations during the quarter. Quarterly mean readmission rates per 1,000 admissions are reported.

- **ED visits**. ED visits are sometimes viewed as a symptom of the inability of the community's health care system to provide adequate preventive and ambulatory care visits. We report an all-cause ED visit rate that excludes ED visits resulting in an inpatient admission (which presumably represents unavoidable visits) and includes overnight ED visits without an inpatient admission. Inclusion criteria for the analyses are the same as for spending, and ED visits are also subject to the same prorating formula as for spending. The mean quarterly ED visit rate per 1,000 patients is reported.

Currently, complete Medicare claims are available through the end of December 2015. Medicaid claims for awardees were taken from Alpha-MAX dataset contained in the Chronic Conditions Data Warehouse. Alpha-MAX availability varied by awardee and depended on the state reporting the data, as discussed in the individual awardee sections.

Technical Appendix B.2: Propensity Score Matching, Comparison Group, and Regression Methodology

Changes in This Report

The HCIA awardees do not randomly assign individuals to treatment groups (TGs) and comparison groups (CGs). Thus, evaluating the impact of each innovation is challenging because we cannot compare outcomes for nearly identical persons, as we would under random assignment. To overcome this challenge, we employ several methods to obtain CGs. For the majority of the awardees, we use a standardized propensity score matching (PSM) methodology. For awardees that provided information on a logical comparison population (e.g., eligible nonparticipants), we use that group as the CG. Other HCIA innovations were provider-focused. For these innovations, we selected similar providers and compared the patients of providers participating in the innovation to the patients of providers not participating in the innovation. The selected CG acts as the counterfactual case for the innovation group, providing a proxy for the innovation group's outcomes in the absence of treatment or the innovation. All awardee-specific methodologies are described below.

We have continued to refine CGs in the third annual report. Previously, we applied the rolling entry matching (REM) approach to Medicare analyses. We expanded the REM methodology to Medicaid analyses in this report. For BAHC, MPHI, REMSA-NHL, and U-Chicago, many beneficiaries experienced a spike in spending (and underlying utilization) at the time of enrollment in the innovation. To better match this initial spike in spending and utilization among the innovation group, we added 90 days (one quarter) to each TG beneficiary's original enrollment date (or visit date), so that the original first calendar quarter of the innovation is now considered the last calendar quarter prior to the innovation. Because our PSM method uses spending and utilization variables in the calendar quarter prior to the innovation to match beneficiaries, we end up selecting CG beneficiaries who had similar spending and utilization patterns in the calendar quarter when the spike appears.

We have incorporated new regression models since the previous annual report. We now include readmissions regressions for awardees with sufficient numbers of inpatient admissions and readmissions. Readmissions are only relevant for persons with an inpatient admission; consequently, although most awardees have sufficient observations to support regression analysis for spending, inpatient admissions, and ED visits (where the sample size was based on all participants), only larger innovations have sufficient observations for readmission regressions (our approach for readmission regressions is described later in this appendix). Inpatient admission and ED visit models have been changed from linear probability models to negative binomial count models. The advantage of using count models is that they estimate a person's total number of inpatient or ED visits in a quarter, whereas linear probability models only estimate whether the person had at least one admission or visit in the quarter. This advantage is especially important for ED visits where participants make multiple ED visits in quarter. Using count models, innovation effects are interpreted as the change in the number of inpatient admissions or ED visits, rather than the change in the probability of any inpatient admission or ED visit. Last, we now report annual and cumulative innovation period estimates in addition to quarterly estimates. These effects are presented, on average, per beneficiary and for the innovation as a whole. Yearly and cumulative effects are a combination of the quarterly effects, weighted by the number of beneficiaries in each quarter. When aggregating quarterly effects, it is important to account for the number of beneficiaries that generated the quarterly estimate because the number of beneficiaries decreases in later innovation quarters. Estimates based on fewer beneficiaries are less reliable and should have less influence than estimates based on more beneficiaries.

Standardized Propensity Score Matching Methodology

In the absence of random assignment, PSM is a method for selecting a CG that was observably similar to an innovation group at baseline. The propensity score model generates a propensity score, a summary measure of each individual's likelihood of receiving the innovation according to certain baseline characteristics. After the propensity score was estimated, innovation group individuals are matched to CG individuals with the closest propensity scores. By matching innovation and comparison individuals, we select the CG most likely to be similar to the innovation group in the baseline period. Any changes after the baseline period can be attributed to the innovation.

The HCIA propensity score model matches innovation beneficiaries to comparison beneficiaries with similar demographics, disability status, end-stage renal disease (ESRD) status, chronic condition burden, ED and inpatient utilization, and spending in the baseline period. (The variables used in the propensity score model for each awardee are described below). We match innovation and comparison beneficiaries using 1:variable caliper matching with replacement. Treatment beneficiaries are matched with up to three comparison beneficiaries within the caliper distance (described below). Once the matches were made, we use the Chronic Conditions Data Warehouse claims files to calculate the four core descriptive measures and run difference-in-differences regressions for TGs and CGs.

The first step in the PSM procedure was to limit the sample of potential comparison beneficiaries to those enrolled in FFS Medicare and living in the innovation's relevant geographic area or to eligible nonparticipants. For some innovations, enrolled beneficiaries must meet additional requirements such as having a threshold number of ED, hospital, or outpatient visits. Additional restrictions on CGs were made on an awardee-specific basis and are discussed in each awardee's report.

To estimate the propensity score, we use a logistic regression model to regress treatment status on the variables described in the awardee-specific treatment and control-balancing tables. One limitation of PSM is that the number of matching variables in the propensity score model was directly proportional to the number of treatment beneficiaries. If the number of treatment beneficiaries was small, then the number of matching variables also needed to be small for the logistic model to converge (i.e., approximately one matching variable for every 10 treatment beneficiaries). For relatively small innovations, treatment beneficiaries were matched to comparison beneficiaries using relatively few variables, potentially resulting in greater differences between the TG and CG than for awardees with large innovations.

After the propensity score model was estimated, we matched each treated beneficiary with up to three comparison beneficiaries who had the closest propensity score within the caliper, calculated as 20 percent of the standard deviation of the logit of the propensity score. In rare cases, treatment beneficiaries had no comparison beneficiary within the caliper. In these cases, no adequate comparison beneficiary existed and unmatched treatment beneficiaries were not included in the subsequent analyses. Comparison beneficiaries were matched with replacement, meaning one comparison beneficiary could be matched to multiple treatment beneficiaries. When conducting the descriptive and outcome regression analysis, we used weighting to account for the number of times a comparison beneficiary was used as a control as well as the variable number of comparison beneficiaries across treatment beneficiaries. Matching based on the propensity score rather than all covariates was sufficient to produce unbiased estimates of treatment effects.[1] PSM allowed us to estimate the average treatment effect on the treated (ATT), which was the impact of the innovation on those who participated.[2]

Rolling Entry Matching

We used a technique called REM to precisely match TG beneficiaries to CG beneficiaries with similar characteristics, spending, and utilization in the period immediately prior to the TG beneficiary's enrollment in the innovation. This pre-enrollment matching was important because some TG beneficiaries incurred a spike in spending (and underlying utilization) in the quarter prior to enrollment in the innovation. Often, this spike in spending (utilization) made them eligible for the innovation. The REM approach allowed us to match TG to CG beneficiaries who experienced a similar spike in spending (utilization), improving the similarity of the CG to the TG on observed characteristics in the period prior to enrollment in the innovation.

The CG methodology aimed to select similar CGs and TGs during the baseline period using both the calendar quarter prior to enrollment in the innovation and the four preceding calendar quarters. Because the HCIA awardees enrolled TG beneficiaries over time, the baseline period was different for each enrollee. For example, a TG beneficiary who enrolled in an innovation on April 1, 2013, had a baseline period ending on March 30, 2013, but a TG beneficiary who enrolled in an innovation on January 1, 2014, had a baseline period ending December 31, 2013. The challenge was to select CG and TG beneficiaries with similar characteristics in the baseline period. However, CG beneficiaries did not have a date of enrollment and, therefore, they could theoretically have different baseline periods depending on their matched TG beneficiary.

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[1] Rosenbaum, P., and Rubin, D.B.: The central role of the propensity score in observational studies for causal effects. Biometrika. 70(1):4155, 1983

[2] Imbens, G.: Nonparametric estimation of average treatment effects under exogeneity: A review. Review Econ Stat. 86(1):1–29, 2004.

To overcome this challenge, we used REM to introduce multiple versions of a CG beneficiary into the data prior to estimating a propensity score. We created one version of each potential CG beneficiary for each innovation quarter. Thus, if TG beneficiaries enrolled in the innovation over five calendar quarters, we created five versions of the potential CG beneficiary with each version corresponding to one of the enrollment quarters. This CG beneficiary has five different baseline periods, corresponding to the five different enrollment quarters. Because we observed the enrollment date of the TG, we created variables containing spending and utilization in the baseline period. Although CG beneficiaries did not enroll in the innovation, because we created a version of the CG beneficiary for each possible quarter of enrollment, each person had a corresponding "enrollment" quarter and a corresponding baseline period. We could populate the variables containing last quarter's spending and utilization as well as the spending and utilization in the preceding four calendar quarters for the beneficiaries in each corresponding enrollment period.

For example, if enrollment in the innovation began in the first quarter of 2013 (2013 Q1) and continued through the end of 2014 Q1, we created five versions of each CG beneficiary. The first had an enrollment quarter of 2013 Q1 and last baseline quarter spending from 2012 Q4; the second had an enrollment quarter of 2013 Q2 and last baseline quarter spending from 2013 Q1; and so on through 2014 Q1. ***Table B.2-1*** provides an example of the data layout for two TG beneficiaries and one CG beneficiary with five versions.

Table B.2-1. Example Data Layout

Beneficiary ID	Treatment Group	Enrollment Quarter	Last Baseline Quarter
1	1	2013 Q1	2012 Q4
2	1	2013 Q2	2013 Q1
3	0	2013 Q1	2012 Q4
3	0	2013 Q2	2013 Q1
3	0	2013 Q3	2013 Q2
3	0	2013 Q4	2013 Q3
3	0	2014 Q1	2013 Q4

One key advantage of the REM approach is worth emphasizing. Previously, the propensity score equation included previous annual spending for the beneficiary, where annual spending was a variable in the Master Beneficiary Summary File (MBSF) produced on a calendar year basis (e.g., 2012 annual spending, 2013 annual spending, etc.). As a result, the lag between data availability and enrollment dates could vary for TG beneficiaries depending on when in a year they enrolled in the innovation. For example, annual data from 2013 would be used for a beneficiary who enrolled in the first quarter of 2014, and the same annual data for 2013 would have been used if the person had instead enrolled in the fourth quarter of 2014. For the second case, any acceleration in spending in the quarter prior to enrollment would not be reflected under the previous approach. This approach led to some cases where the spending match between TG and CG beneficiaries appeared reasonable 1 year before enrollment but began to diverge in the quarters prior to enrollment. By including lagged quarterly spending in our new approach, we now reflect the most recent pre-enrollment spending, allowing us to achieve better matches. In addition, we include lagged spending in the four quarters prior to the quarter before enrollment to control for historical spending trends as well as the recent trend (quarter prior to enrollment). These changes do have computational costs—we must now calculate quarterly and lagged annual spending from individual claims instead of getting annual spending per beneficiary already calculated in the MBSF. This includes calculating quarterly and lagged annual spending for all potential CG beneficiaries, not just those who are ultimately matched with TG beneficiaries.

Currently, we only apply the REM approach to Medicare claims. For Medicaid, we do not yet have enough periods of innovation data from Alpha-MAX to warrant REM.

Propensity Score Matching

The TG beneficiaries (one per TG beneficiary) and the CG versions (e.g., five per CG beneficiary) were then included in a PSM process, with logistic regression estimating the probability of participation given selected beneficiary characteristics including last-quarter-before-enrollment spending and the lagged annual spending prior to enrollment. The probability of participation was mechanically lower using the REM methodology because the CG size was multiplied by the number of versions of each person. Propensity scores were estimated for each TG beneficiary and CG version.

Although the logistic equation was estimated following the usual PSM approach, matching was done in several stages to ensure that (1) as many TG beneficiaries as possible received at least one good match, and (2) a CG beneficiary acted as a control in a single enrollment quarter. To meet both requirements, we developed an algorithm that assesses the matches between TG beneficiaries and CG versions. We first allowed multiple CG versions to match with each TG beneficiary, as long as the match was within a specified caliper. Second, if a CG beneficiary was only matched to TG beneficiaries in a single enrollment quarter (i.e., only one of the CG beneficiary's versions was matched, although they may match to more than one TG beneficiary in the same quarter), we retained those matches. Third, we considered the matches for CG beneficiaries who had versions that match TG beneficiaries across multiple quarters. The algorithm chose the set of CG matches (one quarter per CG beneficiary) that resulted in the most TG beneficiaries with at least one good match. Finally, for each TG beneficiary, we limited the maximum number of CG matches to three because prior research showed negligible gains in efficiency beyond three matched controls.[3]

Weighting

After applying the matching algorithm, we generated weights for the matched control beneficiaries. TG beneficiaries received a weight of 1, whereas CG beneficiaries received a weight that accounts for two factors: (1) up to three CG beneficiaries may match with each TG beneficiary (e.g., 1/3,

[3] Haviland, A., Nagin, D.S., and Rosenbaum, P.: Combining propensity score matching and group-based trajectory analysis in an observational study. Psych Methods. 12(3):247, 2007.

2/3 or 3/3); and (2) each CG beneficiary may match more than one TG beneficiary. The weights were incorporated in the balancing tables, summary descriptive tables, and regression analyses.

Post-Matching Diagnostics

For awardees whose CG was selected using PSM, we provided two diagnostic tests to assess the similarity of the treatment and matched control groups.

First, we provided a balancing table that includes the mean and standard deviation of the variables included in the propensity score model. The balancing table also calculated absolute standardized differences in the variables between the TG and CG before and after matching. Comparison of the absolute standardized difference before and after matching allows the reader to assess the improvement in comparability of the unmatched and matched CG, respectively. An absolute standardized difference of 0.10 or lower is considered an acceptable level of balance between TG and CG.[4,5]

Second, we present kernel density plots showing the distribution of propensity scores in the TG and matched CG. In contrast to the balancing table, which assesses differences between the TG and CG one variable at a time, the kernel density plot is a comparison of the propensity score, which is a summary measure of all covariates included in the propensity score model. Overlap in the density implies that the propensity score estimates are similarly distributed in the TG and CG.

The following sections describe specific details of the propensity score models implemented for each awardee.

Asian Americans for Community Involvement

Medicare

Potential CG members included Medicare beneficiaries enrolled in FFS Medicare Parts A and B living near AACI. Patients who visited AACI since the innovation started enrolling patients in October 2013 were excluded. Comparison beneficiaries must have lived in California from 2010 to December 2014, and lived in Santa Clara County for at least 1 month while the innovation enrolled beneficiaries.

PSM was used to select a CG of Medicare beneficiaries similar in observable characteristics to innovation Medicare beneficiaries. The PSM model adjusted for the following potentially confounding factors: age, number of chronic conditions, percentage disabled, percentage ESRD, percentage male, percentage white, payments in calendar quarter prior to enrollment, number of dual-eligible months in the previous calendar year, and total payments in the second, third, fourth, and fifth calendar quarters prior to enrollment. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

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[4] Austin, P.C.: Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. Statist. Med. 28:3083–3107, 2009.

[5] Austin, P.C.: An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behavioral Research. 46(3):399–424, 2011. PMC. Accessed on 2 June 2, 2016.

Altarum Institute

Medicare

The Altarum innovation was directed at changing physician behavior; therefore, we compared the patients of physicians who participated in the innovation to the patients of physicians who did not participate.

We used PSM to select CG physicians with similar characteristics as innovation physicians. The innovation group includes physicians who received ImageSmart training. The set of potential CG physicians included those who were not targeted for training by Altarum. The pool of innovation and potential comparison physicians was limited to those with overlapping specialties to ensure overlap in the types of physicians in the innovation and comparison groups. Innovation and comparison physicians were matched using a logit model predicting the likelihood that a physician was enrolled in the innovation as a function of the number of Medicare patients a physician had, average patient spending, the average number of chronic conditions per patient, the age distribution of patients, patient gender, patient race, ESRD and disability status of patients, and practice specialty. Physicians were matched 1:1 with replacement using a caliper. Because some physicians in the TG did not use the ImageSmart system, the results should have an intent-to-treat interpretation.

After completing PSM, we selected Medicare FFS patients who saw an innovation or matched comparison physician after the physician received ImageSmart training.[6] The first innovation quarter (I1) for innovation and comparison patients was determined by the first date that the patient saw a physician after that physician/practice received ImageSmart training.

Medicaid

As in the Medicare analysis, innovation physicians included those who received ImageSmart training and comparison physicians included those not targeted for training by Altarum. The same set of innovation and comparison physicians were used for the Medicare and Medicaid analyses. The sample contained Medicaid FFS patients who saw an innovation or matched comparison physician after the physician received ImageSmart training. The first innovation quarter (I1) for innovation and comparison patients was determined by the first date that the patient saw a physician after that physician/practice received ImageSmart training.

Ben Archer Health Center

Medicare

Potential CG members included Medicare beneficiaries enrolled in FFS Medicare Parts A and B living in southern Doña Ana County (excluding the city of Las Cruces) and the counties surrounding Doña Ana County (Luna, Sierra, and Otero Counties) during the innovation launch.

[6] CG physicians did not receive ImageSmart training. Each comparison physician was assigned the same training date as the matched TG physician.

We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of dual-eligible months, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Medicaid

Potential CG members included Medicare beneficiaries enrolled in FFS Medicare Parts A and B living in southern Doña Ana County (excluding the city of Las Cruces) and the counties surrounding Doña Ana County (Luna, Sierra, and Otero Counties) during the innovation launch.

We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid FFS in the calendar quarter prior to the innovation did not have Medicaid claims data for this quarter, and were matched using demographic variables only. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Bronx Regional Health Information Organization

Medicare

The potential CG included Medicare beneficiaries enrolled in FFS Medicare Parts A and B during the innovation period living in or near the Bronx, New York City, who gave consent for use of their patient information to Bronx RHIO.

We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each innovation treatment beneficiary with up to three CG beneficiaries with the closest propensity score.

Medicaid

The potential CG included FFS Medicaid beneficiaries in or near the Bronx, New York City, who gave consent for use of their patient information to Bronx RHIO.

We used PSM to select comparison group beneficiaries with characteristics similar to innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, enrollee status, number of months of Medicaid eligibility during the calendar year prior to the innovation, number of ED visits, number of inpatient stays, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid FFS in the calendar quarter prior to innovation did not have Medicaid claims data for this quarter, and were matched separately using demographic variables only. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Children's Hospital and Health System

Medicaid

Children's Hospital provided data on its innovation participants and nonparticipants. We defined nonparticipants as those who, despite agreeing to participate in Care Links, did not receive any home visit or who declined services. We did not use PSM to match participants and nonparticipants because the claims data files provided by Children's Hospital did not contain adequate demographic information to enable us to conduct PSM.

Curators of the University of Missouri

Medicare

Potential CG members included FFS Medicare beneficiaries living in the 23 innovation counties in central Missouri. We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Medicaid

Potential CG members included FFS Medicaid beneficiaries living in the 23 innovation counties in central Missouri. We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, enrollee status, number of months of Medicaid eligibility during the calendar year prior to the innovation, number of ED visits, number of inpatient stays, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in

Medicaid FFS in the calendar quarter prior to the innovation did not have Medicaid claims data for this quarter, and were matched separately using demographic variables only. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Delta Dental Plan of South Dakota

Medicaid

To construct the CG, we used PSM to identify Medicaid FFS patients living in counties in South Dakota (where the American Indian reservations are located) who did not participate in the Delta Dental innovation. We selected CG members under 21 years of age from the same counties to minimize variation in sociodemographic characteristics that may influence service use and expenditures. Program participants and CG members were matched using a logit model predicting the likelihood of program participation as a function of age, a binary indicator for whether the individual was an infant, sex, a binary indicator of whether the individual was Native American/American Indian, disability, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Eau Claire Cooperative Health Centers

Medicare

We constructed a CG of Medicare beneficiaries enrolled in FFS Medicare Parts A and B living in Richland County, South Carolina, during the innovation launch. We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, and total Medicare payments in the calendar quarter prior to the innovation. We matched each TG beneficiary with up to three CG beneficiaries whose propensity scores were within a predefined distance.

Medicaid

We constructed a CG of FFS Medicaid beneficiaries living in Richland County, South Carolina, during the innovation launch. We used PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. We estimated two separate models for beneficiaries with and without Medicaid in the previous calendar quarter. For beneficiaries with Medicaid in the previous calendar quarter, innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, number of ED visits in the calendar quarter prior to the innovation, and total Medicaid payments in the calendar quarter prior to the innovation. For beneficiaries without Medicaid in the previous calendar quarter, innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, and dual Medicare-Medicaid status. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Finity Communications

Medicaid

Baby Partners

Potential CG members included eligible mothers who did not receive incentives from the Baby Partners program. We used PSM to select comparison group beneficiaries (i.e., nonparticipants) with characteristics similar to innovation group beneficiaries (i.e., participants). Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of mother's age, number of children, maternal preexisting conditions (e.g., cerebrovascular or cardiovascular disease, central nervous system–related or gastrological disease, genital, infectious, metabolic, psychiatric, pulmonary, skeletal, or skin-related disease), substance abuse, number of months enrolled, maternal risk score, and existence of maternal complications. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Diabetes

For each claims outcome measure, we compared eligible participants to eligible nonparticipants in the Diabetes Management program. We used PSM to select comparison group beneficiaries (i.e., nonparticipants) with characteristics similar to innovation group beneficiaries (i.e., participants). Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, number of months the patient was a member of the HPP plan, risk score, number of chronic conditions, and gender. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Heart Health

For each claims outcome measure, we compared eligible participants to eligible nonparticipants in the Heart Health LifeTracks program. We used PSM to select comparison group beneficiaries (i.e., nonparticipants) with characteristics similar to innovation group beneficiaries (i.e., participants). Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, number of months the patient was a member of the HPP plan, risk score, number of chronic conditions, and gender. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Imaging Advantage

Medicare

We used PSM to select Chicago-area comparison hospitals with characteristics similar to the hospitals enrolled in the innovation. Treatment and comparison hospitals were matched using a logit model predicting the likelihood that a hospital participated in the innovation as a function of number of beds, race composition of patients, total patient days, the fraction of hospital revenue from Medicaid, the fraction of hospital revenue from Medicare, and the resident-to-bed ratio. Each innovation hospital was matched with the comparison hospital having the nearest propensity score. Since the last report, Norwegian-American Hospital replaced Skokie Hospital as the comparison for MacNeal Hospital because Skokie merged with another hospital during the innovation period. The merge affected the claims reporting for Skokie Hospital; therefore, it was no longer an appropriate counterfactual.

Because the IA innovation focused on imaging services in the ED, our claims analysis focused on patients who were seen in the ED. For each treatment and comparison hospital, we generated a list of all patients who visited the ED during the quarter. In each quarter, the sample size was the number of unique patients who visited a treatment or comparison hospital. Costs and utilization for patients visiting the ED in the comparison hospitals were then compared with the corresponding variables for patients who visited the ED in the treatment hospitals.

Medicaid

We used PSM to select Chicago-area comparison hospitals with characteristics similar to hospitals enrolled in the innovation. We used the same set of comparison hospitals for the Medicaid analysis that we used for the Medicare analysis.

Intermountain Health Care Services, Inc.

Medicare

Potential CG members included Medicare beneficiaries enrolled in FFS Medicare Parts A and B living in the state of Utah during the innovation launch, who were not enrolled in the innovation. The primary focus of the claims analysis was on patients participating in the IndiGO, shared savings model (SSM), and hot spotting (population management) components of Intermountain's innovation. Because of the complementarity of the IndiGO and SSM components, we divided the innovation beneficiaries into four groups for analysis: those enrolled in both IndiGO and SSM (Cohort 1), those enrolled in IndiGO only (Cohort 2), those enrolled in SSM only (Cohort 3), and those enrolled in hot spotting (Cohort 4).

We used PSM to select CG and TG beneficiaries with similar characteristics for Cohorts 1, 2, and 3. Because few patients were enrolled in hot spotting at the time of the report, we were not able to construct a CG for this cohort. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of chronic conditions, total payments in second, third, fourth, and fifth calendar quarters prior to enrollment, number of ED visits in calendar quarter prior to enrollment, number of inpatient stays in calendar quarter prior to enrollment, and total Medicare payments in the calendar quarter and calendar year prior to enrollment. We matched each TG beneficiary with up to three CG beneficiaries whose propensity scores were within a predefined distance.

Mineral Regional Health Center

Medicare

Mineral Regional is a network of 25 critical access hospitals (CAHs). Montana has a total of 48 CAHs, so the CG included the 23 nonparticipating CAHs in the state. Because our analysis centered on patient outcomes, we assumed that users are randomly distributed across CAHs so that people would use the CAHs nearest to them.

Medicaid

The CG consisted of Medicaid beneficiaries who used one of the 23 nonparticipating CAHs in Montana. Three of the comparison CAHs were located in American Indian reservations and did not serve any Medicaid FFS beneficiaries. As in the Medicare analysis, we assumed that users were randomly distributed across CAHs so that people used the CAHs nearest to them; therefore, no PSM was performed.

Michigan Public Health Institute

Medicare

To construct the CG, we used PSM to identify individuals located in the same three Michigan counties (Saginaw, Muskegon, and Ingham) where the innovation was conducted, who had two or more chronic conditions, and who were not enrolled in the innovation. We selected CG members from the same counties where the innovation was conducted to minimize variation in sociodemographic characteristics that may have influenced service use and expenditures. Program participants and CG members were matched using a logit model predicting the likelihood of program participation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Medicaid

To construct the CG, we used PSM to identify individuals located in the same three Michigan counties (Saginaw, Muskegon, and Ingham) where the innovation was conducted, who were enrolled in FFS Medicaid, and who were not enrolled in the innovation. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age and a binary indicator for adult, gender, race, disability, dual Medicare-Medicaid status, number of months of dual status, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicaid payments in the calendar quarter prior to the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Northeastern University

Medicare

To construct the CG for Cambridge Health Alliance (CHA), we used PSM to identify individuals living in the Greater Boston area (Middlesex, Essex, Norfolk, Plymouth, and Suffolk Counties) who were not enrolled in the innovation. We selected CG members from the Greater Boston area to minimize variation in sociodemographic characteristics that may have influenced service use and expenditures. Program participants and CG members were matched using a logit model predicting the likelihood of program participation as a function of demographics (age, gender, and ethnicity), number of dual-eligible months, health characteristics in the calendar year prior to enrollment (number of chronic conditions, disability status, and ESRD status), health care utilization in the lagged quarter prior to enrollment (number of inpatient admissions and ED visits), and spending in the quarter and year prior to program participation. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

To construct the CG for Lahey, we used PSM to identify individuals living in the Greater Boston area (Middlesex, Essex, Norfolk, Plymouth, and Suffolk Counties) who ever had congestive heart failure and who were not enrolled in the innovation. We used the same propensity score covariates as described above.

Medicaid

To construct the CG for CHA, we used PSM to identify individuals living in the Greater Boston area (Middlesex, Essex, Norfolk, Plymouth, and Suffolk Counties) who were not enrolled in the innovation. We used PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, number of ED visits and inpatient stays in the calendar quarter before the innovation, and total Medicare payments in the calendar quarter and calendar year before the innovation. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

The number of FFS Medicaid beneficiaries enrolled in the Lahey innovation was too low to support a Medicaid claims analysis for that group.

Prosser Public Hospital District

Medicare

The CG includes FFS Medicare beneficiaries who were eligible for the innovation but did not participate (i.e., people who were offered participation but declined). We considered the trade-off of using PSM to further refine the comparison group. However, PSM did not appreciably improve the statistical balance of characteristics between the innovation and comparison groups, and would have excluded 72 participants in the innovation group who could not be closely matched to individuals in the comparison group. In addition, the potential comparison group was quite small originally, limiting the ability of PSM to find close matches. Therefore, we did not use the PSM results and instead retained everyone in the innovation and comparison groups.

Medicaid

Similar to above, the CG included FFS Medicaid beneficiaries who were eligible for the innovation but did not participate (i.e., people who were offered participation but declined).

Regional Emergency Medical Services Authority

Medicare

The potential CG for REMSA Nurse Health Line (NHL) consisted of beneficiaries enrolled in FFS Medicare Parts A and B living in Washoe County, Nevada.

The potential CG for REMSA Ambulance Transport Alternatives (ATA) consisted of beneficiaries enrolled in FFS Medicare Parts A and B and living in Washoe County, Nevada. We identified and excluded from the comparison group individuals in the claims data who had an inpatient admission within 7 days of an ED visit. This exclusion eliminated serious cases or true emergencies, and thus reflects the characteristics of the participating sample in the first innovation quarter. Those who had an ED visit without hospitalization within 7 days served as the potential comparison sample. This restriction does not apply to subsequent ED visits in the innovation period. Those who had an ED visit without hospitalization within 7 days served as the potential comparison sample.

The potential CG for Community Paramedics (CP) consisted of beneficiaries enrolled in FFS Medicare Parts A and B living in Washoe County, Nevada. Additionally, comparison beneficiaries had to meet the criterion of being hospitalized during the innovation period for congestive heart failure, myocardial infarction, or chronic obstructive pulmonary disease.

We used PSM to select CG beneficiaries with characteristics similar to TG beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. For REMSA ATA, the propensity score model also included indicators for inebriation, substance abuse, or psychiatry in the participation year because the alternative locations are primarily detoxification centers and mental health hospitals. For REMSA CP, the propensity score model also matched on congestive heart failure, myocardial infarction, and chronic obstructive pulmonary disease. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Medicaid

The CG for REMSA ATA was the set of callers who were not transported either due to refusal or lack of eligibility, but were informed by the telephone triage that they needed to go to the ED.

Southeast Mental Health Services

Medicaid

We used PSM to select a CG of beneficiaries that appeared in the Integrated Community Health Partnership (ICHP) data but were not enrolled in the innovation. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age and gender. We were limited to using only age and gender in the propensity score model because these were the only patient characteristics included in the claims data provided by ICHP.

South County Community Health Center

Medicare

Potential CG members included FFS Medicare beneficiaries with at least one chronic disease who lived near South County (i.e., in the same zip code as South County or a surrounding zip code). Patients who visited the South County Community Health Center since the innovation started enrolling patients in January 2013 were excluded. We also specified that comparison beneficiaries must have lived in California from 2010 to present and in San Mateo County for at least 1 month while the innovation enrolled beneficiaries (January 2013 to present).

Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of race, gender, number of chronic conditions, dual Medicare-Medicare status months in the previous calendar year, and total Medicare payments in the calendar year prior to the innovation. Beneficiaries not enrolled in Medicare FFS in the calendar quarter prior to the innovation did not have Medicare claims data for this quarter. These beneficiaries were matched based on age, gender, dual Medicare-Medicaid status, and disabled status. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

Medicaid

The CG included FFS Medicaid beneficiaries who lived near South County, but did not visit South County after the start of the innovation. Similar to above, comparison beneficiaries must have lived in California from 2010 to present and in San Mateo County for at least 1 month while the innovation enrolled beneficiaries (January 2013 to present).

We used PSM to select CG beneficiaries with similar observable characteristics as TG beneficiaries. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, total Medicare payments in the calendar quarter prior to the innovation, and dual Medicare-Medicaid status. Fifty of the 93 beneficiaries were not enrolled in Medicaid FFS in the calendar quarter prior to the innovation and, therefore, did not have Medicaid claims data for this quarter. These beneficiaries were matched based on age, gender, dual Medicare-Medicaid status, and disabled status. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

University of Chicago

Medicare

Potential CG members included Medicare beneficiaries enrolled in FFS Medicare Parts A and B living in the 16 innovation zip codes of the South Side of Chicago. We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, ESRD status, dual Medicare-Medicaid status, number of chronic conditions, number of ED visits and inpatient stays in the calendar quarter prior to the innovation, and outpatient, professional, and total Medicare payments in the calendar quarter and calendar year prior to the innovation. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Medicaid

Potential CG members included Medicaid beneficiaries enrolled in FFS Medicare Parts A and B living in the 16 innovation zip codes of the South Side of Chicago. We used PSM to select CG and TG beneficiaries with similar characteristics. Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability, dual Medicare-Medicaid status, enrollee status, number of months of Medicaid eligibility during the calendar year prior to the innovation, number of ED visits, number of inpatient stays, other therapy payments, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Beneficiaries who were not enrolled in Medicaid FFS in the calendar quarter prior to the innovation did not have Medicaid claims data for this quarter, and were matched separately using demographic variables only. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

YMCA of the USA

Medicare

The potential CG included beneficiaries enrolled in FFS Medicare for at least 1 month since the innovation began enrolling beneficiaries and who lived in one of the 17 YMCA zip codes or zip codes representing the residential location of the innovation's population. We excluded individuals who had ever been classified as having diabetes. Furthermore, we included only individuals who met the requirement criteria for enrollment in the Diabetes Prevention Program: at least 65 years of age and diagnosed with prediabetes. To identify prediabetes patients, we used the following ICD-9 codes: 790.29 (abnormal glucose); 277.7 (metabolic syndrome); 790.21 (impaired fasting glucose levels, but not yet diagnosed with diabetes); and 790.22 (failed glucose tolerance test, but still not diagnosed with diabetes).

Innovation and comparison beneficiaries were matched using a logit model predicting the likelihood that a beneficiary was enrolled in the innovation as a function of age, gender, race, disability status, ESRD status, dual eligibility status, number of chronic conditions, total Medicare payments in the calendar quarter and year prior to the innovation, number of inpatient stays in the calendar quarter prior to enrollment, number of ED visits in the calendar quarter prior to enrollment, and whether an individual lives in the same zip code of a participating YMCA. We used one-to-variable matching with replacement, matching each TG beneficiary with up to three CG beneficiaries with the closest propensity score.

Regression Analyses

The difference-in-differences (DinD) analytic approach was used to identify and quantify innovation effects of the HCIA demonstrations. This approach was used when baseline data are available and whenever it was possible to identify a CG. The DinD regression specification involved both a comparison and innovation group along with baseline (or innovation) data on both. The preferred Quarterly Fixed Effects (QFE) model was designed by Professor Partha Deb for CMS's "rapid-cycle evaluations."

We performed QFE DinD regression analyses to determine the impact of the innovation on spending, the number of hospitalizations, and the number of ED visits. In addition to the quarter, treatment, and demonstration period indicators, all regressions controlled for age, gender, race, disability, ESRD, dual eligibility, number of months of dual eligibility status during the calendar year prior to the innovation, and the number of chronic conditions. The regression specification assumed the same quarterly fixed effect for treatment and comparison individuals in the baseline period and allowed for a separate quarterly effect for treatment individuals after enrolling in the innovation. The QFE model, in equation form, is:

$$y_{i,t} = \alpha_0 + \mu I_i + \sum_t^T \beta_t Q_t + \sum_t^T \theta_t (Q_t \cdot I_{i,t} \cdot D_t) + \sum_k \lambda_k X_{i,t,k} + \varepsilon_{i,t} \qquad \text{(B-1)}$$

$y_{i,t}$ = a performance measure (e.g., Medicare payments per beneficiary per quarter) for the i^{th} beneficiary in period t

$I_{i,t}$ = 0,1 indicator of the observation in the comparison (=0) or innovation (=1) group

Q_t = 0,1 indicator of the observation in the tth quarter

D_t = 0,1 indicator (= 0, baseline period, = 1, demonstration period)

$X_{i,t,k}$ = a vector of k patient, practice, and/or other characteristics

$\varepsilon_{i,t}$ = regression error term

The I_i coefficient, μ, measured the average difference in performance between the innovation and CG across all base and demonstration quarters. If innovation and comparison samples were well matched on baseline performance, then we expect μ = 0. Separate quarter indicators (Q_t) were used from t = 2, the second baseline quarter (first baseline effects are in α_0) to the most current evaluation quarter (T). The β_t coefficients reflected the individual quarter-to-quarter changes in average CG performance through the entire baseline and innovation periods. Rising β coefficients in later quarters indicated greater spending per patient. During baseline quarters, performance for the innovation sites would be ($\mu + \beta_t$) ignoring the intercept. To determine the marginal effects of the innovation during only the demonstration period, the quarterly indicators are interacted with an indicator representing a demonstration period quarter (D_t). The θ_t coefficients reflected the deviation from the innovation's baseline μ-effect in the demonstration quarters. The average (not the marginal) performance of innovation sites during the tth demonstration quarter is given by the sum of ($\mu + \beta_t + \theta_t$). A vector of patient, practice, and/or other relevant characteristics are also included to further explain variance in performance and improve the reliability of the estimated coefficients. These characteristics are also necessary for inclusion in the regression when it is not possible to perfectly match the CG's characteristics to those of the innovation group.

When the outcome variable is Medicare payments, linear QFE models were estimated using ordinary least squares (OLS). When outcome variables were utilization counts (inpatient stays or ED visits), nonlinear QFE models were estimated using logits (logistic regressions) and negative binomials (negative binomial regressions).

Advantages of QFE Models

An obvious advantage of QFE modeling is its flexibility. It does not require a prior specification of the functional form of innovation effects over the life of the innovation or even the baseline period. For example, baseline trends in spending likely are not linear but exponential from compounded volume and price effects; nor is it reasonable to expect innovation effects to be linear if innovations start slowly, then produce accelerated effects.

Another advantage of QFE is that it reports innovation performance, relative to a CG, quarter-by-quarter. This knowledge enables the researcher and policy maker to see any trends in performance that might be lost in a linear slope estimate of effects. How quickly a decision can be made to abandon, scale up, or refine an innovation depends on the observed pattern of θ_t coefficients. A minor advantage is that

QFE modeling does not require seasonal adjustors because each quarter's effects are estimated separately, thereby "controlling" for season.

Disadvantages of QFE Models

Although QFE represents the most flexible approach to program testing, it adds to model complexity. The fact that QFE estimation can involve many more coefficients could be considered a computational disadvantage. Another concern is that one or two large quarters of "savings" or "losses" may not be sustained. This concern is heightened when estimating the model on small data sets with just a few hundred innovation observations—particularly for volatile spending information. Large savings in one quarter can turn into large losses in the next quarter. In both cases, the estimates may be insignificant at common levels of significance (10%, 5%), which makes inferences difficult. This problem is addressed to some degree through linear combination tests over several quarters, but it becomes an (unknown) tradeoff between working with smaller samples and the number of quarters of data. Generally, smaller samples require more quarters of consistently better (or worse) performance in the innovation group. Also, tradeoffs exist between how often to "look" at performance (monthly, quarterly, annually) and how significant short-period coefficients will be. More "looks" will show more volatility (and increase the likelihood of false-positives). Therefore, policy makers should view the quarterly coefficients carefully, and in the context of the results for a number of quarters.

Readmission Regressions

For the unplanned hospital readmission measure, the unit of observation was an index hospital admissions within a quarter. The dependent variable was set to one if the individual had an unplanned hospital readmission within 30 days after the initial index hospital admission. As a result, the sample size of index hospital admissions within a quarter can be much smaller than the original sample of beneficiaries in the study. Only about 10 to 20 percent of inpatient admissions resulted in unplanned readmissions, so small numbers of inpatient admissions led to ever smaller numbers of readmissions. Thus, the number of explanatory variables that could be included in any readmission regression was limited. A standard rule of thumb for logistic regressions was that there should be 10 events (readmissions) for every explanatory variable included in the regression. This rule of thumb limited our ability to estimate DinD regressions with quarterly fixed effects, which require a large number of quarterly fixed effects.

Because of these factors, we only conducted regression analyses for unplanned readmissions on awardees with at least 100 inpatient admissions in an innovation quarter. During analysis of unplanned readmissions, we performed DinD logistic regression analyses to determine the impact of the innovation on the likelihood that a patient who was hospitalized during the quarter had an unplanned hospital readmission within 30 days. We present marginal effects that are interpreted as the change in the probability of having a readmission during the innovation period as a whole.

The DinD regression for readmissions, in equation form, is:

$$y_{i,t} = \alpha_0 + \mu I_i + \beta D_t + \theta I_i D_t + \sum_k \lambda_k X_{i,t,k} + \varepsilon_{i,t} \tag{B-2}$$

- $y_{i,t}$ = a performance measure (e.g., Medicare payments per beneficiary per quarter) for the i^{th} beneficiary in period t
- I_i = 0,1 indicator of the observation in the comparison (=0) or innovation (=1) group
- D_t = 0,1 indicator (= 0, baseline period, = 1, demonstration period)
- $X_{i,t,k}$ = a vector of k patient, practice, and/or other characteristics
- $\varepsilon_{i,t}$ = regression error term

The θ coefficient in Eq. (B-2) represents the change in innovation mean performance minus the change in CG mean performance for the demonstration and baseline period controlling for other covariates.

Appendix C

Awardee-Specific Data Collection and Analysis Methods

Technical Appendix C: Awardee-Specific Data Collection and Analysis Methods

Data Collection

As part of their contract with CMS, all awardees developed a self-monitoring measurement plan that specified the data to be collected and was used to monitor the progress of the innovation over time. In general, the data were collected as part of the innovation (e.g., spreadsheets tracking enrollment numbers) or were pulled from existing electronic health record (EHR) or other data collection systems.

We reviewed each awardee's self-monitoring measurement plan and identified relevant measures, including clinical effectiveness and health outcome measures that would be useful to include as part of our evaluation of awardees' innovations. Our goal for the health outcomes measures was to determine which would be most useful in assessing the impact of the innovation on patient health. We met with all awardees to discuss their willingness to provide the selected data to RTI. While all awardees ultimately agreed to provide the data requested when available, in many instances the awardee did not ultimately collect measures initially listed in the self-monitoring measurement plans.

In June 2014, awardees began providing these secondary data for each quarter. As of June 2015, all awardees provided some type of secondary data to be used in RTI's evaluation. Once we received the data, we cleaned the data and provided a file containing patient identifiers (e.g., Medicare HIC number, Medicaid ID, social security number, name, address) to the claims analysis team. We then created new variables or recoded existing variables to include in the patient characteristics (e.g., age, race/ethnicity, sex, payer category), reach (e.g., first quarter of enrollment), and dose (e.g., number and types of services received) tables, as well as the clinical effectiveness (e.g., foot exam, blood pressure screening) and health outcomes sections (e.g., poor HbA1c control, blood pressure control), in the individual awardee chapters. Once the report was completed, we archived the data to help us answer inquiries, if any, that would be made on the data included in the report.

To avoid overburdening the awardees, we did not place a lot of requirements on the structure or format of the data files they provided. We agreed to accept the raw data "as is" from their EHR or project-related tracking systems, which made it more difficult for us to process and manage the data. Most awardees provided the data across multiple files that needed to be merged. Some awardees provided data for only the most recent quarter completed, whereas other awardees provided cumulative data of all patients ever enrolled each quarter. Files provided by different awardees included:

- Backup copy of a SQL database
- More than 15 cumulative data files

- More than 50 reports with patient-level data
- Documents for abstraction of qualitative data
- Photocopies of EHR data

Although we requested that awardees provide the data in the same format as provided in the previous quarters, we often discovered changes over time that made working with the data more challenging, such as:

- Names of variables changed, making it difficult to simply merge previous data with new data (e.g., Patient_Id in Q7 data file, patientid in Q8 data file, Personid in Q10 data file).
- Values of variables changed (e.g., a patient's enrollment date in the data for Q9 differed from the enrollment date in the data provided for Q8—sometimes with an earlier date, sometimes with a later date).
- Calculation of variables changed (e.g., awardee provided the health outcome value available prior to the encounter date to determine control through Q10, but at some point began instead to use the value actually taken on the encounter date in Q11).
- Existing enrollees "disappeared" (e.g., if the awardee provided cumulative data, in some instances patients "disappeared" from the data in subsequent quarters).
- New enrollees appeared (e.g., a new patient with an enrollment date from Q8 was not included in the data provided for Q8, but appeared in the data for Q9).

Even when the data were provided in the same format as in the previous quarters, there were other challenges, including:

- Duplicate records: Sometimes, an entire record was a duplicate; other times, for example, date of birth was missing in one record but included in another record for the same patient.
- Duplicate records with mismatched identifiers: Two records might have the same medical record number (MRN) but different social security numbers, making it difficult to distinguish between a true duplicate record and a record in which a typo occurred.
- Improbable/invalid values: For example, systolic blood pressure >500 mm Hg; enrollment dates prior to the HCIA funding.
- Values of variables represented in multiple ways, including misspellings (e.g., Male, M, MALE, male, mael)
- Invalid patient identifiers: The patient identifiers that we received could not be matched with any of the enrollment files for Medicare or Medicaid claims data.
- Two related variables provided in separate files (e.g., systolic blood pressure and diastolic blood pressure provided separately, with no way to determine which systolic goes with which diastolic value—unless the patient had only one reading on a specific date).
- Multiple values per cell separated by commas or not clearly delimited.

With 24 awardees providing data from different EHR systems and other sources, we had to develop rules (e.g., recode as “missing” any systolic blood pressure reading that is <70 or >250 and any diastolic blood pressure reading that is <45 or >150) to deal with all of these issues consistently across awardees.

Data Analysis

Clinical effectiveness refers to the extent to which patients with certain health conditions are provided with appropriate clinical care. Clinical effectiveness measures include the percentage of:

- asthma participants who received an FEV1 test;
- coronary artery disease (CAD) participants who were prescribed aspirin or clopidogrel or had a low-density lipoprotein cholesterol (LDL-C) test;
- chronic obstructive pulmonary disease (COPD) participants who were prescribed an inhaled bronchodilator or had spirometry results documented;
- diabetes participants who received a foot exam, an eye exam, an HbA1c test, or an LDL-C test;
- hypertension participants who received a blood pressure reading;
- participants who received an influenza immunization or pneumococcal vaccination; and
- participants who received a body mass index (BMI) assessment.

We provided the percentage of relevant patients who received at least one of the above tests during the innovation period.

Health outcome measures include the percentage of:

- asthma participants with an FEV1 test indicating good control;
- diabetes participants with an HbA1c test indicating poor control or an LDL-C test indicating good control;
- hypertension participants with a blood pressure reading indicating good control; and
- participants with BMIs indicating they are overweight or obese

We used the health outcome data to generate run charts showing the percentage of participants with the health condition with a test indicating they were in control. For awardees from which we received health outcome data, we conducted multivariate generalized estimating equations (GEE) to assess changes in health outcomes over time, while controlling for repeated measures (i.e., within-subject covariance). More specifically, HbA1c values and LDL-C values among those with diabetes, LDL-C values among those with CAD, and systolic and diastolic blood pressure values among those with hypertension were regressed onto dose (which varied by awardee) and innovation quarter. Innovation quarter was included in the model to assess the overall change in health outcomes over time. We controlled for the baseline health outcome being examined in the regression (i.e., HbA1c, LDL-C, or blood pressure at innovation enrollment), age, sex, race, and insurance type. Changes over the innovation for each health outcome measure were examined in separate regression analyses, and are presented in the individual awardee sections.

Appendix D

Qualitative Data Collection and Analysis Methods

Technical Appendix D: Qualitative Data Collection and Analysis Methods

This technical appendix describes RTI's approach to collecting and analyzing qualitative data for the evaluation of the Community Resource Planning, Prevention, and Monitoring awardees. We provide an overview of our approach throughout the evaluation process, and provide greater detail when describing data sources and analyses from the third year of the evaluation, Q11-Q14 (Jan. 2015-Dec. 2015).

Evaluation Approach

We used a case study evaluation approach to guide our qualitative research methods and analyses. The case study evaluation approach examines the influence of programs on participants, and assumes that participants' actions are best understood within the specific contexts in which they occur.[1] With regard to the HCIA case study evaluation, this approach entails studying the structures and processes that awardees use to effectively implement their innovations and the internal and external factors that seem to be related to how well they succeed.

We began the evaluation with the premise that *implementation effectiveness* and *workforce issues* would help explain the reasons that the innovations achieved or did not achieve their intended impact on health care quality, health outcomes, and health care costs. Two primary research questions, therefore, oriented our qualitative data collection tools and analysis strategies for the entirety of the evaluation:

- What is the implementation effectiveness of each innovation and across similar interventions?
- What are the workforce issues with respect to each awardee and across similar awardees?

Our study of implementation effectiveness assessed the reach and dose of the innovations. Throughout the evaluation, we sought to understand whether, how, and why innovations were delivered to the number of patients intended, and delivered as often and intensely as the target population required. We also considered the relationship between implementation effectiveness and program impact—that is, considering each innovation's theory of change, would we expect to see an impact of the innovation on health care or health outcomes in light of the fidelity, reach, and dose that awardees achieved?

With respect to workforce issues, our evaluation examined how awardees defined health care roles, how effectively awardees staffed health care positions, and what workforce development opportunities were available to HCIA staff and their partners. We considered HCIA staff feedback

[1] Yin, R.K.: Case Study Research, Design and Methods. 3rd edition. Newbury Park. Sage Publications, 2003.

throughout implementation on the effectiveness of innovation-supported training, and studied how staff experienced their roles (e.g., levels of satisfaction and burnout). We paid particular attention to emerging health care positions, including jobs involving care coordination and the analysis of health information technology (HIT) data.

Construct Development

RTI developed a conceptual framework aligned with our evaluation questions to make sense of each awardee's processes, barriers, and facilitators in implementing their innovations, and to better understand the extent to which implementation experiences were unique to the awardees (see Appendix A). As part of this effort, members of the qualitative evaluation team identified relevant evaluation constructs. Constructs can be simple words (e.g., execution, sustainability) or more descriptive phrases (e.g., team dynamics, lessons learned) that enable analysts to think about distinct elements of interventions and the implementation process. The constructs serve as a shared vocabulary for describing the innovations and understanding the attributes that unite or distinguish them.

We used both deductive and inductive approaches to construct development.[1] Deductive approaches start with a theory or hypothesis, and then assess how the theory or hypothesis applies to a set of data. We developed deductive constructs relevant to our research questions and the vast literature and research in the field of implementation science and innovation diffusion. We drew heavily on different adaptations of the Consolidated Framework for Implementation Research (CFIR)[2] (see http://cfirguide.org/constructs.html), which explores how contextual factors (e.g., exogenous and endogenous) shape the development, rollout, and evolution of health care interventions.

Inductive approaches differ from deductive approaches in that they start with a set of data from which analysts identify new ideas through immersion.[3] Data-driven interpretation and reasoning then contribute to the development of new theories and hypotheses.[4] We identified inductive constructs to capture those ideas, concepts, actions, relationships, meanings, etc., that came up in the data and represented something distinct from those constructs that we predefined. For example, our qualitative data suggested that work dynamics between clinical and nonclinical staff were not highlighted in the existing literature, but appeared to influence implementation effectiveness. We also determined that awardees had created a wide variety of care coordinator roles, each with different titles and responsibilities that seemed important to distinguish.

Table D-1 identifies the evaluation constructs most closely associated with each qualitative section of the awardee chapters in this 2016 annual report (AR3), broken down by report heading. We identify the sources used to define our constructs in the table footnotes.

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[2] Rojas Smith, L., Ashok, M., Dy, S.M., et al.: Contextual frameworks for research on the implementation of complex system interventions. Prepared by the RTI International-University of North Carolina at Chapel Hill Evidence-based Practice Center under Contract No. 290-2007-10056-I. 2014.

[3] Glaser, B.G.: The grounded theory perspective III: Theoretical Coding. Mill Valley, CA. Sociology Press, 2005.

[4] Haig, B.D.: An abductive theory of scientific method. Psychological Methods 10(4):371-388, 2005.

Table D-1. Evaluation Constructs Focal in Qualitative Sections of 2016 Annual Report

Section of Awardee Report	Construct	Definition	Subconstructs
Hiring and Retention	Staffing Capacity	The extent to which staff have or do not have the capacity to implement the innovation. Includes adequacy of the number and availability of staff to work on the innovation (staffing resources) and capacity of staff to do the work.	None
	Staff Recruitment[1]	An organization's strategies and approach to identifying candidates to fill new staff positions or expand numbers of existing positions.	None
	Staff Satisfaction[1]	Staff satisfaction (or lack thereof) with new roles and responsibilities, training, and with the innovation more generally; the degree to which providers are able to work "at the top of their license."	Burnout, Staff Retention or Turnover
Skills, Knowledge & Training	Staff Roles & Responsibilities	Roles and responsibilities define program staff specific involvement and contribution to the program team. Program staff's ability to identify and adhere to roles and responsibilities may facilitate or impede successful implementation of the program's intervention(s).	Specific roles (e.g., CHW, Patient Navigator, HIT Analyst)
	Education & Training[1, 2]	Assessing staff members' existing knowledge to identify knowledge gaps in order to plan for and support any additional education needs. Use of a training program that has institutional recognition or accreditation. Use of education or training that accommodates the adult learner. Training program provides the appropriate skill sets and prepares staff for new roles and/or responsibilities. Includes discipline-specific training issues. Interprofessional education occurs when two or more professions (e.g., physicians, nurses, pharmacists, etc.) learn with, from, and about each other to improve collaboration and the quality of care.	None
Leadership	Leadership Support[3]	Commitment, involvement, and accountability of leaders and managers for the innovation, including middle managers. Directionality of leadership for the innovation (top-down vs. bottom-up) and a clearly designated implementation leader.	Organizational Leadership, Program Leadership
Organizational Capacity	Resources/ Capacity[1, 3]	The extent to which resources are dedicated to implementing the innovation, and the adequacy of those resources. Includes physical space and equipment, HIT and general IT, staff time. The level of resources dedicated for implementation and ongoing operations including money, training, education, physical space, and time.	None

(continued)

Table D-1. Evaluation Constructs Focal in Qualitative Sections of AR3 (continued)

Section of Awardee Report	Construct	Definition	Subconstructs
Innovation Adoption and Workflow Integration	Workflow Process: CHW[4, 5, 6]	The tasks and workflows, including interdependencies between them that are the focus of the change strategy or that will be affected by it. The flow or path of the work steps, i.e., the way in which work progresses, including factors like order of steps and selection between alternative steps. Like a process, a workflow has inputs and outputs, i.e., resources (mass, energy, information), and the people or things that perform the steps or activities that comprise the work are considered. It is an established business process describing how the tasks are done, by whom, in what order, and how quickly. Care coordination is the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services. Organizing care involves the marshalling of personnel and other resources needed to carry out all required patient care activities, and is often managed by the exchange of information among participants responsible for different aspects of care.	Adoption: CHW, Integration: CHW
	Workflow Process: HIT[4, 7]	The tasks and workflows, including interdependencies between them that are the focus of the change strategy or that will be affected by it. The flow or path of the work steps, i.e., the way in which work progresses, including factors like order of steps and selection between alternative steps. Like a process, a workflow has inputs and outputs, i.e., resources (mass, energy, information), and the people or things that perform the steps or activities that comprise the work are considered. It is an established business process describing how the tasks are done, by whom, in what order, and how quickly. HIT workflow entails the flow or path of electronic information exchange, and the tasks and steps that comprise that flow and interdependencies among them. It is an established business process describing how the tasks are done, by whom, in what order, and how quickly.	Adoption: HIT, Integration: HIT
Innovation Reach	Reach[8]	Reach is an individual-level measure (e.g., patient or employee) of participation. Reach refers to the percentage and risk characteristics of persons who receive or are affected by a policy or program. It is measured by comparing records of program participants and complete sample or "census."	Reach within Population, Reach within Organization
Innovation Dose	Dosage[9]	Dosage or exposure refers to the amount of an intervention received by participants; in other words, whether the frequency and duration of the intervention is as full as prescribed by its designers.	None

(continued)

Table D-1. Evaluation Constructs Focal in Qualitative Sections of AR3 (continued)

Section of Awardee Report	Construct	Definition	Sub-Constructs
Sustainability	Sustainability[10]	The extent to which a newly implemented treatment is maintained or institutionalized within a service setting's ongoing, stable operations.	Formalization of Care Coordinator Role
	Replicability[1]	Plans, timing, and/or methods of spread within and beyond the adopting site.	None

CHW = community health worker; HIT = health information technology.

[1] Agency for Healthcare Research and Quality. Developing and Assessing Contextual Frameworks for Research on the Implementation of Complex System Interventions. 2014. Available from https://effectivehealthcare.ahrq.gov/ehc/products/490/1882/contextual-frameworks-complex-interventions-report-140318.pdf.

[2] Freeth, D., Hammick, H., Reeves, S., et al.: Effective Interprofessional Education: Development, Delivery and Evaluation. Oxford. Blackwell, 2005.

[3] Damschroder, L.J., Aron, D.C., Keith, R.E., et al.: Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. Implementation Science 4(50), 2009. DOI:10.1186/1748-5908-4-50

[4] Cain, C., and Haque, S.: Organizational workflow and its impact on work quality, in: Patient Safety and Quality: An Evidence-based Handbook for Nurses. National Center for Biotechnology Information, National Library of Medicine. 2008. Available from http://www.ncbi.nlm.nih.gov/books/NBK2638/

[5] National Coalition on Care Coordination (N3C). Policy Brief on Implementing Care Coordination in Patient Protection and Affordable Care Act (PPACA). Available from https://www.rush.edu/sites/default/files/Implementing%20Care%20Coordination%20in%20the%20Patient%20Protection%20and%20Affordable%20Care%20Act.pdf.

[6] Agency for Healthcare Research and Quality. Care Coordination Measures Atlas Update. June 2014. Available from http://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/atlas2014/index.html.

[7] Agency for Healthcare Research and Quality. Health Information Technology: Best Practices Transforming Quality, Safety, and Efficiency. 2013. Available from http://healthit.ahrq.gov/health-it-tools-and-resources/workflow-assessment-health-it-toolkit/research.

[8] Glasgow, R., Vogt, T.M., and Boles, S.M.: Evaluating the public health impact of health promotion interventions: The RE-AIM framework. American Journal of Public Health 89(9):1322-1327, 1999.

[9] Carroll, C., Patterson, M., Wood, S. et al.: A conceptual framework for implementation fidelity. Implementation Science. 2(40):1-9, 2007.

[10] Proctor, E., Silmere, H., Raghavan, R., et al.: Outcomes of implementation research: Conceptual distinctions, measurement challenges, and research agenda. Adm. Policy Ment. Health 38:65-76, 2011.

Data Collection

The 2016 annual report includes data collected during Q11-Q14 (Jan. 2015-Dec. 2015), as available for each awardee. Focal reports collected and analyzed during the final year of the evaluation include the following documents, which RTI's evaluation team received from the Center for Medicare & Medicaid Innovation (CMMI).

- *Quarterly Awardee Performance Reports (QAPRs)*: Extensive inventories of standardized categorical and numerical data that awardees submit to CMMI through the independent implementation and monitoring contractor on a quarterly basis; include data on organizational characteristics, expenditures, staffing, training, and program participant characteristics.

- *Narrative Progress Reports (NPRs)*: Descriptive, unstructured accounts of the project's accomplishments, lessons learned to date, planned activities, and self-monitoring findings; an implementation update from the awardee's perspective.

- Sustainability Plans: Descriptive, unstructured explanations detailing how the awardee intends to continue offering innovation services after the HCIA grant funding period ends.

In addition to qualitative data captured in reports, the evaluation findings in the 2016 annual report draw heavily on insights drawn from closeout interviews with innovation staff and key partners. The interviews explored changes in the innovation, implementation process, and supporting staff and resources since our site visits; implementation effectiveness; sustainability efforts; and lessons learned from the implementation experience. Closeout interviews allowed the evaluation team to gain a more in-depth understanding of the innovation and its implementation than could be gleaned from secondary sources alone. The interviews allowed us to probe for participant insights into why aspects of the innovation or its implementation succeeded or failed. Closeout interviews were less useful for assessing the impact of awardees' programs, although we used the interview to contextualize our quantitative findings. Closeout interviews offered a somewhat limited point of view, however, in that we targeted interviewees responsible for overseeing innovations or major components of innovations, rather than contacting a wider array of stakeholders (e.g., frontline staff, patients) who may or may not agree with the leaders' assessments.

Subject matter experts (SMEs) and responsible persons (RPs) staffing each awardee-specific evaluation team used their knowledge of the awardee to identify interviewees for the closeout interviews. We targeted potential interviewees in the following roles:

- Innovation leadership/ project coordinators
- Leader/expert on care coordination/HIT component(s)
- Leader of/expert on emerging staff role
- End user (e.g., a physician, nurse, or other provider)
- Key partner(s)

The SME and RP then tailored a standard interview protocol, developed by RTI and approved by CMMI, for each awardee and interviewee, focusing on successes, challenges, and issues specific to each innovation. When tailoring, we paid particular attention to emerging issues or changes noted in the final QAPRs or NPRs, as well as unresolved topics identified while preparing earlier evaluation reports.

All closeout interviews featured in this 2016 annual report were conducted by phone between February 2015 and December 2015, and were audio-recorded using a handheld recorder or computer application. The SME typically led interviews while RPs took notes. Conversations generally lasted from 30 to 60 minutes, depending on the availability of the interviewee.

Table D-2 summarizes all new qualitative data sources included in this 2016 annual report. RTI received Q11 and Q12 *QAPRs* and *NPRs* for all awardees, but Q13 and Q14 reports were limited to awardees that received no-cost extensions (NCEs). Half of the awardees submitted at least one sustainability plan to CMMI by Q14. This annual report includes closeout interview data for 19 awardees in total, although only one awardee has new closeout interviews analyzed since RTI prepared the 2015 annual report. We do not present closeout interview data for Bronx RHIO, Curators, MPHI, REMSA, and

Y-USA, because these awardees received NCEs lasting at least 9 months, and their closeout interviews will be analyzed for the 2016 annual report addendum.

Table D-2. New Qualitative Data Sources Featured in 2016 Annual Report, by Awardee

Awardee	*QAPR*s and *NPR*s				Sustainability Plan	Close-out Interview Data
	Q11	Q12	Q13 (NCE only)	Q14 (NCE only)		
Altarum Institute (Altarum)	✓	✓	—	—	—	—
Asian Americans for Community Involvement (AACI)	✓	✓	—	—	✓	—
Ben Archer Health Center (BAHC)	✓	✓	—	—	✓	—
Bronx Regional Health Information Organization (Bronx RHIO)	✓	✓	✓	✓	✓	—
Children's Hospital and Health System (Children's Hospital)	✓	✓	—	—	—	—
Curators of the University of Missouri (Curators)	✓	✓	✓	✓	—	—
Delta Dental Plan of South Dakota (Delta Dental)	✓	✓	—	—	✓	—
Eau Claire Cooperative Health Centers (ECCHC)	✓	✓	—	—	—	—
Finity Communications (Finity)	✓	✓	—	—	—	—
Imaging Advantage (IA)	✓	✓	—	—	✓	—
Intermountain Health Care Services, Inc. (Intermountain)	✓	✓	✓	✓	✓	✓
Mary's Center for Maternal & Child Care (Mary's Center)	✓	✓	—	—	—	—
Michigan Public Health Institute (MPHI)	✓	✓	✓	✓	✓	—
Mineral Regional Health Center (Mineral Regional)	✓	✓	—	—	✓	—
National Health Care for the Homeless Council (NHCHC)[1]	✓	✓	—	—	—	—
Northeastern University (NEU)	✓	✓	—	—	—	—
Prosser Public Hospital District (Prosser)	✓	✓	—	—	✓	—
Regional Emergency Medical Services Authority (REMSA)	✓	✓	✓	✓	✓	—
South County Community Health Center (South County)	✓	✓	—	—	—	—
Southeast Mental Health Services (SEMHS)	✓	✓	—	—	—	—
University of Chicago (U-Chicago)	✓	✓	—	—	—	—
University of Miami (U-Miami)	✓	✓	—	—	✓	—
Women and Infants Hospital of Rhode Island (W&I)	✓	✓	✓	—	—	—
YMCA of the USA (Y-USA)	✓	✓	✓	✓	✓	—
Total	24	24	7[1]	6	12	1

NCE = no-cost extension; *NPR* = *Narrative Progress Report*; Q = quarter; *QAPR* = *Quarterly Awardee Performance Report*.
[1] NHCHC received a 3-month NCE, but did not submit a QAPR or NPR in Q13. Instead, RTI received an Excel file with innovation data collected by NHCHC.

In addition to the main data sources collected and analyzed for the 2016 annual report, awardee teams continued to draw on insights from data captured earlier in the evaluation process. Among these sources, all awardees submitted the following documents to RTI through CMMI:

- Applications (Baseline): Awardees' original applications for HCIA funding, which provide a baseline understanding of innovation goals, the innovation's theory of change, the target population, and plans for implementation. The applications serve as a benchmark for assessing fidelity, but not all applications contained the same level of detail.

- Operational Plans: Detailed work plans used to monitor and track awardee progress using goals and milestones specified in the innovations' driver diagrams (logic models). The operational plans helped RTI evaluate whether or not the awardees implemented their innovations according to plan, although the plans varied in quality with respect to level of detail and fit for the innovation.

- Self-Monitoring Measurement Plans (SMMPs): Plans identifying metrics captured by awardees to monitor innovation outcomes related to health care quality, health outcomes, and cost savings. As of Q5, CMMI required that awardees submit SMMPs on a quarterly basis. The list of measures included is extensive and is tied to the goals of the innovation.

RTI's legacy data also include notes from site visit interviews and focus groups conducted in 2014 and 2015. All awardees participated in an in-person site visit between April and August 2014, during which RTI validated our understanding of the programs, obtained detailed information about implementation to date, and sought to thoroughly understand the data being collected by awardees that RTI could use to assess the innovation's impact on key outcomes. Specifically, we studied innovation characteristics, the implementation process, program participant characteristics, endogenous and exogenous characteristics of the awardee or innovation in relation to implementation effectiveness, and, ultimately, each innovation's targeted outcomes. In-person visits lasted at least 2 days, included up to 10 interviews per day, and were led by the SMEs and RPs primarily responsible for evaluating each awardee.

Nine awardees with innovations focusing on HIT participated in site visits between February and May 2015, three of which were in person and six of which were virtual. Follow-up site visits took place when awardees had not made significant implementation progress at the time of our first visit, or when concerns regarding the availability of self-monitoring evaluation and/or claims data suggested the need for additional contact. These follow-up site visits were similar in structure and content to those conducted previously. Virtual site visits took place entirely by phone, included an average of three interviews, and were led by the SMEs and RPs primarily responsible for evaluating each awardee. For the awardees that did not participate in the follow-up visits, we completed end-of-year interviews by phone with one to three key innovation leaders.

Coding

We used a coding process to retrieve and organize the large amount of qualitative data collected for the evaluation. As Miles and Huberman state, coding *"involves how you differentiate and combine the* *data you have retrieved and the reflections you make about this information."*[5] In practical terms, coding entails applying a consistent set of terms ("codes") to the raw data, and then grouping text flagged as representative of the term to identify more specific patterns and themes.

Our codebook includes, but is not limited to, the deductive and inductive constructs described in the construct development section. We arranged the constructs hierarchically, such that some constructs are considered part of larger ones. In addition to coding topic areas and the content of response, the coding scheme includes attributes assigned to different types of informants (e.g., program coordinators, data managers, physicians, etc.), or awardees. This enabled us to assess whether and how the lessons we gleaned from our data vary depending on the source.

We used qualitative data analysis software (QSR NVivo 10.0 and 11.0, www.qsrinternational.com) to automate the coding process. First, we entered our constructs and data attributes into the software. Second, we imported all data sources (site visit interviews, progress reports, call notes, etc.). Third, we divided responsibility for assigning the constructs to a team of trained coders, selected from among our evaluation team. Finally, after the coders independently applied the codes to our raw data, we merged their databases and used the final file to output reports.

We adopted several practices to ensure the rigor of our coding process. First, we conducted ongoing training with coders. We began the analysis process by selecting coders with qualitative data analysis experience, provided a codebook with definitions for all evaluation constructs, and met frequently to discuss the constructs in detail. In many cases, the coders had helped to establish the evaluation constructs at the beginning of the project, and thus began coding with considerable content knowledge. After we began applying the codes, we used debriefing meetings with the coding team to discuss uncertainties relating to the coding, refine the meaning of the evaluation constructs, and develop new constructs. Ultimately, debriefings should enhance agreement among coders by creating a similar interpretive framework that analysts share as they review raw data.[6]

Second, at the conclusion of each round of coding, we assessed interrater reliability. Measures of interrater reliability capture the level of agreement among independent coders on the categorization of qualitative data. Measuring interrater reliability attempts to reduce the error and bias generated in processing and interpreting narrative or textual data.[7] To ensure high interreliability (> 85%) for this evaluation, two analysts independently and concurrently coded a subset (20%) of data (e.g., interview notes, narrative documents). When they were finished, the qualitative task manager used NVivo to run a coding comparison report to identify any codes with weak (< 85%) agreement. The task manager adjudicated disagreements when agreement was below the project threshold, and the debriefing meetings provided opportunities to review and refine the codes in question. Weak agreement among

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[5] Miles, M., and Huberman, A.: Qualitative data analysis. London. Sage, 1984.
[6] Hruschka, D.J., Schwartz, D., St. John, D.C., et al.: Reliability in open-ended data: Lessons learned from HIV behavioral research. Field Methods 16(3):307-331, 2004.
[7] Mays, N., and Pope, C.: Rigor and qualitative research. BMJ 311(6997):109-12, 1995.

coders became rarer as the evaluation continued, given convergence in skill and knowledge among members of the coding team.

Analysis

Coding enabled RTI's team to synthesize evaluation themes and findings both within an awardee and across awardees. After the coding team finished processing qualitative data in NVivo and adjudicated and discussed areas of weak agreement among coders, evaluation team leaders output code reports using the software. The two qualitative awardee chapter authors received reports specific to the innovation they were studying, limited to the constructs listed in Table D-1 and the sources identified in Table D-2. The awardee chapter authors read the reports, considered the content in light of their knowledge from earlier in the evaluation, and prepared written text summarizing key themes and findings relevant to each innovation. Senior project staff reviewed drafts of the report, scrutinizing the findings, and frequently requested that authors add information or explanation to better address the project's evaluation questions.

Cross-awardee chapter authors received reports focusing on specific constructs or sets of constructs relevant to their research topic or question. Evaluation team leaders limited the reports to single awardees or subsets of awardees (e.g., awardees using care coordinators, awardees using HIT), as appropriate. Cross-awardee chapter authors typically used an inductive approach to identify themes from within their reports. Authors shared these themes during evaluation team meetings, and received guidance on their analysis and presentation of the findings during check-in calls with a senior reviewer.

Appendix E

Qualitative Comparative Analysis Methods

Technical Appendix E: Qualitative Comparative Analysis Methods

Methods

Drawing from mathematical set theory, qualitative comparative analysis (QCA) examines which condition sets (similar to variables)—individually or in combination—are necessary or sufficient to produce an outcome.[1] An analysis using QCA assesses the combinations of all condition sets at high or low levels and uses formal logic and Boolean algebra to reduce solutions. A finding of a necessary condition set or combination of condition sets indicates that the condition set (or combination of condition sets) must be present for the outcome to occur, but does not guarantee that the outcome will occur. A finding of a sufficient condition set or combination of condition sets means that if the condition set (or combination of condition sets) is present, then the outcome is also present.[2] QCA differs from probabilistic methods, which employ linear algebra and assess which factors (holding all other factors constant) maximize the likelihood of an outcome.[3]

Following all site visits and closeout interviews, site visit teams completed a QCA summary form (see ***Figure E-1***) to assess awardees on several domains—awardee leadership engagement, history of implementing similar innovations, organizational priority of the innovation, and implementation effectiveness.[4] To collect systematic data on each of these domains, we compiled a list of indicators from Consolidated Framework for Implementation Research (CFIR) domains (Damschoder and Lowery[5]); through key informant interviews and awardee reports, site visits teams could obtain objective data on whether the indicators occurred. For example, the teams could assess whether high-level leaders provided 0.5 full-time equivalent (FTE) for the innovation through triangulating key informant interview reports with awardee reports submitted to CMMI for implementation monitoring of staffing. For more "subjective" assessments, such as whether high-level leaders understood the innovation and could articulate direct involvement, site visit teams obtained and triangulated information from key informants and provided a brief description of leadership knowledge and direct involvement in the form. To ensure consistency of outcomes, implementation effectiveness, we applied a multistep process. First, RTI analysts rated the awardee as very successful, successful, somewhat successful, or not at all successful—and then explained each awardee's score. Additionally, an independent rater, knowledgeable about all awardees, compiled the reach, fidelity, and dose information for each awardee

[1] Schneider, C.Q., and Wagemann, C.: Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge. Cambridge University Press, 2012.
[2] Ragin, C.C.: Fuzzy-Set Social Science. Chicago: University of Chicago Press, 2000.
[3] Longest, K.C., and Thoits, P.A.: Gender, the stress process, and health: a configurational approach. Soc Ment Hlth. 2(3), 187-206, 2012.
[4] For this analysis, we present new definitions and fuzzy calibrations for history and priority as compared to the analysis included in the 2015 annual report.
[5] Damschroder, L.J., and Lowery, J.C.: Evaluation of a large-scale weight management program using the consolidated framework for implementation research (CFIR). Imple Science, 8, 2013.

and scored them on the same scale. During a single meeting, the independent rater and all site visit teams compared scores and adjudicated all ratings across awardees to ensure common application of the scoring. We selected these dimensions (awardee leadership engagement, history of implementing similar innovations, organizational priority of the innovation, and implementation effectiveness) on the basis of organizational theories of implementation (e.g., Damschoder and Lowery,[6] Weiner and colleagues[7]). Moreover, because we had 24 awardees, we limited the number of conditions so as to avoid creating too much limited diversity (i.e., having no empirical cases for combinations). QCA examines all combinations of conditions at high and low levels therefore, the number of possible combinations increases exponentially with each additional condition in the model. ***Table E-1*** provides the definition of each condition included in the analysis and how it was calibrated. We compiled the values into a single dataset (see ***Table E-1***) and used the dataset to develop a truth table (see ***Table E-2***), the central analytic tool in QCA analyses.[8] Using best practices outlined by Schneider and Wagemann,[9] we conducted a conventional QCA and employed R's QCA and SetMethods packages to implement these analyses.[10]

Table E-1. Conditions, Definitions, and Calibration Decision

Condition Set	Definition	Calibration	Score
Strong leadership support	Leadership support refers to the commitment, involvement, and accountability of leaders for implementation. We assessed this support by asking site visit teams to indicate whether the awardee leadership displayed several attributes: • Understands the innovation well and can articulate their direct involvement • Attends staff meetings involving the innovation • Provides in-kind resources • Provides for staff resources (i.e., created at least 0.5 FTE jobs that are not funded by HCIA) • Ensures adequate space and/or equipment is allocated for the innovation • Serves as a liaison to external partners for the innovation • Other	• If the awardee had 7 leadership attributes OR provided in-kind resources or funded additional staff for the innovation, it was scored as fully in the set of having high-level leadership support.	1.0
		• If the awardee had 5–6 leadership attributes, it was scored as more in than out of the set of having high-level leadership support.	0.66
		• If the awardee had 3–4 leadership attributes, it was scored as more out than in of the set of having high-level leadership support.	0.33
		• If the awardee had 2 or fewer leadership attributes, it was scored as fully out of the set of having high-level leadership support.	0

(continued)

[6] Damschroder, L.J., and Lowery, J.C.: Evaluation of a large-scale weight management program using the consolidated framework for implementation research (CFIR). Imple Science, 8, 2013.
[7] Weiner, B.J., Lewis, M.A., and Linnan, L.A.: Using organization theory to understand the determinants of effective implementation of worksite health promotion programs. Health Ed Res. 24(2), 292-305, 2009. doi:10.1093/her/cyn019
[8] Ragin, C.C.: Fuzzy-Set Social Science. Chicago. University of Chicago Press, 2000.
[9] Schneider, C.Q., and Wagemann, C.: Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge. Cambridge University Press, 2012.
[10] Dusa, A., and Theim, A.: Qualitative Comparative Analysis. R Package Version 1.1-4, 2014. Retrieved March 19, 2015, from http://cran.r-project.org/package=QCA

Table E-1. Conditions, Definitions, and Calibration Decision (continued)

Condition Set	Definition	Calibration	Score
History of implementing innovations	History refers to whether the awardee (or implementing organization) had experience implementing the innovation (or a similar innovation) or was scaling up an existing innovation.	• If the awardee (or implementing organization) had experience in implementing all components of their HCIA innovation, it was scored as fully in the set of history of implementing the innovation.	1.0
		• If the awardee (or implementing organization) had experience implementing some or most of their innovation components, it was scored as more in than out of the set of history of implementing the innovation.	0.66
		• If the awardee (or implementing organization) had experience implementing similar innovations, but not the same HCIA innovation, it was scored as more out than in the set of history of implementing the innovation.	0.33
		• If the awardee (or implementing organization) has no experience in implementing the HCIA or similar innovation (i.e., the innovation is completely new), it was scored as 0.0, fully out of in the set of history of implementing the innovation.	0
High organizational priority for the innovation	This condition refers to individuals' shared perception of the importance of the implementation of the innovation within the organization and whether competing programs or initiatives distract or compete with the innovation. To capture this, site visit teams indicated whether • The HCIA-funded innovation was seen as a critical activity that aligned with organizational goals, strategic plans, or vision; • Most awardee staff considered the work related to the innovation to be their real work; • Any other major initiatives or programs competed for staff's attention; • Awardee had clear and specific sustainability plans; and • Workforce development specific to skills needed for the innovation had been taken seriously by awardee.	• If the awardee had 5 of the characteristics selected, it was scored as fully in the set of high organizational priority.	1.0
		• If the awardee had 4 of the 5 characteristics, it was scored as mostly but not fully in the set of high organizational priority.	0.8
		• If the awardee had 3 of the 5 characteristics, it was scored as more or less in the set of high organizational priority.	0.6
		• If the awardee had 2 of the 5 characteristics, it was scored as more or less out of the set of high organizational priority.	0.4
		• If the awardee had 1 of the 5 characteristics, it was scored as mostly but not fully out of the set of high organizational priority.	0.2
		• If the awardee had 0 of the 5 characteristics, it was scored as fully out of the set of high organizational priority.	0

(continued)

Table E-1. Conditions, Definitions, and Calibration Decision (continued)

Condition Set	Definition	Calibration	Score
OUTCOME: Achieving implementation effectiveness	Effective implementation (also known as implementation success) refers to delivering the innovation as planned or with purposive changes to a substantial proportion of the targeted population in doses associated with effectiveness. RTI analysts rated the awardee as to whether awardee was very successful, successful, somewhat successful, or not at all successful. Additionally, an independent rater, knowledgeable about all awardees, compiled the reach, fidelity, and dose information for each awardee and scored them. The independent rater and all site visit teams met and adjudicated all ratings to ensure common application of the scoring.	• If the awardee was rated as very successful, it was scored as fully in the set of achieving implementation effectiveness.	1.0
		• If the awardee was rated as successful, it was scored as more in than out of the set of achieving implementation effectiveness.	0.66
		• If the awardee was rated as somewhat successful, it was scored as more out of than in the set of achieving implementation effectiveness.	0.33
		• If the awardee was rated as not at all successful, it was scored as fully out of the set of achieving implementation effectiveness.	0
Strong leadership support	Leadership support refers to the commitment, involvement, and accountability of leaders for implementation. We assessed this support by asking site visit teams to indicate whether the awardee leadership displayed several attributes: • Understands the innovation well and can articulate their direct involvement • Attends staff meetings involving the innovation • Provides in-kind resources • Provides for staff resources (i.e., created at least 0.5 FTE jobs that are not funded by HCIA) • Ensures adequate space and/or equipment is allocated for the innovation • Serves as a liaison to external partners for the innovation • Other	• If the awardee had 7 leadership attributes OR provided in-kind resources or funded additional staff for the innovation, it was scored as fully in the set of having high-level leadership support.	1.0
		• If the awardee had 5–6 leadership attributes, it was scored as more in than out of the set of having high-level leadership support.	0.66
		• If the awardee had 3–4 leadership attributes, it was scored as more out than in of the set of having high-level leadership support.	0.33
		• If the awardee had 2 or fewer leadership attributes, it was scored as fully out of the set of having high-level leadership support.	0

(continued)

Table E-1. Conditions, Definitions, and Calibration Decision (continued)

Condition Set	Definition	Calibration	Score
History of implementing innovations	History refers to whether the awardee (or implementing organization) had experience implementing the innovation (or a similar innovation) or was scaling up an existing innovation.	• If the awardee (or implementing organization) had experience in implementing all components of their HCIA innovation, it was scored as fully in the set of history of implementing the innovation.	1.0
		• If the awardee (or implementing organization) had experience implementing some or most of their innovation components, it was scored as more in than out of the set of history of implementing the innovation.	0.66
		• If the awardee (or implementing organization) had experience implementing similar innovations, but not the same HCIA innovation, it was scored as more out than in the set of history of implementing the innovation.	0.33
		• If the awardee (or implementing organization) has no experience in implementing the HCIA or similar innovation (i.e., the innovation is completely new), it was scored as 0.0, fully out of in the set of history of implementing the innovation.	0
High organizational priority for the innovation	This condition refers to individuals' shared perception of the importance of the implementation of the innovation within the organization and whether competing programs or initiatives distract or compete with the innovation. To capture this, site visit teams indicated whether • The HCIA-funded innovation was seen as a critical activity that aligned with organizational goals, strategic plans, or vision; • Most awardee staff considered the work related to the innovation to be their real work; • Any other major initiatives or programs competed for staff's attention; • Awardee had clear and specific sustainability plans; and • Workforce development specific to skills needed for the innovation had been taken seriously by awardee.	• If the awardee had 5 of the characteristics selected, it was scored as fully in the set of high organizational priority.	1.0
		• If the awardee had 4 of the 5 characteristics, it was scored as mostly but not fully in the set of high organizational priority.	0.8
		• If the awardee had 3 of the 5 characteristics, it was scored as more or less in the set of high organizational priority.	0.6
		• If the awardee had 2 of the 5 characteristics, it was scored as more or less out of the set of high organizational priority.	0.4
		• If the awardee had 1 of the 5 characteristics, it was scored as mostly but not fully out of the set of high organizational priority.	0.2
		• If the awardee had 0 of the 5 characteristics, it was scored as fully out of the set of high organizational priority.	0

(continued)

Table E-1. Conditions, Definitions, and Calibration Decision (continued)

Condition Set	Definition	Calibration	Score
OUTCOME: Achieving implementation effectiveness	Effective implementation (also known as implementation success) refers to delivering the innovation as planned or with purposive changes to a substantial proportion of the targeted population in doses associated with effectiveness. RTI analysts rated the awardee as to whether awardee was very successful, successful, somewhat successful, or not at all successful. Additionally, an independent rater, knowledgeable about all awardees, compiled the reach, fidelity, and dose information for each awardee and scored them. The independent rater and all site visit teams met and adjudicated all ratings to ensure common application of the scoring.	• If the awardee was rated as very successful, it was scored as fully in the set of achieving implementation effectiveness.	1.0
		• If the awardee was rated as successful, it was scored as more in than out of the set of achieving implementation effectiveness.	0.66
		• If the awardee was rated as somewhat successful, it was scored as more out of than in the set of achieving implementation effectiveness.	0.33
		• If the awardee was rated as not at all successful, it was scored as fully out of the set of achieving implementation effectiveness.	0

Notes: FTE = full-time equivalent; HCIA = Health Care Innovation Award.

Table E-2. Data Matrix with Awardees and Their Scores

Awardee	Leadership	Organizational Priority	History	Implementation Effectiveness
AACI	1	0.6	0	0.66
Altarum	1	0.4	0.66	0.33
BAHC	1	1	1	0.66
Bronx RHIO	1	1	0.66	0.66
Children's Hospital	0	0	0	0.33
Curators	1	0.8	0.66	0.66
Delta Dental	0.33	1	0.66	0.66
ECCHC	1	0.4	0	0.33
Finity	1	1	0.66	0.66
IA	1	0	0.66	0.33
Intermountain	1	1	1	0.33
Mary's Center	0.33	0.8	0	0.33
MPHI	0.33	0.8	0.66	0.66
Mineral Regional	0	0.6	0	0.33
NHCHC	1	0.8	0.33	0.66
NEU	0	0.4	0.33	0.33
Prosser	1	1	0	0.66
REMSA	1	0.8	0.33	0.66
South County	1	1	0	0.66
SEMHS	0.33	0.4	0	0.33
U-Chicago	0	0.6	0.33	0.66
U-Miami	0	0.6	0.66	0.33
W&I	1	0.8	0.66	1
Y-USA	0.33	1	1	1

Analysis

To prepare for the analysis, we compiled the values from each awardee's QCA summary form into a single dataset and used the dataset to develop a truth table (see ***Table E-3***). Using the truth table and R software,[11],[12] we assessed individual condition sets for necessity and sufficiency, examined the necessary and sufficient combinations of conditions (hereafter, combinations), and calculated measures of consistency and coverage (i.e., parameters of fit within QCA). Consistency indicates the "degree to which the empirical data are in line with the postulated subset relation" (p.324).[13] Coverage identifies empirical relevance of a solution (i.e., a rare instance would have low coverage and would suggest that the solution lacked relevance for policymaking).

Table E-3. Truth Table

Row #	Strong Leadership Engagement	Having a History of Implementing the Innovation	High Organizational Priority for the Innovation	Number of Awardees in this Combination with Set Membership Value >.5	Consistency
1	0	0	0	3	0.655
2	0	0	1	0	—
3	0	1	0	3	0.794
4	0	1	1	4	0.917
5	1	0	0	1	0.910
6	1	0	1	2	0.735
7	1	1	0	5	0.894
8	1	1	1	6	0.839

Because we lacked empirical cases in truth table row 2, we also examined the conservative, parsimonious, and intermediate solutions for this combination. These three solutions make different assumptions about how to handle a row with no cases when logically reducing the solutions. The conservative solution does not include any of the rows without cases in the logical reduction; the parsimonious solution uses the rows that achieve the fewest number of solution terms. The intermediate solution draws on theoretical expectations to determine whether to include a row. Our theoretical assumptions included that strong leadership engagement, a history of implementing the innovation, and high organizational priority would contribute to achieving implementation effectiveness. The intermediate and conservative solutions were identical; the parsimonious solutions presented supersets of the intermediate and conservative solutions (as it drew upon an additional row without cases to simplify the solutions). We present the intermediate solution in this report; this is currently a best practice in reporting

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[11] Dusa, Adrian: User manual for the QCA (GUI) package in R. J Bus Res 60(5), 576-586, 2007.
[12] Medzihorsky, J., Oana, I-E., Quaranta, M., and Schneider, C. Q.: SetMethods: Functions for Set-Theoretic Multi-Method Research and Advanced QCA. R package version 2.0., 2016. Accessed on August 20, 2016. https://cran.r-project.org/w…/packages/SetMethods/index.html).
[13] Schneider, C. Q., and Wagemann, C.: Set-theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge. Cambridge University Press, 2012.

QCA results. The super/subset relationship between the parsimonious and intermediate or conservative solutions support the robustness of the results. Also, to assess robustness, we tested our findings at different consistency thresholds, 0.75, .80, and 0.90; the results are logically consistent, which supports robustness.[14]

Because an underlying principle of QCA is asymmetry of potential solutions for an outcome, we conducted the same analyses for the non-occurrence of the outcome (i.e., NOT achieving implementation effectiveness) to ensure that no contradictory findings arose (i.e., one cannot find that X is sufficient for Y, and also for not-Y because sufficiency implies that where X is present, Y is also present). In assessing the non-occurrence of the outcome, we determined that the software used row 5 for the minimization of the outcome and non-occurrence of the outcome, which is logically contradictory (i.e., one cannot argue that the same pathway leads to both the outcome and the non-occurrence of the outcome). This logical contradiction can happen in fuzzy sets because cases have membership in multiple truth table rows (or simultaneous subset relations). To rectify this logical contradiction, we reviewed the product of the proportional reduction in inconsistency (PRI) and row consistency value for the truth table row. We determined that row 5 included one case that did not achieve implementation effectiveness, and the product of PRI and consistency value for that row was greater for the non-occurrence of the outcome. Thus, we recoded row 5 in our final analysis to exclude it from use on the minimization of the outcome but included it in the analysis of the non-occurrence of the outcome.

Detailed Findings

Fourteen awardees were scored as achieving 0.66 or higher on the implementation effectiveness rating; the remaining 10 awardees were scored as 0.33 or lower on implementation effectiveness. None of the individual condition sets were necessary or sufficient for achieving implementation effectiveness; no necessary combinations occurred.

Analysis of the sufficient combinations for the outcome showed two consistent combinations:

1. Having strong leadership support and having a high organizational priority
2. Having a high organizational priority and having a history of implementing the innovation

Table E-4 displays the solutions, their individual consistency and coverage values, and the total solution consistency and coverage.

The first combination (strong leadership support and a high organizational priority) accounted a substantial portion of the outcome (raw coverage = 0.705); the awardees that best fit into this solution included AACI, BAHC, Bronx RHIO, Curators, Finity, Intermountain, NHCHC, Prosser, REMSA, South County, and W&I (Intermountain did not achieve a rating of 0.66 or higher on implementation effectiveness, reducing the consistency for this solution). The second combination (organizational priority and a history of implementing the innovation) also had a substantial coverage value (0.600). Awardees

[14] Ibid.

that best fit into this solution included BAHC, Bronx RHIO, Curators, Delta Dental, Finity, Intermountain, MPHI, U-Miami, W&I, and Y-USA. However, U-Miami and Intermountain did not achieve a rating of 0.66 or higher on implementation effectiveness.

Five awardees that achieved implementation effectiveness (BAHC, Bronx RHIO, Curators, Finity, and W&I) appeared in both solutions, which resulted in lower unique coverage. Taken together, these solutions accounted for most (0.880) of the set membership value of outcome set, implementation effectiveness, and together had a 0.784 consistency, which translates into being almost always sufficient.[15]

Table E-4. Sufficient Combinations for Achieving Implementation Effectiveness

Sufficient Combination	Raw Coverage	Unique Coverage	Consistency
1. Having strong leadership support and a high organizational priority	0.705	0.281	0.761
2. Having a high organizational priority and a history of implementing the innovation	0.600	0.175	0.855
Total solution consistency = 0.784			
Total solution coverage = 0.880			

Figure E-1. QCA Structured Instrument

<table>
<tr><td colspan="2">IMPORTANT! Most measures represented in this document are specific to the awardee. Thus, you will need to rely on your substantive knowledge of the awardee to make a qualitative judgment as to whether awardees meet particular thresholds for the categories provided.</td></tr>
<tr><td colspan="2">Leadership Engagement</td></tr>
<tr><td colspan="2">Generic Definition: Commitment, involvement, and accountability of leaders and managers, including middle managers, for the implementation</td></tr>
<tr><td>Evaluator Assessment of Leadership Engagement in the Implementation Process
Using information you have collected through document review, interviews, or field observations, evaluate the leadership engagement of the implementation process within the awardee organization.
Awardee leadership is defined as the person(s) to whom the Principal Investigator (PI) or Project Director (PD) of the innovation report. They should be in a position of authority, not funded more than 25% of their time by the Health Care Innovation Awards (HCIA) and have the power to make resource allocation decisions. Awardee leadership referred to throughout this document is NOT the PI/PD or program staff. Awardee leadership may be organizational leaders, such as the chief executive officer (CEO).</td><td>Please mark all that apply:
☐ Awardee leadership understands the innovation well and can articulate their direct involvement
☐ Awardee leadership attends staff meetings involving the innovation
☐ Awardee leadership provides in-kind resources
☐ Awardee leadership provides for staff resources (i.e., created at least 0.5 full-time equivalent [FTE] jobs that are not funded by HCIA)
☐ Awardee leadership ensures adequate space and equipment are allocated for the innovation
☐ Awardee leadership serves as a liaison to external partners for the program
☐ Other, specify:</td></tr>
</table>

(continued)

[15] Ragin, C.C.: Fuzzy Set Social Science. Chicago. University of Chicago Press, 2000.

Figure E-1. QCA Structured Instrument (continued)

<table>
<tr><th colspan="2">Implementation climate—relative priority</th></tr>
<tr><td colspan="2">Generic Definition:
Relative priority refers to “individuals’ shared perception of the importance of the implementation within the organization” relative to other activities and initiatives. In organizations with high priority, staff identify the innovation as part of their work and see how the innovation fits in with their organization’s goals (e.g., “this is important work because it helps us meet our performance measures”). Other activities or initiatives may be going on in the organization, but staff do not see those other activities as competing or as drawing away resources. In organizations with low priority, staff define the innovation as a distraction from or irrelevant to their real work (e.g., “my boss is making me do this”) and do not see how the innovation relates to their organization’s goals or mission (e.g., the innovation is merely a mechanism to get funding). Such organizations may have many other initiatives that compete with each other and make staff feel overwhelmed.</td></tr>
<tr><td>Evaluator Assessment of Relative Priority:
Using information you have collected through document review, interviews, or field observations, evaluate the relative priority of the innovation within the awardee organization.

The innovation team is defined as the core team of the innovation; this includes the PI or PD and anyone else internally who was considered key to their implementation.</td><td>Please check all the factors that apply to your awardee:

☐ HCIA was seen as a critical activity that aligned with organizational goals, strategic plans, or vision

☐ Most awardee staff consider the work related to the innovation to be their real work (e.g., they would be doing this anyway—one respondent said this innovation “is the backbone of what they do”)

☐ No other major initiatives or programs compete for staff’s attention (e.g., this is the “biggest thing on their plate,” staff are not “wearing too many hats,” this is not something they had to add to their plate and be burdened by, it is something that automatically fits into their role)

☐ Awardee has clear and specific sustainability plans (e.g., the innovation will definitely be integrated into their ongoing work; the awardee can be sustaining some or all the components of their innovation)

☐ Workforce development specific to skills needed for the innovation has been taken seriously by awardee such that INTERNAL (i.e., awardee did not merely refer staff to small informal trainings external to the organization, such as brown bags) training has been developed or provided</td></tr>
</table>

(continued)

Figure E-1. QCA Structured Instrument (continued)

Implementation climate—experience with previous work or models	
Generic definition: Experience with implementing innovations similar to the HCIA innovation	
Evaluator Assessment of Experience with Previous Work/Models Using information you have collected through document review, interviews, or field observations, evaluate the experience with previous work/models within the awardee organization. *NOTE: If the awardee (i.e., funded organization) served as the fiduciary agent for distributing funds and a separate organization actually implemented the innovation, please answer this question about the organization that was actually responsible for implementation.* For multi-site implementations, base your assessment only on sites that have been interviewed or visited, unless the awardee at the main or leading site has provided enough information for you to make assessments at sites that you did not interview or visit.	**Select one of the following:** ☐ The awardee (or implementing organization) has experience in implementing all components of their HCIA innovation. They may have expanded an existing innovation to other clinical settings, sites, or new target populations for HCIA. ☐ The awardee (or implementing organization) has experience implementing some or most of their innovation components. (At least one component is new to the awardee.) ☐ The awardee (or implementing organization) has experience implementing similar innovations, but not the same HCIA innovation. ☐ The awardee (or implementing organization) has no experience in implementing the HCIA or similar innovation (i.e., the innovation is completely new). Provide brief comments/justification for your rating below: *Brief justification*
Exogenous factors: Elements outside/external to the organization or program that may influence implementation and/or related outcomes. Generally, the outer setting includes the economic, political, and social context within which an organization resides.	
Please list any external factors that had an impact on implementation.	
Endogenous factors: Tangible and intangible manifestation of characteristics of the organizations involved in the intervention, including structural characteristics, networks and communications, culture, climate, and readiness that all interrelate and influence implementation.	
Please list any internal factors that had an impact on implementation.	
Internal key stakeholder engagement	
Generic definition: Involving appropriate internal stakeholders (i.e., necessary entities within the organization) throughout planning and implementation. The engagement of internal key players helps to focus the program and research on meaningful outcomes and increases the likelihood of buy-in and sustainability of the program.	

(continued)

Figure E-1. QCA Structured Instrument (continued)

Innovation team is defined as the core team of the innovation, to include the PI or PD and anyone else internally who is considered key to their implementation. Innovation leader is the PI or PD. By internal key stakeholder, we mean other individuals who are responsible for parts of the organizations that the innovation team needed to collaborate with to implement the innovation successfully (e.g., IT department had to be on board with the clinicians for a health IT innovation).	**Please mark all that apply:** ☐ The innovation team attracted and involved appropriate individuals in implementation (e.g., used training programs, marketing strategies to inform stakeholders about rollout, role modeling). ☐ Members of the innovation team were carefully and thoughtfully selected. ☐ Innovation team is a cohesive team. ☐ Innovation team includes champions (or other key stakeholders who are most likely to make implementation successful). ☐ All (or most) internal key stakeholders are involved in the implementation. ☐ Internal key stakeholders are engaged in solving problems or addressing implementation challenges. ☐ Key innovation team members report having dedicated time for the innovation. ☐ Key innovation team members feel supported and empowered in their efforts. ☐ Key innovation team members are similar to the intended users (e.g., cultural background, similar SES). ☐ Implementation process has clearly defined leader(s). ☐ Innovation leader(s) were identified early in the planning or implementation process. ☐ Innovation leader(s) have been involved or engaged throughout the implementation process. ☐ None of the above.
Execution	
Generic definition: The processes for achieving the program's objectives. Execution of an implementation plan may be organic with no obvious or formal planning, which makes execution difficult to assess. Quality of execution may consist of the degree of fidelity of implementation to planned courses of action, intensity (quality and depth) of implementation, timeliness of task completion, and degree of engagement of key involved individuals (e.g., implementation leaders) in the implementation process. The effectiveness of carrying out the tasks of the program may be facilitated or impeded by decision-making processes, organizational arrangements, or implementation planning.	

(continued)

Figure E-1. QCA Structured Instrument (continued)

<table>
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Evaluator Assessment of Execution

Using information you have collected through document review, interviews, or field observations, evaluate the execution processes within the awardee organization.

Innovation team is defined as the core team of the innovation, to include the PI or PD and anyone else internally who was considered key to their implementation. Implementation leader is the PI or PD.

</td>
<td>

Please mark all that apply:

☐ Innovation team had a well-developed documented implementation plan that included the following (**mark all that apply**):

- ☐ A detailed timeline
- ☐ Detailed milestones
- ☐ Staff assignments for key milestones or steps
- ☐ Contingency plans (i.e., what they will do if problems are encountered)
- ☐ Specific measures mapped to measurable outcomes

☐ Innovation team made decisions that supported implementation *(please explain below)*.
☐ Organizational structure facilitated implementation.
☐ PI or PD considered staff input in the implementation process.
☐ All or most of required tasks for implementation have been completed on time.
☐ Innovation team tried dry runs or practice sessions to train team members before going live.
☐ Innovation team used incremental process (i.e., breaking down complex interventions into smaller, more manageable components that are gradually introduced).
☐ Innovation team worked with necessary entities within the organization to implement the innovation (e.g., no collaboration with counselors).
☐ Innovation team is on track to complete all milestones by the end of the funding cycle (i.e., operational plan milestones)—*they are well below their numbers.*
☐ None of the above.

HEALTH IT ONLY (i.e., only answer if an innovation program component included health IT)

The technical staff developing the IT interfaces or programs believed they understood what the users (e.g., clinical staff, analysts) needed before development.

☐ Yes
☐ No
☐ Not applicable (no health IT component)

The users of the IT interfaces or programs (e.g., clinical staff, analysts) believed that the IT interfaces or programs that were developed for the innovation took their needs into consideration.

☐ Yes
☐ No
☐ Not applicable (no health IT component)

</td>
</tr>
</table>

(continued)

Figure E-1. QCA Structured Instrument (continued)

Staff retention	
Evaluator Assessment of staff adequacy Using information you have collected through document review, data analysis, interviews, or field observations, evaluate the staffing adequacy, turnover, or gaps the awardee experienced.	<u>**Awardee experienced**</u> ☐ **Great staff adequacy**. Innovation team always had necessary staff in place to implement the innovation. Innovation team never experienced staff shortfall; innovation team lost no staff (i.e., retained all staff). ☐ **Considerable staff adequacy**. Innovation had necessary staff in place most of the time. The innovation team may have lost a few staff (minimal turnover) but COULD replace easily (thus, experiencing minimal staffing gaps). ☐ **Minimal staff adequacy.** Innovation team seldom had all the staff they needed to implement the innovation. Innovation team may have lost a few staff and could not easily replace (thus, experienced staffing gaps). ☐ **Poor/no staff adequacy.** Innovation team was never or almost never staffed adequately to implement the innovation; key roles were consistently unfilled. Innovation team may have lost several staff members or a single key staff member critical to the innovation and could not easily replace them.
Self-monitoring	
Generic Definition: Self-monitoring is a procedure (possibly with tracking tools) whereby the innovation team uses administrative and program data they collect to assess their progress and make mid-course corrections in their implementation.	
Evaluator Assessment of Data Systems Using information you have collected through document review, interviews, or field observations, evaluate the processes and systems in place to document and monitor innovation implementation (e.g., enrollment rates, services provided to patients, workforce development efforts, employment of trainees).	To what extent does the innovation team have processes or systems in place to document and monitor innovation implementation (to ensure the innovation is on course to meet its goals)? ☐ A great extent ☐ A considerable extent ☐ A slight extent ☐ No extent Did the innovation team have data systems in place to provide usable data to RTI by December 31, 2014? ☐ Yes ☐ No To what extent is the innovation team using systems to inform ongoing program development and quality improvement? ☐ A great extent ☐ A considerable extent ☐ A slight extent ☐ No extent

(continued)

Figure E-1. QCA Structured Instrument (continued)

<table>
<tr><th colspan="2">Innovation characteristics</th></tr>
<tr><th colspan="2">Complexity</th></tr>
<tr><td colspan="2">Generic Definition: Duration, scope, radicalness, centrality, intricacy, and number of steps required to implement (length) and number of choices or pathways available at various decision points (breadth). Complexity is also increased when targeting a larger number of potential targets or multiple organizational units. Innovations can be technically complex, administratively complex, or both.</td></tr>
<tr><td>Evaluator Assessment of Intervention Complexity:
Using information you have collected through document review, data analysis, interviews, or field observations, evaluate the complexity of the innovation.</td><td>How does the innovation team enroll patients into the innovation (i.e., how complex of a process is it to identify, recruit, and enlist a patient into the innovation for those directly serving patients)? Please mark all that apply:
☐ They invite patients to enroll as they come in for other services (i.e., captive audience).
☐ They obtain a list of patients from an external source (e.g., Medicaid eligible patients they have served) who meet specific criteria (e.g., emergency room [ER] visit in last month) and reach out to them by phone.
☐ They obtain a list of patients from an internal roster (e.g., their electronic medical records) who meet specific criteria (e.g., ER visit in last month) and reach out to them by phone.
☐ They conduct community outreach (e.g., through home visits) in areas where the target population lives and identify patients through in-person contact.
☐ The patient is referred to the innovation by an external partner or provider.
☐ The patient is referred to the innovation by an internal partner or provider.
☐ Not relevant (the innovation serves indirect patients only).
☐ Other, please specify ____________________
☐ Other, please specify ____________________</td></tr>
<tr><td></td><td>What level of coordination within the awardee organization was needed to start the innovation?
☐ Great
☐ Considerable
☐ Slight
☐ None</td></tr>
</table>

(continued)

Figure E-1. QCA Structured Instrument (continued)

	What level of coordination within the awardee organization was needed to ***maintain*** the innovation? ☐ Great ☐ Considerable ☐ Slight ☐ None To what extent did the awardee have to change their workflow for the innovation? ☐ A great extent ☐ A considerable extent ☐ A slight extent ☐ No extent To what extent did the innovation change people's roles and responsibilities? ☐ A great extent ☐ A considerable extent ☐ A slight extent ☐ No extent
Implementation effectiveness	
Dosage	
Generic Definition: how many of the services or intervention an individual should receive specific to the context and nature of the innovation (e.g., medical office visits, phone calls, counseling sessions). With this measure, we are trying to get a more accurate picture of the extent to which the awardee actually delivered the dose or exposure to the innovation as they had planned. We are not claiming that a longer or more frequent dose is better—we are simply trying to quantify what they delivered and can examine the extent to which these qualities are associated with key outcomes. This assessment is for all participants enrolled to the innovation, on average—so it is an innovation-level measure not an individual-level assessment. In our data collection, we talked about dose in terms of three measures: 1. Intensity, or the degree of exposure to the innovation (e.g., number of services they received over time, level of effort for those services such that if it's making an appointment for someone, that may be low intensity whereas a home visit would be high intensity) 2. Duration or the range of time patients received services (e.g., could be a one-time exposure, which would be low or no duration, or a 3-month follow-up period, which would be high duration) 3. Frequency or the number of times over the period of duration the innovation was delivered (e.g., many were just one-time events so that frequency is low while others were several interactions over the course of a week or month, which would be higher)	

(continued)

Figure E-1. QCA Structured Instrument (continued)

Evaluator Dosage Assessment:

Using what is now known about this innovation, what is your opinion on the following measures for dose?

- What was the intensity of the innovation delivered (on average) to patients or participants? Please provide your assessment of the intensity and any notes to help explain why you rate it that way ("cannot determine" is not an option because we want you to give your opinion).
  - ☐ High (long contacts in person such as home visits)
  - ☐ Medium (contacts with participants lasted at least 30 minutes or more by phone or in person)
  - ☐ Medium low (contacts with participants were short (greater than the low category and <30 minutes), such as a reminder phone call, and required fairly low interaction with participant)
  - ☐ Low (contacts with participants were virtual (IT) or passive such as giving them print material)
  - ☐ Not applicable because ____________________________

  Please briefly explain your answer:

- What was the duration of the innovation delivered (on average) to patients or participants? Please provide your assessment of the intensity and any notes to help explain why you rate it that way ("cannot determine" is not an option because we want you to give your opinion).
  - ☐ High (>30 days or a month)
  - ☐ Medium (> 2 weeks but <30 days or a month)
  - ☐ Medium low (>1 day but ≤ 2 weeks)
  - ☐ Low (≤ 1 day/time/event)
  - ☐ Not applicable because ____________________________

  Please briefly explain your answer:

- What was the frequency of the innovation delivered (on average) to patients or participants? Please provide your assessment of the intensity and any notes to help explain why you rate it that way ("cannot determine" is not an option because we want you to give your opinion).
  - ☐ High (>10 encounters)
  - ☐ Medium (6–10 encounters on average)
  - ☐ Medium Low (2–5 encounters on average)
  - ☐ Low (≤ 1 time/event)
  - ☐ Not applicable because ____________________________

  Please briefly explain your answer:

Overall implementation effectiveness

Generic Definition: Effective implementation (i.e., implementation success) is the presence of the innovation delivered as intended (fidelity) to a substantial proportion of the targeted population (reach) in doses associated with effectiveness (dosage).

Evaluator Implementation Effectiveness Assessment:

Using your responses above and overall impression of the awardee's innovation, please rate their overall effectiveness in their innovation implementation *(awardees will never know what you rated them—please come to an agreement as a team for one rating)*:

☐ Very successful
☐ Successful
☐ Somewhat successful
☐ Not at all successful

Provide brief comments/justification for your rating:

Brief justification

Appendix F

Detailed Methods for Cross-Awardee Analyses

Technical Appendix F.1: Qualitative Analysis of Innovation Adoption of Radiology Clinical Decision Support Tools

Methods

This case study uses qualitative research methods to compare and contrast the factors affecting adoption of two radiology clinical decision support (CDS) interventions in projects implemented by two Health Care Innovation Award (HCIA) awardees, Altarum Institute (Altarum) and Imaging Advantage (IA). This case study involved both a prospective and a retrospective approach to identify key components of clinician adoption of these radiology-based CDS interventions, accounting for structural and contextual differences. In addition, some quantitative data on measures of reach—such as the number of providers trained, accessing, and using the CDS—and some survey data on provider acceptance were included for additional context. We analyzed both qualitative and quantitative data to elicit key factors for adoption that differentiate the adoption and implementation of these similar radiology-based CDS initiatives.

The Process Redesign framework[1] developed from the Consolidated Framework for Implementation Research (CFIR) framework[2], was used to organize, analyze, and compare the Altarum and IA innovations. Key elements of the framework for this evaluation were Innovation Characteristics, Implementation Process, and Implementation Measures, with a discussion of Characteristics of Individuals and Teams, and Evaluation Measures and mention of Internal Context and External Context. The framework used in this analyses mapped to the primary framework for the overall HCIA evaluation analysis is outlined in ***Table F.1-1***.

[1] Rojas Smith, L., Ashok, M., Dy, *S.* M., Wines, R .C., and Teixeira-Poit, S.: Contextual Frameworks for Research on the Implementation of Complex System Interventions. Methods Research Report. (Prepared by the RTI International– University of North Carolina at Chapel Hill Evidence-based Practice Center under Contract No. 290-2007-10056-I.) AHRQ Publication No. 14-EHC014-EF. March 2014. www.effectivehealthcare.ahrq.gov/reports/final.cfm

[2] Damschroder, L., Aron, D., Keith, R., et al.: Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 4(1):50. 2009. PMID: 19664226.

Table F.1-1. Mapping Between Primary HCIA Evaluation Framework (and Process Redesign Framework

Primary HCIA Evaluation Framework HCIA CREF)	Process Redesign Framework
Exogenous Factors	External Context
Endogenous Factors	Internal Context
Innovation Characteristics	Innovation Characteristics
Workforce Development and Participant Characteristics	Characteristics of Individuals and Teams
Implementation Process	Implementation Process
Implementation Effectiveness	Measures of Implementation
Health Care Outcomes (including Coordinated Care, Clinical Effectiveness, and Health Outcomes)	Evaluation Measures

Our specific research aims were to:

1. Examine specific characteristics that affect adoption.
2. Accounting for contextual differences, prioritize the characteristics identified in Aim #1 that affect adoption from greatest to least.

To focus the effort, only characteristics that were most likely to affect adoption; innovation characteristics and implementation process and measures of implementation were addressed in detail, other factors were reviewed at a high level.

Data Analysis

Senior project staff reviewed coded reports of qualitative data collected through site visit interviews to identify innovation framework characteristics related to successful adoption, which was defined as the reach each awardee specified when applying for HCIA funding. We used an inductive process, with guidance from senior reviewers, to elicit adoption factors for which one awardee might have had an advantage over the other, thereby fostering more successful adoption. These factors were then collated among the reviewers to observe areas of overlap and differentiation. A tie-breaker session with all three reviewers and a senior reviewer was convened to resolve conflicts. The level of agreement among the three reviewers was high, and the conflicts were considered fairly minor.

We also reviewed the provider survey, which elicited feedback from family and internal medicine physicians from Altarum and a mix of physicians and mid-level providers, such as physician assistants, for IA. Care setting differences between the awardees were mitigated through weighting and specific targets were identified as key factors for adoption among physicians within each adoption factor. The goal was to make meaningful comparisons between the awardees, thereby developing a final set of key factors that impacted successful adoption, which differentiated these two awardees.

Technical Appendix F.2: Qualitative Comparative Analysis of Provider Engagement and Provider Satisfaction

Methods

To examine how engaging providers influences provider satisfaction, RTI used qualitative comparative analysis (QCA) to determine which factors—alone or in combination—were necessary and/or sufficient to produce the outcome of interest—provider satisfaction. Providers that met the criteria for the outcome indicated that they were extremely satisfied with the innovation.

To understand how engaging providers influences provider satisfaction, we reviewed peer-reviewed articles to assess the following four provider engagement factors: (1) provider involvement in the innovation (i.e., was a leader, directly involved or indirectly involved in the implementation of the innovation); (2) perceived patient benefit of the innovation; (3) integration of the innovation into clinical workflow; (4) sufficient resources to implement the innovation. In this analysis, we hypothesized that involving providers as integral leaders and decision makers in the development and implementation of an innovation has a positive impact on provider satisfaction.[3, 4]

QCA assesses multiple combinations that lead to an outcome above a certain threshold instead of trying to find the one solution that leads to the highest outcome.[5] For this analysis, we examine combination of factors with the outcome of interest above the 80 percent threshold, based on Ragin's sufficiency criterion.[6] For a general description of how a QCA works, what methods it draws on, and the basic interpretation of necessary and of sufficient condition, see ***Appendix E***.

Data and Sample

This analysis relied largely on quantitative survey responses from providers, defined as staff members responsible for direct patient medical care. They ranged from counselors and therapists to physicians, pharmacists, and nurses. Staff not directly responsible for patient clinical care, such as community health workers and health navigators, were excluded from the sample. The providers surveyed came from a subset of the 24 awardees in the HCIA Community Resource Planning,

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3 Friedberg, M.W.: Factors Affecting Physician Professional Satisfaction and Their Implications for Patient Care, Health Systems, and Health Policy, RAND, 2013. Available at: http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR439/RAND_RR439.pdf

4 Linn, L.S., Brook, R.H., Clark, V.A., Davies, A.R., Fink, A., and Kosecoff, J.: Physician and patient satisfaction as factors related to the organization of internal medicine group practices, Medical Care 23(10): 1171-1178,1985, Oct.

5 Longest and Thoits, Gender, the Stress Process, and Health: A Configurational Approach, *Society and Mental Health*, 2012, pp. 4.

6 Ragin, C.C.: Fuzzy-Set Social Science. Chicago: University of Chicago Press, 2000.

Prevention, and Monitoring, portfolio. The 10 awardees all had (1) innovations wherein providers were key users of the innovation and (2) more than 10 providers across all sites. The purpose of the survey was to gather information on the activities of providers involved in the innovations and their impressions of the impact of the innovations on their respective practices. The surveys were fielded both online as well as mailed to providers from March through June 2015.

The response rate to the RTI-administered provider survey was approximately 45 percent. A total of 366 provider responses were included in this analysis. We also used qualitative findings from interviews conducted in spring 2014 from the 10 awardees to help illustrate the different combinations for producing provider satisfaction.

Analysis

We examined providers' level of engagement through the following four factors: provider involvement, perceived patient benefit, clinical workflow integration, and access to sufficient resources. ***Table F.2-1*** provides the definition of each factor, related survey question(s), and the calibration decision for a fuzzy-set QCA. We compiled all the calibrated values into a single dataset that was imported into R's QCA and SetMethods packages to implement these analyses.[7, 8]

Table F.2-1. Conditions, Definitions, and Calibration Decision

Factors	Definition	Provider Survey Question	Calibration Decision
Provider Involvement	Providers are engaged in the implementation of the innovation within the practice setting and feel that investing time, energy, and resources to the innovation are worthwhile.	In what ways have you been involved with "[insert innovation name]"?	• If the provider was a leader or champion that oversaw implementation, it was scored as 1.0. • If the provider was directly involved (for example, was the end user of the health IT innovations), it was scored as a 0.6. • If the provider was indirectly involved (for example, did not work directly with the health IT innovations, but members of their staff or colleagues did), it was scored as a 0.3. • If the provider was not involved with the innovation, it was scored as 0.0.
		Investing in "[insert innovation name]" is worthwhile in terms of time, energy, and resources	• If the provider strongly agreed, it was scored as1.0. • If the provider somewhat agreed, it was scored as 0.6. • If the provider neither agreed or disagreed or somewhat disagreed, it was scored as 0.0.

(continued)

7 Dusa, A.: User manual for the QCA (GUI) package in R. Journal of Business Research 60(5), 2007, 576-586. Retrieved April 7, 2016.
8 Medzihorsky, J., Oana, I.E., Quaranta, M., and Schneider, C.: SetMethods: Functions for Set-Theoretic Multi-Method Research and Advanced QCA. R package version 2.0., 2016. https://cran.r-project.org/w…/packages/SetMethods/index.html). Retrieved August 20, 2016.

Table F.2-1. Conditions, Definitions, and Calibration Decision (continued)

Factors	Definition	Provider Survey Question	Calibration Decision
Provider Involvement (continued(		Responses from both questions were weighed according to the following decisions	Examined scores from both questions according the following calibration decisions: • If both responses were high (1) or if one response was high (1) and the other was mostly high (0.6), it was scored as1.0, fully in the set of provider involvement. • If one response was high (1) and the other was somewhat low (0.3) or if both responses were mostly high (0.6), it was scored as 0.6, more in than out of the set of provider involvement. • If one response was high (1) and the other was low (0) or if one response was mostly high (0.6) and the other was low (0) or if one response was mostly high (0.6) and another was somewhat low (0.3) or if both responses were somewhat low (0.3), it was scored as 0.3, more out than in the set of provider involvement. • If one response was somewhat low (0.3) and the other was low (0) or if both responses were low (0.3), it was scored as 0.0, fully out of the set of provider involvement.
Clinical Workflow Integration	Provider's involvement with the innovation is linked to his/her perception that the innovation was successfully integrated into clinical workflow.	[Insert innovation name] has been integrated into clinical workflow	• If the provider strongly agreed it was scored as 1.0, fully in the set of clinical workflow integration. If the provider somewhat agreed, it was scored as 0.6, more in than out of the set of clinical workflow integration. • If the provider neither agreed or disagreed or somewhat disagreed, it was scored as 0.3, more out than in the set of clinical workflow integration. If the provider strongly disagreed, it was scored as 0.0, fully out of the set of clinical workflow integration.
Perceived Patient Benefit	Provider's involvement with the innovation is linked to his/her perception that the innovation is beneficial to the patient's overall health and/or health care.	[Insert innovation name] helps me provide better patient care	• If the provider strongly agreed, it was: scored a 1.0, fully in the set of perceived patient benefit. • If the provider somewhat agreed, it was assigned a score of 0.6, more in than out of the set of perceived patient benefit. • If the provider neither agreed or disagreed or somewhat disagreed, it was scored a 0.3, more out than in the set of perceived patient. • If the provider strongly disagreed, it was scored a 0.0, fully out of the set of perceived patient benefit

(continued)

Table F.2-1. Conditions, Definitions, and Calibration Decision (continued)

Factors	Definition	Provider Survey Question	Calibration Decision
Sufficient Resources	Provider perceives that he/she has sufficient resources such as training, equipment, IT support and tools, and administrative support to implement an innovation.	Sufficient resources (e.g., support staff, time, training) have been provided for me to use/interact with "[insert innovation name]"	• If the provider strongly agreed, it was: scored a 1.0, fully in the set of sufficient resources. • If the provider somewhat agreed, it was assigned a score of 0.6, more in than out of the set of sufficient resources. • If the provider neither agreed or disagreed or somewhat disagreed, it was scored a 0.3, more out than in the set of sufficient resources. • If the provider strongly disagreed, it was scored a 0.0, fully out of the set of sufficient resources.
OUTCOME: Provider Satisfaction	Provider satisfaction (according to literature) is tied to many factors, but overall involvement, clinical workflow integration, patient benefit, and sufficient resources are driving factors for greater provider satisfaction.	How satisfied are you with "[insert innovation name]" overall?	• If the provider was extremely satisfied, it was scored a 1.0, fully in the set of provider satisfaction. • If the provider was very satisfied or moderately satisfied, it was scored a 0.6, more in than out of the set of provider satisfaction. • If the provider was slightly satisfied, it was scored a 0.3, more in than out of the set of provider satisfaction. • IF the provider was not at all satisfied, it was scored a 0.0, fully out of the set of provider satisfaction.

Using best practices outlined by Schneider and Wagemann[9], we developed a truth table (see ***Table F.2-2***), the essential analytic tool in QCA analyses.[10] We assessed individual factors for necessity and sufficiency. We examined the necessary and sufficient combinations of factors (hereafter, combinations) and how these achieved our outcome of provider satisfaction.

[9] Schneider, C.Q., and Wagemann, C.: Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge: Cambridge University Press; 2012.
[10] Ragin, C.C.: Fuzzy-Set Social Science. Chicago: University of Chicago Press, 2000.

Table F.2-2. Truth Table

Row Number	Provider Involvement	Clinical Workflow	Patient Benefit	Sufficient Resources	Outcome	Number of Providers in this combination	Consistency
1	0	0	0	0	0	61	0.521
2	0	0	0	1	0	9	0.711
3	0	0	1	0	0	29	0.726
4	0	0	1	1	0	13	0.813
5	0	1	0	0	0	7	0.738
6	0	1	0	1	0	9	0.779
7	0	1	1	0	0	17	0.797
8	0	1	1	1	1	23	0.842*
9	1	0	0	0	0	3	0.773
10	1	0	0	1	0	3	0.817
11	1	0	0	1	1	10	0.869*
12	1	0	1	1	1	22	0.893*
13	1	1	0	0	0	2	0.839
14	1	1	0	1	0	3	0.855
15	1	1	1	0	1	24	0.881*
16	1	1	1	1	1	131	0.916*

* = Combinations that met or succeeded Ragin's sufficiency criterion of 0.8 and received an outcome value of 1.These five configurations entered into reduction.

We calculated measures of consistency and coverage (i.e., parameters of fit within QCA). Consistency is the strength of the relationship between the combination of factors and the outcome. The consistency value indicates which combinations will be considered sufficient to achieve the outcome of interest. For this analysis, we set a cutoff for consistency at 0.8, choosing only to examine the potential explanation behind relationships of the outcome with combinations that achieved a consistency of more than 0.8. Whereas looking at the consistency of the combinations allowed us to establish which were sufficient and worth further interpretation, the coverage tells us to what extent each combination accounts for the outcome and whether any combinations qualify as necessary. Combinations with higher coverage are commonly considered more common in real-life settings.

After determining which individual factors were sufficient and/or necessary for achieving our outcome of interest, we assessed the truth table to determine the solutions. Solutions appear in ***Table F.2-3***. The two solutions that produce extremely high provider satisfaction are the following: (1) Involvement and Benefit (I*B); (2) Workflow and Benefit and Resources (W*B*R).[11] When any of these two combinations are present, the outcome is consistently present. The two solutions have good consistency values (lowest to highest: 0.839, 0.863);[12] thus, these values indicate a strong relationship with the outcome. As for coverage, these two solutions are empirically relevant. The solutions have a

[11] All capital letters indicate that the factor was present at a high level in the solution.
[12] Ragin, CC.: Fuzzy-Set Social Science. 2000. Chicago: University of Chicago Press.

moderate raw coverage (lowest to highest: 0.715, 0.765) and low unique coverage (lowest to highest: 0.079, 0.129), which suggests that the cases in the two solutions overlap to a great extent.

Table F.2-3. Coverage and Consistency Scores for Provider Engagement Factors with Extremely High Provider Satisfaction among All Providers

Reduced Solutions	Raw Coverage	Unique Coverage	Solution Consistency
Involvement and Benefit	0.765	0.129	0.839
Workflow and Benefit and Resources	0.715	0.079	0.863
Total consistency = 0.807 **Total coverage = 0.844**			

Also, to assess robustness, we tested our findings at different consistency thresholds, 0.75 and 0.90; the results were logically consistent, which supports robustness of our solutions.[13] We also ran the negation of the outcome as a way to test the robustness of our findings (results available on request).Because an underlying principle of QCA is asymmetry of potential solutions for an outcome, we conducted the same analyses for the non-occurrence of the outcome (i.e., NOT achieving implementation effectiveness) to ensure that no contradictory findings arose (i.e., one cannot find that X is sufficient for Y, and also for not-Y because sufficiency implies that where X is present Y is also present). In assessing the non-occurrence of the outcome, we determined that the software used rows 4, 10, 13, and 14 for the minimization of the outcome and non-occurrence of the outcome, which is logically contradictory (i.e., one cannot argue that the same pathway leads to the outcome and the non-occurrence of the outcome). This logical contradiction can happen in fuzzy sets because cases have membership in multiple truth table rows (or simultaneous subset relations), To rectify this logical contradiction, we reviewed the product of the proportional reduction in inconsistency (PRI) value and row consistency value for each row.

We determined that rows 4, 10, 13, and 14 includes cases that did not achieve extremely satisfied providers, and the product of the PRI and consistency value for that row was greater for the non-occurrence of the outcome. Thus, we recoded rows 4, 10, 13, and 14 in our final analysis to exclude it from use on the minimization for the occurrence outcome, but include it in the analysis of the non-occurrence of the outcome. For the non-occurrence of the outcome, we determined that rows 8 and 11 included cases that did achieve the outcome and the product of the PRI and consistency value for that row was greater for the occurrence of the outcome. Thus, we recoded rows 8 and 11 in our final analysis to exclude it from use on the minimization of the non-occurrence of the outcome, but include it in the analysis of the occurrence of the outcome. This analysis did not produce logically contradictory results, which affirms the robustness of our solutions described above.

[13] Schneider, C.Q., and Wagemann, C.: Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge: Cambridge University Press; 2012.

Technical Appendix F.3: Standardizing Dose at the Awardee and Patient Levels

Methods

Table F.3-1 provides the frequency and intensity categorizations for each service that awardees provided. We assessed the frequency of each service by calculating the average number of services provided to participants who received at least one occurrence of the service. The average frequency of services provided to participants across awardees ranged from 1 to 41, with a mean of 5.0. We categorized the frequency of each service, based on a tertiary split, as low (1-2), moderate (3-7), or high (8+).

For intensity, we reviewed, categorized, and assigned a score of low (1), moderate (2), or high (3) intensity to each service awardees provided to participants. These categories were based on the expected impact across all participants in the innovation. We recognize that some services may have had a greater impact on some participants compared to other participants. For instance, community linkages, language services, and transportation were categorized as low-intensity services since their impact would be less direct compared to high-intensity services, such as health coaching, home visits, and telehealth services. However, these lower-intensity services may be a crucial first step to getting care for some participants. Thus, services categorized as low-intensity were relative to those categorized as high-intensity services. The average intensity score across all services provided was 1.9.

Table F.3-1. Frequency and Intensity of Services Provided by Awardee

Awardee	Service	Average Number Services Per Participant	Frequency of Service (Low=1; Moderate=2; High=3)	Intensity of Service (Low=1; Moderate=2; High=3)
AACI				
	Appointment assistance or reminders	1.2	1	1
	Assistance with filling out forms	1.7	1	1
	Health education	1.3	1	2
	In-person visit	1.2	1	3
	Language assistance	1	1	1
	Transportation assistance	1.3	1	1
	Other service	1.1	1	
BAHC				
	Primary care visits	4.7	2	2
	IC management home visits	9.8	3	3

(continued)

Table F.3-1. Frequency and Intensity of Services Provided by Awardee (continued)

Awardee	Service	Average Number Services Per Participant	Frequency of Service (Low=1; Moderate= 2; High=3)	Intensity of Service (Low=1; Moderate= 2; High=3)
Children's Hospital				
	No visits	0	1	1
	One visit	1	1	1
	Two visits	2	2	2
	Three visits	3	2	2
Curators				
	Align resources and needs	31	3	2
	Assess needs and goals	22	3	2
	Communication between patients and NCMs	14	3	2
	Community resources link	31	3	1
	Facilitate transitions	31	3	2
	Plan of care	33	3	2
	Self-management support	41	3	2
Delta Dental				
	Infants visit a dentist before their first birthday	1	1	1
	Children aged 0 to 9 receive one annual dental prophylaxis	1		1
	Children aged 6 to 8 receive necessary sealants and fluoride varnishes once per year	1		2
ECCHC				
	Home and micro-clinic visits	8.5	3	3
	Asthma health coaching	2.7	2	3
	Diabetes health coaching	14	3	3
	Hypertension coaching	5.1	2	3
Finity				
	BabyPartners: One type of visit only (e.g. prenatal visit, dental visit, or postpartum visit)	1	1	2
	BabyPartners: Two type of visits (e.g., prenatal visit, dental visit, and/or postpartum visit)	1	1	2
	BabyPartners: Completed all three types of visits and received bonus payment	1	1	2
	Diabetes: LDL-C test	1	1	2
	Diabetes: HbA1c assessment	1	1	2
	Diabetes: Provider visit	1	1	2
	Diabetes: Monthly contact with peer health mentor	2	2	2
	Heart Health: LDL-C test	1	1	2
	Heart Health: Primary care visit	1	1	2
	Heart Health: Improved blood pressure	2	1	2
	Heart Health: Medication adherence	1	1	2
	Heart Health: Monthly contact with peer health mentor	3	2	2
Mary's Center				
	Care plans completed	1	1	3
	Phone calls answered	7.2	2	1

(continued)

Table F.3-1. Frequency and Intensity of Services Provided by Awardee (continued)

Awardee	Service	Average Number Services Per Participant	Frequency of Service (Low=1; Moderate=2; High=3)	Intensity of Service (Low=1; Moderate=2; High=3)
MPHI				
	Medical referral	5.5	2	2
	Social service referral	4.2	2	2
	Medication assessment	1.2	1	2
	Education	2.9	2	2
	Health insurance	1.1	1	2
	Medical home	1.2	1	2
	PHQ-9 Screening Tool	1.5	1	1
	Fall Prevention Tool	1.3	1	1
NHCHC				
	Eligibility assistance/financial counseling	1.3	1	2
	Health education/supportive counseling	1.8	1	2
	Interpretation services	1	1	1
	Transportation	1	1	1
Prosser				
	Assisting with one specific service only (i.e., PCP appointment, fill prescription, review discharge instructions)	1	1	1
	Assisting with two specific services (i.e., PCP appointment, fill prescription, review discharge instructions)	1	1	1
	Assisting with all three services (i.e., PCP appointment, fill prescription, review discharge instructions)	1	1	2
REMSA				
	Home visits made by CPs	1	1	3
SEMHS				
	Outreach behavioral health, either telephone calls or in-person visits	1.2	1	2
	Case management	6.4	2	3
	Individual skills training	21.4	3	2
	Group skills training	32.5	3	2
	Transportation	19.4	3	1
	Nonbillable (scheduling, reminders)	8.5	3	1
	Other	2		
South County				
	Comprehensive assessment completed	1	1	2
	Care plan initiated	1	1	2
	Contact with health coaches	4.3	2	2
	Referred to IBHS	1.2	1	1
U-Chicago				
	1 Healthe*Rx* report	1	1	1
	2 Healthe*Rx* reports	2	1	1
	3+ Healthe*Rx* reports	3	2	1

(continued)

Table F.3-1. Frequency and Intensity of Services Provided by Awardee (continued)

Awardee	Service	Average Number Services Per Participant	Frequency of Service (Low=1; Moderate=2; High=3)	Intensity of Service (Low=1; Moderate=2; High=3)
U-Miami				
	Dental services	3.7	2	3
	Assistance with ACA, Kidcare, or Medicaid application	1	1	1
	Behavioral health/counseling	1	1	2
	Community health resources	1	1	1
	Food stamps/SNAP/WIC assistance	1	1	1
	Health education	1	1	2
	Dermatology	1	1	2
	Mental health	1	1	2
W&I				
	Receive 1-month assessment	1	1	2
	Receive 3-month assessment	1	1	2
	Complete Edinburgh Depression Scale	1	1	1
	Receive additional calls during first month after discharge	1	1	3
	Receive additional calls during 3 months after discharge	1	1	3
	Receive a post-discharge phone call	1	1	3
	Receive a nurse practitioner home visit	1	1	3
Y-USA				
	Lifestyle coaching	14.2	3	2

ACA = Affordable Care Act; CP = community paramedic; IBHS = integrated behavioral health services; LDL-C = NCM = nurse care manager; PCP = primary care provider; SNAP = Supplemental Nutrition Assistance Program.

To arrive at awardee-level dose intensity and frequency, we averaged the intensity and frequency scores across all services that an awardee provided. The average awardee-level dose intensity score ranged from 1 to 3, with a mean of 1.6 (***Table F.3-2***). The average awardee-level dose frequency score ranged from 1 to 3, with a mean of 1.9 (Table F.3-2). For ease of interpretation, we categorized the awardee-level intensity and frequency scores into low (1–1.5) and high (1.6–3.0).

Table F.3-2. Average Dose Intensity and Frequency by Awardee

Awardee	Average Dose Frequency	Average Dose Intensity
AACI	1.0	1.5
BAHC	2.5	2.5
Children's Hospital	1.5	1.5
Curators	3.0	1.9
Delta Dental	1.0	1.3
ECCHC	2.5	3.0
Finity	1.2	2.0
Mary's Center	1.5	2.0
MPHI	1.4	1.8
NHCHC	1.0	1.5
Prosser	1.0	1.3
REMSA	1.0	3.0
SEMHS	2.5	1.8
South County	1.3	1.8
U-Chicago	1.3	1.0
U-Miami	1.1	1.8
W&I	1.0	2.4
Y-USA	3.0	2.0

Technical Appendix F.4: Qualitative and Quantitative Analysis of Sustainability Factors

To assess the sustainability of the HCIA innovations, RTI relied on quantitative and qualitative data from our evaluation of 24 HCIA awardees—including a sustainability checklist and the qualitative comparative analysis (QCA). For details on the QCA methodology, see Appendix E. These quantitative data were supplemented by qualitative data, including site visit interviews, awardee narrative progress reports, and quarterly awardee performance reports, which are described in more detail in ***Appendix D***. In this appendix, we provide details on the sustainability checklist and the factor analysis used with the QCA data.

Sustainability Checklist

RTI developed a sustainability checklist to assess the HCIA innovations' efforts related to sustainability. As shown in ***Table F.4-1***, this checklist captures the presence or absence of components associated with sustainable innovations, such as funding, partnerships, workforce development, and integration/adoption. Responses to the items in the table were based on awardees' achievements related to sustainability planning and execution. Based on the responses, a sustainability score that ranged from 0 (not sustainable) to 4 (highly sustainable) was assigned to each awardee. We used these results to group awardees on their progress toward developing sustainable innovations; higher scores indicated greater levels of preparedness and increased likelihood of sustainability.

Table F.4-1. Sustainability Checklist Components and Related Items

Components	Items
Funding	Has the awardee secured public funding?
	Has the awardee secured private funding?
	Has the awardee secured reimbursement of services?
	Has the awardee coordinated the sale of products/services?
Partnerships	Is the awardee able to maintain the current commitment level from partners beyond HCIA funding?
	Have the roles of any existing partners expanded to sustain innovation components beyond HCIA funding?
	Have new partners come on board to sustain any parts of the innovation beyond HCIA funding?
Workforce Development	Is the awardee maintaining at least some current employees that were supported by HCIA funding?
	Is the awardee hiring new employees to continue any or all aspects of the innovation?
Integration/ Adoption	Has the awardee made any system-level changes to their organization as a result of the innovation?

Awardees were scored across four categories in the sustainability checklist related to sustainable innovations: funding, partnerships, workforce, and integration/adoption. Each category was assigned 1 point, for a maximum score of 4 points. The higher the score, the more sustainable an awardee's innovation. Awardees received 1 point for every Yes related to checklist questions in a given category. Only one Yes entry was required for an awardee to receive the full point for each category. If awardees did not receive any Yes entries for a given category (i.e., they received all No entries), then they were not awarded any points for that category. ***Table F.4-2*** includes scoring results for each awardee.

Table F.4-2. Sustainability Checklist Scores by HCIA Awardee

	Funding				Partnerships			Workforce Development		Integration/ Adoption	
HCIA Awardees	Has the awardee secured public funding? (Y/N)	Has the awardee secured private funding? (Y/N)	Has the awardee secured reimbursement of services? (Y/N)	Has the awardee coordinated the sale of products/ services? (Y/N)	Is the awardee able to maintain the current commitment level from partners beyond HCIA funding? (Y/N)	Have the roles of any existing partners expanded to sustain innovation components beyond HCIA funding? (Y/N)	Have new partners come on board to sustain any parts of the innovation beyond HCIA funding? (Y/N)	Is the awardee maintaining at least some current employees that were supported by HCIA funding? (Y/N)	Is the awardee hiring new employees to continue any or all aspects of the innovation? (Y/N)	Has the awardee made any system-level changes to their organization as a result of the innovation? (e.g., cultural changes, differences in staff capacity, workflow changes, etc.) (Y/N)	Sustainability Score
AACI	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	4
NHCHC	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes	4
Prosser	No	Yes	Yes	No	Yes	No	No	Yes	No	Yes	4
South County	Yes	Yes	Unknown	No	Yes	No	No	Yes	Yes	Yes	4
Y-USA	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	4
Finity	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	4
Intermountain	No	No	Yes	No	Yes	Yes	No	Yes	No	Yes	4
NEU	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes	4
Delta Dental	Yes	Yes	No	No	No	No	No	Yes	No	Yes	3
ECCHC	Yes	No	No	No	No	No	No	Yes	No	Yes	3
REMSA	No	No	No	No	Yes	No	No	Yes	No	Yes	3
SEMHS	Yes	No	No	No	Yes	Yes	No	Yes	Yes	No	3
W&I	No	No	No	No	Yes	No	No	Yes	No	Yes	3
IA	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	3
Curators	Yes	No	No	No	No	No	No	Yes	No	Yes	3
Mary's Center	Yes	No	No	No	No	No	Yes	Yes	No	No	3

(continued)

Table F.4-2. Sustainability Checklist Scores by HCIA Awardee (continued)

	Funding				Partnerships			Workforce Development		Integration/ Adoption	
HCIA Awardees	Has the awardee secured public funding? (Y/N)	Has the awardee secured private funding? (Y/N)	Has the awardee secured reimbursement of services? (Y/N)	Has the awardee coordinated the sale of products/ services? (Y/N)	Is the awardee able to maintain the current commitment level from partners beyond HCIA funding? (Y/N)	Have the roles of any existing partners expanded to sustain innovation components beyond HCIA funding? (Y/N)	Have new partners come on board to sustain any parts of the innovation beyond HCIA funding? (Y/N)	Is the awardee maintaining at least some current employees that were supported by HCIA funding? (Y/N)	Is the awardee hiring new employees to continue any or all aspects of the innovation? (Y/N)	Has the awardee made any system-level changes to their organization as a result of the innovation? (e.g., cultural changes, differences in staff capacity, workflow changes, etc.) (Y/N)	Sustainability Score
Bronx RHIO	No	Yes	No	Yes	No	No	No	Yes	No	Yes	3
MPHI	No	No	No	No	No	Yes	No	Yes	No	No	2
Altarum	No	Yes	No	No	No	No	No	Yes	No	No	2
U-Chicago	Yes	Yes	No	No	No	No	No	Yes	Unknown	No	2
U-Miami	Yes	Yes	Yes	No	No	No	No	Yes	No	No	2
BAHC	No	No	No	No	No	No	No	Yes	No	No	1
Children's Hospital	No	No	No	No	No	No	No	Yes	No	No	1
Mineral Regional	No	No	No	No	No	No	No	No	No	No	0

Awardees were scored across four categories in the sustainability checklist related to sustainable innovations: funding, partnerships, workforce, and integration/adoption.
Each category was assigned 1 point, for a maximum score of 4 points. The higher the score, the more sustainable an awardee's innovation.
Awardees received 1 point for every Yes related to checklist questions in a given category. Only one Yes entry was required for an awardee to receive the full point for each category.
If awardees did not receive any Yes entries for a given category (i.e. they received all No entries), then they were not awarded any points for that category.

Factor Analysis

To determine whether the QCA components could be combined into a single scale, we conducted an exploratory factor analysis. As described in detail in Appendix E, QCA draws on mathematical set theory, to determine which set of conditions (similar to variables)—individually or in combination—are necessary or sufficient for producing an outcome. Evaluation teams completed a QCA summary form on each HCIA awardee. These forms assess awardees on several domains.

RTI used a subset of 8 QCA components relevant to sustainability as variables for our factor analysis. These items are listed in ***Table F.4-3***. As a first step in conducting the factor analysis, RTI examined the factorability of the 8 QCA items selected using several well-recognized criteria. First, the sample to variable ratio is 3:1, making it sufficient for factor analysis. Second, 7 of the 8 items were significantly correlated at least 0.30 with at least one other item, suggesting reasonable factorability. Third, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.62, slightly above the recommended value of 0.6, and Bartlett's test of sphericity was significant ($X^2(28) = 96.5$, $p<0.05$). Finally, the communalities were all above 0.3 (see Table F.4-3), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted with all 8 items.

Table F.4-3. Factor Loadings and Communalities

QCA Item	Factor Loadings	Communality
1. Leadership engagement	0.61	0.49
2. Feasible sustainability plan in place	0.45	0.59
3. Involving appropriate internal stakeholders throughout planning and implementation	0.81	0.88
4. Execution	0.80	0.84
5. Staff retention	0.73	0.65
6. Processes/systems to document and monitor implementation	0.80	0.74
7. Systems to inform ongoing program development	0.57	0.50
8. Overall effectiveness of implementation	0.71	0.87

QCA = qualitative comparative analysis.

The eigen values showed that the first factor explained 74 percent of the variance, the second factor 14 percent of the variance, and subsequent factors 11 percent or less of the variance. Since the initial factor analysis resulted in one factor accounting for a majority of the variance, and rotation methods led to more complicated results, we chose to accept the unrotated factor analysis results. ***Table F.4-4*** shows the factor loadings for the first factor. QCA Item 2, "feasible sustainability plan in place," loaded higher as the only item on the third factor, which accounted for 11 percent of the variance. Therefore, we decided to drop this item from the final solution. The remaining items had factor loadings of 0.57 and above.

Internal consistency of the scale was moderate as examined by Cronbach's alpha (α=0.72). A composite score was created by summing the seven items. Descriptive results of this composite score are shown in Table F.4-3. The theoretical range was 0 to 31. The actual range was 6.99 to 28.64, with a mean of 21.76, and tolerable skewness.

Table F.4-4. Factor Analysis Results

	Number of items	M (SD)	Skewness	Alpha	Min	Max
Factor 1	7	21.76 (6.26)	−1.13	0.72	6.99	28.64

Overall, these analyses indicated that there was one distinct factor underlying sustainability-related QCA components, and that this factor was moderately internally consistent. One of the 8 QCA items was eliminated. An approximately normal distribution was evident for the composite.