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

THIRD ANNUAL REPORT ADDENDUM

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Overview of Findings

In 2012, the Centers for Medicare & Medicaid Services (CMS) awarded $162,622,080 to 24 health care organizations over a 3-year period 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/). The evaluation of the HCIA awardees assessed their impact on the three overarching goals of the Affordable Care Act of 2010: smarter spending, better care, and healthier people. This addendum is an update to the March 2017 third annual report.[1] It includes new data received through June 2016, including claims data for 21 awardees and qualitative data for five awardees that received no-cost extensions [Bronx Regional Health Information Organization (Bronx RHIO), Curators of the University of Missouri (Curators), Michigan Public Health Institute (MPHI), Regional Emergency Management Services Authority (REMSA), and YMCA of the USA (Y-USA)].[a] Evaluation questions are unchanged from prior reports, and key findings highlighted in this report reflect the theory of action of the innovation. In other words, the activities of the innovation could be plausibly expected to directly reduce costs or change utilization.

In ***Table ES-1*** we highlight seven awardees with statistically significant reductions in spending, inpatient admissions, unplanned readmissions, and ED visits consistent with their theory of action. Later, we present findings for other awardees with positive findings possibly due to factors unrelated to the innovation. We also note key final insights for workforce development, implementation, and sustainability.

Table ES-1. Awardees with Notable Reductions in Spending and Utilization Outcomes

Awardee	Savings	Inpatient Admissions	Unplanned Readmissions	ED Visits
Ben Archer Health Center (BAHC)				●
Children's Hospital and Health System (Children's Hospital)		●	●	
Curators of the University of Missouri (Curators)				●
Eau Claire Cooperative Health Centers (ECCHC)				●
Regional Emergency Management Services Authority (REMSA)		●		
Women and Infants Hospital of Rhode Island (W&I),	●		●	●
YMCA of the USA (Y-USA)	●	●		●

Awardees

The HCIA Community Resource awardees included five federally qualified health centers, three academic institutions, two health plans, two integrated health systems, two hospitals, and 10 other health care organizations. Each awardee received on average $6.7 million to implement their innovations, which targeted such components as coordination of care, process of care, health information technology, decision support, provider payment reform, direct health care and dental services, and the health care workforce. ***Figure ES-1*** provides an overview of the types of innovations the awardees implemented as well as their organization type, target population, state, payer, and funding amount.

[a] We report no updates for U-Miami, NHCHC, and Finity because no new data were available for this report.

Figure ES-1. Summary of HCIA Community Resource Awardees

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

Notes:

- **Source**: 2014 & 2015 site visits, *Q12 Narrative Progress Report*.

Demographic characteristics did not change markedly from those presented in the third annual report. More than half of awardees in their innovations targeted patients covered by Medicare, and nearly all awardees enrolled patients covered by Medicaid. These enrollees included racial/ethnic minorities, children, families, patients with special health conditions, and those living in rural regions. Half of the participants (49.6%) were adults younger than 65 years of age and predominantly female (60.6%); more than half were nonwhite (52.2%). Participant payer categories included Medicaid (35.2%), Medicare (33.1%), or dually eligible (3.2%).

Methodology

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—Medicare spending, hospitalizations, readmissions, emergency department (ED) visits and health status—and the organizational and contextual factors that influenced implementation effectiveness. These sources did not change for this report and included quarterly performance reports, awardee narrative reports, claims data, and interview data. Additional information about these sources can be found in Table 1-1 of Section 1.2.1 of the third annual report. Individual awardee sections of the report include updated clinical outcomes for diabetes and hypertension and qualitative data for the awardees that received 12-month extensions (Bronx RHIO, Curators, MPHI, REMSA and Y-USA).

Table ES-2 shows the availability of Medicare and Medicaid data for descriptive and regression analysis**.** For these analyses, we constructed comparison groups to assess what would have happened in the absence of the innovation, as discussed in the individual awardee chapters and ***Appendix B-2***.

Table ES-2. Claims Data Available for Analyses Presented in the HCIA Community Resource Third Annual Report Addendum

Awardee	Medicare Descriptive	Medicare Regression	Medicaid Descriptive	Medicaid Regression
AACI	●	●	●	●
Altarum	●	●	●	●
BAHC	●	●	●	●
Bronx RHIO	●	●	●	●
Children's Hospital			●	●
Curators	●	●	●	●
Delta Dental			●	●
ECCHC	●		●	●
Finity			●	●
IA	●	●	●	●
Intermountain	●	●	●	●
Mary's Center			●	●
Mineral Regional	●	●	●	●
MPHI	●	●	●	●
NHCHC	N/A	N/A	N/A	N/A

(continued)

Table ES-2. Claims Data Available for Analyses Presented in the HCIA Community Resource Third Annual Report Addendum (continued)

Awardee	Medicare Descriptive	Medicare Regression	Medicaid Descriptive	Medicaid Regression
NEU	●	●	●	●
Prosser	●	●	●	●
REMSA	●	●	●	
SEMHS	●	●	●	●
South County	●		●	●
U-Chicago	●	●	●	●
U-Miami	N/A	N/A	N/A	N/A
W&I			●	●
Y-USA	●	●		
Totals	17	15	21	20

Terms and Definitions
- NA = not available.

Descriptive Analysis
- Examines the four spending and utilization outcomes over time for both the comparison group and the innovation group to assess trends before and after the innovation started.

Regression Analysis
- Evaluates whether the changes in these outcomes quarter to quarter and over the entire project period were due to chance, other factors, or to the effect of the innovation itself.

Notes on Missing Data
- Medicare beneficiaries not targeted: Children's Hospital, Delta Dental, Finity, Mary's Center, W&I
- Medicaid beneficiaries not targeted: Y-USA
- No patient identifiers: U-Miami, NHCHC
- No new data through June-2016 period: NEU, Finity

Key Findings

Two Awardees Achieved Notable Savings

Six awardee innovations had statistically significant health care savings (p-value < 0.10); as shown in ***Table ES-3***. Notably, the Y-USA and W&I innovations resulted in better health outcomes for participants, which may have led to less high-cost utilization. W&I intensive outreach and support services for families with premature newborns reduced unplanned readmissions and ED visits as designed and planned. The savings observed for IA are probably not due to the innovation, as the focus on imaging services constitutes only a modest portion of overall spending. Intermountain's shared savings model was in pilot stage through most of the innovation period and was targeted to providers, so the savings observed are also unlikely to be due to the innovation. Bronx RHIO produced reports for subscribing providers that might have led to savings; however, we lacked data on whether providers used these reports to engage patients in better care that then might lead to lower spending. Without these data, we are unable to determine whether these savings support the innovation's theory of action. The overall findings do not support NEU's theory of action because the aim of the innovation was primarily to improve system processes not to reduce spending and utilization. The changes to systems at CHA might have led to reductions; however, the scope of our evaluation did not include assessing these system changes at CHA.

Table ES-3. Summary of Statistically Significant Savings Per Beneficiary Per Quarter

Awardee	Weighted Quarterly Impact				
	Sample Size	Total	90% CI		P-Value
Medicare					
Bronx RHIO	3,892	−$345	−$630	−$60	0.05
Y-USA (Full sample)	3,317	−$246	−$357	−$136	<.01
Y-USA (No diabetes dx)	2,300	−$272	−$392	−$151	<.01
Medicaid					
Intermountain- Cohort 3 (SSM only)	299	−$576	−$1,135	−$17	0.09
NEU-CHA	1,463	−$348	−$469	−$227	<.01
W&I	321	−$4,591	−$8,392	−$790	0.05
IA	3,088	−$462	−$910	−$14	.09

Notes:

- **Total spending** is the weighted average change in spending per participant per quarter from a difference-in-difference quarterly fixed effects model. Quarterly savings estimates are derived using ordinary least squares regression, then combined into an average effect using the number of participants in the quarter as the weight.
- Medicaid periods may vary, but we received claims no later than June 2016.
- Medicare period covered through June 2016.

Terms and Definitions

- CI = confidence interval; CP = community paramedic; SSM = shared saving model.

Seven Awardees Notably Reduced Utilization

Seven of the 15 awardees shown in ***Table ES-4*** reduced one or more utilization measures consistent with their theory of action. These awardees include:

- **BAHC.** The decrease in ED visits was the intended goal of community health workers (CHWs) who helped patients access a regular source of care and address health problems before they became emergencies.
- **Children's Hospital.** This innovation was not designed to target patients post-discharge after an admission or those who had a recent hospitalization; however, CHW visits could have resulted in lower hospitalizations.
- **Curators.** The decline in ED visits was an intended goal of nurse case managers providing care coordination and oversight for complex patients.
- **ECCHC.** The decline in ED visits was an intended goal of the innovation's efforts to connect high-utilizing patients to a traditional primary care home.
- **REMSA.** The decline in in-patient admissions was the intended goal of the CP 30-day enrollment program, which provided home visits to patients to recently discharged patients.
- **W&I.** The declines in unplanned readmissions and ED visits were goals of home services for high-risk infants with a NICU admission of 5 or more days.
- **Y-USA.** The declines in in-patient admissions and ED visits may have resulted from participants receiving resources to manage their diabetes-related health difficulties.

The results for the remaining awardees did not directly target the utilization measure and may be due to other factors unrelated to the innovation. The Bronx RHIO innovation could plausibly reduce utilization but, as noted above, we lacked data regarding provider use of Bronx reports to manage their patients. Finally, the results for NEU-CHA are not consistent for the NEU innovation overall, because the primary goal was to improve system processes for better efficiency and workflow. The changes to CHA's scheduling system aimed to increase timely access to primary care visits, which may have indirectly led to fewer ED visits. However, we lacked implementation data on the CHA project and cannot assess the degree to which system changes resulted in reduced ED visits.

Table ES-4. Summary of Statistically Significant Improvements in Utilization through June 2016

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	45,964	−7	−9	−4	<0.01	—	—	—	—	—	—	—	—
BAHC	180	—	—	—	—	—	—	—	—	−29	−48	−11	<0.01
Bronx RHIO	3,892	−9	−15	−2	0.03	—	—	—	—	—	—	—	—
Curators	6,476	—	—	—	—	—	—	—	—	−17	−21	−12	<0.01
Imagining Advantage	—	—	—	—	—	−6	−11	−1	0.04	−76	−91	−61	<0.01
Mineral Regional	13,823	−7	−11	−3	0.01	—	—	—	—	—	—	—	—
NEU-CHA	950	—	—	—	—	—	—	—	—	−21	−40	−2	0.07
REMSA-ATA	115	−210	−317	−102	<0.01	—	—	—	—	—	—	—	—
REMSA-CP-30	183	−426	−482	−279	<0.01	—	—	—	—	—	—	—	—
SEMHS	106	—	—	—	—	−273	−489	−57	0.04	—	—	—	—
U-Chicago	8,381	−17	−21	−13	<0.01	−18	−37	0	0.10	—	—	—	—
Y-USA	3,317	−8	−10	−5	<0.01	—	—	—	—	−7	−11	−3	0.01
Y-USA (no diabetes dx)	2,300	−7	−10	−4	<0.01	—	—	—	—	−6	−11	−2	0.02
Medicaid													
Children's Hospital	513	−20	−38	−2	0.07	−97	−186	−8	0.07	—	—	—	—
ECCHC	274	—	—	—	—	—	—	—	—	−106	−178	−34	0.02
Finity-BP: Mothers	2,604	—	—	—	—	−3	−6	0	0.01	—	—	—	—
Imaging Advantage	3,088	−43	−67	−20	<0.01	—	—	—	—	—	—	—	—
NEU-CHA	1,463	−15	−25	−4	0.02	—	—	—	—	−111	−132	−90	<0.01
U-Chicago	3,042	—	—	—	—	—	—	—	—	−51	−67	−35	<0.01
W&I	321	—	—	—	—	−76	−123	−29	<0.01	−334	−389	−279	<0.01

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 in contrast to the comparison group. Acute care inpatient admissions are the product of these admissions (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model, as discussed in Appendix B.2
- **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 in contrast to the comparison group. Hospital-wide all-cause unplanned readmissions are the product of these readmissions (per 1,000 admissions) and the number of person quarters. Estimates are derived using a logistic regression model, as discussed in Appendix B.2
- **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 in contrast to the comparison group. ED visits not leading to a hospitalization are the product these visits (per 1,000 participants) and the number of person quarters. Estimates are derived using a negative binomial count model, as discussed in Appendix B.2
- Medicaid periods may vary, but we received claims no later than June 2016.
- Medicare period covered through June 2016.

Terms and Definitions

- CI = confidence interval; ED = emergency department; N/A= did not significantly decrease.
- — Not available.

Workforce Development Highlights

- In settings where staff did not feel supported, the champion's role created a buffer and helped staff overcome implementation challenges. Where staff cohesion and support were strong, the team worked together to meet challenges and, thus, the importance of the champion role became less critical.
- Navigators enhanced health information technology (HIT)-enabled innovations when their workflow and information needs were embedded into the designs of electronic health record (EHR) systems and when the skills required to effectively manage technology were considered in staff recruitment and training. Embedding navigator tasks into the EHR created efficient workflows that enhanced communication and timely information exchange. Using data analytics to identify high-need patients also allowed navigators to prioritize their limited time to those at highest risk.

Implementation Highlights

- More than two-thirds of awardees reached approximately 70 percent or more of their target population (high reach), and half provided a high-intensity dose: that is, they delivered an innovation that required more involvement or effort.
- Implementation effectiveness is a necessary but not sufficient condition to produce desired outcomes. Mixed results demonstrated that some innovation outcomes could have been more sensitive to implementation effectiveness than others. Implementation effectiveness was associated with reduced ED visits but not hospital readmissions.
- Greater innovation complexity was associated with both increases and decreases in impatient admissions and affected payer groups in different ways. These mixed results may have been due to the unique and different needs of each payer group. Although more difficult to implement (and more vulnerable to failure), more complex innovations may be necessary for high-need patient populations if the goal is to reduce unplanned inpatient admissions.
- Awardees with health information exchanges (HIEs) facilitated successful interoperability through two factors: (1) presence of strong governance structures both within the HIE and each contributing organization; and (2) attention to processes and technical tools to support information exchange, quality, and timeliness.
- For two-thirds of awardees, the state or local policy environment was the most significant external factor in implementation success. It was equally positive and negative in its influence. Awardees had little direct control of this factor, but a few worked with stakeholders to shape policies conducive to implementation and sustainability.

Sustainability Highlights

- Two-thirds of awardees achieved high levels of sustainability on one or more innovation components in various ways: developing formal sustainability plans, maintaining partners, making system-level change to their organizational cultures, and changing existing workflows.

Table ES-5 shows most awardees had secured additional funding or reimbursement for one or more components of their innovation. These findings are similar to those presented in the third annual report. REMSA and MPHI secured additional funding for their innovations, which raised their sustainability scores from the prior report.

Table ES-5. HCIA Awardee Sustainability Characteristics 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 planned 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	•	•	•	•	4	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	•	•	•		3	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

Conclusions

The findings in this third annual addendum report remain largely unchanged from those reported in the third annual report. Overall, seven HCIA Community Resource awardees met one or more goals of smarter spending and better care in a manner consistent with their innovation's theory of action. Most awardees reached over two-thirds or more of their targeted participants, and half provided high-intensity services. Consequently, most awardees sustained all or part of their innovation. Qualitative findings provided additional insights regarding factors affecting implementation: the policy and political environment, HIE governance, process standardization, integrating navigators into the HIT workflow, the role of champions, and team cohesion and support.

References

1 Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

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 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/) and funded 24 awardees for a 3-year period (2012 to 2015). In March 2017, CMMI released the third annual report presenting the cumulative findings for this initiative through June 2016 (https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf).

This addendum to the third annual report updates those findings through December 2016. We present only new or updated findings in this report and reference the third annual report for those findings that remain unchanged. ***Table 1-1*** lists the awardees with new or updated findings.

Table 1-1. Awardees with Updated Findings in the Addendum to the Third Annual Report

Awardee[1]	Additional Medicare Claims Analyses	Additional Medicaid Claims Analyses	Additional Qualitative/Secondary Data Analyses
AACI	•	•	
Altarum	•	•	
BAHC	•		
Bronx RHIO	•	•	•
Children's Hospital		•	
Curators	•	•	•
Delta Dental		•	
ECCHC	•		
IA	•		
Intermountain	•	•	
Mary's Center		•	
Mineral	•		
MPHI	•	•	•

(continued)

Table 1-1. Awardees with Updated Findings in the Addendum to the Third Annual Report (continued)

Awardee[1]	Additional Medicare Claims Analyses	Additional Medicaid Claims Analyses	Additional Qualitative/Secondary Data Analyses
NEU	•		
Prosser	•		
REMSA	•		•
SEMHS	•		
South County	•	•	
U-Chicago	•		
W&I		•	
Y-USA	•		•
Totals	17	12	5

[1] No update for U-Miami, NHCHC, and Finity.

The primary source of updated findings is an additional 6 months of claims data from Medicare and a variety of updated data from Medicaid. Four awardees (YMCA, REMSA, Curators, MPHI) received 12-month no-cost extensions and one awardee (Bronx RHIO) received a 9-month no-cost extension. This report presents qualitative findings from closeout interviews and program data for these five awardees.

The organization and content of the third annual report addendum is as follows:

- **Section 1 Introduction** (this section) provides an overview of the characteristics of the HCIA innovations, an update of the patient characteristics for the populations served, and a description of the claims analyses carried out for each awardee.
- **Section 2 Awardee-Level Findings** presents updated claims and qualitative findings for those awardees listed in Table 1-1.
- **Section 3 Cross-Awardee Findings** presents findings from analyses using new data from multiple awardees including summary findings for spending and utilization outcomes, workforce development, implementation effectiveness and sustainability.
- **Updates to Appendices B through F** present the methods used to conduct the awardee-level and cross-awardee analyses in this report. Appendix A includes the evaluation framework and can be found in the third annual report.

1.1 Overview of HCIA Community Resource Awardees

1.1.1 HCIA Community Resource Awardee Characteristics and Innovation Components

HCIA Community Resource 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 (BAHC) to $14,991,005 (Mary's Center). 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). Figure 1-1 also characterizes the various components of each innovation and shows their complexity. Some of these components may have been embedded in programs or initiatives that predated HCIA or operated concurrently with other funding. Additional detail is presented in Section 1.1 of the third annual report.

Figure 1-1. Summary of HCIA Community Resource Awardees

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

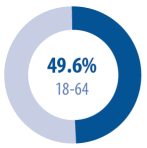
Notes:

- **Source:** 2014 & 2015 Site Visits, *Q12 Narrative Progress Report*.

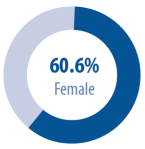
1.1.2 Participant Characteristics

Demographic characteristics shown in ***Figure 1-2*** did not change markedly from those presented in the third annual report. Half of the participants (49.6%) were adults younger than 65 years of age and predominantly female (60.6%); more than half were nonwhite (52.2%). Participant payer categories included Medicaid (35.2%), Medicare (33.1%), or dually eligible (3.2%).

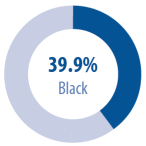
Figure 1-2. Demographics of Participants in HCIA-Community Resource Innovations



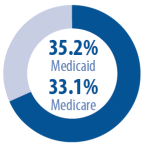
Age	Number of Participants	Percentage of Participants
< 18	98,210	19.0
18-64	**256,133**	**49.6**
65+	154,617	30.0
Missing	7,278	1.4
Total	516,238	



Sex	Number of Participants	Percentage of Participants
Female	**312,870**	**60.6**
Male	181,681	35.2
Transgender	2	0.0
Missing	21,685	4.2
Total	516,238	



Race/ethnicity[1]	Number of Participants	Percentage of Participants
White	75,766	27.6
Black	**109,648**	**39.9**
Hispanic	15,843	5.8
Asian	5,159	1.9
American Indian or Alaska Native	7,374	2.7
Native Hawaiian or Other Pacific Islander	614	0.2
Other	4,738	1.7
Missing/refused	55,520	20.2
Total	274,662	



Payer category[2]	Number of Participants	Percentage of Participants
Dual	10,818	3.2
Medicaid	**121,302**	**35.2**
Medicare	**114,049**	**33.1**
Medicare Advantage	3,770	1.2
Other	46,818	13.6
Uninsured	24,209	7.0
Missing	23,199	6.7
Total	344,165	

[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.

1.2 Data and Methods

1.2.1 Data Sources

The evaluation combined multiple sources of qualitative and quantitative data 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. These sources did not change for this report and included quarterly performance reports, awardee narrative reports, claims data, and interview data. Additional information about these sources can be found in Table 1-1 of Section 1.2.1 of the third annual report.

1.2.2 Data Availability

Claims. Claims-based measures linked to beneficiary identifiers are presented in this third annual report addendum. As shown in ***Table 1-2***, this report includes descriptive and regression findings for each awardee's spending and utilization, depending on the availability of Medicare and Medicaid data. The descriptive analyses examined spending and utilization outcomes over time to assess general trends. The regression analysis assessed whether the changes in the awardees outcomes quarter to quarter and over the entire project period were due to chance alone or the effect of the innovation itself.

For the descriptive analysis, a total of 17 awardees had patient identifiers that RTI could match with existing Medicare data in the Chronic Conditions Data Warehouse and a sample of at least 20 beneficiaries. A total of 15 awardees had a matched Medicare claims sample of 100 beneficiaries, sufficient for regression analyses.

Availability of Medicaid claims varied by the state where awardees were located. In total, we present descriptive Medicaid claims findings for 21 awardees who met the same criteria used for the Medicare descriptive findings and 20 who met the criteria for regression analyses.

Two awardees, NHCHC and U Miami, had neither Medicare nor Medicaid data available for analysis for the reasons listed below in the notes section of Table 1-2.

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

Awardee	Medicare Descriptive	Medicare Regression	Medicaid Descriptive	Medicaid Regression
AACI	●	●	●	●
Altarum	●	●	●	●
BAHC	●	●	●	●
Bronx RHIO	●	●	●	●
Children's Hospital			●	●
Curators	●	●	●	●
Delta Dental			●	●
ECCHC	●		●	●
Finity			●	●
IA	●	●	●	●
Intermountain	●	●	●	●
Mary's Center			●	●
Mineral Regional	●	●	●	●
MPHI	●	●	●	●
NHCHC	N/A	N/A	N/A	N/A
NEU	●	●	●	●
Prosser	●	●	●	●
REMSA	●	●	●	
SEMHS	●	●	●	●
South County	●		●	●

(continued)

Table 1-2. Claims Data Available for Analyses Presented in the HCIA Community Resource Third Annual Report Addendum (continued)

Awardee	Medicare Descriptive	Medicare Regression	Medicaid Descriptive	Medicaid Regression
U-Chicago	●	●	●	●
U-Miami	N/A	N/A	N/A	N/A
W&I			●	●
Y-USA	●	●		
Totals	17	15	21	20

Terms and Definitions

- NA = not available.

Descriptive Analysis

- Examines the four spending and utilization outcomes over time for both the comparison group and the innovation group to assess trends before and after the innovation started.

Regression Analysis

- Evaluates whether the changes in these outcomes quarter to quarter and over the entire project period were due to chance, other factors, or to the effect of the innovation itself.

Notes on Missing Data

- Medicare beneficiaries not targeted: Children's Hospital, Delta Dental, Finity, Mary's Center, W&I
- Medicaid beneficiaries not targeted: Y-USA
- No patient identifiers: U-Miami, NHCHC
- No new data through June-2016 period: NEU, Finity

Awardee-specific data. The evaluation also relied on awardee-specific data to identify demographic characteristics of patients exposed to the innovation and to assess the clinical effectiveness and health outcomes described in Section 3.3 of the third annual report. For the awardees with no cost extensions, awardee-specific data were used where appropriate 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.

1.2.3 Evaluation Measures

The evaluation collected four core measures from Medicare and Medicaid claims so that the impact on spending and utilization could be assessed across all HCIA awards supported by CMMI. To assess the impact on the health of participants, RTI collected, constructed, and analyzed innovation-specific measures from other awardee-specific data.

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 measure specifications 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. At the aggregate level, however, effects may not be statistically detectable because the targeted conditions or procedure represent only a small fraction of total spending, inpatient admissions, hospital unplanned readmissions, and ED visits.

1.2.4 Claims Data Methods

Claims data analysis was a multistep process that included the construction of patient files and comparison groups to use for descriptive and regression analysis. These methods are described in detail in the third annual report in Section 1.2.4 and in ***Appendix B.2***.

1.2.5 Awardee-Specific Data Methods

Awardee-specific data methods are described in detail in Section 1.2.5 of the third annual report and ***Appendix C***. For the clinical outcomes analysis included in this addendum report, we generated descriptive statistics showing the percentage of participants with diabetes or hypertension who were in control of that condition. This report presents updated diabetes and/or hypertension outcomes for Bronx, Curators, MPHI and Y-USA.

1.2.6 Qualitative Methods

For this addendum report, RTI analyzed qualitative data on workforce development, implementation context, and implementation effectiveness from reports requested by CMMI and delivered to RTI quarterly. These methods are described in detail in the third annual report in Section 1.2.6

The new qualitative evaluation data presented in this report include closeout interviews with innovation leaders during the final quarter of implementation. The interviews, which were conducted between February to December 2015 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 awardee reports and closeout interview notes using NVivo qualitative analysis software. The coding process is discussed in detail in Appendix D of the third annual report.

1.3 Data Challenges and Limitations

The third annual report described the main challenges to the evaluation, and these limitations remain relevant to the analyses conducted for this addendum report:

- 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, although highly unlikely, a privately insured individual could have had the same identifier as a Medicare ID.
- 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.

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

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

Awardee-specific limitations related to these issues are discussed in the individual awardee sections.

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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)

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Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Altarum

Data Source	Period Covered
Medicare claims data	April 2013–June 2016
Medicaid claims data	April 2013–June 2016
Terms and Definitions • Altarum = Altarum Institute.	

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. Below we present the goals and findings of this innovation, which aimed to improve general practice clinicians' selection of appropriate radiologic imaging studies—thereby reducing cost and unnecessary radiation exposure.

1. **Smarter spending.**

   Goal: 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.

   Findings: Although Medicare spending was higher among the innovation group during the third year of the innovation, spending was no different between the innovation and comparison group for the 3-year innovation as a whole. For the Medicare sample, the estimated probability that the innovation generated savings is 57 percent. The Altarum innovation was aimed at physicians and was not expected to have a detectable impact on total patient spending.

   Medicaid spending did not differ between the innovation and comparison group, which is expected given the innovation's focus on altering providers' imaging behavior. The probability that the innovation generated savings for Medicaid was 23 percent.

2. **Better care.**

   Goal: 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.

   Findings: Inpatient admissions rates were lower among the Medicare innovation group, while ED visits were higher. There was no difference in unplanned readmissions between the Medicare innovation and comparison groups. Among Medicaid beneficiaries, inpatient admissions, readmissions, and ED visits were higher in the innovation group. However, spurious results could be generated by the small Medicaid sample size since the innovation was not expected to impact utilization.

3. **Healthier people**.

   Goal: Improve health by reducing patient radiation exposure, misdiagnosis, and unnecessary treatment and providing patient and provider education.

   Findings: None to report

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected 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 Year 3 of the innovation. Inpatient stays fell during Year 1, but rose during Years 2 and 3. Inpatient admissions were lower than the comparison group's admissions and the estimate is statistically significant. The rate of unplanned readmissions did not change. 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 are only a small portion of overall spending and utilization; therefore, results should be interpreted with caution.

Table 2. Summary of Medicare Claims-Based Findings: Altarum

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$10.770	−$106.800, $85.273	−$85.290, $63.750	−$35.600	−$121.600, $50.379	$7.304	−$9.515, $24.124	$17.520	$9.850, $25.191
Acute care inpatient stays	−2,228	−3,052, −1,404	−2,870, −1,586	−3675	−4,381, −2,969	553	175, 932	894	701, 1,087
Hospital-wide all-cause unplanned readmissions	−55	−312, 202	−255, 145	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	1,714	740, 2,689	955, 2,474	−531	−1,353, 291	1370	890, 1,850	875	665, 1,085
Average impact per quarter									
Spending per participant	−$34	−$332, $265	−$265, $198	−$203	−$694, $288	$67	−$87, $220	$479	$269, $689
Acute care inpatient stays (per 1,000 participants)	−7	−9, −4	−9, −5	−21	−25, −17	5	2, 8	24	19, 30
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−2	−10, 6	−8, 5	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	5	2, 8	3, 8	−3	−8, 2	12	8, 17	24	18, 30

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2011 to June 2016.
- **Sample size**: 45,964, unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Altarum = Altarum Institute.

Table 3 summarizes findings based on Medicaid claims collected during the innovation period. Overall, we found no statistically significant impact on Medicaid spending; however, a statistically significant increase occurs in Year 2 followed by a decrease in Year 3. Inpatient admissions, readmissions, and ED visits are higher in the innovation group. The Medicaid sample size was very small (220 innovation participants) and even smaller in Years 2 and 3. Results from these years should be interpreted cautiously because they are based on a small sample and may not represent all participants.

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

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$0.177	−$0.217, $0.572	−$0.129, $0.484	$0.051	−$0.244, $0.346	$0.158	$0.006, $0.311	−$0.032	−$0.043, −$0.021
Acute care inpatient stays	27	4, 50	9, 45	18	−3, 39	10	0, 19	−1	−2, 0
Hospital-wide all-cause unplanned readmissions	4	1, 7	2, 7	—	—	—	—	—	—
ED visits	133	38, 228	59, 207	96	12, 181	33	−10, 77	3	−3, 10
Average impact per quarter									
Spending per participant	$171	−$210, $552	−$125, $467	$84	−$403, $571	$405	$15, $795	−$838	−$1,120, −$557
Acute care inpatient stays (per 1,000 participants)	26	4, 49	9, 44	30	−5, 65	25	0, 49	−40	−87, 7
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	175	50, 300	78, 273	—	—	—	—	—	—
ED visits (per 1,000 participants)	128	36, 220	57, 200	159	20, 298	85	−27, 196	86	−91, 263

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** March 2011 to June 2016.
- **Sample size**: 220 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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 (per 1,000 participants)** is 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 is the product of ED visits (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; Altarum = Altarum Institute.
- — 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 4 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 4. Claims-Based Outcome Measures: Altarum

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

Terms and Definitions

- ED = emergency department; Altarum = Altarum Institute.

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. Although the innovation and comparison physicians are the same as in previous reports, the sample of patients has grown because more claims data have become available. The sample contained 45,964 innovation patients and 43,326 comparison patients. The claims analysis uses data through June 30, 2016. Additional details can be found in the third annual report.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 5 reports Medicare spending per patient in the 8 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 1*** illustrates the Medicare spending per beneficiary in Table 5 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 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. Average spending is similar in the innovation and comparison groups during the first six innovation quarters. Starting in I7, the spending series separate and the innovation group's spending level rises above the comparison group's. This trend is consistent with the findings in the third annual report.

Table 5. 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**	**I12**
Innovation Group																				
Spending rate	$2,454	$2,464	$2,529	$2,511	$2,683	$2,672	$2,796	$3,092	$5,307	$4,080	$3,617	$3,443	$3,477	$3,517	$3,475	$3,574	$3,662	$3,642	$3,614	$4,045
Std dev	$7,107	$7,131	$7,123	$7,244	$7,514	$7,662	$8,053	$9,050	$11,916	$10,563	$9,702	$9,146	$9,266	$9,517	$9,273	$9,609	$9,846	$9,463	$9,169	$10,135
Unique patients	38,397	39,068	39,717	40,459	41,187	42,065	43,057	44,527	45,964	45,248	43,936	39,992	35,703	30,283	24,856	18,875	15,431	11,260	7,348	2,524
Comparison Group																				
Spending rate	$2,459	$2,467	$2,400	$2,458	$2,595	$2,554	$2,683	$2,917	$5,202	$3,973	$3,505	$3,337	$3,432	$3,450	$3,261	$3,269	$3,230	$3,305	$3,562	$3,524
Std dev	$7,054	$7,293	$6,674	$6,906	$7,765	$7,265	$7,695	$8,337	$11,672	$10,522	$9,539	$9,079	$9,532	$9,816	$8,736	$9,161	$8,529	$9,208	$11,021	$9,653
Weighted patients	35,471	36,241	36,864	37,569	38,389	39,346	40,427	41,919	43,326	42,656	41,311	38,098	34,944	31,549	28,141	24,475	20,548	15,467	11,326	4,994
Savings per Patient																				
	$5	$2	−$129	−$53	−$88	−$118	−$113	−$175	−$105	−$107	−$112	−$105	−$45	−$67	−$214	−$305	−$432	−$337	−$52	−$521

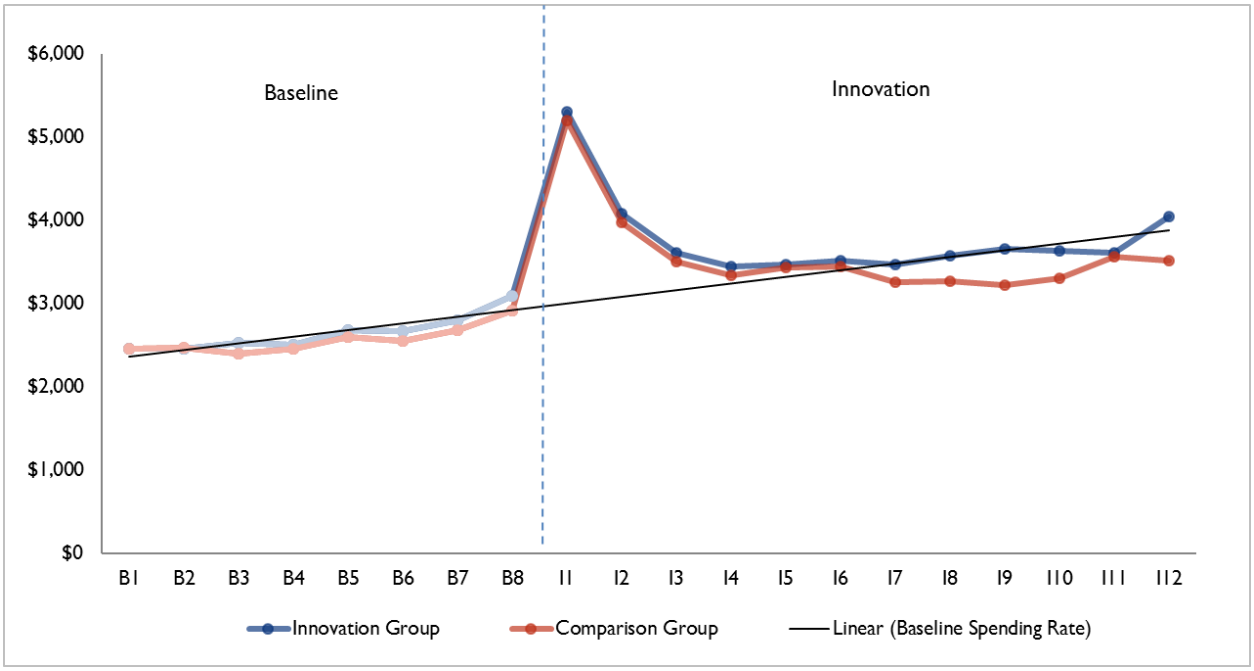
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.

Figure 1. Medicare Spending per Participant: Altarum



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- Altarum = Altarum Institute.

2.4.2 Regression Results

As shown ***Table 6****, 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 $34 (90% CI: −$332, $265). This effect is not statistically significant and is consistent with findings from the third annual report. 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 quarterly effects derived from 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. Spending estimates are initially negative, then become positive and large in later innovation quarters. Quarterly spending estimates are statistically significant in I8 through I12. The sample size falls dramatically as the innovation quarters progress: only a fraction of patients is 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.

Table 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−$517	$729	0.479
I2	−$133	$251	0.597
I3	−$103	$137	0.452
I4	−$32	$94	0.732
I5	−$48	$105	0.648
I6	−$23	$114	0.839
I7	$171	$114	0.134
I8	$289	$144	0.046
I9	$512	$133	0.000
I10	$488	$158	0.002
I11	$355	$208	0.089
I12	$600	$317	0.060
Overall average	−$34	$181	0.853
Overall aggregate	−$10,770,000	$58,218,478	0.853
Overall aggregate (IY1)	−$35,600,000	$52,114,530	0.495
Overall aggregate (IY2)	$7,304,093	$10,195,311	0.474
Overall aggregate (IY3)	$17,520,329	$4,649,421	0.000

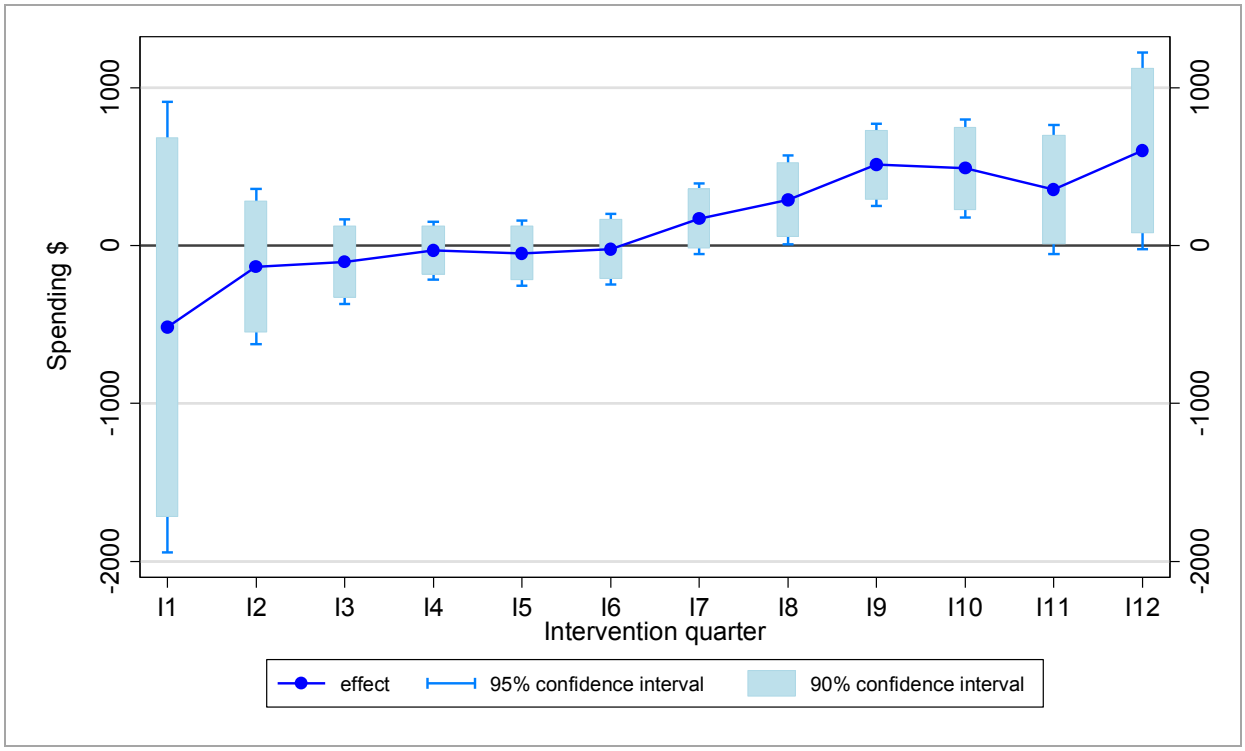
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; Altarum = Altarum Institute

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Altarum



Notes:

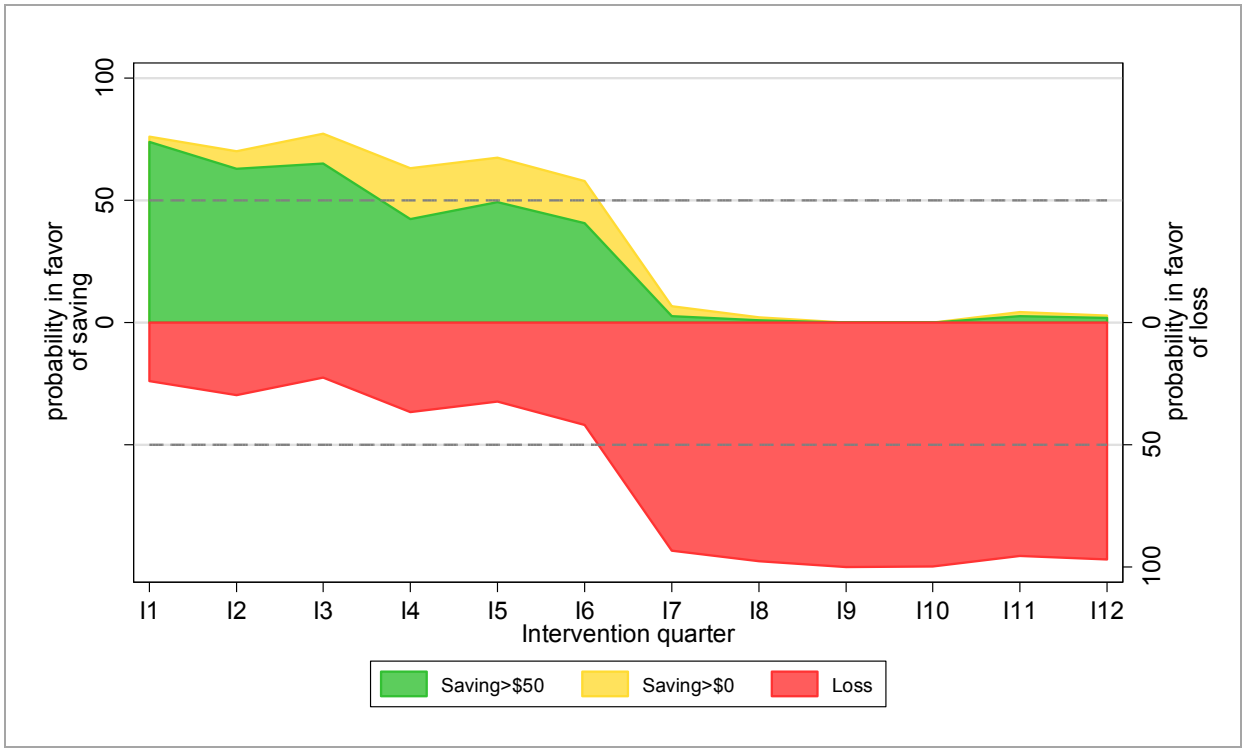
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** April 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; Altarum = Altarum Institute.

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 for saving or losing money on this initiative. 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. The probability that the innovation generated savings is 57 percent overall. 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 was a small portion of overall spending.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Altarum



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 7*** and ***Figure 4***. 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 I7, then lower than the innovation group's rate from I8 to I12. These results are comparable to the third annual report results.

Table 7. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Admit rate	84	86	87	84	89	90	92	105	254	145	127	121	123	124	122	126	126	131	124	141
Std dev	356	352	359	351	363	362	377	409	624	477	447	438	440	439	441	445	446	450	421	488
Unique patients	38,397	39,068	39,717	40,459	41,187	42,065	43,057	44,527	45,964	45,248	43,936	39,992	35,703	30,283	24,856	18,875	15,431	11,260	7,348	2,524
Comparison Group																				
Admit rate	88	89	84	92	96	95	104	116	305	157	138	132	129	128	123	121	111	114	114	119
Std dev	359	347	332	348	358	364	372	399	635	478	447	450	429	423	431	421	401	403	390	392
Weighted patients	35,471	36,241	36,864	37,569	38,389	39,346	40,427	41,919	43,326	42,656	41,311	38,098	34,944	31,549	28,141	24,475	20,548	15,467	11,326	4,994
Innovation − Comparison Rate																				
	−4	−3	3	−8	−7	−5	−12	−10	−51	−12	−11	−11	−5	−4	−1	5	16	17	10	22

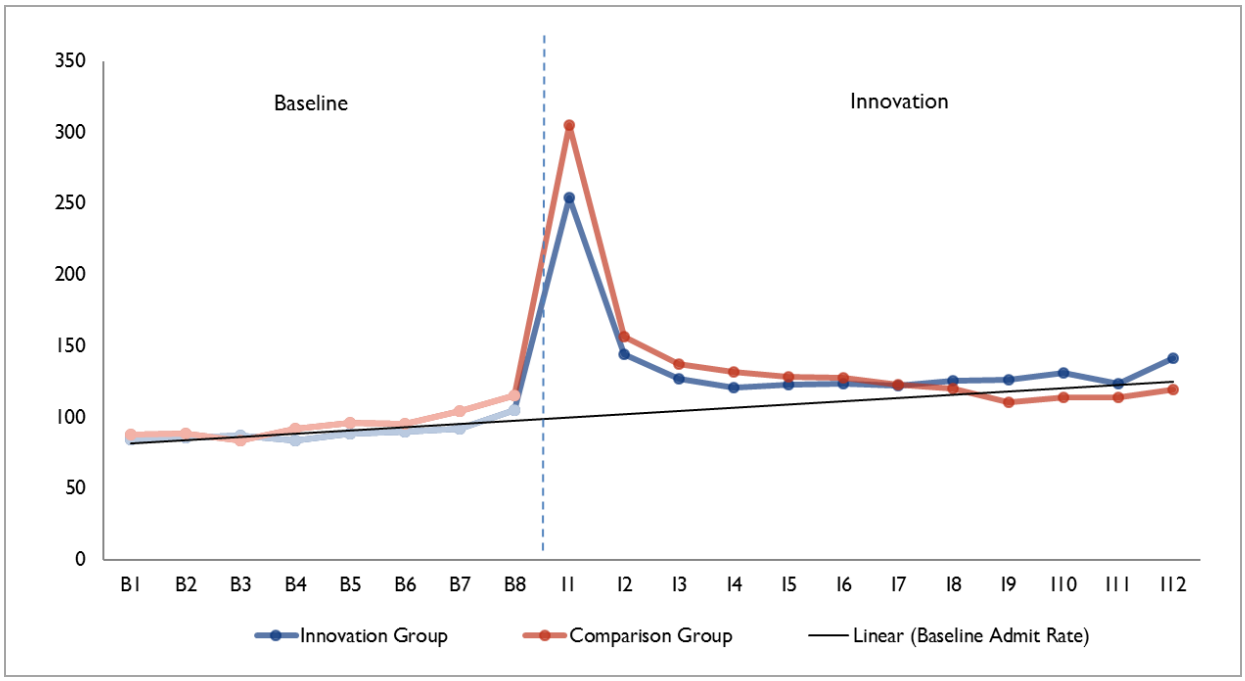
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Altarum



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- Altarum = Altarum Institute.

2.5.2 Regression Results

As shown in ***Table 8***, 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 for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −9, −4). This finding is similar to the third annual report.

We also present quarterly effects 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 are significantly lower than the comparison group's during I1 and I2. Beginning in I7, inpatient admissions are statistically higher among the comparison group. Overall, the innovation group's inpatient admissions are significantly lower and in Year 1 of the innovation, but are higher during Years 2 and 3.

Table 8. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−61	7	0.000
I2	−9	4	0.024
I3	−6	4	0.102
I4	−4	4	0.242
I5	0	4	0.902
I6	4	4	0.317
I7	8	4	0.073
I8	12	5	0.011
I9	24	5	0.000
I10	26	6	0.000
I11	20	7	0.004
I12	33	12	0.006
Overall average	−7	2	0.000
Overall aggregate	−2,228	501	0.000
Overall aggregate (IY1)	−3,675	429	0.000
Overall aggregate (IY2)	553	230	0.016
Overall aggregate (IY3)	894	118	0.000

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.

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 5***. 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. These trends are similar to the third annual report. 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 9. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Altarum Institute

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**	**I12**
Innovation Group																				
Readmit rate	99	89	102	106	106	108	107	120	137	145	125	138	132	128	131	118	126	122	117	157
Std dev	299	285	303	308	307	310	309	325	344	352	331	345	338	334	337	322	332	328	322	364
Total admissions	2,428	2,520	2,608	2,539	2,697	2,804	2,949	3,483	8,756	4,618	3,906	3,371	3,099	2,654	2,144	1,752	1,387	1,031	562	191
Comparison Group																				
Readmit rate	113	98	100	112	102	112	105	126	139	171	154	138	118	120	116	125	99	103	79	105
Std dev	317	297	300	315	302	316	307	332	346	377	361	345	323	325	320	331	299	304	269	307
Total admissions	2,357	2,396	2,258	2,513	2,558	2,714	2,951	3,255	8,893	4,527	3,782	3,334	3,058	2,755	2,408	2,067	1,592	1,274	828	332
Innovation − Comparison Rate																				
	−14	−9	2	−5	4	−5	1	−5	−3	−26	−28	0	13	8	15	−7	27	19	39	52

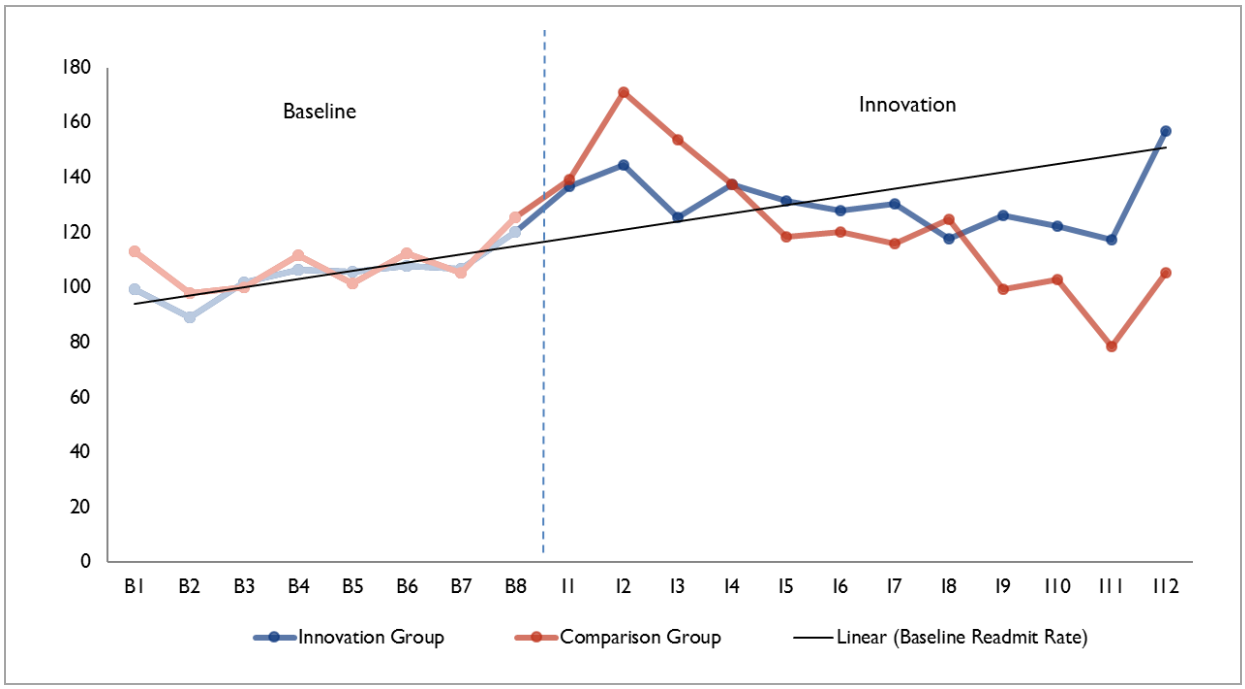
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Altarum



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 and June 2016.

Terms and Definitions

- Altarum = Altarum Institute.

2.6.2 Regression Results

Table 10 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 −2 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters and is consistent with the findings in the third annual report. The effect is not statistically significant (90% CI: −10, 6).

Table 10. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Altarum

Quarter	Coefficient	Standard Error	P-Values
Overall average	−1.74	4.96	0.725
Overall aggregate	−54.86	156.06	0.725

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- Altarum = Altarum Institute.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 11*** and ***Figure 6.*** 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. These trends are consistent with the trends in the third annual report. 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 11. ED Visits per 1,000 Medicare Participants: Altarum Institute

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**	**I12**
Innovation Group																				
ED rate	115	114	117	122	121	120	127	137	179	139	135	131	128	124	116	107	110	112	105	111
Std dev	517	522	512	539	517	518	544	585	660	575	632	560	535	507	486	463	451	439	433	446
Unique patients	38,397	39,068	39,717	40,459	41,187	42,065	43,057	44,527	45,964	45,248	43,936	39,992	35,703	30,283	24,856	18,875	15,431	11,260	7,348	2,524
Comparison Group																				
ED rate	103	103	106	108	107	102	110	119	176	130	121	115	119	115	110	111	117	108	116	129
Std dev	644	655	629	650	643	632	647	756	1019	878	798	776	899	904	1,005	900	834	861	816	726
Weighted patients	35,471	36,241	36,864	37,569	38,389	39,346	40,427	41,919	43,326	42,656	41,311	38,098	34,944	31,549	28,141	24,475	20,548	15,467	11,326	4,994
Innovation − Comparison Rate																				
	12	10	11	15	14	17	17	17	4	9	14	16	9	9	6	−3	−7	4	−10	−18

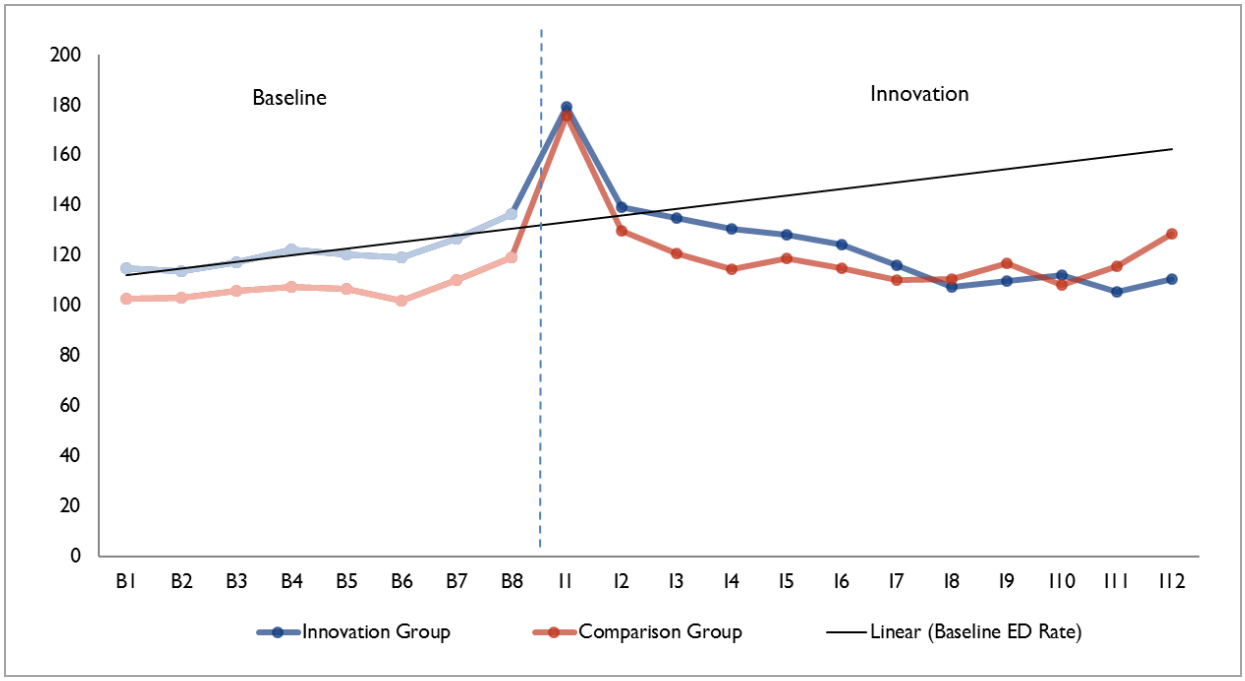
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Altarum = Altarum Institute.

Figure 6. ED Visits per 1,000 Medicare Participants: Altarum



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- ED = emergency department; Altarum = Altarum Institute.

2.7.2 Regression Results

As shown in ***Table 12***, the average quarterly difference-in-differences estimate for ED visits is an increase of 5 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: 2, 8). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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 and I5, the innovation group has more ED visits than the comparison group. Differences between the two are statistically significant in 8 out of 12 innovation quarters. Because the Altarum innovation focused on changing outpatient physician imaging behavior, it was not expected to impact ED visits.

Table 12. 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	−14	7	0.041
I2	0	5	0.929
I3	−5	5	0.337
I4	9	5	0.072
I5	5	5	0.318
I6	13	5	0.013
I7	17	5	0.001
I8	19	5	0.000
I9	20	6	0.000
I10	33	6	0.000
I11	21	7	0.004
I12	15	12	0.227
Overall average	5	2	0.004
Overall aggregate	1,714	593	0.004
Overall aggregate (IY1)	−531	500	0.288
Overall aggregate (IY2)	1,370	292	0.000
Overall aggregate (IY3)	875	128	0.000

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: April 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- I = Innovation Quarter; IY = Innovation Year; Altarum = Altarum Institute.

2.8 Discussion: Medicare Results

Medicare patients who saw physicians participating in the innovation had higher spending during Year 3, but the effect for the entire innovation period was not statistically significant. Inpatient stays were lower among the innovation group overall while ED visits were higher among the innovation group overall.

The Medicare results do not support the innovation's theory of change. The Altarum innovation aimed to alter physician behavior (reduce inappropriate imaging studies) which would indirectly impact patient outcomes. Changes in imaging studies would likely have only a small impact on total health care spending, inpatient visits, readmissions, and ED visits. Although the innovation might be expected to reduce spending on imaging, it represents a small fraction of total spending. In the third annual report, we conducted a regression analysis that tested for changes in imaging service orders and found no evidence

that the Altarum innovation altered physician behavior.[1] Limited adoption of the clinical decision support tool also suggests that observed changes in spending, inpatient stays, and ED visits are unlikely to be associated with the innovation.

2.9 Medicaid Comparison Group

The same set of innovation-comparison physician matches were used for the Medicare and Medicaid analyses and did not change since the third annual report. The Medicaid sample contained 220 innovation patients and 372 comparison patients. Details regarding the comparison group can be found in the third annual report.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 13 reports Medicaid spending per patient in the 8 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 7*** illustrates Medicaid spending per beneficiary. The blue line represents values for beneficiaries enrolled in the innovation; it 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, spending for innovation and comparison groups trends upward. 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 varies highly due to the small sample size and skewed health care expenditures. Newly available Medicaid data increased the innovation group's sample size from 53 to 220 patients between the third annual report and this addendum; therefore, these results are different from those in the third annual report.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 13. Medicaid Spending per Participant: Altarum

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

	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	$517	$532	$538	$609	$614	$499	$425	$963	$556	$546	$542	$1,095	$315	$426	$1,091	$608	$536	$224	—	—
Std dev	$1,887	$1,595	$1,516	$1,856	$2,554	$1,720	$1,062	$3,947	$1,848	$2,343	$2,017	$4,880	$1,884	$2,359	$4,110	$2,558	$1,386	$648	—	—
Unique patients	107	118	114	96	98	148	170	223	220	132	140	114	118	124	76	73	26	12	—	—
Comparison Group																				
Spending rate	$401	$502	$486	$495	$551	$822	$1,021	$837	$1,086	$535	$334	$301	$318	$339	$382	$191	$1,503	$650	—	—
Std dev	$1,199	$1,857	$1,106	$1,589	$1,940	$2,777	$7,863	$4,357	$3,973	$2,379	$1,224	$977	$1,135	$957	$1,023	$708	$11,820	$1,852	—	—
Weighted patients	202	196	191	185	201	209	262	379	372	229	267	294	244	227	191	169	114	45	—	—
Savings per Patient																				
	−$117	−$30	−$52	−$114	−$63	$323	$595	−$125	$529	−$11	−$208	−$794	$3	−$87	−$709	−$417	$967	$427	—	—

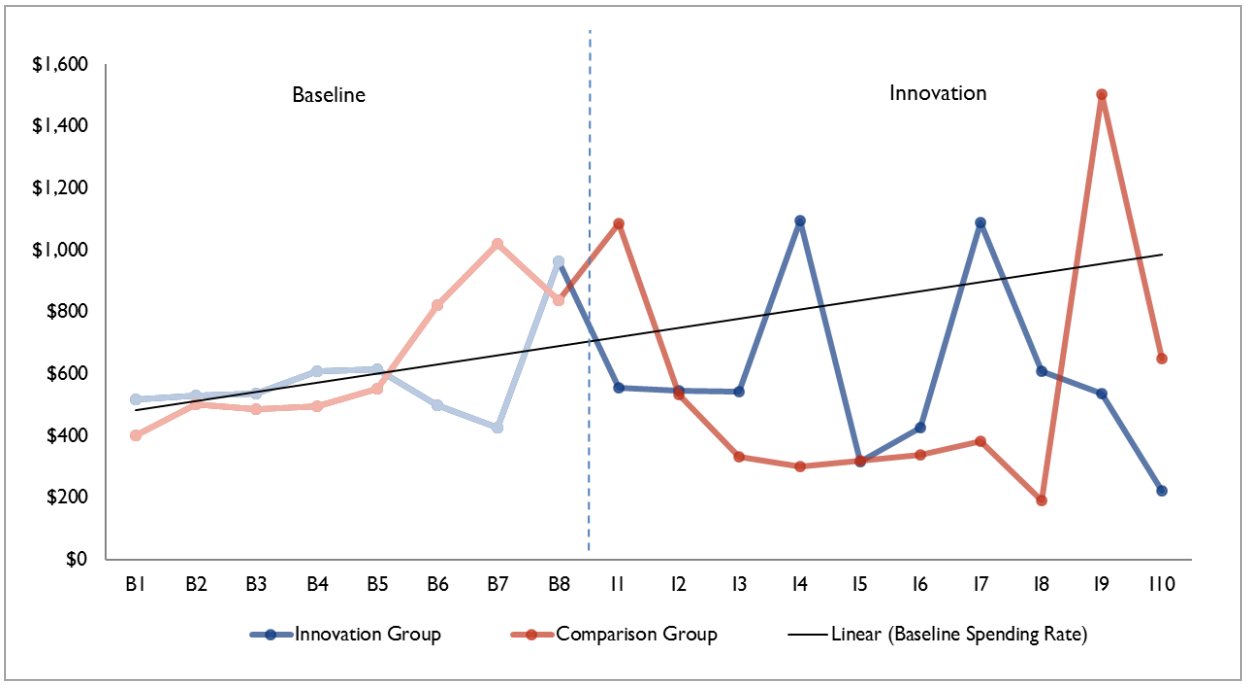
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.
- — Data not yet available.

Figure 7. Medicaid Spending per Participant: Altarum



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- Altarum = Altarum Institute.

2.10.2 Regression Results

In the third annual report, no regressions were completed for Medicaid beneficiaries because of the small sample size. In this report, because we have a larger 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 a loss, is $171 (90% CI: −$210, $552). 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 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 8*** illustrates these quarterly difference-in-differences estimates. The quarterly estimate is negative in I1, positive, in I2 through I8, and negative in I9 and I10, reflecting the volatile nature of the spending data. Some quarters have statistically significant savings and losses, which average to an overall result that is not statistically

significant. The Altarum innovation focused on changing provider imaging behavior and was not expected to have a detectable impact on spending because imaging services are a small fraction of total spending.

Table 14. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−$443	$466	0.343
I2	$60	$355	0.866
I3	$226	$253	0.374
I4	$955	$495	0.056
I5	$151	$290	0.604
I6	$267	$332	0.424
I7	$880	$464	0.060
I8	$555	$201	0.007
I9	−$1,060	$275	0.000
I10	−$358	$344	0.301
Overall average	$171	$230	0.457
Overall aggregate	$177,292	$237,724	0.457
Overall aggregate (IY1)	$50,882	$177,864	0.775
Overall aggregate (IY2)	$158,264	$91,882	0.088
Overall aggregate (IY3)	−$31,854	$6,451	<.0001

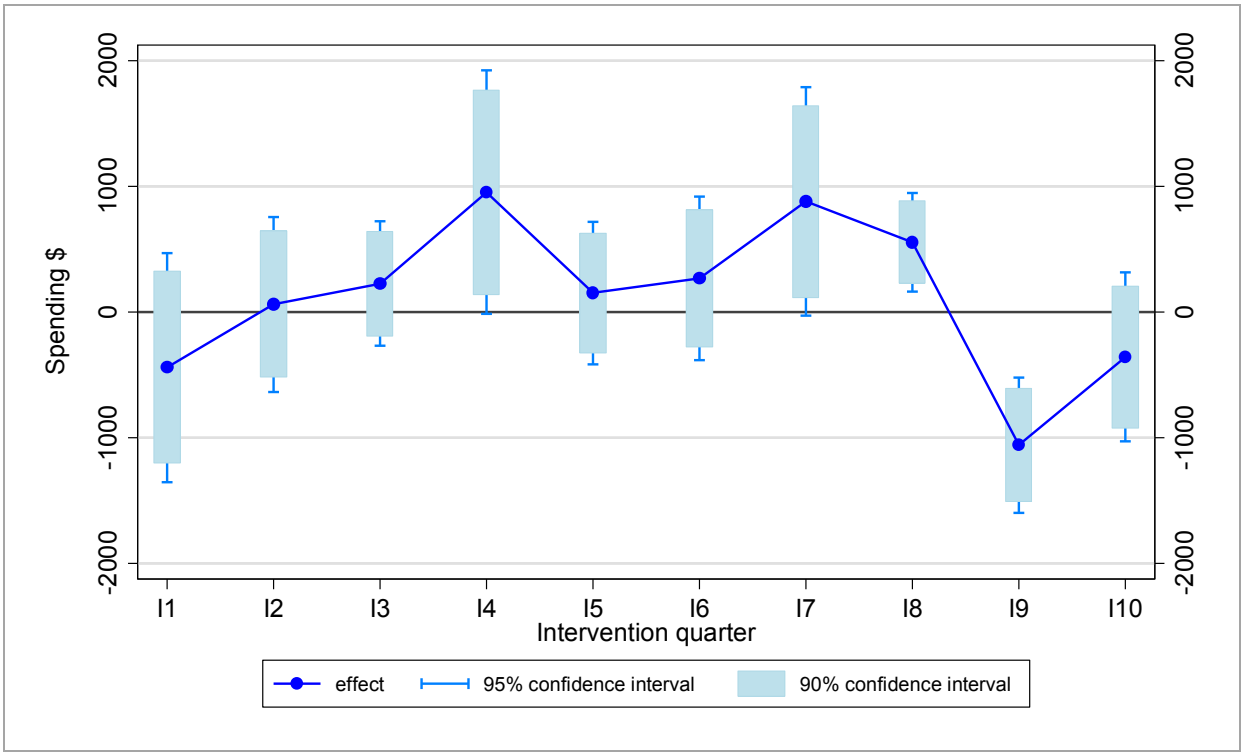
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **The regression coefficients** are 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; OLS = ordinary least squares; Altarum = Altarum Institute.

Figure 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Altarum



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- OLS = ordinary least squares; Altarum = Altarum Institute.

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 for saving or losing money on this initiative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Overall, the probability of the innovation generating Medicaid savings is 23 percent.

Figure 9. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Altarum

Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- Altarum = Altarum Institute.

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***. The all-cause inpatient admissions rate is highly variable during the baseline and innovation period for both groups. During the innovation period, the comparison group's inpatient admissions rate falls relative to the innovation group's. Even with the new data, this finding is comparable to the third annual report.

Table 15. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Altarum

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

	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																				
Admit rate	37	59	44	63	102	34	29	58	41	53	57	88	17	32	66	82	38	0	—	—
Std dev	235	301	206	283	465	271	201	253	220	310	288	508	130	359	298	400	196	0	—	—
Unique patients	107	118	114	96	98	148	170	223	220	132	140	114	118	124	76	73	26	12	—	—
Comparison Group																				
Admit rate	35	46	26	43	35	67	38	42	51	13	15	17	16	18	16	12	53	22	—	—
Std dev	209	233	190	229	209	347	211	238	244	114	122	154	202	162	125	108	261	149	—	—
Weighted patients	202	196	191	185	201	209	262	379	372	229	267	294	244	227	191	169	114	45	—	—
Innovation − Comparison Rate																				
	3	13	18	19	67	−33	−9	16	−10	40	42	71	1	15	50	70	−14	−22	—	—

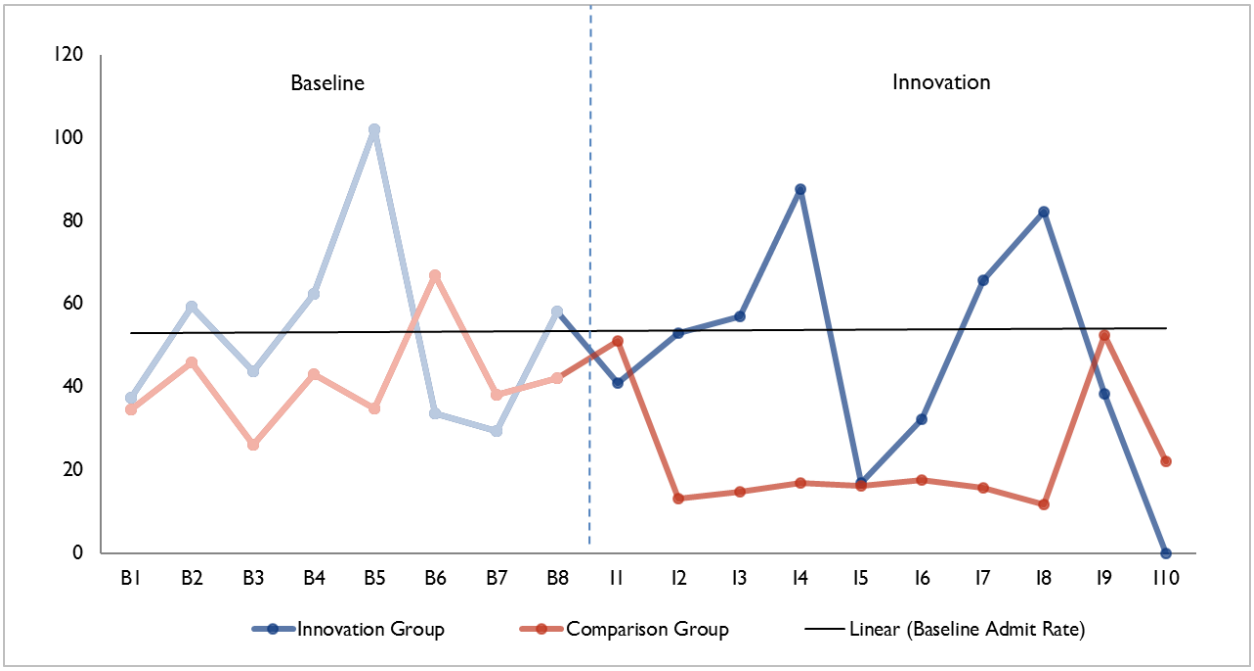
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **Admit rate: (**Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.
- — Data not yet available.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Altarum



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- Altarum = Altarum Institute.

2.11.2 Regression Results

As shown in ***Table 16***, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 26 inpatient admissions per 1,000 participants relative to the comparison group. The regression utilized nine quarters of innovation data because inpatient admissions were insufficient in the 10th innovation quarter for the regression to converge. 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, 49).

We also present quarterly effects 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. Six of the nine quarterly estimates are positive; however, eight out of nine estimates are not statistically significant because of the small number of inpatient admissions. The Altarum innovation was not expected to impact inpatient admissions because it focused on altering provider behavior in ordering imaging services.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−12	47	0.800
I2	40	33	0.223
I3	47	21	0.025
I4	79	48	0.102
I5	0	14	0.980
I6	14	32	0.654
I7	51	34	0.131
I8	56	42	0.193
I9	−40	29	0.171
I10	—	—	—
Overall average	26	14	0.056
Overall aggregate	27	14	0.056
Overall aggregate (IY1)	18	13	0.154
Overall aggregate (IY2)	10	6	0.098
Overall aggregate (IY3)	−1	1	0.171

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **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.
- **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, 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.
- I = Innovation Quarter; IY = Innovation Year; Altarum = Altarum Institute.
- — Data not yet available.

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***. Consistent with the third annual report, the small number of hospitalizations in the innovation and comparison groups results in a small number of unplanned readmissions and a highly variable rate of unplanned readmissions per 1,000 admissions.

Table 17. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Altarum

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

	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																				
Readmit rate	333	0	0	0	286	0	200	111	0	333	250	333	0	0	0	400	0	0	—	—
Std dev	471	0	0	0	452	0	400	314	0	471	433	471	0	0	0	490	0	0	—	—
Total admissions	3	3	3	4	7	2	5	9	2	6	4	3	2	1	0	5	1	0	—	—
Comparison Group																				
Readmit rate	0	167	0	0	0	364	0	100	100	0	0	0	0	0	0	0	250	0	—	—
Std dev	0	373	0	0	0	481	0	300	300	0	0	0	0	0	0	0	433	0	—	—
Total admissions	5	6	4	7	4	11	3	10	10	2	2	3	1	3	0	1	4	1	—	—
Innovation − Comparison Rate																				
	333	−167	0	0	286	−364	200	11	−100	333	250	333	0	0	0	400	−250	0	—	—

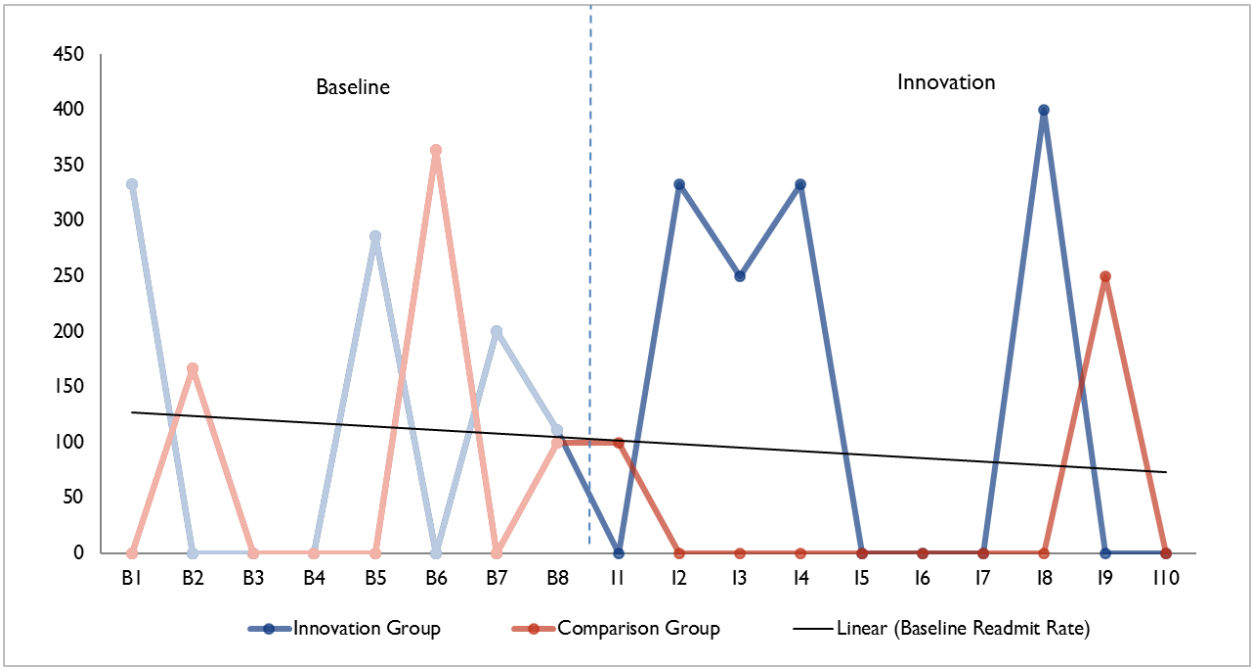
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Altarum = Altarum Institute.
- — Data not yet available.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Altarum



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- Altarum = Altarum Institute.

2.12.2 Regression Results

Table 18 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 176 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 0.79, 273).

Table 18. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: Altarum

Quarter	Coefficient	Standard Error	P-Values
Overall average	176	76	0.029
Overall aggregate	4	2	0.029

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **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, 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.
- Altarum = Altarum Institute.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 19*** and ***Figure 12.*** During the baseline period, the ED visit rate for the innovation group trends slightly upward and the comparison group's rate is similar to the innovation group's rate. The ED visit rate for the innovation group is above the rate for the comparison group during the innovation period. These results differ from those in the third annual report because there are additional quarters of data and the sample size increased.

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

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

	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																				
ED rate	280	441	338	510	551	257	288	487	409	405	468	1057	161	254	908	295	423	583	—	—
Std dev	1,217	1,651	1,019	2,156	2,323	848	823	1,442	1,465	1,856	2,159	4,766	924	1,441	4,891	1,382	1,238	1,379	—	—
Unique patients	107	118	114	96	98	148	170	223	220	132	140	114	118	124	76	73	26	12	—	—
Comparison Group																				
ED rate	374	378	406	284	336	627	366	379	466	312	360	451	352	322	183	127	360	411	—	—
Std dev	1,189	1,172	1,274	809	1,042	2,071	1,695	1,181	1,364	1,219	1,589	1,955	1,323	924	579	526	906	1,184	—	—
Weighted patients	202	196	191	185	201	209	262	379	372	229	267	294	244	227	191	169	114	45	—	—
Innovation − Comparison Rate																				
	−93	63	−68	227	215	−370	−78	108	−57	93	108	606	−191	−68	725	167	63	172	—	—

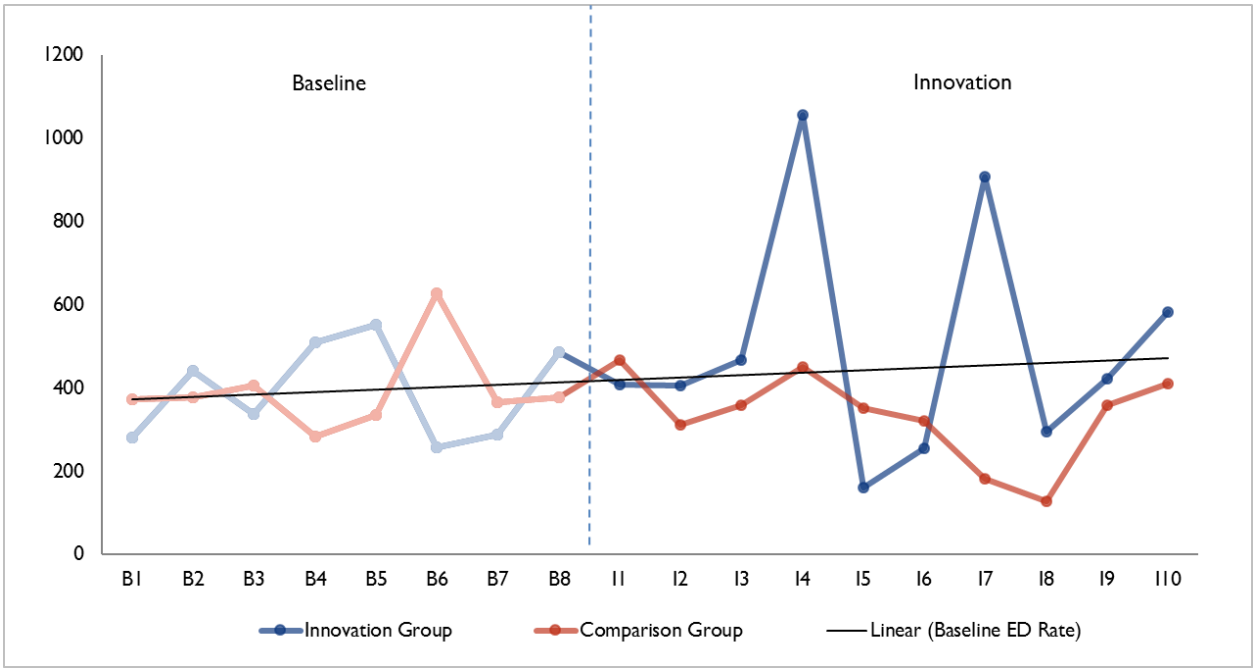
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Altarum = Altarum Associates.
- — Data not yet available.

Figure 12. ED Visits per 1,000 Medicaid Participants: Altarum



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- ED = emergency department; Altarum = Altarum Institute.

2.13.2 Regression Results

As shown in ***Table 20***, the average quarterly difference-in-differences estimate for ED visits is 128, indicating that the innovation-comparison difference is 1.28 percentage points higher 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: 36, 220).

We also present quarterly effects 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. Eight of the 10 quarterly effects are positive, and the estimates are statistically insignificant. The Altarum innovation was not expected to impact ED visits because it focused on changing providers' imaging behavior.

Table 20. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Altarum

Quarter	Coefficient	Standard Error	P-Values
I1	−8	116	0.944
I2	92	178	0.608
I3	326	213	0.128
I4	355	203	0.084
I5	−57	91	0.532
I6	12	112	0.912
I7	420	252	0.099
I8	88	73	0.228
I9	2	129	0.990
I10	268	197	0.201
Overall average	128	56	0.022
Overall aggregate	133	58	0.022
Overall aggregate (IY1)	96	51	0.060
Overall aggregate (IY2)	33	27	0.212
Overall aggregate (IY3)	3	4	0.431

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** March 2011 to September 2015.

Terms and Definitions

- **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, 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.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Altarum = Altarum Institute.

2.14 Discussion: Medicaid Results

We found that the innovation had no impact on total spending. Although we did find some statistically significant results indicating higher utilization among the innovation group, these results should not be interpreted as resulting from the innovation. The claims analysis included a relatively small sample size and the utilization measures were volatile, which may lead to spurious statistically significant results.

The Medicaid results do not support the innovation's theory of change for the same reasons noted in the Medicare discussion. Altarum aimed to alter physician behavior not patient outcomes and adoption of the clinical decision support was limited. Spending on imaging would have a small impact on total spending.

The results may not fully represent the overall population that the innovation served. These beneficiaries represent less than 1 percent of the overall population reached by the innovation.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: AACI

Data Source	Period Covered
Medicare claims data	October 2013–June 2016
Medicaid claims data	October 2013–September 2015

Terms and Definitions
- AACI = Asian Americans for Community Involvement.

Asian Americans for Community Involvement

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. Below, we present AACI's HCIA goals along with the associated findings:

1. **Smarter spending.**

   Goal: Reduce unnecessary ED visits, saving $3,373,602 in gross medical expenditures.

   Findings: The overall impact of the innovation on spending among individuals enrolled in the innovation was not statistically significant, and no clear pattern was discernible for savings or losses for both Medicare and Medicaid. The innovation had a 55 percent probability of generating savings.

2. **Better care.**

   Goal: 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.

   Findings: We found a statistically significant increase in the number of inpatient stays for Medicare beneficiaries enrolled in the innovation. On average, the innovation group had a lower number of unplanned readmissions and a higher number of ED visits relative to the comparison group, but results did not achieve statistical significance. We found statistically significant results for ED visits in the first and second years of the innovation, with an increase in ED visits in the first year and a decrease in the second year. For Medicaid, on average, the innovation group had a higher number of hospital admissions and a lower number of ED visits relative to the comparison group, but results did not achieve statistical significance.

   AACI's innovation was designed to increase access to primary and behavioral health care. Although we see elevated primary care use among members of the intervention group relative to the comparison group in Years 2 and 3, these effects may be due to a decline in primary care use among comparison group beneficiaries. Since the main service that innovation patients accessed was assistance filling out forms, and patients received fewer than two services each on average, it is unlikely that the innovation changed participants' utilization or spending.

3. **Healthier people.**

   Goal: Improve cancer and diabetes prevention and early treatment in part by creating 29 nonclinical health worker jobs and training 165 young adults.

   Findings: None to report.

2.2.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected during the innovation period. The overall impact of the innovation on spending among individuals enrolled in the innovation is not statistically significant. The innovation group has, on average, a statistically significant increase in the number of inpatient admissions relative to the comparison group. On average, the innovation group has a lower number of unplanned readmissions relative to the comparison group; however, this difference is not statistically significant. The statistically insignificant increase in the average number of ED visits over the innovation period, relative to the comparison group, is driven by statistically significant differences in Years 1 and 2 of the innovation, where ED visits for the innovation group increase for Year 1 and decrease for Year 2. It is unlikely that these effects are due to the provision of PN services, which were designed to decrease utilization and spending by helping patients access primary and behavioral health care, but mostly entailed assistance with filling out forms.

Table 2. Summary of Medicare Claims-Based Findings: AACI

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$0.099	−$1.491, $1.294	−$1.183, $0.986	$0.054	−$0.921, $1.030	−$0.162	−$0.814, $0.489	$0.009	−$0.390, $0.408
Acute care inpatient stays	28	4, 51	10, 46	14	−3, 31	9	−5, 22	5	−4, 14
Hospital-wide all-cause unplanned readmissions	−4	−13, 5	−11, 3	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	24	−10, 57	−2, 50	41	14, 68	−26	−44, −9	9	−1, 19
Average impact per quarter									
Spending per participant	−$27	−$401, $348	−$318, $265	$25	−$422, $472	−$132	−$664, $399	$29	−$1,237, $1,294
Acute care inpatient stays (per 1,000 participants)	7	1, 14	3, 12	7	−1, 14	7	−4, 18	16	−12, 45
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−65	−199, 69	−169, 40	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	6	−3, 15	−1, 13	19	6, 31	−21	−36, −7	28	−3, 60

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** October 2011 to June 2016.
- **Sample size**: 603 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; AACI = Asian Americans for Community Involvement.

Table 3 summarizes findings based on Medicaid claims collected during the innovation period. The overall impact of the innovation on spending, hospital admissions and ED visits among individuals enrolled in the innovation is not statistically significant. During the first year of the innovation, statistically significant savings occur in the innovation group, a result that is not maintained during the second year of the innovation. The low number of hospital admissions and readmissions precluded a regression analysis for readmissions. The lack of effects in the Medicaid sample could be due to the limited number and type of services that patients received.

Table 3. Summary of Medicaid Claims-Based Findings: AACI

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI
Aggregated results							
Total spending (in millions)	−$0.244	−$0.560, $0.072	−$0.490, $0.002	−$0.273	−$0.525, −$0.021	$0.029	−$0.095, $0.153
Acute care inpatient stays	1	−10, 13	−7, 10	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
ED visits	−2	−19, 14	−15, 10	N/A	N/A	N/A	N/A
Average impact per quarter							
Spending per participant	−$93	−$214, $28	−$188, $1	−$135	−$260, −$10	$49	−$159, $256
Acute care inpatient stays (per 1,000 participants)	1	−4, 5	−3, 4	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
ED visits (per 1,000 participants)	−1	−7, 5	−6, 4	N/A	N/A	N/A	N/A

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** October 2011 to September 2015.
- **Sample size**: 615 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is the average quarterly effect from a negative binomial count model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays is the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** no regression analysis possible due to low number of hospital admissions and readmissions.
- **ED visits (per 1,000 participants)** is the average quarterly effect from a negative binomial count model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits is the product of ED visits (per 1,000 participants) and the number of person quarters.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size; AACI = Asian Americans for Community Involvement

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?
- Has the innovation increased primary care visits?

Table 4 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 4. Claims-Based Outcome Measures: AACI

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

Terms and Definitions

- ED = emergency department.
- AACI = Asian Americans for Community Involvement

2.3 Medicare Comparison Group

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. This analysis includes two more quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 603 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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. See third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 5 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 1*** illustrates the Medicare 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 innovation enrollees, spending increases slightly in the baseline quarters. Up to innovation quarter I10, the comparison group spending is greater than the innovation group spending for all innovation periods except I2. The spending spike in I11 is associated with a lower sample size and higher uncertainty. Except for innovation quarter 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 5, meaning the data points tend to be spread over a wide range of values rather than at the mean. These trends are similar to the third annual report. 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 5. Medicare Spending per Participant: AACI

Awardee Number: 1C1CMS331035
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	$1,185	$1,273	$979	$1,299	$1,087	$1,273	$1,328	$1,221	$1,672	$2,275	$1,648	$1,928	$1,373	$2,447	$1,419	$1,947	$1,371	$2,401	$8,749
Std dev	$4,181	$6,905	$2,804	$5,712	$3,396	$6,322	$5,256	$4,545	$6,038	$10,010	$5,562	$10,310	$4,252	$10,986	$4,537	$6,612	$3,483	$8,691	$27,796
Unique patients	497	511	522	542	557	572	587	603	603	571	531	477	414	344	278	189	169	107	39
Comparison Group																			
Spending rate	$1,534	$1,518	$1,596	$1,441	$1,330	$1,525	$1,386	$1,170	$1,799	$1,909	$2,210	$2,572	$1,972	$2,771	$1,963	$2,192	$2,697	$3,647	$4,526
Std dev	$6,643	$6,027	$7,639	$5,540	$5,308	$6,333	$4,619	$4,229	$7,069	$7,897	$9,374	$11,055	$8,505	$12,991	$6,450	$6,352	$9,181	$12,370	$10,370
Weighted patients	514	522	533	544	560	583	599	603	603	574	534	469	394	326	270	179	158	106	37
Savings per Patient																			
	$349	$244	$616	$143	$243	$252	$58	−$50	$127	−$366	$561	$644	$599	$324	$543	$245	$1,326	$1,246	−$4,223

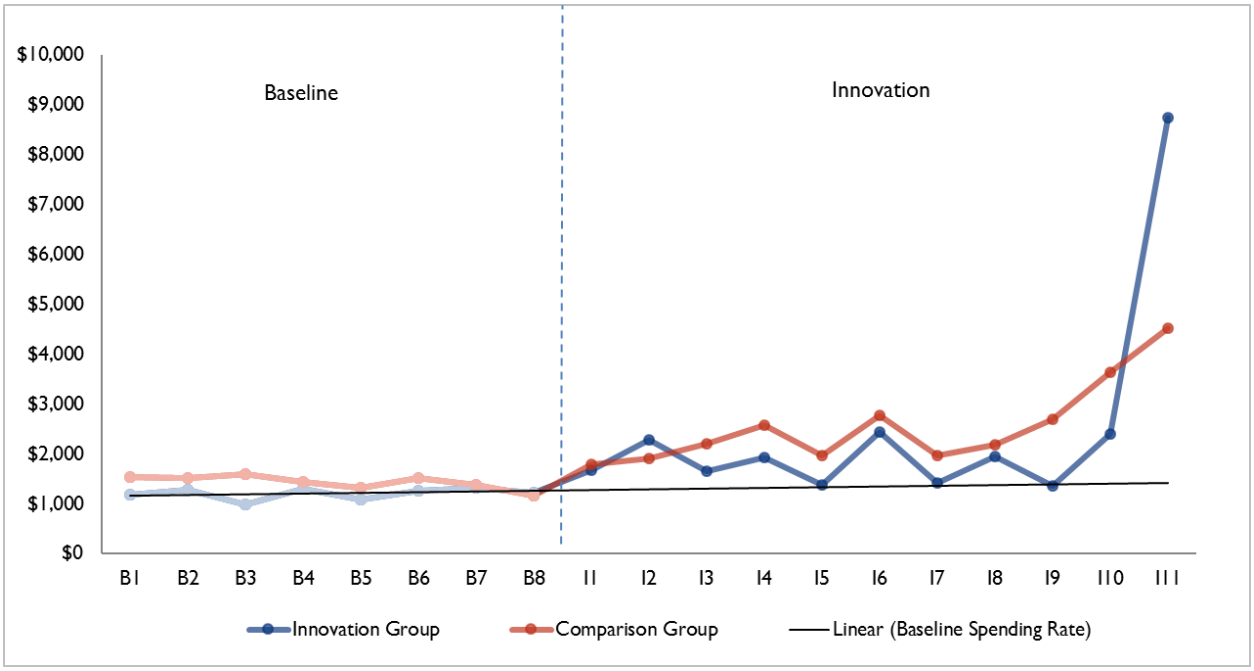
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

Figure 1. Medicare Spending per Participant: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions:

- AACI = Asian Americans for Community Involvement

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 −$27 (90% CI: −$401, $348). 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. Compared to the third annual report, the estimated change in spending is closer to 0 and remained insignificant.

In addition to the average effect over the innovation period, we also present quarterly effects. ***Table 6*** 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. Figure 3 shows that the trend in the estimated quarterly spending differences suggests that the innovation might lead to long-term savings. Except for innovation quarters I1, I2, I8, and

I11, the change in spending among the innovation group is lower than the change in spending for comparison group individuals. However, no difference is statistically significant.

Table 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: AACI

Quarter	Coefficient	Standard Error	P−Values
I1	$108	$317	0.733
I2	$637	$478	0.183
I3	−$332	$397	0.403
I4	−$416	$589	0.480
I5	−$318	$336	0.345
I6	−$53	$831	0.949
I7	−$197	$378	0.603
I8	$223	$558	0.689
I9	−$772	$530	0.145
I10	−$738	$1,087	0.497
I11	$5,603	$4,580	0.221
Overall average	−$27	$227	0.907
Overall aggregate	−$98,764	$846,102	0.907
Overall aggregate (IY1)	$54,368	$592,717	0.927
Overall aggregate (IY2)	−$162,219	$395,820	0.682
Overall aggregate (IY3)	$9,087	$242,253	0.970

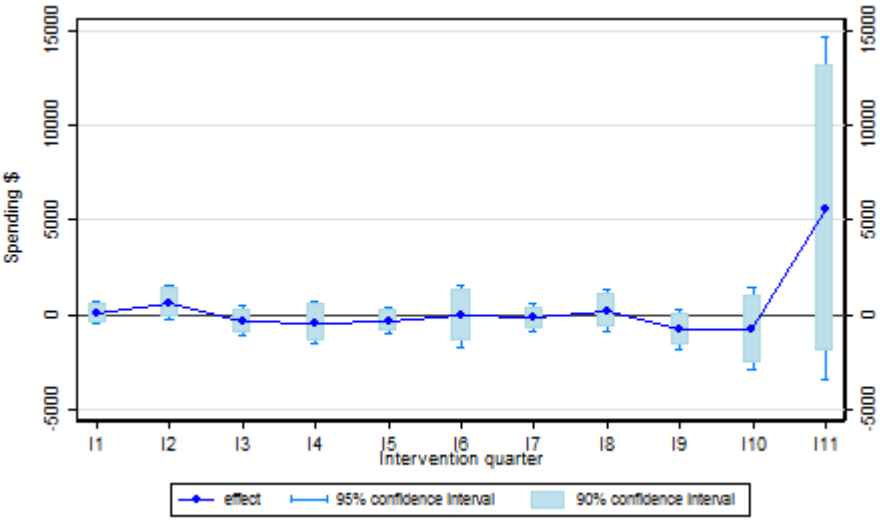
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; AACI = Asian Americans for Community Involvement.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** October 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; AACI = Asian Americans for Community Involvement.

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 for saving or losing money on this initiative. Figure 3 illustrates that, except for I1, I2, I8, and I11, the innovation has a higher probability of generating savings rather than losses, and a 55 percent overall probability of generating savings.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: AACI

Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- 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 7*** and ***Figure 4***. The trend is similar to the third annual report. The innovation group has a lower number of inpatient admissions than the comparison group for all innovation quarters except I2, I6, and I11. The spike in I11 for both groups is associated with a reduced sample size. As Table 8 shows, the standard deviation is high for all periods, meaning the data points tend to be spread over a wide range of values rather than at the mean. The next section describes the regression analysis we conducted to assess the impact of the innovation on inpatient admissions.

Table 7. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: AACI

Awardee Number: 1C1CMS331035
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	8	14	8	13	18	9	17	12	30	35	17	21	19	49	14	21	24	65	154
Std dev	89	116	87	128	146	93	153	107	189	256	129	170	154	254	189	144	187	342	426
Unique patients	497	511	522	542	557	572	587	603	603	571	531	477	414	344	278	189	169	107	39
Comparison Group																			
Admit rate	33	26	27	27	29	27	30	20	34	34	34	45	37	40	31	31	47	69	91
Std dev	197	163	169	154	173	214	193	142	198	207	220	233	219	227	190	200	255	272	321
Weighted patients	514	522	533	544	560	583	599	603	603	574	534	469	394	326	270	179	158	106	37
Innovation − Comparison Rate																			
	−25	−12	−20	−14	−11	−19	−13	−8	−5	1	−17	−24	−18	9	−16	−10	−23	−4	63

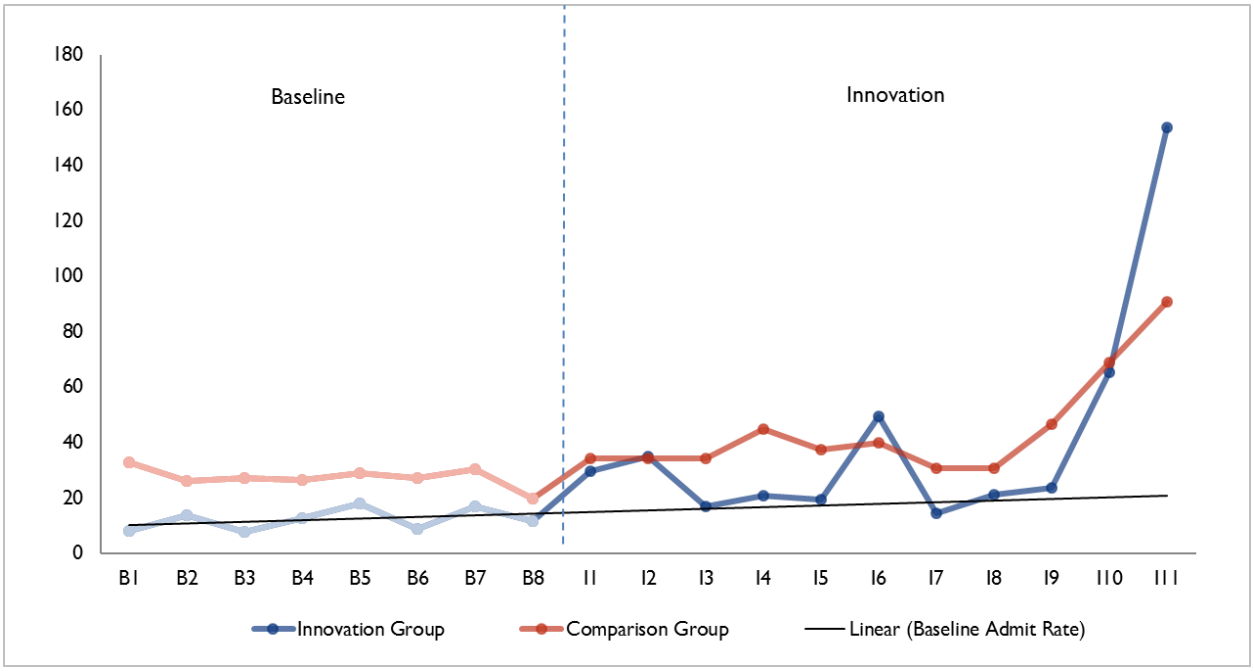
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.5.2 Regression Results

As shown in ***Table 8,*** 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 for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 1, 14). The estimated impact of the innovation on inpatient admissions was similar but not significant in the third annual report.

In addition to the average effect over the innovation period, we also present quarterly effects 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 innovation quarters I1, I2, I6, I8, I10, and I11 the number of inpatient admissions 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 I6 only where the innovation group, on average, has 29 more inpatient admissions per 1,000 participants.

Table 8. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: AACI

Quarter	Coefficient	Standard Error	P-Values
I1	12	9	0.179
I2	17	11	0.122
I3	−4	8	0.623
I4	−1	10	0.914
I5	−4	9	0.700
I6	29	16	0.068
I7	−3	13	0.838
I8	3	13	0.790
I9	−8	16	0.643
I10	24	36	0.507
I11	100	66	0.137
Overall average	7	4	0.051
Overall aggregate	28	14	0.051
Overall aggregate (IY1)	14	11	0.177
Overall aggregate (IY2)	9	8	0.290
Overall aggregate (IY3)	5	5	0.340

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; 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 9*** and ***Figure 5***. Readmissions rates are highly variable before enrollment and up to I6 after enrollment, reflecting the relatively small number of hospital admissions for both groups during each quarter. After I6, the innovation group has no readmissions. With few admissions (the denominator in the readmission rate) and a relatively low underlying percentage of readmissions, the readmissions rate varies widely over time. This trend is comparable to the trend in the third annual report.

Table 9. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: AACI

Awardee Number: 1C1CMS331035
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																			
Readmit rate	0	0	0	0	143	0	125	0	0	154	0	0	167	0	0	0	0	0	0
Std dev	0	0	0	0	350	0	331	0	0	361	0	0	373	0	0	0	0	0	0
Total admissions	3	7	3	6	7	5	8	6	16	13	9	5	6	7	1	3	0	1	4
Comparison Group																			
Readmit rate	36	0	70	34	60	123	23	34	57	60	132	179	53	37	40	0	0	125	0
Std dev	186	0	255	181	237	329	151	183	231	238	338	384	225	189	196	0	0	331	0
Total admissions	9	10	10	10	11	14	14	10	18	17	15	13	13	9	8	5	6	5	1
Innovation − Comparison Rate																			
	−36	0	−70	−34	83	−123	102	−34	−57	94	−132	−179	113	−37	−40	0	0	−125	0

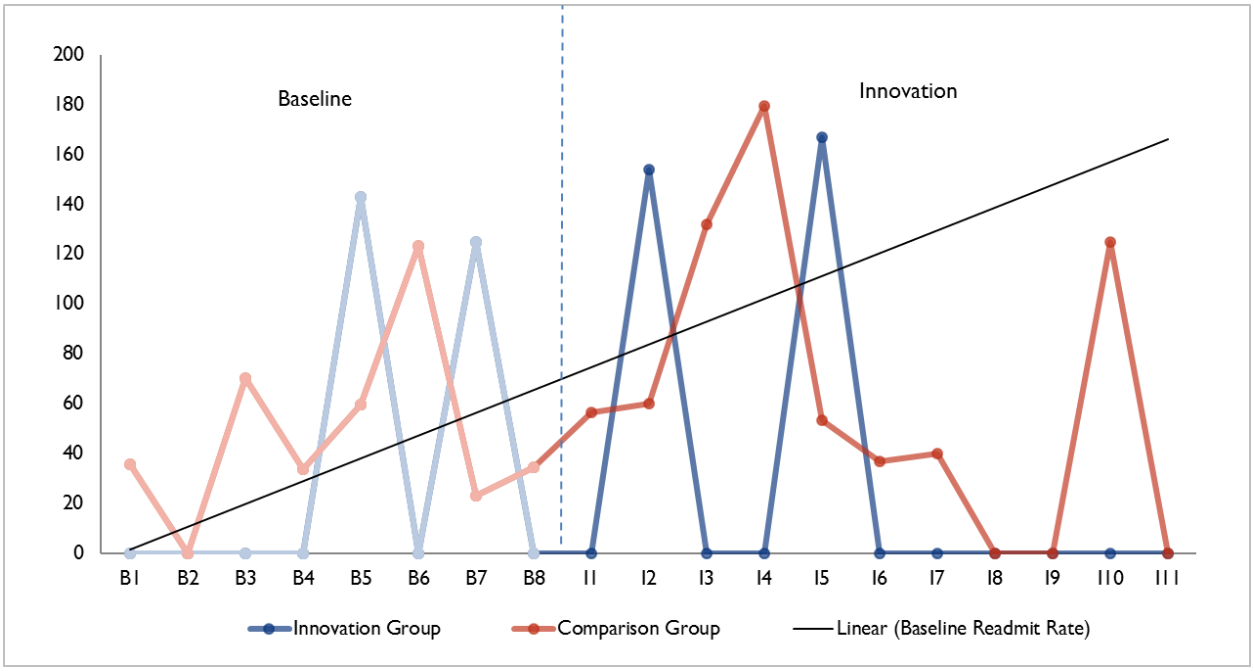
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 and June 2016.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.6.2 Regression Results

Table 10 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 −65 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: −199, 69). This finding is consistent with those in the third annual report.

Table 10. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: AACI

Quarter	Coefficient	Standard Error	P-Values
Overall average	−65	82	0.430
Overall aggregate	−4	5	0.430

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **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, 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.
- 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 11*** and ***Figure 6.*** 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 up to I11. The increase in ED visits from I10 to I11 is associated with a steep decrease in the number of patients and, therefore, also associated with higher uncertainty. These trends are consistent with the trends in the third annual report. 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 11. ED Visits per 1,000 Medicare Participants: AACI

Awardee Number: 1C1CMS331035
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																			
ED rate	48	59	42	39	74	82	46	68	86	75	58	59	48	32	43	42	83	56	103
Std dev	257	251	252	220	480	541	233	306	335	345	250	261	256	207	236	227	317	231	307
Unique patients	497	511	522	542	557	572	587	603	603	571	531	477	414	344	278	189	169	107	39
Comparison Group																			
ED rate	94	75	77	91	90	79	77	73	78	68	81	81	88	68	111	111	72	60	121
Std dev	373	207	215	237	264	216	221	228	223	208	243	224	239	185	281	260	200	156	247
Weighted patients	514	522	533	544	560	583	599	603	603	574	534	469	394	326	270	179	158	106	37
Innovation − Comparison Rate																			
	−46	−16	−35	−52	−17	3	−31	−5	8	8	−22	−22	−40	−36	−68	−69	11	−4	−18

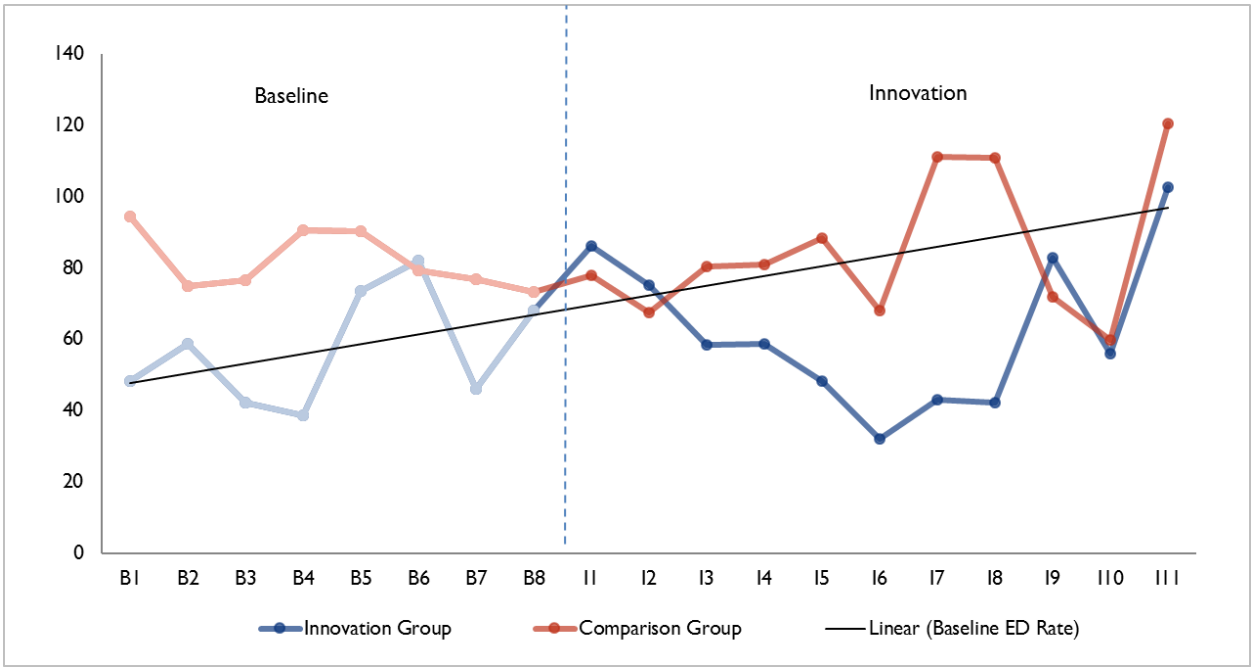
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

Figure 6. ED Visits per 1,000 Medicare Participants: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- ED = emergency department; AACI = Asian Americans for Community Involvement.

2.7.2 Regression Results

As shown in ***Table 12***, the average quarterly difference-in-differences estimate for ED visits is an increase of 6 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: −3, 15). The overall aggregate estimates show that, throughout the innovation period, the innovation group has 24 more ED visits relative to the comparison group; this result is not statistically significant (90% CI: −10, 57). These results are similar to the third annual report's findings; however, in the third annual report the increase in ED visits was statistically significant.

In addition to average and aggregate effects over the innovation period, we also present quarterly effects 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 fluctuates considerably. For innovation quarters I5 to I8 the number of ED visits is higher for the comparison group, and for the remaining quarters the number is higher for the innovation group. The results are statistically significant for I1 and I2 where the innovation group, on average, has 36 and 27 more ED visits per 1,000

participants, respectively; and statistically significant for I7 where the innovation group, on average, has 37 less ED visits per 1,000 participants.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: AACI

Quarter	Coefficient	Standard Error	P-Values
I1	36	16	0.025
I2	27	13	0.043
I3	4	15	0.780
I4	4	16	0.792
I5	−10	14	0.475
I6	−17	15	0.255
I7	−37	21	0.076
I8	−31	23	0.166
I9	35	29	0.219
I10	13	27	0.631
I11	39	57	0.499
Overall average	6	5	0.246
Overall aggregate	24	20	0.246
Overall aggregate (IY1)	41	16	0.013
Overall aggregate (IY2)	−26	11	0.013
Overall aggregate (IY3)	9	6	0.144

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: October 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- I = Innovation Quarter; IY = Innovation Year; AACI = Asian Americans for Community Involvement.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

AACI's patient navigation (PN) services aimed at facilitating primary care access through appointment scheduling assistance or reminders, health education, language assistance, or transportation assistance. Therefore, this section describes the innovation's impact on primary care visits. Primary care visits per 1,000 participants are shown in ***Table 13*** and ***Figure 7.*** Primary care visit rates trend slightly upward during the baseline period. After the innovation began, primary care visit rates for the innovation group remained fairly stable, while for the comparison group rates decreased. Primary care visits for the innovation group remained below the baseline trend line, and above that line for the comparison group. The next section describes the regression analysis we conducted to assess the impact of the innovation on primary care visits.

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Table 13. Primary Care Visits per 1,000 Medicare Participants: AACI

Awardee Number: 1C1CMS331035
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																			
Primary care rate	225	229	220	231	217	290	257	229	228	254	243	215	202	237	158	143	164	162	269
Std dev	636	629	647	634	680	1085	828	747	807	802	996	682	653	795	553	527	597	631	1038
Unique patients	497	511	522	542	557	572	587	603	603	571	531	477	414	344	278	189	169	107	39
Comparison Group																			
Primary care rate	891	937	931	898	955	1,001	1,026	1,068	1,091	949	922	895	731	631	583	579	532	513	625
Std dev	1,323	1,456	1,350	1,364	1,466	1,455	1,469	1,541	1,481	1,425	1,441	1,694	1,335	1,309	1,281	1,375	1,305	1,229	1,632
Weighted patients	514	522	533	544	560	583	599	603	603	574	534	469	394	326	270	179	158	106	37
Innovation − Comparison Rate																			
	−665	−708	−711	−667	−739	−711	−769	−839	−863	−695	−680	−680	−529	−394	−425	−436	−368	−351	−356

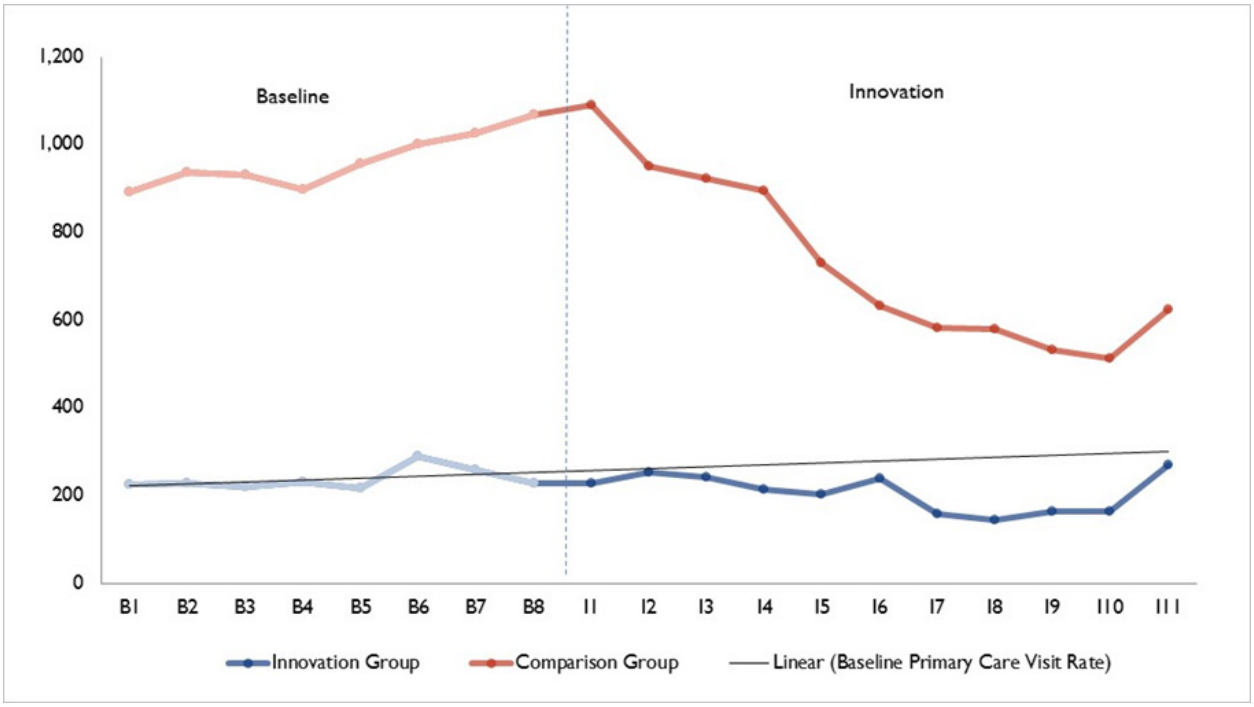
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

Figure 7. Primary Care Visits per 1,000 Medicare Participants: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.8.2 Regression Results

As shown in ***Table 14*** the average quarterly difference-in-differences estimate for primary care visits is an increase of 16 primary care visits per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −7, 39). The overall aggregate estimates show that, throughout the innovation period, the innovation group has 60 more primary care visits relative to the comparison group; this result is not statistically significant (90% CI: −8, 147).

In addition to average and aggregate effects over the innovation period, we also present quarterly effects derived from a model with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. Except in innovation quarters I1, I4, and I8, the number of primary care visits increases for the innovation group relative to the comparison group. The results are statistically significant for I1 and I6 where the innovation group, on average, has 50 fewer and 118 more primary care visits per 1,000 participants, respectively.

Table 14. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicare Participants: AACI

Quarter	Coefficient	Standard Error	P-Values
I1	−50	28	0.081
I2	24	34	0.485
I3	12	40	0.770
I4	−24	39	0.551
I5	21	42	0.626
I6	118	55	0.033
I7	27	46	0.555
I8	−15	58	0.800
I9	35	64	0.590
I10	85	96	0.376
I11	313	284	0.277
Overall average	16	14	0.257
Overall aggregate	60	53	0.257
Overall aggregate (IY1)	−21	39	0.582
Overall aggregate (IY2)	54	31	0.081
Overall aggregate (IY3)	27	19	0.145

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; AACI = Asian Americans for Community Involvement.

2.9 Discussion: Medicare Results

Overall we did not observe any impact of the innovation on spending among individuals enrolled in the innovation. A significant increase occurs in the number of inpatient stays for individuals enrolled in the innovation, which as for all other results, might be due to unobservable factors not controlled for in the regression analyses. We do not observe any statistically significant differences in unplanned readmissions, primary care visits or ED visits for the period of the innovation.

The Medicare results partially support the innovation's theory of change, because AACI's PNC innovation entailed increasing AACI patient access to primary and behavioral health care. PN services, such as appointment scheduling assistance and reminders and transportation assistance, should have

increased patients' use of primary care—and we observe increased use of primary care among intervention group members relative to the comparison group in Years 2 and 3. However, differences in primary care use between the intervention and control groups may be driven by the reduction in primary care among comparison group beneficiaries, not an increase in primary care use among innovation participants (see ***Figure 7***). As we described in the third annual report,[1] assistance with filling out forms was the only PN service accessed by at least 25 percent of innovation patients, and the average participant accessed an average of only 1.9 services of any type. These services may not have been sufficient to change innovation participants' primary care utilization. Based on the type and dose of services that patients typically received, it is also unlikely that the innovation affected spending, ED visits, admissions, or readmissions.

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 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.

2.10 Medicaid Comparison Group

We include patients who were enrolled prior to July 31, 2015, and we present Medicaid claims data through September 30, 2015. This data has not been previously reported. The Medicaid claims analysis focuses on 615 Medicaid beneficiaries enrolled in fee-for-service 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 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 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, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Fifteen of the 617 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 and race. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three comparison group beneficiaries with the closest propensity score.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 15 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 15. Mean Values and Standardized Differences of Variables in Propensity Score Model: AACI (Medicaid)

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	73.54	10.05	53.01	27.75	0.98	73.54	10.04	74.04	11.35	0.05
Percentage female	61.30	48.75	59.30	49.13	0.04	61.30	48.71	59.77	49.04	0.03
Percentage Asian Pacific	68.44	46.51	23.27	42.26	1.02	68.44	46.48	68.27	46.54	0.00
Percentage nondisabled	89.53	30.64	78.57	41.03	0.30	89.53	30.61	90.92	28.73	0.05
Percentage dual eligibility	99.50	7.05	62.55	48.40	1.07	99.50	7.04	99.22	8.77	0.03
Payments in calendar quarter prior to enrollment	973	2,176	1,449	5,923	0.11	973	2,174	891	3,332	0.03
Total payments in year prior to enrollment	3,141	7,066	5,457	18,417	0.17	3,141	7,060	2,809	6,540	0.05
Number of beneficiaries	602	—	70,034	—	—	602	—	1760	—	—
Number of unique beneficiaries[1]	—	—	14,768	—	—	602	—	1429	—	—
Number of weighted beneficiaries	—	—	—	—	—	602	—	602	—	—
No Medicaid in Previous Quarter										
Age	69.47	10.17	63.54	11.39	0.55	67.38	8.31	67.67	10.09	0.03
Percentage Asian Pacific	53.33	51.64	31.18	46.35	0.46	46.15	49.85	43.59	49.59	0.05
Number of beneficiaries	15	—	943	—	—	13	—	39	—	—
Number of unique beneficiaries[1]	—	—	818	—	—	13	—	33	—	—
Number of weighted beneficiaries	—	—	—	—	—	13	—	13	—	—

[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).

Notes:

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

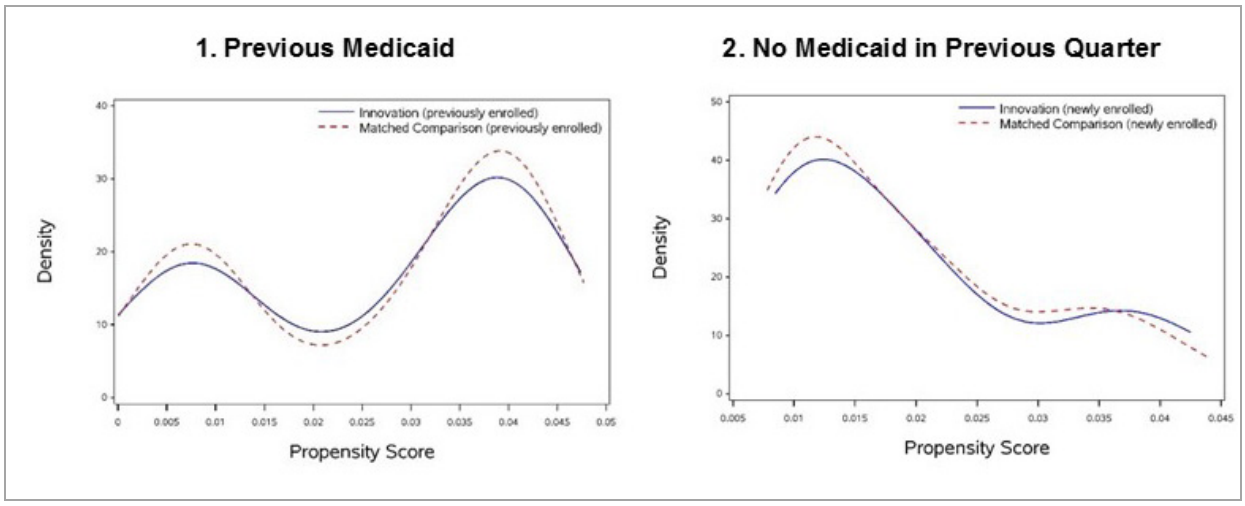
Terms and Definitions

- SD = standard deviation; AACI = Asian Americans for Community Involvement.
- — 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 15). The results in Table 15 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables.

Figure 8 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 8. Distribution of Propensity Scores for Comparison and Innovation Groups: AACI (Medicaid)



Notes:

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

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 16 reports Medicaid spending per patient in the 8 quarters before and the 8 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 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 baseline quarters.

As shown by the baseline period trend line for the innovation group, trends in spending trend upward before enrollment. The time series for both the innovation and comparison groups decreases after innovation quarter I6, and high standard deviations are evident for all periods. The innovation group spending rate is above the comparison group rate for all innovation quarters except for I2. The higher spending for the innovation group might be related to AACI's patient navigation innovation focus on linking patients to more services. 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 16. Medicaid Spending per Participant: AACI

Awardee Number: 1C1CMS331035
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	$757	$772	$772	$792	$827	$831	$897	$973	$1,002	$998	$1,016	$962	$1,178	$1,078	$1,032	$816
Std dev	$1,825	$1,834	$1,885	$1,813	$1,915	$1,827	$1,988	$2,176	$2,020	$2,198	$2,181	$2,103	$2,427	$2,298	$1,893	$1,531
Unique patients	522	530	534	546	555	570	586	602	615	545	471	384	273	195	96	33
Comparison Group																
Spending rate	$610	$604	$639	$632	$676	$683	$725	$891	$996	$1,013	$993	$921	$907	$999	$979	$811
Std dev	$1,018	$955	$1,077	$1,045	$1,072	$1,053	$1,099	$2,164	$2,650	$2,170	$2,089	$1,605	$1,224	$1,437	$1,426	$1,169
Weighted patients	559	562	563	573	577	577	584	602	615	560	478	396	276	195	99	31
Savings per Patient																
	−$147	−$168	−$132	−$160	−$151	−$149	−$172	−$82	−$6	$15	−$23	−$41	−$271	−$79	−$53	−$4

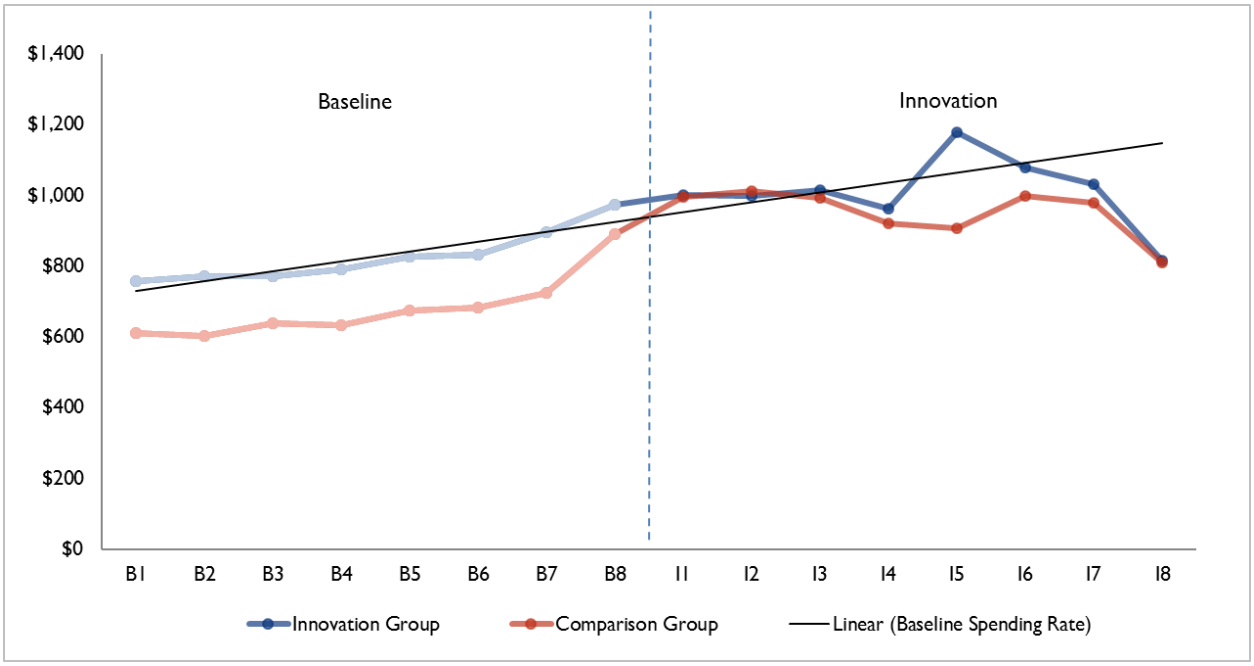
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1. AACI = Asian Americans for Community Involvement.

Figure 9. Medicaid Spending per Participant: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to July 2015.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.11.2 Regression Results

In ***Table 17,*** 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 −$93 (90% CI: −$214, $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 and aggregate effects over the innovation period, we also present quarterly effects derived from 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*** shows that the trend in the estimated quarterly spending differences suggests the innovation might lead to savings. Except for innovation quarters I5 and I7, the change in spending among the innovation group is lower than the change in spending for comparison group individuals. However, no difference is statistically significant.

Table 17. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant

Quarter	Coefficient	Standard Error	P-Values
I1	−$140	$103	0.175
I2	−$163	$108	0.129
I3	−$119	$111	0.282
I4	−$109	$111	0.327
I5	$122	$124	0.326
I6	−$7	$156	0.964
I7	$23	$220	0.917
I8	−$154	$299	0.607
Overall average	−$93	$73	0.204
Overall aggregate	−$243,788	$191,972	0.204
Overall aggregate (IY1)	−$272,829	$153,110	0.075
Overall aggregate (IY2)	$29,041	$75,347	0.700

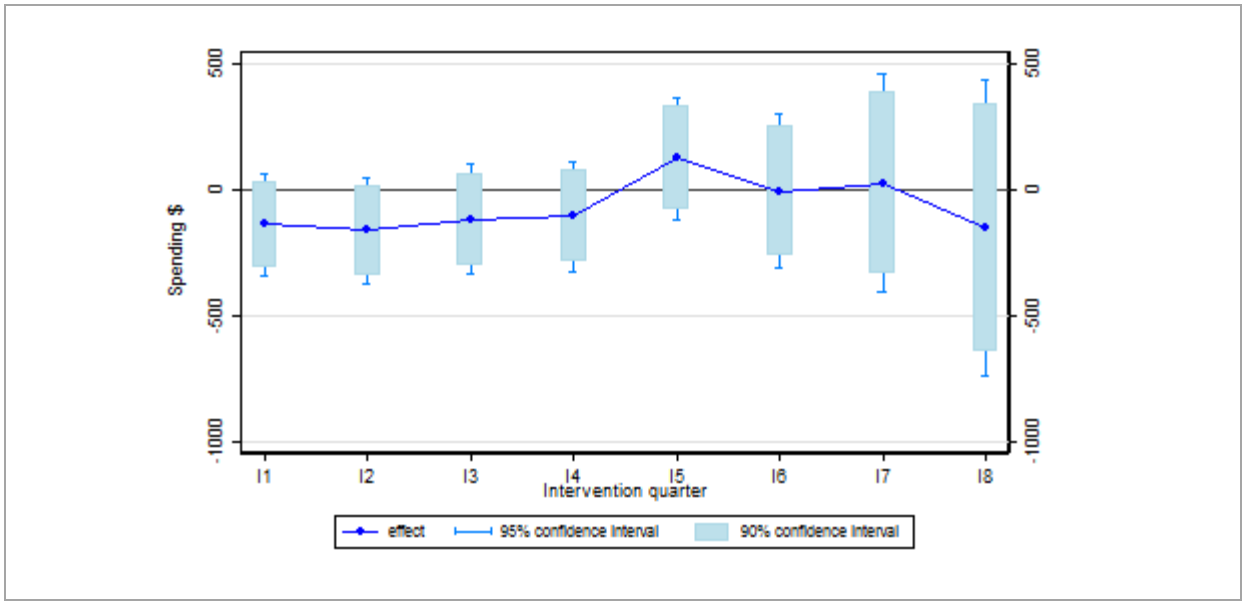
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- **The regression coefficients** are quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for age, gender, race, and 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 as compared to their matched comparison group
- I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; AACI = Asian Americans for Community Involvement.

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



Notes:

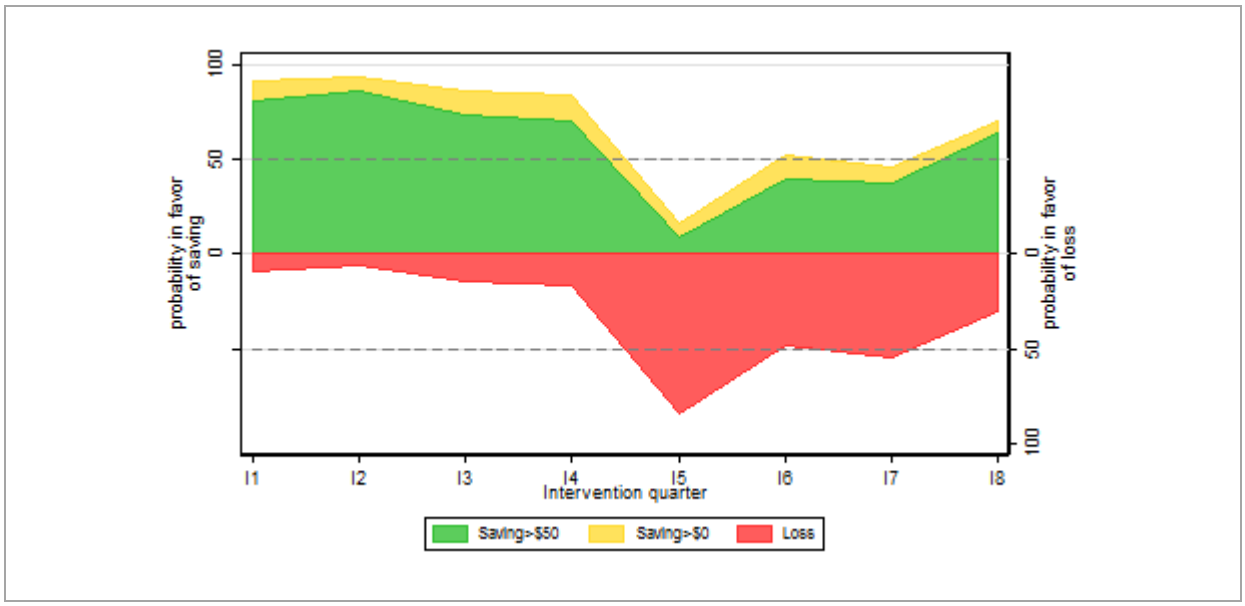
- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

OLS = ordinary least squares; AACI = Asian Americans for Community Involvement.

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 for saving or losing money on this initiative. Figure 12 illustrates that, except for innovation quarters I5 and I7, the innovation has a higher probability of generating savings rather than losses and a 55 percent overall probability of generating savings.

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



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 18*** and ***Figure 12***. Inpatient admissions for the comparison and innovation groups vary considerably and fluctuate around the baseline trend line for all innovation quarters. As Table 18 shows, 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 18. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: AACI

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

	Baseline Quarters								Innovation Quarters							
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**
Innovation Group																
Admit rate	4	2	2	5	5	5	5	7	10	4	11	5	0	10	0	0
Std dev	62	43	43	74	73	72	71	100	114	61	122	72	0	101	0	0
Unique patients	522	530	534	546	555	570	586	602	615	545	471	384	273	195	96	33
Comparison Group																
Admit rate	3	4	6	6	5	3	6	10	12	8	9	3	1	7	3	0
Std dev	35	39	51	51	47	41	56	64	79	71	62	33	23	53	37	0
Weighted patients	559	562	563	573	577	577	584	602	615	560	478	396	276	195	99	31
Innovation − Comparison Rate																
	1	−2	−4	−1	0	2	−1	−3	−2	−5	2	3	−1	3	−3	0

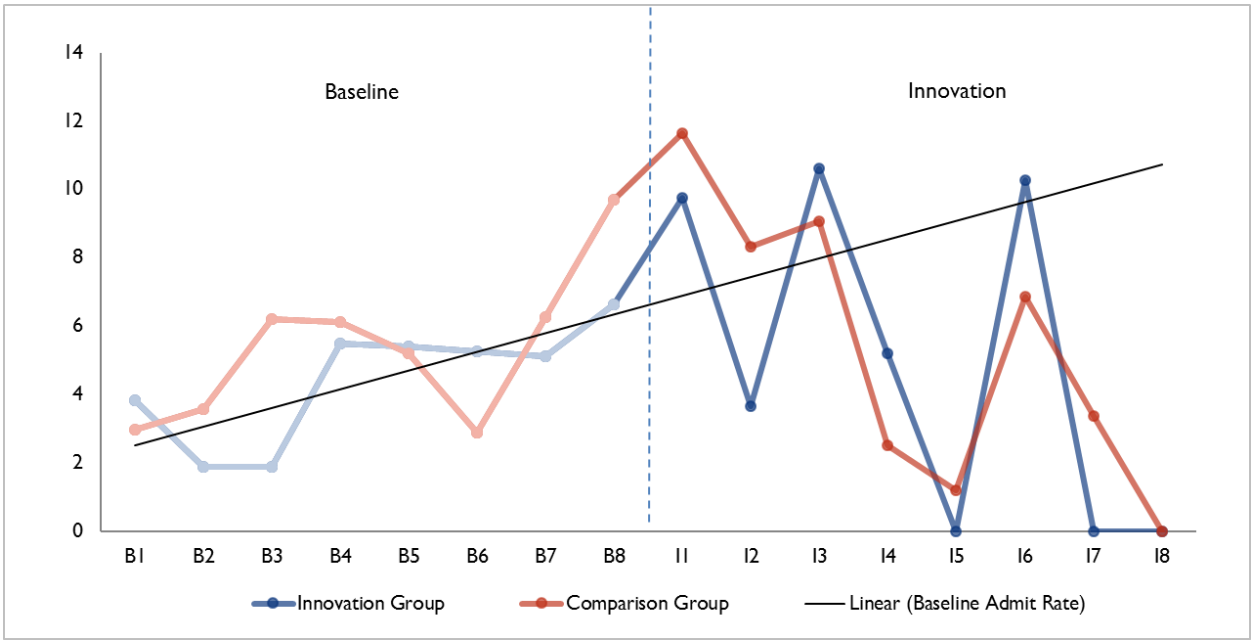
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- **Admit rate: (**Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions
- B1 = Baseline Q1; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

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



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.12.2 Regression Results

Table 19 presents the results of a model with the dependent variable set to the number of hospital visits for each individual. Because inpatient visits are relatively infrequent in the data, we could not estimate separate quarterly fixed effects for the innovation effects; instead we estimated a single, constant innovation effect for all innovation quarters. The average difference-in-differences estimate for inpatient admissions is an increase of 0.6 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. The effect is not statistically significant (90% CI: −4, 5).

Table 19. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: AACI

	Coefficient	Standard Error	P-Values
Overall average	0.567	2.598	0.827
Overall aggregate	1.482	6.787	0.827

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- **The overall average** is the weighted average treatment effect for all quarters during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- **The negative binomial count model regression coefficients** are the difference-in-differences estimates. The regression controls for age, gender, race, and disability. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups that have the same impact on the innovation and comparison groups.
- AACI = Asian Americans for Community Involvement.

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 20*** and ***Figure 13***. Readmissions rates are zero for most innovation quarters, reflecting the extremely 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. The low number of readmissions (only two readmissions occurred during the innovation period, both in the innovation group) precluded the assessment of the impact of the innovation on readmissions through regression analysis.

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

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

	Baseline Quarters								Innovation Quarters							
Description	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	333	250	0	333	0	0	0	0	0
Std dev	0	0	0	0	0	0	0	471	433	0	471	0	0	0	0	0
Total admissions	2	1	1	2	3	3	1	3	4	2	3	2	0	1	0	0
Comparison Group																
Readmit rate	0	0	0	0	0	200	125	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	0	0	400	331	0	0	0	0	0	0	0	0	0
Total admissions	1	2	4	3	3	2	3	5	6	2	4	0	0	1	0	0
Innovation − Comparison Rate																
	0	0	0	0	0	−200	−125	333	250	0	333	0	0	0	0	0

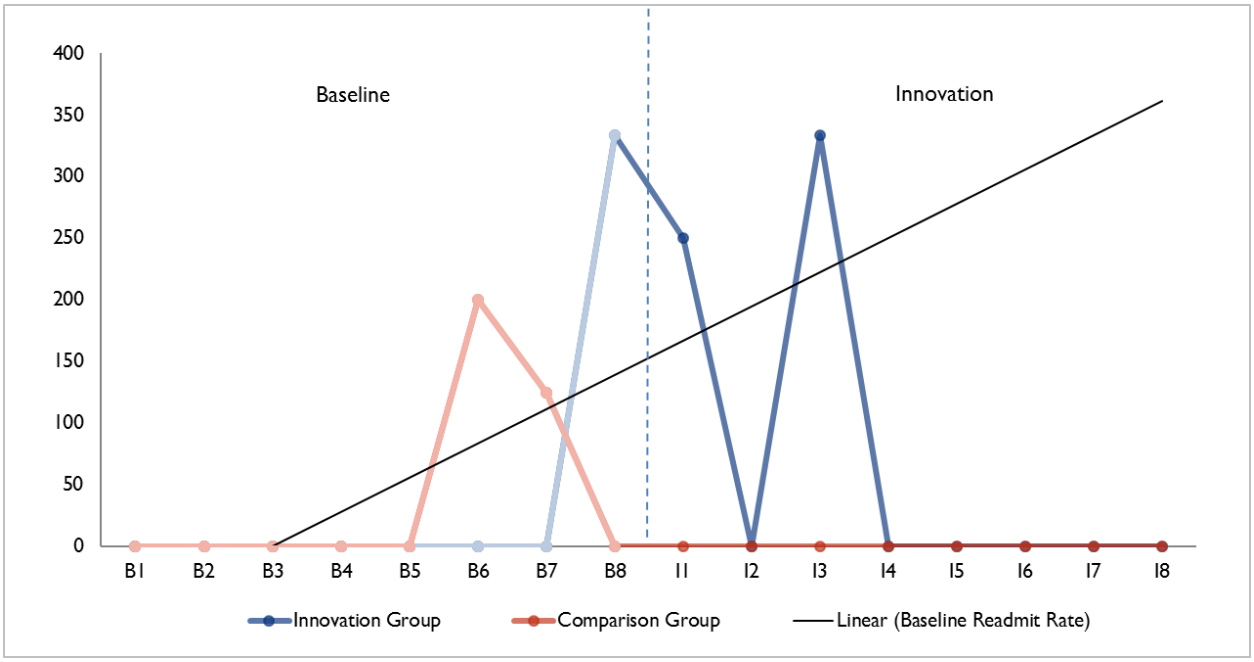
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions
- B1 = Baseline Q1; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement

Figure 13. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: AACI



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- AACI = Asian Americans for Community Involvement.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 21*** and ***Figure 14.*** Innovation group ED visits trend downward during the baseline period. The number of ED visits is very low for both groups and all quarters. 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 21. ED Visits per 1,000 Medicaid Participants: AACI

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

	Baseline Quarters								Innovation Quarters							
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**
Innovation Group																
ED rate	6	0	0	4	4	4	3	0	7	2	8	5	0	0	0	0
Std dev	98	0	0	60	60	59	83	0	99	43	113	72	0	0	0	0
Unique patients	522	530	534	546	555	570	586	602	615	545	471	384	273	195	96	33
Comparison Group																
ED rate	4	2	3	1	2	1	2	4	11	8	1	0	0	9	3	0
Std dev	67	27	37	22	27	16	35	44	106	99	24	0	0	89	37	0
Weighted patients	559	562	563	573	577	577	584	602	615	560	478	396	276	195	99	31
Innovation − Comparison Rate																
	2	−2	−3	3	2	3	2	−4	−4	−6	7	5	0	−9	−3	0

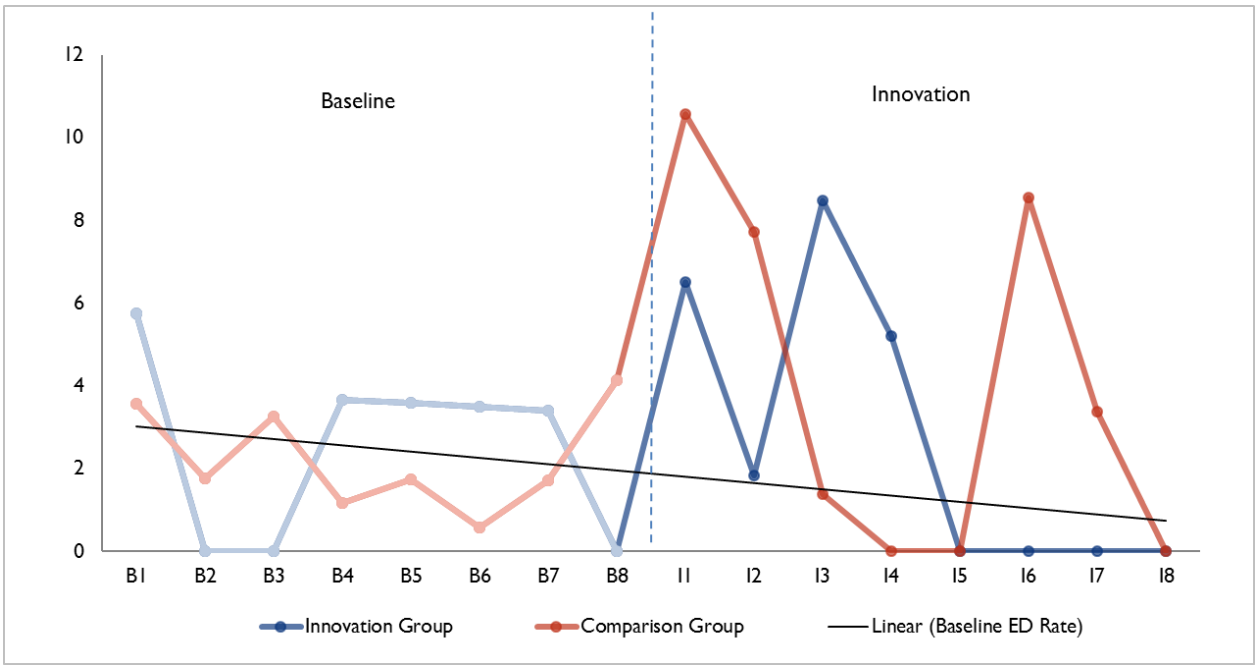
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; AACI = Asian Americans for Community Involvement.

Figure 14. ED Visits per 1,000 Medicaid Participants: AACI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015.

Terms and Definitions

- ED = emergency department; AACI = Asian Americans for Community Involvement.

2.14.2 Regression Results

Table 22 presents the results of a model with the dependent variable set to the number of ED visits for each individual. Because ED visits are relatively infrequent in the data, we could not estimate separate quarterly fixed effects for the innovation effects; instead we estimated a single, constant innovation effect for all innovation quarters. The average difference-in-differences estimate for ED visits is a decrease of 0.9 ED 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. The effect is not statistically significant (90% CI: −7, 5).

Table 22. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: AACI

	Coefficient	Standard Error	P-Values
Overall average	−0.904	3.754	0.810
Overall aggregate	−2.361	9.806	0.810

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** October 2011 to September 2015

Terms and Definitions

- **The negative binomial count model regression coefficients** are the difference-in-differences estimates. The regression controls for age, gender, race, and disability. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups 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.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; AACI = Asian Americans for Community Involvement.

2.15 Discussion: Medicaid Results

The overall impact of the innovation on spending among individuals enrolled in the innovation is not statistically significant for the full period of the innovation. Statistically significant savings occur only in the innovation's first year. We do not observe any statistically significant differences in the number of hospital admissions and ED visits.

The Medicaid results are mostly inconsistent with the innovation's theory of change, because AACI's PNC innovation entailed providing PN services to AACI patients to increase access to primary and behavioral health care. PN services such as appointment scheduling assistance and reminders and transportation assistance should have increased patients' use of primary care, but as we previously explained, few innovation participants received these services, and the average number of services that patients accessed was low. Based on the type and dose of services that patients typically received, it is unlikely that the innovation affected spending, ED visits, admissions, or readmissions.

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, Medicaid beneficiaries in Santa Clara County are enrolled in managed care, and the claims analysis is constrained to fee-for-service data available in the CMS Alpha-MAX files. This explains the low spending values and extremely low number of hospital admissions and ED visits.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: BAHC

Data Source	Period Covered
Medicare claims data	September 2012–June 2016
Terms and Definitions • BAHC = Ben Archer Health Care.	

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. Below, we present BAHC's HCIA goals along with the associated findings:

1. **Smarter spending.**

   Goal: Reduce total spending in northern Doña Ana County by 10 percent.

   Findings: The BAHC innovation increased patient spending during the first year of the innovation, but did not have a significant effect on spending for the first 3 years after the innovation. The overall probability of increased cost was 88 percent.

2. **Better care.**

   Goal: 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.

   Findings: Inpatient stays and primary care increased, while ED visits decreased among innovation participants. The innovation did not generate a detectable change in readmissions.

3. **Healthier people.**

   Goal: Improve health for the population of northern Doña Ana County by increasing HbA1c, low-density lipoprotein cholesterol (LDL-C), and hypertension control.

   Findings: None to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected 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 has no impact on unplanned readmissions. ED visits are significantly lower in the innovation group overall and in Years 2 and 3 of the innovation.

Table 2. Summary of Medicare Claims-Based Findings: BAHC

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$0.848	−$0.346, $2.043	−$0.082, $1.779	$0.428	$0.010, $0.846	−$0.096	−$0.630, $0.437	$0.517	−$0.201, $1.235
Acute care inpatient stays	82	52, 113	59,106	48	28, 67	11	−6, 28	23	8, 39
Hospital-wide all-cause unplanned readmissions	−1	−14, 12	−11, 9	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−49	−79, −19	−71, −25	−6	−25, 14	−27	−45, −9	−16	−30, −1
Average impact per quarter									
Spending per participant	$514	−$210, $1,239	−$59, $1,079	$622	$14, $1,231	−$172	−$1,122, $778	$1,293	−$502, $3,088
Acute care inpatient stays (per 1,000 participants)	50	32, 68	36, 64	70	41, 98	20	−10, 50	59	19, 98
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−6	−116, 103	−91, 79	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−29	−48, −11	−44, −15	−8	−36, 20	−49	−81, −49	−39	−75, −4

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** October 2010 to June 2016.
- **Sample size**: 180 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; BAHC = Ben Archer Health Center.

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 3 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 3. Claims-Based Outcome Measures: BAHC

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

Notes:

- We do not report Medicaid results in this report because no new Medicaid data are available for BAHC, which serves the state of New Mexico, during the reporting period. We refer readers to the third annual report for the evaluation of this innovation's impact on Medicaid beneficiaries.[1]

Terms and Definitions

- ED = emergency department; BAHC = Ben Archer Health Center.

2.3 Medicare Comparison Group

We include patients in the claims analysis who were enrolled in the innovation prior to the end of the intervention, and we present Medicare claims data through June 30, 2016. This analysis includes two additional quarters (Jan-June 2016) of Medicare claims data since the third annual report. The Medicare claims analysis focuses on 180 BAHC Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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). See the third annual report for additional details.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 4 reports Medicare spending per patient in the 8 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 1*** illustrates Medicare spending per beneficiary. 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; these trends are similar to the third annual report. 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 wide variability of spending data and the small sample size, spending has a high standard deviation, the data points tend to be spread over a wide range of values rather than at the mean. In the next section, we present a regression analysis that tests for differences in spending between the innovation and comparison groups.

Table 4. Medicare Spending per Participant: BAHC

Awardee Number: 1C1CMS331013
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	$1,190	$1,175	$1,165	$1,421	$1,160	$1,600	$1,494	$2,506	$2,275	$2,724	$3,362	$3,209	$2,110	$2,263	$2,918	$3,326	$3,257	$3,675	$3,670	$5,645
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	$6,240	$14,700	$8,535	$8,564	$14,362	$9,029	$18,500
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	138	132	122	109	90	79
Comparison Group																				
Spending rate	$1,487	$1,608	$1,232	$1,074	$1,321	$985	$1,517	$2,419	$1,527	$2,060	$1,697	$2,513	$2,637	$2,809	$2,363	$1,898	$1,848	$1,687	$2,386	$2,796
Std dev	$4,934	$5,486	$3,694	$3,195	$3,834	$2,882	$4,628	$8,367	$4,693	$6,976	$5,687	$9,572	$7,794	$9,540	$7,427	$6,128	$5,291	$4,380	$6,771	$7,949
Weighted patients	161	163	166	169	174	177	179	180	180	179	174	169	161	155	149	145	138	124	105	94
Savings per Patient																				
	$297	$433	$67	−$347	$162	−$615	$22	−$86	−$748	−$663	−$1,665	−$697	$527	$547	−$555	−$1,429	−$1,408	−$1,988	−$1,284	−$2,850

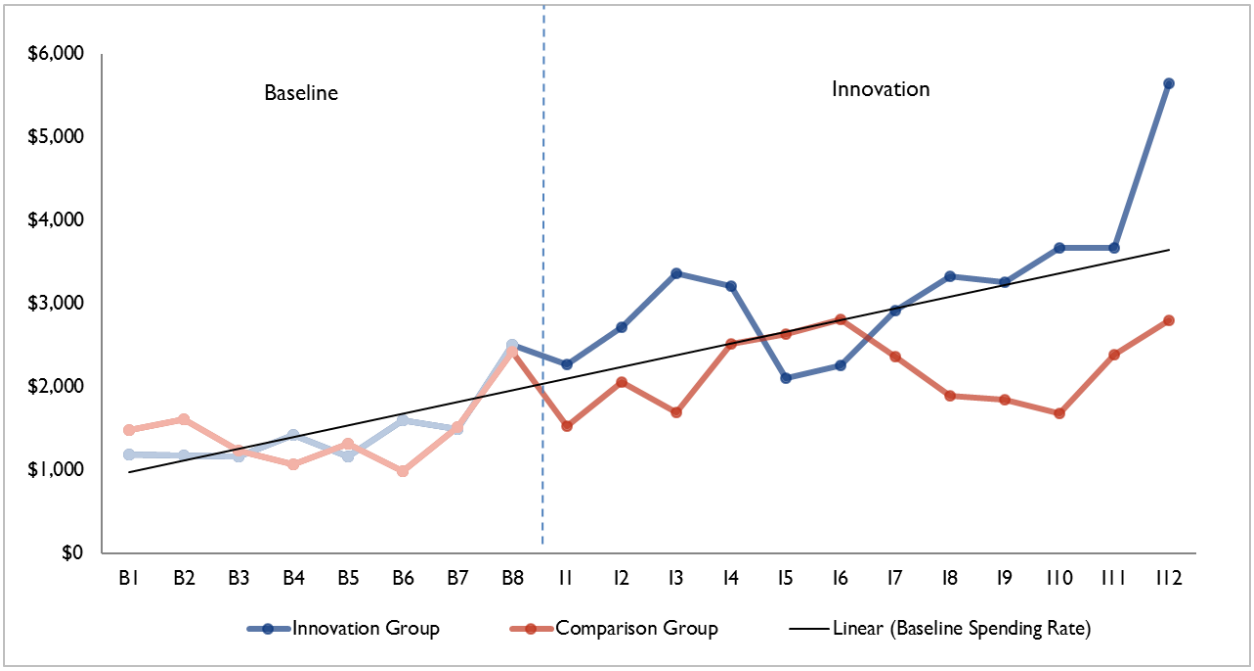
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; BAHC = Ben Archer Health Center.

Figure 1. Medicare Spending per Participant: BAHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- BAHC = Ben Archer Health Center

2.4.2 Regression Results

In ***Table 5, 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 $514 (90% CI: −$210, $1,239). This effect is not statistically significant. This is similar to the finding in the third annual report. 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 quarterly effects derived from 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. All quarterly estimates are positive, indicating higher spending among the innovation group. However, none of the quarterly estimates are statistically significant. In Year 1, spending was statistically higher among the innovation group. Year 2 and 3 results are not statistically significant.

Table 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	$481	$398	0.228
I2	$385	$479	0.421
I3	$1,340	$1,013	0.186
I4	$300	$686	0.662
I5	−$833	$567	0.142
I6	−$901	$638	0.158
I7	$172	$1,262	0.892
I8	$1,005	$769	0.192
I9	$842	$779	0.280
I10	$1,579	$1,382	0.254
I11	$729	$965	0.450
I12	$2,238	$2,066	0.279
Overall average	$514	$440	0.243
Overall aggregate	$848,265	$725,231	0.243
Overall aggregate (IY1)	$427,521	$253,792	0.093
Overall aggregate (IY2)	−$96,486	$324,129	0.766
Overall aggregate (IY3)	$517,230	$435,850	0.236

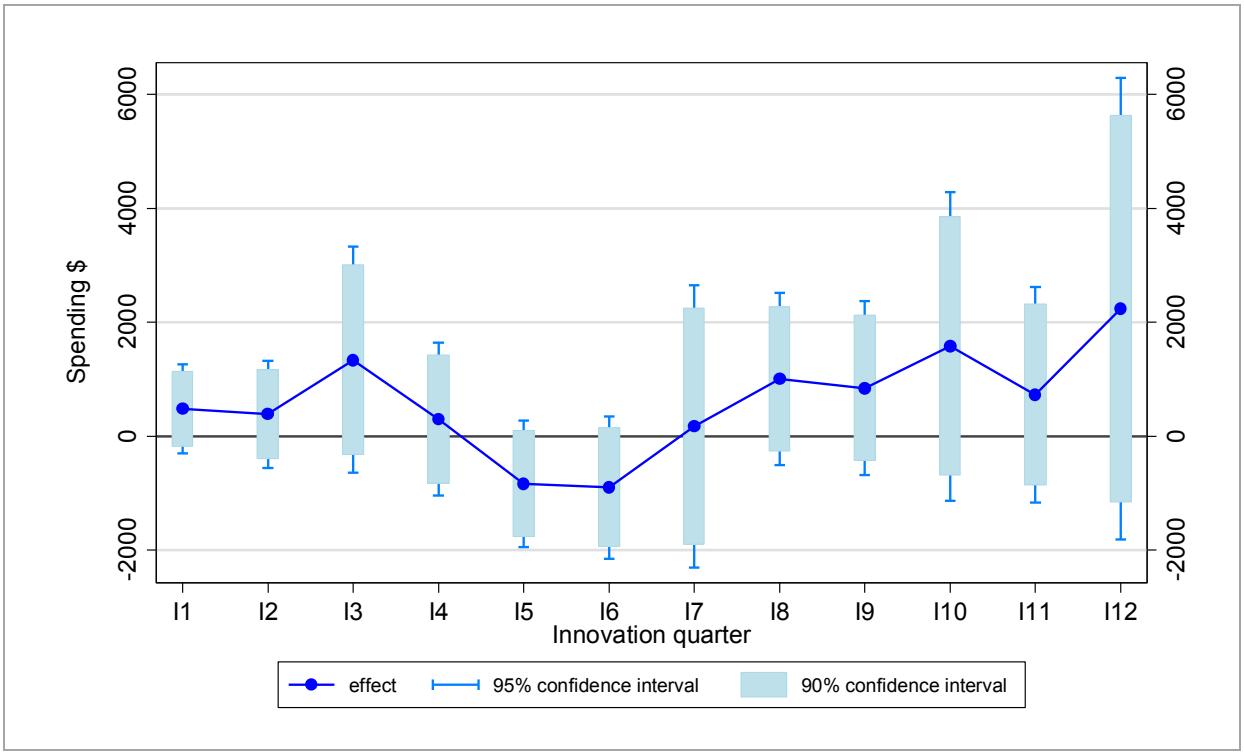
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; BAHC = Ben Archer Health Center

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: BAHC



Notes:

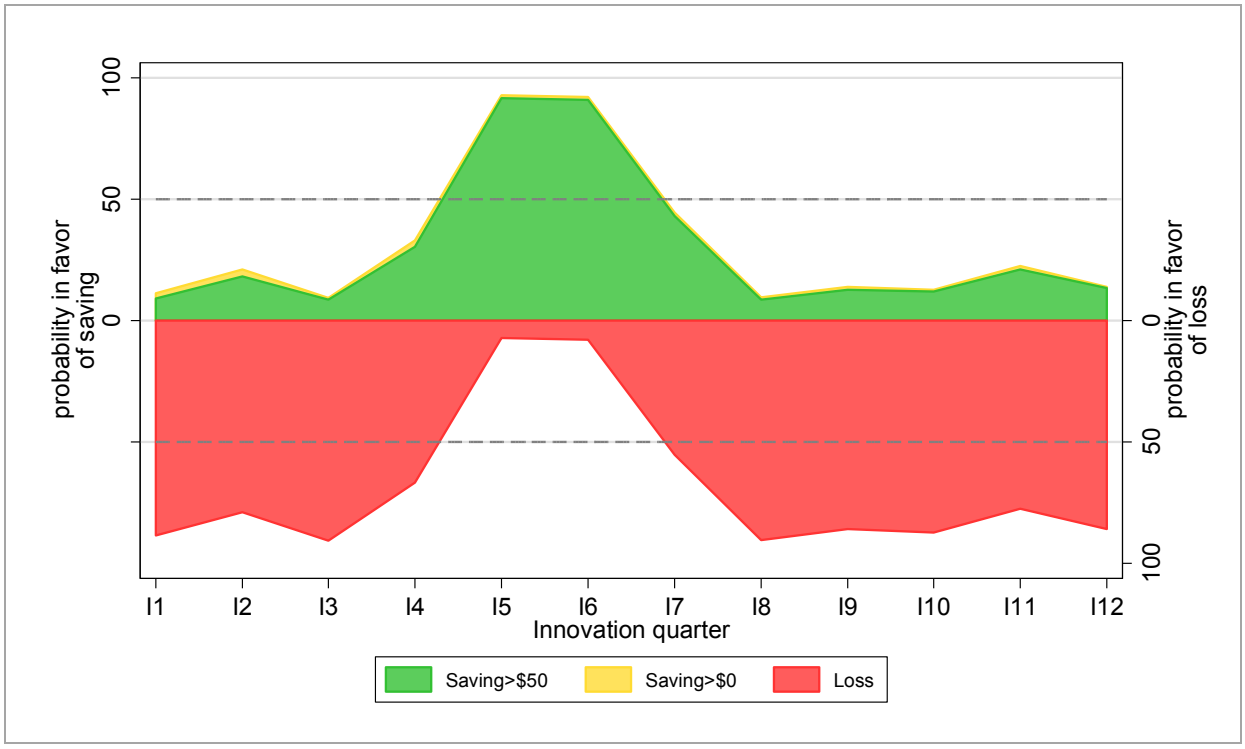
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** October 2010 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; BAHC = Ben Archer Health Center.

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 for saving or losing money on this initiative. Spending regression estimates are generally higher for the innovation group, and Figure 3 supports the finding that the innovation generated a loss during most quarters. Overall, the probability that the innovation generated a loss is 88 percent.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: BAHC



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- 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 6*** and ***Figure 4***. During the baseline period, the innovation and comparison groups have similar inpatient admissions rates. During the innovation period, the innovation group's rate bounces around the baseline trend, but rises above the comparison group's rate. This trend is similar to the trend observed in the third annual report. Inpatient admissions are relatively infrequent and the sample size is small; therefore, this measure has a high standard deviation, the data points tend to be spread over a wide range of values rather than at the mean.

Table 6. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: BAHC

Awardee Number: 1C1CMS331013
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																				
Admit rate	49	27	33	39	50	61	47	83	83	112	108	142	80	85	80	121	98	110	111	152
Std dev	245	163	180	224	218	465	237	420	331	380	477	414	337	346	362	409	349	436	348	480
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	138	132	122	109	90	79
Comparison Group																				
Admit rate	42	64	43	34	45	32	62	96	30	58	49	74	92	71	72	39	56	41	74	90
Std dev	219	282	229	220	232	223	290	388	180	284	239	372	352	349	368	216	259	234	316	408
Weighted patients	161	163	166	169	174	177	179	180	180	179	174	169	161	155	149	145	138	124	105	94
Innovation − Comparison Rate																				
	7	−37	−9	5	5	29	−15	−12	53	54	59	68	−12	13	8	82	42	70	37	62

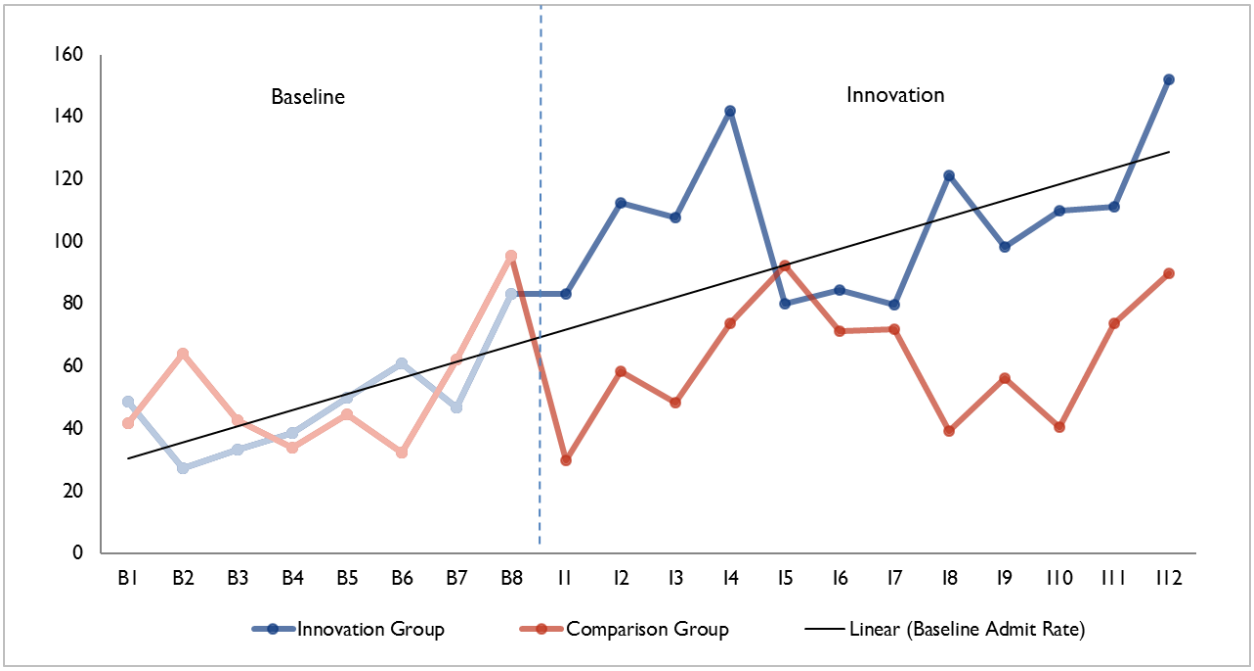
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; BAHC = Ben Archer Health Center.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: BAHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- BAHC = Ben Archer Health Center.

2.5.2 Regression Results

As shown in ***Table 7*** the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 50 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: 32, 68). This finding is consistent with the finding in the third annual report.

We also present quarterly effects 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 inpatient admissions rate is statistically higher in the innovation group in I1, I2, I3, I4, I5, I8, and I10. These results support the conclusion that inpatient admissions rose for innovation participants relative to the comparison group.

Table 7. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	61	28	0.028
I2	67	31	0.032
I3	69	40	0.084
I4	83	40	0.039
I5	−9	40	0.816
I6	14	33	0.671
I7	4	38	0.911
I8	76	32	0.019
I9	43	42	0.303
I10	80	44	0.068
I11	38	48	0.439
I12	77	63	0.224
Overall average	50	11	0.000
Overall aggregate	82	18	0.000
Overall aggregate (IY1)	48	12	0.000
Overall aggregate (IY2)	11	10	0.271
Overall aggregate (IY3)	23	10	0.015

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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; BAHC = Ben Archer Health Center

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 8*** and ***Figure 5.*** Because of 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. The same level of variability occurs in the third annual report. In the next section, we discuss a regression analysis that tests for differences between the innovation and comparison groups' unplanned readmissions.

Table 8. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: BAHC

Awardee Number: 1C1CMS331013
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																				
Readmit rate	200	0	0	0	0	0	0	375	100	77	455	63	0	0	0	77	0	333	111	125
Std dev	400	0	0	0	0	0	0	484	300	267	498	242	0	0	0	267	0	471	314	331
Total admissions	5	1	5	4	7	4	7	8	10	13	11	16	5	8	8	13	10	9	9	8
Comparison Group																				
Readmit rate	0	0	71	67	0	77	40	86	83	83	0	0	0	95	150	77	0	143	63	125
Std dev	0	0	258	249	0	267	196	280	276	276	0	0	0	294	357	267	0	350	242	331
Total admissions	6	8	5	5	6	4	8	12	4	8	6	7	12	7	7	4	6	5	5	5
Innovation − Comparison Rate																				
	200	0	−71	−67	0	−77	−40	289	17	−6	455	63	0	−95	−150	0	0	190	49	0

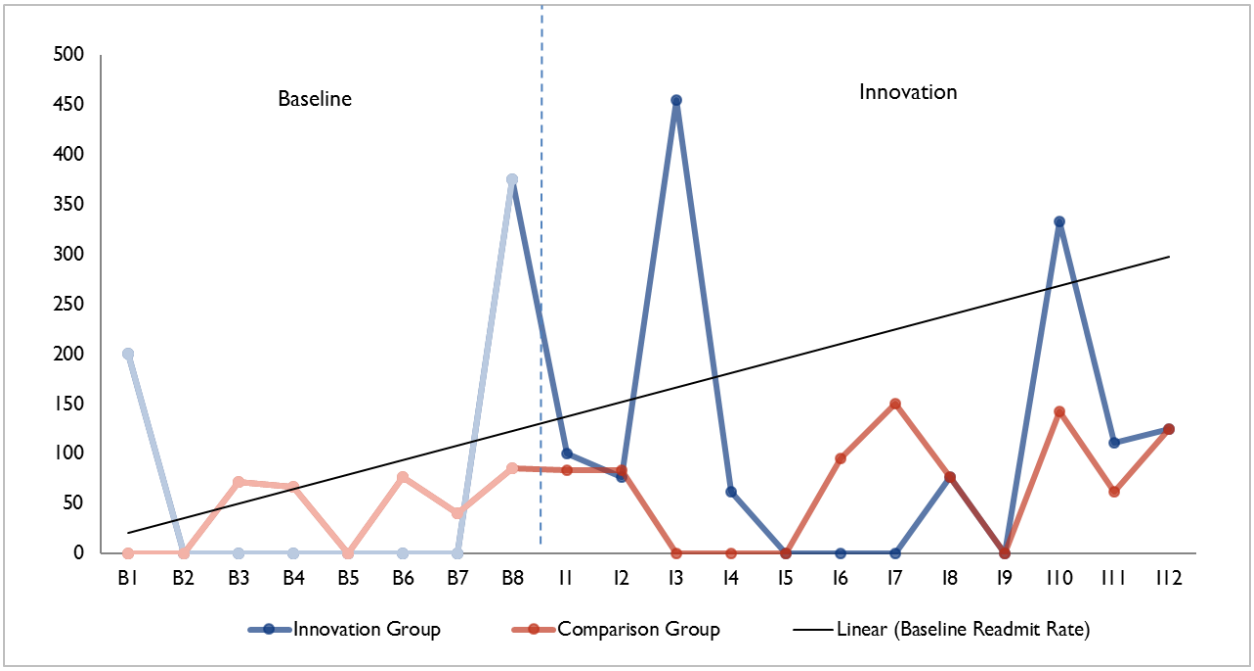
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; BAHC = Ben Archer Health Center.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: BAHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 and June 2016.

Terms and Definitions

- BAHC = Ben Archer Health Center.

2.6.2 Regression Results

Table 9 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, indicating that the innovation-comparison difference is lower in the innovation group 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: −116, 103). These results are consistent with the findings in the third annual report.

Table 9. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: BAHC

Quarter	Coefficient	Standard Error	P-Values
Overall average	−6	66	0.924
Overall aggregate	−1	8	0.924

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **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 10*** and ***Figure 6.*** During the baseline period, the innovation and comparison groups' ED rates overlap and have an upward trajectory. The difference in rates appears to widen during the innovation period when the comparison group's rate rises above the innovation group's rate. This finding is consistent with the findings in the third annual report.

Table 10. ED Visits per 1,000 Medicare Participants: BAHC

Awardee Number: 1C1CMS331013
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																				
ED rate	69	27	87	110	88	67	82	117	78	90	78	130	73	92	101	68	123	64	100	101
Std dev	255	163	365	450	344	353	315	399	373	341	290	488	286	335	388	253	398	281	337	304
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	138	132	122	109	90	79
Comparison Group																				
ED rate	93	110	106	59	94	81	125	122	102	123	119	136	166	157	157	141	140	115	188	157
Std dev	192	220	220	151	201	188	228	215	234	261	226	250	342	301	253	265	261	237	297	305
Weighted patients	161	163	166	169	174	177	179	180	180	179	174	169	161	155	149	145	138	124	105	94
Innovation − Comparison Rate																				
	−24	−83	−20	51	−6	−14	−43	−6	−24	−33	−41	−6	−93	−65	−55	−72	−17	−51	−88	−55

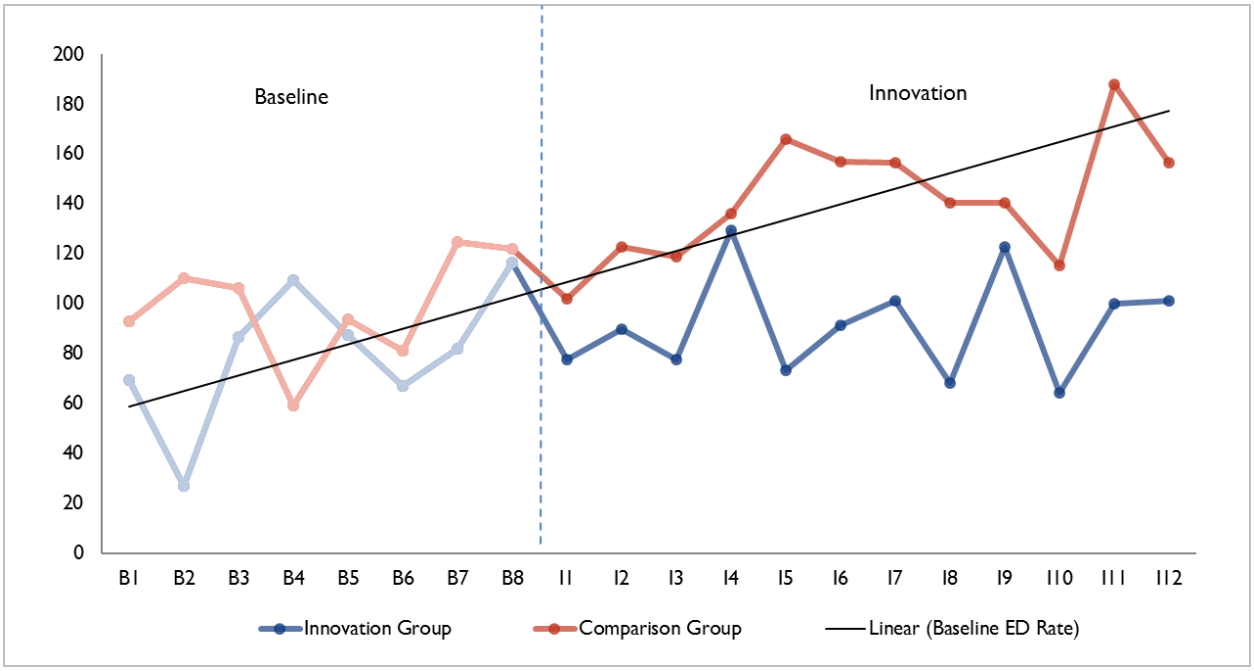
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; BAHC = Ben Archer Health Center.

Figure 6. ED Visits per 1,000 Medicare Participants: BAHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- ED = emergency department; BAHC = Ben Archer Health Center.

2.7.2 Regression Results

As shown in ***Table 11***, the average quarterly difference-in-differences estimate for ED visits is a decrease of 29 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: −48, −11). This finding is consistent with the finding in the third annual report.

In addition to the average effect over the innovation period, we also present quarterly effects 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 estimates are negative, indicating that ED visits fell in the innovation group relative to the comparison group. The decrease in ED visits is significant overall and during Years 2 and 3 of the innovation.

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	−8	32	0.800
I2	−11	31	0.722
I3	−28	29	0.341
I4	16	43	0.714
I5	−70	42	0.098
I6	−37	39	0.338
I7	−33	42	0.438
I8	−54	31	0.090
I9	−10	42	0.814
I10	−36	33	0.274
I11	−75	50	0.142
I12	−48	49	0.331
Overall average	−29	11	0.008
Overall aggregate	−49	18	0.008
Overall aggregate (IY1)	−6	12	0.638
Overall aggregate (IY2)	−27	11	0.013
Overall aggregate (IY3)	−16	9	0.071

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: October 2010 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; BAHC = Ben Archer Health Center.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 12*** and ***Figure 7.*** The primary care visit rate for the comparison group is higher than the rate for the innovation group. Low primary care visit rates among participants during baseline are consistent with BAHC's stated goal of providing increased access to preventive care through home visits to patients who have difficulties seeing a provider in the office. Difference-in-differences regressions account for the difference in levels between the groups. We present regression results from difference-in-differences regressions in the next section.

Table 12. Primary Care Visits per 1,000 Medicare Participants: BAHC

Awardee Number: 1C1CMS331013
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																				
Primary care rate	362	416	327	341	308	261	317	278	383	500	369	335	302	341	301	382	494	410	392	545
Std dev	937	916	795	855	783	755	885	775	1,146	1,470	1,222	1,048	1,012	959	1,003	1,446	1,542	1,121	1,011	1,886
Unique patients	144	147	150	155	160	164	171	180	180	178	167	162	150	142	138	132	122	109	90	79
Comparison Group																				
Primary care rate	894	754	860	864	848	882	921	935	1,037	1,069	1,038	998	1,012	901	979	1,054	915	864	938	908
Std dev	1,350	1,203	1,376	1,426	1,290	1,442	1,507	1,438	1,614	1,561	1,543	1,578	1,618	1,477	1,610	1,735	1,392	1,503	1,629	1,466
Weighted patients	161	163	166	169	174	177	179	180	180	179	174	169	161	155	149	145	138	124	105	94
Innovation − Comparison Rate																				
	−532	−338	−533	−523	−540	−621	−605	−657	−654	−569	−669	−663	−710	−560	−678	−672	−422	−454	−546	−362

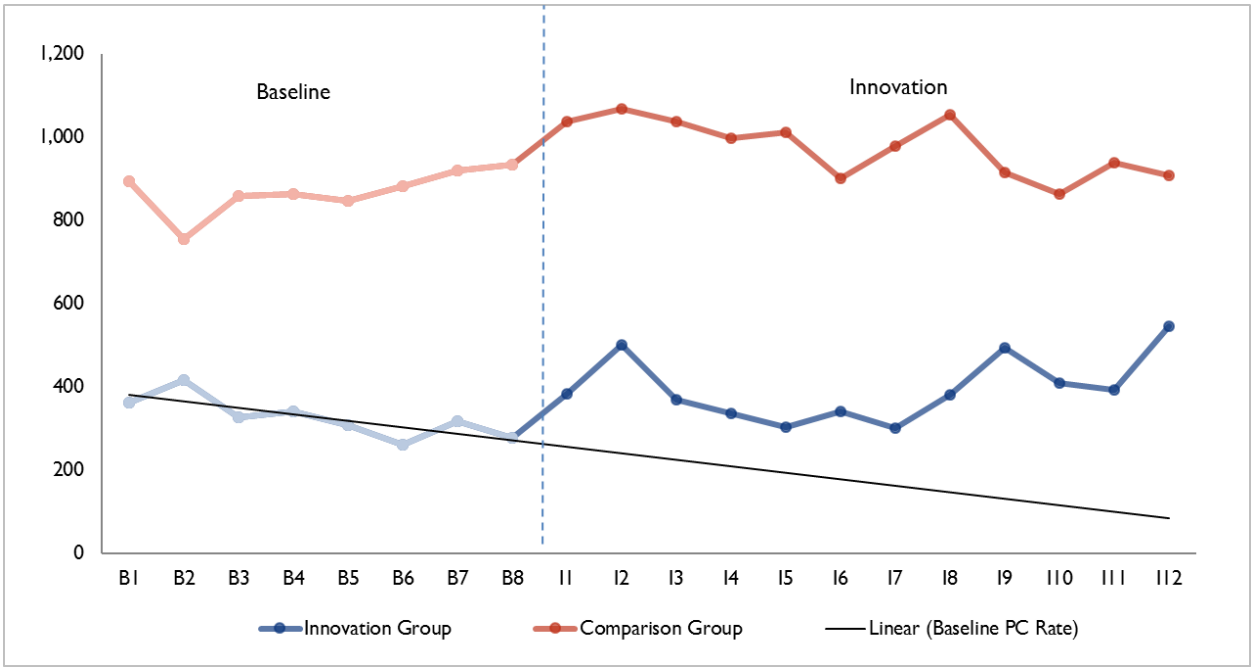
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; BAHC = Ben Archer Health Center.

Figure 7. Primary Care Visits per 1,000 Medicare Participants: BAHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- BAHC = Ben Archer Health Center.

2.8.2 Regression Results

As shown in ***Table 13***, the average quarterly difference-in-differences estimate for primary care visits is a decrease of one primary care visit per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −55, 52).

In addition to the average effect over the innovation period, we also present quarterly effects with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. None of the quarterly estimates are statistically significant. The estimates for Years 1 and 2 of the innovation are not statistically significant, but the estimate for Year 3 is statistically significant and positive, indicating an increase in primary care visits relative to the comparison group.

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicare Participants: BAHC

Quarter	Coefficient	Standard Error	P-Values
I1	−39	94	0.677
I2	63	112	0.575
I3	−63	101	0.535
I4	−77	93	0.408
I5	−99	94	0.290
I6	−25	82	0.760
I7	−86	90	0.345
I8	−52	127	0.684
I9	154	151	0.308
I10	110	111	0.324
I11	70	142	0.624
I12	207	205	0.317
Overall average	−1	33	0.964
Overall aggregate	−2	54	0.964
Overall aggregate (IY1)	−19	35	0.588
Overall aggregate (IY2)	−37	28	0.181
Overall aggregate (IY3)	53	30	0.078

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; BAHC = Ben Archer Health Center.

2.9 Discussion: Medicare Results

The BAHC innovation generated higher spending in Year 1 of the innovation and a higher rate of inpatient stays during Years 1 and 2. The innovation also reduced ED visits among participants. No detectable change in primary care visits was observed in Years 1 and 2, but primary care visits increased during the third year of the innovation.

The Medicare results are consistent with the innovation's theory of change, because the goal of the BAHC innovation was to improve patient health via CHWs and NHEs that connect patients to services; therefore, spending and 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 decrease in ED visits is encouraging because it suggests that patients may be utilizing preventive care in the appropriate setting and avoiding unnecessary ED visits. The increase in primary care visits during Year 3 supports this hypothesis. Based on the type and dose of services that patients typically received, the innovation possibly resulted in short-term increases in spending and inpatient stays, fewer ED visits, and increased use of primary care.

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 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.

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 ($622; 90% CI: $14, $1,231). 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 ($514; 90% CI: −$210, $1,239).

Better care. Medicare beneficiaries enrolled in the innovation had higher rates of inpatient stays per 1,000 participants per quarter overall (50; 90% CI: 32, 68). ED visits per 1,000 participants per quarter were lower among the innovation group overall (−29; 90% CI: −48, −11), 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 Addendum 2017

Awardee-Level Findings:

Bronx Regional Health Information Organization

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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 interviews through the 15th or 16th and final 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. RTI has 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 Addendum: Bronx RHIO

Data Source	Period Covered
Awardee Narrative Progress Report	February 2014–Q15 (March 2016)
Quarterly Awardee Performance Report	February 2014–Q15 (March 2016)
Medicare	February 2014–June 2016
Medicaid	February 2014–June 2015
Awardee-specific data	February 2014–June 2016

Terms and Definitions

- Q = quarter.
- Bronx RHIO = Bronx Regional Health Information Organization.

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. Below we present the goals, as well as the findings, for the innovation.

1. **Smarter spending.**

   Goal: Reduce spending by improving clinical quality in the member RHIO sites; Bronx RHIO expected net savings of $15 million over 3 years.

   Findings: The regression results suggest that Medicare beneficiaries incurred a lower level of spending compared to the comparison group in the innovation period, and the cumulative probability of savings was estimated at 98 percent. Medicaid spending remained similar between the innovation and comparison groups, and the cumulative probability of savings was around 66 percent.

2. **Better care.**

   Goal: 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.

   Findings: Medicare beneficiaries had significantly fewer inpatient admissions, but significantly more unplanned readmissions during the innovation period, whereas we observe significant reductions in inpatient admissions for Medicaid beneficiaries.

   Bronx RHIO generated 626 BRIC reports that included 22,485 patients, which is 40.7 percent of the target population. More than one-third of participants (39.8%) were included in one BRIC report, nearly one-third (31.9%) were included in two BRIC reports, with the remaining 28.3 percent included in three or more BRIC reports. It is unclear whether and how providers leveraged the reports to deliver more appropriate care.

3. **Healthier people**.

   Goal: 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.

   Findings: 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 through I4, then decreased in I5. However, since the denominator dropped dramatically in I5, we do not feel confident making any strong conclusions that HbA1c control improved over time for those included in a diabetes-related BRIC report.

The Bronx RHIO executed a well-led program, and innovation components were implemented successfully. RTI's ability to evaluate outcomes of the innovation is limited by a lack of data on whether and how RHIO providers used the BRIC reports. Although qualitative interviews earlier in the evaluation suggest that some providers eagerly used the reports and alerts to improve services for their patients, RTI has limited information on how many providers acted on the results, what types of interventions were made on patients' behalf, and whether these varied depending on patient diagnosis.

Innovation management indicated that the startup period, while necessary to improve the reliability of services, was longer than expected. As a result, sustainability planning occurred toward the end of the award period. To ensure there was enough time to properly implement a sustainability plan, and to spend remaining project funds, the Bronx RHIO requested and received a no-cost extension through March 31, 2016. All noteworthy progress made during the extension period revolved around implementing this sustainability plan. The pilot sites transitioned to a new web-based tool called SPECTRUM, which allowed them direct access to the data that the Bronx RHIO was producing manually for them. The database was also expanded to include claims data tables, and the initial claims data feed was implemented. Finally, through the NY State Medicaid Delivery System Reform Incentive Payment program, BRIC services were engaged to support two Performing Provider Systems (PPSs) in their multiyear Medicaid reform projects effective April 1, 2016, and all BRIC staff employed directly by the RHIO were reassigned to work on those projects.

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) 15 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through March 31, 2016.

Table 2. Summary of Updates as of Quarter 15, March 31, 2016: Bronx RHIO

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2016)
Innovation Components	No changes. 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	Less than half of participants (49.4%) were 45 to 74 years of age, and more than half (55.5%) were female. Among participants for whom RTI received data, more than one-third (35.7%) were black, approximately one quarter (26.1%) were Hispanic, and approximately 20 percent were white. Less than one-half had Medicaid or Medicare (40.3% and 43.1%, respectively).
Workforce Development	
Hiring and retention	20 staff employed in Q15, and 2 separations occurred.
Skills, knowledge, and training	No changes. 15,128 cumulative training hours for 407 trainees since launch.
Context	
Award execution	Cumulative expenditure rate of 98.1% at end of Q15, 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 establishing 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	22,485 patients, 40.7% of the target population, were enrolled in the innovation.
Innovation dose	More than one-third of participants (39.8%) were included in one BRIC report, nearly one-third (31.9%) in two BRIC reports, and the remaining 28.3% in three or more BRIC reports.
Sustainability	Pilot sites transitioned to a web-based tool for direct access to Bronx RHIO data without manual intervention by Bronx RHIO staff. To sustain the Bronx RHIO, contracts were secured to support two provider systems in their multiyear Medicaid reform projects effective April 1, 2016, and all BRIC staff employed directly by the RHIO were reassigned to work on those projects.

Notes:

- **Sources**: *Q15 Narrative Progress Report; Q15 Quarterly Awardee Performance Report*.
- Patient-level data: Provided to RTI.
- **Period of activity:** January 2016 to March 2016.

Terms and Definitions

- BRIC = Bronx Regional Informatics Center; FTE = full-time equivalent; NCM = nurse case manager; Bronx RHIO = Bronx Regional Health Information Organization.

Table 3 summarizes findings based on Medicare claims collected during the innovation period. The overall estimate for the difference in quarterly spending is negative and statistically significant, indicating that the innovation group (in the BRIC reports) incurs less spending in the innovation period as the comparison group. Overall, the Medicare innovation group has significantly lower inpatient admissions and higher unplanned readmissions than the comparison group, and a similar level of ED visits, since the estimate is not statistically significant. Sensitivity analyses revealed that spending and utilization patterns vary by patient subpopulations when we analyze different types of BRIC reports.

Table 3. Summary of Medicare Claims-Based Findings: Bronx RHIO

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$8.605	−$15.710, −$1.495	−$14.140, −$3.065	−$5.583	−$10.230, −$0.932	−$3.022	−$7.117, $1.074	N/A	N/A
Acute care inpatient stays	−216	−381, −50	−345, −86	−113	−245, 18	−102	−203, −2	N/A	N/A
Hospital-wide all-cause unplanned readmissions	72	7, 137	22, 123	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−60	−278, 158	−230, 110	−91	−257, 75	31	−110, 172	N/A	N/A
Average impact per quarter									
Spending per participant	−$345	−$630, −$60	−$567, −$123	−$387	−$709, −$65	−$287	−$676, $102	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−9	−15, −2	−14, −3	−8	−17, 1	−10	−19, 0	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	26	3, 50	8, 45	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−2	−11, 6	−9, 4	−6	−18, 5	3	−10, 16	N/A	N/A

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2012 to June 2016.
- **Sample size:** 3,892, unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Bronx RHIO = Bronx Regional Health Information Organization.

Table 4 summarizes findings based on Medicaid claims collected during the innovation period. 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 few inpatient stays than the comparison group, but a similar level of readmissions and ED visits as the comparison group.

Table 4. Summary of Medicaid Claims-Based Findings: Bronx RHIO

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$0.627	−$3.194, $1.939	−$2.627, $1.372	−$0.626	−$3.030, $1.777	−$0.001	−$0.439, $0.437	N/A	N/A
Acute care inpatient stays	−225	−391, −58	−354, −95	−177	−336, −19	−47	−98, 3	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−7	−56, 41	−45, 30	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−202	−597, 194	−510, 106	−125	−509, 259	−76	−169, 16	N/A	N/A
Average impact per quarter									
Spending per participant	−$47	−$237, $144	−$195, $102	−$52	−$253, $148	−$1	−$299, $297	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−17	−29, −4	−26, −7	−15	−28, −2	−32	−66, 2	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−6	−43, 31	−35, 23	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−15	−44, 14	−38, 8	−10	−42, 22	−52	−115, 11	N/A	N/A

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2012 to June 2015.
- **Sample size:** 3,929 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Bronx RHIO = Bronx Regional Health Information Organization.

2.1.1 Innovation Components

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. The innovation components and partners described in previous reports have not changed over time.

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 2016 annual report, based on data through Q14. Since that time, Bronx RHIO enrolled an additional 618 patients and the distribution of patient characteristics remains similar. More specifically, a majority of participants (49.4%) were 45 to 74 years old and more than half (55.5%) were female. Most participants (27.4%) were black, and 20% were Hispanic. Approximately one-third were covered by Medicare or Medicaid (34.3% and 32.1%, respectively).

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through March 2016: Bronx RHIO

Characteristic	Number of Participants	Percentage of Participants
Total	22,485	100.0
Age		
< 18	21	0.1
18–24	720	3.2
25–44	3,079	13.7
45–64	6,277	27.9
65–74	4,824	21.5
75–84	3,604	16.0
85+	1,887	8.4
Missing	2,073	9.2
Sex		
Female	12,478	55.5
Male	6,913	30.7
Missing	3,094	13.8
Race/ethnicity		
White	3,522	15.6
Black	6,164	27.4
Hispanic	4,496	20.0
Asian	160	0.7
American Indian or Alaska Native	35	0.2
Native Hawaiian or other Pacific Islander	10	0.1
Other	2,862	12.7
Missing/refused	5,236	23.3

(continued)

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through March 2016: Bronx RHIO (continued)

Characteristic	Number of Participants	Percentage of Participants
Payer category		
Dual	596	2.6
Medicaid	7,208	32.1
Medicare	7,710	34.3
Other	0	0.0
Uninsured	93	0.4
Missing	2,275	10.1

Notes:
- **Source:** Patient-level data provided to RTI by Bronx RHIO.

Terms and Definitions
- Bronx RHIO = Bronx Regional Health Information Organization.

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: Bronx RHIO

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

Terms and Definitions
- ED = emergency department; Bronx RHIO = Bronx Regional Health Information Organization.

2.3 Medicare Comparison Group

We received 626 BRIC reports requested by partners of the RHIO; each focused on a specific group of patients the provider requested 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 626 BRIC report extraction dates ranged from April 18, 2014 to April 1, 2016. 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 include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. The Medicare claims analysis focuses on 3,892 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 dropped Medicare beneficiaries who appeared only in a Hepatitis C BRIC report because they were incorrectly included in previous reports.

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 and calendar year before 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. Eight innovation beneficiaries were 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: Bronx RHIO (Medicare)

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 enrolment	$7,921	$18,980	$5,050	$13,785	0.17	$7,886	$18,946	$7,625	$18,538	0.01
Total payments in second, third, fourth, and fifth calendar quarters prior to enrolment	$23,757	$42,352	$18,101	$36,279	0.14	$23,673	$42,184	$23,203	$40,068	0.01
Age	71.38	14.16	65.7	15.78	0.38	71.4	14.13	71.61	13.87	0.02
Percentage male	35.05	47.71	39.79	48.95	0.10	35.05	47.71	34.94	47.68	0.00
Percentage white	26.23	43.99	36.32	48.09	0.22	26.23	43.99	28.2	45	0.04
Percentage disabled	33.79	47.3	45.49	49.8	0.24	33.74	47.28	32.74	46.93	0.02
Percentage ESRD	6.82	25.21	4.82	21.43	0.09	6.81	25.19	6.19	24.09	0.03
Number of dual eligible months in the previous calendar year	6.29	5.84	6.15	5.82	0.02	6.28	5.84	6.57	5.83	0.05
Number of chronic conditions	9.43	3.94	7.29	4.61	0.50	9.43	3.94	9.51	4.26	0.02
Number of ED visits in calendar quarter prior to enrolment	0.23	0.83	0.21	0.88	0.02	0.23	0.83	0.23	0.92	0.00
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrolment	1.36	3.03	1.18	3.29	0.06	1.36	3.03	1.31	3.24	0.01
Number of inpatient stays in calendar quarter prior to enrollment	0.24	0.68	0.14	0.5	0.16	0.24	0.68	0.23	0.66	0.01
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrolment	0.71	1.49	0.52	1.3	0.13	0.71	1.48	0.7	1.45	0.01
Number of beneficiaries	3,900	—	189,871	—	—	3,892	—	11,669	—	—
Number of unique beneficiaries[1]	3,900	—	30,974	—	—	3,892	—	9,299	—	—
Number of weighted beneficiaries	—	—	—	—	—	3,892	—	3,892	—	—

[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).

Notes:

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

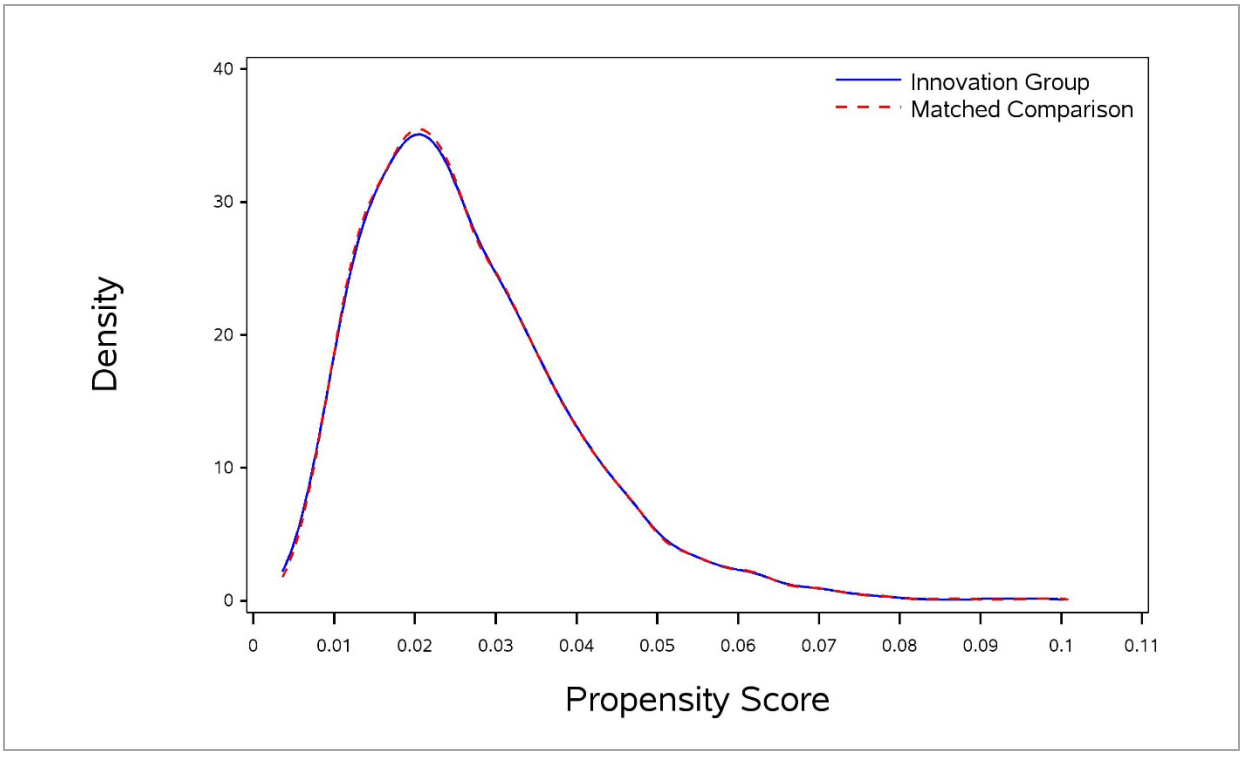
Terms and Definitions

- ED = emergency department; ESRD = end-stage renal disease; SD = standard derivation; Bronx RHIO = Bronx Regional Health Information Organization.
- — 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.

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 (Medicare)



Notes:

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

Terms and Definitions

- 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 8 reports Medicare 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 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.

As shown by the baseline trend line for innovation enrollees, spending trends upward in the baseline quarters for both innovation and comparison beneficiaries. After the innovation launch, spending decreases for both the innovation and comparison groups. There is a visible spending gap between the two groups during the innovation quarters. However, it is premature to conclude any impact of the innovation on spending on this basis. As shown in Table 8, data points are spread over a wide range of values rather than clustered at the mean, representing the variability in expenditures. These trends are comparable to trends in the third annual report. We will estimate the statistical impact of the innovation in the difference-in-differences analyses that follow.

Table 8. 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	I7	I8
Innovation Group																
Spending rate	$4,996	$5,149	$5,841	$5,871	$5,750	$5,959	$6,758	$7,886	$7,060	$6,651	$6,896	$6,866	$6,158	$6,180	$5,877	$5,397
Std dev	$13,785	$12,819	$15,716	$14,562	$14,236	$14,391	$17,132	$18,946	$16,401	$16,599	$18,343	$17,333	$15,515	$16,372	$15,336	$14,332
Unique patients	3,679	3,696	3,717	3,743	3,762	3,791	3,838	3,892	3,892	3,804	3,490	3,242	3,045	2,659	2,529	2,301
Comparison Group																
Spending rate	$5,306	$5,291	$5,750	$5,704	$5,844	$6,353	$6,467	$7,625	$7,429	$8,157	$7,303	$6,906	$6,797	$6,700	$6,407	$6,792
Std dev	$13,831	$12,789	$14,668	$13,931	$13,959	$15,618	$16,311	$18,538	$17,418	$19,016	$18,552	$15,744	$16,376	$15,993	$15,826	$18,262
Weighted patients	3,321	3,391	3,475	3,562	3,649	3,741	3,851	3,892	3,892	3,852	3,442	3,156	2,901	2,467	2,331	2,069
Savings per Patient																
	$310	$142	−$91	−$167	$93	$394	−$292	−$261	$369	$1,505	$407	$40	$639	$520	$530	$1,396

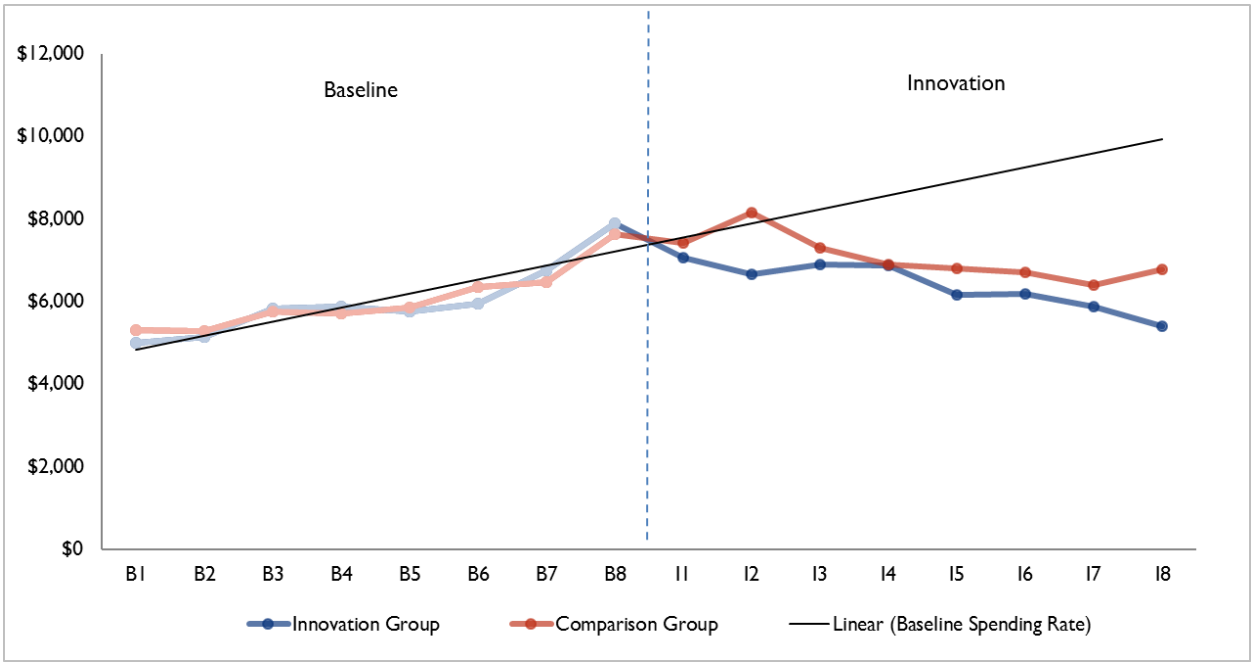
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 2. Medicare Spending per Participant: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.4.2 Regression Results

We present in ***Table 9*** 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 −$345 (90% CI: −$630, −$60). This effect is statistically significant and is comparable to the finding in the third annual report. 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 quarterly effects 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. Most of the quarterly estimates are negative and some are statistically significant.

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

Quarter	Coefficient	Standard Error	P-Values
I1	−$233	$281	0.405
I2	−$1,283	$294	<0.001
I3	−$163	$334	0.625
I4	$240	$333	0.472
I5	−$331	$323	0.306
I6	−$34	$361	0.926
I7	$59	$352	0.866
I8	−$901	$391	0.021
Overall average	−$345	$173	0.047
Overall aggregate	−$8,604,705	$4,322,107	0.047
Overall aggregate (IY1)	−$5,582,884	$2,827,121	0.048
Overall aggregate (IY2)	−$3,021,821	$2,489,698	0.225

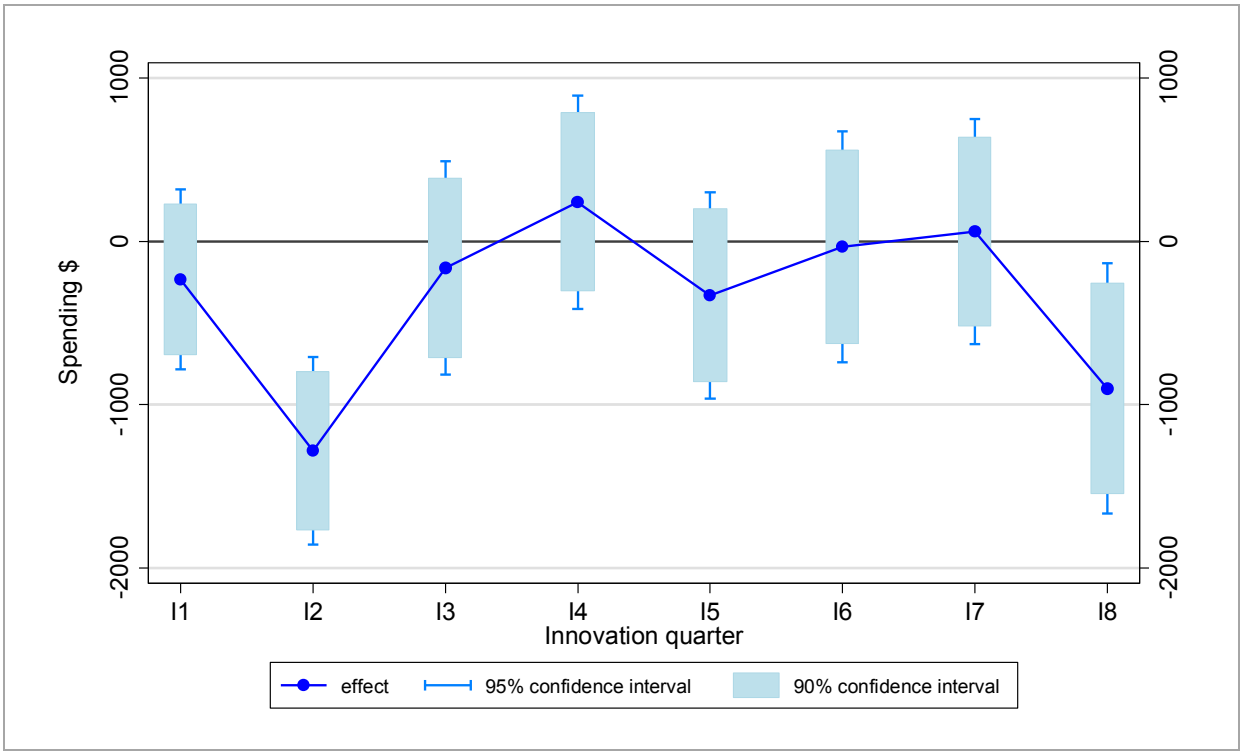
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **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.
- **Average:** 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; Bronx RHIO = Bronx Regional Health Information Organization.

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



Notes:

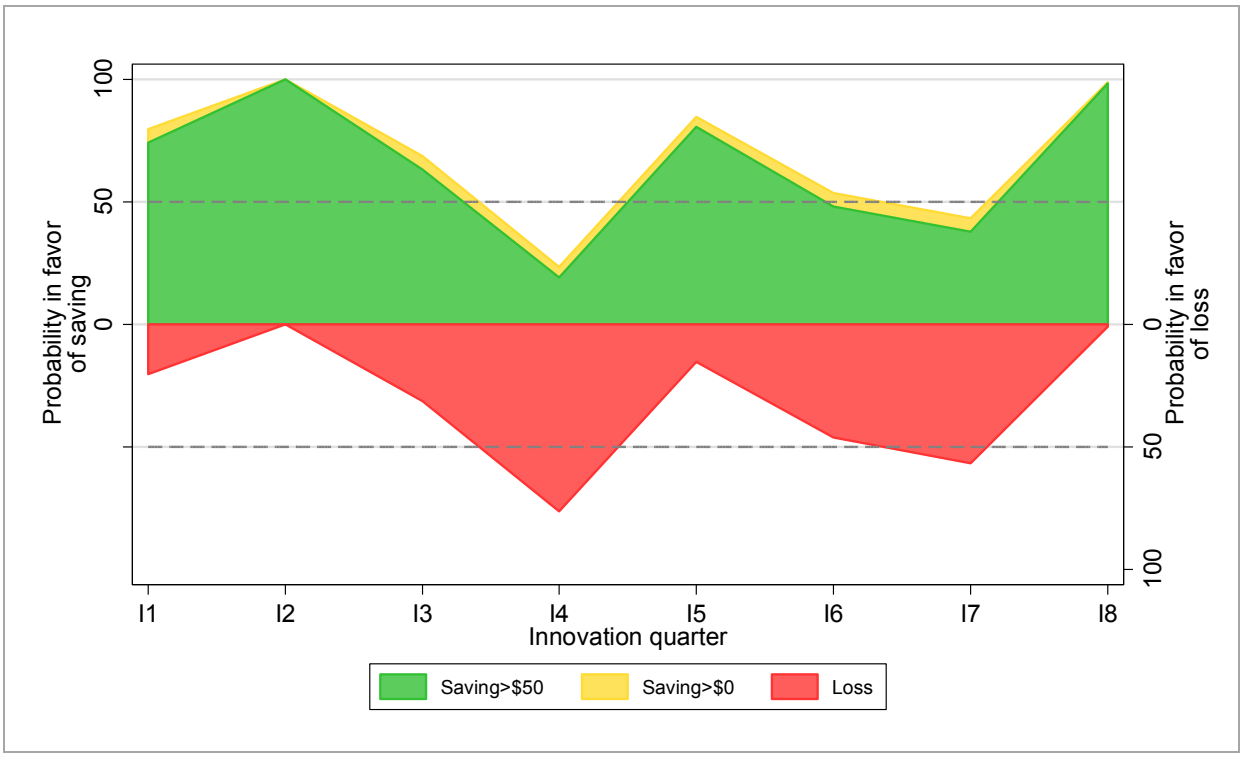
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- 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 for saving or losing money on this initiative. The quarterly spending estimates were mostly negative in the innovation period, and we observed an overall 98 percent probability of savings versus loss for the innovation period.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- 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 10*** and ***Figure 5***. Inpatient admissions trend slightly upward and are similar in the baseline period for both the innovation and comparison groups. Inpatient admissions fall below the trend line for both the innovation and comparison groups during the innovation quarters. This finding is consistent with the findings in the third annual report. 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 10. 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	I7	I8
Innovation Group																
Admit rate	140	146	167	166	163	166	192	228	189	181	197	190	159	161	151	140
Std dev	477	473	526	521	500	505	570	650	587	569	618	578	501	507	483	483
Unique patients	3,679	3,696	3,717	3,743	3,762	3,791	3,838	3,892	3,892	3,804	3,490	3,242	3,045	2,659	2,529	2,301
Comparison Group																
Admit rate	150	149	162	155	167	164	178	202	196	208	185	169	173	169	159	164
Std dev	491	471	497	482	526	531	561	633	599	597	568	553	538	524	504	499
Weighted patients	3,321	3,391	3,475	3,562	3,649	3,741	3,851	3,892	3,892	3,852	3,442	3,156	2,901	2,467	2,331	2,069
Innovation − Comparison Rate																
	−10	−3	5	11	−4	3	14	26	−7	−26	12	21	−14	−9	−8	−25

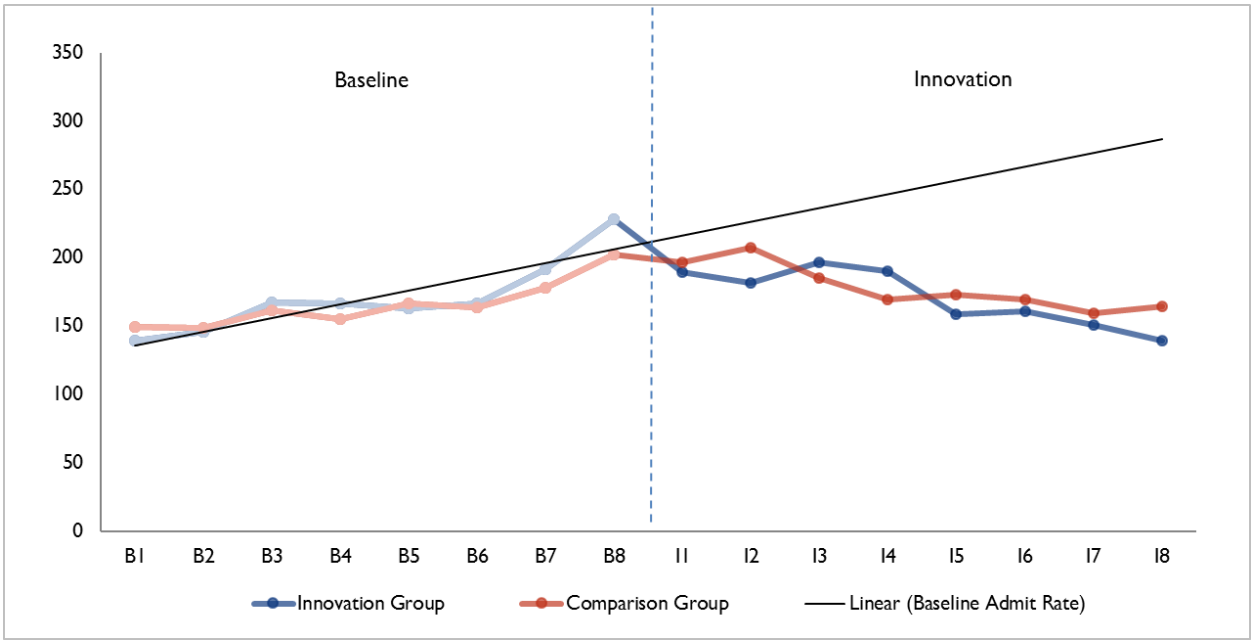
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.5.2 Regression Results

As shown in ***Table 11***, the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 9 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: −15, −2) and is a smaller decrease than the finding in the third annual report.

We also present quarterly effects 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 some are statistically significant.

Table 11. 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	−18	11	0.093
I2	−34	11	0.002
I3	9	11	0.436
I4	18	11	0.119
I5	−14	11	0.215
I6	−4	12	0.722
I7	−2	12	0.866
I8	−19	12	0.111
Overall average	−9	4	0.032
Overall aggregate	−216	101	0.032
Overall aggregate (IY1)	−113	80	0.157
Overall aggregate (IY2)	−102	61	0.095

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Bronx RHIO = Bronx Regional Health Information Organization.

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***. Hospital unplanned readmissions rates fluctuate around the trend line before the innovation's launch, and the trend line slopes up. The readmissions rates for the innovation group decreases more than the comparison group's during the latter part of the innovation period. This result is comparable to the findings in the third annual report. 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 12. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Bronx RHIO

Awardee Number: 1C1CMS331065
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**
Innovation Group																
Readmit rate	121	147	149	145	170	135	172	182	223	218	223	217	175	236	178	164
Std dev	326	354	356	353	376	342	378	386	417	413	416	412	380	425	382	370
Total admissions	323	375	404	392	423	444	487	572	488	427	426	396	297	305	259	159
Comparison Group																
Readmit rate	154	126	127	147	151	160	161	160	186	184	173	174	175	170	163	134
Std dev	361	332	333	354	358	367	368	367	389	388	378	380	380	376	369	341
Total admissions	333	346	397	399	436	438	480	563	560	530	415	354	307	270	242	137
Innovation − Comparison Rate																
	−33	21	22	−2	19	−25	11	22	38	33	50	43	0	66	15	30

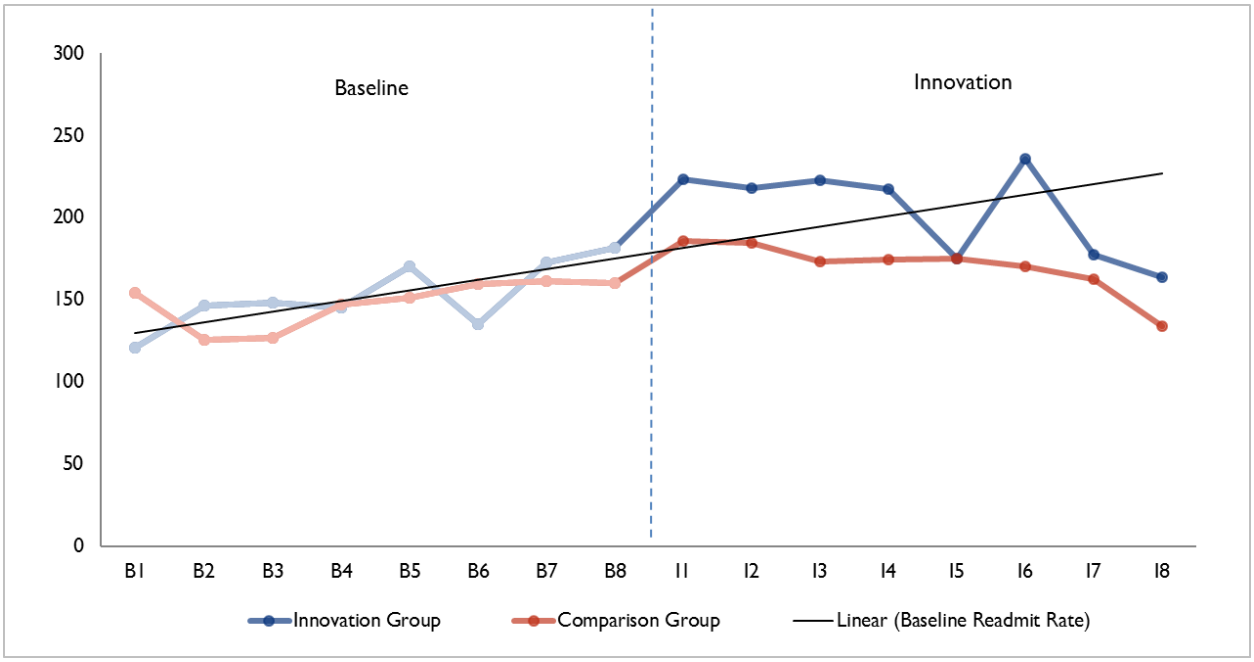
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

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 26 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 3, 50). This finding differs from the third annual report finding, where readmissions did not significantly change.

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

Quarter	Coefficient	Standard Error	P-Values
Overall average	26	14	0.068
Overall aggregate	72	40	0.068

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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.

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 remains stable before launch and trends slightly upward for both the innovation and comparison groups. During the subsequent innovation quarters, the ED visit rate decreases for both the innovation and the comparison groups. These trends are similar to those in the third annual report, except that the ED visit rates for the innovation and comparison groups remain close together during the intervention period in this report. As with the other variables, we will include statistical tests on the ED visit rate in the following section.

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

Awardee Number: 1C1CMS331065
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**
Innovation Group																
ED rate	186	180	189	191	195	190	212	227	198	209	193	189	201	181	192	140
Std dev	686	609	967	883	721	727	896	865	893	898	763	883	921	713	939	465
Unique patients	3,679	3,696	3,717	3,743	3,762	3,791	3,838	3,892	3,892	3,804	3,490	3,242	3,045	2,659	2,529	2,301
Comparison Group																
ED rate	183	194	178	191	193	197	208	230	219	212	203	208	199	196	207	193
Std dev	412	420	429	445	513	570	615	615	495	491	595	620	459	467	533	514
Weighted patients	3,321	3,391	3,475	3,562	3,649	3,741	3,851	3,892	3,892	3,852	3,442	3,156	2,901	2,467	2,331	2,069
Innovation − Comparison Rate																
	4	−13	11	0	2	−7	4	−3	−22	−3	−11	−19	2	−16	−14	−53

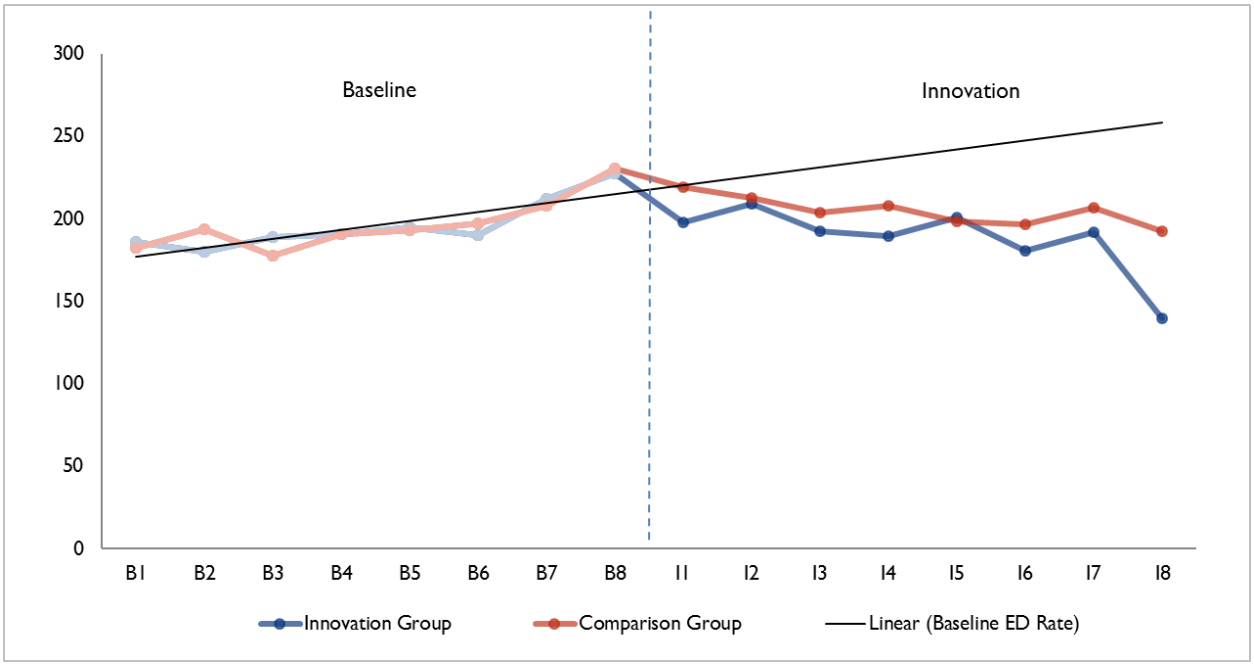
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- ED = emergency department; Bronx RHIO = Bronx Regional Health Information Organization.

2.7.2 Regression Results

As shown in ***Table 15***, 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: −11, 6). This finding is different from the statistically significant decrease in ED visits in the third annual report.

We also present quarterly effects 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 in the innovation group is lower than the comparison group, but the estimates are not statistically significant for the most part.

Table 15. 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	−16	14	0.247
I2	−6	13	0.664
I3	−3	14	0.857
I4	0	15	0.981
I5	22	16	0.164
I6	7	15	0.646
I7	7	19	0.727
I8	−30	16	0.050
Overall average	−2	5	0.650
Overall aggregate	−60	132	0.650
Overall aggregate (IY1)	−91	101	0.366
Overall aggregate (IY2)	31	86	0.718

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Bronx RHIO = Bronx Regional Health Information Organization.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 16*** and ***Figure 8.*** The primary care visit rate follows a fairly stable increasing trend prior to innovation launch for both the innovation and the comparison groups. After the innovation starts, the rate falls below the trend line starting at the third innovation quarter and decreases over time for both the innovation and comparison groups. As with the other variables, we will include statistical tests on the primary care visit rate in the following section.

Table 16. Primary Care Visits per 1,000 Medicare Participants: Bronx RHIO

Awardee Number: 1C1CMS331065
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**
Innovation Group																
Primary care rate	1,297	1,338	1,418	1,479	1,470	1,500	1,514	1,696	1,726	1,602	1,504	1,575	1,527	1,418	1,363	1,341
Std dev	1,979	2,007	2,253	2,464	2,530	2,489	2,879	2,947	3,148	2,826	2,695	2,995	2,882	2,540	2,402	2,055
Unique patients	3,679	3,696	3,717	3,743	3,762	3,791	3,838	3,892	3,892	3,804	3,490	3,242	3,045	2,659	2,529	2,301
Comparison Group																
Primary care rate	1,377	1,407	1,464	1,498	1,533	1,597	1,636	1,789	1,860	1,885	1,702	1,708	1,600	1,493	1,493	1,416
Std dev	2,354	2,419	2,570	2,521	2,572	2,715	2,811	2,939	3,028	3,158	3,118	3,364	3,253	3,166	2,892	2,680
Weighted patients	3,321	3,391	3,475	3,562	3,649	3,741	3,851	3,892	3,892	3,852	3,442	3,156	2,901	2,467	2,331	2,069
Innovation − Comparison Rate																
	−80	−69	−47	−19	−63	−97	−123	−93	−134	−283	−199	−133	−73	−75	−130	−75

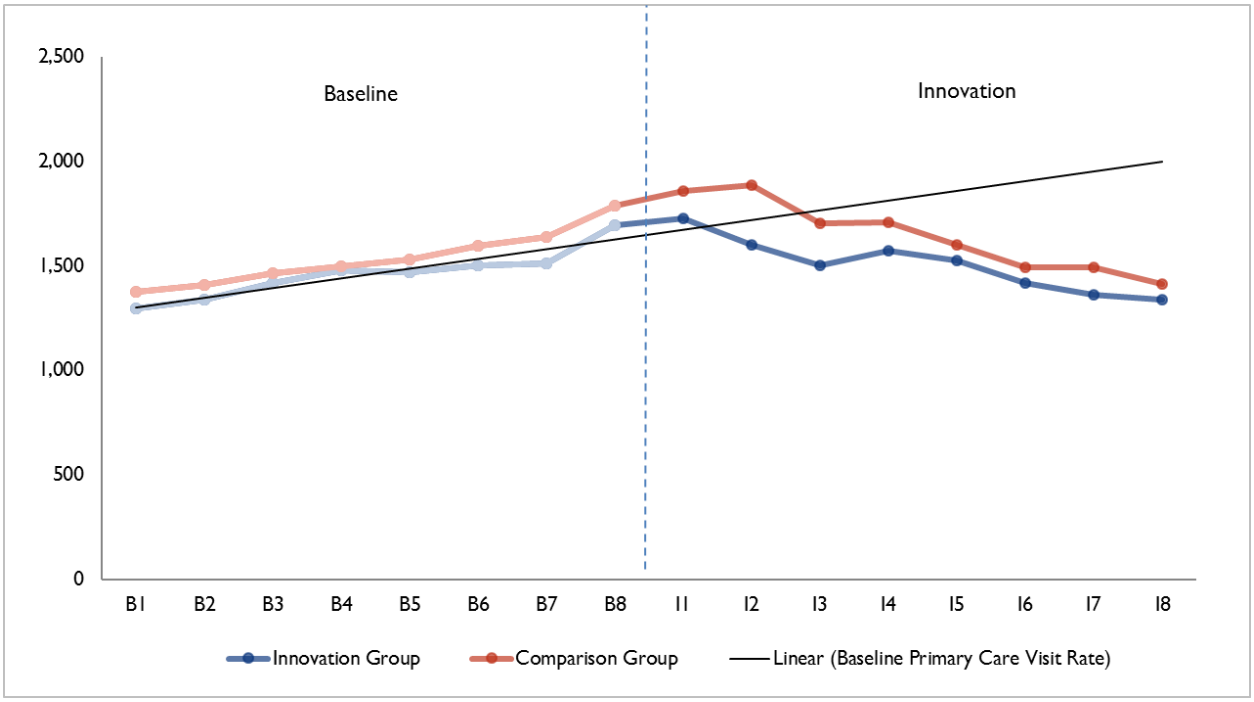
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative values indicate fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 8. Primary Care Visits per 1,000 Medicare Participants: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.8.2 Regression Results

As shown in ***Table 17***, the average quarterly difference-in-differences estimate for primary care visits is a decrease of 47 primary care visits per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −78, −16).

In addition to the average effect over the innovation period, we also present quarterly effects derived from a negative binomial count model with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. The average quarterly differences in primary care visits between the innovation group and comparison groups are mostly negative, and some of the estimates are statistically significant.

Table 17. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicare Participants: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	−35	46	0.446
I2	−150	44	0.001
I3	−90	48	0.061
I4	−28	56	0.613
I5	6	58	0.912
I6	−1	58	0.990
I7	−34	61	0.577
I8	0	59	0.997
Overall average	−47	19	0.012
Overall aggregate	−1,179	468	0.012
Overall aggregate (IY1)	−1,111	348	0.001
Overall aggregate (IY2)	−67	312	0.829

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2012 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Bronx RHIO = Bronx Regional Health Information Organization.

2.9 Discussion: Medicare Results

The regression results suggest that the innovation group has lower spending, inpatient admissions, and primary care visits than the comparison group, although we found higher unplanned readmission rates. Based on the innovation's theory of change, RTI cannot conclude that the innovation led to reductions in utilization. The patients identified in the BRIC reports may not necessarily have subsequent contact or treatment. In the BRIC reports we received from Bronx RHIO, only 60 people were designated as follow-ups for the health system. Without a mechanism to ensure that providers actually use the reports to follow up and manage their patients, we would not expect that providing information would reduce spending or utilization. Qualitative evidence suggests that at least some providers were highly engaged in the innovation and used the reports to quickly intervene with their highest need patients.

To get a better understanding of the overall claims results, we also restricted the population to two different types of BRIC reports (asthma and diabetes), and performed subgroup analysis on each cohort. The population from the diabetes BRIC reports (n = 305) showed significant reductions in inpatient

stays and ED visits in the innovation group. The other subgroup, asthma (n = 886), showed insignificant results in all claims measures. The subgroup analyses suggest that heterogeneity exists among different BRIC report patients, and we should not generalize the observed spending and utilization patterns across all BRIC report patients.

The five claims 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. The innovation was launched 20 months into the initiative period on February 20, 2014 and was under way for only 24 months before funding ended in March 2016. Therefore, 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 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 17 percent of the overall population reached by the innovation.

2.10 Medicaid Comparison Group

We include patients who were enrolled prior to June 30, 2015, and we present Medicaid claims data through Q2 2015. The Medicaid claims analysis focuses on 3,929 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 dropped Medicaid beneficiaries who appeared only in a Hepatitis C BRIC report because they were mistakenly included in previous reports.

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, 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 use 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 9*** 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 18. Mean Values and Standardized Differences of Variables in Propensity Score Model: Bronx RHIO (Medicaid)

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	$2,478	$8,297	$2,443	$8,308	0.00	$2,394	$7,786	$2,484	$9,061	0.01
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$7,353	$24,049	$8,457	$27,216	0.04	$7,181	$23,076	$6,709	$22,448	0.02
Age	64.53	15.51	57.76	18.24	0.40	64.56	15.5	63.55	15.93	0.06
Percentage blind, disabled, or aged	60.32	48.93	59.77	49.04	0.01	60.37	48.91	58.29	49.31	0.04
Percentage female	59.6	49.08	58.58	49.26	0.02	59.7	49.05	59.42	49.1	0.01
Percentage black	28.16	44.98	25.48	43.57	0.06	28.15	44.97	29.05	45.4	0.02
Percentage Hispanic	48.02	49.97	46.63	49.89	0.03	48.02	49.96	45.25	49.77	0.06
Percentage dually eligible	91.21	28.32	73.69	44.03	0.47	91.25	28.26	90.58	29.22	0.02
Number of months of Medicaid eligibility in lagged year prior to enrollment	11.08	2.65	11.3	2.04	0.09	11.08	2.65	10.8	2.8	0.10
Number of ED visits in calendar quarter prior to enrollment	0.43	1.74	0.21	0.94	0.15	0.41	1.66	0.38	1.62	0.02
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.18	3.71	0.66	2.38	0.17	1.14	3.25	0.97	3.67	0.05
Number of inpatient stays in calendar quarter prior to enrollment	0.23	0.63	0.1	0.41	0.24	0.22	0.56	0.2	0.67	0.02
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.54	1.49	0.32	1.01	0.17	0.52	1.32	0.43	1.24	0.07
Number of beneficiaries	3,594	—	65,718	—	—	3,588	—	10,658	—	—
Number of unique beneficiaries	3,594	—	17,967	—	—	3,588	—	7,318	—	—
Number of weighted beneficiaries	—	—	—	—	—	3,588	—	3,588	—	—
No Medicaid in Previous Quarter										
Age	57.08	20.73	37.98	15.25	1.05	57.08	20.70	55.16	19.53	0.10
Percentage blind, disabled, or aged	20.24	40.23	7.37	26.13	0.38	20.24	40.17	16.62	37.22	0.09
Percentage female	61.00	48.85	70.55	45.59	0.20	61.00	48.78	53.23	49.90	0.16
Percentage black	26.69	44.30	13.72	34.40	0.33	26.69	44.23	27.57	44.68	0.02
Percentage Hispanic	32.85	47.03	20.59	40.44	0.28	32.85	46.96	34.51	47.54	0.04
Percentage dually eligible	49.56	50.07	6.87	25.30	1.08	49.56	50.00	49.36	50.00	0.00
Number of beneficiaries	341	—	13,217	—	—	341	—	1,013	—	—
Number of unique beneficiaries[1]	341	—	12,296	—	—	341	—	665	—	—
Number of weighted beneficiaries	—	—	—	—	—	341	—	341	—	—

[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).

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

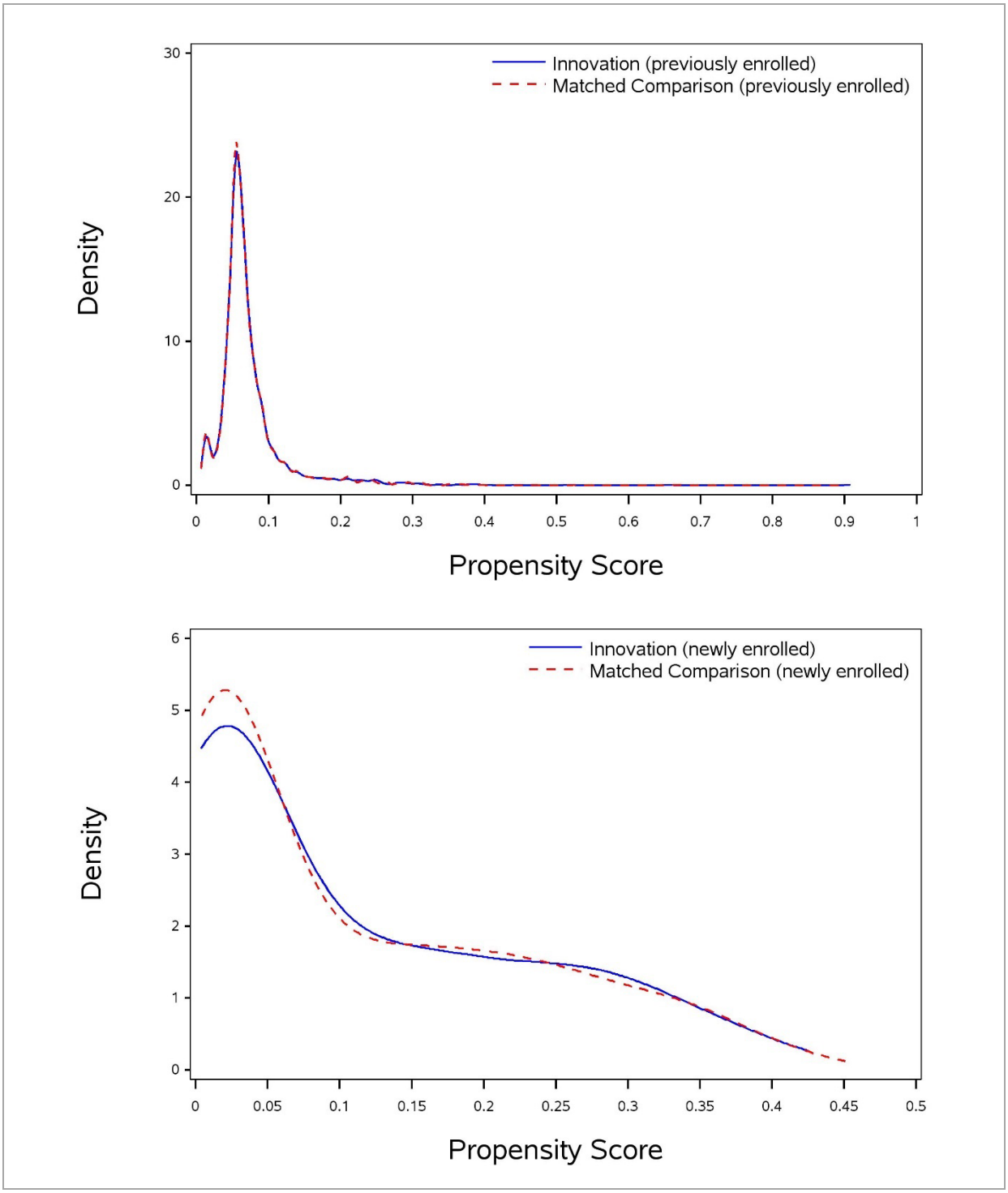
Terms and Definitions

- ED = emergency department; SD = standard deviation; Bronx RHIO = Bronx Regional Health Information Organization.
- — 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 18). The results in Table 18 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables except for the percentage of female variable for those beneficiaries who were not enrolled in Medicaid fee-for-service in the calendar quarter prior to innovation.

Figure 9 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 9. Distribution of Propensity Scores for Comparison and Innovation Groups: Bronx RHIO (Medicaid)



Notes:

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

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 19 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 10*** illustrates the Medicaid spending per beneficiary in Table 19 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, spending trends up in the baseline quarters for both the innovation and comparison beneficiaries. Spending in the innovation period decreases for the innovation group, and it also falls for the comparison group. Differences in quarterly spending between the innovation and comparison group are smaller than observed in the third annual report and the overall trends are similar to those previously observed. It is premature to conclude any impact of the innovation on spending among enrolled beneficiaries. As shown in Table 19, the data points tend to spread over a wide range of values.

Table 19. 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	I4	I5
Innovation Group													
Spending rate	$2,082	$1,917	$1,958	$2,082	$2,028	$2,038	$2,046	$2,394	$2,265	$1,874	$1,752	$1,596	$1,241
Std dev	$7,378	$6,687	$7,021	$7,371	$6,592	$7,135	$6,926	$7,787	$7,414	$7,640	$7,351	$7,562	$4,117
Unique patients	3,028	3,056	3,106	3,166	3,277	3,298	3,390	3,588	3,929	3,422	2,429	2,213	1,468
Comparison Group													
Spending rate	$1,920	$1,954	$1,858	$1,959	$1,875	$1,859	$1,972	$2,484	$2,162	$1,963	$1,963	$1,657	$1,296
Std dev	$4,544	$5,651	$4,707	$5,114	$4,675	$4,472	$4,541	$6,345	$5,848	$5,031	$4,991	$4,045	$3,558
Weighted patients	3,287	3,243	3,208	3,203	3,221	3,199	3,280	3,588	3,929	3,366	2,435	2,296	1,497
Savings per Patient													
	−$161	$38	−$100	−$123	−$153	−$179	−$74	$90	−$103	$89	$211	$61	$55

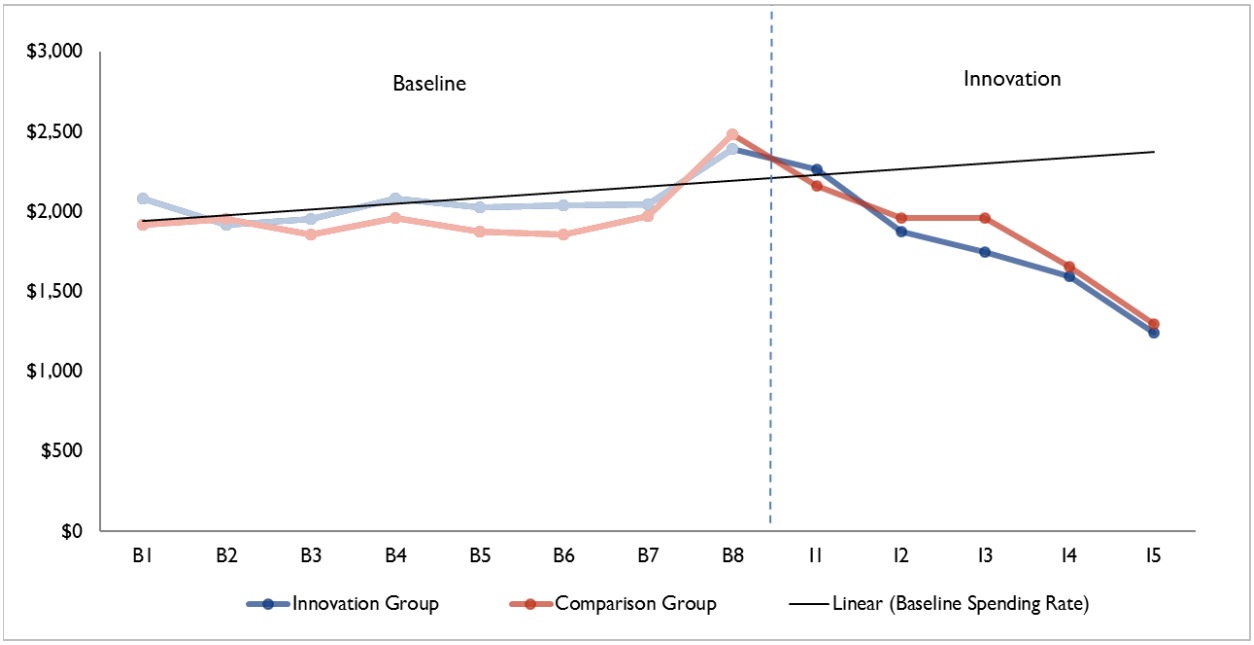
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 10. Medicaid Spending per Participant: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.11.2 Regression Results

We present in ***Table 20*** 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 −$47 (90% CI: −$237, $144). This effect is not statistically significant and is comparable to the effect in the third annual report. 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 quarterly effects derived from 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 11*** illustrates these quarterly difference-in-differences estimates. Most of the quarterly estimates are negative but not statistically significant.

Table 20. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	$113	$126	0.367
I2	−$126	$152	0.406
I3	−$220	$179	0.219
I4	−$47	$188	0.802
I5	−$1	$181	0.997
Overall average	−$47	$116	0.688
Overall aggregate	−$627,444	$1,560,312	0.688
Overall aggregate (IY1)	−$626,284	$1,461,026	0.668
Overall aggregate (IY2)	−$1,160	$266,182	0.997

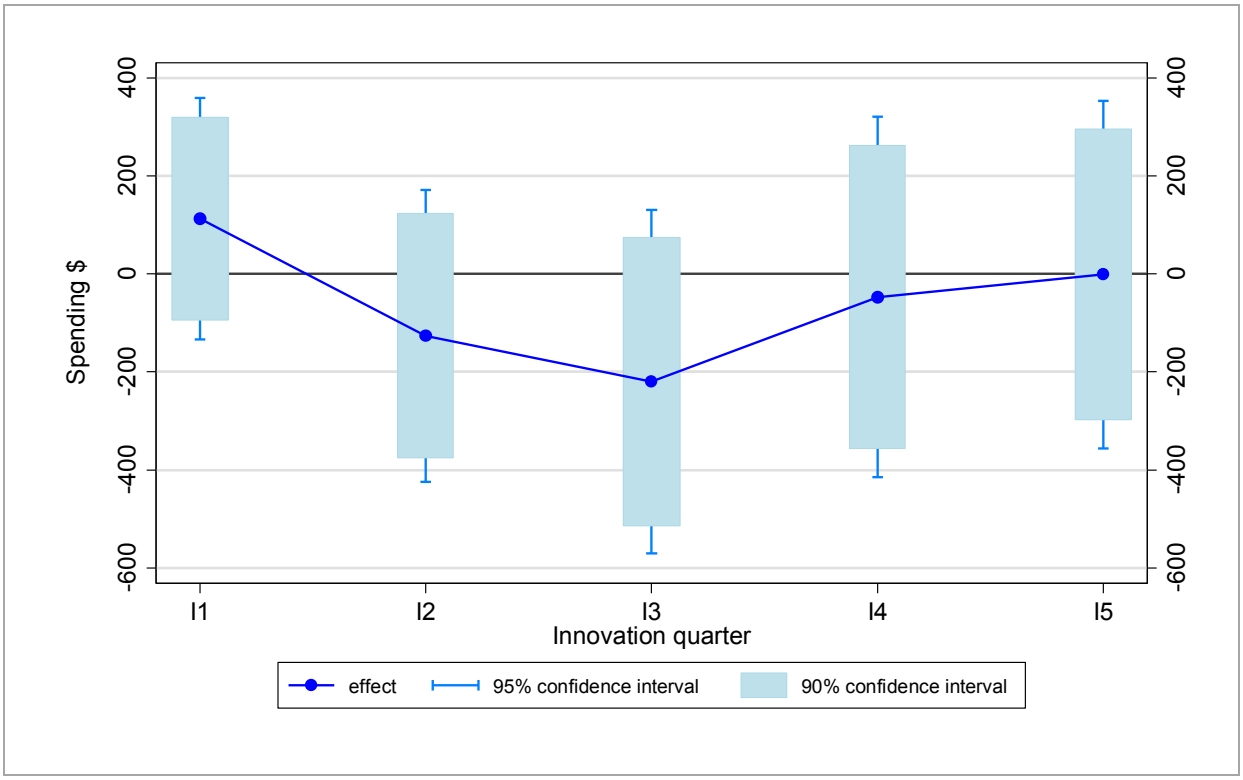
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **Regression coefficients:** 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.
- **Overall average:** 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; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 11. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Bronx RHIO



Notes:

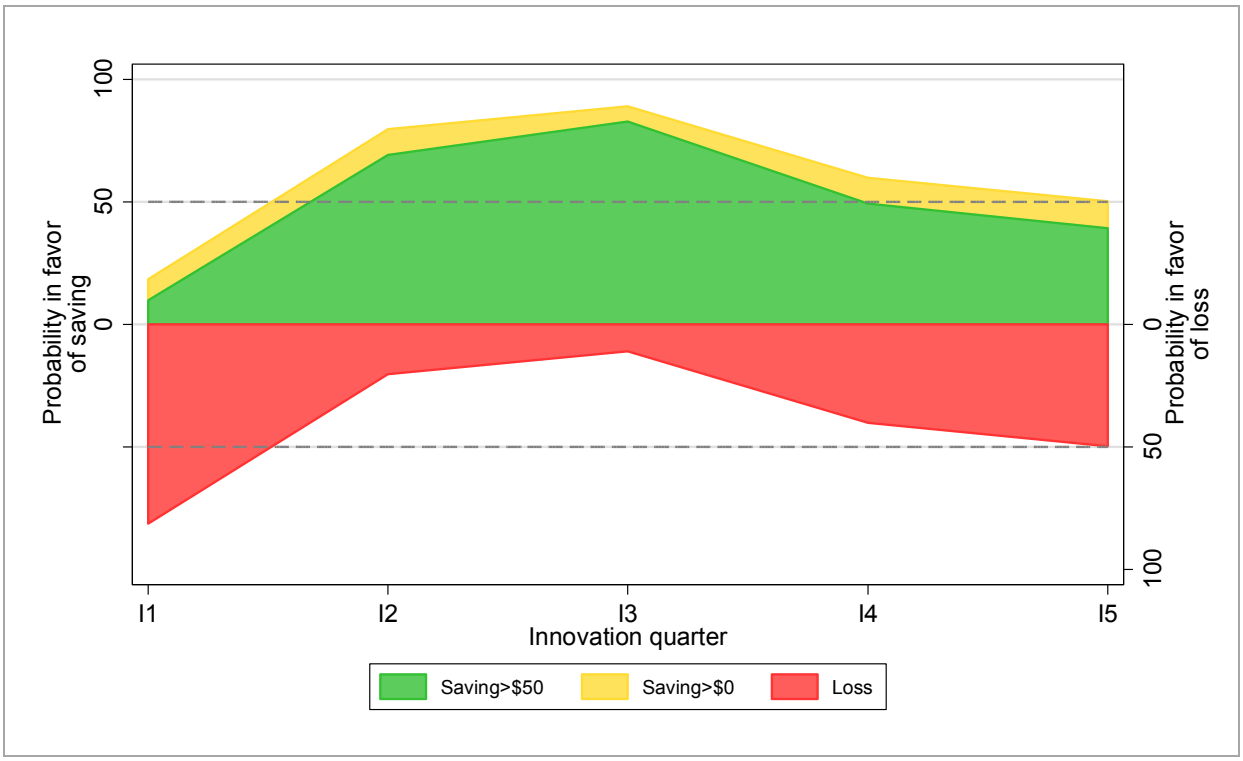
- Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- Period of activity: April 2012 to June 2015.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization; OLS = ordinary least squares.

Figure 12 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate for saving or losing money on this initiative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. The overall probability of savings is estimated at 66 percent.

Figure 12. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 21*** and ***Figure 13***. 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 period for both the innovation and the comparison groups. The increased sample size and two additional quarters of data slightly changed the trends in inpatient admissions since the third annual report.

Table 21. 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	I4	I5
Innovation Group													
Admit rate	142	124	138	138	140	144	167	218	174	130	128	100	60
Std dev	519	491	452	459	447	522	530	564	518	488	488	479	257
Unique patients	3,028	3,056	3,106	3,166	3,277	3,298	3,390	3,588	3,929	3,422	2,429	2,213	1,468
Comparison Group													
Admit rate	125	100	113	122	115	119	140	205	145	126	139	102	91
Std dev	337	291	305	327	282	311	364	470	382	354	368	287	340
Weighted patients	3,287	3,243	3,208	3,203	3,221	3,199	3,280	3,588	3,929	3,366	2,435	2,296	1,497
Innovation − Comparison Rate													
	17	24	25	16	25	26	27	13	29	4	-11	-1	-31

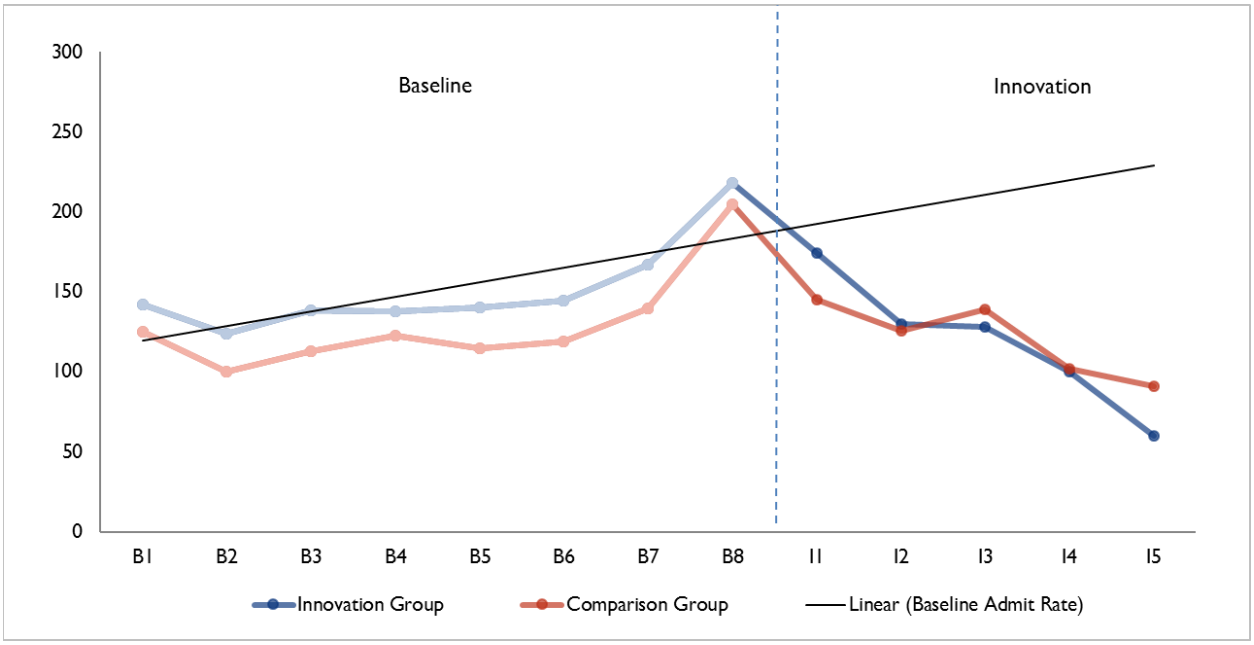
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **Admit rate:** (Total nonquarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 13. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.12.2 Regression Results

As shown in ***Table 22***, the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 17 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: −29, −4) and is different from the nonstatistically significant findings in the third annual report.

In addition to the average effect over the innovation period, we also present quarterly effects from 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. Most of the quarterly estimates are negative but not statistically significant.

Table 22. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Medicaid Participants: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
I1	1	16	0.930
I2	−20	15	0.186
I3	−33	17	0.049
I4	−15	14	0.288
I5	−32	21	0.123
Overall average	−17	8	0.027
Overall aggregate	−225	101	0.027
Overall aggregate (IY1)	−177	96	0.066
Overall aggregate (IY2)	−47	31	0.123

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **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.
- **Overall average:** 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; Bronx RHIO = Bronx Regional Health Information Organization.

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 23*** and ***Figure 14***. Hospital unplanned readmission rates fluctuate around the trend line prior to the innovation's launch for the innovation group, and the trend is flat. The unplanned readmissions rates decrease after innovation launch for both the innovation and comparison groups and are similar to the trends in the third annual report.

Table 23. 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	I4	I5
Innovation Group													
Readmit rate	210	164	153	161	161	212	208	194	191	174	141	169	61
Std dev	407	370	360	367	367	409	406	395	393	379	348	375	239
Total admissions	348	287	352	348	380	386	452	624	517	333	234	148	66
Comparison Group													
Readmit rate	248	202	227	223	138	236	244	341	240	232	298	211	271
Std dev	432	402	419	416	345	425	429	474	427	422	458	408	445
Total admissions	343	273	302	326	300	308	352	572	436	314	265	182	91
Innovation − Comparison Rate													
	−38	−38	−73	−62	22	−24	−36	−147	−48	−58	−157	−42	−210

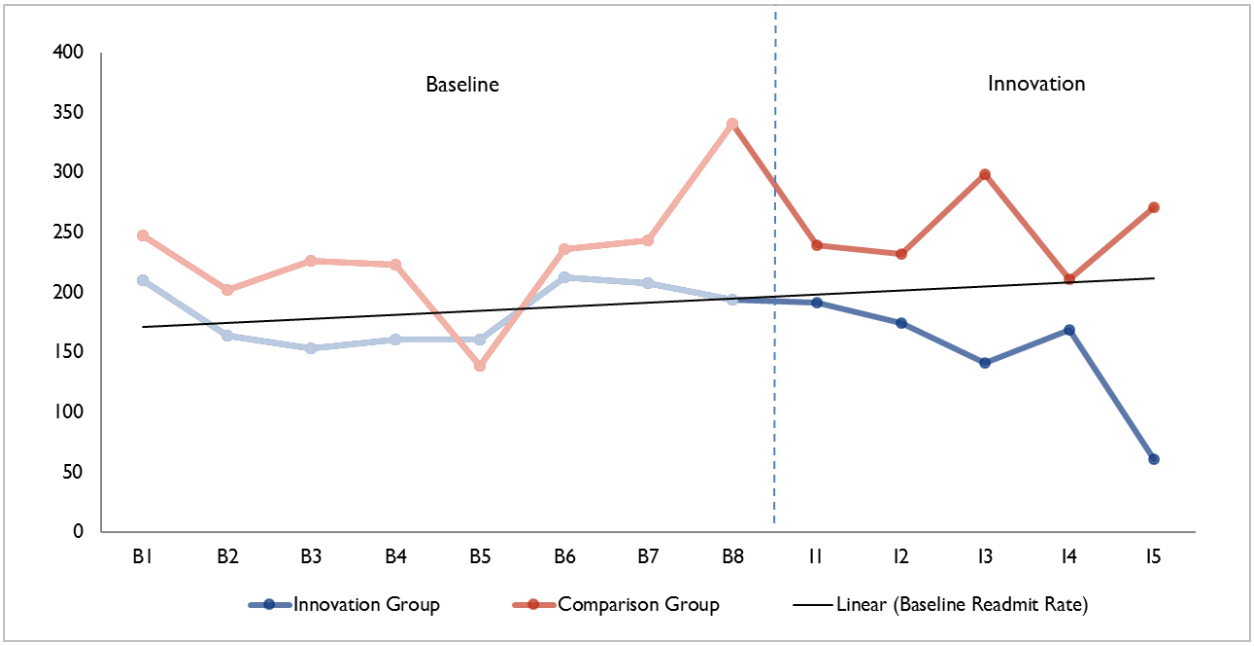
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 14. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.13.2 Regression Results

Table 24 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. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −43, 31). This nonsignificant finding is similar to the result in the third annual report.

Table 24. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: Bronx RHIO

Quarter	Coefficient	Standard Error	P-Values
Overall average	−6	23	0.802
Overall aggregate	−7	29	0.802

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **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.
- Bronx RHIO = Bronx Regional Health Information Organization.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 25*** and ***Figure 15.*** The ED visit rate fluctuates around the trend line and trends up for the innovation group. During the innovation period, the ED visit rate decreases for both the innovation group and the comparison groups. These trends are similar to the findings in the third annual report.

Table 25. 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	I4	I5
Innovation Group													
ED rate	315	324	306	308	309	331	342	409	392	298	292	219	114
Std dev	1128	1156	1010	1105	1024	1069	1194	1665	1642	1331	1364	946	424
Unique patients	3,028	3,056	3,106	3,166	3,277	3,298	3,390	3,588	3,929	3,422	2,429	2,213	1,468
Comparison Group													
ED rate	262	249	238	285	270	263	293	378	296	275	297	222	163
Std dev	774	677	749	929	745	729	876	1137	841	903	1080	912	712
Weighted patients	3,287	3,243	3,208	3,203	3,221	3,199	3,280	3,588	3,929	3,366	2,435	2,296	1,497
Innovation − Comparison Rate													
	52	75	68	24	40	68	49	31	96	23	−6	−4	−49

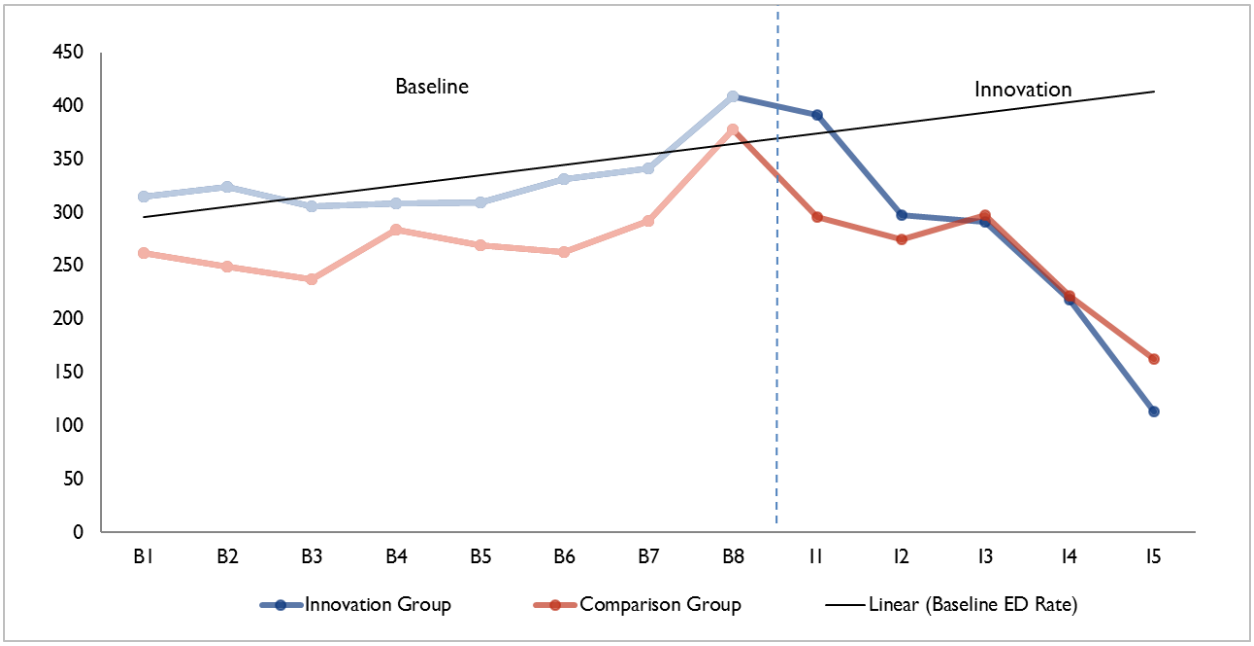
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Bronx RHIO = Bronx Regional Health Information Organization.

Figure 15. ED Visits per 1,000 Medicaid Participants: Bronx RHIO



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization; ED = emergency department.

2.14.2 Regression Results

As shown in ***Table 26***, the average quarterly difference-in-differences estimate for ED visits is a decrease of 15 visits per 1,000 participants relative to the comparison group. This is the average difference in ED visit for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −44, 14). These findings are different from statistically significant increase in ED visits reported in the third annual report. The findings in this report are based on a larger sample size and include two additional intervention quarters.

We also present quarterly effects from a 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 of the quarterly estimates are negative but not statistically significant.

Table 26. 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	56	41	0.175
I2	−27	34	0.420
I3	−70	39	0.071
I4	−36	35	0.304
I5	−52	38	0.175
Overall average	−15	18	0.401
Overall aggregate	−202	240	0.401
Overall aggregate (IY1)	−125	234	0.592
Overall aggregate (IY2)	−76	56	0.175

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2012 to June 2015.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Bronx RHIO = Bronx Regional Health Information Organization.

2.15 Discussion: Medicaid Results

For the innovation period overall, we found a significant decrease in inpatient admission, but no statistically significant changes in total spending, unplanned readmissions, or ED visits for Medicaid beneficiaries. To get a better understanding of the claims results, we also restricted the population to two different types of BRIC reports (asthma and diabetes), and performed subgroup analysis on each cohort. The population from the diabetes BRIC reports (n = 616) showed significant reductions in spending and inpatient admissions, but a similar level of readmissions and ED visits relative to the comparison group. The population from the asthma BRIC reports (n = 848) showed a significant increase in inpatient admissions. The results vary among different subgroups, indicating heterogeneity exists among different BRIC report patients, and we should not generalize the observed spending and utilization patterns across all BRIC report patients.

The Bronx RHIO innovation was indirect. Bronx RHIO aggregated and analyzed data and produced reports for participating pilot test providers but was not involved in the educational or clinical interventions that resulted from those reports. Bronx RHIO collected a negligible amount of information

about interventions with patients. Based on the nature of the innovation, data that might substantiate a direct correlation between BRIC reports and claims results were not collected.

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 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 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 17 percent of the overall population reached by the innovation.

2.16 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 questions.

Bronx RHIO submitted data to RTI that were current through March 2016. ***Table 27*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested. The results of analyses for HbA1c poor control are included in this report.

Table 27. Awardee-Specific Outcome Measures: Bronx RHIO

Evaluation Domains	Subdomains	Measure	Status
Health outcomes	Diabetes	Percentage of patients with diabetes who had hemoglobin A1c > 9.0 %	Data received from Bronx RHIO

Notes:
- **Source:** Patient-level data provided to RTI by Bronx RHIO.
- **Period of activity:** April 2013 to March 2016.

Terms and Definitions
- 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 considers 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.

2.17 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.

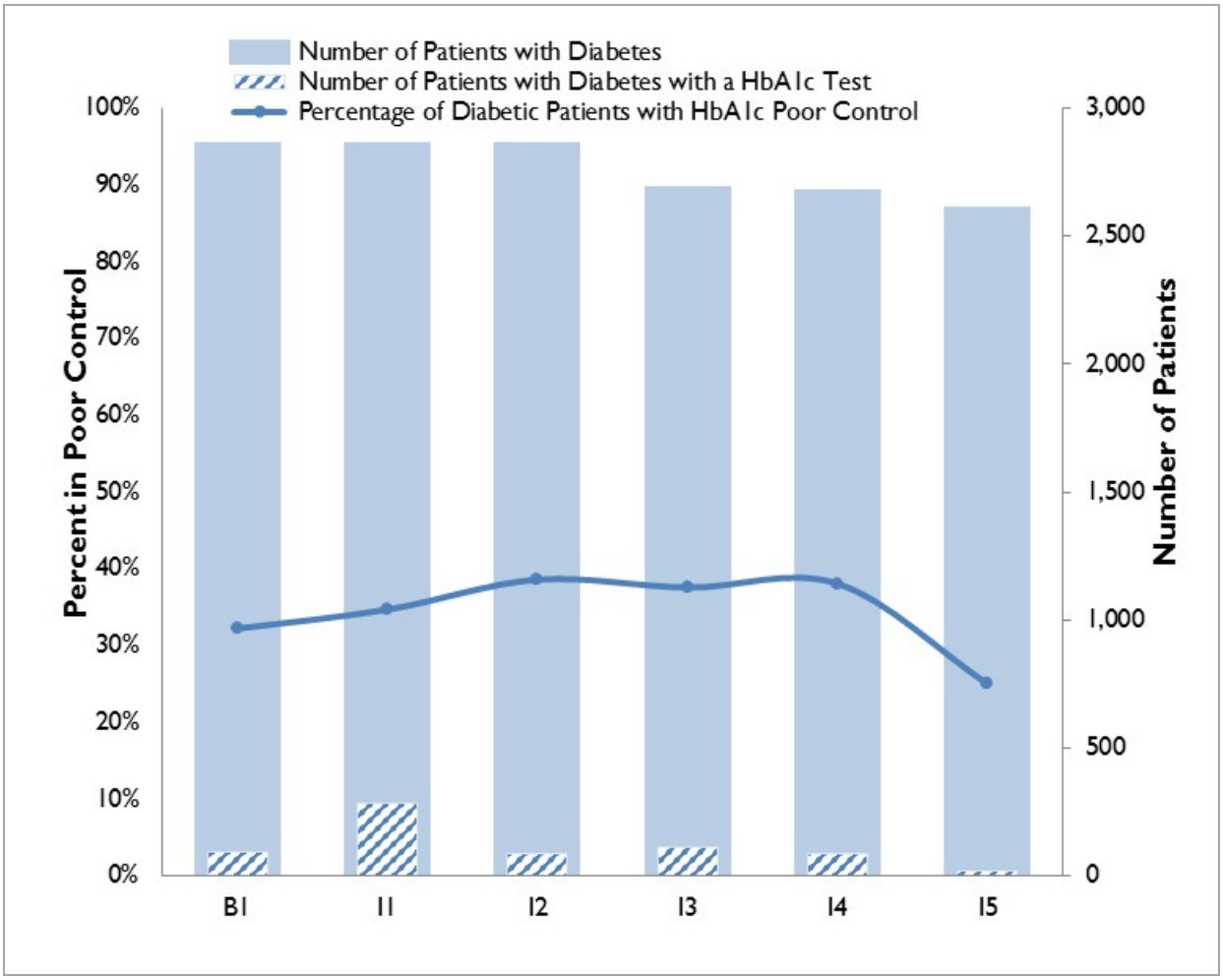
Evaluation Question

- Has the percentage of diabetes patients with poor HbA1c control decreased over time among those enrolled in the innovation?

2.17.1 Descriptive Results

Approximately 10 percent of patients (n=2,817) enrolled in the innovation had diabetes. ***Figure 16*** 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 over time from 34.7 percent in I1 to 38.1 percent in I4. In I5, the percentage with poor HbA1c control dropped to 25 percent. However, it is important to note that the denominator changed dramatically over time, making any interpretation of the findings tentative.

Figure 16. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



	Quarter	B1	I1	I2	I3	I4	I5
●	Percentage of patients with diabetes with poor HbA1c control	32.2	34.7	38.6	37.6	38.1	25.0
	Number of patients with diabetes with a HbA1c test	93	285	88	109	84	16
	Number of patients with diabetes	2,817	2,817	2,817	2,640	2,630	2,562

Notes:

- **Source:** Patient-level data provided to RTI by Bronx RHIO.
- **Period of activity:** April 2014 to March 2016.

Terms and Definitions

- Bronx RHIO = Bronx Regional Health Information Organization.

2.18 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 increased during the first four innovation quarters, but then decreased in I5. However, as noted above, the denominator dropped dramatically in I5, so we caution against any strong conclusions. It is important to note that 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. A nurse practitioner began collecting data on whether patients included in BRIC reports received follow-up care. However, she was only able to gather data on a very small subset of patients, which does not likely represent the actual number of patients who received follow-up care. Therefore, we chose not to report those data in this annual report addendum.

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 28*** lists the quantifiable measures of implementation and their status as of March 31, 2016 that RTI obtained from Bronx RHIO *Narrative Progress Reports* and *Quarterly Awardee Performance Reports.*

The findings presented in the following sections are based on data from Q15 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 28. Measures of Implementation: Bronx RHIO

Evaluation Domains	Subdomains	Measures	Source
Award execution	NCE expenditures	Direct and indirect expenditures during NCE	*Quarterly Awardee Performance Reports*
	Cumulative expenditures	Cumulative direct and indirect expenditures since inception	*Quarterly Awardee Performance Reports*
Workforce development	Staffing	Number of staff in Q15	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q15	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q15	*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 from Bronx RHIO
	Dose	Number/percentage of participants with which the health system followed up after receiving a BRIC report	Data from Bronx RHIO

Notes:

- **Source**: *Quarterly Awardee Performance Reports;* Patient-level data provided to RTI by Bronx RHIO.
- **Period of activity:** June 2012 to March 2016.

Terms and Definitions

- BRIC = Bronx Regional Informatics Center; Bronx RHIO = Bronx Regional Health Information Organization; NCE = no-cost extension.

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. We present here any changes in workforce development occurring in the last 3 months of operation not reported in the third annual report.[2]

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

2.20.1 Hiring and Retention

In Q15 (March 2016), the innovation was staffed with 20 staff members, and 2 separations occurred. Staffing decreased slightly from Q14 (December 2015), due to a reduction of award activity during the no-cost extension period, but was adequate to complete the remaining work.

2.20.2 Skills, Knowledge, and Training

407 trainees received 15,128 hours of training during the award; no new training occurred in Q15.

2.21 Qualitative Findings: Context

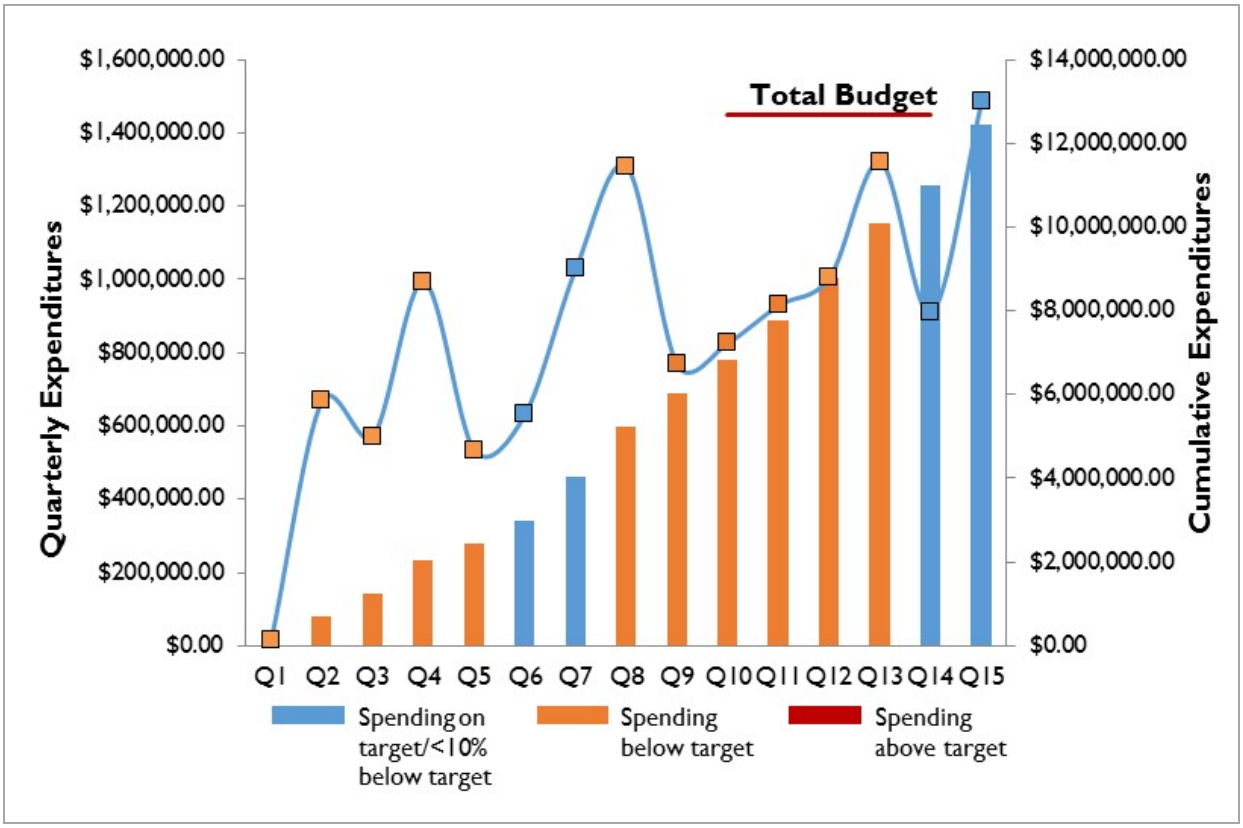
The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. This section provides updates to award execution only, as RTI received no new data on leadership, organizational capacity, or innovation adoption and workflow integration since our previous report.[3]

2.21.1 Award Execution

The annual report highlights the significance of Bronx RHIO's expenditure rates on implementation. As of March 2016 (Q15), Bronx RHIO spent 98.1 percent of its total budget, which is below the projected target (see ***Figure 17***). The Bronx RHIO very nearly spent its entire budget, and was slightly below projections due to staffing decreases during the no-cost extension period.

[3] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Figure 17. Cumulative Spend Rate from Q1 (June 1, 2012) to Q15 (March 31, 2016): Bronx RHIO



Notes:

- **Source:** *Quarterly Awardee Performance Report*.
- **Period of activity:** June 2012 to March 2016.

Terms and Definitions

- Q = quarter; Bronx RHIO = Bronx Regional Health Information Organization.

2.22 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). This section provides an update to the reach measures presented in the Third Annual Report.

2.22.1 Innovation Reach

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 asthma and other (e.g., BRIC report with patient demographic data generated). More than 25 percent of patients

were included in BRIC reports related to asthma, and less than 15 percent were in BRIC reports related to diabetes and geriatrics.

Table 29. BRIC Report Topics by Number and Percentage of Patients

BRIC Report Topic (n=626)	Number of Patients (Percentage) (n=22,485)
Other	9,279 (41.3)
Asthma	6,403 (28.5)
Geriatric	3,068 (13.6)
Diabetes	2,817 (12.5)
Ambulatory intervention	2,196 (9.8)
Four or more diseases	1,593 (7.1)
Nursing/home health	689 (3.1)
Congestive heart failure	37 (0.2)

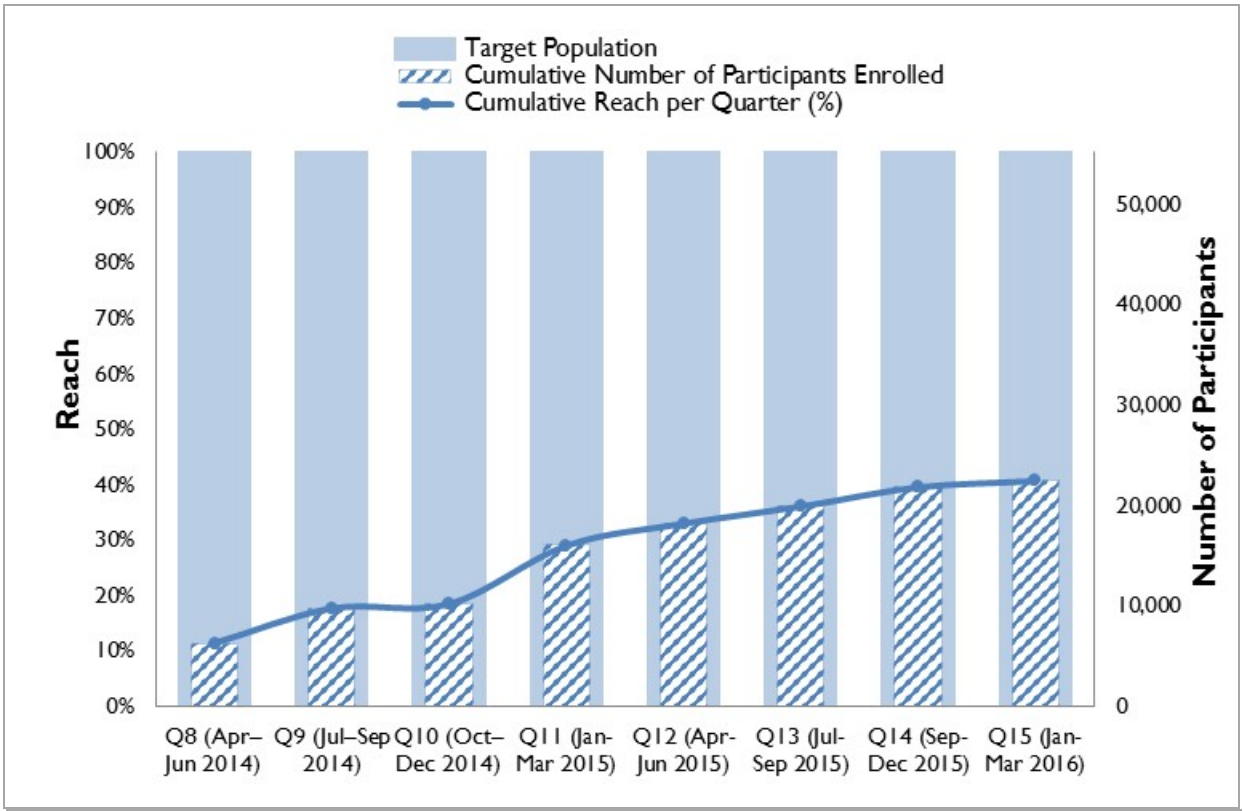
Notes:
- **Source**: Patient-level data provided to RTI by Bronx RHIO.
- **Period of activity:** April 2014 to March 2016.

Terms and Definitions
- Bronx RHIO = Bronx Regional Health Information Organization.

Figure 18 shows reach by quarter since the launch of the innovation based on the 626 BRIC reports with patient-level data that Bronx RHIO provided to RTI through Q15. We last reported reach in third annual report, based on data through Q14. Prior to the completion of this annual report addendum, Bronx RHIO indicated that one BRIC report from Q11 should not have been provided to RTI. That report included 6,977 patients with Hepatitis C. Those patients have been removed from the data for this annual report addendum. Since Q14, Bronx RHIO provided an additional 45 BRIC reports with data, which included an additional 618 unique patients in the innovation; reach 40.7 percent.

While the no-cost extension period allowed Bronx RHIO to incrementally reach additional patients through continued delivery of service, the main focus during this period was on developing and implementing a sustainability plan. No significant change in the approach to optimizing reach occurred.

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



	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)	Q15 (Jan-Mar 2016)
●	Cumulative reach per quarter (%)	11.3	17.6	18.4	29.0	33.0	36.1	39.6	40.7
	Target population	55,215	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	16,022	18,239	19,954	21,867	22,485

Notes:

- **Source:** Patient-level data provided to RTI by Bronx RHIO.
- **Period of activity:** April 2014 to March 2016.

Terms and Definitions

- Q = quarter; Bronx RHIO = Bronx Regional Health Information Organization.

2.22.2 Innovation Dose

Table 30 shows 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. The distribution of these measures is similar to dose last reported in the third annual report, based on data through Q14. More than one-third of participants (39.8%) were included in only one BRIC report, nearly one-third (31.9%) were included in two BRIC reports, with the remaining 28.3 percent included in 3 or more BRIC reports. Notably, patients included in more than one BRIC report are likely in 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.

While the no-cost extension period allowed Bronx RHIO to incrementally increase dose, the main focus during this period, as noted earlier, was on developing and implementing a sustainability plan. No significant change occurred in the approach to optimizing dose.

Table 30. Number and Types of Services Provided to Participants: Bronx RHIO

Number of BRIC Reports in Which Participants were Included	Number of Participants	Percentage (%) of Enrolled Participants (N=22,485)
1 report	8,949	39.8
2 reports	7,166	31.9
3-5 reports	4,975	22.1
6-10 reports	1,185	5.3
11+ reports	210	1.0

Notes:
- **Source**: Patient-level data provided to RTI by Bronx RHIO.
- **Period of activity:** April 2014 to March 2016.

Terms and Definitions
- BRIC = Bronx Regional Informatics Center; Bronx RHIO = Bronx Regional Health Information Organization.

2.23 Qualitative Findings: Sustainability

The sustainability plan for the Bronx RHIO is to provide high-quality, high-value data and analytic support to its members in order to justify the accompanying membership fees in exchange for receiving these ongoing services. Although Bronx RHIO made great progress toward this goal during their original award period, a significant amount of work remained, and a no-cost extension was granted through March 31, 2016. This extension allowed Bronx RHIO time to accomplish technical and visualization application development/refinement, to do the outreach and demonstration of the new tools to inform their members and other unaffiliated providers about the services, and to implement them across the Bronx provider networks.

Bronx RHIO management reported that all sustainability goals were met during the extension period. Bronx RHIO transitioned its pilot project sites to Spectrum, a, web-based tool that allows sites to directly access key data the RHIO was providing in BRIC reports. Sites are now able to access data “on demand”, substantially enhancing their workflows. The Bronx RHIO also expanded its database to include claims data tables, and their initial claims data feed was implemented. Last, the Bronx RHIO’s sustainability plan consisted of successfully contracting with local PPS partners. PPS was created on April 1, 2015 by the NY State Medicaid Delivery System Reform Incentive Payment program. As of March 31, 2016, the Bronx RHIO has a contract with the SBH Health System-led PPS, Bronx Partners for Healthy Communities, and a Memorandum of Understanding in place with Bronx Lebanon Hospital

Center for their PPS, Bronx Health Access. Staff are transitioning to this work as of April 1, 2016. Bronx RHIO achieved sustainability for the duration of these projects and, through Spectrum, is well-positioned to expand delivery of services.

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 one-third of participants (39.8%) were included in one BRIC report, nearly one-third (31.9%) in two BRIC reports, and the remaining 28.3 percent in three or more BRIC reports.	***Innovation reach:***	22,485 patients, 40.7 percent of the target population, were enrolled in the innovation.
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:***	Nearly half of participants (49.4%) were 45 to 74 years of age, and 55.5 percent were female. Among participants for whom RTI received data, 35.7 percent were black, 26.1 percent were Hispanic, and around 20 percent were white. Less than one-half had Medicaid or Medicare (40.3% and 43.1%, respectively).
Sustainability:	Pilot sites transitioned to a web-based tool for direct access to Bronx RHIO data without manual intervention by Bronx RHIO staff. To sustain the Bronx RHIO, contracts were secured to support two provider systems in their multiyear Medicaid reform projects effective April 1, 2016, and all BRIC staff employed directly by the RHIO were reassigned to work on those projects.		
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 (−$345; 90% CI: −$630, −$60). Medicaid spending did not change significantly (−47; 90% CI: −$237, $144).

Better care. Total changes in inpatient stays and unplanned inpatient readmissions for Medicare beneficiaries were statistically significant and amounted to 9 (90% CI: −15, −2) fewer inpatient stays per 1,000 participants per quarter, but 26 (90% CI: 3, 50) more readmissions per 1,000 admissions per quarter. ED visits per 1,000 participants per quarter did not change significantly (−2; 90% CI: −11, 6). Changes in ED visits (−15; 90% CI: −44, 14) and unplanned readmissions (−6; 90% CI: −43, 31) did not change significantly for Medicaid beneficiaries. However, inpatient admissions for Medicaid beneficiaries decreased significantly, amounting to 17 (90% CI: −29, −4) fewer inpatient stays 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 report poor HbA1c control over time for those with diabetes. The percentage of those with poor HbA1c control increased slightly through I4 (from 34.7% to 38.1%).

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

Children's Hospital and Health System

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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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Children's Hospital

Data Source	Period Covered
Medicaid claims data	November 2012–March 2015
Terms and Definitions • Children's Hospital = Children's Hospital and Health System, Inc..	

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), 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 household members. Children's Hospital sought to achieve the following HCIA goals:

1. **Smarter spending.**

   Goal: Decrease annual ED visits by a total of 2,030 for CCHP members (for a savings of $406,000).

   Findings: Total health care spending trended downward. We found statistically insignificant savings of $161 per member per quarter for all members, and statistically significant savings of $269 per member per quarter for those who received all three home visits. The innovation has a 93 percent overall probability of generating savings.

2. **Better care.**

   Goal: Educate and empower members to navigate the health care system and use preventive care so that ED visits are avoided when possible.

   Findings: We found statistically significant lower inpatient admissions for the innovation group, a reduction that was statistically significant for those who completed the innovation but not for partial completers. The probability of readmissions for the innovation group also showed a statistically significant reduction. ED and primary care visits did not change significantly for the innovation group. We did not find statistically significant results in the dose analysis on the probability of readmission or number of ED and primary care visits.

[1] In the Q7 report, this name was changed to Care Links.

3. **Healthier people**.

   Goal: Improve management of chronic diseases, including diabetes and asthma.

   Findings: None to report.

Spending and Utilization Overview

Table 2 summarizes findings based on Medicaid claims collected during the innovation period. The average spending differential in the innovation period, indicating savings for the innovation group, is −$161 per participant per quarter. This difference is not statistically significant (90% CI: −$338, $5). Inpatient admissions decreased, on average, by 20 admissions per 1,000 participants per quarter relative to the comparison group. The effect is statistically significant (90% CI: −38, –2). The effect is statistically significant (90% CI: −186, −8). ED visits decreased by an average of 18 ED visits per 1,000 participants per quarter relative to the comparison group. The effect is not statistically significant (90% CI: −94, 58).

We conducted a dose analysis to assess whether receiving all three home visits (i.e., completing the innovation), when compared to receiving one or two home visits (i.e., partially completing the innovation), had a "dose effect" whereby those who had more support better managed their health condition. The dose analysis shows statistically significant average savings of −$269 (90% CI: −$465, −$73) per member for innovation completers, and nonsignificant savings of $19 (90% CI: −$248, $209) for partial completers. There is a statistically significant decrease of 31 inpatient admissions per 1,000 participants for innovation completers (90%CI: −50, −13), and a nonstatistically significant decrease of 4 inpatient admissions per 1,000 participants for partial completers (90% CI: −28, 21). There is a reduction in readmissions of 96 per 1,000 admissions among completers (90% CI −198, 6) and 98 per 1,000 among noncompleters (90% CI -204, 8), both not statistically significant. The dose analysis shows a decrease of 43 ED visits per 1,000 participants for innovation completers (90% CI –130, 44) and an increase of 19 ED visits per 1,000 participants for partial completers (90% CI -91, 128). However, neither difference is statistically significant. Overall, those who completed the innovation showed reduced spending and inpatient admissions than those who only partially completed the innovation. There was no differential impact on ED visits or readmissions.

Table 2. Summary of Medicaid Claims-Based Findings: Children's Hospital

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI
Aggregated results							
Total spending (in millions)	−$0.294	−$0.618, $0.029	−$0.547, −$0.426	−$0.207	−$0.488, $0.064	−$0.088	−$0.196, $0.021
Acute care inpatient stays	−37	−70, −4	−63, −11	−21	−51, 9	−15	−28, −2
Hospital-wide all-cause unplanned readmissions	−12	−22, −2	−20, −4	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−33	−172, 106	−141, 75	6	−119, 132	−40	−99, 20
Average impact per quarter							
Spending per participant	−$161	−$338, $5	−$299, −$23	−$113	−$262, $35	−$48	−$107, $11
Acute care inpatient stays (per 1,000 participants)	−20	−38, −2	−34, −6	−15	−35, 6	−42	−81, −3
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−97	−186, −8	−166, −28	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−18	−94, 58	−77, 41	4	−81, 90	−110	−277, 56

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** February 2011 to March 2015.
- **Sample size**: 535 unique Medicaid beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Children's Hospital = Children's Hospital and Health System, Inc.

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, ED visits that do not lead to a hospitalization, and primary care visits. 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?
- Has the innovation increased primary care visits?
- Do patients who receive all three homes visits have lower health care spending, lower hospital utilization, and higher primary care utilization than those who receive only one or two home visits?

Table 3 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 3. Claims-Based Outcome Measures: Children's Hospital

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

Notes:

- The innovation only serves Medicaid patients; therefore, we do not present Medicare claims analyses.

Terms and Definitions

- ED = emergency department; Children's Hospital = Children's Hospital and Health System, Inc.

The primary source of Medicaid data for evaluating HCIA awardees is the Centers for Medicare & Medicaid Services Alpha-MAX data files. However, as of June 2016, 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 used 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.

As of March 2015, 5,103 potential Care Links participants (i.e., with at least 2 ED visits in the 6 months prior to enrollment) were contacted and located. 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 enrolled patients 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 all measures between groups of participants (innovation group) and statistically matched nonparticipants (comparison group).

2.3 Medicaid Comparison Group

In addition to including patients who enrolled but did not receive any home visits, the comparison group also includes patients who declined services. Patients with no 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. This approach might suffer from selection bias if unobservable characteristics, not controlled for in the analysis, are associated with the probability of declining services and the outcome variables of interest. However, the same would apply if the comparison group was restricted to those with no home visits. The comparison group includes both patients with no home visits and those who declined services because those who declined services were also originally selected for the innovation as part of the prioritization process Children's Hospital created. Therefore, it is reassuring that results for those who did not receive any home visits were similar to those who declined services. By including those who declined services, we increased the comparison group sample size considerably. For these four reasons, the claims analysis compares those with at least one home visit to those who declined or accepted but did not receive any visit.

In addition to comparing Children's Hospital's innovation participants before and after implementation of the innovation, the claims analysis compares all measures between groups of participants or potential participants (innovation group) and statistically matched nonparticipants (comparison group). The previous claims analysis in the third annual report did not adjust the comparison group to match the innovation group.[2] Further evaluation of observable characteristics revealed statistically significant differences between the two groups that could affect the results.

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

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

age, gender, race, number of ED visits, inpatient admissions, readmissions and primary care visits, and expenditures 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 4 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, all innovation beneficiaries had an appropriately matched comparison beneficiary.

Table 4. Mean Values and Standardized Differences of Variables in Propensity Score Model: Children's Hospital

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	18.31	14.98	19.23	14.76	0.062	18.31	14.98	18.83	14.32	0.035
Percentage male	15.38	36.08	9.01	28.63	0.196	15.38	36.08	16.11	36.77	0.020
Percentage white	8.92	28.50	4.85	21.49	0.161	8.92	28.50	8.74	28.24	0.006
Percentage black	22.55	41.79	10.31	30.41	0.335	22.55	41.79	24.50	43.01	0.046
Percentage Hispanic	13.81	34.50	4.25	20.16	0.338	13.81	34.50	13.26	33.91	0.016
Percentage Asian	0.35	5.90	0.09	3.05	0.055	0.35	5.90	0.41	6.37	0.009
Percentage Native American	0.35	5.90	0.23	4.82	0.022	0.35	5.90	0.12	3.41	0.048
Inpatient admissions	0.11	0.48	0.09	0.40	0.048	0.11	0.48	0.10	0.46	0.014
Readmissions	0.03	0.26	0.02	0.21	0.040	0.03	0.26	0.02	0.25	0.007
ED visits	1.90	1.56	1.67	1.34	0.157	1.90	1.56	1.87	1.48	0.018
Primary care visits	4.12	5.01	3.08	4.11	0.226	4.12	5.01	4.02	5.64	0.018
Expenditures	1,419	3,220	1,372	4,380	0.012	1,419	3,220	1,444	3,807	0.007
Number of beneficiaries	535	—	2,143	—	—	535	—	994	—	—
Number of weighted beneficiaries	—	—	2,143	—	—	535	—	535	—	—

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.

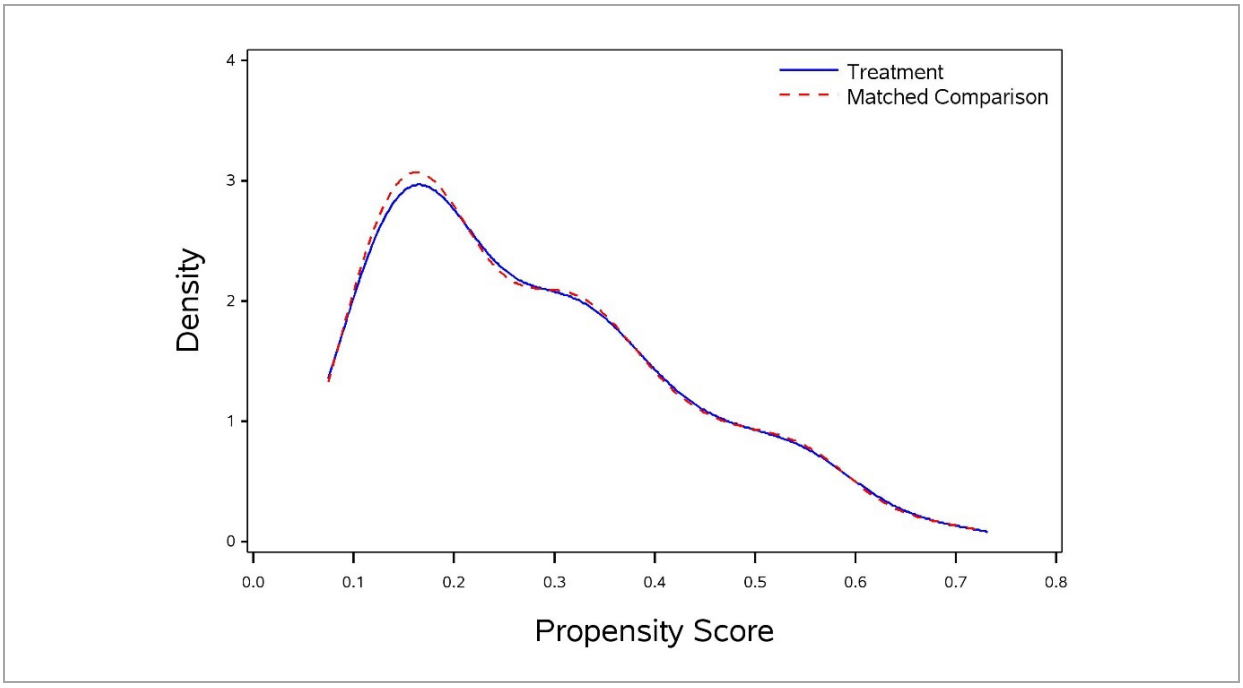
Terms and Definitions

- SD = standard deviation; — not applicable; Children's Hospital = Children's Hospital and Health System, Inc.

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 4). 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 4 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: Children's Hospital



Notes:

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

Terms and Definitions

- Children's Hospital = Children's Hospital and Health System, Inc.

The following sections present descriptive and regression results for the four core measures and primary care visits. 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 had a zero payment if the patient had a

[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.

non-missing claim before and after the quarter where the claim was 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. This analysis uses data directly provided by Children's Hospital.

The regression analyses in the sections below determine the impact of the innovation on spending, number of hospital visits, number of ED visits, probability of hospital readmission, and number of primary care visits. 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 community health navigators identified the patient's most critical needs in the first visit, the second and, particularly, the third visits were more targeted at the patient's chronic 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, primary care, and ED visits.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 5 reports Medicaid spending per patient in the 8 quarters before and the 8 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 5 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 during I1 and higher spending afterward. However, the standard deviation in spending is high for both groups, the data points tend to be spread over a wide range of values rather than at the mean, as shown in Table 5. The regression analysis that follows assesses the impact of the innovation on the difference in spending between the innovation and comparison groups.

Table 5. 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	$1,254	$1,090	$1,015	$882	$747	$774	$721	$717
Std dev	$3,250	$1,919	$1,696	$1,966	$1,371	$2,298	$2,644	$3,314	$2,580	$2,077	$2,344	$1,629	$1,427	$1,307	$982	$1,108
Unique patients	196	230	286	353	416	481	538	535	513	434	307	214	146	107	66	39
Comparison Group																
Spending rate	$760	$716	$869	$1,014	$954	$775	$957	$1,497	$1,228	$1,291	$1,028	$914	$967	$875	$1,002	$888
Std dev	$1,717	$1,604	$1,953	$3,616	$2,163	$1,791	$1,690	$3,924	$2,596	$3,947	$4,156	$2,290	$2,949	$2,957	$6,117	$1,534
Weighted patients	183	214	261	328	392	463	523	535	503	451	358	265	164	108	53	17
Savings per Patient																
	−$224	−$261	−$62	$5	$105	−$312	−$219	$38	−$26	$201	$13	$32	$220	$101	$281	$171

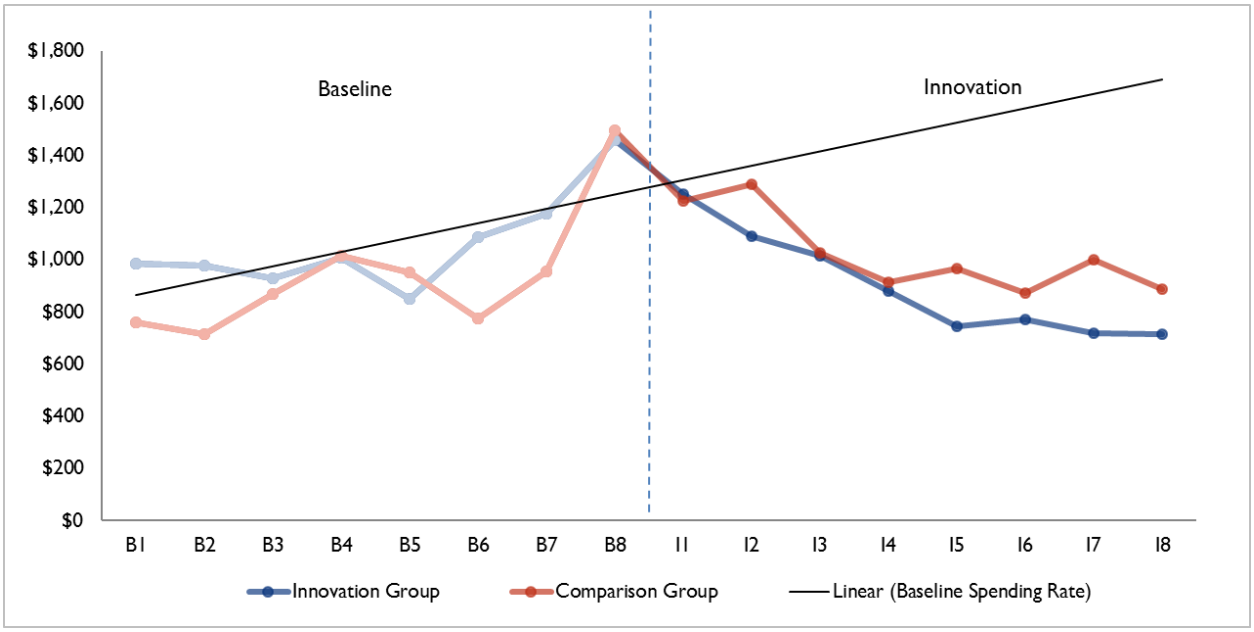
Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Children's Hospital = Children's Hospital and Health System, Inc.

Figure 2. Medicaid Spending per Participant: Children's Hospital



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- 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 −161 (90% CI: −$338, $5). This effect is not statistically significant. This result is similar to the finding in the third annual report. 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, e also present quarterly effects. ***Table 6*** 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 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 I2, I5, and I7, where the change in spending was on average $300 lower in the innovation group. The differences in spending estimates are not statistically significant for all quarters. Even though the lower spending among innovation group individuals is not statistically significant for all

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 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	−47	144	0.745
I2	−284	177	0.109
I3	−123	193	0.525
I4	−104	165	0.530
I5	−310	206	0.132
I6	−117	303	0.698
I7	−359	508	0.480
I8	−160	391	0.682
Overall average	−161	108	0.134
Overall aggregate	−294,627	196,625	0.134
Overall aggregate (IY1)	−206,914	164,583	0.209
Overall aggregate (IY2)	−87,713	65,940	0.183

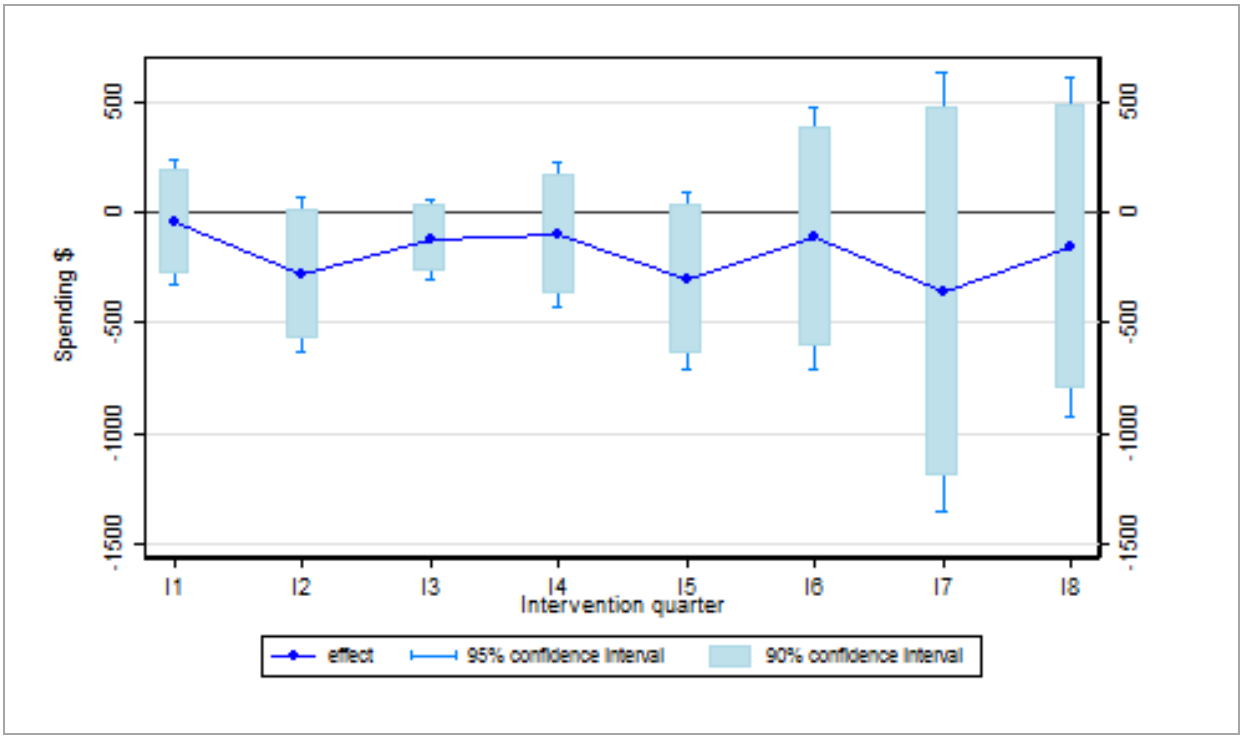
Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **The regression coefficients** are 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 as compared to their matched comparison group
- I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Children's Hospital = Children's Hospital and Health System, Inc.

Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Children's Hospital



Notes:

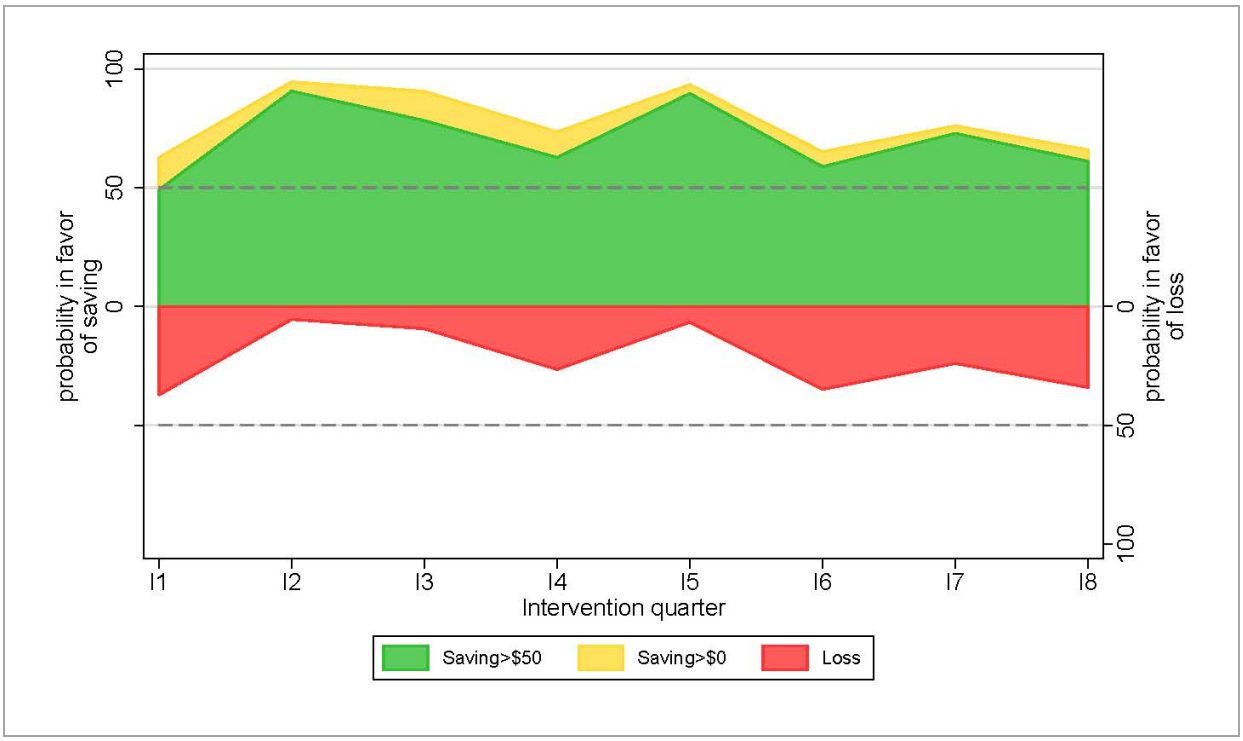
- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- OLS = ordinary least squares.
- Children's Hospital = Children's Hospital and Health System, Inc.

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 for the hypothesis for saving or losing money on this initiative. The figure shows that the innovation has a considerably higher probability of generating savings rather than losses throughout all innovation periods. The innovation has a 93 percent overall probability of generating savings.

Figure 4. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Children's Hospital



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- Children's Hospital = Children's Hospital and Health System, Inc.

Table 7 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 −$161 (90% CI: −$338, $16) and −$269 (90% CI: −$465, −$73) per member for the full innovation and innovation completer groups, respectively. This effect is statistically significant for innovation completers. Partial completers have nonsignificant savings of $19 (90% CI: −$248, $209). Our results show that the innovation generates savings overall (although this effect is not statistically significant), particularly when all three home visits are delivered (this effect is statistically significant).

Table 7. 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	−161	108	0.134
Innovation completers	−269	119	0.024
Partial completers	−19	139	0.889

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.
- Completers received all three home visits and partial completers received one or two home visits.

Terms and Definitions

- **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
- Children's Hospital = Children's Hospital and Health System, Inc.

Table 8 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 a statistically significant difference exists between the coefficients for each innovation group within each quarter. The results in Table 8 show that the change in spending among those who completed the innovation is much lower than for partial completers except for I8. The trend shows consistent savings throughout all quarters for completers, and all quarters except for I4 for partial completers. The quarterly changes are statistically significant in innovation quarters I2, I5 and I7 for treatment completers, all other changes are not statistically significant. The coefficients of the two innovation groups are not significantly different from each other for all quarters. The results reinforce the finding that those who completed the innovation are driving the downward spending trend. This finding is consistent with the findings in the third annual report.

Table 8. 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	−73	193	0.703	100.9	223.0	0.651	0.503
I2	−358	205.6	0.0814	−29.90	239.6	0.901	0.241
I3	−231	239.6	0.334	−46.14	270.6	0.865	0.568
I4	−277	275.7	0.315	18.66	326.6	0.954	0.445
I5	−593	332.2	0.0743	−268.3	396.9	0.499	0.486
I6	−190	387.4	0.623	−39.09	480.1	0.935	0.782
I7	−833	497.0	0.0939	−369.3	642.2	0.565	0.513
I8	0	702.1	1.000	−49.15	849.5	0.954	0.957

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.
- Completers received all three home visits and partial completers received one or two home visits.

Terms and Definitions

- **The regression coefficients** are 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.
- Children's Hospital = Children's Hospital and Health System, Inc.

2.5 Medicaid Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 9*** and ***Figure 5***. Inpatient admissions trend upward during the baseline period. After the innovation began, inpatient admissions decrease for the innovation group and fluctuate for the comparison group, remaining below the baseline trend for both groups. These results vary highly. This finding is consistent with the trend in the third annual report. We conducted a regression analysis to assess the impact of the innovation on inpatient admissions, discussed next.

Table 9. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters							
Description	**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	88	85	62	42	34	47	30	26
Std dev	272	371	315	304	301	374	402	495	356	296	291	223	182	212	173	160
Unique patients	196	230	286	353	416	481	538	535	513	434	307	214	146	107	66	39
Comparison Group																
Admit rate	79	65	89	73	101	58	90	108	85	103	58	54	75	96	79	65
Std dev	295	259	299	320	354	262	308	470	360	464	377	281	344	606	295	259
Weighted patients	183	214	261	328	392	463	523	535	503	451	358	265	164	108	183	214
Innovation − Comparison Rate																
	−22	40	−13	9	−12	53	11	8	3	−18	4	−12	−41	−49	−1	−32

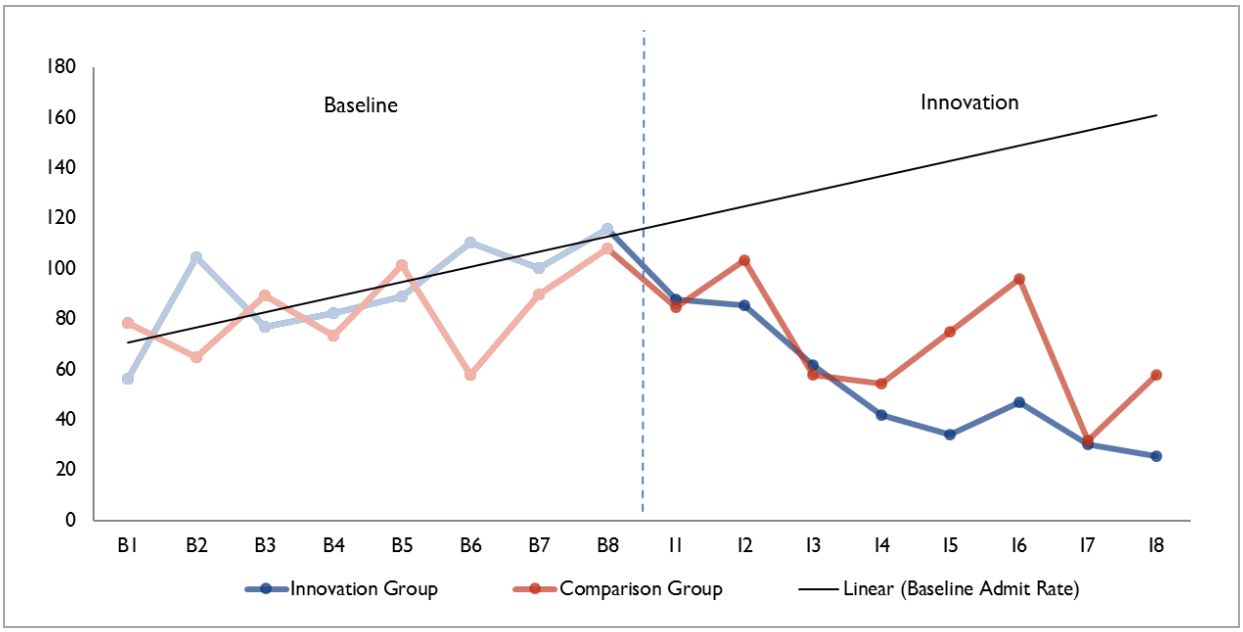
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **Admit rate: (**Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Children's Hospital = Children's Hospital and Health System, Inc.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Children's Hospital



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- Children's Hospital =Children's Hospital and Health System, Inc.

2.5.2 Regression Results

Table 10 shows that the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 20 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: −38, −2).

We also present quarterly effects 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. The only statistically significant result is for I5, where inpatient admissions decrease by 49 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 (90% CI -81, -3).

Table 10. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admissions per 1,000 Medicaid Participants: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	−7	2	0.754
I2	−28	26	0.279
I3	−4	24	0.840
I4	−20	22	0.371
I5	−49	28	0.081
I6	−55	61	0.364
I7	−6	30	0.830
I8	−43	76	0.566
Overall average	−20	11	0.066
Overall aggregate	−37	20	0.066
Overall aggregate (IY1)	−21	18	0.234
Overall aggregate (IY2)	−15	8	0.073

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **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.
- **The negative binomial count model 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 the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
- I = Innovation Quarter; IY = Innovation Year; Children's Hospital = Children's Hospital and Health System, Inc.

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 31 inpatient admissions per 1,000 participants for innovation completers (90%CI: −50, −13), and a nonstatistically significant decrease of 4 inpatient admissions per 1,000 participants for partial completers (90% CI: −28, 21). This result suggests that completing the innovation results in a lower number of inpatient admissions for the innovation group.

2.6 Medicaid Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 11*** and ***Figure 6***. 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. This finding is consistent with the trend in the third annual report. We conducted a regression analysis to assess the impact of the innovation on readmissions, discussed next.

Table 11. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters							
Description	**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	222	27	211	0	0	0	0	0
Std dev	0	373	287	253	0	358	428	428	416	162	408	0	0	0	0	0
Total admissions	11	24	22	29	37	53	54	62	45	37	19	9	5	5	2	1
Comparison Group																
Readmit rate	93	48	43	139	134	38	57	242	141	350	403	209	162	323	0	0
Std dev	290	214	203	346	341	190	231	428	348	477	491	407	369	467	0	0
Total admissions	14	14	23	24	40	27	47	58	43	47	21	14	12	10	2	1
Innovation − Comparison Rate																
	−93	118	48	−70	−134	113	184	0	82	−323	−193	−209	−162	−323	0	0

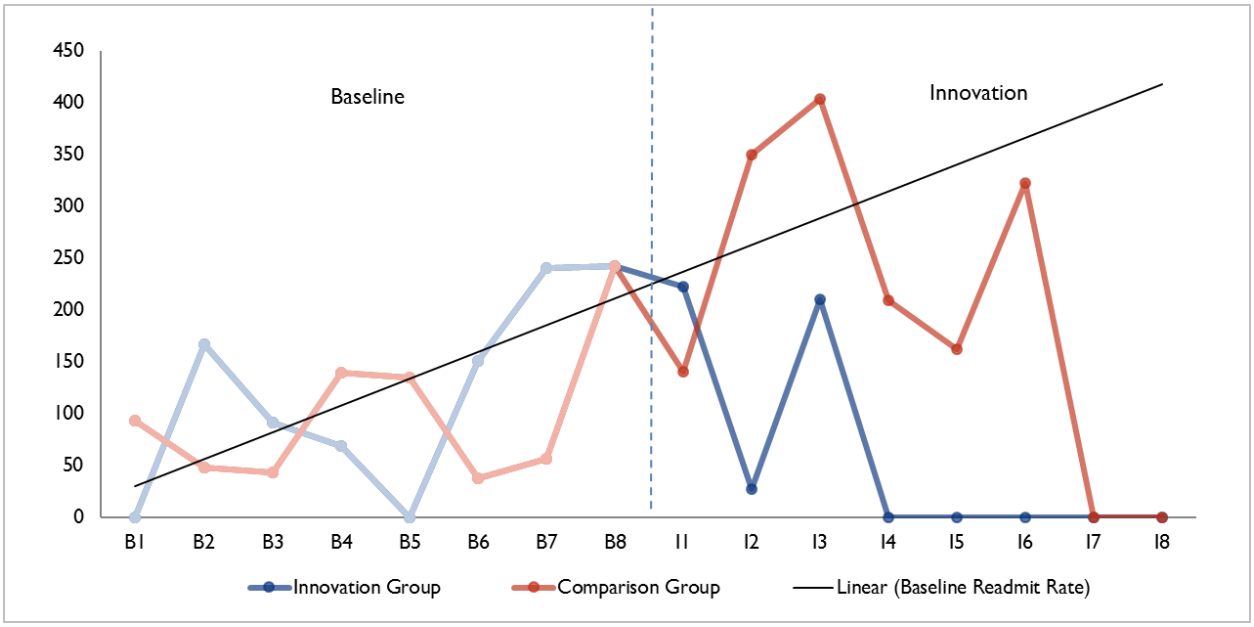
Notes:

- **Source**: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Children's Hospital = Children's Hospital and Health System, Inc.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Children's Hospital



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- Children's Hospital = Children's Hospital and Health System, Inc.

2.6.2 Regression Results

Table 12 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, indicating that the innovation-comparison difference is lower for the innovation group during the innovation period. This is the average difference in readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −186, −8). This finding is consistent with the findings in the third annual report.

Table 12. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
Overall average	−97	54	0.072
Overall aggregate	−12	6	0.082

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **The logistic regression model regression coefficient** is the simple difference-in-differences estimate. Besides the innovation indicator, 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.

We also completed a dose analysis that tested for reductions in readmissions separately for completers and noncompleters for all innovation quarters. The reduction in readmissions was 96 per 1,000 admissions among completers (90% CI −198, 6) and 98 per 1,000 among noncompleters (90% CI −204, 8).

2.7 Medicaid Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 13*** and ***Figure 7.*** 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. This finding is consistent with the trends in the third annual report. Regression results in the next section assess whether quarterly differences in ED visit rates between the innovation and comparison groups are affected by the innovation.

Table 13. ED Visits per 1,000 Medicaid Participants: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters							
Description	**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	1,355	988	847	804	760	860	636	795
Std dev	1,238	1,078	1,368	1,196	1204	1,316	1,508	1,564	1,804	1,693	1,313	1,162	1,564	1,707	835	1,321
Unique patients	196	230	286	353	416	481	538	535	513	434	307	214	146	107	66	39
Comparison Group																
ED rate	700	751	760	704	732	792	1,056	1,912	1,201	814	746	793	928	726	648	673
Std dev	939	1,120	1,218	1,154	1,100	1,068	1,238	1,504	1,473	1,265	1,251	1,481	1,554	1,064	974	1,084
Weighted patients	183	214	261	328	392	463	523	535	503	451	358	265	164	108	53	17
Innovation − Comparison Rate																
	106	41	159	118	109	152	275	9	153	174	101	10	−168	133	−11	122

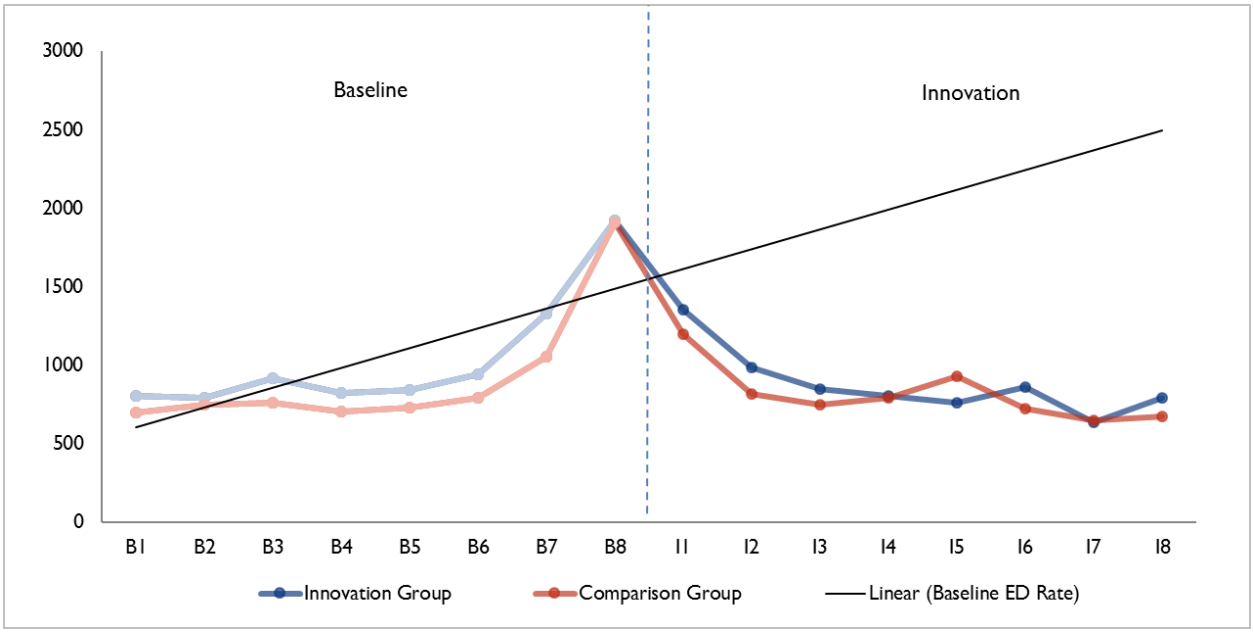
Notes:

- **Source**: RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Children's Hospital = Children's Hospital and Health System, Inc.

Figure 7. ED Visits per 1,000 Medicaid Participants: Children's Hospital



Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- ED = emergency department.
- Children's Hospital = Children's Hospital and Health System, Inc.

2.7.2 Regression Results

Table 14 shows that 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 not statistically significant (90% CI: −94, 58). This finding is consistent with the findings in the third annual report.

We also present quarterly effects derived from 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 I1 and I2 and decreases thereafter, up to I6, where it increases again and fluctuates up to I8. 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 14. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	6	100	0.951
I2	63	94	0.501
I3	−8	97	0.934
I4	−103	113	0.359
I5	−283	175	0.106
I6	52	190	0.782
I7	−99	170	0.561
I8	64	286	0.823
Overall average	−18	46	0.693
Overall aggregate	−33	84	0.693
Overall aggregate (IY1)	6	76	0.934
Overall aggregate (IY2)	−40	36	0.274

Notes:

- **Source:** RTI analysis of Medicaid managed care claims data provided by Children's Hospital.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **The negative binomial count model 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 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; Children's Hospital = Children's Hospital and Health System, Inc.

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 43 ED visits per 1,000 participants for innovation completers (90% CI −130, 44) and an increase of 18 ED visits per 1,000 participants for partial completers (90% CI −91, 128). However, neither difference is statistically significant.

2.8 Medicaid Primary Care Visits

2.8.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 15*** and ***Figure 8.*** As shown by the baseline trend line for innovation enrollees, primary care visits increase slightly in the baseline quarters. The number of innovation group primary care visits is greater than the number of comparison group primary care visits for all innovation periods except I6, and increases steeply after I7. Community health navigators provide outreach and education services about the appropriate places to receive care. The services include helping make appointments for a primary care visit, which might explain an increase in

the number of primary care visits in the innovation group for all innovations periods except I6. The higher increase of primary care visits in the last two quarters of the innovation is also associated with a reduced sample size and high standard deviations, the data points tend to be spread over a wide range of values rather than at the mean. The regression analysis in the next section assesses the impact of the innovation in the difference in the number of primary care visits between the innovation and comparison groups.

Table 15. Primary Care Visits per 1,000 Medicaid Participants: Children's Hospital

Awardee Number: 1C1CMS330974
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters							
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**
Innovation Group																
Primary care rate	2,990	3,117	3,500	3,598	3,584	3,362	3,461	4,067	3,741	3,758	3,560	3,505	3,158	2,785	3,909	5,846
Std dev	3,948	3,788	4,378	6,397	4764	4,263	4,419	4,823	4,848	4,605	4,879	4,930	5,158	3,418	4,627	11,731
Unique patients	196	230	286	353	416	481	538	535	513	434	307	214	146	107	66	39
Comparison Group																
Primary care rate	2,726	2,514	2,592	2,725	3,040	2,700	2,899	4,097	3,423	3,065	3,191	2,864	2,860	3,022	2,359	2,942
Std dev	3,676	3,348	3,933	3,999	4,282	3,551	3,746	5,759	4,573	4,567	4,067	3,876	4,734	5,836	2,648	3,378
Weighted patients	183	214	261	328	392	463	523	535	503	451	358	265	164	108	53	17
Innovation − Comparison Rate																
	264	603	908	873	544	662	562	−30	318	693	369	641	298	−237	1,550	2,904

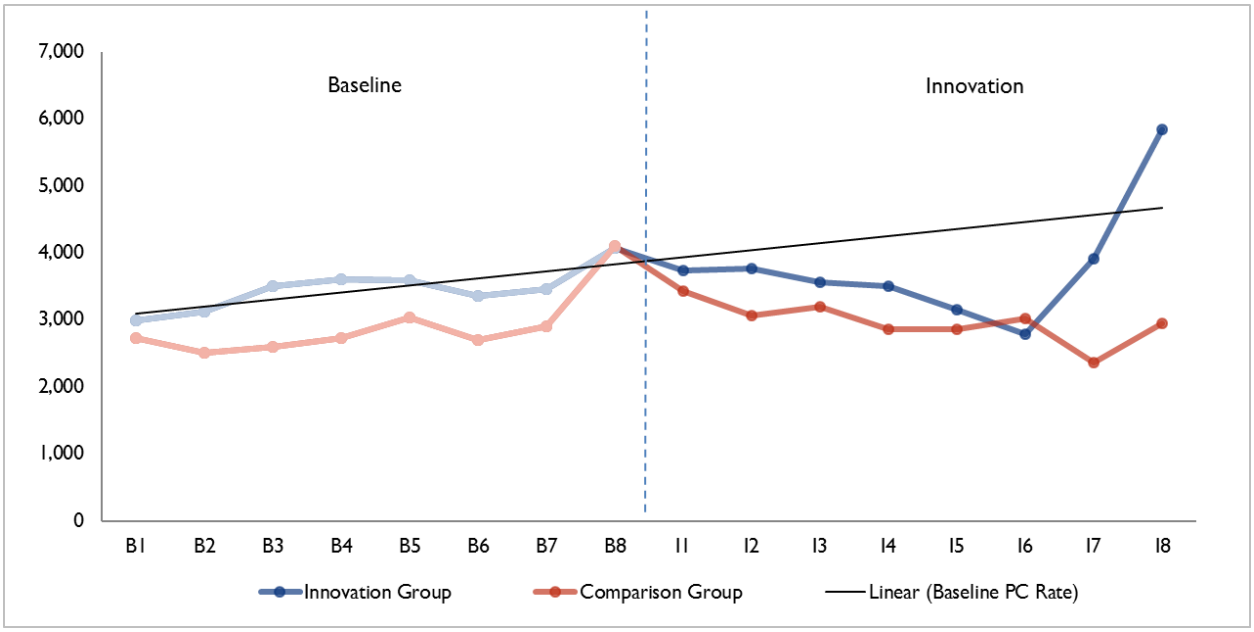
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative values indicate fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; Children's Hospital = Children's Hospital and Health System, Inc.

Figure 8. Primary Care Visits per 1,000 Medicaid Participants: Children's Hospital



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- Children's Hospital = Children's Hospital and Health System, Inc.

2.8.2 Regression Results

Table 16 shows the average quarterly difference-in-differences estimate for primary care visits is a decrease of 20 primary care visits per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −267, 226).

We also present quarterly effects derived from a model with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. The number of primary care visits for the innovation group, relative to the comparison group, increases for innovation quarters I2, I4, I7 and I8, and decreases for the other innovation quarters. The only statistically significant result is for I7, where primary care visits increase by 1,098 per 1000 participants.

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicaid Participants: Children's Hospital

Quarter	Coefficient	Standard Error	P-Values
I1	−253	283	0.371
I2	213	308	0.490
I3	−282	348	0.418
I4	116	396	0.769
I5	−163	533	0.760
I6	−722	635	0.256
I7	1,098	659	0.096
I8	2,326	1,757	0.186
Overall average	−20	150	0.893
Overall aggregate	−37	273	0.893
Overall aggregate (IY1)	−99	240	0.680
Overall aggregate (IY2)	62	131	0.636

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** February 2011 to March 2015.

Terms and Definitions

- **The negative binomial count model 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 the innovation and comparison groups and for quarterly effects that have the same impact on the innovation and comparison groups.
- **Overall average:** 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.
- Children's Hospital = Children's Hospital and Health System, Inc.

The dose analysis for the average difference in the number of primary care visits for innovation completers and partial completers, when compared to the comparison group and for all innovation quarters, shows a decrease of 131 visits per 1,000 participants for innovation completers (90% CI −388, 127) and an increase of 150 visits per 1,000 participants for partial completers (90% CI −236, 535). However, no difference is statistically significant.

2.9 Discussion: Medicaid Results

The trend in the estimated quarterly spending differences for innovation participants suggests that that the innovation might lead to long-term savings; however, this result was not statistically significant at conventional significance levels. We found that the innovation has a 93 percent overall probability of generating savings and that participants who received all three home visits are driving the downward spending trend. We see statistically insignificant savings of $161 per member per quarter for all members and statistically significant savings of $269 per member per quarter for those who received all three home visits. Those who received all three home visits (i.e., completers) were slightly younger on average (18 years old) compared to those who did not complete all three home visits (noncompleters) 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 show statistically significant reductions in the number of inpatient admissions for the innovation group relative to the comparison group. The dose analysis found statistically significant results for a decrease in inpatient admissions for those who completed the innovation but not for partial completers. The probability of readmissions for the innovation group has a statistically significant reduction compared to the comparison group. ED visits decrease for the innovation group compared to the comparison group, but the difference is not statistically significant. The number of primary care visits for the innovation group also decreases, relative to the comparison group, but the difference is not statistically significant. We did not find statistically significant results for dose analysis on the probability of readmission or number of ED and primary care visits.

The Medicaid results are somewhat consistent with the innovation's theory of change because Children's Hospital targeted its innovation to CCHP members who were at a high risk for ED use. CHNs provided support services including home visits, health education and counseling, and referral to follow-up care to reduce inappropriate ED use and increase use of primary care. Based on the type and dose of services that patients typically received, the innovation possibly resulted in savings and fewer inpatient admissions among completers. Since Children's Hospital did not target patients post discharge, changes in readmissions were not anticipated.

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.

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 $269 (90% CI: −$465, −$73) 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: −$339, $17).

Better care. We found a significant pattern of lower inpatient admissions per 1,000 participants per quarter for the innovation group, (−20; 90% CI: −38, −2) over the course of the innovation. We found a larger statistically significant decrease in inpatient admissions per 1,000 participants per quarter overall only for those who completed the innovation (−31; 90% CI: −50, −13). We also found a statistically significant reduction in the overall probability of readmissions per 1,000 admissions per quarter for the innovation group (−97; 90% CI: −185, −8). Average quarterly changes in ED visits were not significant for the innovation group (−18; 90% CI: −93, 58).

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 Addendum 2017

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 interviews through the 15th or 16th and final 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. RTI has 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 Addendum: Curators

Data Source	Period Covered
Awardee Narrative Progress Report	February 2013–Q16 (June 2016)
Quarterly Awardee Performance Report	February 2013–Q16 (June 2016)
Medicare	February 2013–June 2016
Medicaid	February 2013–June 2016
Awardee-specific data	February 2013–June 2016

Terms and Definitions

- Curators = Curators of the University of Missouri.

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 used a combination of advanced information technology tools (High Tech) and comprehensive health care coordination (High Touch) to improve outcomes for Medicare and Medicaid patients receiving services in a primary care setting. 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. Below we present the goals, as well as the findings, for the innovation.

1. **Smarter spending.**

   Goal: Achieve a net savings of $17.7 million over the 3.5 years of the project by providing targeted services.

   Findings: Medicare beneficiaries incurred higher spending than their comparison group in all innovation years after the innovation launch and have a 100 percent probability of incurring a loss. Medicaid beneficiaries incurred higher spending in the first innovation year and have an overall 79 percent probability of incurring a loss. Increased spending in the short term may be expected, as nurse care managers (NCMs) connected patients to appropriate care.

2. **Better care.**

   Goal: Provide appropriate care to patients through improved coordination, a focus on preventive care services, and patient engagement.

   Findings: 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. Increased inpatient visits could reflect innovation participants accessing appropriate treatment for chronic conditions. Differences in utilization between the innovation and comparison groups become less evident over time, consistent with the innovation's theory of change.

   Curators enrolled 100 percent of its target population by July 2012. Most coronary artery disease (CAD) patients were prescribed aspirin or clopidogrel and received a low-density lipoprotein cholesterol (LDL) test during their enrollment period. Similarly, a majority of patients with chronic obstructive pulmonary disease (COPD) were prescribed an inhaled bronchodilator. In addition,

most diabetes patients received an HbA1c test or an LDL-C test, and nearly all patients with hypertension received at least one blood pressure reading.

3. **Healthier people**.

   Goal: Improve management of chronic diseases, including asthma, CAD, COPD, diabetes, and hypertension.

   Findings: Overall changes in health outcomes were nominal: in both higher- and lower-risk tiers some patients with specific conditions improved. In higher-risk tiers, patients' Hba1c control improved. In lower-risk tiers, those with CAD and diabetes had improved LDL control.

   These results may be due to characteristics of the innovation or because measures of long-term conditions may require more time to demonstrate meaningful results.

   Curators achieved high implementation effectiveness and sustained its innovation. Curators established a cohort of enrolled patients, so cumulative reach remained at 100 percent throughout the award. Approximately two-thirds of enrolled patients received an NCM-provided service, and patients who had the greatest need for services were most likely to receive them. Early sustainability planning gave the Curators team time to plan for hiring NCMs and incorporating health IT tools and population management into the University health system. During the final 6 months of the award, Curators focused on showing the impact of the innovation and disseminating findings; they conducted additional analyses and wrote articles for peer-reviewed publications.

2.1.1 Spending and Utilization Overview

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)15–16 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through June 30, 2016.

Table 2. Summary of Updates as of Quarter 16, June 30, 2016: Curators

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2016)
Innovation Components	The 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 nurse care managers (NCMs).
Program Participant Characteristics	Demographic characteristics of all participants enrolled in innovation did not change since third annual report (https://downloads.cms.gov/files/ cmmi/hcia-communityrppm- thirdannualrpt.pdf). Majority (77.7%) of participants aged 45 or older; most (60.1%) were female. Most (85.8%) were white; about 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 January and June 2016, staffing remained constant at 2.5 FTEs. This met the effort expected during the NCE period, and was adequate to complete the remaining tasks.
Skills, knowledge, and training	Curators did not provide any new training in Q15 or Q16. By the end of June 2016, Curators provided 4,632.25 hours of training to 1,295 individuals on the LIGHT^2 tools and innovation goals.
Context	
Award execution	Curators spent 95.4% of its total budget as of Q16.
Leadership	Project leadership remained constant since inception and addressed challenges with attribution, tiers, and claims data analysis.
Organizational capacity	Project director was supported by internal staff and Cerner as their EHR vendor and partner. The University and Cerner formed the Tiger Institute for Health Innovation, which provided all health IT services for the project and remains part of the project.
Innovation adoption and workflow integration	The NCM role and tools they used were assimilated into the University health system and the EHR, thus integrating the innovation into ongoing operations.
Implementation Effectiveness	
Innovation reach	Reach did not change since the third annual report (https://downloads.cms.gov/files/ cmmi/hcia-communityrppm-thirdannualrpt.pdf). Cumulative reach was 100%, but only 68.2% of those enrolled received at least one of NCM dose service.
Innovation dose	Dose did not change since the third annual report (https://downloads.cms.gov/files/ cmmi/hcia-communityrppm-thirdannualrpt.pdf). A greater percentage of patients in Tiers 3 and 4 (89.0%) received services than patients in Tiers 1 and 2 (64.2%).
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. HIAs were incorporated into the University in other roles and continue to work on dissemination.

Notes:

- **Sources**: *Q15–Q16 Narrative Progress Report; Q15–Q16 Quarterly Awardee Performance Report*.
- **Patient-level data:** Provided to RTI.
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions

- EHR = electronic health record; FTE = full-time equivalent; HCIA = Health Care Innovation Award; HIA = health information analyst; IT = information technology; NCE = no-cost extension; NCM = nurse case manager; Curators = Curators of the University of Missouri.

Table 3 summarizes findings based on Medicare claims collected during the innovation period. In all 3 years after the innovation launch, the innovation group incurs higher spending than the comparison group. Spending differences are significant in Years 1 and 2, and nearly significant in Year 3. Overall, the innovation group incurs significantly higher spending than the comparison group. The innovation group has significantly more inpatient admissions, the same level of unplanned readmissions, and significantly fewer ED visits than the comparison group. NCMs arranged for preventive care services among cohorts of relatively healthy patients and offered care coordination and oversight for more complex patients. This additional care may have led to additional spending, primary care visits, and inpatient admissions in the near term and a decline in ED visits as Medicare beneficiaries relied on NCMs.

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

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$15.595	$8.634, $22.555	$10.172, $21.018	$7.560	$4.493, $10.626	$5.268	$2.062, $8.474	$2.767	−$0.325, $5.859
Acute care inpatient stays	777	591, 964	632, 923	371	261, 480	299	188, 411	107	5, 210
Hospital-wide all-cause unplanned readmissions	18	−41, 77	−28, 64	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−1183	−1516, −849	−1443, −923	−441	−635, −247	−356	−550, −162	−386	−576, −196
Average impact per quarter									
Spending per participant	$220	$122, $318	$143, $296	$298	$177, $419	$223	$87, $358	$126	−$15, $267
Acute care inpatient stays (per 1,000 participants)	11	8, 14	9, 13	15	10, 19	13	8, 17	5	0, 10
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	5	−12, 22	−8, 18	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−17	−21, −12	−20, −13	−17	−25, −10	−15	−23, −7	−18	−26, −9

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2011 to June 2016.
- **Sample size:** 6,476 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Curators = Curators of the University of Missouri.

Table 4 summarizes findings based on Medicaid claims collected during the innovation period. In the first year after the innovation launch, the innovation group has higher spending than the comparison group. However, in subsequent years the innovation group incurs a similar level of spending as the comparison group, and the overall spending levels are similar between the innovation and comparison groups. The innovation group has more inpatient stays and ED visits than the comparison group, and the results are statistically significant. As with the Medicare population, higher spending and inpatient visits may be due to care coordination services delivered by NCMs. The increase in ED visits is not consistent with the innovation design.

Table 4. Summary of Medicaid Claims-Based Findings: Curators

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$1.842	−$1.857, $5.540	−$1.040, $4.723	$2.180	$0.521, $3.839	$0.567	−$1.289, $2.423	−$0.905	−$1.927, $0.117
Acute care inpatient stays	198	125, 270	141, 254	154	101, 208	35	−4, 74	9	−21, 39
Hospital-wide all-cause unplanned readmissions	25	−11, 60	−3, 52	N/A	N/A	N/A	N/A	N/A	N/A
ED visits	711	347, 1074	427, 994	587	414, 760	257	38, 476	−133	−366, 100
Average impact per quarter									
Spending per participant	$92	−$93, $278	−$52, $237	$250	$60, $440	$74	−$169, $318	−$254	−$540, $33
Acute care inpatient stays (per 1,000 participants)	10	6, 14	7, 13	18	12, 24	5	0, 10	2	−6, 11
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	49	−21, 118	−6, 103	N/A	N/A	N/A	N/A	N/A	N/A
ED visits (per 1,000 participants)	36	17, 54	21, 50	67	47, 87	34	5, 62	−37	−103, 28

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Significance levels:** *<.10 **<.05 ***<.01.
- **Period of activity:** April 2011 to September 2015.
- **Sample size:** 2,397 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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 (per 1,000 participants)** is 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 is the product of ED visits (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; Curators = Curators of the University of Missouri.

2.1.2 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, which was ultimately replaced by similar Cerner tools; (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 tools and data analytics. These components have not changed since our previous annual report.[1]

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 have not changed, except that JEN Associates' role in data analytics ended when the NCE period began.

2.1.3 Program Participant Characteristics

The program was a cohort study with recruitment frozen at 9,932 participants to track progress of patients enrolled in the innovation over time. Therefore, the demographic characteristics of all participants ever enrolled in the innovation did not change since the third annual report.[2]

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?

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

[2] Ibid.

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: Curators

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

Terms and Definitions
- ED = emergency department; Curators = Curators of the University of Missouri.

2.3 Medicare Comparison Group

We include patients in the claims analysis enrolled in the innovation prior to the end of the intervention, and we present Medicare claims data through June 30, 2016. This includes two more quarters of Medicare claims data than the 2016 annual report (Jan-June 2016). The Medicare claims analysis focuses on 6,476 Curators Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as the 2016 annual report. 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. See the third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 6 reports Medicare spending per patient in the 8 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 1*** illustrates the Medicare 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 innovation enrollees, spending trends upward in the baseline quarters for both innovation and comparison beneficiaries. After the innovation launch, spending increases more for the innovation group than the comparison group. The spending gap between the two

groups persists during the innovation quarters, although the gap becomes smaller during the last three innovation quarters. These trends are similar to the third annual report. As shown in Table 6, the standard deviation for spending is very high, the data points tend to be spread over a wide range of values rather than at the mean, representing variable expenditures. We estimate the statistical impact of the innovation in the difference-in-differences analyses that follow.

Table 6. 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**	**I12**
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	$2,637	$2,569	$2,590	$2,573
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	$9,090	$7,720	$8,021	$7,274	$8,121
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	5,735	5,635	5,532	5,458	5,355
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	$2,369	$2,388	$2,447	$2,500	$2,493
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	$7,406	$7,474	$7,570	$8,019	$7,942
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	5,807	5,723	5,636	5,553	5,444
Savings per Patient																				
	−$1	$1	−$67	$48	−$66	$36	$125	$0	−$376	−$331	−$261	−$203	−$184	−$95	−$309	−$343	−$249	−$122	−$90	−$80

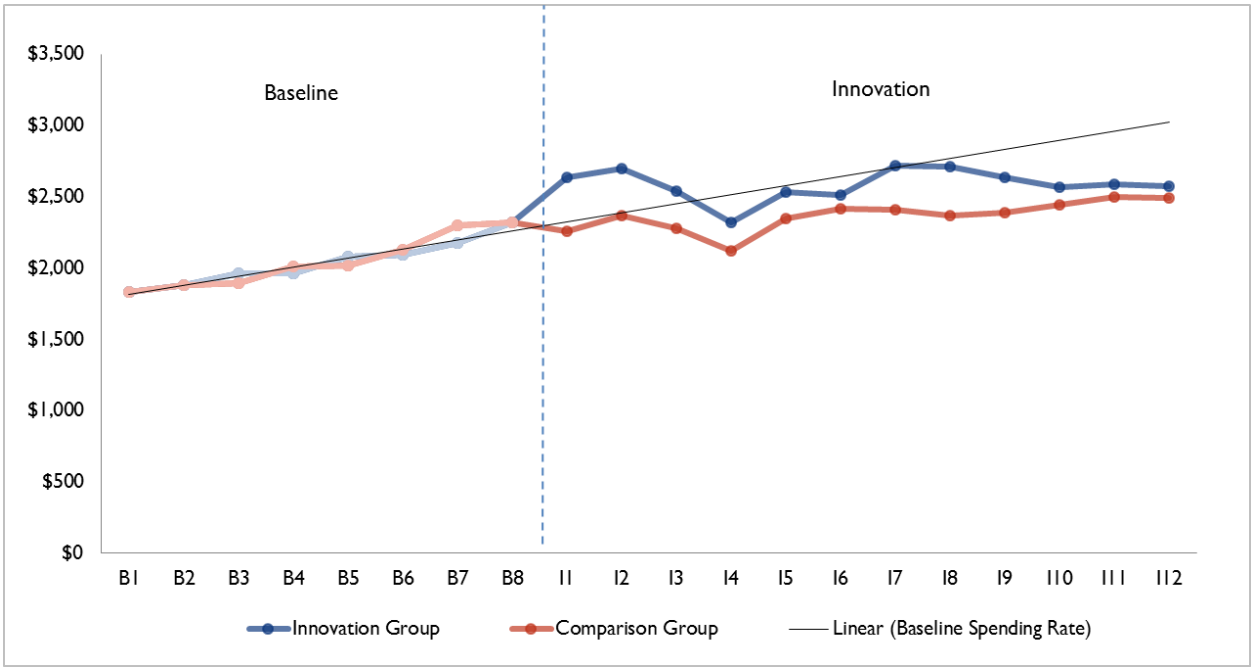
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

Figure 1. Medicare Spending per Participant: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.4.2 Regression Results

We present in ***Table 7*** 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 $220 (90% CI: $122, $318). This effect is statistically significant. This finding is consistent with the findings in the third annual report. 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 quarterly effects derived from 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. All of the quarterly estimates are above zero and most are statistically significant.

Table 7. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	$371	$116	0.001
I2	$340	$126	0.007
I3	$269	$115	0.019
I4	$207	$119	0.082
I5	$183	$117	0.118
I6	$89	$118	0.451
I7	$297	$120	0.014
I8	$327	$136	0.016
I9	$239	$124	0.055
I10	$112	$126	0.373
I11	$76	$121	0.526
I12	$72	$135	0.594
Overall average	$220	$60	<0.001
Overall aggregate	$15,594,606	$4,231,487	<0.001
Overall aggregate (IY1)	$7,559,823	$1,864,228	<0.001
Overall aggregate (IY2)	$5,268,235	$1,949,005	0.007
Overall aggregate (IY3)	$2,766,548	$1,879,703	0.141

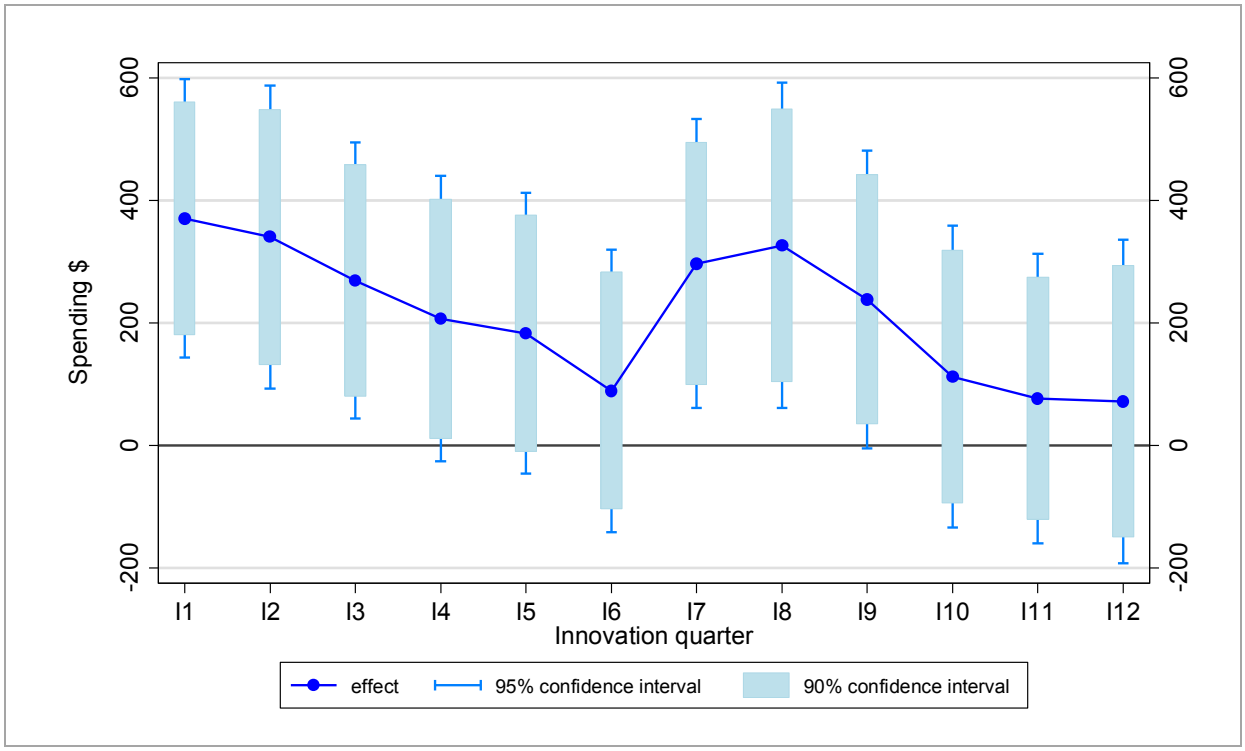
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Average:** 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; Curators = Curators of the University of Missouri.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Curators



Notes:

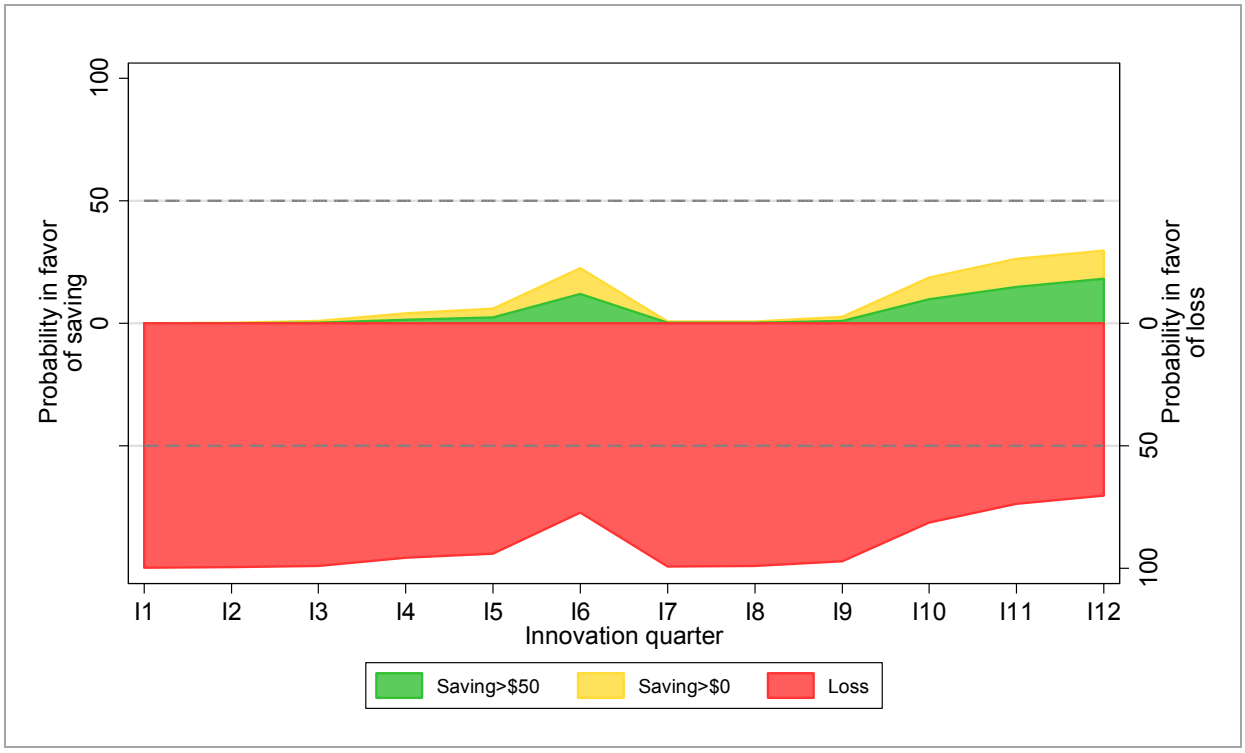
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- Curators = Curators of the University of Missouri; 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 for saving or losing money on this initiative. Because the quarterly spending estimates were always positive and mostly statistically significant in the entire innovation period, we observed a 100% probability of loss for the innovation period.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 8*** and ***Figure 4***. Inpatient admissions trend slightly upward during the baseline period, and the admissions rates from the comparison group are slightly higher than those in the innovation group. However, after the innovation begins, inpatient admissions rise for beneficiaries enrolled in the innovation and are consistently higher than those from the comparison group except for the last two innovation quarters. These trends are similar to the third annual report. 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 8. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Admit rate	62	60	65	69	66	63	61	81	86	87	85	76	85	78	88	92	83	75	75	79
Std dev	303	306	316	320	307	293	284	345	359	357	360	335	345	350	385	363	346	356	322	318
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	5,735	5,635	5,532	5,458	5,355
Comparison Group																				
Admit rate	67	66	66	76	65	70	73	81	73	78	73	74	76	77	79	83	76	72	79	84
Std dev	308	306	306	337	320	327	339	369	325	353	338	331	337	347	345	352	346	335	359	368
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	5,807	5,723	5,636	5,553	5,444
Innovation − Comparison Rate																				
	−5	−6	−1	−7	2	−7	−12	0	13	8	11	2	9	1	9	9	7	3	−4	−5

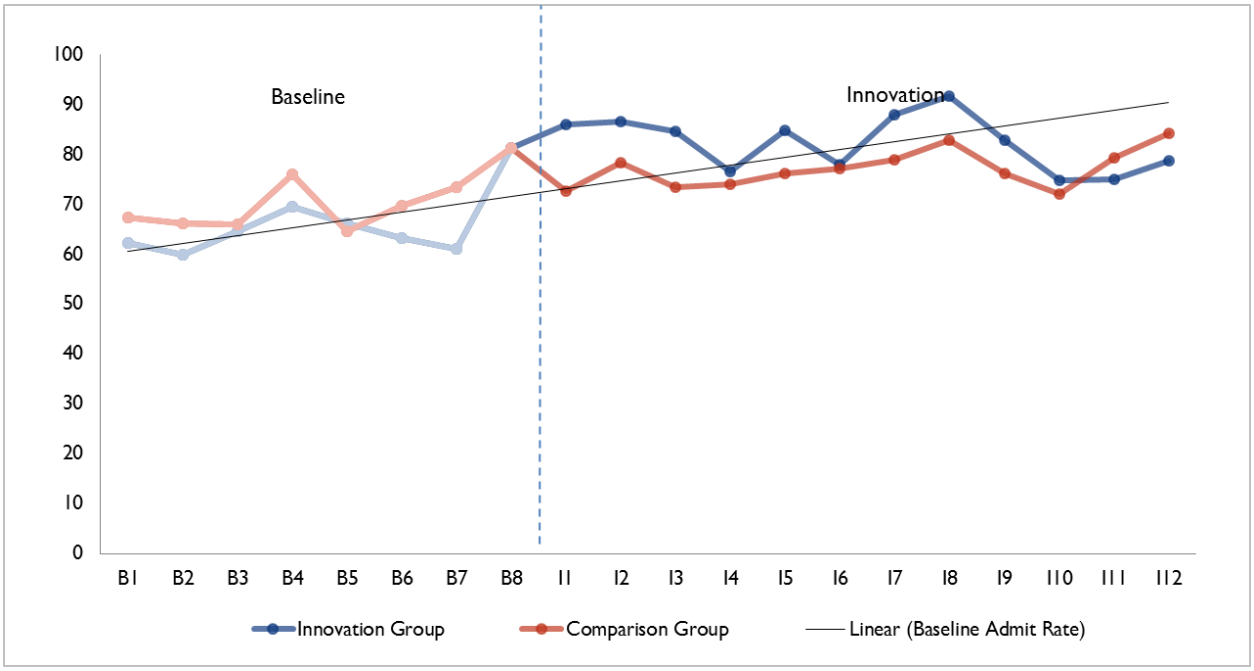
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 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 is statistically significant (90% CI: 8, 14). This finding is consistent with the findings in the third annual report. We also present quarterly effects.

Table 9 presents the results of a 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 9. 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	19	5	<0.001
I2	14	5	0.008
I3	15	5	0.006
I4	11	5	0.044
I5	14	5	0.011
I6	7	6	0.244
I7	15	6	0.014
I8	16	6	0.009
I9	13	6	0.022
I10	6	6	0.307
I11	1	6	0.868
I12	0	6	0.972
Overall average	11	2	<0.001
Overall aggregate	777	114	<0.001
Overall aggregate (IY1)	371	66	<0.001
Overall aggregate (IY2)	299	68	<0.001
Overall aggregate (IY3)	107	62	0.084

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Curators = Curators of the University of Missouri.

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 5***. Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch, and the trend line slopes down. 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. These trends are similar to the third annual report. 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 10. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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**	**I12**
Innovation Group																				
Readmit rate	81	50	88	77	71	31	29	96	88	70	95	77	72	71	110	67	91	106	97	71
Std dev	273	218	284	266	257	174	167	294	284	255	294	266	258	256	313	249	287	308	296	257
Total admissions	209	200	204	248	239	225	245	314	328	315	325	287	320	269	309	300	287	235	237	268
Comparison Group																				
Readmit rate	62	80	69	76	62	79	87	82	73	95	104	94	127	94	90	83	80	86	104	103
Std dev	242	272	253	265	241	270	282	274	261	293	305	293	334	292	287	276	272	280	305	304
Total admissions	241	232	257	290	253	279	305	323	305	303	292	282	301	273	295	304	270	240	266	300
Innovation − Comparison Rate																				
	19	−30	19	1	9	−48	−59	14	15	−25	−8	−18	−56	−24	20	−17	10	20	−7	−32

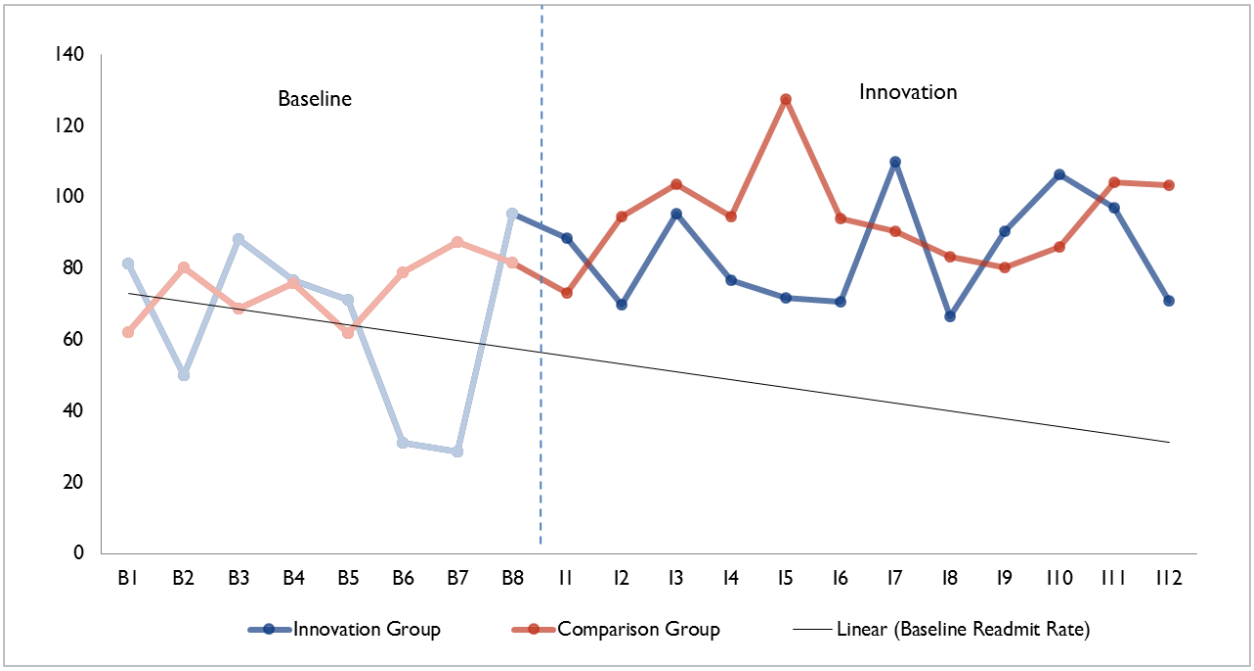
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.6.2 Regression Results

Table 11 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, indicating that the innovation-comparison difference is higher for the innovation group 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: −12, 22). This finding is consistent with the findings in the third annual report.

Table 11. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Admissions: Curators

Quarter	Coefficient	Standard Error	P-Values
Overall average	5	10	0.624
Overall aggregate	18	36	0.624

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- 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 12*** and ***Figure 6.*** The ED visit rate follows a fairly stable increasing trend prior to innovation launch for both innovation and comparison groups. The rate is below the trend line during all innovation quarters for both innovation and comparison groups, and the gap between the two groups narrows. These trends are similar to the third annual report. As with the other variables, we will include statistical tests on the ED visit rate in the following section.

Table 12. ED Visits per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
ED rate	162	180	175	184	189	189	189	178	177	194	164	157	166	181	176	176	176	187	167	173
Std dev	557	584	572	598	619	605	625	606	594	637	618	564	593	651	692	647	634	724	627	590
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	5,735	5,635	5,532	5,458	5,355
Comparison Group																				
ED rate	132	154	149	155	160	166	168	175	175	171	163	150	169	162	170	160	170	174	157	165
Std dev	300	375	379	390	405	405	402	391	397	412	402	372	392	386	426	346	403	403	364	367
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	5,807	5,723	5,636	5,553	5,444
Innovation − Comparison Rate																				
	30	26	27	29	29	22	21	3	1	23	1	8	-3	19	7	16	6	14	11	7

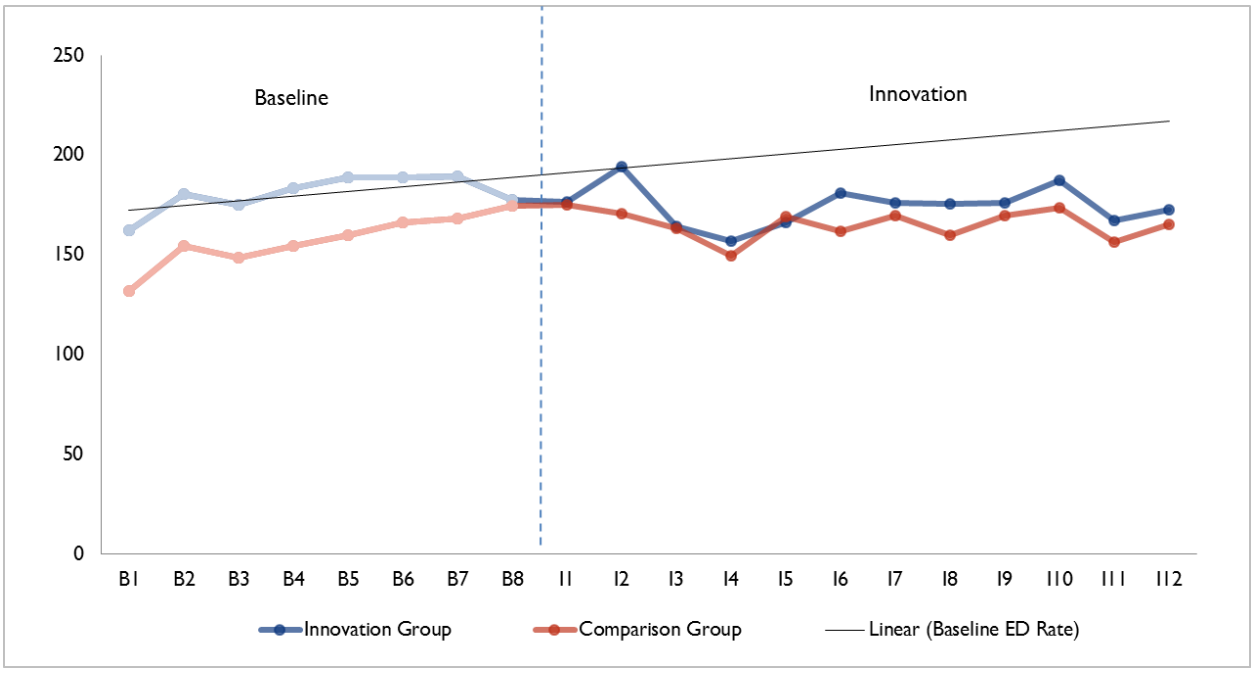
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

Figure 6. ED Visits per 1,000 Medicare Participants: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- ED = emergency department; Curators = Curators of the University of Missouri.

2.7.2 Regression Results

As shown in ***Table 13***, the average quarterly difference-in-differences estimate for ED visits is a decrease of 17 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: −21, −12). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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 and comparison groups are all negative, and most of the estimates are statistically significant.

Table 13. 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	10	0.008
I2	−2	9	0.818
I3	−26	9	0.006
I4	−16	9	0.073
I5	−24	9	0.008
I6	−4	10	0.667
I7	−18	11	0.088
I8	−13	10	0.196
I9	−18	10	0.082
I10	−15	11	0.175
I11	−15	10	0.134
I12	−22	10	0.033
Overall average	−17	3	<0.001
Overall aggregate	−1,183	203	<0.001
Overall aggregate (IY1)	−441	118	<0.001
Overall aggregate (IY2)	−356	118	0.003
Overall aggregate (IY3)	−386	115	0.001

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Curators = Curators of the University of Missouri.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 14*** and ***Figure 7.*** The primary care visit rate follows a fairly stable increasing trend prior to innovation launch for the innovation group, although the trend is flat for the comparison group. After the innovation starts, the rate falls below the trend line during all innovation quarters for the innovation group and it is almost parallel to the comparison group. As with the other variables, we will include statistical tests on the primary care visit rate in the following section.

Table 14. Primary Care Visits per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Primary care rate	881	926	947	984	1,014	1,024	1,072	1,104	1,206	1,132	1,136	1,063	1,126	1,124	1,113	1,066	1,121	1,073	1,082	1,051
Std dev	1,173	1,230	1,195	1,293	1,259	1,333	1,346	1,348	1,562	1,504	1,513	1,428	1,465	1,498	1,485	1,456	1,503	1,475	1,465	1,393
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	5,735	5,635	5,532	5,458	5,355
Comparison Group																				
Primary care rate	671	680	692	690	652	654	704	690	728	709	701	682	726	707	721	741	757	755	747	757
Std dev	1,165	1,213	1,163	1,212	1,162	1,190	1,249	1,264	1,292	1,267	1,243	1,271	1,306	1,296	1,271	1,324	1,358	1,357	1,367	1,356
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	5,807	5,723	5,636	5,553	5,444
Innovation − Comparison Rate																				
	209	246	255	294	363	370	368	414	478	423	435	381	400	418	392	324	364	318	334	294

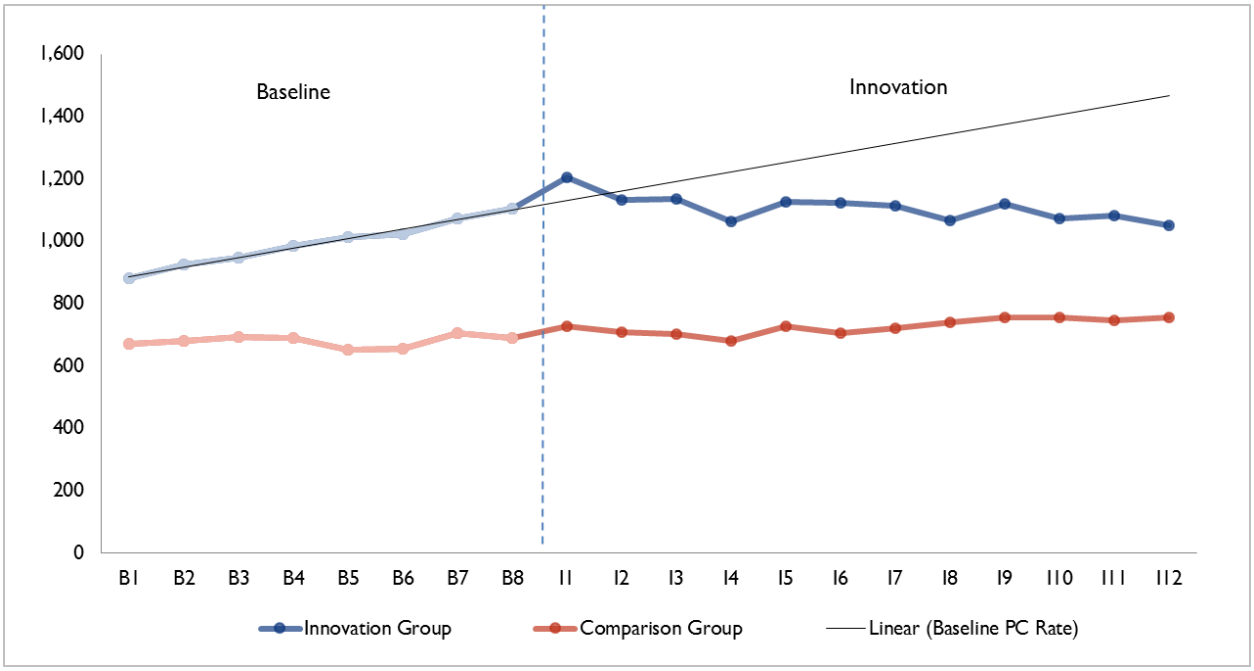
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

Figure 7. Primary Care Visits per 1,000 Medicare Participants: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.8.2 Regression Results

As shown in ***Table 15***, the average quarterly difference-in-differences estimate for primary care visits is an increase of 39 primary care visits per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 27, 51).

We also present quarterly effects from a model with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. The average quarterly difference in primary care visits between the innovation and comparison groups are mostly positive, and most of the estimates are statistically significant.

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

Quarter	Coefficient	Standard Error	P-Values
I1	123	22	<0.001
I2	85	21	<0.001
I3	95	22	<0.001
I4	66	22	0.002
I5	63	23	0.007
I6	90	24	<0.001
I7	51	25	0.037
I8	−27	25	0.286
I9	13	27	0.613
I10	−37	27	0.171
I11	−25	28	0.368
I12	−72	28	0.009
Overall average	39	7	<0.001
Overall aggregate	2,768	498	<0.001
Overall aggregate (IY1)	2,352	276	<0.001
Overall aggregate (IY2)	1,064	287	<0.001
Overall aggregate (IY3)	−648	299	0.030

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Curators = Curators of the University of Missouri.

2.9 Discussion: Medicare Results

We found increased spending, inpatient utilization, and primary care visits, but 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 readmissions measure, outperformed in the ED visit measure, but underperformed in Medicare spending and all-cause inpatient admissions rates. We also analyzed a subgroup of high-risk patients (those with a risk tier rating of 3 or 4) and found similar results.

The Medicare results are consistent with the innovation's theory of change. The results suggest that patients received more appropriate care by replacing ED visits with alternate care, as evidenced in

elevated primary care visits, inpatient admissions, and spending identified among intervention group beneficiaries. The benefits of health information technology and the NCMs on spending and utilization may take time to develop, and convergence between the intervention and comparison groups with respect to spending and inpatient visits starting in I10 suggests a trend in the expected direction.

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 65 percent of the overall population reached by the innovation.

2.10 Medicaid Comparison Group

We include patients in the claims analysis who were enrolled in the innovation prior to the end of the intervention, and we present Medicaid claims data through Q3 2015. The Medicaid claims analysis focuses on 2,387 Curators Medicaid beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as the 2016 annual report, although we lost 10 innovation beneficiaries and 7 comparison beneficiaries due to eligibility updates in Medicaid claims. 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. See the third annual report for additional details.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 16 reports Medicaid spending per patient in the eight quarters before and the ten 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 8*** 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 baseline quarters.

As shown by the baseline trend line, spending trends up in the baseline quarters for innovation beneficiaries. Innovation period spending is below the baseline period trend line for both innovation and comparison groups. This finding is consistent with the findings in the third annual report. It is premature to conclude any impact of the innovation on spending among enrolled beneficiaries. As shown in Table 16, the standard deviation for spending is very high, the data points tend to be spread over a wide range of values rather than at the mean, representing variable expenditures.

Table 16. 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	I8	I9	I10
Innovation Group																		
Spending rate	$4,352	$4,666	$4,767	$4,558	$4,846	$4,950	$4,723	$4,568	$4,399	$4,748	$4,826	$4,629	$4,640	$4,572	$4,388	$4,882	$4,719	$3,614
Std dev	$7,987	$9,685	$9,132	$8,455	$9,057	$9,442	$9,283	$9,097	$8,842	$9,524	$9,737	$9,257	$9,075	$9,642	$8,491	$9,977	$9,573	$8,192
Unique patients	1,744	1,778	1,783	1,949	1,996	2,054	2,116	2,267	2,387	2,212	2,102	2,016	1,975	1,921	1,887	1,845	1,805	1,762
Comparison Group																		
Spending rate	$3,861	$4,023	$4,000	$4,311	$4,234	$4,434	$4,544	$4,697	$4,093	$4,170	$4,103	$4,037	$4,291	$3,978	$4,087	$4,560	$4,622	$3,585
Std dev	$5,502	$5,814	$5,681	$5,919	$5,534	$6,129	$6,261	$6,581	$5,921	$5,732	$6,096	$5,795	$6,470	$5,563	$5,652	$6,790	$6,559	$4,860
Weighted patients	2,170	2,171	2,162	2,139	2,132	2,146	2,188	2,270	2,390	2,290	2,263	2,246	2,212	2,160	2,109	2,067	2,019	1,974
Savings per Patient																		
	−$491	−$643	−$767	−$247	−$612	−$516	−$179	$129	−$306	−$578	−$723	−$593	−$349	−$595	−$302	−$321	−$97	−$29

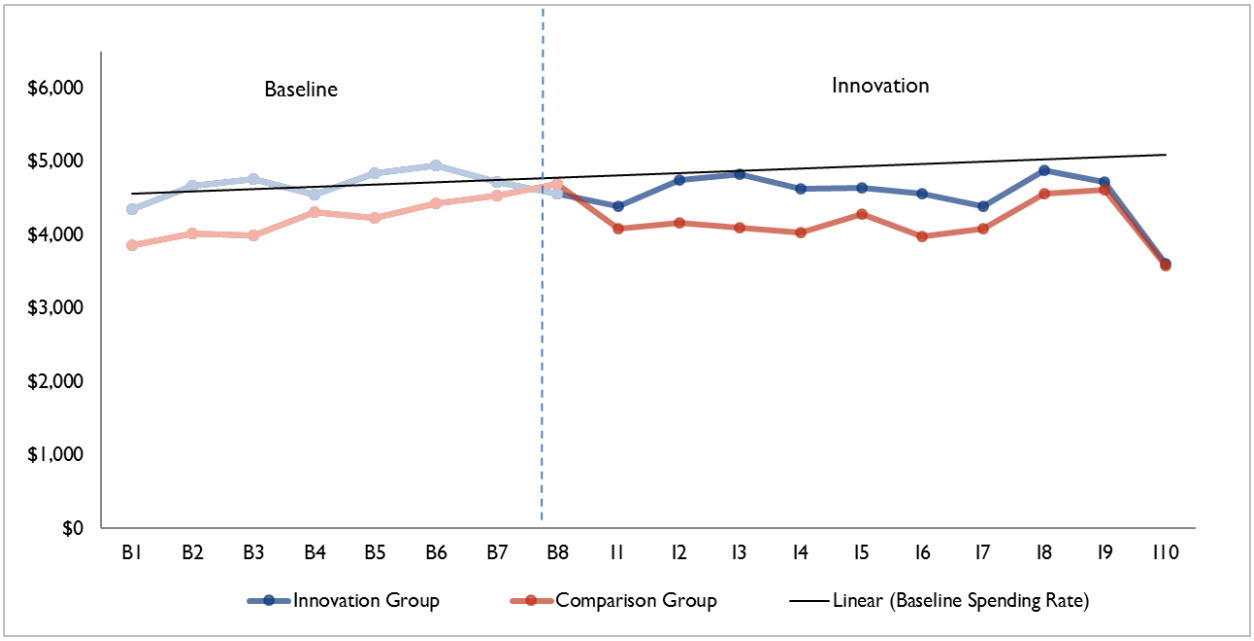
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

Figure 8. Medicaid Spending per Participant: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.11.2 Regression Results

We present ***Table 17*** 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 $92 (90% CI: −$93, $278). This effect is not statistically significant. This finding is consistent with the findings in the third annual report. 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 quarterly effects from 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 9*** 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 17. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Curators

Quarter	Coefficient	Standard Error	P-Values
I1	$61	$136	0.656
I2	$310	$155	0.047
I3	$404	$160	0.012
I4	$248	$165	0.133
I5	$42	$192	0.826
I6	$263	$173	0.129
I7	−$22	$161	0.891
I8	$11	$236	0.963
I9	−$232	$215	0.280
I10	−$276	$199	0.167
Overall average	$92	$113	0.413
Overall aggregate	$1,841,574	$2,248,000	0.413
Overall aggregate (IY1)	$2,179,623	$1,008,426	0.031
Overall aggregate (IY2)	$566,907	$1,128,108	0.615
Overall aggregate (IY3)	−$904,956	$621,025	0.145

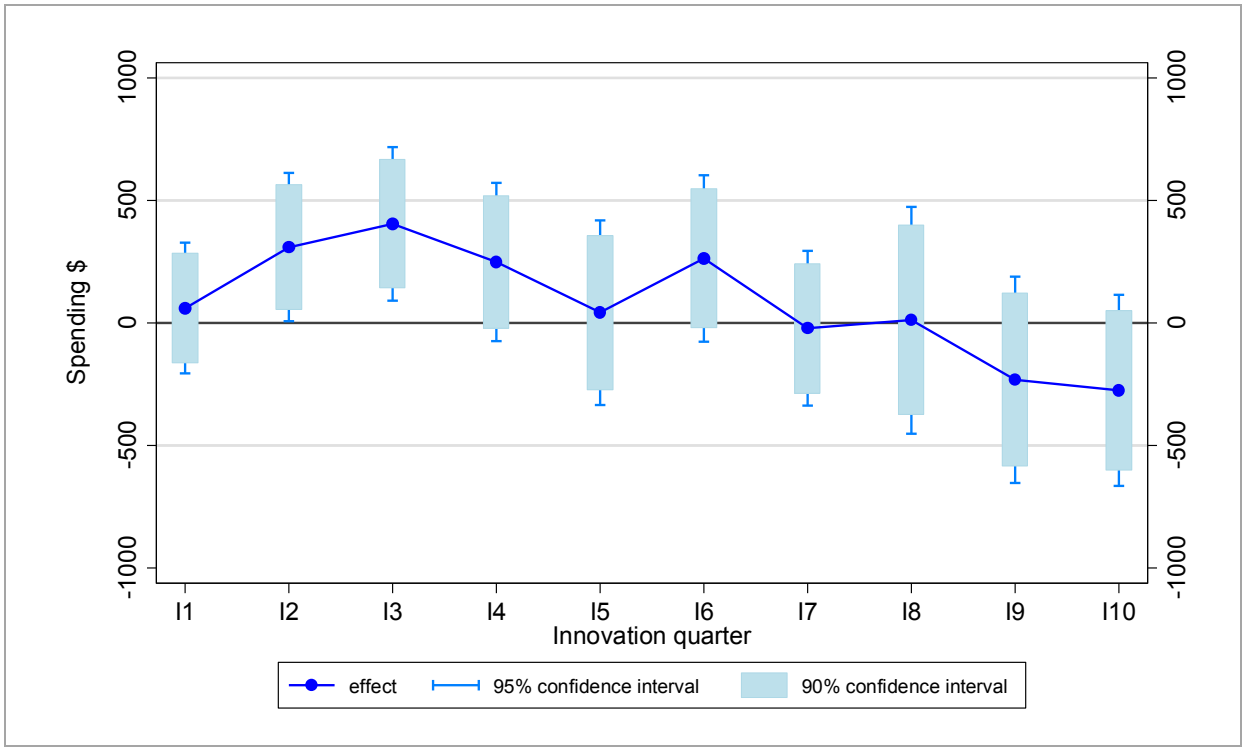
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **Regression coefficients:** 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.
- **Overall average:** 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; Curators = Curators of the University of Missouri.

Figure 9. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Curators



Notes:

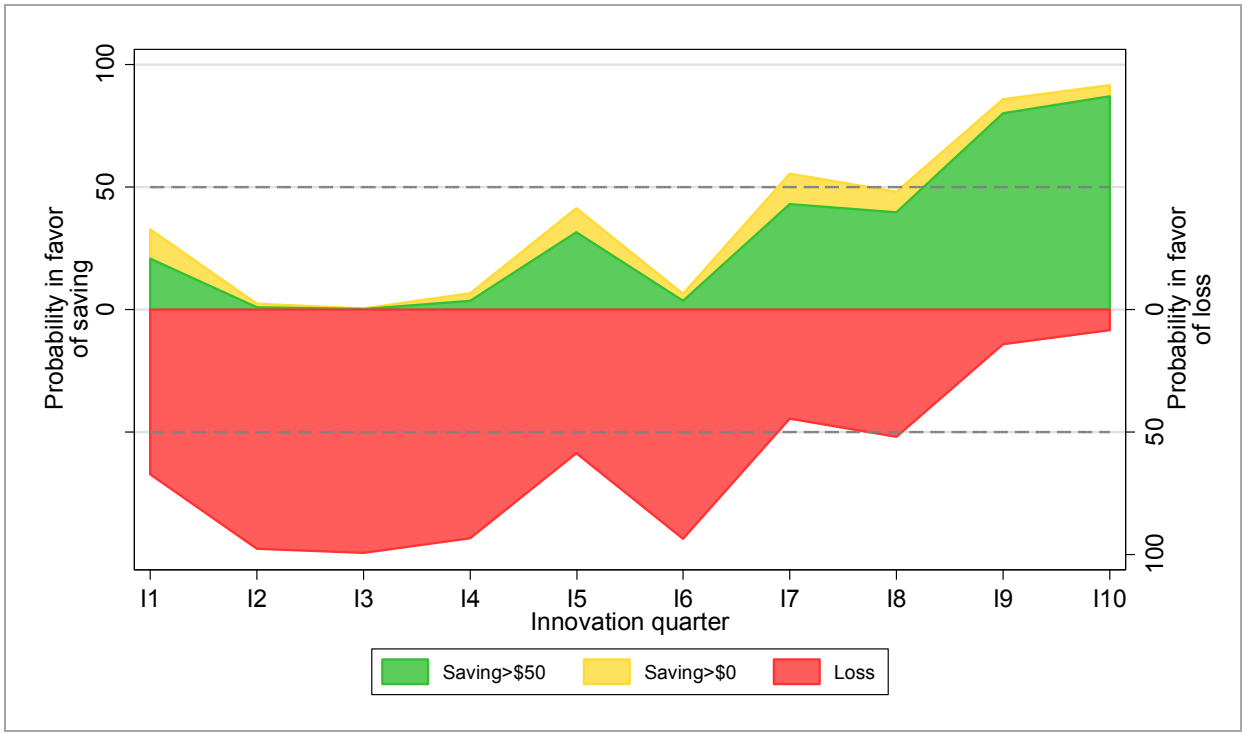
- Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- Period of activity: April 2011 to September 2015.

Terms and Definitions

- Curators = Curators of the University of Missouri; 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 for saving or losing money on this initiative. Because the quarterly spending estimates are higher for the innovation group than the comparison group in most of the innovation quarters, we observe a 79 percent probability of loss overall.

Figure 10. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Curators



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 18*** and ***Figure 11***. 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. This finding is similar to trends in the third annual report.

Table 18. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters									
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**
Innovation Group																		
Admit rate	49	40	40	38	51	56	36	45	41	52	39	32	23	21	29	22	29	26
Std dev	301	260	245	232	289	370	218	241	240	321	276	230	186	171	195	192	228	184
Unique patients	1,744	1,778	1,783	1,949	1,996	2,054	2,116	2,267	2,387	2,212	2,102	2,016	1,975	1,921	1,887	1,845	1,805	1,762
Comparison Group																		
Admit rate	64	56	49	66	53	52	53	54	41	33	28	30	29	30	25	33	40	31
Std dev	254	236	226	291	206	223	255	251	179	158	153	171	154	155	145	183	206	211
Weighted patients	2,170	2,171	2,162	2,139	2,132	2,146	2,188	2,270	2,390	2,290	2,263	2,246	2,212	2,160	2,109	2,067	2,019	1,974
Innovation − Comparison Rate																		
	−14	−16	−9	−28	−2	4	−16	−9	0	19	11	2	−7	−8	4	−11	−10	−6

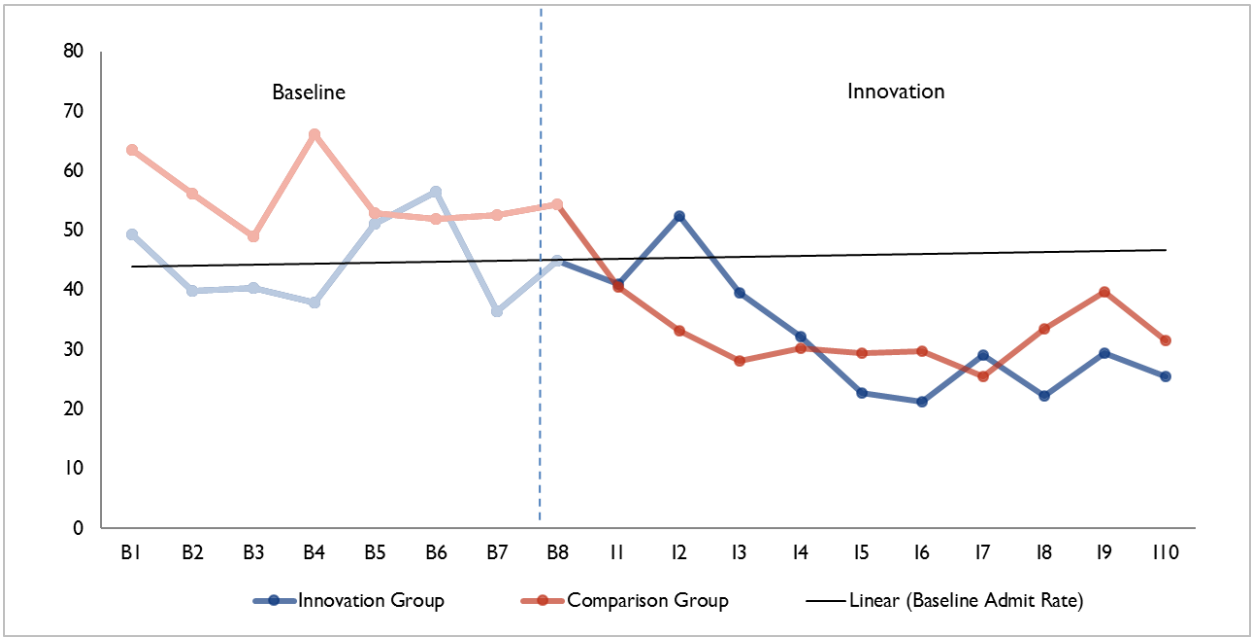
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.12.2 Regression Results

As shown in ***Table 19,*** 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 statistically significant (90% CI: 6, 14). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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 is higher than the comparison group, and four out of ten quarterly estimates are statistically significant.

Table 19. 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	10	8	0.217
I2	31	8	<0.001
I3	19	7	0.006
I4	12	6	0.072
I5	5	6	0.431
I6	2	6	0.748
I7	12	6	0.062
I8	0	7	0.961
I9	1	8	0.927
I10	4	7	0.550
Overall average	10	2	<0.001
Overall aggregate	198	44	<0.001
Overall aggregate (IY1)	154	33	<0.001
Overall aggregate (IY2)	35	24	0.138
Overall aggregate (IY3)	9	18	0.641

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **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.
- **Overall average:** 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; Curators = Curators of the University of Missouri.

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 20*** and ***Figure 12.*** Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch. The unplanned readmissions rates are mostly above the trend line in the innovation quarters for both innovation and comparison groups. These trends are consistent with the third annual report.

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

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters									
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**
Innovation Group																		
Readmit rate	270	172	155	177	218	381	123	141	138	315	264	237	256	176	209	172	154	143
Std dev	444	378	362	382	413	486	329	348	344	464	441	425	437	381	407	378	361	350
Total admissions	74	58	58	62	87	97	65	85	80	89	72	59	39	34	43	29	39	21
Comparison Group																		
Readmit rate	256	256	394	350	140	326	371	295	164	159	157	232	269	244	185	283	303	179
Std dev	436	436	489	477	347	469	483	456	370	366	364	422	444	430	389	451	460	383
Total admissions	116	105	92	123	99	89	103	106	79	65	54	55	55	52	41	57	73	43
Innovation − Comparison Rate																		
	15	−83	−239	−172	78	55	−247	−154	−26	156	106	5	−13	−68	24	−111	−149	−36

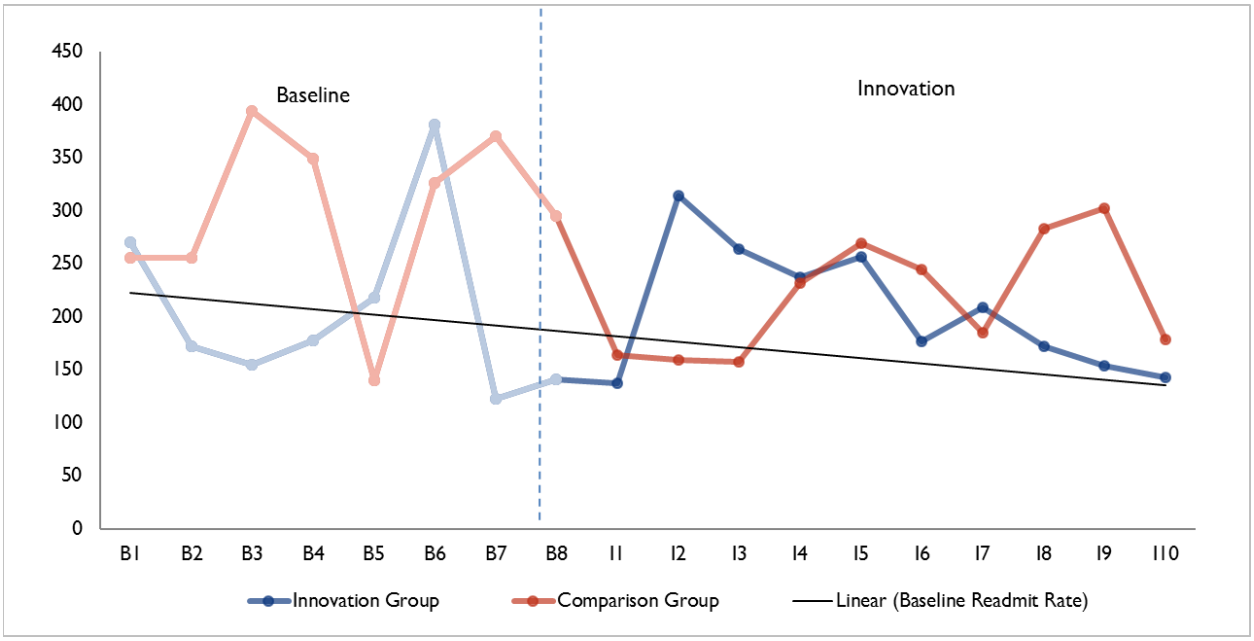
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.13.2 Regression Results

Table 21 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 49 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is higher for the innovation group 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: −21, 118). This finding is consistent with the findings in the third annual report.

Table 21. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicaid Admissions: Curators

Quarter	Coefficient	Standard Error	P-Values
Overall average	49	42	0.254
Overall aggregate	25	21	0.254

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **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.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 22*** and ***Figure 13.*** The ED visit rate remains stable before innovation launch and drops downward during the innovation period for the innovation group, although we observe a larger drop in ED visits for the comparison group. The gap between the innovation group and the comparison group narrows in the innovation period. This finding is consistent with the trends in the third annual report.

Table 22. ED Visits per 1,000 Medicaid Participants: Curators

Awardee Number: 1C1CMS331001
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters									
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**
Innovation Group																		
ED rate	230	195	198	186	253	222	201	181	179	215	155	139	169	158	146	160	132	119
Std dev	935	656	729	718	918	882	778	730	698	833	664	606	790	680	710	771	626	557
Unique patients	1,744	1,778	1,783	1,949	1,996	2,054	2,116	2,267	2,387	2,212	2,102	2,016	1,975	1,921	1,887	1,845	1,805	1,762
Comparison Group																		
ED rate	298	289	294	300	303	324	366	395	235	238	176	154	197	186	238	228	236	237
Std dev	775	732	850	825	748	860	1,009	1033	620	648	576	461	573	619	827	866	879	1040
Weighted patients	2,170	2,171	2,162	2,139	2,132	2,146	2,188	2,270	2,390	2,290	2,263	2,246	2,212	2,160	2,109	2,067	2,019	1,974
Innovation − Comparison Rate																		
	−69	−93	−97	−114	−50	−102	−165	−214	−57	−23	−21	−14	−28	−28	−92	−69	−105	−119

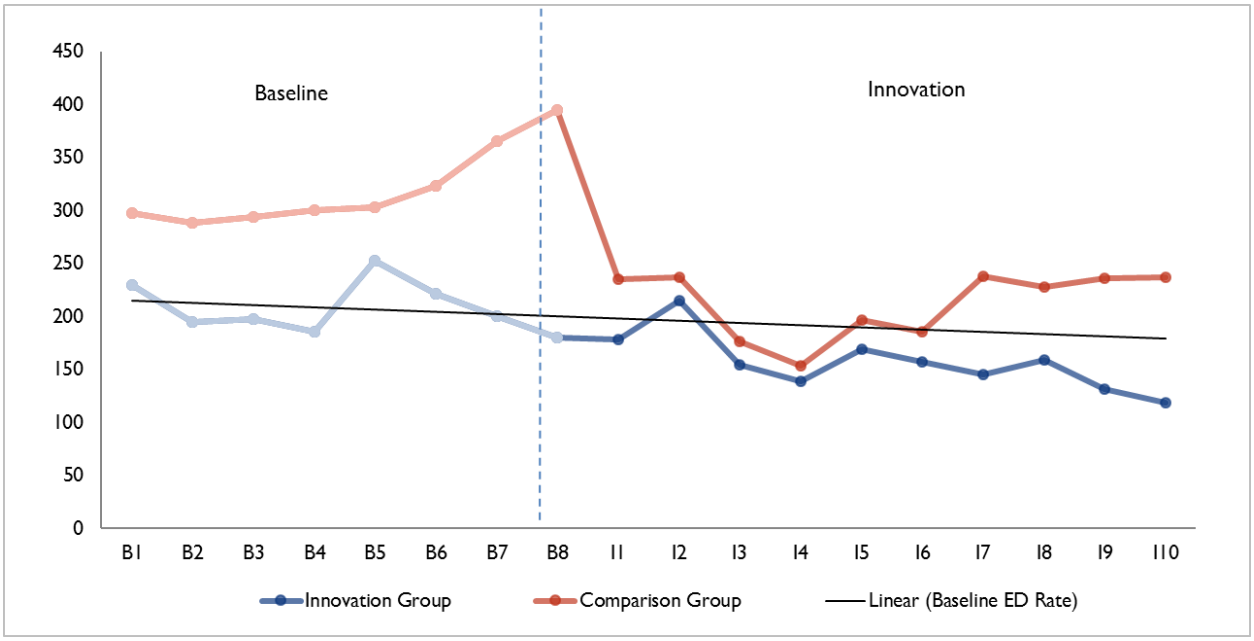
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Curators = Curators of the University of Missouri.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- Curators = Curators of the University of Missouri; ED = emergency department.

2.14.2 Regression Results

As shown in ***Table 23***, the average quarterly difference-in-differences estimate for ED visits admissions is an increase of 36 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: 17, 54). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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 majority of quarterly estimates are positive and statistically significant, indicating more ED visits among the innovation group.

Table 23. 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	27	0.030
I2	89	27	0.001
I3	60	21	0.005
I4	61	18	0.001
I5	69	24	0.004
I6	61	22	0.005
I7	−7	40	0.872
I8	9	48	0.860
I9	−18	47	0.696
I10	−57	64	0.379
Overall average	36	11	0.001
Overall aggregate	711	221	0.001
Overall aggregate (IY1)	587	105	<0.001
Overall aggregate (IY2)	257	133	0.054
Overall aggregate (IY3)	−133	142	0.348

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to September 2015.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Curators = Curators of the University of Missouri.

2.15 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. We also performed a subgroup analysis focusing on high-risk patients (those with a risk tier rating of 3 or 4) and found similar significant results.

The Medicaid results are mostly consistent with the innovation's theory of change. The results suggest that NCMs may have connected patients to appropriate care and thus increased total spending in the short term. Differences between the innovation and comparison groups are evident in Year 1 but disappear for spending and inpatient visits during Year 2 and ED visits in Year 3. Based on the type and dose of services that patients typically received, the innovation likely resulted in elevated spending and utilization in the short term, but few differences between the groups in the long term. Improvements in

spending and utilization may become more evident over time, as the goal of the innovation was to improve care for chronic conditions and complex patients.

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 24 percent of the overall population reached by the innovation.

2.16 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 questions.

Table 24 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 report.

Table 24. Awardee-Specific Outcome Measures: Curators

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	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

Notes:

- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- 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 an FEV1 test, the percentage of patients with CAD who were prescribed aspirin or clopidogrel or had an 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.

The subsections below describe the results of each of the clinical effectiveness and health outcome measures.

2.17 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. 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

- What percentage of patients with asthma received an FEV1 test during the innovation period?
- Has the percentage of patients with asthma with FEV1 control increased over time?

2.17.1 Descriptive Results

Table 25 shows less than one-fifth of patients with asthma received the FEV1 test during the innovation period.

Table 25. Percentage of Patients with Asthma who Received Clinical Services: Curators

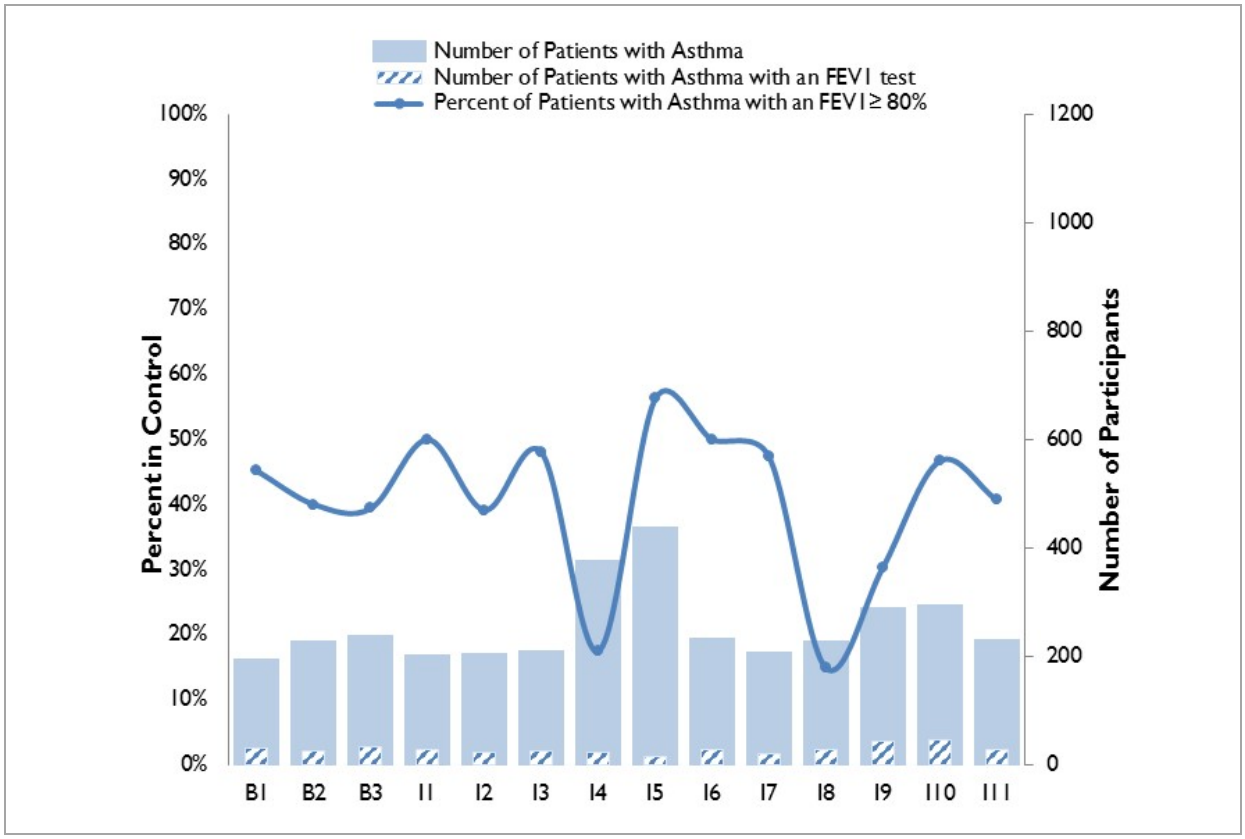
	Percentage of Patients Receiving Clinical Services
Asthma (n=1,165)	
Percentage of patients with asthma who received an FEV1 test	18.3

Notes:
- **Source:** Patient-level data provided to RTI by Curators.

Terms and Definitions
- Curators = Curators of the University of Missouri.

Figure 14 presents the percentage of participants with asthma with an 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 41 percent by I11. These findings suggest that FEV1 among patients with asthma enrolled in the innovation did not improve over time.

Figure 14. Percentage of Patients with Asthma with FEV-1 Control over Time: Curators



(continued)

Figure 14. Percentage of Patients with Asthma with FEV-1 Control over Time: Curators (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%	45.2	40.0	39.4	50.0	39.1	48.0	17.4	56.3	50.0	47.4	14.8	30.2	46.7	40.7
	Number of patients with asthma	173	208	217	181	184	190	356	418	213	188	208	269	274	209
	Number of patients with asthma with an FEV1 test	31	25	33	28	23	25	23	16	28	19	27	43	45	27

Notes:

- **Source:** Patient-level data provided to RTI by Curators.

Terms and Definitions

- FEV1 = forced expiratory volume in 1 second; Curators = Curators of the University of Missouri.

2.18 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. 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

- 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?
- Has the percentage of patients with CAD with LDL-C control increased over time?

2.18.1 Descriptive Results

Table 26 shows that 74 percent of patients with CAD were prescribed aspirin or clopidogrel and approximately 90 percent received a LDL-C test during the innovation period. Thus, a majority of patients with CAD received appropriate clinical services.

Table 26. Percentage of Patients with CAD who Received Clinical Services: Curators

	Percentage of Patients Receiving Clinical Services
CAD (n=838)	
Percentage of patients with CAD who were prescribed aspirin or clopidogrel	74.0
Percentage of patients with CAD who received a LDL-C test	89.9

Notes:
- **Source:** Patient-level data provided to RTI by Curators.
- **Period of activity:** January 2013 to September 2015.

Terms and Definitions
- CAD = coronary artery disease; Curators = Curators of the University of Missouri.

Figure 15 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 increased slightly between baseline quarters and Q13. Approximately 69 percent of higher-risk tier patients had LDL-C control in baseline, which increased to 80 percent in I11, but then dropped to 71 percent in I13. A similar, but sustained, increase occurred 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 86 percent in I13. These findings suggest that LDL-C tended to improve over time for CAD patients in the lower-risk tiers, but did not for those in the higher-risk tiers.

Figure 15. Percentage of CAD Patients with LDL-C Control over Time: Curators

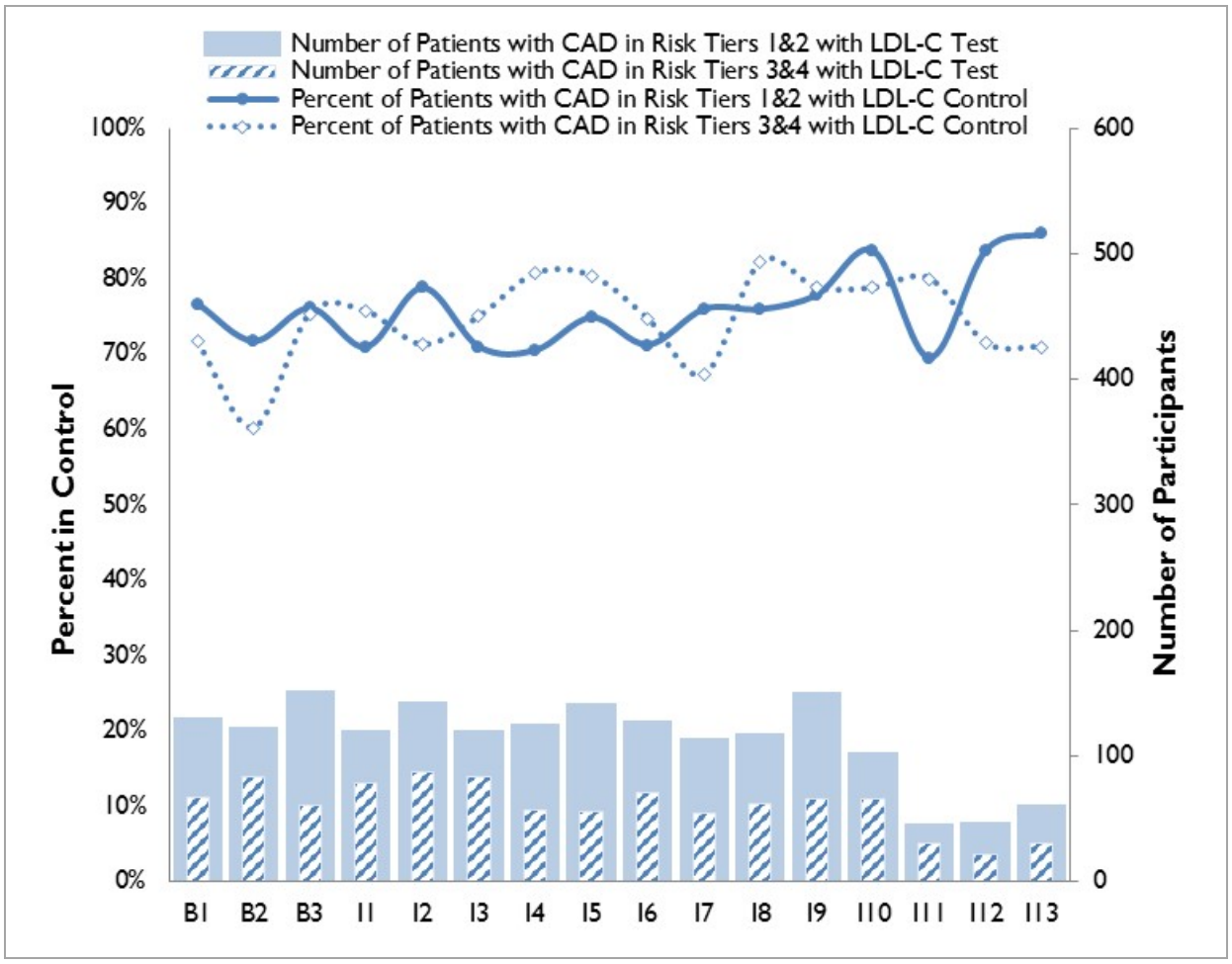


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Figure 15. Percentage of CAD Patients with LDL-C Control over Time: Curators (continued)

	Quarter	B1	B2	B3	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
●	Percentage of patients with CAD in low risk Tiers 1 & 2 with LDL-C control	76.7	71.7	76.1	70.9	78.8	70.9	70.4	74.8	71.2	76.0	75.9	77.9	83.7	69.4	83.8	86.0
◊	Percentage of patients with CAD in risk Tiers 3 & 4 with LDL-C control	71.6	60.2	75.4	75.6	71.3	75.0	80.7	80.4	74.6	67.3	82.3	78.8	78.8	80.0	71.4	71.0
	Number of patients with CAD in risk Tiers 1 & 2 with LDL-C test	120	113	142	110	132	110	115	131	118	104	108	140	92	36	37	50
	Number of patients with CAD in risk Tiers 3 & 4 with LDL-C test	67	83	61	78	87	84	57	56	71	55	62	66	66	30	21	31

Notes:

- **Source:** Patient-level data provided to RTI by Curators.

Terms and Definitions

- CAD = coronary artery disease; LDL-C = low-density lipoprotein cholesterol; Curators = Curators of the University of Missouri.

2.19 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?

2.19.1 Descriptive Results

As shown in ***Table 27***, more than three-quarters of patients with COPD were prescribed an inhaled bronchodilator and less than one-third had spirometry results documented.

Table 27. Percentage of Patients with COPD who Received Clinical Services: Curators

	Percentage of Patients Receiving Clinical Services
COPD (n=834)	
Percentage of patients with COPD who were prescribed an inhaled bronchodilator	77.7
Percentage of patients with COPD who had spirometry results documented	31.2

Notes:
- **Source:** Patient-level data provided to RTI by Curators.
- **Period of activity:** January 2013 to September 2015.

Terms and Definitions
- COPD = chronic obstructive pulmonary disease; Curators = Curators of the University of Missouri.

2.20 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. We also analyzed outcome data for HbA1c and LDL-C among those with diabetes to examine changes in these outcomes 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?
- 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?

2.20.1 Descriptive Results

Table 28 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 an LDL-C test (86.1% and 84.4%, respectively).

Table 28. Percentage of Patients with Diabetes who Received Clinical Services: Curators

	Percentage of Patients Receiving Clinical Services
Diabetes (n=2,050)	
Percentage of patients with diabetes who received an HbA1c test	86.1
Percentage of patients with diabetes who received an LDL-C test	84.4

Notes:
- **Source:** Patient-level data provided to RTI by Curators.
- **Period of activity:** January 2013 to September 2015.

Terms and Definitions
- COPD = chronic obstructive pulmonary disease; Curators = Curators of the university of Missouri.

Figure 16 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 expected, more of these patients are in the higher-risk tiers (Tiers 3 and 4) than in the lower-risk tiers (Tiers 1 and 2). Among those in the higher-risk tiers, the percentage with poor HbA1c control decreased over time, from approximately 18 percent in the baseline quarters, to approximately 12 percent by I14. However, among those in the lower-risk tiers, poor HbA1c control increased slightly from approximately 9 percent in the baseline quarters to approximately 10 percent by I14. These findings suggest that HbA1c control tended to improve over time for diabetes patients in the higher-risk tiers, but not for those in the lower-risk tiers.

Figure 16. Percentage of Patients with Diabetes with Poor HbA1c Control over Time: Curators

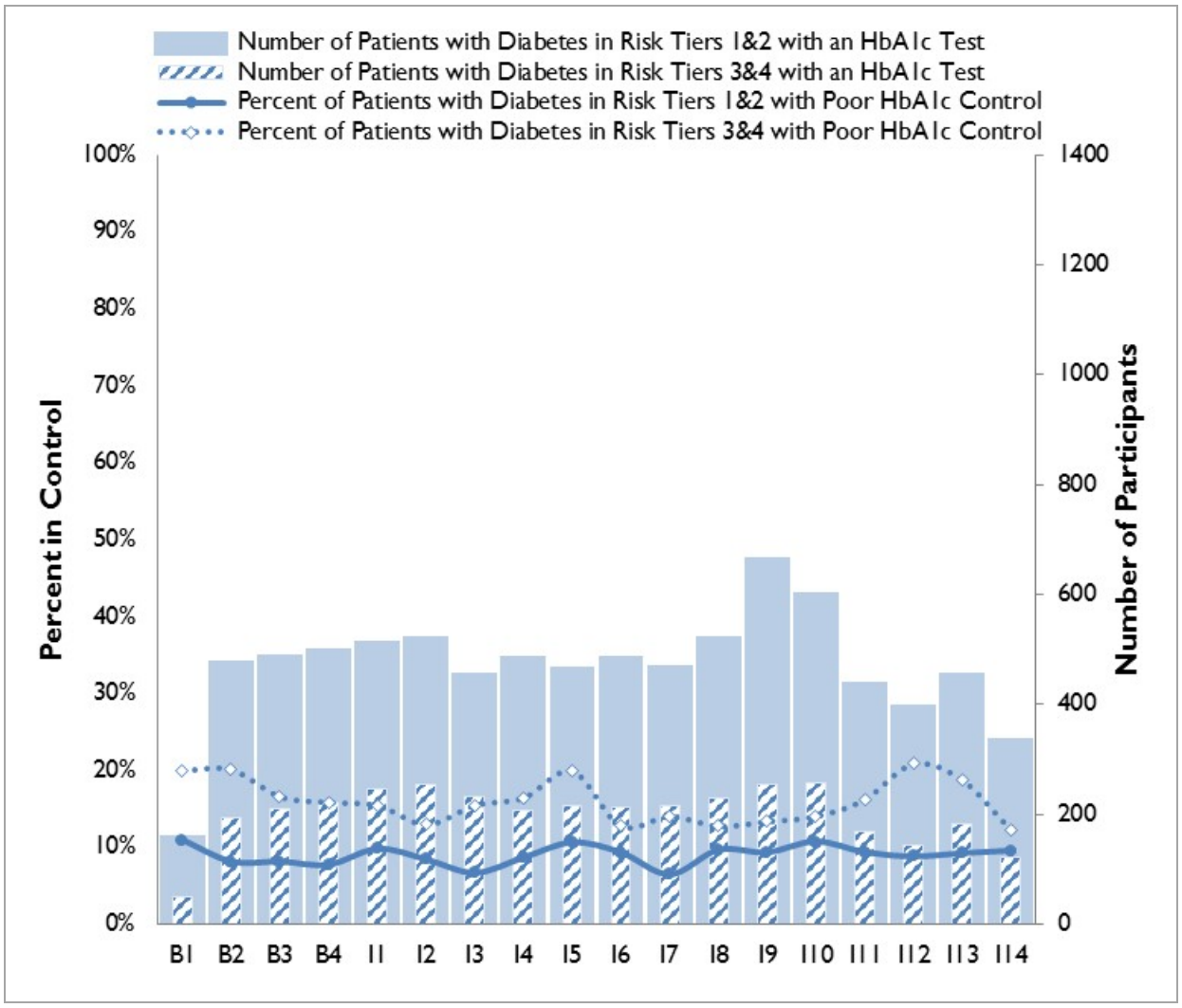

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Figure 16. Percentage of Patients with Diabetes with Poor HbA1c Control over Time: Curators (continued)

	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
●	Percentage of patients with diabetes in risk Tiers 1 & 2 with poor HbA1c control	10.9	8.1	8.1	7.7	9.8	8.4	6.7	8.6	10.6	9.3	6.5	9.6	9.3	10.7	9.3	8.8	9.2	9.5
◊	Percentage of patients with diabetes in risk Tiers 3 & 4 with poor HbA1c control	20.0	20.1	16.6	15.8	15.4	12.9	15.5	16.4	19.9	12.7	14.0	12.7	13.3	14.0	16.2	20.8	18.8	12.3
	Number of patients with diabetes in risk Tiers 1 & 2 with HbA1c test	138	455	468	479	492	500	434	463	445	463	448	499	645	580	418	376	435	315
	Number of patients with diabetes in risk Tiers 3 & 4 with HbA1c test	50	194	211	221	246	255	233	207	216	212	214	228	255	257	167	144	181	122

Notes:

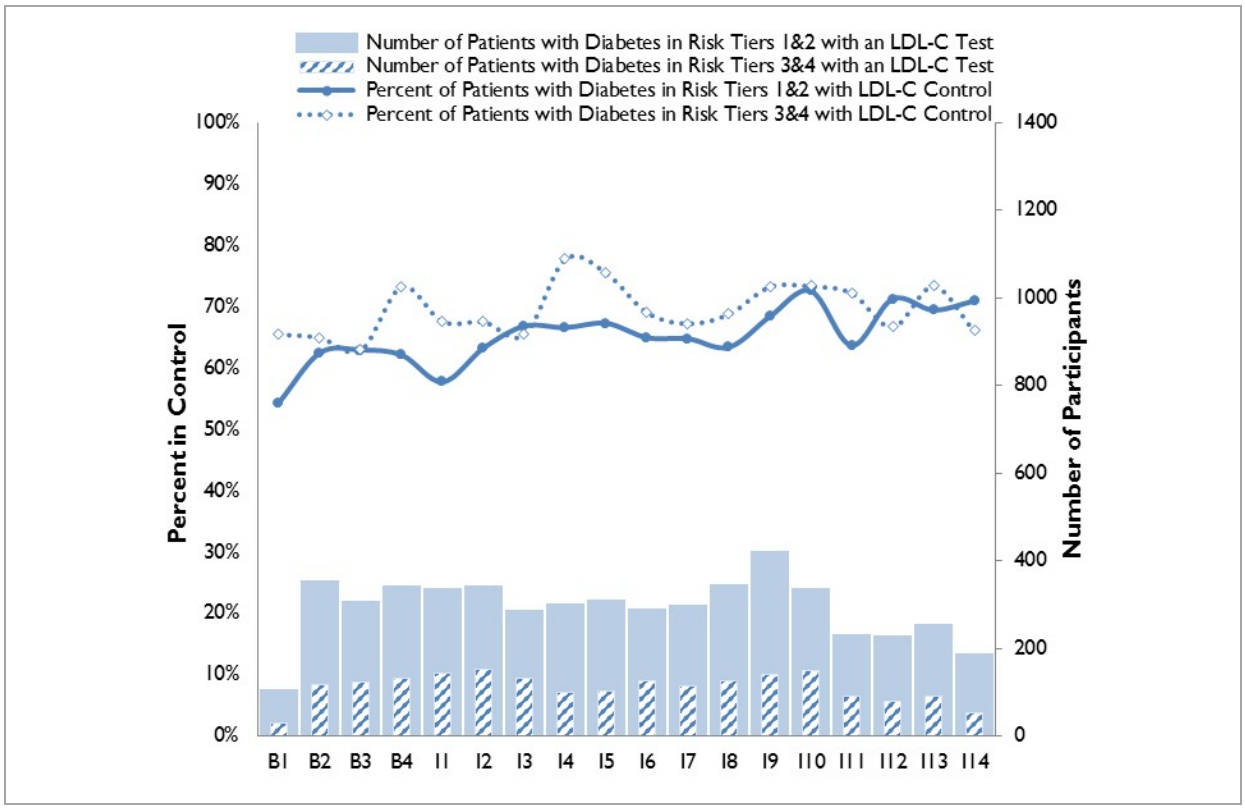
- **Source:** Patient-level data provided to RTI by Curators.

Terms and Definitions

- Curators = Curators of the University of Missouri.

Figure 17 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, more patients with LDL-C control are in the higher-risk tiers (Tiers 3 and 4) 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 66 percent of higher-risk tier patients had LDL-C control in the baseline quarters, which was approximately the same as that in I14 (i.e., 66%). The percentage of patients in the lower-risk tiers increased from approximately 60 percent in the baseline quarters to 71 percent in I14. This increase 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 17. Percentage of Diabetes Patients with LDL-C Control over Time: Curators



	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
●	Percentage of patients with diabetes in risk Tiers 1 & 2 with LDL-C control	54.3	62.4	62.9	62.1	57.7	63.2	66.8	66.5	67.2	64.9	64.7	63.4	68.3	72.5	63.6	71.2	69.4	70.9
◊	Percentage of patients with diabetes in risk Tiers 3 & 4 with LDL-C control	65.5	65.0	62.9	73.3	67.6	67.5	65.4	77.8	75.5	69.0	67.3	68.8	73.2	73.3	72.2	66.7	73.3	66.0
	Number of Patients with diabetes in risk Tiers 1 & 2 with an LDL-C test	81	330	283	319	312	318	262	278	287	265	275	322	398	313	209	205	232	165
	Number of Patients with diabetes in risk Tiers 3 & 4 with an LDL-C test	29	117	124	131	145	151	133	99	102	126	113	125	142	150	90	78	90	53

Notes:

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

Terms and Definitions

- DL-C = low-density lipoprotein cholesterol; Curators = Curators of the University of Missouri.

2.21 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. 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?

2.21.1 Descriptive Results

Table 29 shows that nearly all patients with hypertension received a blood pressure reading during the innovation period.

Table 29. Percentage of Patients with Hypertension who Received Clinical Services: Curators

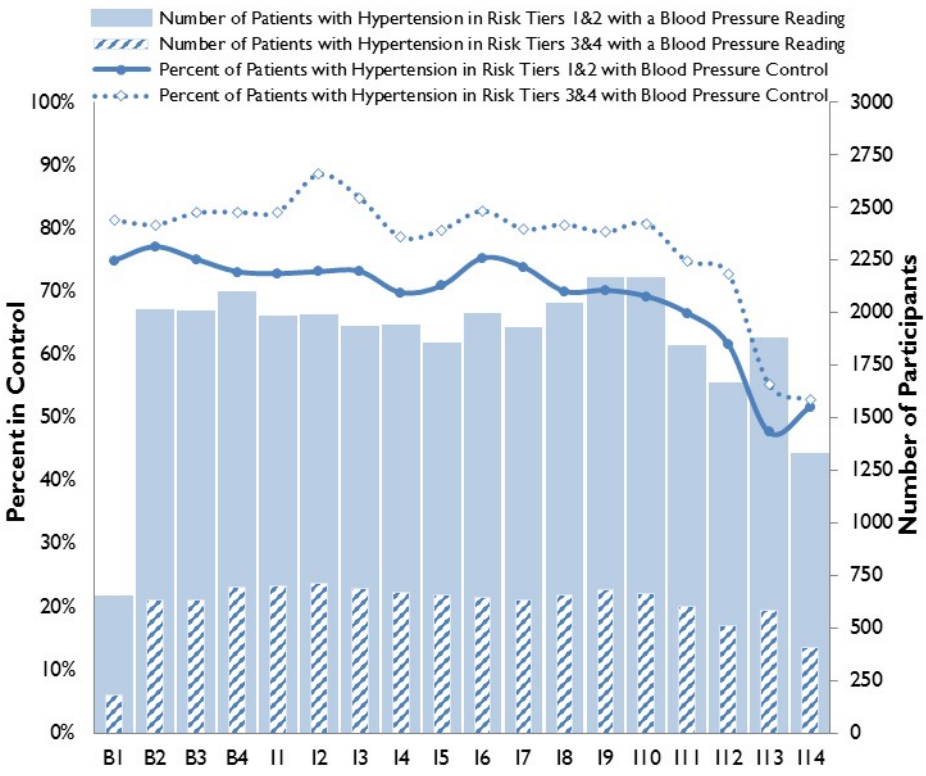
	Percentage of Patients Receiving Clinical Services
Hypertension (n=3,968)	
Percentage of patients with hypertension who received a blood pressure reading	93.4

Notes:
- **Source:** Patient-level data provided to RTI by Curators.
- **Period of activity:** January 2013 to September 2015.

Terms and Definitions
- Curators = Curators of the University of Missouri.

Figure 18 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. As shown in the figure, the percentage of patients with blood pressure control tended to decrease over time. More specifically, approximately 82 percent of higher-risk tier patients had blood pressure control in the baseline quarters, but approximately 53 percent did in I14. The percentage of lower-risk tier patients decreased from approximately 75 percent in the baseline quarters to approximately 52 percent by I14. Thus, blood pressure did not improve over time among hypertensive patients enrolled in the innovation, regardless of risk tier.

Figure 18. Percentage of Hypertension Patients with Blood Pressure Control over Time: Curators



	Quarter	B1	B2	B3	B4	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
●	Percentage of patients with hypertension in risk Tiers 1 & 2 with blood pressure control	74.9	77.0	75.1	73.1	72.8	73.1	73.2	69.8	70.9	75.3	73.8	70.0	70.2	69.2	66.6	61.7	47.7	51.7
◊	Percentage of patients with hypertension in risk Tiers 3 & 4 with blood pressure control	81.3	80.6	82.5	82.6	82.7	88.6	84.9	78.7	79.8	82.8	79.9	80.6	79.4	80.8	74.8	72.9	55.2	52.8
	Number of patients with hypertension in risk Tiers 1 & 2 with blood pressure reading	601	1965	1959	2049	1931	1942	1882	1891	1807	1944	1877	1995	2115	2115	1793	1617	1831	1280
	Number of patients with hypertension in risk Tiers 3 & 4 with blood pressure reading	182	630	634	691	698	712	689	670	658	646	633	656	681	663	603	513	585	407

Notes:

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

Terms and Definitions

- Curators = Curators of the University of Missouri.

2.22 Discussion: Awardee-Specific Data

Curators provided necessary clinical services to patients with CAD, diabetes, and hypertension. A majority of patients with COPD were prescribed an inhaled bronchodilator. 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, less than one-fourth of patients with asthma received an FEV1 test.

The health outcomes findings were mixed. The percentage of asthma patients with normal FEV1 decreased, rather than increased, over time. Among those in the higher-risk tiers, those with diabetes showed improvements in HbA1c control. However, there were no changes in LDL-C control for those with CAD or diabetes. Among those in the lower-risk tiers, those with CAD and diabetes showed improved LDL-C control over time. However, patients with diabetes showed no improvement in HbA1c. Patients with hypertension in both the lower- and higher-risk tiers did not show improvement in blood pressure control. These results should be interpreted with caution due to their descriptive nature and lack of a comparison group.

2.23 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 30*** lists the quantifiable measures of implementation and their status as of June 30, 2016 that RTI obtained from Curators' *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 Q15 and Q16 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 30. Measures of Implementation: Curators

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 Q16	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q15 and Q16	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q15 and Q16	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participants enrolled for services	Data received from Curators
		Number/percentage of participants	Data received from Curators
	Dose	Number and type of NCM services provided to patients	Data received from Curators

Notes:
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions
- Curators = Curators of the University of Missouri; FTE = full-time equivalent; NCM = nurse care manager.

2.24 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. Here we present any changes in workforce development in the last 6 months of operation not reported in the 2016 annual report.

2.24.1 Hiring and Retention

By the end of Q16, innovation staffing remained at about 2.5 FTE. The innovation employed 3 IT technicians/specialists and 5 management or administrative staff. One separation occurred in Q16. Staffing decreased to reflect the reduced level of effort expected during the NCE and was adequate to complete the remaining tasks.

2.24.2 Skills, Knowledge, and Training

Curators provided 4,632.25 hours of training to 1,295 individuals throughout the project, and offered no new training in Q15 or Q16. 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.

2.25 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. This section provides updates to award execution only, as RTI received no new data on leadership, organizational capacity, or innovation adoption and workflow integration since our previous report.[3]

Evaluation Questions

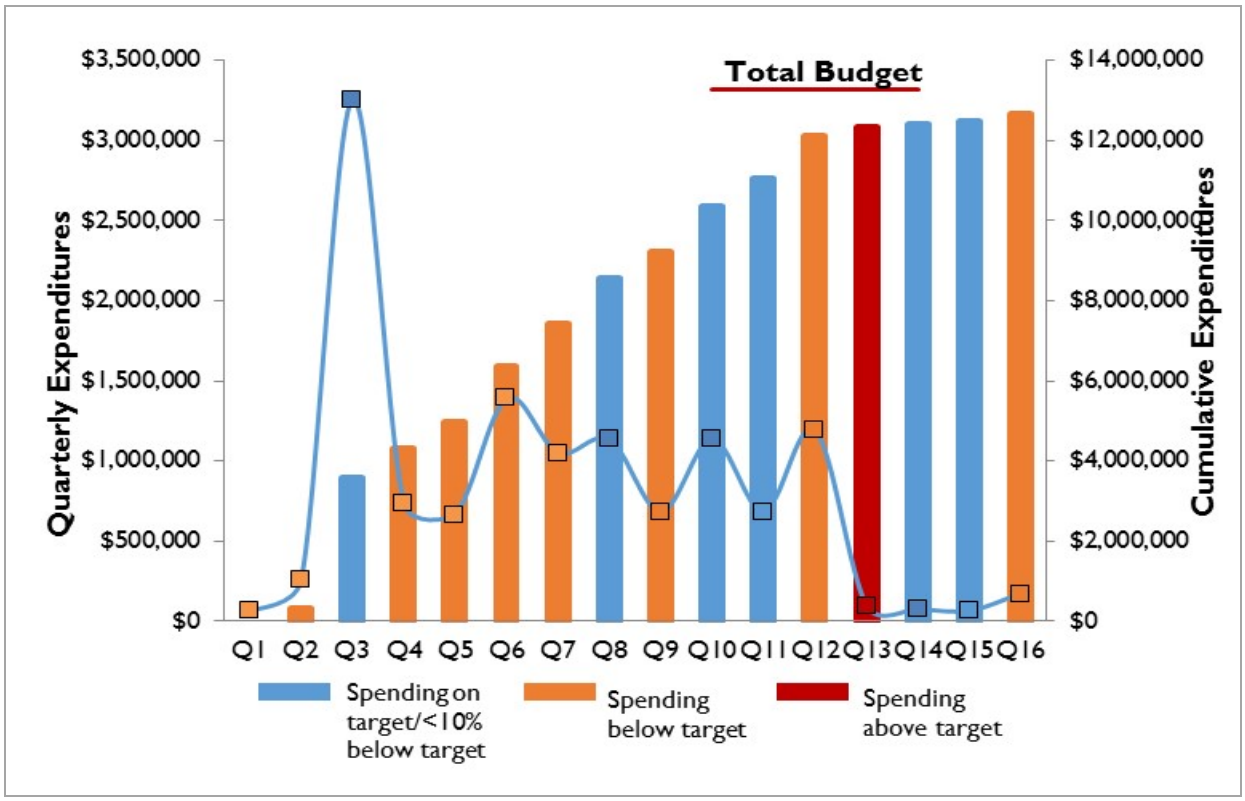
- What is the overall execution of the innovation award in the overall rate of expenditures relative to the projected rate?
- Does the awardee have sufficient leadership to implement the innovation effectively?
- Does the awardee have sufficient overall organizational capacity to implement the innovation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

2.25.1 Award Execution

The annual report highlights the significance of Curators' expenditure rates on implementation. As of June 2016 (Q16), Curators spent 95.4 percent of its total budget, which is below the projected target (see ***Figure 19***). Spending focused on staff for additional data analysis and writing to support the production of peer-reviewed publications. Topics included health utilization patterns and risk stratification, heat-mapping and geospatial applications, application of advanced machine-learning techniques to predict increased healthcare utilization, and a cluster analysis of those LIGHT^2 patients with the highest healthcare utilization. Curators likely did not spend 100 percent of their total budget because staffing significantly decreased during the no-cost extension period to reflect the reduced level of effort. No organizational barriers to spending were identified.

[3] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Figure 19. Cumulative Spend Rate from Q1 (June 1, 2012) to Q16 (June 30, 2016): Curators



Notes:

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

Terms and Definitions

- Curators = The Curators of the University of Missouri

2.26 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). This section provides an update to the reach measures presented in the 2016 annual report.

2.26.1 Innovation Reach

Innovation reach did not change since the third annual report.[4] Cumulative reach concluded at 100 percent, but only 68.2 percent of those enrolled received at least one NCM dose service. Twenty-five percent of patients had enrolled in the LIGHT[2] patient portal, with patient interest gradually growing toward the end of implementation.

[4] Ibid.

2.26.2 *Innovation Dose*

Dose did not change since the third annual report.[5] A greater percentage of patients in Tiers 3 and 4 (89.0%) received services than did patients in Tiers 1 and 2 (64.2%).

2.27 Qualitative Findings: Sustainability

The NCE focused on data analytics performed by HIAs to document project outcomes and development of peer-reviewed papers to disseminate the findings. Curators regarded such analyses as important for future sustainability planning. Curators' *Q16 Awardee Progress Report* suggests that analyses assessing cost savings and changes in health outcomes were expected to continue after the NCE period.

As we described in our third annual report,[6] when LIGHT^2 ended in June 2015, the University of Missouri health system sustained the NCM workforce and population management scorecard. RTI has no additional data on innovation sustainability to report.

5 Ibid.
6 Ibid.

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 in a primary care environment.

Awardee Overview

Innovation dose:	Approximately 68 percent 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 percent; only 68.2 percent of those enrolled received at least one of NCM dose services. 25 percent 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:***	The majority (77.7%) of participants were 45 or older; 60.1 percent were female, 85.8 percent were white, and around 11 percent were black. Most (79.1%) were covered by Medicare or dually eligible; 18.1 percent 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 ($220; 90% CI: $122, $318) than their comparison group, whereas Medicaid beneficiaries incurred significantly higher average quarterly spending in the first innovation year only ($250; 90% CI: $60, $440).

Better care. Medicare beneficiaries had more inpatient admissions per 1,000 participants per quarter (11; 90% CI: 8, 14) but fewer emergency department (ED) visits per 1,000 participants per quarter (−17; 90% CI: −21, −12) relative to the comparison group. Medicaid beneficiaries had more inpatient admissions per 1,000 participants per quarter (10; 90% CI: 6, 14) and ED visits per 1,000 participants (36; 90% CI: 17, 54) relative to the comparison group. There were no significant changes in average readmissions per 1,000 admissions per quarter for Medicare (5; 90% CI: −12, 22) or Medicaid (49; 90% CI: −21, 118) patients.

Healthier people. Overall changes in health outcomes were nominal: in both higher- and lower-risk tiers some patients with specific conditions improved. For diabetes health outcomes, the percentage of patients in the higher-risk tiers with poor HbA1c control decreased from 18 percent at baseline to 12 percent at the end of the innovation period, but the percentage with LDL-C control did not change substantially. The percentage of patients in the lower-risk tiers with poor HbA1c control increased slightly from 9 percent at baseline to 10 percent at the end of the innovation period, while the percentage with LDL-C control increased from 60 percent to 71 percent. For hypertension, blood pressure control decreased over time for both the lower- and higher-risk tier groups, 23 and 29 percentage points, respectively.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

Delta Dental Plan of South Dakota

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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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Delta Dental

Data Source	Period Covered
Medicaid claims data	January 2013–September 2015

Terms and Definitions
- Delta Dental = Delta Dental Plan of South Dakota.

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. Below we present the goals, as well as the findings, for the innovation.

1. **Smarter spending.**

   Goal: Reduce spending by 11 percent by improving oral health care through preventive interventions.

   Findings: Regression-adjusted differences between the innovation and comparison group showed no statistically significant effect on spending overall across the 3 years. During the first innovation year, however, the innovation group had significantly higher spending than the comparison group. This difference might have been due to the increased rates of dental spending among the innovation group in the first innovation year. Overall, the average probability of savings over the 3 years was 21 percent. The lack of significant savings is not surprising, given that 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.

2. **Better care.**

   Goal: 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.

   Findings: Innovation participants had significantly lower inpatient stays during Year 2, even though there was no significant impact overall. ED visit rates were higher among the innovation group across the 3 years of the innovation. 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 dental treatment to children in a relatively short innovation timeframe. The increase in ED visit rates may have been related to factors outside the innovation.

   After analyzing the dental spending rates, we find that the innovation might have succeeded in improving access to dental services for the target population, as it was designed to do. Throughout the baseline period, dental spending was noticeably lower for the innovation group, suggesting that the target population was indeed underserved in dental services. The innovation group's rate increased dramatically in the first two innovation quarters and remained above the baseline rates.

3. **Healthier people**.

   Goal: Improve infant and child oral health.

   Findings: Delta Dental did not provide health outcome data to RTI; thus, no results on this goal are presented in this report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicaid claims collected during the innovation period. No statistically significant savings for the innovation group compared to the comparison group were evident over the 3 years examined, even though the innovation group had significantly higher spending in Year 1. The number of ED visits was significantly higher for the innovation group compared to the comparison group. No differences in inpatient stays or unplanned readmissions were detected between the two groups overall across the 3 years. The Circle of Smiles innovation was not expected to have an impact on hospital admissions, readmissions, or ED visits because it focused on dental treatment to children in a relatively short innovation timeframe. The impact on inpatient admissions and ED visit rates may have been related to factors outside the innovation.

Table 2. Summary of Medicaid Claims-Based Findings: Delta Dental

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$1.100	−$1.142, $3.342	−$0.647, $2.847	$1.250	$0.094, $2.406	−$0.467	−$1.306, $0.373	$0.316	−$0.525, $1.158
Acute care inpatient stays	−4	−47, 40	−38, 30	27	−7, 62	−27	−51, −3	−4	−16, 8
Hospital-wide all-cause unplanned readmissions	−2	−12, 8	−10, 6	—	—	—	—	—	—
ED visits	404	176, 632	226, 582	376	196, 556	96	−34, 226	−68	−121, −15
Average impact per quarter									
Spending per participant	$31	−$32, $94	−$18, $80	$62	$5, $120	−$37	−$105, $30	$105	−$175, $386
Acute care inpatient stays (per 1,000 participants)	0	−1, 1	−1, 1	1	0, 3	−2	−4, 0	−1	−5, 3
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−7	−42, 29	−34, 21	—	—	—	—	—	—
ED visits (per 1,000 participants)	11	5, 18	6, 16	19	10, 28	8	−3, 18	−23	−40, −5

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** January 2011 to September 2015.
- **Sample size**: 5,390 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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 (per 1,000 participants)** is 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 is the product of ED visits (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; Delta Dental = Delta Dental Plan of South Dakota.
- — = not applicable due to small sample size.

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 3 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 3. Claims-Based Outcome Measures: Delta Dental

Evaluation Domain	Subdomains	Measure	Medicare	Medicaid
Health care outcomes	Utilization	All-cause inpatient admissions rate	No	Yes
		Hospital unplanned readmissions rate	No	Yes
		ED visit rate	No	Yes
	Spending	Spending per patient	No	Yes
		Estimated cost savings	No	Yes
		Any dental spending rate	No	Yes

Notes:

- We do not include analyses of the innovation's impact on Medicare beneficiaries 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.

Terms and Definitions

- ED = emergency department; Delta Dental = Delta Dental Plan of South Dakota.

2.3 Medicaid Comparison Group

Alpha-MAX Medicaid claims data are available through September 30, 2015. The Medicaid claims analysis focuses on 5,390 Delta Dental beneficiaries enrolled in fee-for-service Medicaid during the innovation period. This report includes the same comparison group as used in the third annual report. 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. See the third annual report for additional details.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 4 reports Medicaid 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 1*** illustrates the Medicaid spending per beneficiary in Table 4 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 the comparison group for most of the period; these trends are similar to the third annual report. The innovation and comparison groups have similar per-person spending levels in the final quarters of the baseline period, but then diverge again as per-person spending in the innovation group increases. The innovation group realizes slightly lower spending than the comparison group for the first time in quarters 7 and 8, possibly benefiting from the gains of the innovation's preventive care; however, the gap widens again starting in quarter 9. Innovation group spending is noticeably higher in quarters 9 and 10. We will explore the differences between the two groups further in the regression analysis section.

Table 4. Medicaid Spending per Participant: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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	$830	$788	$704	$697	$691	$706	$682	$647	$704	$661	$582	$587	$541	$557	$475	$479	$682	$609	$291
Std dev	$7,884	$5,457	$2,494	$2,110	$2,131	$2,161	$2,392	$1,905	$1,691	$1,669	$1,458	$1,791	$1,481	$2,615	$1,299	$1,078	$7,727	$6,119	$975
Unique patients	4,510	4,578	4,671	4,782	4,909	5,029	5,129	5,259	5,390	5,295	4,905	4,476	3,804	3,311	3,061	2,288	1,507	985	509
Comparison Group																			
Spending rate	$669	$643	$647	$630	$591	$672	$703	$692	$550	$539	$525	$470	$511	$506	$506	$485	$433	$440	$312
Std dev	$2,408	$2,915	$3,676	$2,822	$1,571	$2,330	$4,313	$2,829	$1,614	$2,840	$2,598	$1,533	$1,979	$1,654	$3,373	$2,546	$941	$1,364	$1,265
Weighted patients	4,769	4,793	4,830	4,862	4,887	4,981	5,062	5,259	5,390	5,253	4,908	4,527	3,907	3,428	3,177	2,393	1,571	1,029	532
Savings per Patient																			
	−$161	−$146	−$57	−$67	−$99	−$33	$21	$44	−$154	−$122	−$58	−$118	−$30	−$51	$31	$6	−$249	−$169	$22

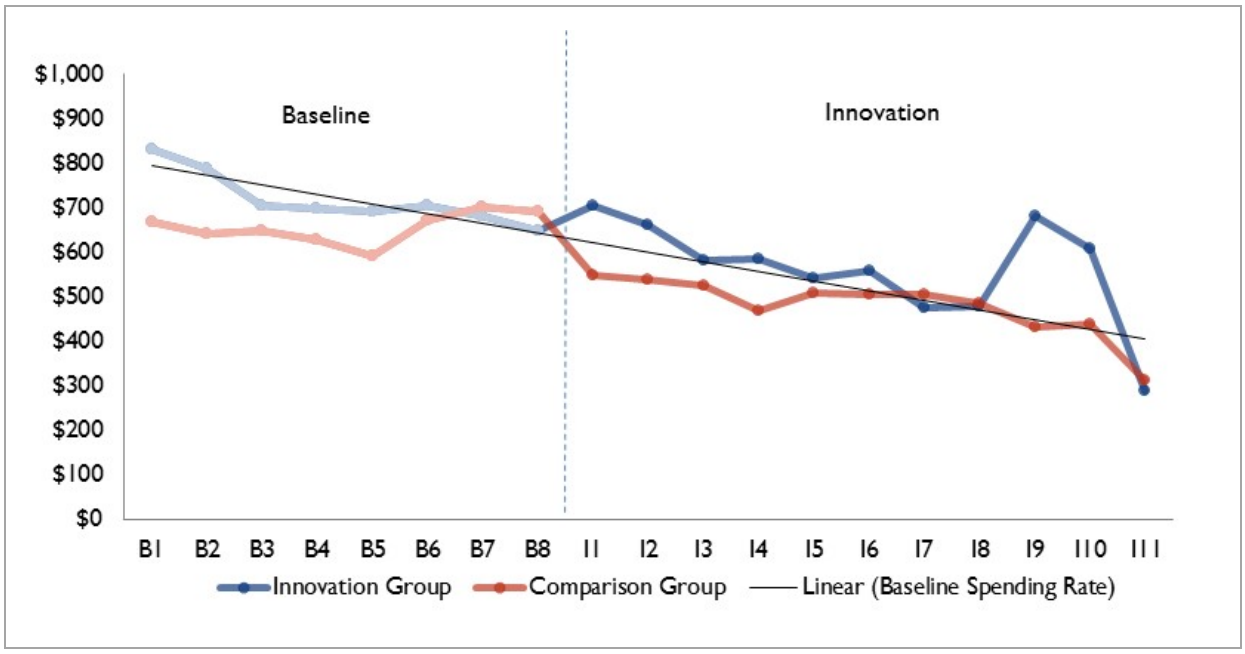
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Delta Dental = Delta Dental Plan of South Dakota.

Figure 1. Medicaid Spending per Participant: Delta Dental



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- Delta Dental = Delta Dental Plan of South Dakota.

2.4.2 Regression Results

In ***Table 5*** 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 $31 (90% CI: −$32.14, $94.06) This effect is not statistically significant. This finding is consistent with the finding in the third annual report. 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 quarterly effects derived from 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 effect of the innovation on spending is statistically significant only in the first innovation quarter, where the spending for the innovation group is higher than the comparison group spending. The quarterly estimates are negative in quarters 7, 8, and 11 even though they are not statistically significant. The lack of an impact on total spending during most quarters

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 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
I1	$101	$37	0.006
I2	$69	$44	0.114
I3	$6	$47	0.895
I4	$69	$44	0.117
I5	−$20	$49	0.676
I6	$0	$44	0.995
I7	−$81	$62	0.195
I8	−$62	$59	0.293
I9	$183	$204	0.370
I10	$91	$203	0.654
I11	−$97	$76	0.201
Overall average	$31	$38	0.420
Overall aggregate	$1,100,129	$1,363,002	0.420
Overall aggregate (IY1)	$1,250,304	$702,813	0.075
Overall aggregate (IY2)	−$466,589	$510,153	0.360
Overall aggregate (IY3)	$316,414	$511,365	0.536

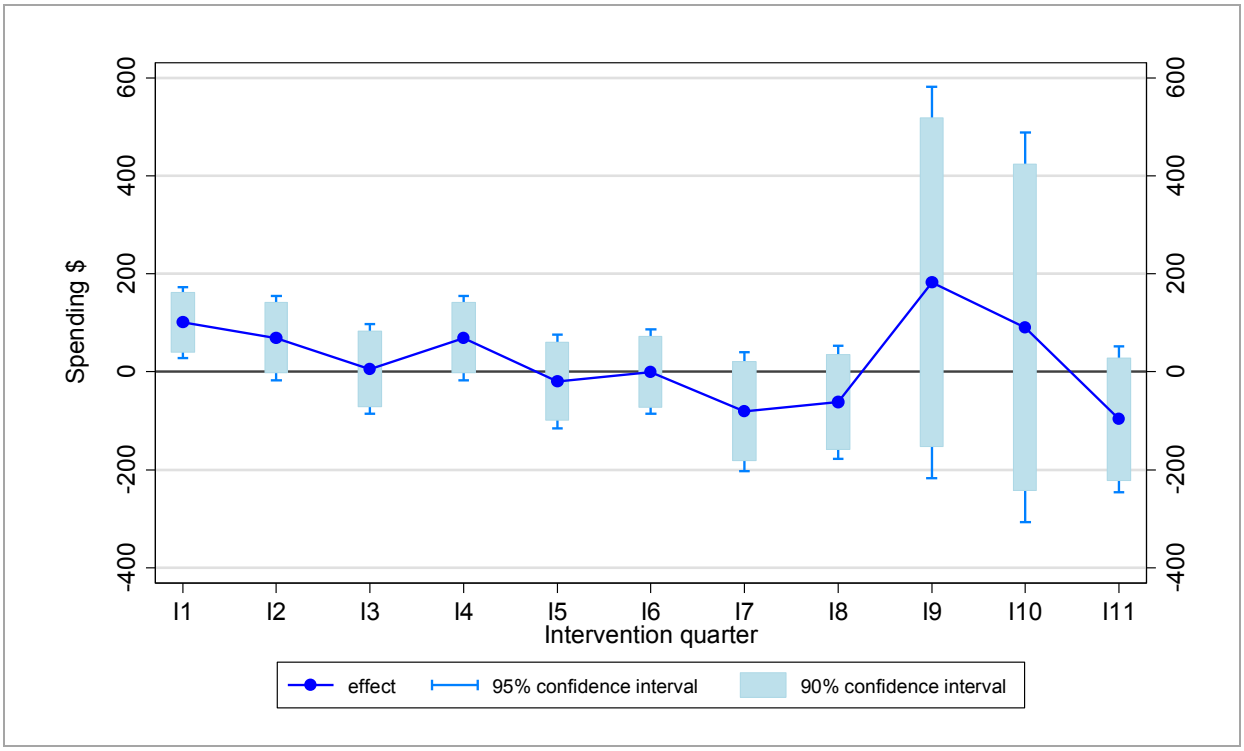
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **The regression coefficients** are 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 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 as compared to their matched comparison group
- I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Delta Dental = Delta Dental Plan of South Dakota.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Delta Dental



Notes:

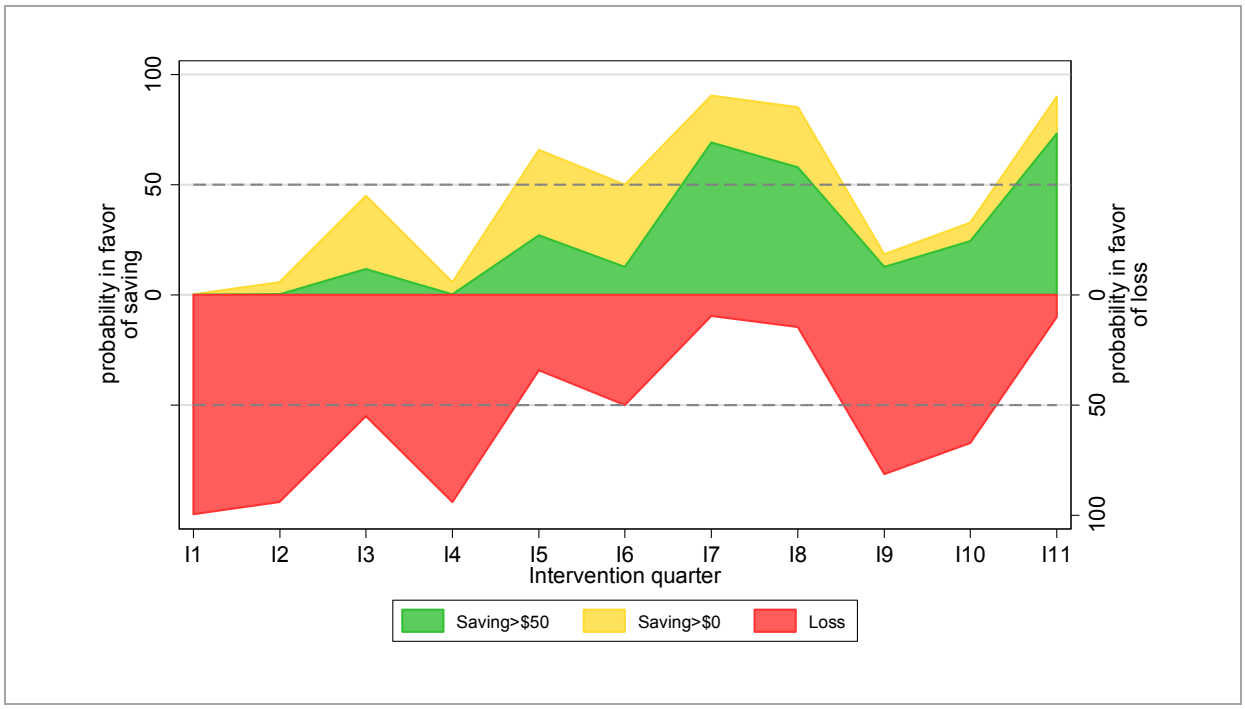
- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- OLS = ordinary least squares; Delta Dental = Delta Dental Plan of South Dakota.

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 for saving or losing money on this initiative. The higher quarterly spending estimates for the innovation group in the early quarters of the innovation suggest that the innovation generated losses, represented by the red areas in the figure. Overall, the average probability of savings over the intervention period is 21 percent.

Figure 3. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Delta Dental



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- 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 6*** and ***Figure 4***. 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. This finding is similar to the trend observed in the third annual report. Overall, admissions rates are quite low, which is expected from a population of healthy children. Overall, the two groups have similar inpatient admissions rates throughout the innovation period. We will explore the differences between the two groups further in the regression analysis section below.

Table 6. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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	29	28	28	24	25	25	17	14	12	11	11	12	9	8	4	8	8	8	4
Std dev	188	181	176	164	161	170	140	130	113	104	110	124	108	96	60	102	89	100	63
Unique patients	4,510	4,578	4,671	4,782	4,909	5,029	5,129	5,259	5,390	5,295	4,905	4,476	3,804	3,311	3,061	2,288	1,507	985	509
Comparison Group																			
Admit rate	33	22	20	18	22	27	21	21	15	9	8	9	11	11	8	6	7	11	7
Std dev	154	125	124	114	133	135	129	120	100	78	74	82	91	92	75	65	66	113	67
Weighted patients	4,769	4,793	4,830	4,862	4,887	4,981	5,062	5,259	5,390	5,253	4,908	4,527	3,907	3,428	3,177	2,393	1,571	1,029	532
Innovation − Comparison Rate																			
	−4	6	8	6	3	−2	−4	−7	−2	1	2	4	−2	−3	−4	2	1	−3	−3

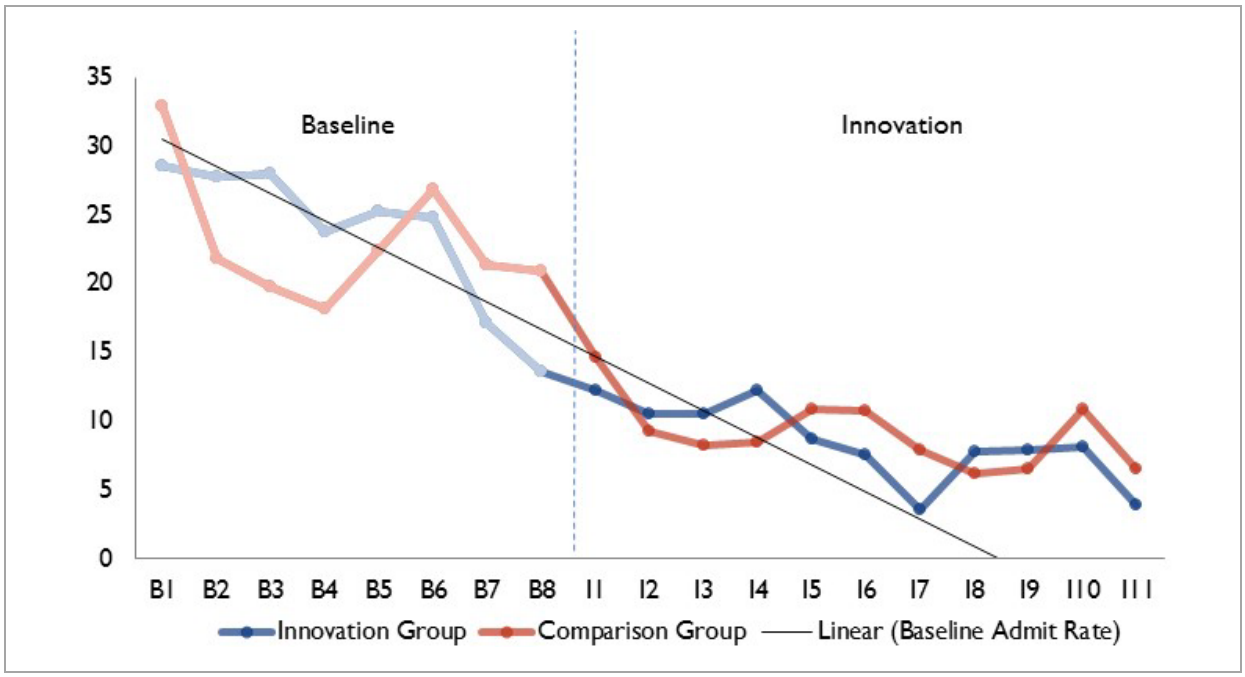
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **Admit rate: (**Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Delta Dental = Delta Dental Plan of South Dakota.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Delta Dental



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- Delta Dental = Delta Dental Plan of South Dakota.

2.5.2 Regression Results

As shown in ***Table 7***, the average quarterly difference-in-differences estimate for inpatient admissions is 0 inpatient admissions per 1,000 participants, representing no difference between the innovation and comparison groups. 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: −1.33, 1.11). This finding is consistent with the finding in the third annual report.

We also present quarterly effects 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 innovation quarters 4 and 7, in which the innovation group has, on average, 4 more and 4 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 (−27, p = 0.060).

Table 7. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
I1	−2	2	0.366
I2	1	2	0.425
I3	3	2	0.167
I4	4	2	0.044
I5	−2	2	0.401
I6	−3	2	0.194
I7	−4	2	0.020
I8	1	2	0.547
I9	1	3	0.774
I10	−4	5	0.483
I11	−3	4	0.402
Overall average	0	1	0.883
Overall aggregate	−4	26	0.883
Overall aggregate (IY1)	27	21	0.190
Overall aggregate (IY2)	−27	14	0.060
Overall aggregate (IY3)	−4	7	0.580

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **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.
- **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, sex, an indicator for infant (age ≤ 1), 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.
- I = Innovation Quarter; IY = Innovation Year; Delta Dental = Delta Dental Plan of South Dakota.

2.6 Medicaid Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 8*** and ***Figure 5***. Major fluctuations in the readmissions rate occur throughout both the baseline and innovation periods for both the control and innovation groups, mostly because of the small number of admissions in a given quarter. The same level of variability occurs in the third annual report The frequent fluctuations in the observed readmissions rates among both groups hinders comparison and interpretation of the trends.

Table 8. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																			
Readmit rate	122	73	41	57	34	55	24	138	0	0	116	61	36	176	0	125	0	0	0
Std dev	327	260	198	232	182	227	154	345	0	0	321	240	186	381	0	331	0	0	0
Total admissions	123	123	122	105	117	110	82	65	58	40	43	49	28	17	10	16	10	8	2
Comparison Group																			
Readmit rate	79	43	68	56	116	41	80	66	38	26	31	74	131	44	31	28	39	328	0
Std dev	270	202	252	230	321	199	272	248	192	159	174	261	337	204	172	164	194	469	0
Total admissions	148	98	88	80	102	122	100	102	70	38	32	32	33	31	22	12	9	10	2
Innovation − Comparison Rate																			
	43	31	−27	1	−82	13	−56	73	−38	−26	85	−12	−95	133	−31	97	−39	−328	0

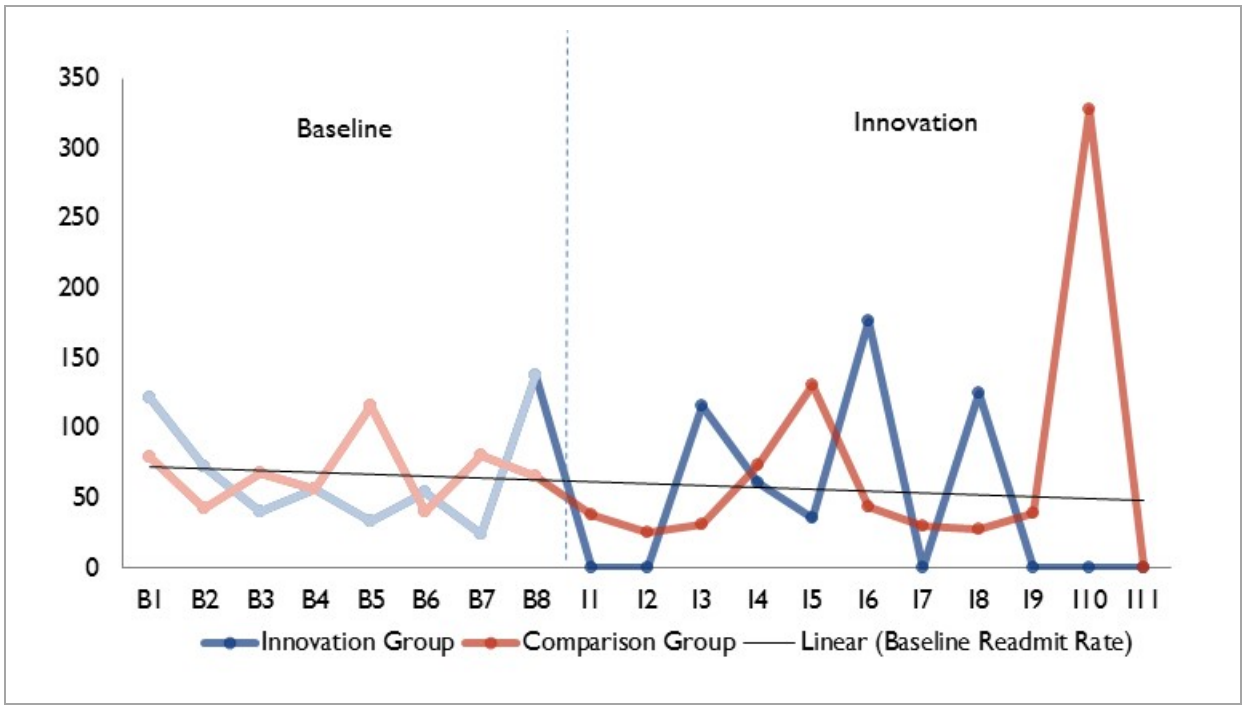
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Delta Dental = Delta Dental Plan of South Dakota.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Delta Dental



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- Delta Dental = Delta Dental Plan of South Dakota.

2.6.2 Regression Results

Table 9 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 −7 per 1,000 inpatient admissions, indicating that the innovation−comparison difference is lower for the innovation group 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: −42, 29). This finding is consistent with the finding in the third annual report.

Table 9. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
Overall average	−7	22	0.762
Overall aggregate	−2	6	0.762

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **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, sex, an indicator for infant (age ≤ 1), 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 10*** and ***Figure 6.*** The ED visit rate decreases for the innovation group in the baseline quarters with a slight dip in the innovation period. This finding is consistent with the findings in the third annual report. The comparison group rate follows a similar trend overall. The comparison group ED visit rate is consistently lower than the innovation group through the first eight quarters of the innovation period; however, the innovation and comparison group rates converge in the final three quarters examined. We will further analyze whether the innovation had any significant effects on the ED rate in the regression analysis section below.

Table 10. ED Visits per 1,000 Medicaid Participants: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																			
ED rate	223	224	217	212	194	217	194	201	194	188	165	149	156	142	136	128	115	93	72
Std dev	553	569	562	556	535	579	523	535	522	525	478	460	464	439	414	443	387	362	274
Unique patients	4,510	4,578	4,671	4,782	4,909	5,029	5,129	5,259	5,390	5,295	4,905	4,476	3,804	3,311	3,061	2,288	1,507	985	509
Comparison Group																			
ED rate	217	198	195	207	176	189	187	184	157	146	147	135	132	124	116	118	124	100	81
Std dev	473	433	429	440	408	410	399	392	381	352	361	333	335	328	319	317	317	303	247
Weighted patients	4,769	4,793	4,830	4,862	4,887	4,981	5,062	5,259	5,390	5,253	4,908	4,527	3,907	3,428	3,177	2,393	1,571	1,029	532
Innovation − Comparison Rate																			
	6	26	22	4	18	27	8	16	36	42	17	15	24	18	20	9	-9	-7	-9

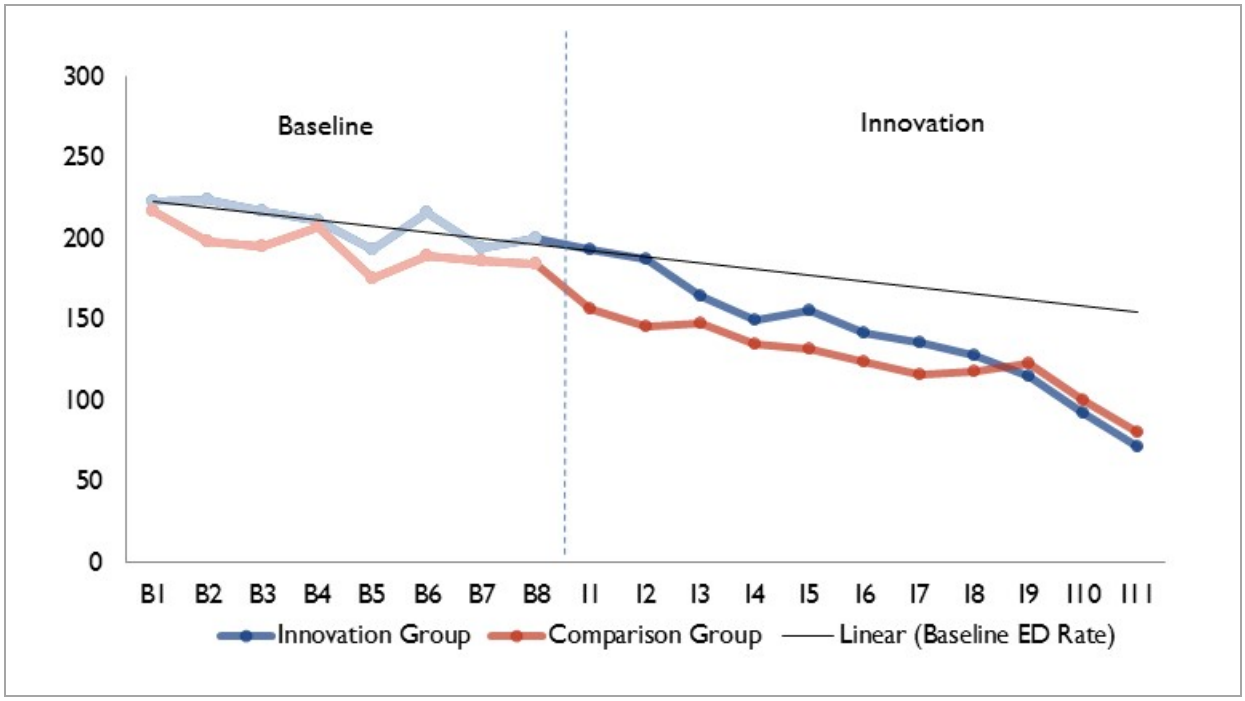
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Delta Dental = Delta Dental Plan of South Dakota.

Figure 6. ED Visits per 1,000 Medicaid Participants: Delta Dental



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- ED = emergency department; Delta Dental = Delta Dental Plan of South Dakota.

2.7.2 Regression Results

As shown in ***Table 11***, the average quarterly difference-in-differences estimate for ED visits is an increase of 11 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: 5, 18). This finding is consistent with the finding in the third annual report.

We also present quarterly effects 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 most of the innovation quarters are not significant, indicating that the likelihood of an ED visit is not statistically different for the innovation and comparison groups. However, significant positive increases in ED visits occur in the innovation group compared with the comparison group in the first two innovation quarters. In innovation quarters 1 and 2, the innovation group has, on average, 28 and 32 more ED visits per 1,000 participants, respectively. Overall, the innovation group has significantly more ED visits in the first innovation year and cumulatively over the 3 years of the innovation.

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Delta Dental

Quarter	Coefficient	Standard Error	P-Values
I1	28	10	0.006
I2	32	11	0.005
I3	6	11	0.601
I4	6	10	0.562
I5	14	12	0.243
I6	7	12	0.551
I7	10	12	0.410
I8	−5	15	0.747
I9	−25	16	0.115
I10	−20	19	0.295
I11	−21	19	0.284
Overall average	11	4	0.004
Overall aggregate	404	139	0.004
Overall aggregate (IY1)	376	110	0.001
Overall aggregate (IY2)	96	79	0.223
Overall aggregate (IY3)	−68	32	0.034

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **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, sex, an indicator for infant (age ≤ 1), 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 as compared to their matched comparison group.
- I = Innovation Quarter; IY = Innovation Year; Delta Dental = Delta Dental Plan of South Dakota.

2.8 Medicaid: Any Dental Spending Rate

In addition to the core four outcome measures listed above, we also present descriptive statistics for an additional outcome in this report: *any dental spending rate*. Since the Delta Dental innovation focuses on dental services for children, this outcome might provide additional insight into the impact of the innovation. *Any dental spending rate* denotes the number of participants with any dental spending (dental spending>0) per 1,000 participants in a given quarter. Dental spending in Alpha-MAX claims data is identified as spending associated with dental procedure codes (i.e., procedure codes that start with letter D). Since most of the dental preventive care services provided were covered by the Delta Dental innovation funds, the *any dental spending rate* we compute most likely represents referrals to pediatric dentists.

2.8.1 Descriptive Results

Any dental spending rate per 1,000 participants is shown in ***Table 12*** and ***Figure 7.*** This measure is relatively flat for both groups in the baseline period; however, it is noticeably lower for the innovation group compared to the comparison group. In all baseline quarters, the comparison group's *any dental spending rate* is more than double the innovation group's rate. For instance, in B1, the innovation group has 90 participants per 1,000 with any dental spending, whereas the comparison group has 187 per 1,000. This discrepancy seems to confirm that the Delta Dental target population was indeed underserved in dental services before the innovation. The innovation group's rate increases dramatically in the first two innovation quarters. Even though the innovation group's rate declines slightly afterward, it remains above the baseline rates. Since the dental spending rate represents referrals to pediatric dentists, the trends are consistent with the innovation group's noticeably lower access to referrals prior to the innovation and improved access in the first two quarters of the innovation. For the remaining innovation period, the innovation group's access to referrals seems to be higher than its baseline rates. Even though these descriptive statistics denote average rates, the trends imply that the innovation might have succeeded in improving access to dental services for the target population.

Table 12. Any Dental Spending Rate per 1,000 Medicaid Participants: Delta Dental

Awardee Number: 1C1CMS330980
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																			
Any dental spending rate	90	93	93	102	95	90	88	71	133	170	109	118	113	104	109	97	101	99	83
Unique patients	4,510	4,578	4,671	4,782	4,909	5,029	5,129	5,259	5,390	5,295	4,905	4,476	3,804	3,311	3,061	2,288	1,507	985	509
Comparison Group																			
Any dental spending rate	187	196	196	205	209	199	224	211	203	207	209	202	207	215	194	171	193	190	179
Weighted patients	4,769	4,793	4,830	4,862	4,887	4,981	5,062	5,259	5,390	5,253	4,908	4,527	3,907	3,428	3,177	2,393	1,571	1,029	532
Innovation − Comparison Rate																			
	−97	−103	−103	−103	−114	−109	−136	−140	−70	−37	−100	−84	−94	−111	−85	−74	−92	−90	−96

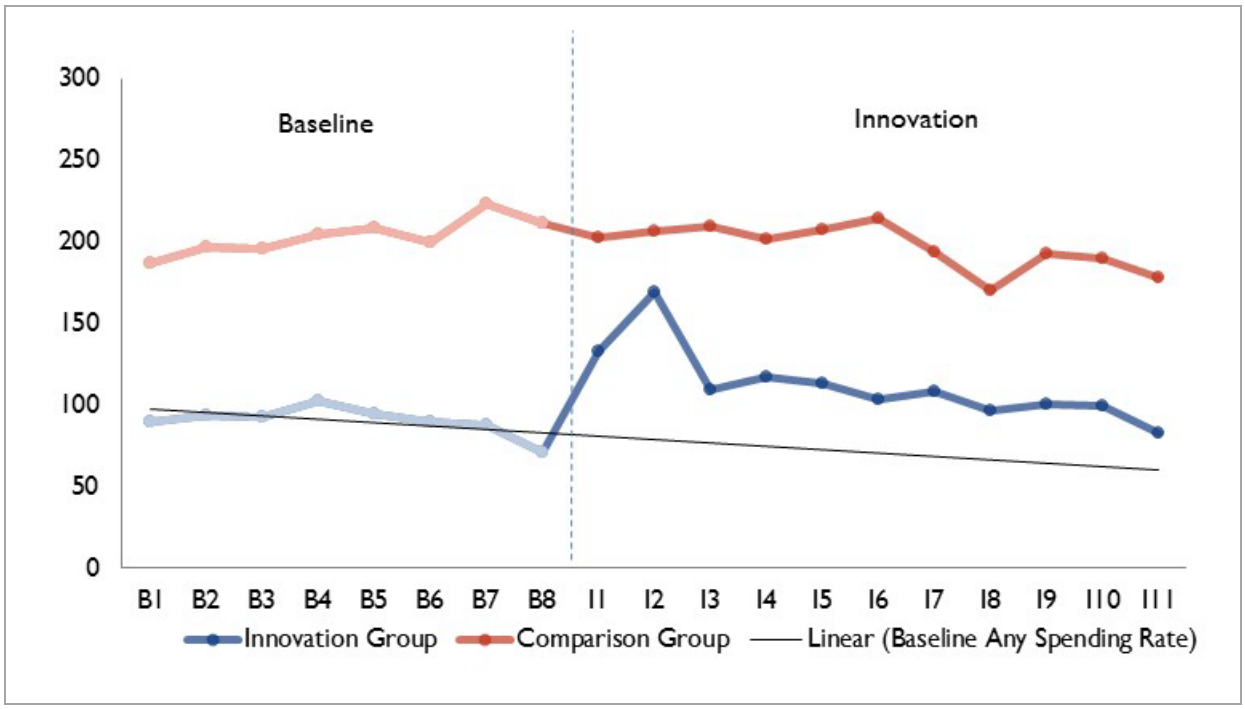
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **Any dental spending rate**: (Number of patients with positive dental spending /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; Delta Dental = Delta Dental Plan of South Dakota.

Figure 7. Any Dental Spending Rate per 1,000 Medicaid Participants: Delta Dental



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- Delta Dental = Delta Dental Plan of South Dakota.

2.9 Discussion: Medicaid Results

Spending increased significantly during Year 1 of the innovation, but we do not observe significant savings in total spending over the 3 years of innovation period. The number of ED visits for the innovation group is significantly higher compared to the comparison group across the 3 innovation years. For inpatient admissions, the results show significantly lower inpatient admissions for the innovation group in Year 2 (−27, p = 0.060), even though there is no significant impact overall. No significant difference in unplanned readmissions is detected between the two groups.

The discrepancies between the innovation and comparison groups in *any dental spending rate* seem to confirm that the Delta Dental target population was indeed underserved in dental services before the innovation. In all baseline quarters, the comparison group's *any dental spending rate* is more than double the innovation group's rate. The innovation group's rate increases dramatically in the first two innovation quarters and remains above the baseline rates. Since the dental spending rate represents referrals to pediatric dentists, the trends are consistent with the innovation group's noticeably lower access to referrals prior to the innovation and improved access afterwards, even though these are merely descriptive statistics denoting average rates.

The Medicaid results are mostly consistent with the innovation's theory of change because the Circle of Smiles innovation focused on enhancing dental services for children, and we find descriptive evidence that dental spending increased in the innovation group. The innovation was not expected to affect Medicaid spending overall because dental spending accounts for only a small proportion of total costs. Based on the type and dose of services that patients typically received, the innovation was also unlikely to have affected inpatient admissions, readmissions, or ED visits.

The results may not fully represent the overall population that the innovation served. 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 about 69 percent of the overall population reached by the innovation.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: ECCHC

Data Source	Period Covered
Medicare claims data	December 2012–June 2016
Terms and Definitions ECCHC = Eau Claire Cooperative Health Centers, Inc.	

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. Below we present the goals as well as the findings for this innovation.

1. **Smarter spending.**

   Goal: Reduce spending by $3,000 per participant per year, or $14,817,600 over 3 years.

   Findings: Trends in Medicare spending per patient for innovation beneficiaries are highly variable and similar to comparison beneficiaries. The sample size is too small to support regression analysis or estimate the impact of the innovation on spending or utilization.

2. **Better care.**

   Goal: 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.

   Findings: The Medicare 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.

3. **Healthier people.**

   Goal: 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.

   Findings: None to report.

2.1.1 Spending and Utilization Overview

Medicaid findings were presented in the third annual report and have not changed; therefore, they are not presented again here.[1] We do not summarize Medicare-claims based regression findings because the sample has too few Medicare beneficiaries (less than 100) to perform regression analyses. However, descriptive results for the Medicare claims-based measures are presented.

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?

2.3 Medicare Comparison Group

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016, including two more quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 76 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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 Richland County, South Carolina, during the innovation launch. See the third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 2 reports Medicare spending per patient in the 8 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 1*** illustrates the

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Medicare spending per beneficiary in Table 2 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. These trends are similar to the third annual report. In innovation quarters, average spending for the innovation group increases relative to the trend line in innovation quarter 1 (I1) through I4 and again in I8 through I12. Spending is highly variable for both the innovation and comparison groups in I5 through I7. We observed a similar trend in spending 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, the data points tend to be spread over a wide range of values rather than at the mean, as shown in Table 2.

The sample size was too small to support regression analysis.

Table 2. Medicare Spending per Participant: ECCHC

Awardee Number: 1C1CMS331045
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	$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	$3,772	$3,539	$5,012	$7,104	$4,253
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	$7,735	$11,330	$11,172	$17,493	$10,622
Unique patients	63	64	66	66	71	72	74	76	76	75	69	67	65	63	62	60	55	53	49	45
Comparison Group																				
Spending rate	$1,661	$1,570	$2,032	$2,424	$2,168	$1,971	$2,213	$1,381	$2,191	$2,835	$2,362	$2,435	$3,359	$2,735	$3,111	$2,475	$3,281	$3,833	$3,503	$2,455
Std dev	$3,365	$4,013	$5,841	$6,728	$6,086	$5,549	$6,433	$3,400	$8,381	$9,441	$6,953	$7,341	$9,687	$7,314	$6,648	$7,561	$11,008	$10,833	$9,389	$5,441
Weighted patients	64	65	66	68	71	73	75	76	76	76	74	72	70	67	63	62	60	58	51	46
Savings per Patient																				
	−$345	$178	−$1,407	−$892	−$172	−$432	−$883	−$319	−$612	−$1,021	−$1,143	−$1,272	$1,039	−$950	$483	−$1,298	−$258	−$1,178	−$3,601	−$1,798

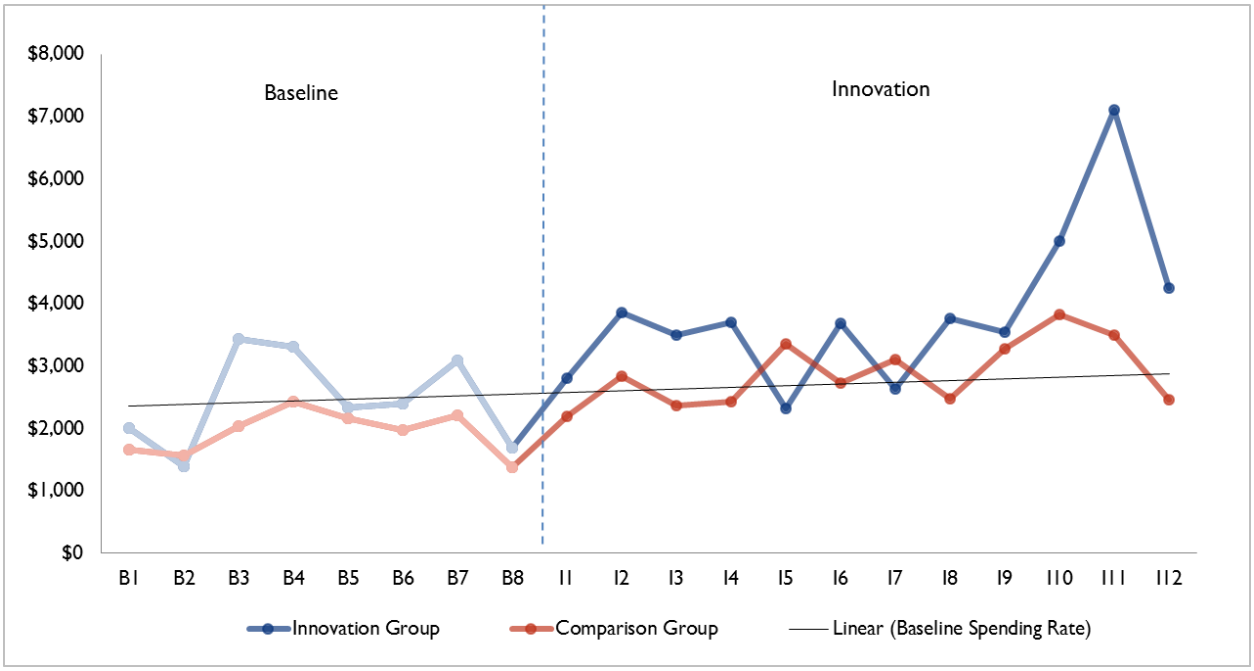
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.

Figure 1. Medicare Spending per Participant: ECCHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- 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 3*** and ***Figure 2***. 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 highly variable rate of inpatient admissions. Inpatient admissions for the innovation group in the innovation quarters are highly variable and similar to the comparison group in most quarters. These trends are similar to the third annual report. The sample size is too small to support regression analysis.

Table 3. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: ECCHC

Awardee Number: 1C1CMS331045
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																				
Admit rate	79	63	121	167	85	42	176	66	66	107	130	119	77	206	81	133	127	189	204	111
Std dev	410	242	477	510	366	200	644	248	296	449	414	324	266	539	326	340	384	675	494	482
Unique patients	63	64	66	66	71	72	74	76	76	75	69	67	65	63	62	60	55	53	49	45
Comparison Group																				
Admit rate	53	51	56	89	70	28	63	35	70	97	50	98	125	120	122	59	111	127	105	88
Std dev	245	281	229	347	273	190	306	184	368	362	236	425	419	463	385	277	432	365	345	330
Weighted patients	64	65	66	68	71	73	75	76	76	76	74	72	70	67	63	62	60	58	51	46
Innovation − Comparison Rate																				
	27	11	66	78	14	14	113	31	−5	10	81	22	−48	86	−41	74	16	62	100	23

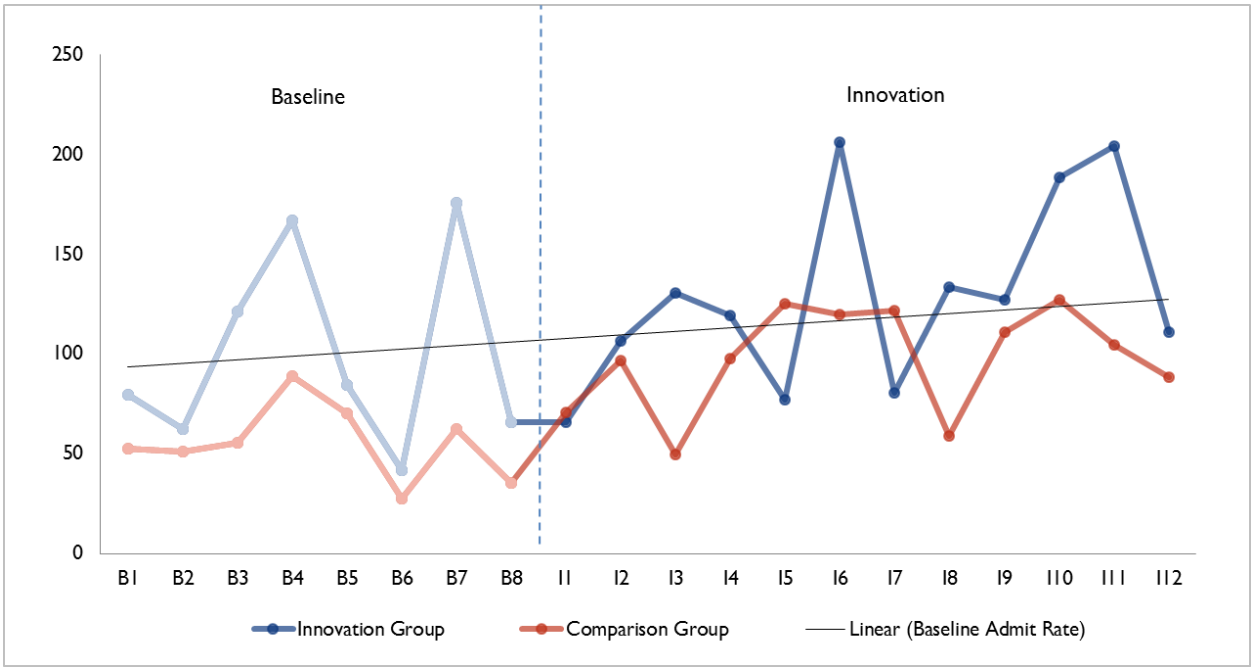
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.

Figure 2. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: ECCHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- 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 4*** and ***Figure 3***. Readmissions rates vary highly 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 readmissions rate) and a relatively low underlying percentage of readmissions, the readmissions rate is highly variable, and there may be little or no clinical significance in the readmissions rate. These trends are similar to the third annual report.

Table 4. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: ECCHC

Awardee Number: 1C1CMS331045
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																				
Readmit rate	0	0	0	200	0	0	167	0	0	0	0	0	0	0	0	0	0	0	0	0
Std dev	0	0	0	400	0	0	373	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	5	1	4	4	1
Comparison Group																				
Readmit rate	125	167	143	83	0	200	182	0	400	143	0	133	83	250	77	0	0	0	0	0
Std dev	331	373	350	276	0	400	386	0	490	350	0	340	276	433	267	0	0	0	0	0
Total admissions	3	2	2	4	4	2	4	1	3	5	2	5	4	4	4	2	4	4	3	2
Innovation − Comparison Rate																				
	−125	−167	−143	117	0	−200	−15	0	−400	−143	0	−133	−83	−250	−77	0	0	0	0	0

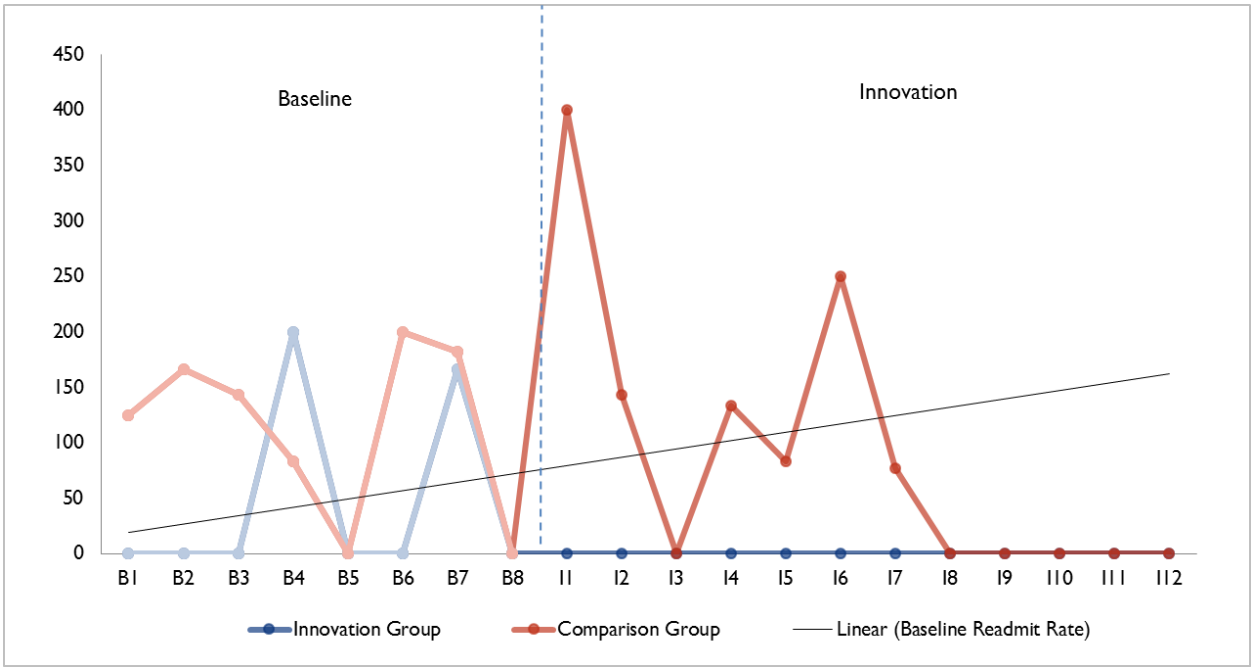
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.

Figure 3. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: ECCHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 and June 2016.

Terms and Definitions

- 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 5*** and ***Figure 4.*** The ED visit rate line shows a slight downward trend in the baseline and innovation periods for both the innovation and comparison groups. These trends are similar to the third annual report. 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. The sample size is too small to support regression analysis.

Table 5. ED Visits per 1,000 Medicare Participants: ECCHC

Awardee Number: 1C1CMS331045
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																				
ED rate	540	578	485	424	535	653	527	474	632	600	493	612	308	556	468	767	545	774	776	1044
Std dev	2161	2724	1721	1746	2137	2563	1932	1536	2285	3045	1491	1915	999	1990	1544	3562	1654	2276	2034	4117
Unique patients	63	64	66	66	71	72	74	76	76	75	69	67	65	63	62	60	55	53	49	45
Comparison Group																				
ED rate	152	102	181	158	187	151	164	180	118	167	130	190	144	154	253	112	144	149	221	146
Std dev	299	203	423	307	319	338	307	292	236	311	231	314	265	239	421	219	229	233	415	239
Weighted patients	64	65	66	68	71	73	75	76	76	76	74	72	70	67	63	62	60	58	51	46
Innovation − Comparison Rate																				
	388	476	304	267	348	501	363	294	513	433	363	422	164	401	215	654	402	624	555	898

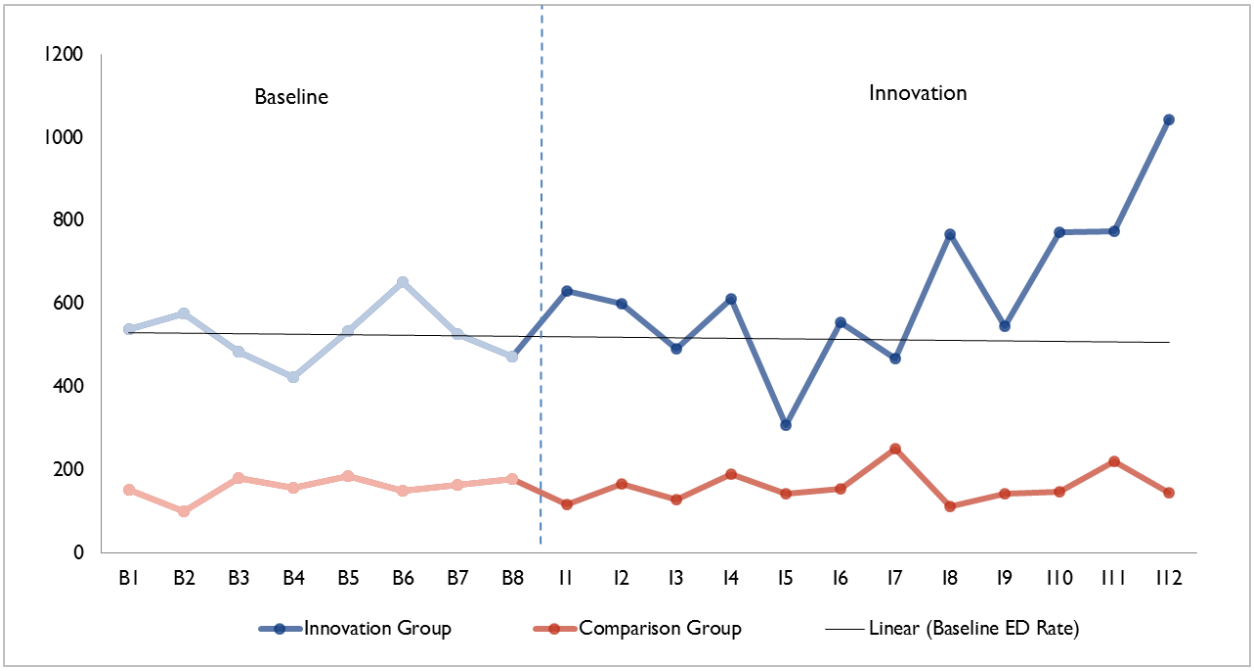
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; ECCHC = Eau Claire Cooperative Health Centers, Inc.

Figure 4. ED Visits per 1,000 Medicare Participants: ECCHC



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
- **Period of activity:** December 2012 to June 2016.

Terms and Definitions

- ED = emergency department; ECCHC= Eau Claire Cooperative Health Centers, Inc.

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 reported trends are very similar to those presented in the third annual report.

The Medicare results do not support the innovation's theory of change, because the Innovations Health program targeted high ED users and aimed to reduce inappropriate service utilization by connecting patients to a medical home. ECCHC envisioned that the medical home would improve health outcomes and decrease spending as patients accessed primary care and learned how to improve their health and health behavior. As described in the third annual report, however, ECCHC struggled to enroll Medicare beneficiaries in the Innovations Health program due to inconsistent staffing and the limited capacity of its clinics.[2]

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

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, this small sample size can hinder detection of changes in spending.

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 Addendum 2017

Awardee-Level Findings:

Finity Communications, Inc.

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Order HHS-500-T0010

RTI INTERNATIONAL

Finity Communications, Inc.

Finity Communications, Inc. (Finity) 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). This project was completed in June 2015, and the final data were included in the third annual report.[1] No new data were available for inclusion in the third annual report addendum.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:
Imaging Advantage

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RTI Project Number 0212790.010.002.004
Contract HHSM-500-2010-00021I
Order HHS-500-T0010

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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: IA

Data Source	Period Covered
Medicare claims data	October 2012–June 2016
Terms and Definitions • IA = Imaging Advantage.	

Imaging Advantage (IA)

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. Below we present the goals, as well as the findings, for the IA innovation.

1. **Smarter spending.**

   Goal: Reduce spending by reducing or eliminating duplicative or clinically unnecessary radiology exams and decreasing final report turnaround time.

   Findings: 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 nonparticipating hospitals. The calculated probability of a loss is 98 percent overall. The pattern of utilization explains this increase in spending: patients in innovation hospitals had increased inpatient stays and reduced outpatient ED visits relative to patients in comparison hospitals. The higher average cost of inpatient stays relative to ED visits may contribute to higher spending among the innovation beneficiaries. Some limited evidence shows reduced outpatient magnetic resonance imaging (MRI) expenditures among Medicare beneficiaries. These results should be interpreted with caution because the IA innovation was not expected to generate a statistically detectable impact on total costs.

2. **Better care.**

   Goal: Improve care by implementing a comprehensive total quality management program that applies a double-blind reading of high-difficulty radiology exams.

   Findings: Patients visiting the ED in participating hospitals had more inpatient stays, fewer readmissions, and fewer outpatient ED visits than patients visiting comparison hospitals. Changes in these measures are unlikely to be a result of the IA innovation because the innovation focused on imaging services. Statistically significant differences in these measures are likely due to differential trends in these outcomes between the innovation and comparison groups and highly powered regressions due to the large sample size.

3. **Healthier people**.

   Goal: Improve health by reducing patient exposure to radiation.

   Findings: None to report.

Table 2 summarizes findings based on Medicare claims collected during the innovation period. Patients who visited participating hospital EDs had higher costs, more inpatient stays, fewer readmissions, and fewer ED visits overall than the comparison group. These differences were statistically significant. Because the innovation focused on reengineering imaging workflow, it was not expected to impact total spending, inpatient stays, readmissions, or ED visits. We also completed separate regression

analyses for payments in the outpatient ED setting for computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance angiography (MRA), X-ray, ultrasound, other types of imaging, and total imaging. Statistically significant reductions occurred in MRI payments in 4 of 12 innovation quarters; and other quarters' coefficients trended toward savings, suggesting that the innovation may have reduced MRI payments in the outpatient ED setting. There was no systematic evidence that the innovation impacted payments for other imaging services.

Medicaid results are not presented because no updated Medicaid data are available since the third annual report.[1]

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 2. Summary of Medicare Claims-Based Findings: IA

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI	Year 4	90% CI
Aggregated results											
Total spending (in millions)	$38.562	$4.348, $72.775	$15.447, $61.677	$2.868	−$5.784, $11.521	$14.553	$5.830, $23.277	$15.902	$0.908, $30.897	$5.237	−$0.493, $10.968
Acute care inpatient stays	2,963	2539, 3387	2633, 3294	422	169, 675	1213	978, 1449	1068	849, 1287	260	150, 371
Hospital-wide all-cause unplanned readmissions	−466	−834, −98	−753, −179	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−3,441	−4079, −2802	−3939, −2943	−89	−470, 292	−1402	−1754, −1050	−1515	−1846, −1183	−434	−605, −265
Average impact per quarter											
Spending per participant	$856	$97, $1,616	$343, $1,370	$184	−$371, $740	$1,029	$412, $1,646	$1,296	$74, $2,518	$1,721	−$162, $3,605
Acute care inpatient stays (per 1,000 participants)	66	56, 75	58, 73	27	11, 43	86	69, 102	87	69, 105	86	49, 122
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−6	−11, −1	−10, −2	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)	−76	−91, −62	−87, −65	−6	−30, 19	−99	−124, −74	−123	−150, −96	−143	−199, −87

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** October 2010 to June 2016.
- **Sample size**: 3,800 unique Medicare fee-for-service beneficiaries with claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; IA = Imaging Advantage.

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

Table 3. Claims-Based Outcome Measures: IA

Evaluation Domain	Subdomains	Measure	Medicare	Medicaid
Health care outcomes	Utilization	All-cause inpatient admissions rate	Yes	No
		Hospital unplanned readmissions rate	Yes	No
		ED visit rate	Yes	No
	Spending	Spending per patient	Yes	No
		Estimated cost savings	Yes	No
		Outpatient ED imaging spending	Yes	No

Notes

- We do not report Medicaid results in this report because no new Medicaid data are available for IA, which serves the state of Illinois, during the reporting period. We refer readers to the third annual report for the evaluation of this innovation's impact on Medicaid beneficiaries.[2]

Terms and Definitions

- ED = emergency department; IA = Imaging Advantage.

2.3 Medicare Comparison Group

The Medicare claims analysis focuses on beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present Medicare claims data through June 30, 2016. This addendum includes two additional quarters of Medicare claims data than the third annual report. This report includes the same comparison group described in the third annual report.

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 innovation and comparison hospital, we generated a list of all patients who entered the ED during the

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

quarter. In each quarter, the sample size is the number of unique patients who visited an innovation 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 innovation hospitals. See the third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 4 reports Medicare spending per patient in the 8 quarters before and the 13 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 Medicare spending per beneficiary. 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 in the comparison group. During I1 and I2, spending in the comparison group is higher than in the innovation group. Beginning in I3, spending among the innovation group becomes larger than spending in the comparison group. These trends are similar to the third annual report.

Table 4. Medicare Spending per Participant: IA

Awardee Number: 1C1CMS331066
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	$11,861	$11,603	$11,549	$11,925	$11,921	$11,710	$12,607	$13,361	$13,646	$14,634	$14,859	$14,836	$15,025	$15,374	$14,828	$15,324	$15,386	$15,010	$15,352	$15,655	$16,121
Std dev	$17,298	$18,060	$18,730	$19,111	$18,276	$17,575	$17,829	$20,096	$19,707	$22,134	$21,628	$22,047	$22,069	$22,184	$21,646	$21,612	$21,040	$21,636	$21,752	$22,025	$23,429
Unique patients	2,934	3,122	3,068	3,254	3,378	3,514	3,552	3,654	3,800	3,952	3,938	3,885	3,789	3,680	3,459	3,212	3,088	3,102	3,045	3,035	3,042
Comparison Group																					
Spending rate	$12,772	$12,843	$12,386	$12,528	$12,355	$13,067	$12,641	$13,584	$14,342	$15,578	$14,413	$14,744	$14,497	$14,775	$14,256	$14,392	$14,188	$14,500	$14,641	$14,293	$15,122
Std dev	$17,593	$18,591	$17,158	$16,470	$17,947	$18,366	$18,183	$19,800	$20,569	$21,830	$20,556	$20,060	$19,942	$19,842	$19,852	$20,155	$19,400	$18,995	$21,246	$20,285	$20,417
Weighted patients	2,820	2,925	3,003	3,161	3,192	3,423	3,574	3,769	3,813	3,874	3,918	3,780	3,877	3,581	3,693	3,464	3,270	3,117	3,244	3,180	3,094
Savings per Patient																					
	$911	$1,240	$838	$603	$434	$1,357	$34	$223	$696	$944	−$445	−$92	−$528	−$598	−$572	−$932	−$1,198	−$510	−$711	−$1,362	−$999

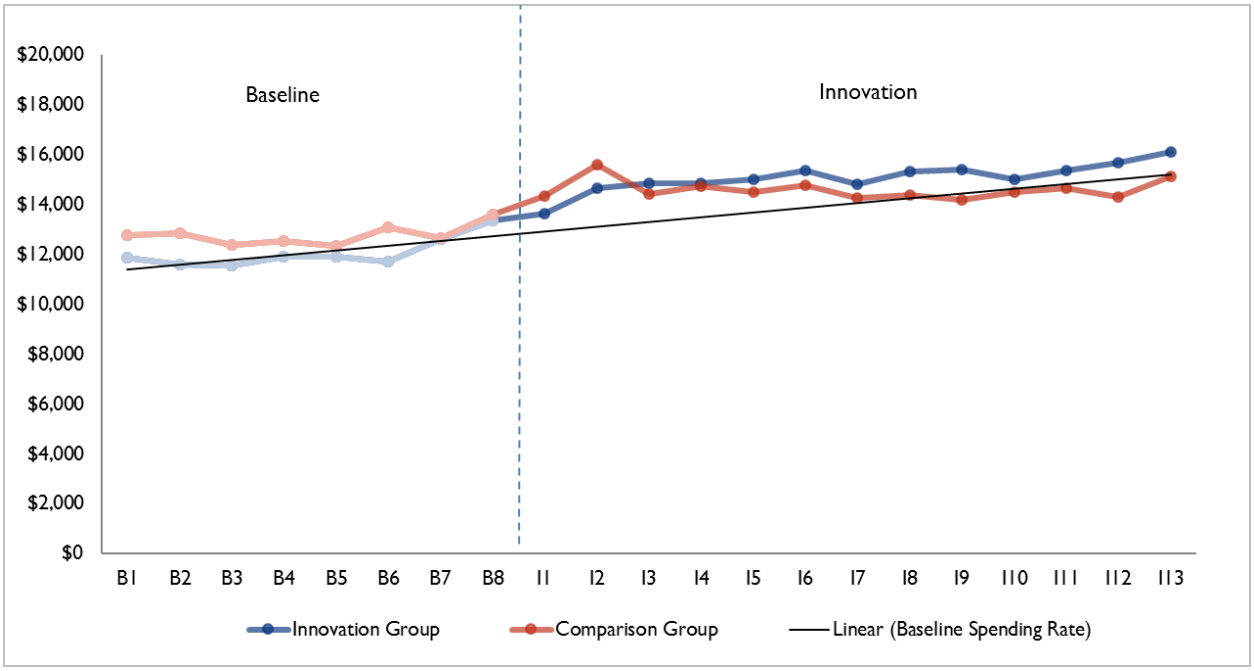
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 1. Medicare Spending per Participant: IA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- IA = Imaging Advantage.

2.4.2 Regression Results

We present in ***Table 5*** 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 $856 (90% CI: $97, $1,616). This effect is statistically significant. This finding is consistent with the findings in the third annual report. 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 quarterly effects derived from an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. The coefficients listed in Table 5 represent the difference in quarterly spending in innovation quarters between the innovation and comparison groups. ***Figure 2*** illustrates these quarterly difference-in-differences estimates. Starting in I3, spending is higher in the innovation group than the comparison group. Using a significance threshold of 10 percent, the innovation group's spending is significantly higher than the comparison group's spending in I4, I8, I11, and I12. Although spending among the innovation group is higher, the innovation's focus on imaging workflow was not expected to have an impact on total patient spending, and results should be interpreted with caution.

Table 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: IA

Quarter	Coefficient	Standard Error	P-Values
I1	−$231	$684	0.746
I2	−$519	$427	0.264
I3	$754	$648	0.283
I4	$727	$306	0.049
I5	$863	$634	0.216
I6	$1,026	$546	0.102
I7	$940	$664	0.200
I8	$1,325	$392	0.012
I9	$1,050	$669	0.161
I10	$1,134	$841	0.220
I11	$1,120	$545	0.079
I12	$1,889	$934	0.083
I13	$1,722	$994	0.127
Overall average	$856	$401	0.070
Overall aggregate	$38,561,884	$18,058,579	0.070
Overall aggregate (IY1)	$2,868,432	$4,567,083	0.550
Overall aggregate (IY2)	$14,553,268	$4,604,339	0.016
Overall aggregate (IY3)	$15,902,400	$7,914,398	0.085

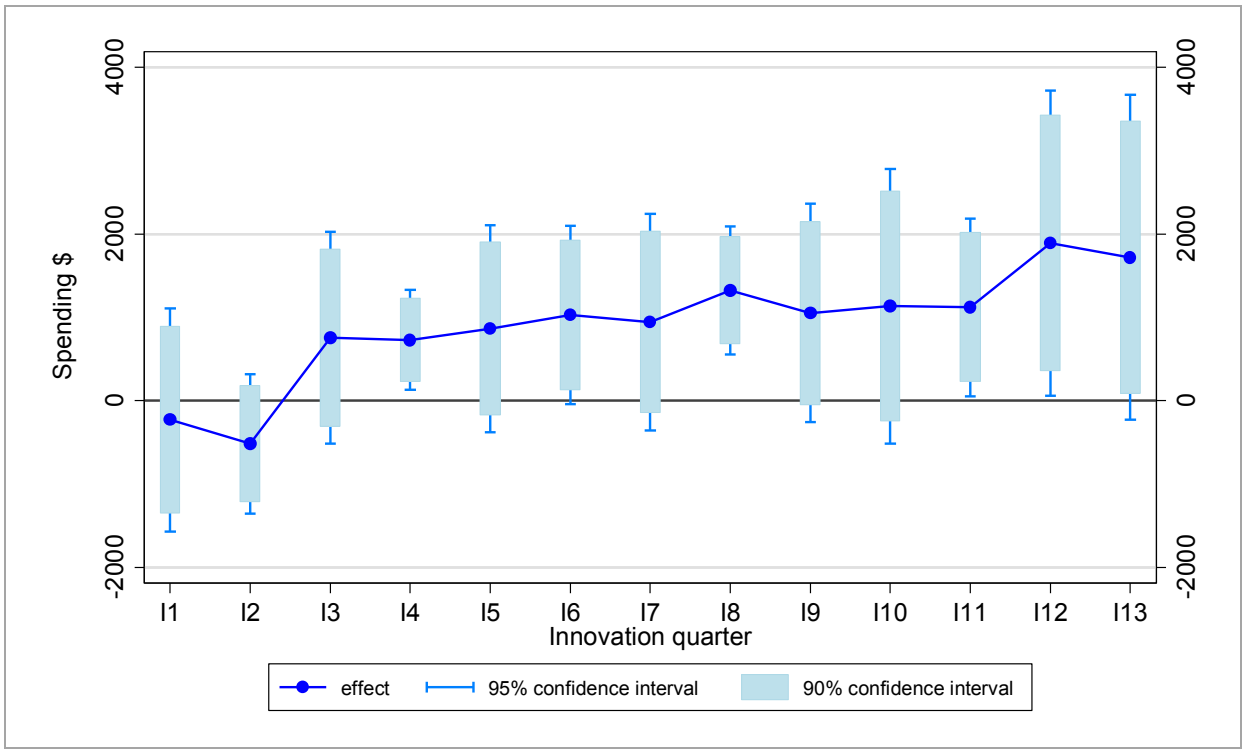
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; IA = Imaging Advantage.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: IA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** October 2010 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; IA = Imaging Advantage.

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 for saving or losing money on this initiative. Because spending among the innovation group is higher than the comparison group, the evidence favors the innovation generating a loss. The calculated probability of a loss is 98 percent overall. However, the innovation's intent was to change 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

Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- 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 6*** 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. These trends are similar to the third annual report.

Table 6. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: IA

Awardee Number: 1C1CMS331066
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																					
Admit rate	636	611	567	590	602	586	610	591	590	650	657	631	656	667	636	665	683	658	662	645	674
Std dev	926	899	893	968	920	907	916	862	880	948	923	904	944	959	963	928	935	888	957	909	919
Unique patients	2,934	3,122	3,068	3,254	3,378	3,514	3,552	3,654	3,800	3,952	3,938	3,885	3,789	3,680	3,459	3,212	3,088	3,102	3,045	3,035	3,042
Comparison Group																					
Admit rate	741	735	715	725	695	710	656	665	681	737	699	685	661	679	641	653	656	678	654	655	690
Std dev	1002	993	1026	982	1017	943	985	903	914	950	1004	974	975	928	939	905	890	911	910	929	929
Weighted patients	2,820	2,925	3,003	3,161	3,192	3,423	3,574	3,769	3,813	3,874	3,918	3,780	3,877	3,581	3,693	3,464	3,270	3,117	3,244	3,180	3,094
Innovation − Comparison Rate																					
	−105	−124	−148	−135	−93	−124	−46	−74	−91	−87	−42	−54	−5	−12	−5	13	27	−20	8	−11	−17

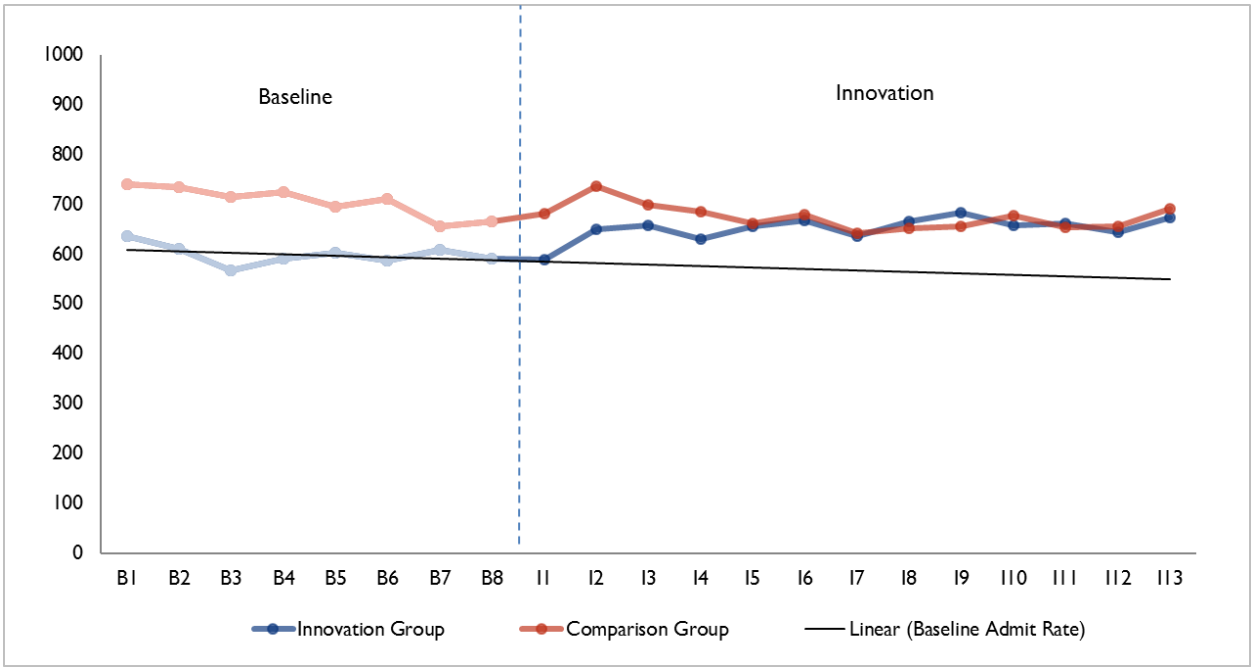
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: IA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- IA = Imaging Advantage.

2.5.2 Regression Results

As shown in ***Table 7***, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 66 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: 56, 75). This is consistent with the findings in the third annual report.

We also present quarterly effects 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 7. 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	3	19	0.863
I2	12	20	0.538
I3	48	20	0.015
I4	44	20	0.026
I5	81	20	0.000
I6	81	20	0.000
I7	79	20	0.000
I8	103	21	0.000
I9	93	22	0.000
I10	78	22	0.000
I11	96	22	0.000
I12	81	21	0.000
I13	86	22	0.000
Overall average	66	6	0.000
Overall aggregate	2,963	258	0.000
Overall aggregate (IY1)	422	154	0.006
Overall aggregate (IY2)	1,213	143	0.000
Overall aggregate (IY3)	1,068	133	0.000

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- I1 = Innovation Q1; 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 8*** and ***Figure 5***. During the baseline period, the unplanned readmissions rate was higher among the comparison group than the innovation group; 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. These trends are similar to the third annual report. In the next section, we use a difference-in-differences regression to test the impact of the innovation on unplanned readmissions.

Table 8. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: IA

Awardee Number: 1C1CMS331066
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																					
Readmit rate	124	121	111	107	107	111	119	115	121	120	119	149	113	128	125	107	129	117	126	124	132
Std dev	330	326	314	309	309	315	324	319	326	325	323	356	317	334	330	310	335	321	332	330	339
Total admissions	1,146	1,191	1,018	1,115	1,182	1,203	1,398	1,378	1,411	1,542	1,559	1,409	1,435	1,437	1,308	1,341	1,309	1,311	1,224	1,263	1,220
Comparison Group																					
Readmit rate	126	139	119	136	144	123	106	123	129	142	159	152	154	142	120	133	118	144	128	131	134
Std dev	332	346	324	342	351	329	308	329	336	349	365	359	361	349	325	339	323	351	334	337	341
Total admissions	1,214	1,300	1,247	1,379	1,378	1,478	1,438	1,663	1,724	1,773	1,702	1,585	1,521	1,456	1,494	1,409	1,423	1,376	1,374	1,241	1,302
Innovation − Comparison Rate																					
	−2	−18	−8	−29	−37	−12	12	−9	−8	−22	−40	−3	−41	−14	5	−25	11	−27	−2	−6	−2

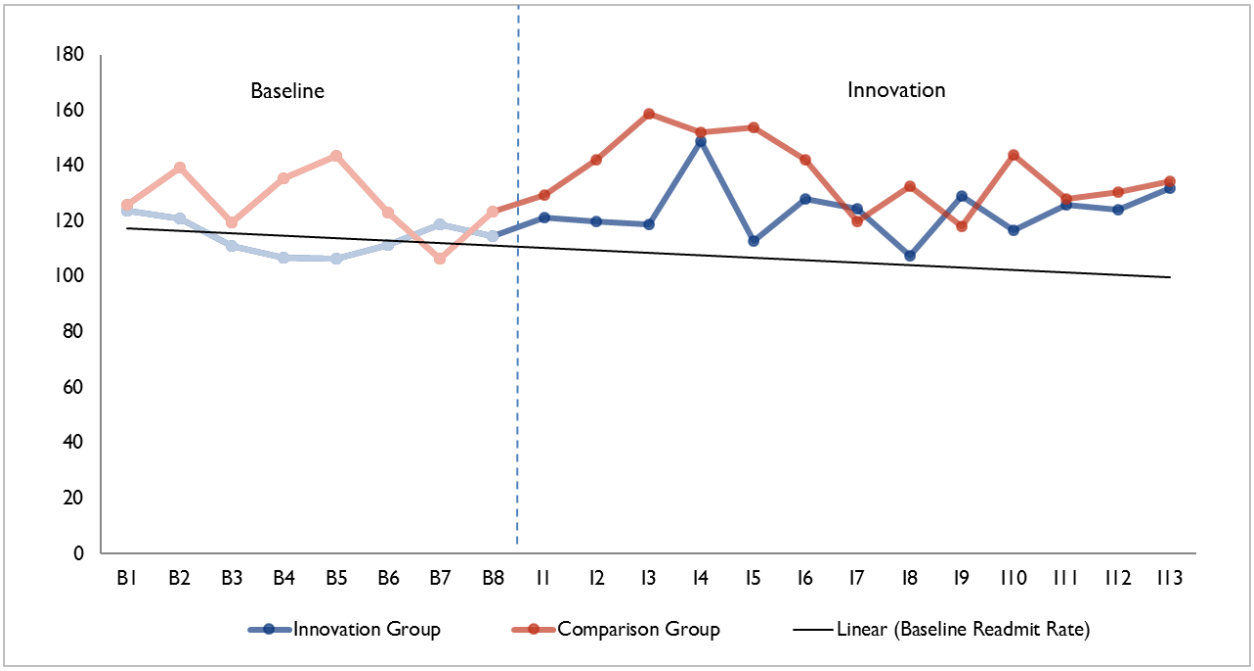
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions
- B1 = Baseline Q1; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: IA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 and June 2016.

Terms and Definitions

- IA = Imaging Advantage.

2.6.2 Regression Results

Table 9 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, indicating that the innovation-comparison difference is lower in the innovation group during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −11, −1). This finding is consistent with the findings in the third annual report.

Table 9. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: IA

Quarter	Coefficient	Standard Error	P-Values
Overall average	−6	3	0.037
Overall aggregate	−466	224	0.037

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **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.
- IA = Imaging Advantage.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 10*** 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. These trends are similar to the third annual report.

Table 10. ED Visits per 1,000 Medicare Participants: IA

Awardee Number: 1C1CMS331066
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																					
ED rate	1,042	1,069	1,097	1,100	1,116	1,107	1,083	1,120	1,078	1,130	1,113	1,061	1,036	1,023	1,009	964	960	1,055	1,074	1,045	1,059
Std dev	1,487	1,454	1,442	1,373	1,564	1,631	1,448	1,930	1,611	2,055	2,067	1,586	1,507	1,451	1,344	1,491	1,497	1,782	1,609	1,449	1,663
Unique patients	2,934	3,122	3,068	3,254	3,378	3,514	3,552	3,654	3,800	3,952	3,938	3,885	3,789	3,680	3,459	3,212	3,088	3,102	3,045	3,035	3,042
Comparison Group																					
ED rate	983	977	1,041	1,028	1,039	1,066	1,107	1,075	1,045	1,026	1,014	1,057	1,077	1,001	1,030	970	1,032	1,013	1,080	1,106	1,101
Std dev	1,707	1,459	1,750	1,861	1,916	1,772	1,789	1,795	1,614	1,801	1,658	1,481	1,528	1,345	1,360	1,169	1,807	1,616	1,647	1,771	1,976
Weighted patients	2,820	2,925	3,003	3,161	3,192	3,423	3,574	3,769	3,813	3,874	3,918	3,780	3,877	3,581	3,693	3,464	3,270	3,117	3,244	3,180	3,094
Innovation − Comparison Rate																					
	59	91	56	71	77	41	−24	45	34	104	99	4	−41	21	−21	−6	−72	43	−6	−61	−43

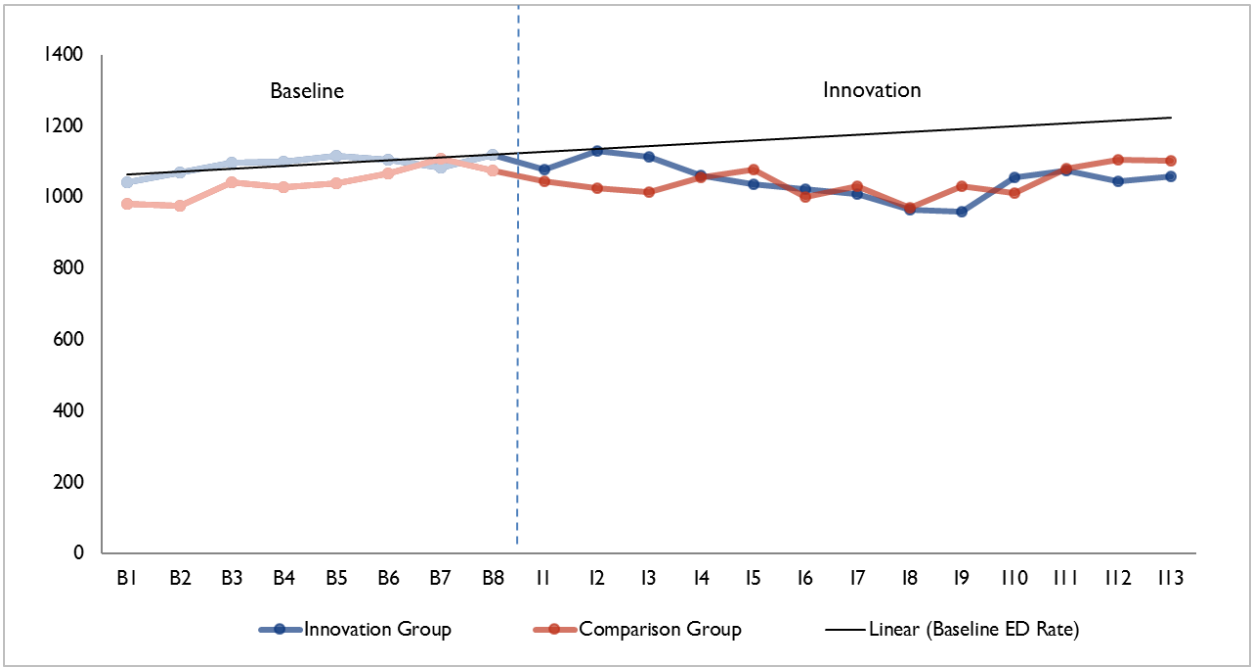
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; IA = Imaging Advantage.

Figure 6. ED Visits per 1,000 Medicare Participants: IA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
- **Period of activity:** October 2010 to June 2016.

Terms and Definitions

- ED = emergency department; IA = Imaging Advantage.

2.7.2 Regression Results

As shown in ***Table 11***, the average quarterly difference-in-differences estimate for ED visits is a decrease of 76 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: −91, −62). This finding is consistent with the finding in the third annual report.

We also present quarterly effects 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 11. 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	−22	30	0.456
I2	41	30	0.164
I3	34	29	0.248
I4	−78	30	0.010
I5	−104	30	0.000
I6	−58	30	0.053
I7	−130	31	0.000
I8	−107	30	0.000
I9	−169	32	0.000
I10	−54	33	0.099
I11	−109	33	0.001
I12	−163	34	0.000
I13	−143	34	0.000
Overall average	−76	9	0.000
Overall aggregate	−3,441	388	0.000
Overall aggregate (IY1)	−89	232	0.701
Overall aggregate (IY2)	−1,402	214	0.000
Overall aggregate (IY3)	−1,515	202	0.000

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: October 2010 to June 2016.

Terms and Definitions

- **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 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 12***. No statistically significant differences in X-ray payments are evident between innovation and comparison hospitals, and the coefficients flip from positive to negative, suggesting no impact of the innovation on X-ray payments. Similarly, differences in CT payments between the two groups are not statistically significant in 12 of the 13 innovation quarters. Thus, 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 I11, indicating that some savings in MRI payments may be generated. For the remaining services analyzed (MRA, ultrasound, other imaging services, and total imaging services overall), results were not statistically significant in the large majority of innovation quarters. These findings are consistent with the results presented in the third annual report.

Table 12. 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	−1.57	0.99	0.157	−1.79	7.41	0.816	−3.96	1.50	0.033
I2	0.40	2.27	0.866	−9.80	3.20	0.018	−1.57	1.45	0.316
I3	−1.57	1.86	0.428	5.52	11.16	0.636	−2.61	2.51	0.333
I4	0.11	2.54	0.968	7.11	11.82	0.566	−2.55	1.28	0.086
I5	1.88	2.11	0.403	0.75	11.78	0.951	−5.07	2.52	0.084
I6	1.82	2.64	0.512	3.41	5.46	0.552	−1.67	2.03	0.437
I7	−0.85	2.45	0.739	0.93	3.56	0.802	−1.24	1.53	0.446
I8	−0.47	6.44	0.944	1.58	2.97	0.612	−0.45	2.31	0.853
I9	−1.45	5.26	0.792	6.18	6.79	0.393	−2.66	2.96	0.399
I10	3.27	3.28	0.353	4.98	9.57	0.619	−1.36	3.06	0.671
I11	2.06	1.69	0.264	10.61	6.74	0.159	−3.30	1.53	0.068
I12	−0.01	2.41	0.996	6.07	5.24	0.285	−2.39	1.88	0.245
I13	0.21	2.90	0.945	3.09	5.72	0.606	−3.53	2.40	0.185

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: October 2010 to June 2016.

Terms and Definitions

- **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; MRI = magnetic resonance imaging; OLS = ordinary least squares; IA = Imaging Advantage.

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. Outpatient imaging service payments in the ED did not show large changes, although some evidence of decreased outpatient MRI spending was found.

IA did not aim to reduce admissions, readmissions, or ED visits, because the innovation entailed implementing changes to provider workflow. Although the innovation was unlikely to affect total Medicare spending (radiology costs are generally a small part of that spending), the innovation may possibly have resulted in decreased outpatient MRI spending.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

Intermountain Healthcare

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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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Intermountain

Data Source	Period Covered
Medicare claims data	June 2013–June 2016
Medicaid claims data	June 2013–June 2016
Terms and Definitions • Intermountain = Intermountain Healthcare, Inc.	

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." Below we present the goals, as well as the findings, for the innovation.:

1. **Smarter spending.**

   Goal: 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.

   Findings: Cohort 1 (IndiGO and SSM) and Cohort 2 (IndiGO only) had a nonsignificant reduction in Medicare spending. The overall probability of savings for Cohort 1 is estimated as 47 percent. The overall probability of savings for Cohort 2 is estimated as 63 percent. Cohort 3 (SSM only) shows significant Medicare losses overall and the probability of savings overall is 0. SSM had a significant reduction in Medicaid spending. The overall probability of savings for Cohort 2 is estimated as 84 percent. The lack of improvements in spending and utilization among Medicare beneficiaries may be explained by limited adoption of the IndiGO tool and implementation of the SSM after the HCIA funding period.

2. **Better care.**

   Goal: 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.

   Findings: Among Medicare patients, 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. Among SSM Medicaid patients, overall innovation period effects for hospital admissions were positive and not significant. Innovation period trends show a greater likelihood of ED visits. We also found a nonsignificant reduction in hospital readmissions. The effects we identified are unlikely to be due to the innovation.

3. **Healthier people**.

   Goal: 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.

   Findings: None to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes Medicare claims-based findings during the innovation period for those who had an IndiGO view and enrolled in shared savings model (SSM) practices (Cohort 1). Results for Cohort 1 show that the overall average spending among innovation group individuals was $16 lower 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 a decrease of 4 inpatient admissions per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: −20, 12). The average quarterly difference-in-differences estimate 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: −60, 55). The average quarterly difference−in−differences estimate for ED visits is a decrease of 22 ED visits per 1,000 participants relative to the comparison group and the effect is not statistically significant (90% CI: −49, 5). Limited implementation of the SSM and adoption of the IndiGO tool during the implementation period may explain why there are few statistically significant effects.

Table 2. Summary of Medicare Claims-Based Findings: Intermountain Cohort 1 (IndiGO and SSM)

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$0.035	−$1.163, $1.094	−$0.914, $0.844	−$0.478	−$0.946, −$0.009	$0.397	−$0.119, $0.913	$0.046	−$0.518, $0.609
Acute care inpatient stays	−9	−43, 26	−35, 18	−27	−47, −7	10	−9, 30	8	−13, 29
Hospital-wide all-cause unplanned readmissions	0	−9, 9	−7, 7	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−48	−107, 10	−94, −3	−34	−64, −4	−8	−46, 31	−7	−39, 26
Average impact per quarter									
Spending per participant	−$16	−$529, $497	−$415, $384	−$623	−$1,234, −$12	$527	−$158, $1,211	$68	−$763, $899
Acute care inpatient stays (per 1,000 participants)	−4	−20, 12	−16, 8	−35	−61, −10	14	−11, 39	12	−19, 42
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−3	−60, 55	−47, 42	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−22	−49, 5	−43, −1	−44	−83, −6	−10	−62, 41	−10	−58, 38

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** June 2011 to June 2016.
- **Sample size**: 192 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Table 3 summarizes Medicare claims-based findings during the innovation period for those who had an IndiGO view only (Cohort 2). Results for Cohort 2 show that the overall average spending among innovation group individuals was $157 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 39 per 1,000 inpatient admissions (3.9 percentage points), indicating that the innovation−comparison difference is 3.9 percentage points higher during the innovation period. The effect is not statistically significant (90% CI: −34, 112). The average quarterly difference-in-differences estimate for ED visits is 2 ED visits per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: −9, 13). As with Cohort 1, the lack of statistically significant results may be explained, in part, by limited provider adoption of the IndiGO tool.

Table 3. Summary of Medicare Claims-Based Findings: Intermountain Cohort 2 (IndiGO only)

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$0.768	−$2.460, $0.925	−$2.086, $0.551	−$0.253	−$0.890, $0.384	−$0.458	−$1.207, $0.291	−$0.056	−$0.825, $0.712
Acute care inpatient stays	−30	−72, 11	−63, 2	5	−20, 30	−17	−41, 6	−19	−42, 5
Hospital-wide all-cause unplanned readmissions	10	−8, 28	−4, 24	—	—	—	—	—	—
ED visits not leading to a hospitalization	12	−42, 66	−30, 54	0	−29, 29	−6	−37, 25	17	−16, 50
Average impact per quarter									
Spending per participant	−$157	−$503, $189	−$426, $113	−$146	−$514, $222	−$274	−$722, $174	−$38	−$555, $479
Acute care inpatient stays (per 1,000 participants)	−6	−15, 2	−13, 0	3	−11, 17	−10	−24, 4	−12	−28, 4
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	39	−34, 112	−18, 96	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	2	−9, 13	−6, 11	0	−17, 17	−3	−22, 15	12	−10, 34

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** June 2011 to June 2016.
- **Sample size**: 434 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Table 4 summarizes Medicare claims-based findings during the innovation period for those enrolled in SSM practices only (Cohort 3). Results for Cohort 3 show that the overall average spending among innovation group individuals was $471 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 14 inpatient admissions per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 13, 16). 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, 1). The average quarterly difference-in-differences estimate for ED visits is an increase of 22 ED visits per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 19, 24).

Table 4. Summary of Medicare Claims-Based Findings: Intermountain Cohort 3 (SSM only)

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$129.660	$113.940, $145.380	$117.420, $141.910	$68.077	$60.307, $75.847	$44.318	$36.325, $52.312	$17.268	$11.160, $23.376
Acute care inpatient stays	3,858	3,442, 4,273	3534, 4181	2,304	2,039, 2,570	1348	1,101, 1,596	205	3, 406
Hospital-wide all-cause unplanned readmissions	−104	−233, 26	−205, −3	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	6,022	5,344, 6,700	5,493, 6,550	3,302	2,880, 3,725	2,019	1,608, 2,429	701	365, 1,036
Average impact per quarter									
Spending per participant	$471	$414, $528	$426, $515	$601	$532, $669	$444	$364, $525	$277	$179, $375
Acute care inpatient stays (per 1,000 participants)	14	13, 16	13, 15	20	18, 23	14	11, 16	3	0, 7
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−6	−13, 1	−11, 0	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	22	19, 24	20, 24	29	25, 33	20	16, 24	11	6, 17

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** June 2011 to June 2016.
- **Sample size**: 28,783 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Table 5 summarizes findings for SSM based on Medicaid claims collected during the innovation period. Results show that the overall average spending among innovation group individuals was $576 lower than spending among comparison group individuals, and the estimate is statistically significant. As noted earlier, the SSM component was never fully implemented thus, these savings were unlikely to have been generated by SSM.

The average quarterly difference-in-differences estimate for inpatient admissions is an increase of 3 inpatient admissions per 1,000 participants relative to the comparison group. The effect is not statistically significant (90% CI: −13, 19). The average quarterly difference-in-differences estimate for unplanned readmissions is -38 per 1,000 inpatient admissions (−3.8 percentage points), indicating that the innovation−comparison difference is 3.8 percentage points lower during the innovation period. The effect is not statistically significant (90% CI: −183, 106). The average quarterly difference-in-differences estimate for ED visits is 69 ED visits per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 31, 107).

Table 5. Summary of Medicaid Claims-Based Findings: Intermountain SSM

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI
Aggregated results							
Total spending (in millions)	−$0.797	−$1.572, −$0.023	−$1.401, −$0.194	−$0.616	−$1.146, −$0.085	−$0.182	−$0.529, $0.166
Acute care inpatient stays	4	−17, 25	−12, 20	11	−8, 30	−7	−16, 2
Hospital-wide all-cause unplanned readmissions	−2	−11, 6	−9, 4	N/A	N/A	N/A	N/A
ED visits	92	41, 142	52, 131	94	44, 145	−3	−11, 5
Average impact per quarter							
Spending per participant	−$576	−$1,135, −$16	−$1,011, −$140	−$619	−$1,153, −$86	−$465	−$1,354, $424
Acute care inpatient stays (per 1,000 participants)	3	−13, 19	−9, 15	12	−8, 31	−19	−42, 4
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−38	−183, 106	−151, 74	N/A	N/A	N/A	N/A
ED visits (per 1,000 participants)	69	31, 107	39, 98	99	47, 152	−8	−28, 13

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** June 2011 to June 2015.
- **Sample size**: 299 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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 (per 1,000 participants)** is 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 is the product of ED visits (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; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

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: Intermountain

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

Terms and Definitions

- ED = emergency department; Intermountain = Intermountain Healthcare, Inc.

2.3 Medicare Comparison Group

We include patients in the claims analysis who were enrolled in the innovation prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. This report includes two additional quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 29,454 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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 state of Utah during the innovation launch. See the third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Tables 7, 8, 9, and ***10*** report Medicare spending per patient in the 8 quarters before and the 12 quarters after enrolling in the innovation for Cohorts 1 and 2, and for the 11 quarters after enrolling in the innovation for Cohorts 3 and 4. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figures 1, 2, 3,*** and 4 illustrate the Medicare spending per beneficiary in Tables 7, 8, 9, and 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.

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. These trends are similar to the third annual report. Innovation period spending in Cohorts 2, 3, and 4 increases above the linear trend line after the innovation, but for Cohort 3, spending falls below the trend line in innovation quarter 8. 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 2 but falls below comparison group spending in quarter 4 and then surpasses comparison group spending beginning 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 7, 8, 9, and 10, the standard deviation for spending is high, in that the data points tend to be spread over a wide range of values rather than at the mean.

Table 7. 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	I12
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	$1,897	$3,286	$3,011	$4,366	$3,571	$3,698	$3,662	$3,673	$3,222
Std dev	$5,314	$7,693	$4,887	$4,184	$5,732	$10,276	$8,540	$5,895	$5,323	$6,858	$9,316	$4,355	$6,757	$6,658	$11,866	$7,905	$9,941	$9,037	$7,780	$8,108
Unique patients	144	148	149	160	167	171	174	192	192	192	192	191	191	189	189	185	179	170	169	160
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	$2,136	$2,735	$2,009	$3,079	$2,236	$2,527	$2,830
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	$5,500	$8,567	$4,649	$17,423	$5,585	$7,279	$7,351
Weighted patients	156	159	162	169	173	181	186	192	192	192	189	183	180	176	172	168	164	158	156	147
Savings per Patient																				
	−$714	−$1,323	−$115	−$199	−$619	−$1,536	−$149	$89	$668	−$549	−$568	$861	−$971	−$874	−$1,631	−$1,562	−$618	−$1,426	−$1,146	−$391

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Table 8. 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**	**I12**
Innovation Group																				
Spending rate	$2,281	$1,886	$1,630	$1,904	$1,945	$2,191	$1,626	$1,814	$2,617	$2,042	$2,222	$2,629	$2,303	$2,555	$2,467	$2,568	$2,324	$2,297	$3,219	$3,564
Std dev	$6,237	$5,870	$4,882	$6,320	$5,330	$6,528	$5,269	$5,365	$8,092	$6,634	$5,589	$7,133	$6,162	$8,860	$6,280	$7,701	$7,058	$5,316	$8,717	$9,100
Unique patients	344	357	368	383	390	403	413	434	434	434	434	431	428	426	416	401	395	382	365	346
Comparison Group																				
Spending rate	$1,679	$1,791	$1,665	$1,847	$1,921	$2,075	$1,971	$1,814	$2,216	$2,096	$2,241	$2,732	$2,531	$2,251	$2,132	$2,619	$2,609	$2,333	$2,219	$2,668
Std dev	$5,199	$5,945	$5,795	$4,966	$5,403	$6,792	$5,827	$5,293	$8,060	$5,911	$7,440	$10,204	$7,169	$6,588	$5,988	$7,329	$7,380	$6,070	$5,544	$7,163
Weighted patients	349	358	366	384	392	402	412	434	434	434	425	415	405	396	381	362	353	335	317	302
Savings per Patient																				
	−$602	−$95	$35	−$57	−$24	−$115	$346	$1	−$401	$54	$19	$103	$229	−$304	−$335	$52	$285	$35	−$1,000	−$897

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.

Table 9. Medicare Spending per Participant: Intermountain Cohort 3 (SSM 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**	**I12**
Innovation Group																				
Spending rate	$2,165	$2,127	$2,282	$2,335	$2,378	$2,368	$2,627	$2,902	$3,799	$3,464	$3,352	$3,256	$3,386	$3,325	$3,434	$3,429	$3,540	$3,242	$3,259	—
Std dev	$6,737	$6,342	$8,626	$7,493	$7,127	$7,129	$7,783	$8,450	$10,175	$9,794	$9,092	$8,732	$10,299	$8,751	$8,743	$9,078	$12,537	$9,852	$8,538	—
Unique patients	22,377	23,319	23,838	24,466	24,955	27,492	28,114	28,783	28,783	28,605	28,306	27,627	26,683	25,337	24,351	23,343	22,133	20,711	19,526	—
Comparison Group																				
Spending rate	$2,069	$2,053	$2,159	$2,133	$2,274	$2,254	$2,395	$2,481	$2,651	$2,658	$2,620	$2,545	$2,628	$2,570	$2,567	$2,474	$2,590	$2,690	$2,712	—
Std dev	$8,661	$7,168	$6,554	$6,634	$10,035	$8,533	$7,665	$7,846	$12,086	$8,012	$7,481	$7,596	$7,769	$7,625	$7,438	$6,887	$7,718	$9,133	$8,096	—
Weighted patients	23,669	24,583	25,100	25,734	26,280	28,023	28,481	28,781	28,781	28,233	27,486	26,435	25,275	23,649	22,569	21,480	20,311	19,018	17,844	—
Savings per Patient																				
	−$96	−$74	−$124	−$202	−$104	−$114	−$233	−$422	−$1,149	−$806	−$732	−$711	−$758	−$755	−$867	−$955	−$950	−$552	−$547	—

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Table 10. Medicare Spending per Participant: Intermountain Cohort 4 (Hot spotting)

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**	**I12**
Innovation Group																				
Spending rate	$5,843	$5,869	$5,892	$3,834	$4,794	$5,857	$5,868	$4,977	$7,996	$7,066	$5,231	$5,434	$6,822	$9,752	$8,109	$9,365	$7,253	$5,979	$7,509	—
Std dev	$9,902	$9,957	$12,328	$6,664	$7,729	$8,534	$10,222	$8,199	$15,804	$11,993	$7,269	$9,722	$18,173	$19,615	$12,998	$18,897	$14,966	$11,056	$11,700	—
Unique patients	52	55	57	57	59	59	60	63	65	68	71	76	78	81	78	79	78	66	60	—
Comparison Group																				
Spending rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Savings per Patient																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

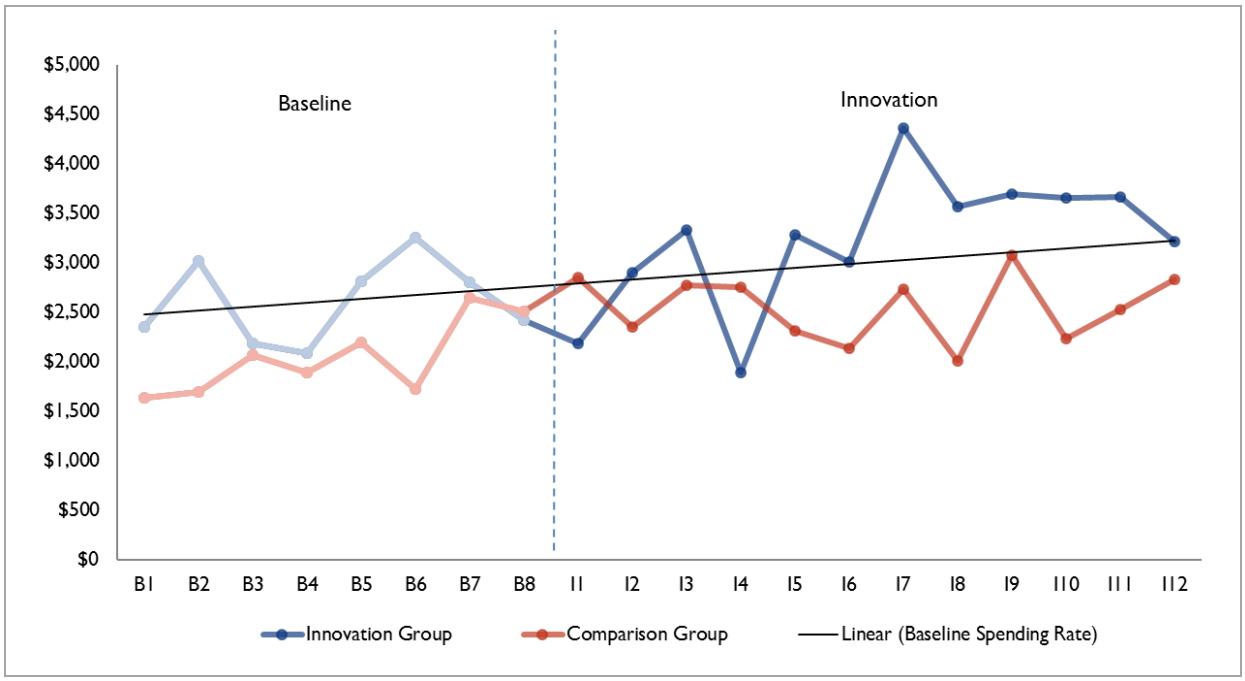
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 1. Medicare Spending per Participant: Intermountain Cohort 1 (IndiGO and SSM)



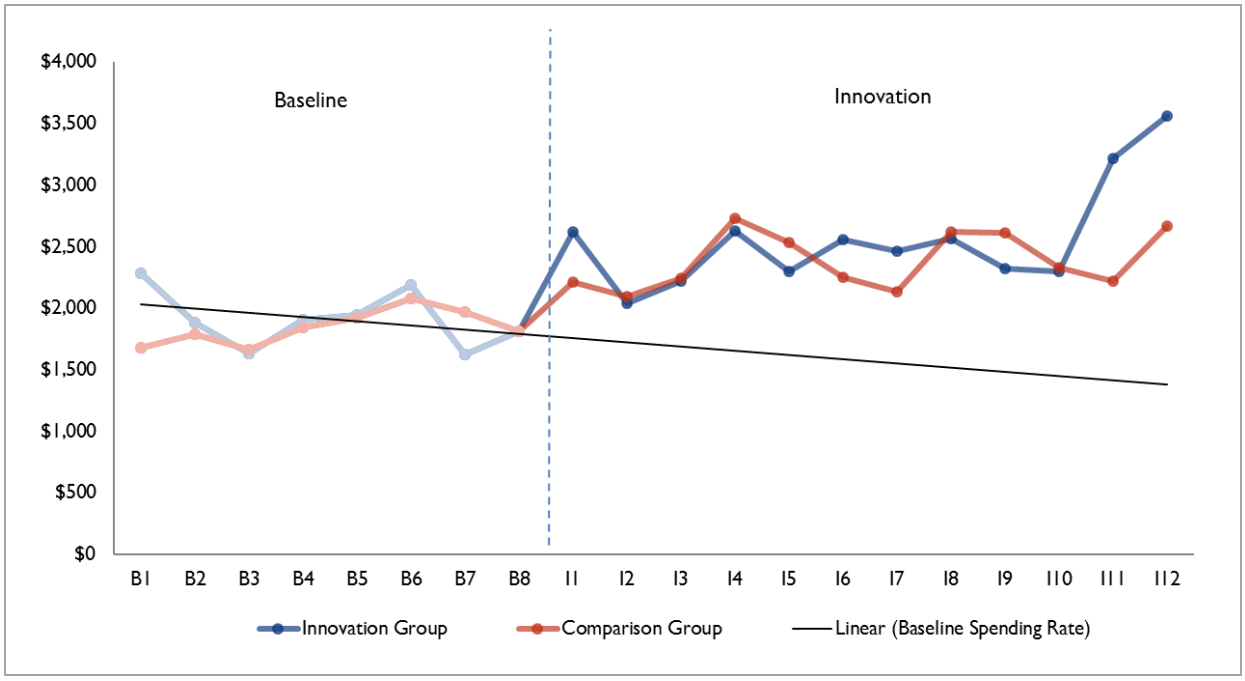
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.; SSM = shared savings model.

Figure 2. Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)



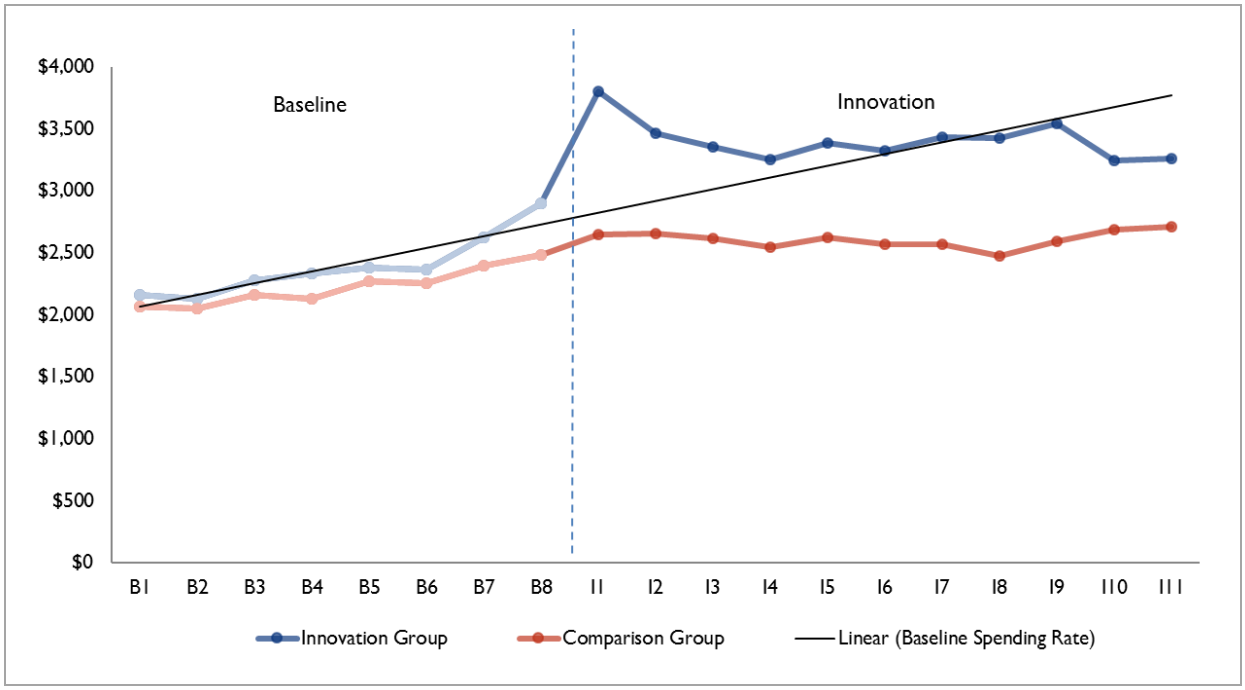
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.

Figure 3. Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)



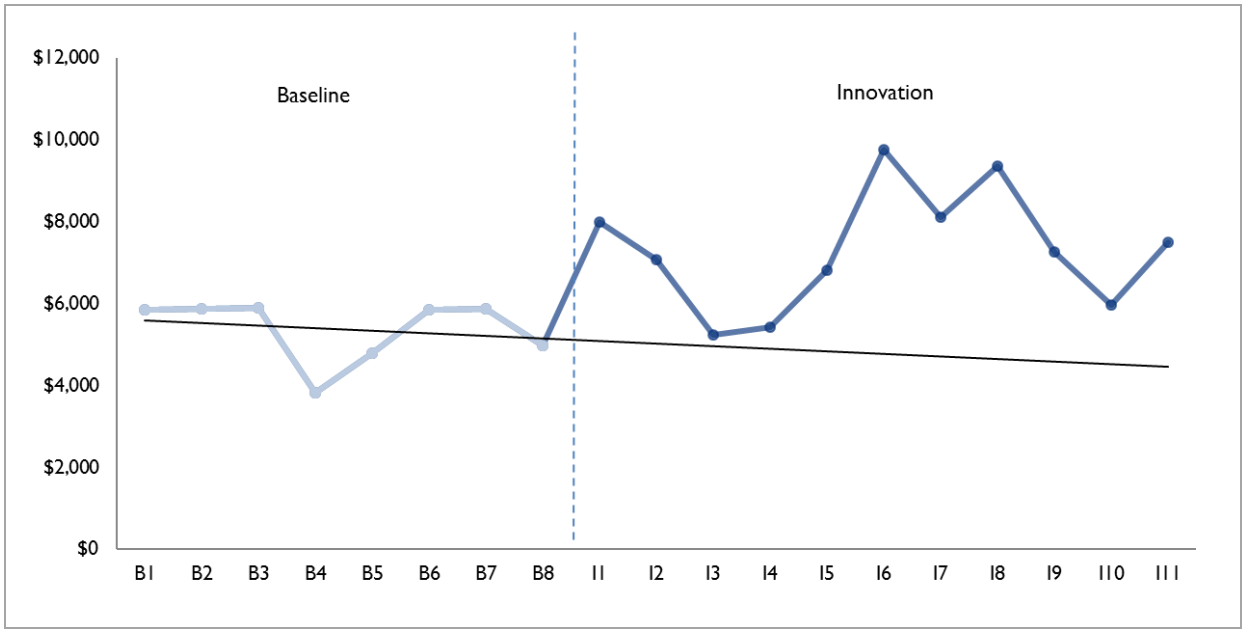
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.; SSM = shared savings model.

Figure 4. Medicare Spending per Participant: Intermountain Cohort 4 (Hot spotting)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.

2.4.2 Regression Results

In ***Table 11*** 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 $16 (90% CI: −$529, $497) 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 −$157 (90% CI: −$503, $189) for Cohort 2. This effect is not statistically significant. The weighted average quarterly spending differential in the innovation period, indicating losses, is $471 (90% CI: $414, $528) for Cohort 3. This effect is statistically significant. These findings are consistent with the findings in the third annual report.

We also present quarterly effects derived from 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.

Results for Cohort 1 show that in innovation Q1 (I1), spending among innovation group individuals is $1,139 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 11. 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	−$1,139	$455	0.013
I2	$72	$501	0.886
I3	$81	$756	0.915
I4	−$1,509	$510	0.003
I5	$284	$553	0.607
I6	$172	$567	0.761
I7	$936	$890	0.293
I8	$721	$574	0.210
I9	−$219	$1,063	0.837
I10	$600	$761	0.431
I11	$312	$713	0.662
I12	−$435	$744	0.559
Overall average	−$16	$312	0.960
Overall aggregate	−$34,651	$685,209	0.960
Overall aggregate (IY1)	−$477,544	$284,543	0.094
Overall aggregate (IY2)	$397,041	$313,438	0.206
Overall aggregate (IY3)	$45,851	$342,142	0.893

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; SSM = shared savings model; Intermountain = Intermountain Healthcare.

Results for Cohort 2 (***Table 12***), show that in I1, spending among innovation group individuals is $265 higher 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 I11 and I12. None of the point estimates are statistically different from zero.

Table 12. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)

Quarter	Coefficient	Standard Error	P-Values
I1	$265	$384	0.490
I2	−$228	$314	0.469
I3	−$218	$350	0.534
I4	−$406	$426	0.341
I5	−$575	$354	0.105
I6	−$64	$448	0.886
I7	−$27	$334	0.934
I8	−$432	$456	0.344
I9	−$647	$444	0.145
I10	−$436	$348	0.210
I11	$585	$501	0.243
I12	$440	$526	0.403
Overall average	−$157	$210	0.455
Overall aggregate	−$767,851	$1,028,411	0.455
Overall aggregate (IY1)	−$253,214	$387,133	0.513
Overall aggregate (IY2)	−$458,158	$454,959	0.314
Overall aggregate (IY3)	−$56,478	$467,134	0.904

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; Intermountain = Intermountain Healthcare.

Results for Cohort 3 (***Table 13***) show that in I1, spending among innovation group individuals is $969 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 13. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)

Quarter	Coefficient	Standard Error	P-Values
I1	$969	$73	<.0001
I2	$560	$68	<.0001
I3	$454	$67	<.0001
I4	$410	$64	<.0001
I5	$443	$71	<.0001
I6	$350	$69	<.0001
I7	$456	$72	<.0001
I8	$536	$74	<.0001
I9	$532	$89	<.0001
I10	$136	$82	0.097
I11	$137	$78	0.077
Overall average	$471	$35	<.0001
Overall aggregate	$129,663,079	$9,556,666	<.0001
Overall aggregate (IY1)	$68,076,902	$4,723,577	<.0001
Overall aggregate (IY2)	$44,318,475	$4,859,565	<.0001
Overall aggregate (IY3)	$17,267,702	$3,713,331	<.0001

Notes:

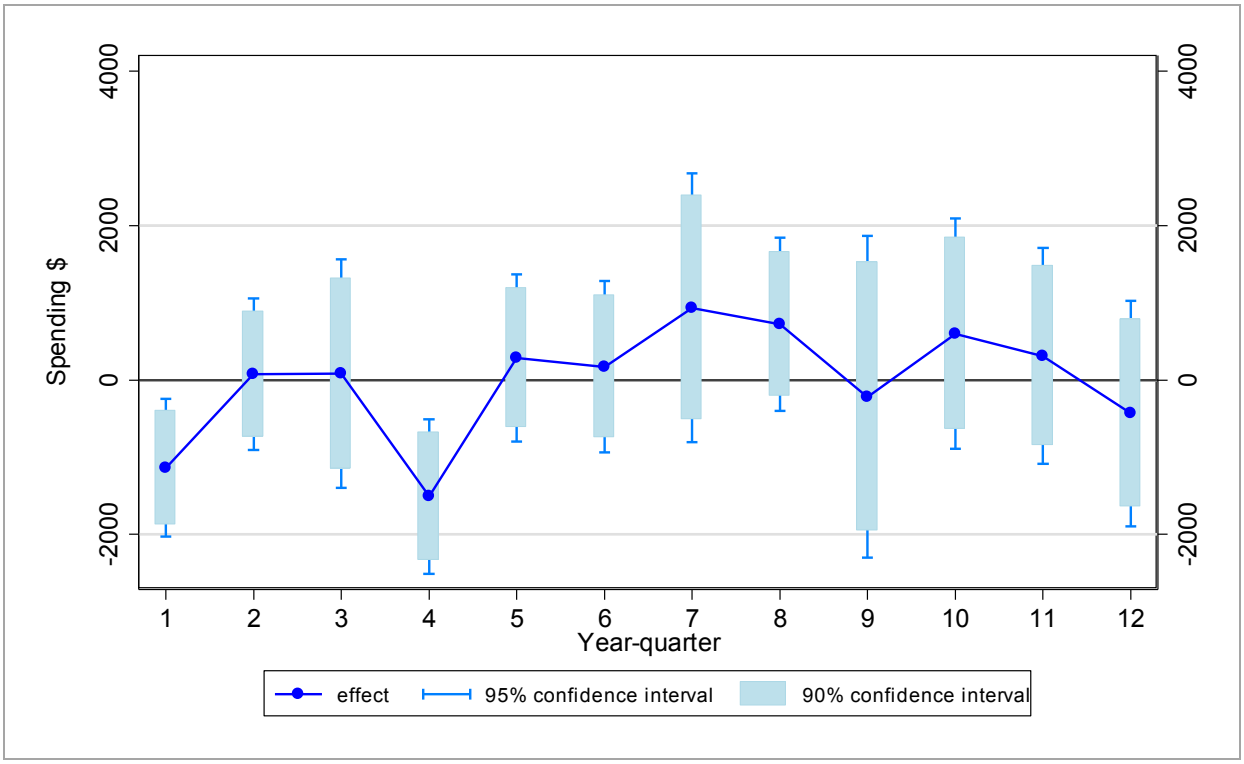
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; SSM = shared savings model; Intermountain = Intermountain Healthcare.

Figures 5, 6, and ***7*** illustrate these quarterly difference-in-differences estimates.

Figure 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 1 (IndiGO and SSM)



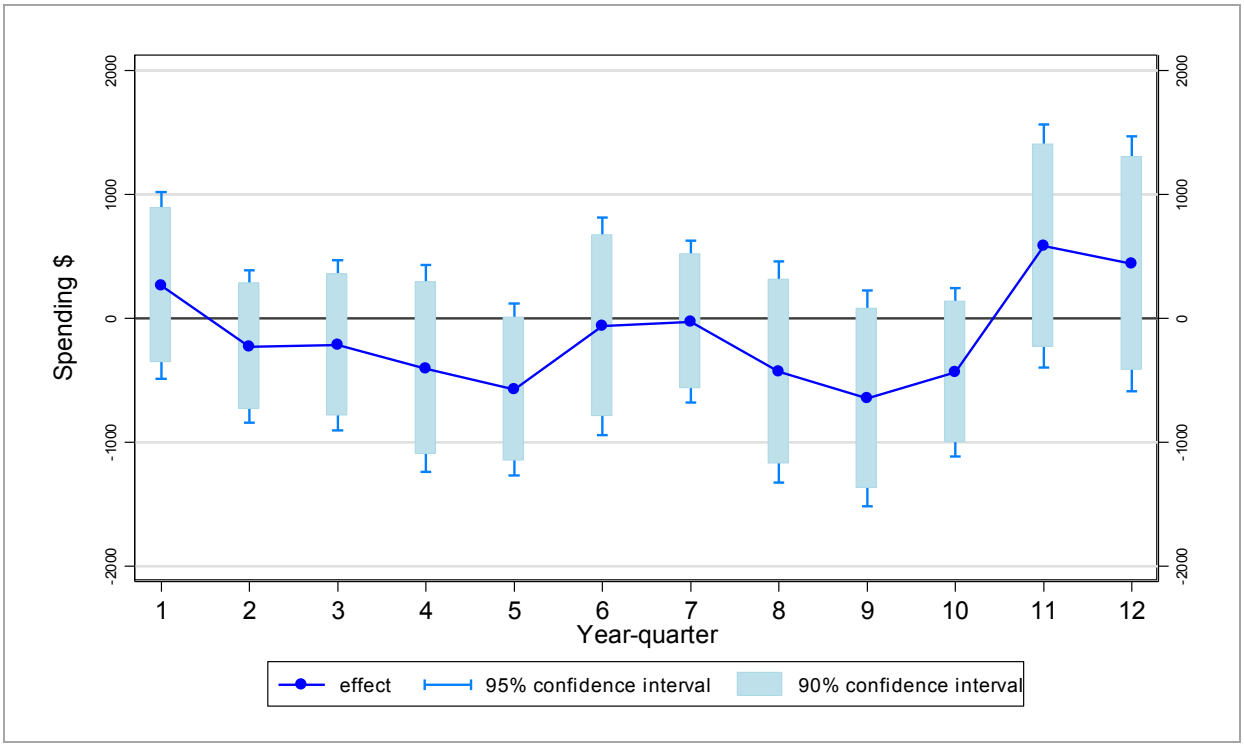
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** June 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; SSM = shared savings model; Intermountain = Intermountain Healthcare.

Figure 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 2 (IndiGO only)



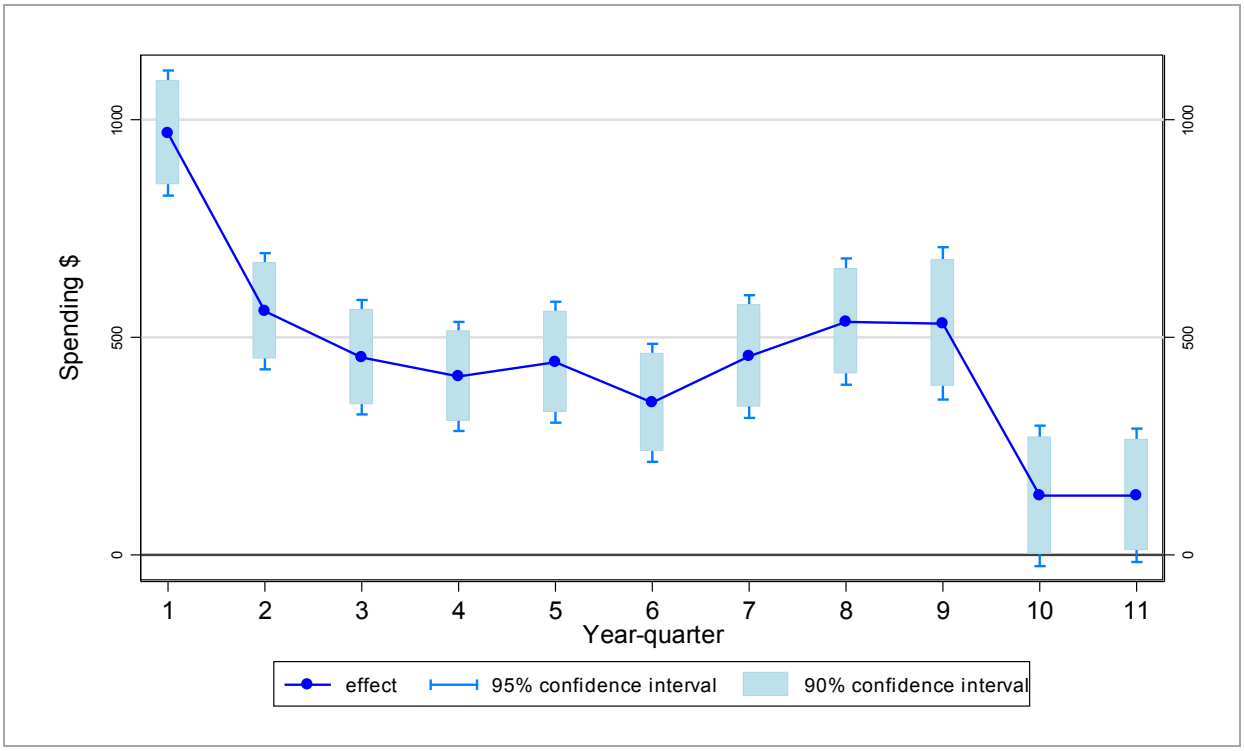
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** June 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; Intermountain = Intermountain Healthcare.

Figure 7. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Intermountain Cohort 3 (SSM only)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** June 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; SSM = shared savings model; Intermountain = Intermountain Healthcare.

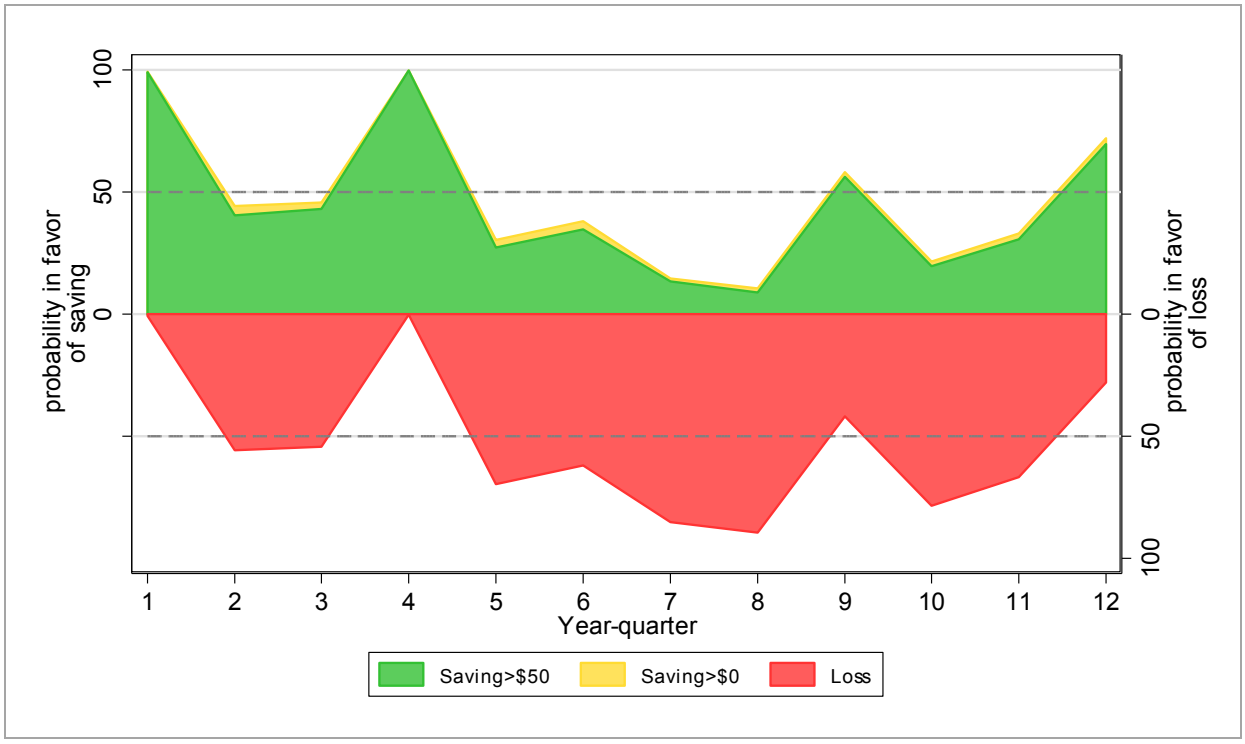
Figures 8, 9, and ***10*** present the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate against the null hypothesis in favor of a one-sided alternative. The larger the probability, the more convincing the evidence is for saving or losing money on this initiative.

For Cohort 1, spending is slightly higher in the innovation group than the comparison group during some quarters and lower during others. The probability of savings for the innovation overall is estimated as 47 percent.

For Cohort 2, Figure 9 shows the probability of a savings is higher than the probability of losses in most quarters. The probability of savings for the innovation overall is estimated as 63 percent.

For Cohort 3, spending is higher in the innovation group than the comparison group in all quarters. During most innovation quarters, the probability of a loss is 100 percent and the overall probability of savings is estimated as 0 percent.

Figure 8. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Intermountain Cohort 1 (IndiGO and SSM)



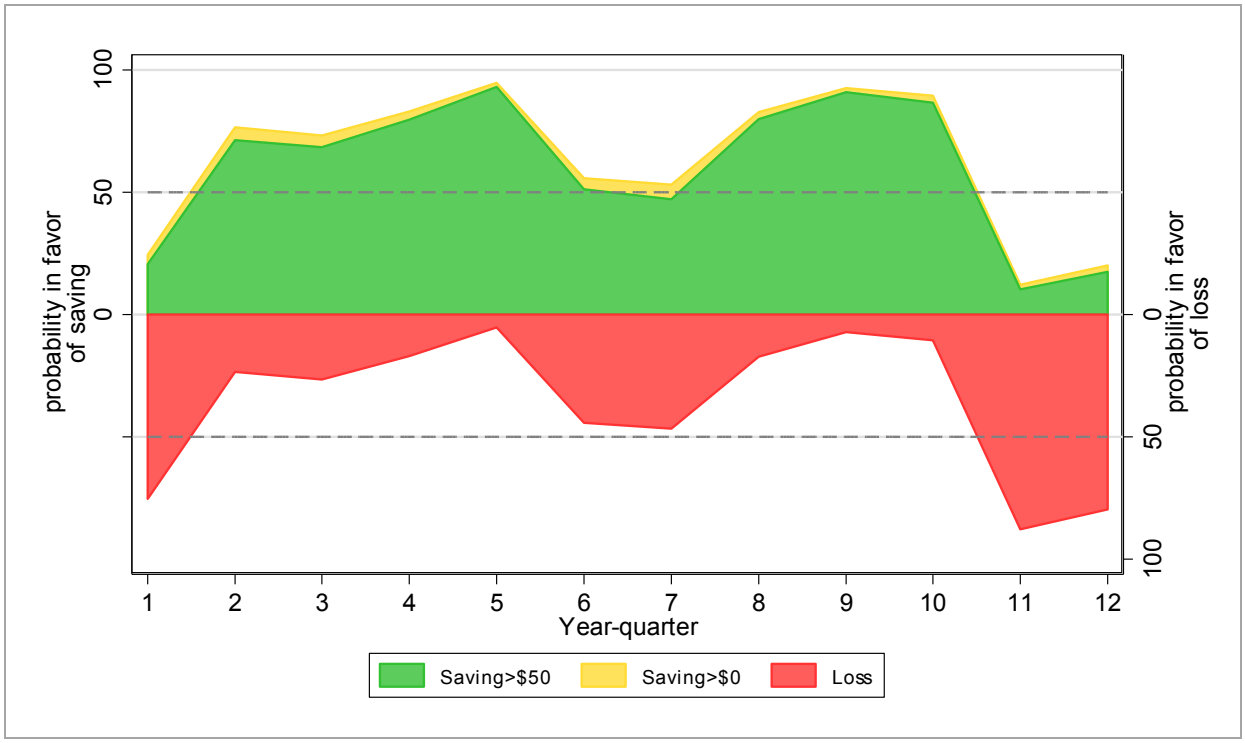
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare.

Figure 9. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Intermountain Cohort 2 (IndiGO only)



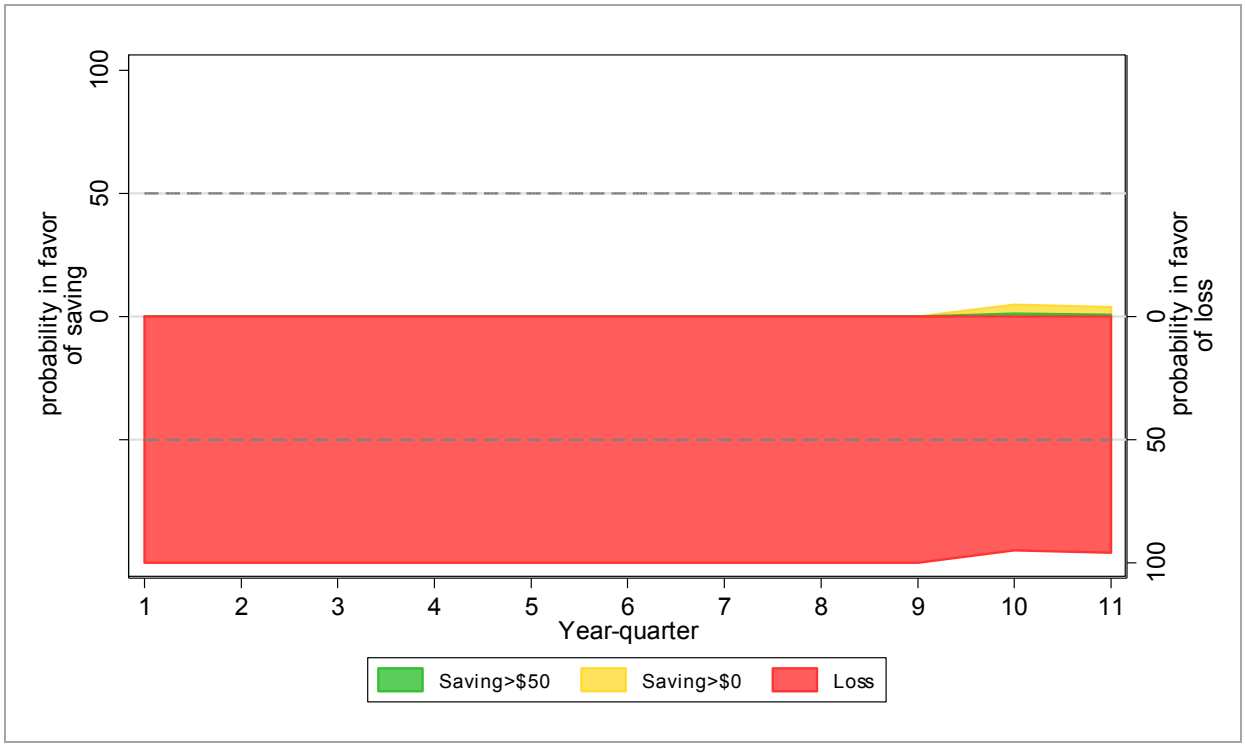
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare.

Figure 10. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Intermountain Cohort 3 (SSM only)



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Tables 14, 15, 16,*** and ***17*** and ***Figures 11, 12, 13,*** and ***14***. 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. These trends are similar to the third annual report. 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 14. 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

	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																				
Admit rate	56	115	81	81	102	117	92	89	57	94	73	52	94	79	138	86	101	118	136	81
Std dev	283	377	338	273	340	517	471	487	292	370	279	245	292	340	439	334	397	357	498	353
Unique patients	144	148	149	160	167	171	174	192	192	192	192	191	191	189	189	185	179	170	169	160
Comparison Group																				
Admit rate	58	52	80	75	60	42	93	83	85	59	92	80	57	40	81	58	57	49	60	75
Std dev	267	288	320	291	288	219	362	339	330	283	388	363	255	231	370	257	265	243	301	311
Weighted patients	156	159	162	169	173	181	186	192	192	192	189	183	180	176	172	168	164	158	156	147
Innovation − Comparison Rate																				
	−2	63	0	6	42	75	−1	5	−28	35	−19	−28	37	40	56	29	44	69	76	6

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Table 15. 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

	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																				
Admit rate	61	56	57	68	64	42	29	39	78	48	51	81	68	54	65	47	38	37	79	84
Std dev	263	264	275	290	275	213	168	216	433	353	239	282	317	305	291	224	216	201	334	277
Unique patients	344	357	368	383	390	403	413	434	434	434	434	431	428	426	416	401	395	382	365	346
Comparison Group																				
Admit rate	40	45	43	70	61	55	59	41	64	50	54	70	61	51	52	73	67	57	57	64
Std dev	240	246	236	286	291	261	284	213	303	260	259	331	301	271	251	314	285	265	253	275
Weighted patients	349	358	366	384	392	402	412	434	434	434	425	415	405	396	381	362	353	335	317	302
Innovation − Comparison Rate																				
	21	11	14	−2	3	−13	−30	−2	14	−2	−4	11	7	3	13	−26	−29	−20	22	20

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.

Table 16. 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

	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																				
Admit rate	61	66	66	63	64	73	76	83	105	97	90	86	86	93	89	86	91	81	77	—
Std dev	284	296	301	288	288	308	325	338	383	365	359	342	338	358	353	343	358	329	323	—
Unique patients	22,377	23,319	23,838	24,466	24,955	27,492	28,114	28,783	28,783	28,605	28,306	27,627	26,683	25,337	24,351	23,343	22,133	20,711	19,526	—
Comparison Group																				
Admit rate	53	55	56	54	55	57	58	58	60	67	62	58	60	63	58	54	56	65	64	—
Std dev	275	282	283	289	284	292	295	307	298	314	301	288	293	295	287	275	280	300	299	—
Weighted patients	23,669	24,583	25,100	25,734	26,280	28,023	28,481	28,781	28,781	28,233	27,486	26,435	25,275	23,649	22,569	21,480	20,311	19,018	17,844	—
Innovation − Comparison Rate																				
	7	11	10	9	9	15	18	25	45	30	28	28	26	30	31	32	34	16	14	—

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Table 17. 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

	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																				
Admit rate	327	255	211	123	136	203	150	206	308	279	127	184	179	309	308	342	282	182	167	—
Std dev	849	667	449	328	342	479	477	477	722	538	373	531	594	621	647	778	1011	672	453	—
Unique patients	52	55	57	57	59	59	60	63	65	68	71	76	78	81	78	79	78	66	60	—
Comparison Group																				
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

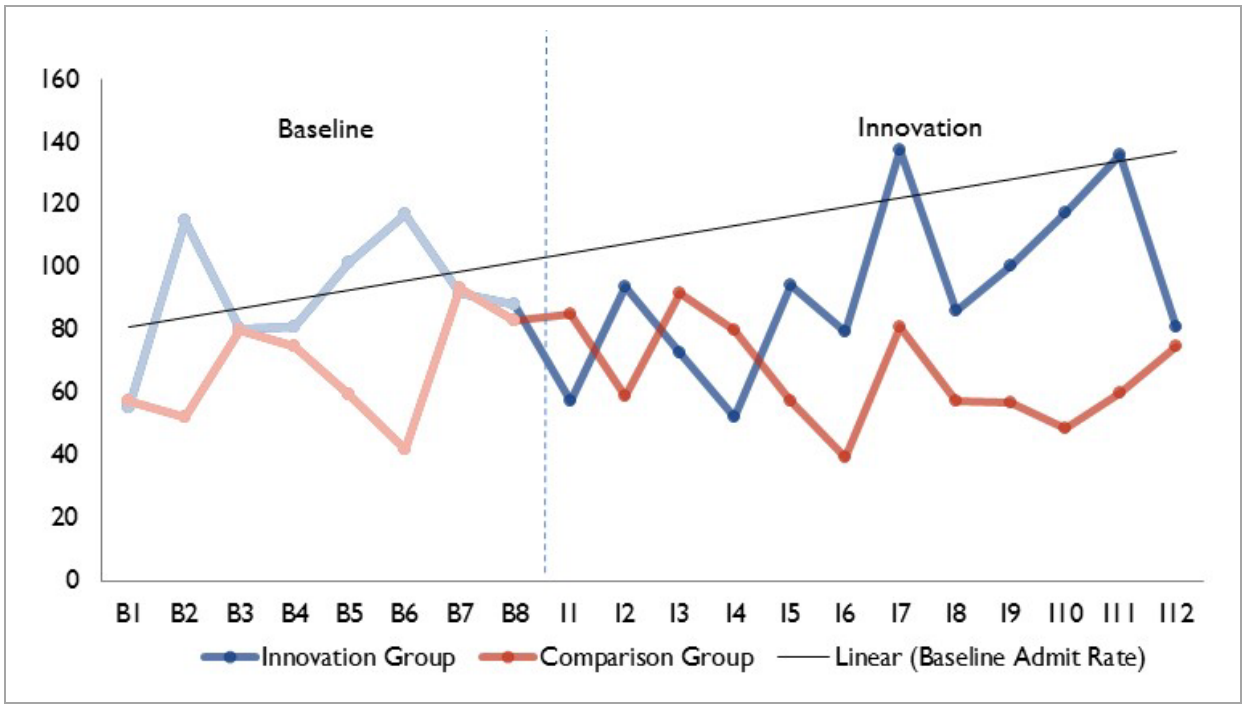
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)



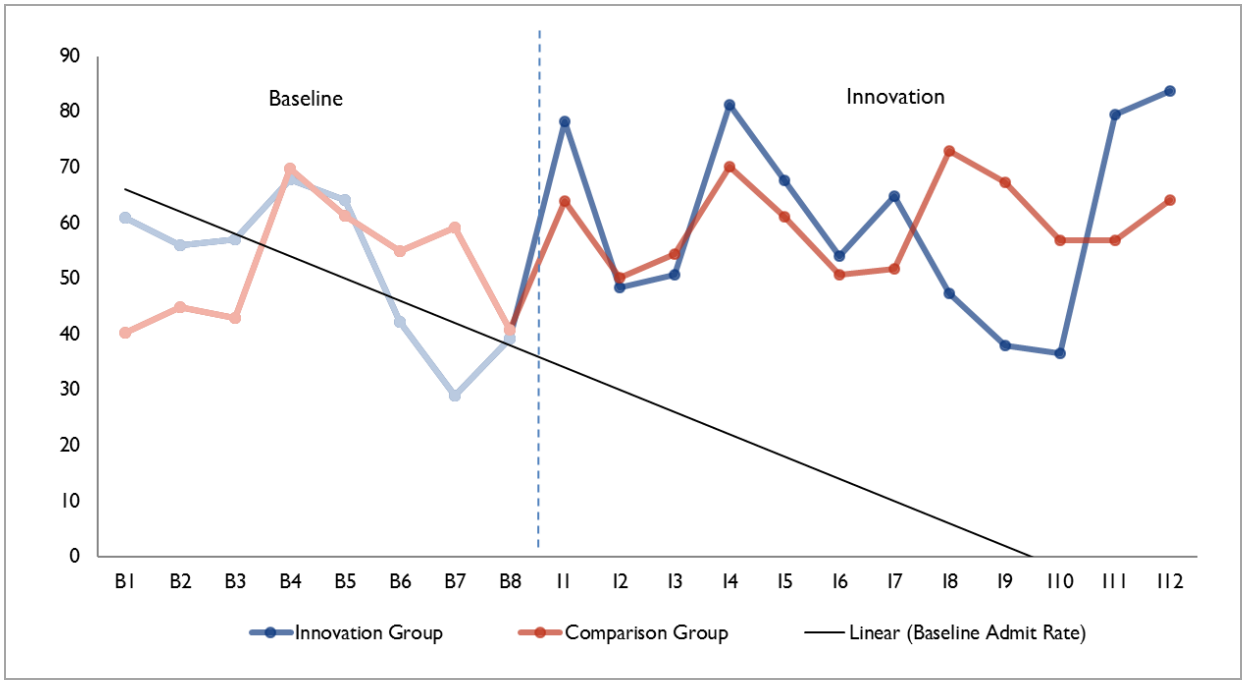
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 12. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)



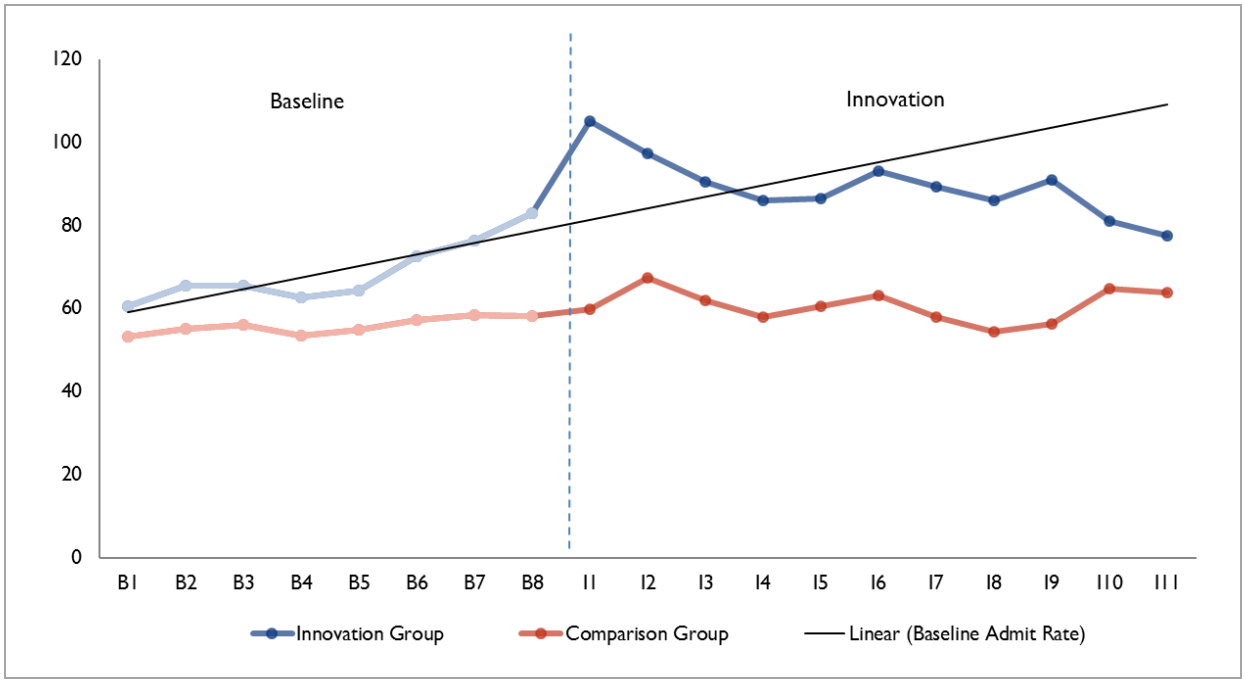
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.

Figure 13. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)



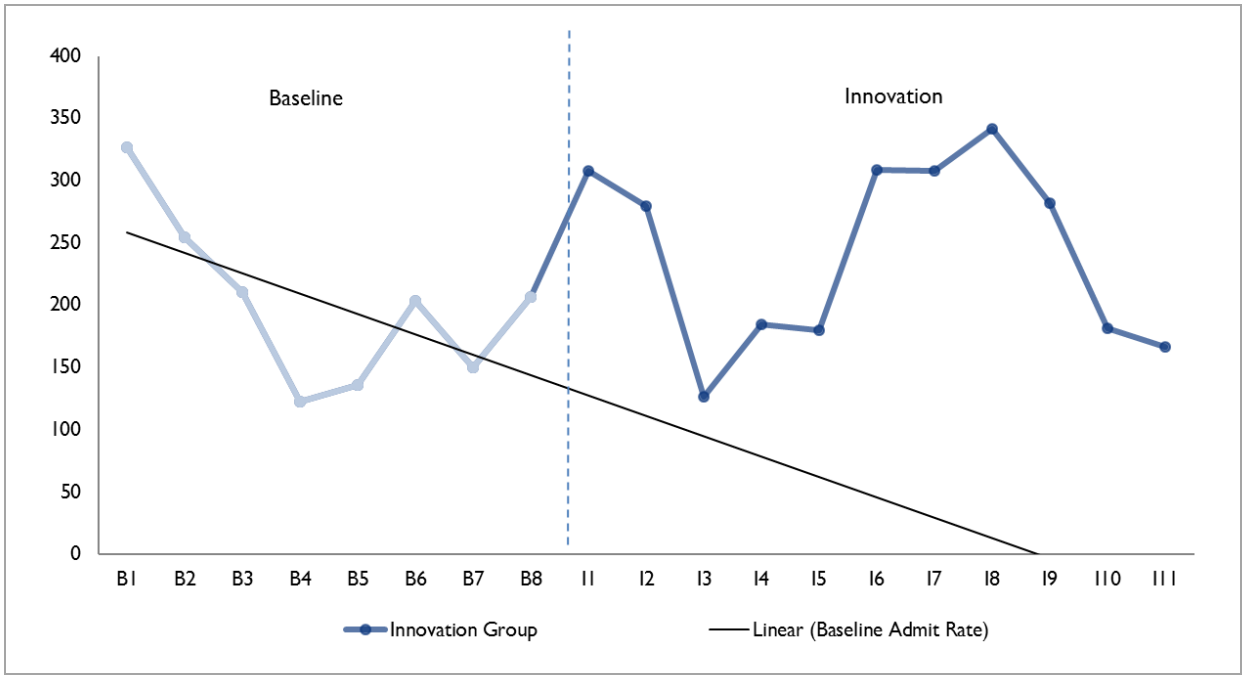
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 14. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Intermountain Cohort 4 (Hot spotting)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.

2.5.2 Regression Results

Tables 18, 19, and ***20*** present the results of a 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 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 not statistically significant (90% CI: −20, 12). We also present quarterly effects. Quarterly effects are not statistically significant in 11 of the 12 quarters. This finding is consistent with the findings in the third annual report.

Table 18. 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	−63	30	0.039
I2	16	27	0.555
I3	−44	33	0.177
I4	−50	34	0.137
I5	11	28	0.705
I6	25	29	0.380
I7	29	37	0.427
I8	−10	29	0.727
I9	10	33	0.769
I10	45	32	0.169
I11	38	39	0.331
I12	−49	44	0.264
Overall average	−4	9	0.680
Overall aggregate	−9	21	0.680
Overall aggregate (IY1)	−27	12	0.024
Overall aggregate (IY2)	10	12	0.368
Overall aggregate (IY3)	8	13	0.528

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

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). We also present quarterly effects; quarterly effects are not statistically significant in 9 of the 12 quarters. This finding is consistent with the findings in the third annual report.

Table 19. 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	9	20	0.638
I2	−3	17	0.843
I3	−3	15	0.813
I4	10	18	0.598
I5	−7	18	0.715
I6	−6	16	0.719
I7	6	16	0.713
I8	−36	18	0.048
I9	−40	18	0.022
I10	−31	17	0.070
I11	17	22	0.452
I12	9	22	0.679
Overall average	−6	5	0.229
Overall aggregate	−30	25	0.229
Overall aggregate (IY1)	5	15	0.729
Overall aggregate (IY2)	−17	14	0.229
Overall aggregate (IY3)	−19	15	0.202

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.

For Cohort 3, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 14 inpatient admissions per 1,000 participants relative to the comparison group. The effect is statistically significant (90% CI: 13, 16). This finding is consistent with the findings in the third annual report. We also present quarterly effects, which are positive and highly significant, except in I10 and I11.

Table 20. 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	34	3	0.000
I2	17	3	0.000
I3	14	3	0.000
I4	16	3	0.000
I5	12	3	0.000
I6	12	3	0.000
I7	14	3	0.000
I8	16	3	0.000
I9	18	3	0.000
I10	−5	3	0.112
I11	−5	3	0.184
Overall average	14	1	0.000
Overall aggregate	3,858	252	0.000
Overall aggregate (IY1)	2,304	161	0.000
Overall aggregate (IY2)	1,348	150	0.000
Overall aggregate (IY3)	205	122	0.094

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Tables 21, 22, 23,*** and ***24*** and ***Figures 15, 16, 17,*** and ***18***. Unplanned readmissions rates fluctuate around the trend lines before the innovation's launch, as shown by the wide spread of the measures data points, rather than a clustering around the mean. Because of the low number of index admissions (the denominator in the readmissions measure) in Cohort 4, the unplanned readmissions rate is highly variable. These trends are similar to the third annual report.

Table 21. 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

	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																				
Readmit rate	0	77	0	0	0	231	125	125	0	0	0	0	0	77	95	77	71	56	63	222
Std dev	0	267	0	0	0	421	331	331	0	0	0	0	0	267	294	267	258	229	242	416
Total admissions	5	13	8	11	13	13	8	8	6	13	12	8	15	13	21	13	14	18	16	9
Comparison Group																				
Readmit rate	43	105	97	0	80	150	64	56	24	67	105	88	40	0	65	0	59	0	83	71
Std dev	204	307	296	0	271	357	244	229	153	249	307	284	196	0	246	0	235	0	276	258
Total admissions	8	6	10	10	8	7	16	12	14	10	13	11	8	6	10	7	6	6	8	9
Innovation − Comparison Rate																				
	−43	−28	−97	0	−80	81	61	69	−24	−67	−105	−88	−40	77	31	77	13	56	−21	151

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Table 22. 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

	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																				
Readmit rate	0	59	111	0	0	0	0	63	103	222	118	37	192	0	217	0	83	0	40	0
Std dev	0	235	314	0	0	0	0	242	305	416	322	189	394	0	413	0	276	0	196	0
Total admissions	17	17	18	22	19	12	11	16	29	18	17	27	26	17	23	17	12	13	25	24
Comparison Group																				
Readmit rate	50	93	24	45	17	33	91	20	127	19	85	47	78	125	102	78	18	21	45	44
Std dev	218	291	153	208	130	178	288	141	333	137	279	211	268	331	303	268	131	144	208	206
Total admissions	13	14	14	22	19	20	22	16	24	17	20	21	21	16	16	21	19	16	15	15
Innovation − Comparison Rate																				
	−50	−34	87	−45	−17	−33	−91	42	−23	203	33	−10	114	−125	115	−78	66	−21	−5	−44

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.

Table 23. 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

	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																				
Readmit rate	47	59	61	46	60	49	76	48	57	55	62	63	53	61	61	40	57	67	41	—
Std dev	212	235	240	209	238	215	264	214	231	228	241	242	225	238	239	195	232	251	198	—
Total admissions	1,043	1,157	1,179	1,157	1,249	1,585	1,666	1,865	2,363	2,051	1,903	1,678	1,760	1,785	1,613	1,464	1,490	1,276	757	—
Comparison Group																				
Readmit rate	52	57	51	56	57	59	55	72	70	63	68	68	65	52	71	57	50	65	50	—
Std dev	223	232	219	230	231	235	229	259	256	244	252	251	246	222	257	231	218	246	218	—
Total admissions	1,048	1,149	1,226	1,168	1,260	1,407	1,451	1,526	1,473	1,448	1,362	1,212	1,226	1,197	1,061	928	902	1,001	609	—
Innovation − Comparison Rate																				
	−5	2	10	−10	3	−10	20	−24	−14	−8	−6	−5	−11	8	−10	−17	7	2	−9	—

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Table 24. 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

	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																				
Readmit rate	0	0	250	0	0	500	0	0	0	0	0	0	0	0	167	100	333	0	0	—
Std dev	0	0	433	0	0	500	0	0	0	0	0	0	0	0	373	300	471	0	0	—
Total admissions	3	4	4	4	5	6	1	3	8	3	2	2	2	7	6	10	3	3	5	—
Comparison Group																				
Readmit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total admissions	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

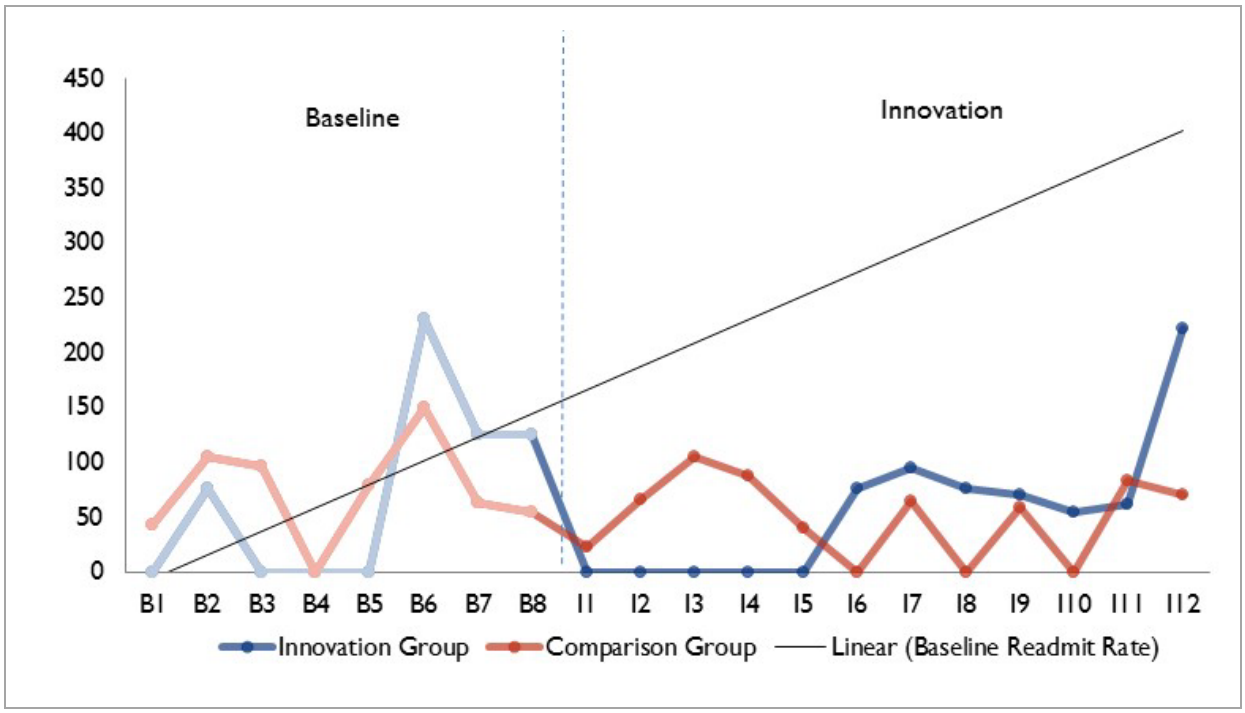
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 15. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 1 (IndiGO and SSM)



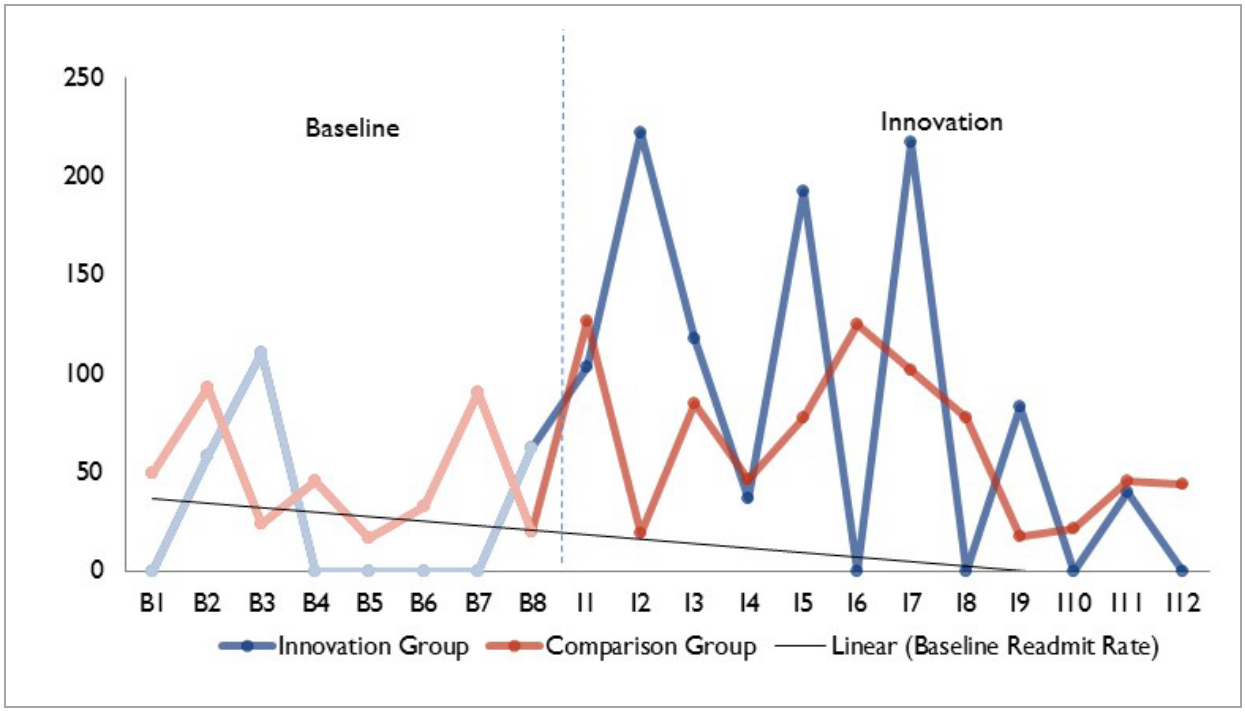
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 and June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 16. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 2 (IndiGO only)



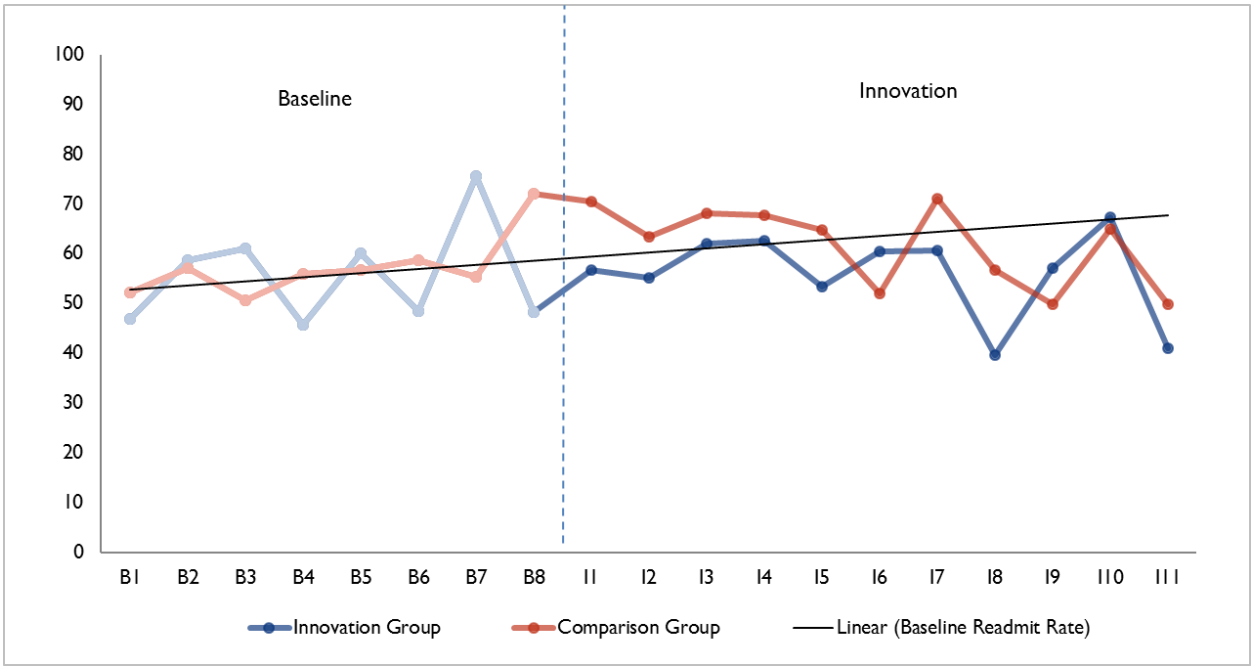
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 and June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.

Figure 17. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 3 (SSM only)



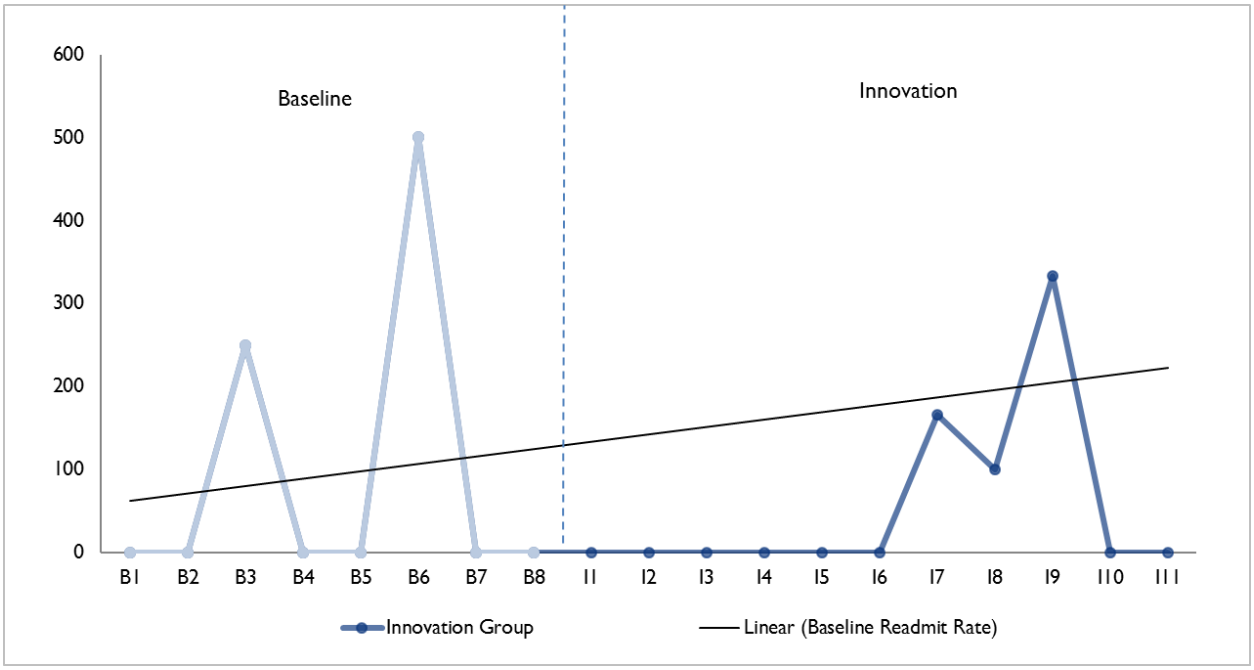
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 and June 2016.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 18. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Intermountain Cohort 4 (Hot spotting)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 and June 2016.

Terms and Definitions

- Intermountain = Intermountain Healthcare, Inc.

2.6.2 Regression Results

Tables 25, 26, and ***27*** 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 −3 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is lower for the innovation group 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: −60, 55). This finding is consistent with the findings in the third annual report.

Table 25. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Intermountain Cohort 1 (IndiGO and SSM)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−3	35	0.940
Overall aggregate	0	5	0.940

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions
- **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; Intermountain = Intermountain Healthcare, Inc.

For Cohort 2, the average quarterly difference-in-differences estimate for unplanned readmissions is 39 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is higher for the innovation group 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: −34, 112). This finding is consistent with the findings in the third annual report.

Table 26. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Intermountain Cohort 2 (IndiGO only)

Quarter	Coefficient	Standard Error	P-Values
Overall average	39	44	0.380
Overall aggregate	10	11	0.380

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions
- **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.
- Intermountain = Intermountain Healthcare, Inc.

For Cohort 3, the average quarterly difference-in-differences estimate for unplanned readmissions is −6 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is lower for the innovation group 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, 1). This finding is consistent with the findings in the third annual report.

Table 27. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Intermountain Cohort 3 (SSM only)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−6	4	0.188
Overall aggregate	−104	79	0.188

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **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; Intermountain = Intermountain Healthcare, Inc.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Tables 28, 29, 30, and 31*** and ***Figures 19, 20, 21,*** and ***22.*** 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. These trends are similar to the third annual report. 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 Cohort 2, but are impacted by the innovation in year 1 for Cohort 1 and every period for Cohort 3.

Table 28. 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

	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																				
ED rate	118	128	121	88	234	199	178	172	135	203	151	162	162	153	212	227	207	259	189	244
Std dev	535	409	434	325	1,312	892	751	653	725	1,209	617	808	523	529	944	985	987	1,122	627	1,354
Unique patients	144	148	149	160	167	171	174	192	192	192	192	191	191	189	189	185	179	170	169	160
Comparison Group																				
ED rate	132	155	129	130	127	134	111	160	137	141	150	185	169	234	133	167	138	137	158	177
Std dev	620	619	451	301	463	523	344	451	453	531	499	868	784	1086	474	409	411	368	543	647
Weighted patients	156	159	162	169	173	181	186	192	192	192	189	183	180	176	172	168	164	158	156	147
Innovation − Comparison Rate																				
	−14	−26	−9	−42	107	65	67	12	−2	63	1	−23	−6	−81	78	60	68	121	31	67

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Table 29. 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

	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																				
ED rate	70	81	52	70	90	60	61	69	92	97	81	74	98	89	101	100	94	141	121	139
Std dev	287	370	266	312	328	310	258	353	341	359	297	319	349	331	380	354	325	424	415	415
Unique patients	344	357	368	383	390	403	413	434	434	434	434	431	428	426	416	401	395	382	365	346
Comparison Group																				
ED rate	90	71	101	108	98	67	85	65	79	113	102	114	114	110	100	127	129	132	114	114
Std dev	208	172	222	258	189	159	199	168	206	253	239	253	262	278	253	294	313	270	263	220
Weighted patients	349	358	366	384	392	402	412	434	434	434	425	415	405	396	381	362	353	335	317	302
Innovation − Comparison Rate																				
	−20	10	−49	−37	−8	−8	−24	4	13	−16	−21	−40	−16	−21	1	−27	−36	9	7	25

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.

Table 30. 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

	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																				
ED rate	116	121	125	131	130	134	140	153	184	162	165	172	170	164	173	172	169	163	165	—
Std dev	445	468	521	514	507	533	511	532	598	594	603	603	599	555	595	594	622	564	580	—
Unique patients	22,377	23,319	23,838	24,466	24,955	27,492	28,114	28,783	28,783	28,605	28,306	27,627	26,683	25,337	24,351	23,343	22,133	20,711	19,526	—
Comparison Group																				
ED rate	103	104	110	116	112	115	118	133	121	122	122	125	122	123	125	127	118	129	135	—
Std dev	307	288	307	332	304	315	319	360	344	316	320	336	324	323	334	343	313	352	376	—
Weighted patients	23,669	24,583	25,100	25,734	26,280	28,023	28,481	28,781	28,781	28,233	27,486	26,435	25,275	23,649	22,569	21,480	20,311	19,018	17,844	—
Innovation − Comparison Rate																				
	14	17	15	15	18	19	22	20	63	40	43	47	48	41	48	45	51	35	30	—

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Table 31. 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

	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																				
ED rate	385	709	632	614	610	780	650	651	523	618	563	605	615	580	628	608	487	318	333	—
Std dev	1,051	2,455	2,388	2,202	1,661	2,158	2,537	1,885	1,032	1,456	1,671	1,601	1,531	1,650	1,547	1,471	1,066	931	681	—
Unique patients	52	55	57	57	59	59	60	63	65	68	71	76	78	81	78	79	78	66	60	—
Comparison Group																				
ED rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

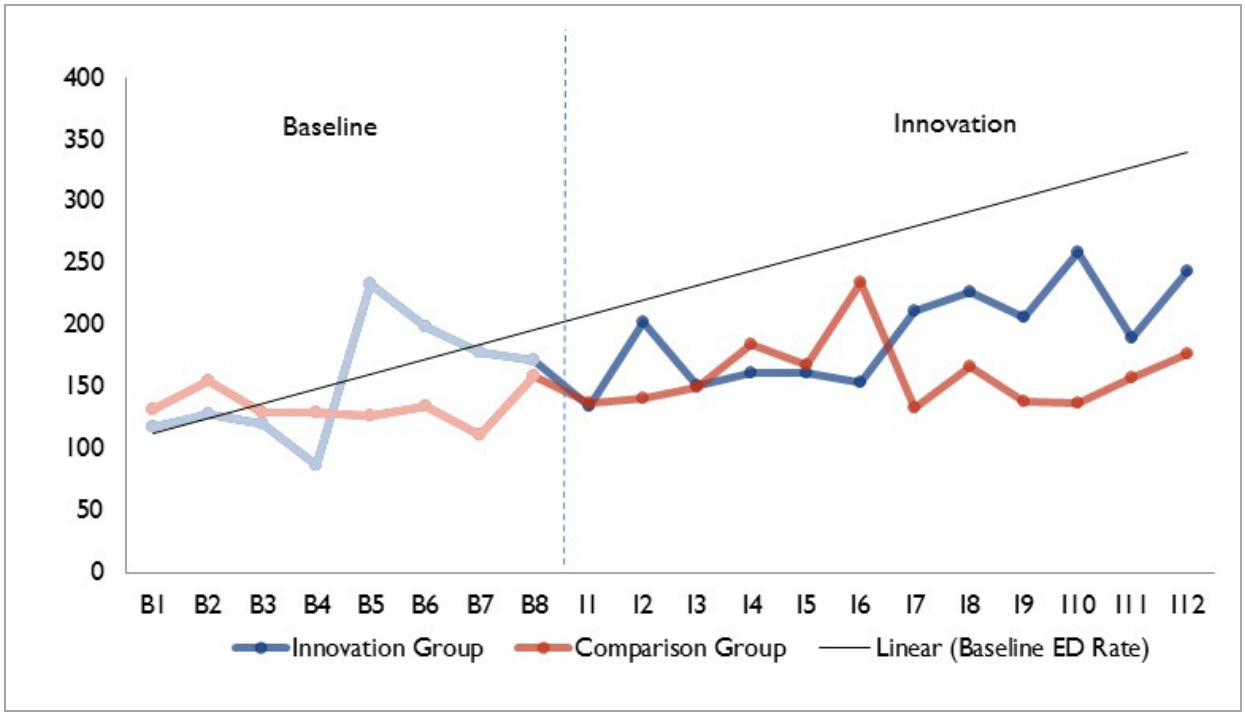
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 19. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 1 (IndiGO and SSM)



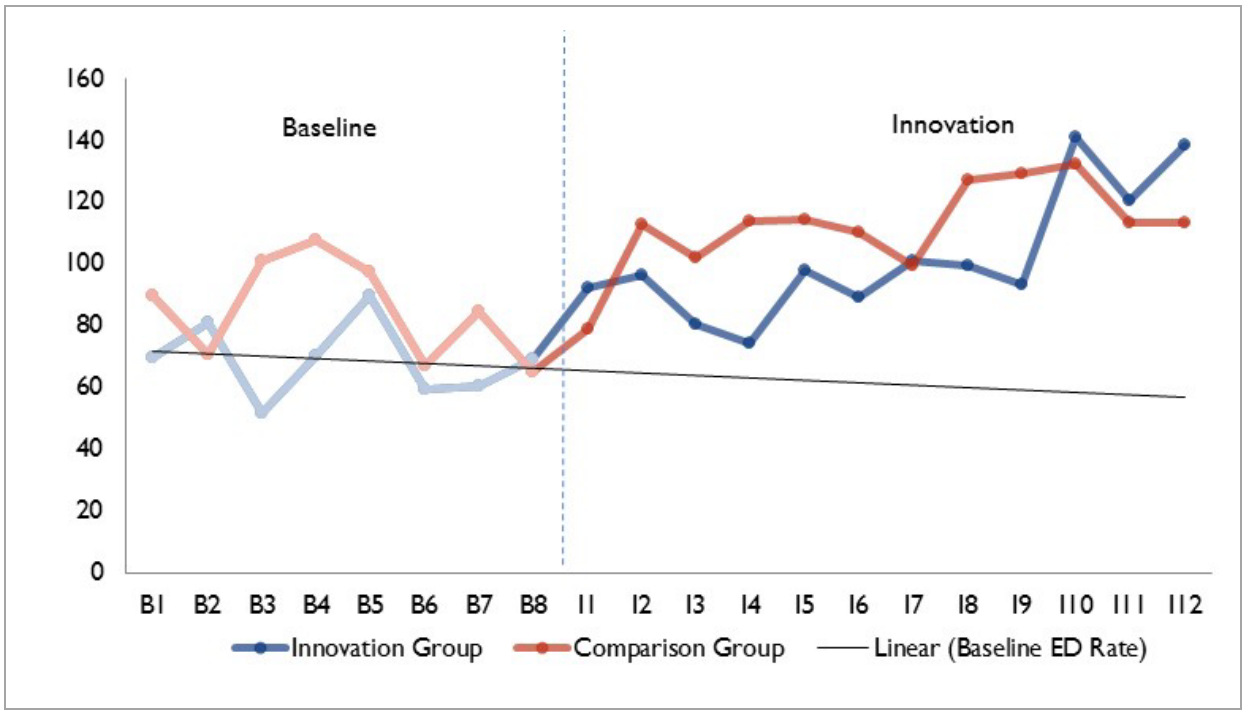
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- ED = emergency department; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 20. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 2 (IndiGO only)



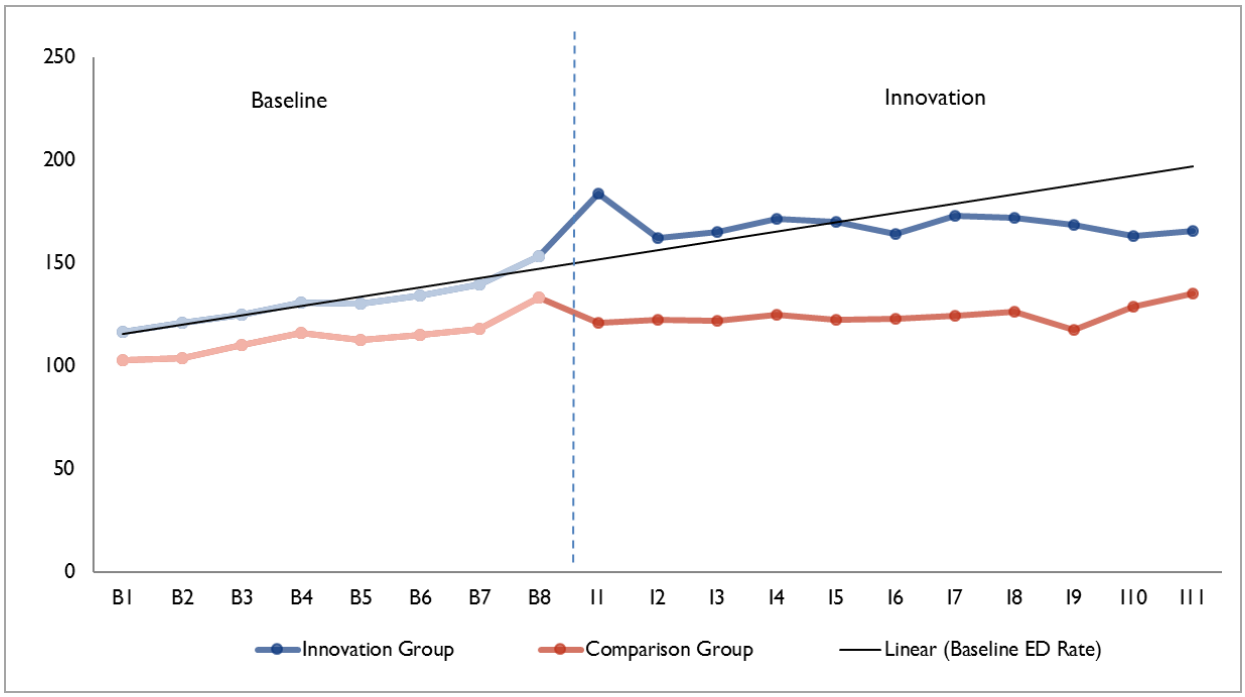
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- ED = emergency department; Intermountain = Intermountain Healthcare, Inc.

Figure 21. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 3 (SSM only)



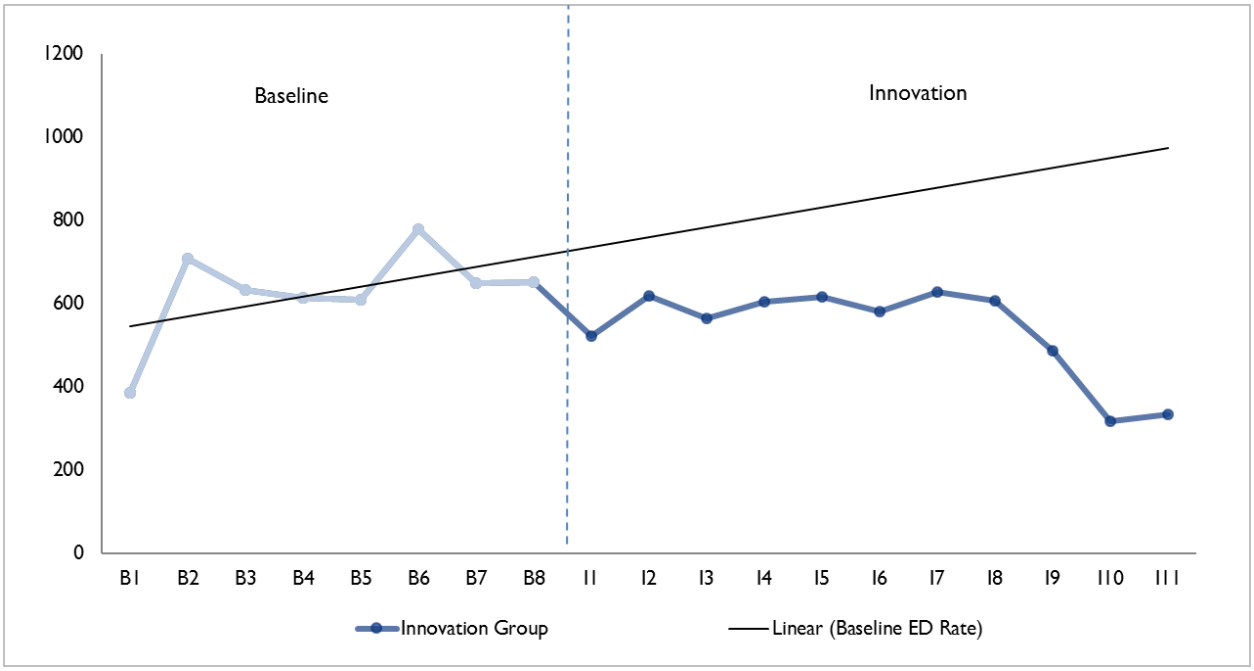
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- ED = emergency department; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 22. ED Visits per 1,000 Medicare Participants: Intermountain Cohort 4 (Hot spotting)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2016.

Terms and Definitions

- ED = emergency department; Intermountain = Intermountain Healthcare, Inc.

2.7.2 Regression Results

Tables 32, 33, and ***34*** present results of a 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 22 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: −49, 5). We also present quarterly effects; no quarterly effects are statistically significant at the 10 percent level; however, Year 1's effect is statistically significant. This finding is consistent with the findings in the third annual report.

Table 32. 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	−42	32	0.197
I2	−1	37	0.978
I3	−47	55	0.398
I4	−87	58	0.134
I5	−1	64	0.989
I6	−79	67	0.234
I7	51	54	0.351
I8	−12	64	0.856
I9	−24	56	0.669
I10	38	56	0.501
I11	−13	63	0.838
I12	−42	58	0.476
Overall average	−22	16	0.175
Overall aggregate	−48	36	0.175
Overall aggregate (IY1)	−34	18	0.060
Overall aggregate (IY2)	−8	24	0.742
Overall aggregate (IY3)	−7	20	0.736

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: June 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

For Cohort 2, the average quarterly difference-in-differences estimate for ED visits is 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 statistically significant (90% CI: −9, 13). None of the quarterly effects are statistically significant. This finding is consistent with the findings in the third annual report.

Table 33. 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	0.151
I2	4	21	0.829
I3	−3	19	0.862
I4	−29	22	0.195
I5	−5	23	0.812
I6	−10	21	0.624
I7	12	22	0.568
I8	−10	25	0.678
I9	−23	25	0.359
I10	20	29	0.492
I11	17	26	0.502
I12	36	27	0.175
Overall average	2	7	0.715
Overall aggregate	12	33	0.715
Overall aggregate (IY1)	0	18	0.994
Overall aggregate (IY2)	−6	19	0.766
Overall aggregate (IY3)	17	20	0.386

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: June 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Intermountain = Intermountain Healthcare, Inc.

For Cohort 3, the average quarterly difference-in-differences estimate for ED visits is an increase of 22 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: 19, 24). This finding is consistent with the findings in the third annual report. Quarterly annual effects are highly statistically significant in all quarters except I10 and I11.

Table 34. 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	48	5	0.000
I2	21	4	0.000
I3	23	5	0.000
I4	24	5	0.000
I5	26	5	0.000
I6	16	5	0.001
I7	21	5	0.000
I8	17	5	0.002
I9	25	5	0.000
I10	6	6	0.263
I11	0	6	0.939
Overall average	22	1	0.000
Overall aggregate	6,022	412	0.000
Overall aggregate (IY1)	3,302	257	0.000
Overall aggregate (IY2)	2,019	250	0.000
Overall aggregate (IY3)	701	204	0.001

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: June 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.8 Discussion: Medicare Results

Cohort 1 (IndiGO and SSM) shows decreased spending, which was significant in Year 1 but not overall. Cohort 2 (IndiGO only) exhibited decreased but nonsignificant changes in spending for the innovation overall. Cohort 3 (SSM only) shows significant losses for each year of the innovation and overall. Changes in hospital admissions for Cohort 1 (IndiGO and SSM) showed significant decreases in Year 1 but not overall. The impact of the innovation on Cohort 2's (IndiGO only) inpatient admissions was not significant. 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. The findings are consistent with the results presented in the third annual report.[1]

The Medicare results do not support the innovation's theory of change. The SSM component evaluated as part of Cohorts 1 and 3 was designed to reduce spending by replacing 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. Because the SSM was still in development throughout the evaluation period, the potential benefits of the SSM component may not be evident in the Medicare findings for Cohorts 1 and 3.

The Medicare results relevant to the IndiGO component, evaluated as part of Cohorts 1 and 2, are somewhat consistent with the innovation's theory of change. Providers used the IndiGO tool to show patients how changes in their health behavior could reduce the risk for adverse health events. Use of the tool should thus result in fewer ED visits and inpatient admissions and reduced spending, assuming that patients change their behavior as intended. While the results here trend in the expected direction, few effects are statistically significant. Qualitative findings reported in the third annual report reflect that provider and patient use of IndiGO was not as widespread as anticipated, which could account for the weak findings.[2]

2.9 Medicaid Comparison Group

We include patients who were enrolled prior to June 30, 2015, and we present Medicaid claims data through June 30, 2015. The Medicaid claims analysis focuses on 299 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 the state of Utah during the innovation launch. These are new data not presented in the third annual report. The claims analysis focused on patients participating in the SSM component of Intermountain's innovation. Enrollment by Medicaid beneficiaries in the IndiGO and population management (hot spotting) components of Intermountain's innovation was too small to perform descriptive and regression analysis.

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 and inpatient stays in the calendar quarter prior to the innovation, and total Medicare

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

[2] Ibid.

payments in the calendar quarter and calendar year 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 35 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 23*** 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 35. Mean Values and Standardized Differences of Variables in Propensity Score Model: Intermountain SSM (Medicaid)

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	
Medicaid in previous quarter										
Payments in calendar quarter prior to enrollment	1,768	5,807	1,573	5,173	0.036	1,776	5,816	2,055	6,782	0.044
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	9,110	31,461	6,570	19,134	0.098	7,709	21,952	8,234	22,994	0.023
Age	48.13	15.83	47.15	18.2	0.057	48.04	15.82	48.8	18.42	0.044
Percentage dual eligible	55.76	49.76	48.84	49.99	0.139	55.81	49.66	59.55	49.08	0.076
Percentage female	57.99	49.45	64.99	47.7	0.144	58.05	49.35	57.18	49.48	0.018
Percentage nonwhite	8.92	28.56	9.27	29.01	0.012	8.61	28.06	12.61	33.2	0.130
Percentage disabled	48.33	50.07	45.78	49.82	0.051	47.94	49.96	51.69	49.97	0.075
Number of ED visits in calendar quarters prior to enrollment	0.32	1.3	0.1	0.52	0.228	0.28	1.04	0.22	0.97	0.056
Number of inpatient stays in calendar quarter prior to enrollment	0.09	0.34	0.03	0.19	0.197	0.07	0.29	0.08	0.35	0.027
Number of beneficiaries	269	—	24,9334	—	—	267	—	799	—	—
Number of unique beneficiaries[1]	—	—	43,243	—	—	267	—	784	—	—
Number of weighted beneficiaries	—	—	—	—	—	267	—	267	—	—
No Medicaid in previous quarter										
Age	50.81	20.22	40.41	17.45	0.551	50.81	19.90	48.00	18.76	0.145
Percentage dual eligible	71.88	45.68	32.96	47.01	0.846	71.88	44.96	68.75	46.35	0.068
Percentage female	46.88	50.70	71.60	45.10	0.520	46.88	49.90	43.75	49.61	0.063
Percentage nonwhite	25.00	43.99	13.71	34.40	0.289	25.00	43.30	31.25	46.35	0.139
Percentage disabled	53.13	50.70	31.47	46.44	0.449	53.13	49.90	50.00	50.00	0.063
Number of beneficiaries	32	—	21751	—	—	32	—	96	—	—
Number of unique beneficiaries[1]	—	—	18,119	—	—	32	—	94	—	—
Number of weighted beneficiaries	—	—		—	—	32	—	32	—	—

[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).

Notes:

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

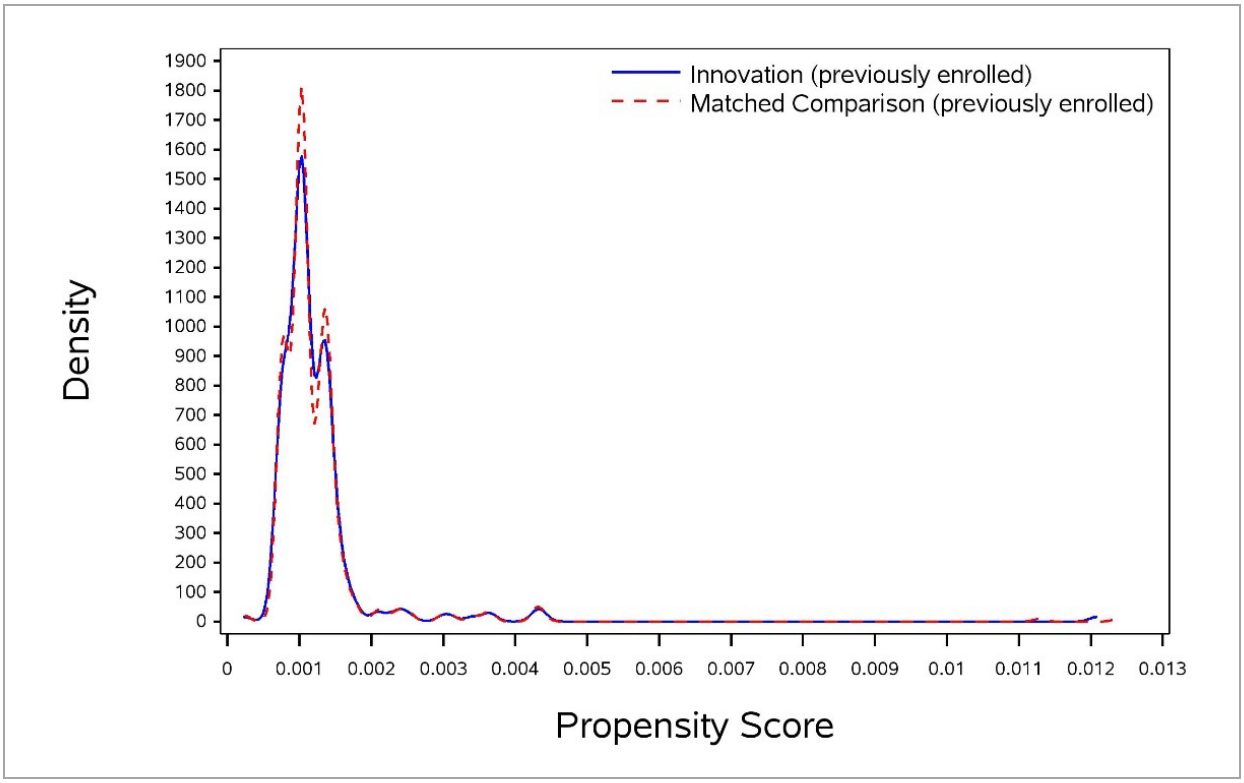
Terms and Definitions

- SD = standard deviation; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — 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 35). The results in Table 35 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. One variable, percentage nonwhite, 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 difference after matching is > 0.10 (0.13). Two variables, age and percentage nonwhite, in the model including beneficiaries without 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 (0.15 and 0.14, 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.

Figures 23 and 24 show the distribution 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 23. Distribution of Propensity Scores for Comparison and Innovation Groups: Intermountain SSM (Medicaid) Medicaid in Previous Quarter



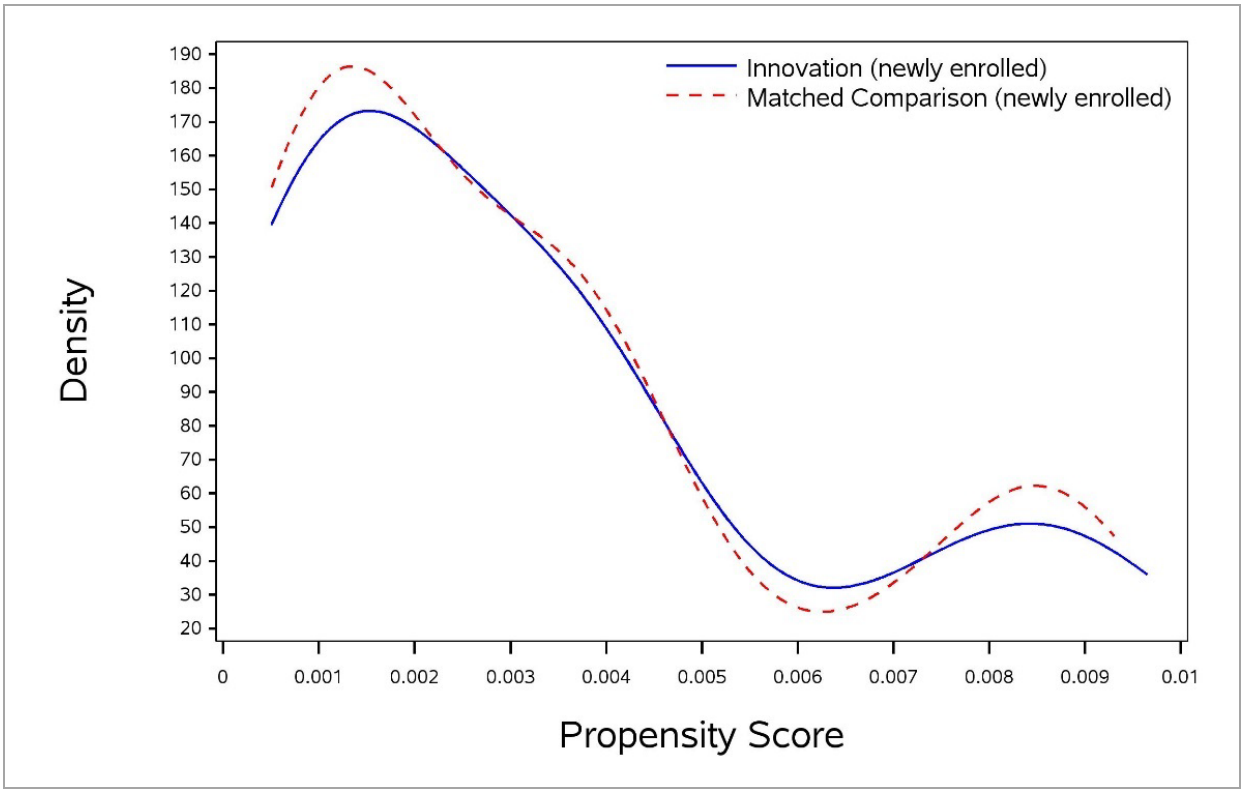
Notes:

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

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 24. Distribution of Propensity Scores for Comparison and Innovation Groups: Intermountain SSM (Medicaid) No Medicaid in Previous Quarter



Notes:

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

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.10 Medicaid Spending

2.10.1 Descriptive Results

Table 36 reports Medicaid spending per patient in the 8 quarters before and the 8 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 25*** illustrates the Medicaid spending per beneficiary in Table 36 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 5 (I5) returning to the trend line in I8. As Table 36 shows, a high standard deviation for spending, in that the data points tend to be spread over a wide range of values rather than at the mean. A similar trend in spending is observed among comparison group individuals.

Table 36. Medicaid Spending per Participant: Intermountain SSM

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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	$3,424	$1,917	$1,861	$1,996	$3,288	$2,528	$1,820	$1,776	$1,494	$1,559	$1,590	$1,463	$1,642	$1,995	$2,075	$1,142	—	—	—	—
Std dev	$14,002	$3,852	$4,127	$4,518	$10,971	$9,459	$9,688	$5,827	$5,256	$6,589	$4,777	$4,293	$4,262	$5,902	$6,676	$4,066	—	—	—	—
Unique patients	145	177	185	192	198	235	257	267	299	257	232	206	115	103	101	72	—	—	—	—
Comparison Group																				
Spending rate	$2,155	$1,978	$1,963	$2,603	$2,210	$1,791	$1,744	$2,055	$1,598	$1,747	$1,934	$2,055	$2,258	$1,929	$2,088	$1,269	—	—	—	—
Std dev	$3,572	$2,964	$3,102	$5,101	$3,669	$2,880	$2,971	$3,960	$2,851	$3,155	$3,171	$3,732	$3,518	$3,005	$3,342	$2,220	—	—	—	—
Weighted patients	278	280	279	277	277	277	279	267	299	259	250	239	158	150	136	97	—	—	—	—
Savings per Patient																				
	−$1,269	$61	$102	$608	−$1,078	−$737	−$76	$279	$104	$188	$345	$592	$616	−$66	$13	$127	—	—	—	—

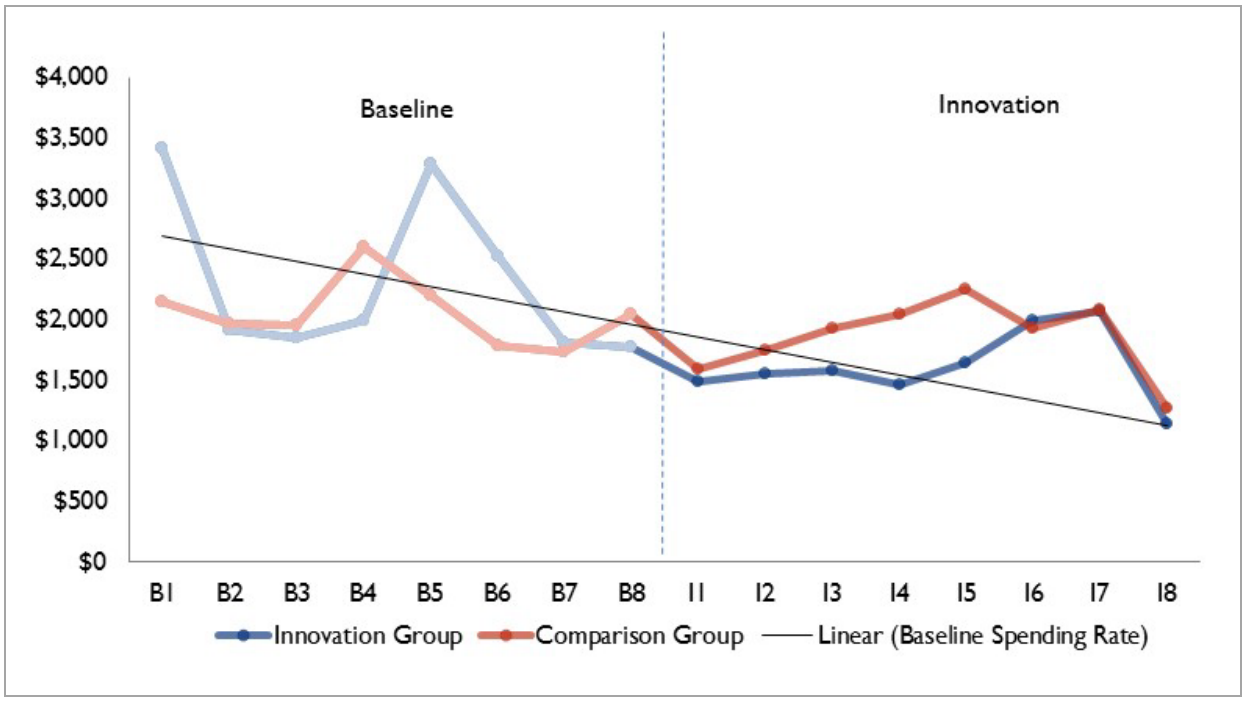
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 25. Medicaid Spending per Participant: Intermountain SSM



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.10.2 Regression Results

We present in ***Table 37*** 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 −576 (90% CI: −$1136, −$16). 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.

We also present quarterly effects derived from 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 26*** illustrates these quarterly difference-in-differences estimates.

Results show that in innovation Q1 (I1), spending among innovation group individuals is $549 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 are negative and statistically different from zero in I3 through I5.

Table 37. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Intermountain SSM

Quarter	Coefficient	Standard Error	P-Values
I1	−$549	$333	0.100
I2	−$380	$420	0.366
I3	−$745	$392	0.058
I4	−$879	$440	0.046
I5	−$872	$497	0.079
I6	−$211	$634	0.740
I7	−$341	$732	0.642
I8	−$353	$598	0.555
Overall average	−$576	$340	0.091
Overall aggregate	−$797,352	$470,649	0.091
Overall aggregate (IY1)	−$615,568	$322,118	0.056
Overall aggregate (IY2)	−$181,784	$211,121	0.389

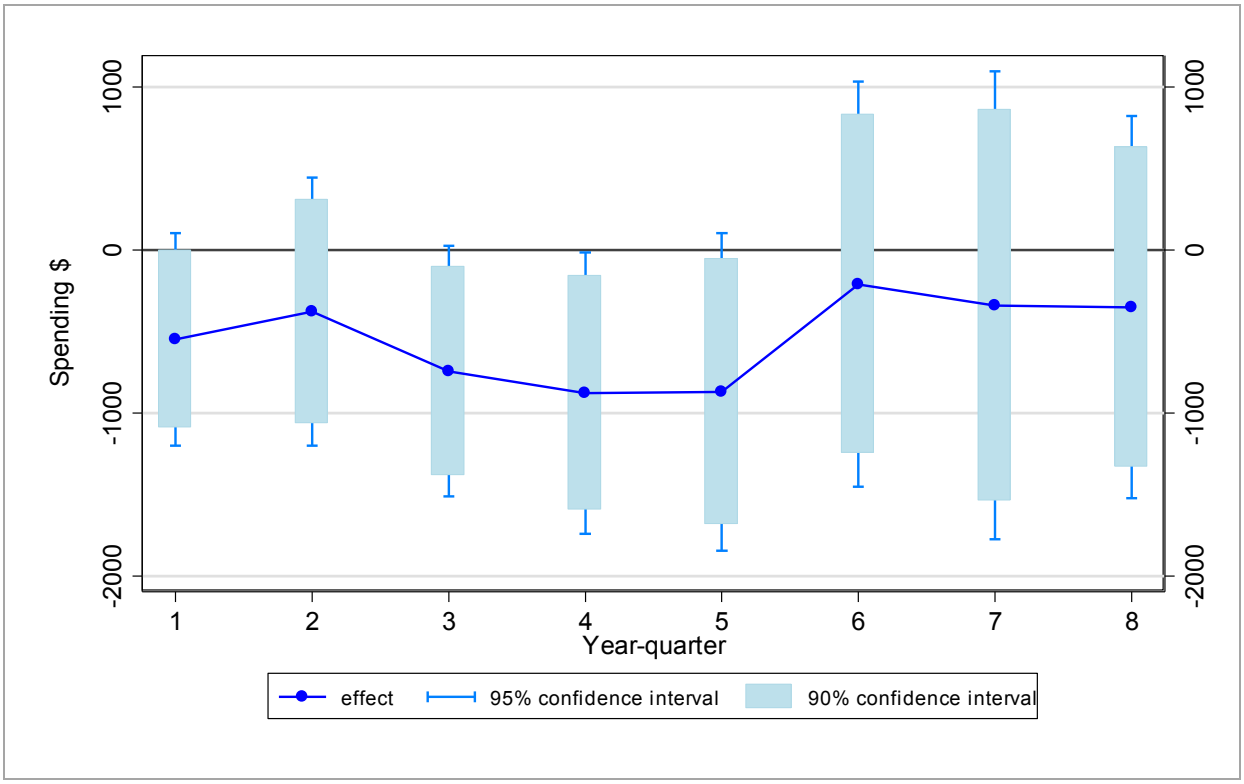
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **The regression coefficients** are 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; OLS = ordinary least squares; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 26. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: Intermountain SSM



Notes:

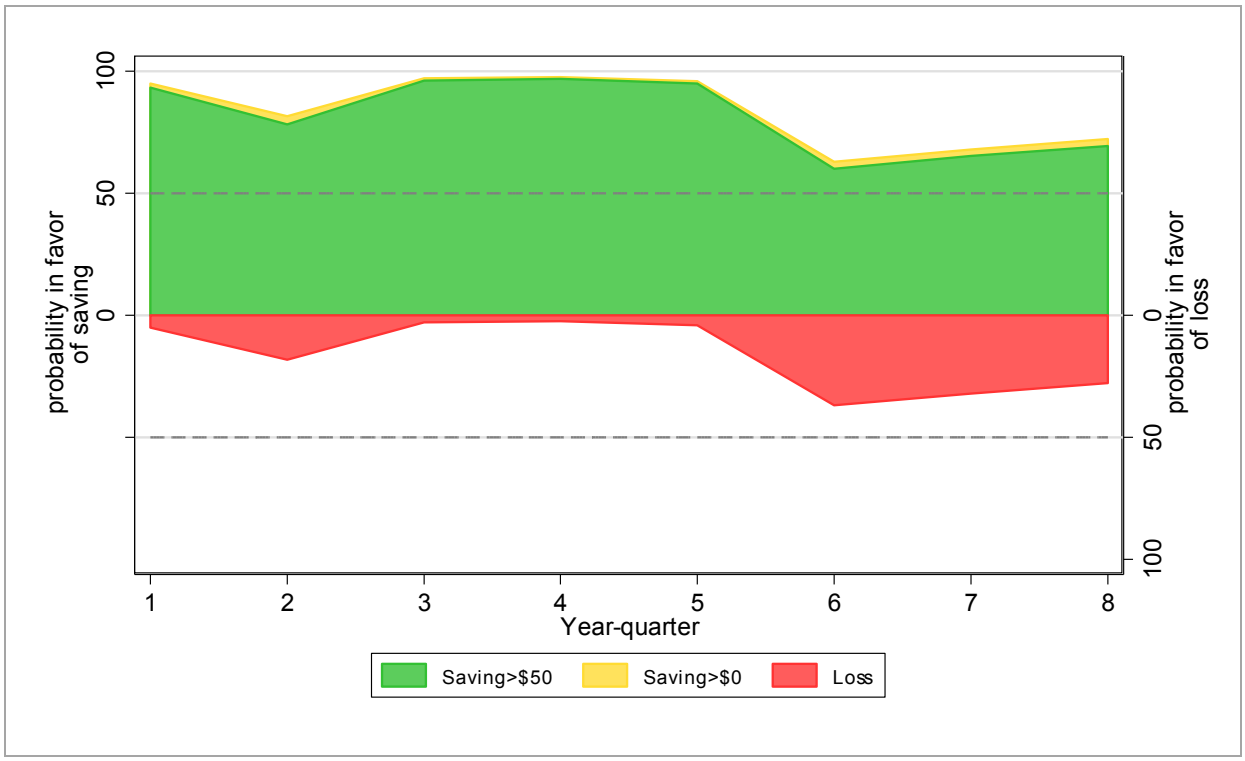
- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- OLS = ordinary least squares; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

Figure 27 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 for saving or losing money on this initiative. Figure 27 shows the probability of savings is higher in the innovation group than the comparison group in all quarters. The probability of savings for the innovation overall is 84 percent.

Figure 27. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: Intermountain SSM



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.11 Medicaid Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 38*** and ***Figure 28.*** The inpatient admissions rate follows a downward trend. The inpatient admissions rate remains below the baseline trend line in all innovation quarters. It also is higher than the comparison group in all innovation quarters except I5. A similar trend is observed for the comparison group in the innovation period.

Table 38. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Intermountain SSM

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
Admit rate	124	85	76	68	111	136	89	75	80	89	73	58	35	49	40	28	—	—	—	—
Std dev	512	317	285	272	437	496	324	291	296	390	292	291	184	216	196	165	—	—	—	—
Unique patients	145	177	185	192	198	235	257	267	299	257	232	206	115	103	101	72	—	—	—	—
Comparison Group																				
Admit rate	41	43	38	66	40	42	39	84	31	29	31	41	36	43	22	14	—	—	—	—
Std dev	120	137	132	183	139	135	128	202	112	102	121	148	127	125	86	68	—	—	—	—
Weighted patients	278	280	279	277	277	277	279	267	299	259	250	239	158	150	136	97	—	—	—	—
Innovation − Comparison Rate																				
	83	42	37	2	71	95	51	−9	49	61	43	18	−1	5	18	14	—	—	—	—

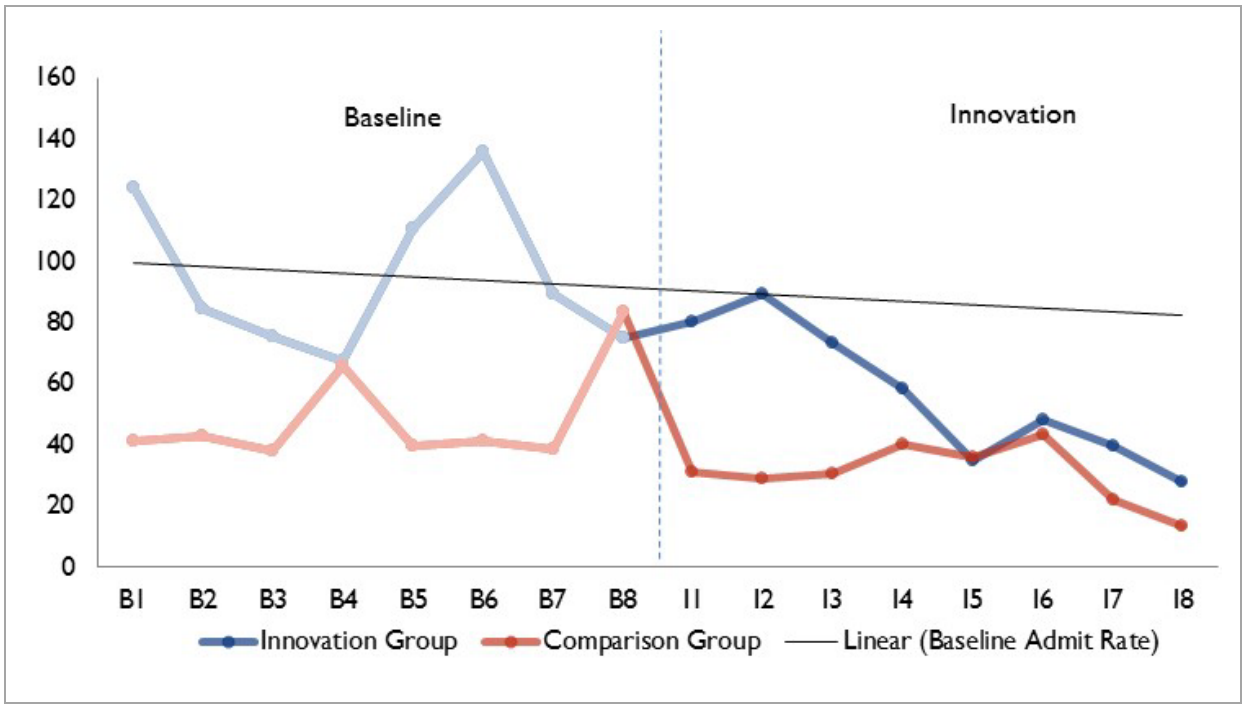
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 28. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: Intermountain SSM



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.11.2 Regression Results

As shown in ***Table 39,*** the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 3 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: −13, 19).

We also present quarterly effects 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 effects are not statistically significant in any quarter.

Table 39. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: Intermountain SSM

Quarter	Coefficient	Standard Error	P-Values
I1	10	20	0.608
I2	33	26	0.207
I3	15	23	0.507
I4	−18	27	0.517
I5	−31	26	0.243
I6	−38	33	0.248
I7	−1	24	0.951
I8	4	24	0.857
Overall average	3	9	0.754
Overall aggregate	4	13	0.754
Overall aggregate (IY1)	11	11	0.332
Overall aggregate (IY2)	−7	5	0.176

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **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.
- **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, 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.
- I = Innovation Quarter; IY = Innovation Year; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.12 Medicaid Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 40*** and ***Figure 29***. 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 40. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Intermountain SSM

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
Readmit rate	313	0	91	111	444	192	125	59	63	188	63	125	0	0	0	0	—	—	—	—
Std dev	464	0	287	314	497	394	331	235	242	390	242	331	0	0	0	0	—	—	—	—
Total admissions	16	14	11	9	18	26	16	17	16	16	16	8	3	2	4	2	—	—	—	—
Comparison Group																				
Readmit rate	36	120	74	306	77	93	57	125	0	125	59	59	167	0	0	0	—	—	—	—
Std dev	187	325	262	461	266	290	231	331	0	331	235	235	373	0	0	0	—	—	—	—
Total admissions	9	8	9	12	9	9	9	16	6	5	6	6	4	5	2	1	—	—	—	—
Innovation − Comparison Rate																				
	276	−120	17	−194	368	100	68	−66	63	63	4	66	−167	0	0	0	—	—	—	—

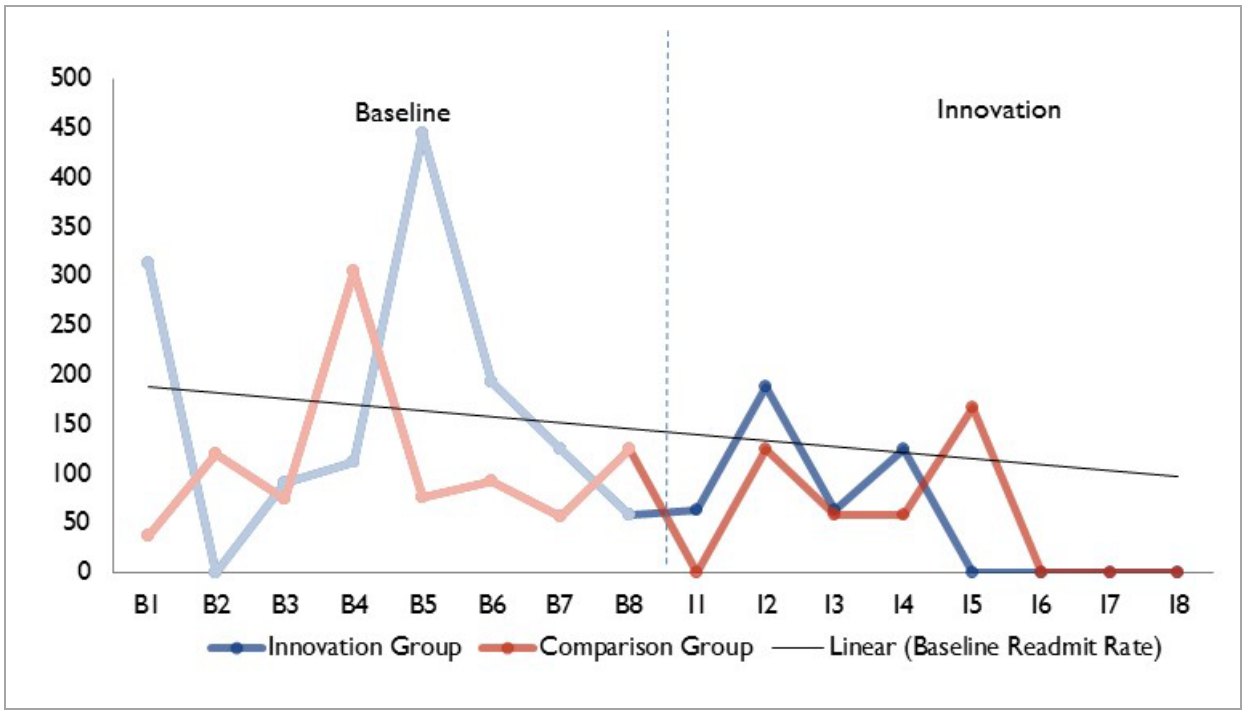
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions
- B1 = Baseline Q1; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 29. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: Intermountain SSM



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.12.2 Regression Results

Table 41 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 −38 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is lower for the innovation group 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: −183, 106).

Table 41. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: Intermountain SSM

Quarter	Coefficient	Standard Error	P-Values
Overall average	−38	88	0.663
Overall aggregate	−2	5	0.663

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **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, 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.
- SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.13 Medicaid Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 42*** and ***Figure 30.*** ED visits follow an upward baseline trend. The trend is similar between the innovation and comparison groups. The number of ED visits are higher for the innovation group than the comparison group in I1 through I4. ED visits for the innovation group are very low and similar in level to the comparison group in I5 through I8.

Table 42. ED Visits per 1,000 Medicaid Participants: Intermountain SSM

Awardee Number: 1C1CMS330978
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
ED rate	97	56	81	76	78	291	300	277	313	313	276	325	35	39	40	28	—	—	—	—
Std dev	360	276	311	291	294	895	984	1044	1079	914	854	1228	184	194	196	165	—	—	—	—
Unique patients	145	177	185	192	198	235	257	267	299	257	232	206	115	103	101	72	—	—	—	—
Comparison Group																				
ED rate	41	49	38	63	51	149	162	220	128	115	136	145	32	42	15	7	—	—	—	—
Std dev	119	141	123	183	149	421	479	565	365	313	461	424	122	130	70	48	—	—	—	—
Weighted patients	278	280	279	277	277	277	279	267	299	259	250	239	158	150	136	97	—	—	—	—
Innovation − Comparison Rate																				
	56	8	43	12	28	142	138	57	185	198	140	180	3	−3	25	21	—	—	—	—

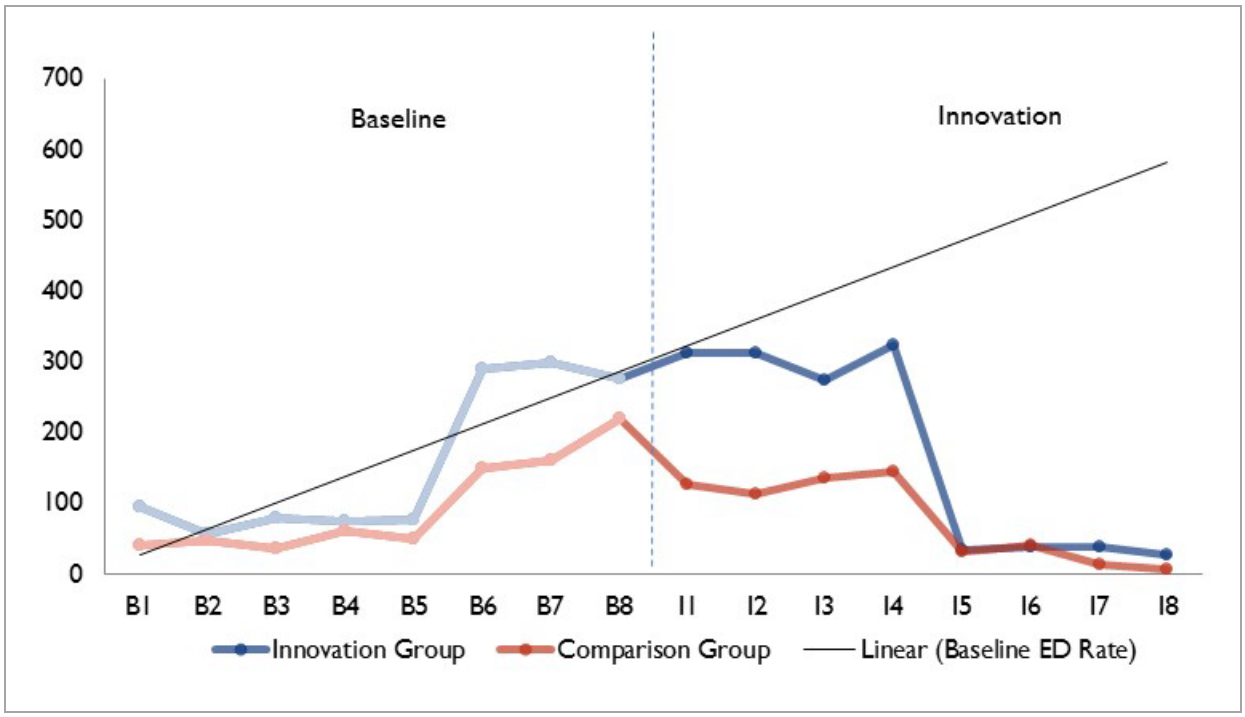
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.
- — Data not yet available.

Figure 30. ED Visits per 1,000 Medicaid Participants: Intermountain SSM



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- ED = emergency department; SSM = shared savings model; Intermountain = Intermountain Healthcare, Inc.

2.13.2 Regression Results

As shown in ***Table 43***, the average quarterly difference-in-differences estimate for ED visits is an increase of 69 ED visits per 1,000 participants relative to the comparison group. 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: 31, 107).

We also present quarterly effects 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. Quarterly effects are positive and statistically significant at the 10 percent level in I1 and I2. In addition, the effect of Year 1 is statistically significant

Table 43. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: Intermountain SSM

Quarter	Coefficient	Standard Error	P-Values
I1	111	57	0.050
I2	134	62	0.031
I3	72	65	0.269
I4	69	76	0.366
I5	−20	25	0.429
I6	−38	30	0.202
I7	18	22	0.399
I8	20	22	0.381
Overall average	69	23	0.003
Overall aggregate	92	31	0.003
Overall aggregate (IY1)	94	30	0.002
Overall aggregate (IY2)	−3	5	0.555

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** June 2011 to June 2015.

Terms and Definitions

- **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, 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; SSM = shared savings model; Intermountain = Intermountain Healthcare.

2.14 Discussion: Medicaid Results

The Medicaid results for the SSM component show decreased spending per patient for the innovation and a high probability of savings. The results show increases for inpatient stays and ED visits due to the innovation; however, the result is only significant for ED visits. There is also a nonsignificant reduction in hospital readmissions.

The Medicaid results do not entirely support the innovation's theory of change. The SSM component was designed to reduce spending by replacing traditional fee for service (FFS) with a risk-adjusted global budget that compensates care through a combination of FFS and partially performance-based methods. However, the SSM component remained in pilot testing throughout 2015 and formal implementation began in 2016 after the HCIA ended. Thus, these savings are unlikely due to the SSM component. It is possible that the SSM would have generated the large and significant savings detected here during the innovation period, had it been in place then.

The results may not fully represent the overall population that the innovation served. The results presented here are only for Medicaid beneficiaries whom we were able to match with the identifiers provided by the site.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Mary's Center

Data Source	Period Covered
Medicaid claims data	February 2013–March 2016

Terms and Definitions

- Mary's Center = Mary's Center for Maternal and Child Care.

Capital Clinical Integrated Network

2.1 Introduction

Mary's Center for Maternal and Child Care 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.**

   Goal: Reduce spending related to hospitalization, ED use, prescription drug use, primary care visits, and specialty visits by $17,712,000.

   Findings: The innovation was associated with a significant decrease in the trajectory of spending among participants. Without a comparison group, we cannot say whether the change in spending resulted from the innovation or outside factors. However, the reduction in spending is encouraging given the program's focus on care coordination for beneficiaries with chronic conditions.

2. **Better care.**

   Goal: Increase patient enrollment in primary care with timely, coordinated access to relevant health care information.

   Findings: We found statistically significant decreases in inpatient stays, readmissions, and ED visits over the innovation period. These results support the conclusion that the program changed beneficiaries' behavior and produced positive health effects. However, results should be interpreted with caution due to the lack of a comparison group.

3. **Healthier people.**

   Goal: Improve control of asthma through appropriate medication use and reduce blood pressure below 140/90 mm Hg in patients with hypertension.

   Findings: None to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicaid claims collected during the innovation period: We were unable to construct a comparison group for CCIN because the Centers for Medicare & Medicaid Services Alpha-MAX data files were not available for the period after the innovation was launched. Without a comparison group, we used a pre-post analysis, comparing the innovation period findings with what we would have expected in the innovation period absent the innovation based on the trend of baseline period data. We found significant savings, as well as decreases in utilization. Without a comparison group, we cannot rule out the influence of outside factors; therefore, we do not recommend interpreting these results as isolating the impact of the CCIN innovation.

Table 2. Summary of Medicaid Claims-Based Findings: CCIN

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$23.481	−$29.477, −$17.524	−$28.115, −$18.847	−$5.066	−$6.351, −$3.781	−$10.817	−$13.600, −$8.073	−$7.598	−$9.526, −$5.671
Acute care inpatient stays	−1,089	−1,239, −939	−1,205, −972	−237	−292, −182	−500	−611, −389	−352	−437, −267
Hospital-wide all-cause unplanned readmissions	−14	−28, −1	−25, −4	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−1,844	−2,223, −1,466	−2,139, −1,550	−412	−560, −264	−852	−1,136, −568	−580	−782, −378
Average impact per quarter									
Spending per participant	−$1,023	−$1,283, −$764	−$1,226, −$821	−$512	−$642, −$382	−$1,310	−$1,643, −$978	−$2,081	−$2,609, −$1,553
Acute care inpatient stays (per 1,000 participants)	−50	−57, −43	−44, −45	−24	−29, −18	−61	−74, −47	−96	−120, −73
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−19	−37, −1	−33, −5	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−85	−102, −67	−98, −71	−42	−57, −27	−103	−138, −69	−159	−214, −104

Notes:

- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Methodology:** Estimates are derived from a pre-/post analysis. Additional details are described in the chapter.
- **Period of activity:** January 2010 to March 2016.
- **Sample size**: 2,507, unique Medicaid fee-for-service and managed care beneficiaries included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and Definitions

- **Spending per participant** is the effect from a linear model that tests for a change in spending in the innovation period compared to a linear projection of spending from the baseline period. Estimates are derived using ordinary least squares.
- **Acute care inpatient stays (per 1,000 participants)** is the effect from a model that tests for a change in inpatient stays visits in the innovation period compared to a projection of inpatient stays from the baseline period. 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)** is the effect from a model that tests for a change in unplanned readmissions in the innovation period compared to a projection of unplanned readmissions from the baseline period. 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)** is the effect from a model that tests for a change in ED visits in the innovation period compared to a projection of ED visits from the baseline period. 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; CCIN = Capital Clinical Integrated Network.

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 3 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 3. Claims-Based Outcome Measures: CCIN

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

Terms and Definitions

- ED = emergency department; CCIN = Capital Clinical Integrated Network.

2.3 Medicaid Awardee Data

We include patients who were enrolled as early as January 1, 2010 and we present Medicaid claims data through March 31, 2016. The Medicaid claims analysis focuses on 2,507 Medicaid beneficiaries enrolled in fee-for-service and managed care Medicaid during the innovation period.

The Centers for Medicare & Medicaid Services Alpha-MAX data files are not available for the period after the innovation was launched. We analyzed data on patients enrolled in the innovation through Medicaid fee-for-service claims and managed care encounters from a CCIN file obtained in June 2016. However, because we did not have Medicaid claims data, we could not create a comparison group to control for changes that may have occurred in spending and utilization during the innovation period but were not attributable to the innovation. CCIN did not provide data on Medicaid enrollment dates 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 the first positive expenditure claim for that individual (Medicaid fee-for-service or managed care) as the Medicaid start enrollment date and the last positive expenditure claim as the enrollment end date.

Medicaid beneficiary enrollment can be variable, with individuals enrolling and disenrolling 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; thus, trends over time should not be greatly affected by our imputation of Medicaid enrollment periods.

Table 4 provides the demographic characteristics of participants included in the CCIN program. Nearly two-thirds of participants (68.8%) were between 25 and 64 years old. Over half the sample was female (61.8%) and African American (77.1%).

Table 4. Characteristics of All Participants Ever Enrolled in the CCIN Innovation through March 2016: CCIN (Medicaid)

Characteristic	Number of Participants	Percentage of Participants
Total	2,507	100.0
Age		
< 18	557	22%
18–24	174	7%
25–44	680	27%
45–64	1,028	41%
65–74	50	2%
75–84	10	0%
85+	3	0%
Missing	5	0%
Sex		
Female	1,531	61%
Male	971	39%
Missing	5	0%
Race/ethnicity		
White	15	1%
Black	1,906	77%
Hispanic	436	18%
Asian	13	1%
American Indian or Alaska Native	2	0%
Native Hawaiian or other Pacific Islander	—	0%
Other	98	4%
Missing/refused	37	1%

Notes:

- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.

Terms and Definitions

- CCIN = Capital Clinical Integrated Network.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 5 reports Medicaid spending per patient in the 8 quarters before and the 12 quarters after enrolling in the innovation. ***Figure 1*** illustrates the Medicaid spending per beneficiary in Table 5 for innovation group beneficiaries. 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.

Spending in the baseline period increases steadily but flattens out after the innovation. Even though spending stops increasing after the start of the innovation, costs remain higher than early baseline quarters. These trends are similar to the third annual report. Spending included fee-for-service Medicaid payments as well as fee-for-service Medicaid equivalents imputed for managed care claims.

Table 5. Medicaid Spending per Participant: CCIN

Awardee Number: 1C1CMS331074
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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	$2,515	$2,379	$2,469	$2,637	$2,861	$3,227	$3,228	$3,390	$3,452	$3,599	$3,549	$3,377	$3,568	$3,454	$3,103	$3,283	$3,051	$3,436	$3,312	$3,311
Std dev	$5,136	$3,879	$3,693	$5,582	$5,562	$7,520	$7,218	$6,969	$7,035	$10,043	$8,039	$6,412	$7,156	$7,926	$5,530	$7,386	$5,612	$7,553	$6,317	$4,695
Unique patients	2,318	2,360	2,404	2,438	2,462	2,485	2,501	2,504	2,507	2,479	2,467	2,444	2,346	2,191	2,011	1,708	1,332	1,042	772	505
Comparison Group																				
Spending rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Savings per Patient																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

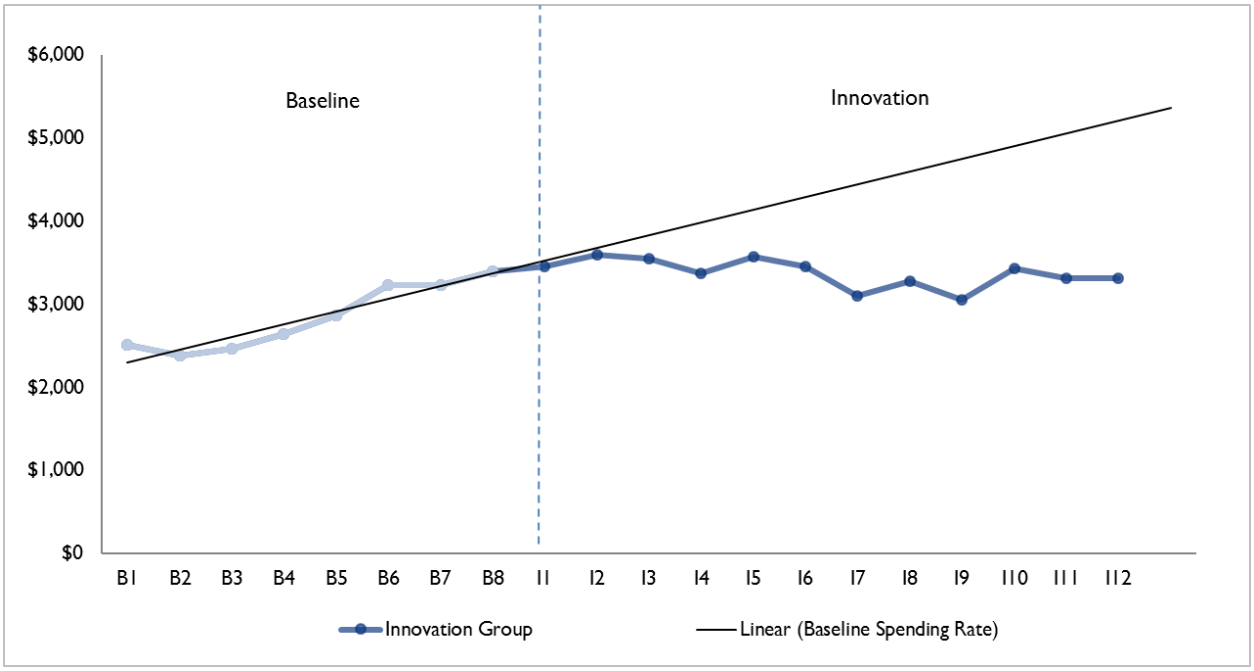
Notes:

- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **Spending rate**: Total quarterly payments/number of unique or weighted patients.
- **Savings per patient:** Positive values indicate savings.
- B1 = Baseline Q1; I1 = Innovation Q1; CCIN = Capital Clinical Integrated Network.
- — Data not yet available.

Figure 1. Medicaid Spending per Participant: CCIN



Notes:

- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- CCIN = Capital Clinical Integrated Network.

2.4.2 Regression Results

We present the average treatment effect per quarter for beneficiaries enrolled in the innovation, comparing their spending during the innovation period to the expected spending rate for the innovation period absent the innovation. Because we were unable to construct a comparison group, we create a counterfactual for this sample using the observed baseline data. The counterfactual is a linear projection of the baseline period trend, and we calculate deviations from that trend to obtain our innovation effects. However, the observed downturn in spending could be due to external factors such as Affordable Care Act initiatives, other policy changes in the Washington, DC Medicaid system, seasonality, or other external sources of a slowdown in spending growth. Without a comparison group, regression estimates cannot control for these external factors and the estimates incorporate the impact of the innovation plus outside factors. Therefore, results should be interpreted with strong caution.

As shown in ***Table 6,*** the average quarterly spending differential in the innovation period, indicating savings, is $1,023 (90% CI: −$1,283, −$764). This effect is statistically significant. This estimate represents the average differential spending per quarter for beneficiaries enrolled in the innovation during the innovation period compared to the baseline counterfactual, 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 quarterly effects derived from an ordinary least squares (OLS) regression with quarterly spending as the dependent variable. We found statistically significant decreases in spending during innovation period. However, because we were unable to construct a comparison group for CCIN, we cannot say for certain that changes in cost or utilization are caused by the innovation.

Table 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant

Quarter	Coefficient	Standard Error	P-Values
I1	−$206	$32	0.000
I2	−$411	$63	0.000
I3	−$617	$95	0.000
I4	−$822	$127	0.000
I5	−$1,028	$158	0.000
I6	−$1,233	$190	0.000
I7	−$1,439	$222	0.000
I8	−$1,645	$254	0.000
I9	−$1,850	$285	0.000
I10	−$2,056	$317	0.000
I11	−$2,261	$349	0.000
I12	−$2,467	$380	0.000
Overall average	−$1,023	$158	0.000
Overall aggregate	−$23,481,265	$3,620,447	0.000
Overall aggregate (IY1)	−$5,065,929	$781,088	0.000
Overall aggregate (IY2)	−$10,817,059	$1,667,823	0.000
Overall aggregate (IY3)	−$7,598,277	$1,171,536	0.000

Notes:

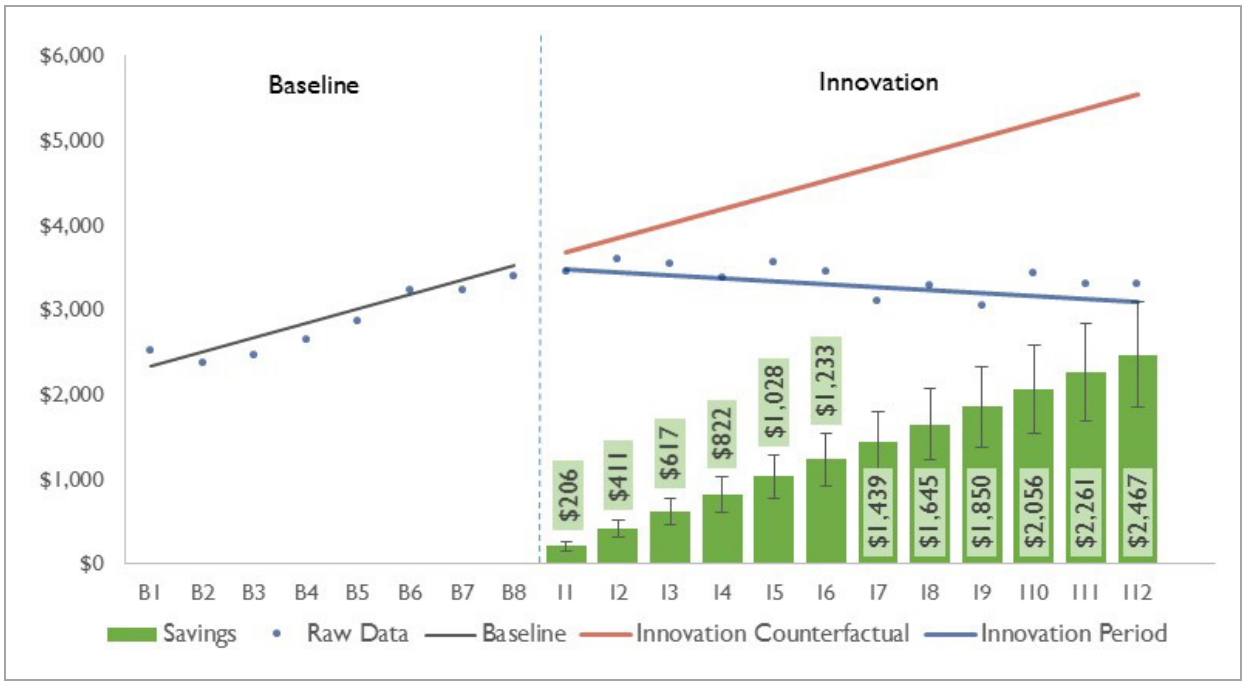
- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **The regression coefficients** are quarterly pre/post estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, race.
- **The overall average** is the weighted average treatment effect per quarter for beneficiaries enrolled in the innovation in the innovation period compared to the expected counterfactual based on the baseline period.
- I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; CCIN = Capital Clinical Integrated Network.

Figure 2 illustrates these quarterly pre/post estimates. The dots represent the observed data from the 8 baseline quarters and 12 innovation quarters. The baseline period line is the fitted regression line including controls for age, race, and sex during the baseline. The red line represents the counterfactual: spending is expected to continue in the innovation in the same way, assuming it maintained the same trajectory as the baseline period. The blue line is the fitted regression line based on observed spending during the innovation period. The difference between the observed data and the expected counterfactual is the estimated amount of savings in the quarter, shown by the vertical bars.

Figure 2. Observed Data and Predicted Results, Medicaid Spending Per Participant: CCIN



Notes:

- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- CCIN = Capital Clinical Integrated Network.

2.5 Medicaid Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rate per 1,000 participants are shown in ***Table 7*** and ***Figure 3***. On average, the inpatient admissions rate increase in the baseline and decrease during the innovation period. The inpatient admission rate is highest in the first quarter of the innovation period and then decreases in each subsequent quarter. In the second year of the innovation period, the inpatient admissions rate is lower than at any point in the baseline period and remains lower for the rest of the innovation period.

Table 7. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: CCIN

Awardee Number: 1C1CMS331074
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
Admit rate	63	46	66	66	71	70	84	80	87	78	73	59	59	51	49	52	45	52	49	50
Std dev	364	242	331	337	310	314	366	372	394	408	429	352	332	264	309	300	276	286	222	308
Unique patients	2,318	2,360	2,404	2,438	2,462	2,485	2,501	2,504	2,507	2,479	2,467	2,444	2,346	2,191	2,011	1,708	1,332	1,042	772	505
Comparison Group																				
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

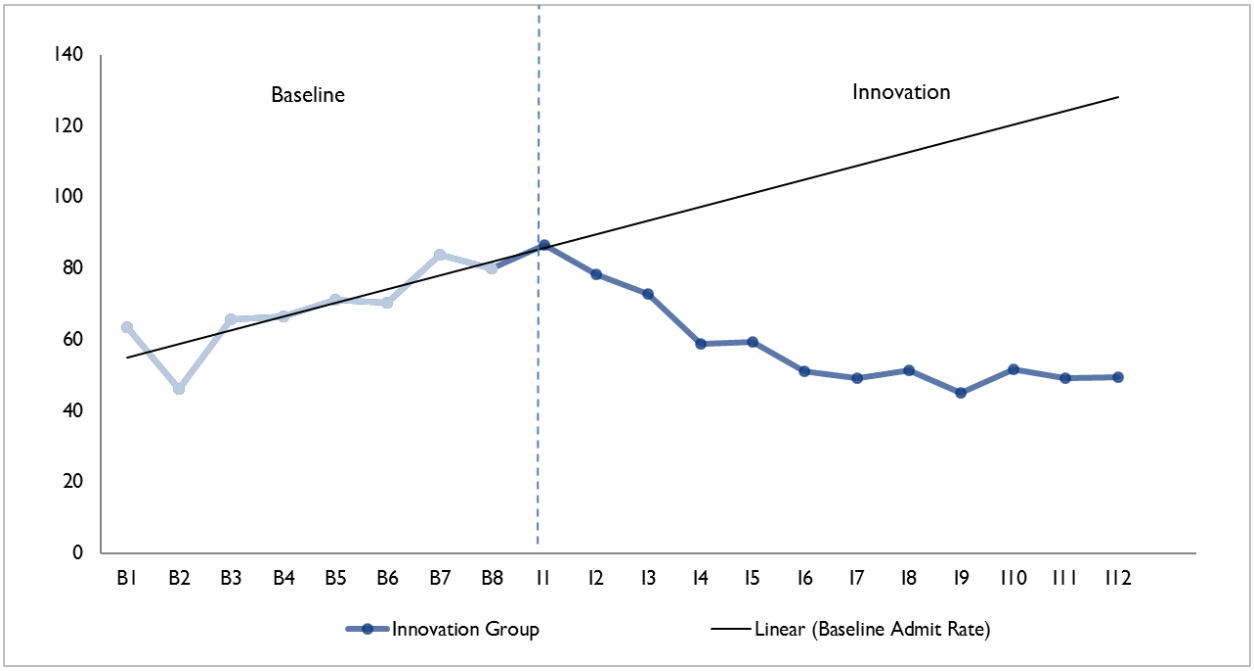
Notes:

- **Source**: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **Admit rate: (**Total quarterly admissions /number of unique or weighted patients)*1,000. Positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; CCIN = Capital Clinical Integrated Network.
- — Data not yet available.

Figure 3. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: CCIN



Notes:

- **Source**: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- CCIN = Capital Clinical Integrated Network

2.5.2 Regression Results

We present the average treatment effect per quarter for beneficiaries enrolled in the innovation, comparing their inpatient visits during the innovation period to the counterfactual, calculated as the expected inpatient visits for the innovation period absent the innovation. See the regression results section under Medicaid spending for more details.

As shown in ***Table 8***, the average quarterly pre/post estimate for inpatient admissions is a decrease of 50 inpatient admissions per 1,000 participants. This is the average treatment effect per quarter for beneficiaries enrolled in the innovation, comparing their inpatient rate during the innovation period to the counterfactual. The effect is statistically significant (90% CI: −57, −43).

We also present quarterly effects with the dependent variable set to the number of hospital 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 inpatient admissions per 1,000 participants. We see statistically significant decreases in inpatient visits (P<=0.001). The observed data in the baseline suggests that inpatient visits increase, and we assume that absent the innovation, the trend would have continued in the innovation period. In the innovation period we see a decrease in the trend in inpatient visits, suggesting that the program was successful in coordinating care and reducing

unplanned inpatient visits for high-use beneficiaries. This trend would be consistent with the program's goals to enroll participants who were high (frequent) users and use care coordination to help beneficiaries gain and maintain control over chronic conditions and change their utilization habits. However, we cannot say for certain that changes in cost or utilization are caused by the innovation because we were unable to construct a comparison group to control for factors external to the innovation.

Table 8. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: CCIN

Quarter	Coefficient	Standard Error	P-Values
I1	−10	2	0.000
I2	−19	5	0.000
I3	−29	7	0.000
I4	−38	10	0.000
I5	−48	12	0.000
I6	−57	15	0.000
I7	−66	18	0.000
I8	−76	21	0.000
I9	−85	24	0.000
I10	−95	27	0.001
I11	−105	31	0.001
I12	−115	34	0.001
Overall average	−50	4	0.000
Overall aggregate	−1089	91	0.000
Overall aggregate (IY1)	−237	33	0.000
Overall aggregate (IY2)	−500	67	0.000
Overall aggregate (IY3)	−352	52	0.000

Notes:

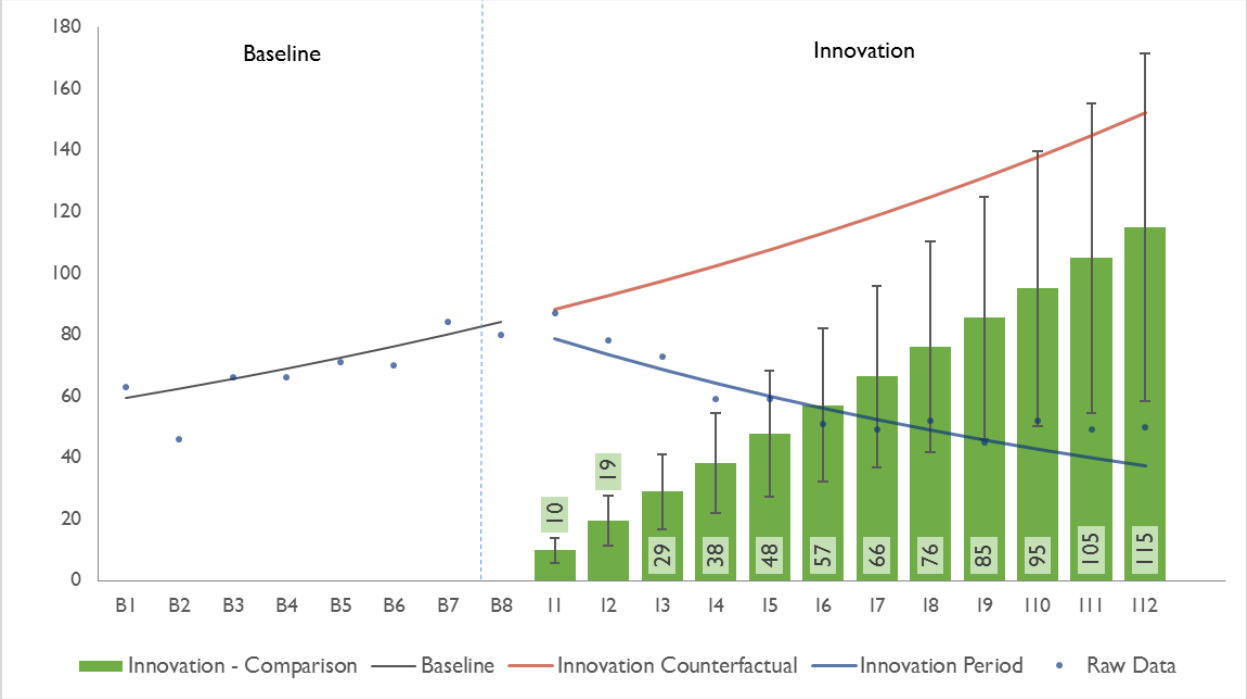
- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **The overall average** is the weighted average treatment effect per quarter for beneficiaries during the innovation period compared to the counterfactual created using the baseline period trend.
- **The negative binomial count model regression coefficients** are the quarterly pre/post estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, and race.
- I = Innovation Quarter; IY = Innovation Year; CCIN = Capital Clinical Integrated Network.

Figure 4 presents a graphical depiction of the observed data and predicted effects for CCIN. The dots represent the observed data from the 8 baseline quarters and 12 innovation quarters. The baseline period line is the fitted regression line including controls for age, race, and sex. The red line represents the counterfactual: the trend in inpatient visits is expected to continue in the innovation period absent the innovation. The blue line is the fitted regression line based on observed inpatient visits during the innovation period. The difference between the observed data and the expected counterfactual is the estimated impact of the innovation on inpatient visits in the quarter, shown by the vertical green bars.

Figure 4. Observed Data and Predicted Results, Inpatient Visits per 1,000 Beneficiaries: CCIN



Notes:

- **Source**: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- CCIN = Capital Clinical Integrated Network

2.6 Medicaid Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 9*** and ***Figure 5***. The readmissions rate is highly variable because such events are rare. Readmissions can only occur after an indexed admission, a rare event.

Table 9. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: CCIN

Awardee Number: 1C1CMS331074
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
Readmit rate	158	278	305	205	174	206	236	285	262	278	270	352	268	146	455	361	536	500	0	333
Std dev	291	391	403	398	323	353	361	388	329	407	392	434	359	291	462	427	509	0	0	577
Total admissions	72	53	80	78	87	87	100	88	89	78	68	55	50	43	33	23	23	13	9	5
Comparison Group																				
Readmit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	——	—	—	—	—	—	—	—	—	—	—	—	—
Total admissions	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

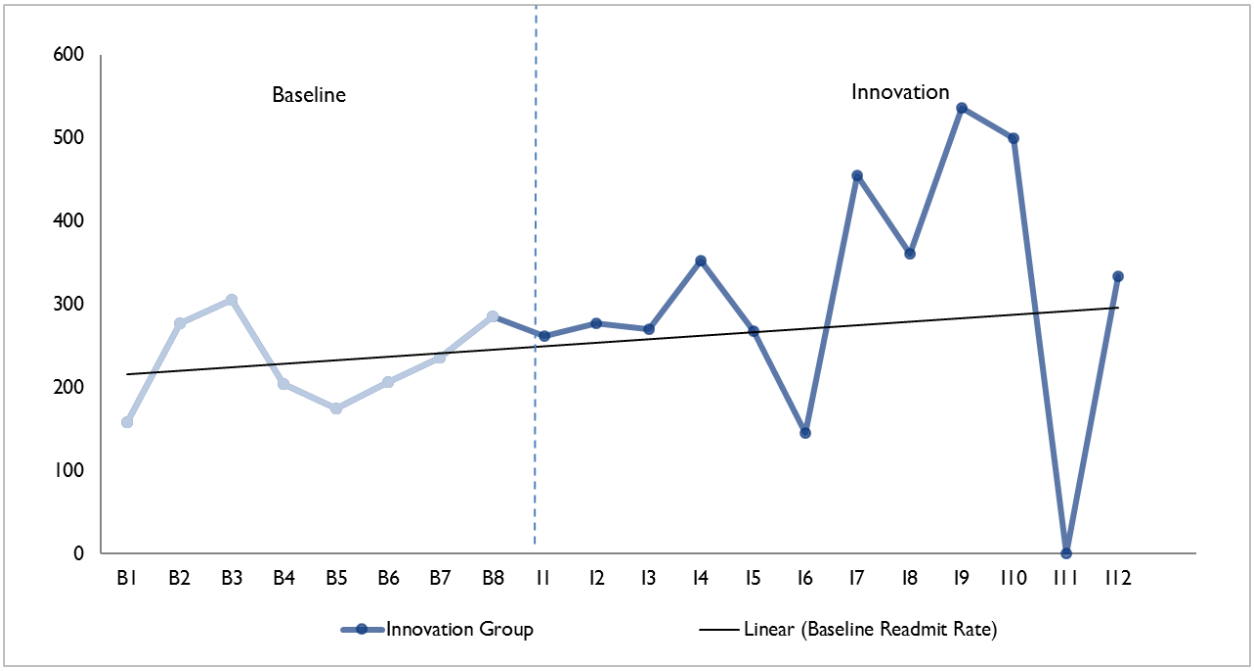
Notes:

- **Source**: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **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. A positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; CCIN = Capital Clinical Integrated Network.
- — Data not yet available.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: CCIN



Notes:

- **Source**: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- CCIN = Capital Clinical Integrated Network.

2.6.2 Regression Results

Table 10 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 pre/post estimate for unplanned readmissions is −19 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is lower in the innovation group during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −37, −1).

Table 10. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: CCIN

Quarter	Coefficient	Standard Error	P-Values
Overall average	−19	11	0.080
Overall aggregate	−14	8	0.080

Notes:
- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions
- **The logistic regression model regression coefficient** is the simple pre/post estimate. Besides the innovation indicator, the regression controls for the following variables: age, gender, and race.
- CCIN = Capital Clinical Integrated Network.

2.7 Medicaid Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 11*** and ***Figure 6.*** On average, the rate of ED visits increase slightly during the baseline period and then decrease in the innovation period, though with a bit of variability. The ED rate is highest in the final two quarters of the baseline period, consistent with the program's goal of enrolling high ED users. The rate falls in the first quarter of the innovation and continues decreasing throughout the first year of the innovation. In general, the ED rate remains low for the rest of innovation period, although with a few jumps to rates similar to the baseline period. These trends are consistent with the finding in the third annual report.

Table 11. ED Visits per 1,000 Medicaid Participants: CCIN

Awardee Number: 1C1CMS331074
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
ED rate	374	392	425	434	435	482	479	464	409	352	336	363	419	390	428	358	285	334	326	428
Std dev	923	1,288	1,152	1,072	1,091	1,271	1,599	1,527	1,529	1,679	1,320	1,267	1,281	1,319	1,257	896	717	794	694	934
Unique patients	2,318	2,360	2,404	2,438	2,462	2,485	2,501	2,504	2,507	2,479	2,467	2,444	2,346	2,191	2,011	1,708	1,332	1,042	772	505
Comparison Group																				
ED rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation − Comparison Rate																				
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

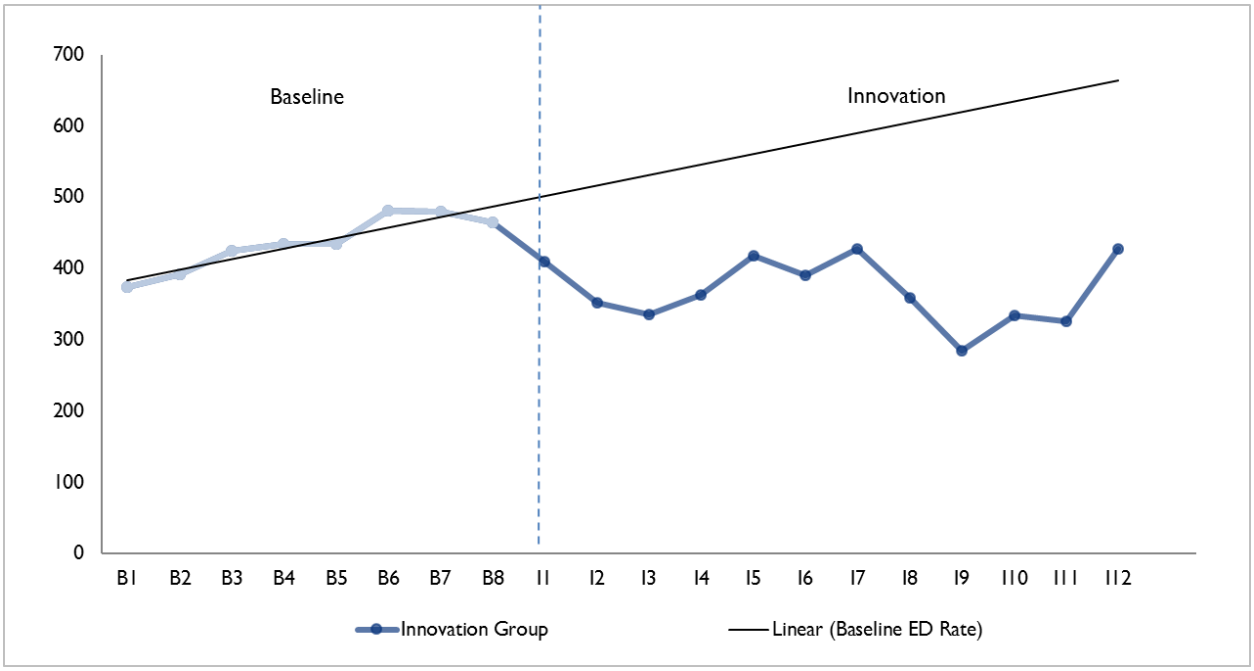
Notes:

- **Source**: RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **ED rate**: (Total quarterly ED visits and observation stays /number of unique or weighted patients)*1,000. A positive value indicates more ER visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; CCIN = Capital Clinical Integrated Network.
- — Data not yet available.

Figure 6. ED Visits per 1,000 Medicaid Participants: CCIN



Notes:

- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- ED = emergency department; CCIN = Capital Clinical Integrated Network.

2.7.2 Regression Results

We present the average treatment effect per quarter for beneficiaries enrolled in the innovation, comparing their ED visits during the innovation period to the counterfactual, calculated as the expected ED visit rate for the innovation period absent the innovation. See the regression results section under Medicaid spending for more details.

As shown in ***Table 12***, the average quarterly pre/post estimate for ED visits is −85 per 1,000 participants, indicating that the innovation-comparison difference is lower in the innovation group during the innovation period. The effect is statistically significant (90% CI: −102, −67).

We also present quarterly effects 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. We found statistically significant decreases in ED visits. The observed data in the baseline suggest that ED visits increase, and we assume that absent the innovation, the trend would have continued in the innovation period. Instead, we see a decrease in the trend in ED visits, suggesting that the program was successful in coordinating care and reducing inappropriate ED visits for high-use

beneficiaries. However, we cannot say for certain that the innovation caused changes in cost or utilization because we were unable to construct a comparison group to control for factors external to the innovation.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: CCIN

Quarter	Coefficient	Standard Error	P-Values
I1	−17	7	0.012
I2	−34	13	0.012
I3	−50	20	0.012
I4	−66	27	0.013
I5	−82	33	0.013
I6	−98	39	0.013
I7	−113	46	0.014
I8	−128	52	0.014
I9	−143	58	0.014
I10	−157	65	0.015
I11	−172	71	0.015
I12	−186	77	0.016
Overall average	−85	11	0.000
Overall aggregate	−1,844	230	0.000
Overall aggregate (IY1)	−412	90	0.000
Overall aggregate (IY2)	−852	173	0.000
Overall aggregate (IY3)	−580	123	0.000

Notes:

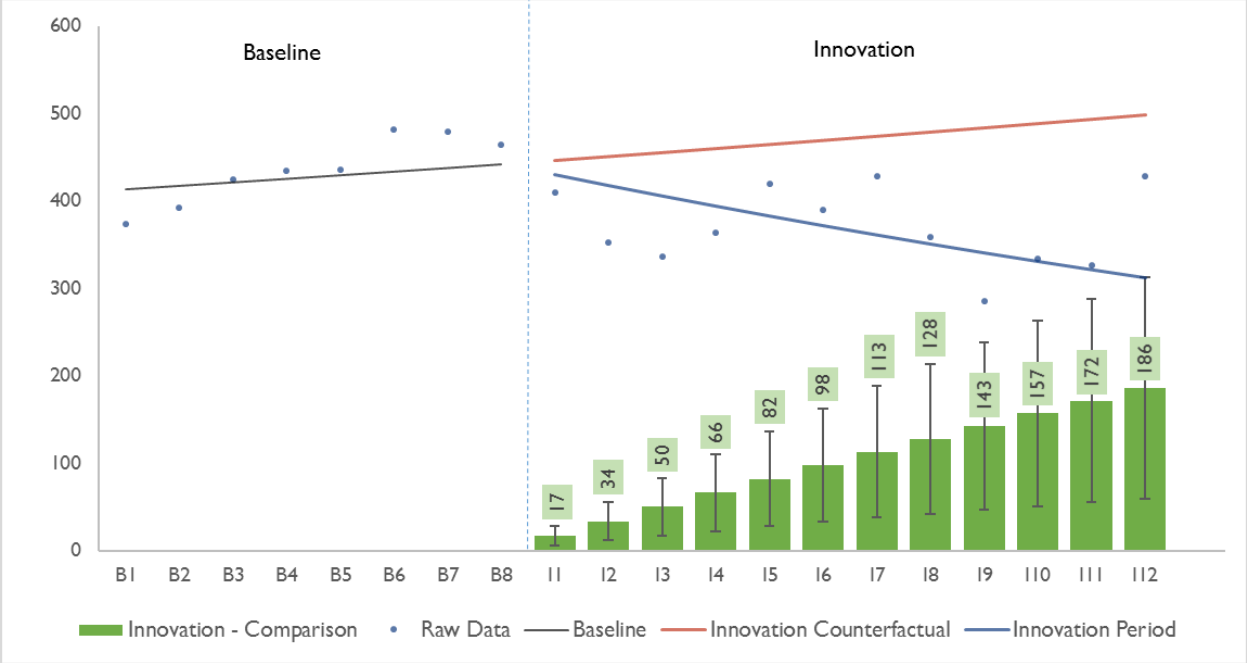
- **Source:** RTI analysis of Medicaid fee-for-service and managed care claims provided by CCIN.
- **Period of activity:** January 2010 to March 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are the quarterly pre/post estimates. Besides the innovation quarters, the regression controls for the following variables: age, gender, and race.
- **The overall average** is the weighted average treatment effect per quarter for beneficiaries during the innovation period compared to the counterfactual created using the baseline period trend.
- I = Innovation Quarter; IY = Innovation Year; CCIN = Capital Clinical Integrated Network.

Figure 7 depicts the observed data and predicted effects for CCIN. The dots represent the observed data from the 8 baseline quarters and 12 innovation quarters. The baseline period line is the fitted regression line including controls for age, race, and sex during the baseline. The red line represents the counterfactual, which is how the trend in ED visits is expected to continue in the innovation period assuming it maintained the same trajectory as the baseline period. The blue line is the fitted regression line based on observed ED visits during the innovation period. The difference between the observed data and the expected counterfactual is the estimated amount of ED visits in the quarter, shown by the vertical bars.

Figure 7. Observed Data and Predicted Results, ED Visits per 1,000 Beneficiaries



2.8 Discussion: Medicaid Results

We found significant decreases in spending, inpatient admissions, and ED visits in the innovation period compared to projections of the baseline period trends. Despite these supportive findings for the program, we are unable to rule out the influence of outside factors because we did not have a control group. We cannot say for certain that changes in cost or utilization are caused by the innovation and results should not be interpreted as the causal impact of the CCIN innovation.

The Medicaid results, although based only on a trend analysis, are consistent with the innovation's theory of change: CCIN enrolled participants who were high ED users with chronic conditions and used care coordination to help beneficiaries change their utilization habits and to control chronic conditions. These findings suggest that the innovation may have helped participants change their health care utilization. In the third annual report, we found an increase in the number of home visits and improved control over chronic conditions, which would support our findings of decreases in spending, inpatient admissions, and ED visits.[1] Nonetheless, it is impossible to isolate the effects of the innovation without a control group.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 interviews through the 15th or 16th and final 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. RTI has 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 Addendum: MPHI

Data Source	Period Covered
Awardee Narrative Progress Report	January 2013–Q16 (June 2016)
Quarterly Awardee Performance Report	January 2013–Q16 (June 2016)
Medicare	January 2013–June 2016
Medicaid	January 2013–June 2016
Awardee-specific data	January 2013–June 2016

Terms and Definitions
- MPHI = Michigan Public Health Institute.

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. Below we present the goals, as well as the findings, for the innovation.

1. **Smarter spending.**

   Goal: Decrease spending by 2 percent over 1 year ($17,498,641 over 3 years) by reducing unnecessary ED visits and hospitalizations.

   Findings: The pathways innovation led to increased spending among Medicare participants enrolled in the innovation, perhaps because high-needs patients were appropriately connected to more pathways by community health workers (CHWs). The increase in spending was concentrated in the subgroup of individuals who utilized six or more pathways which indicates the innovation was reaching a high-need population.

   The innovation had no statistically significant effects on Medicaid spending; however, the Medicaid results are from a small subset of the overall population served by the innovation.

   On average, there was only a 0.3 percent chance of overall Medicare savings greater than 0 and a 56 percent chance of overall Medicaid savings greater than 0.

2. **Better care.**

   Goal: 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.

   Findings: The innovation had no effect on inpatient admissions for Medicare beneficiaries enrolled in the MPHI program. However, primary care (PC) visits had a significant increase, as expected based on the theory of change. PC visits were higher in Year 1 and lower in Year 3 but had no statistically significant effect overall. Individuals who accessed one to five pathways had higher PC visits overall while PC visits fluctuated for individuals who access six or more pathways.

   Overall, the innovation had no effect on ED visits for Medicare beneficiaries but ED visits had a statistically significant increase in Year 1 and a significant decrease in Year 2. Individuals who were not active in the program (accessed no pathways) had higher ED visits in the innovation

[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.

period, and individuals who accessed six or more pathways also had higher ED visits, but the effect was only significant in Year 1.

For Medicaid beneficiaries, the innovation increased inpatient stays in Year 2 and ED visits in Year 3. We found no statistically significant effects for inpatient stays, readmissions, or ED visits for the entire innovation period overall.

Overall reach increased from 76.3 percent in Q14 to 78.3 percent in Q16 for those enrolled, and 68.9 percent in Q14 to 70.6 percent in Q16 for those considered active. In addition, participants completed an average of approximately three pathways. The most common pathways were medical referrals, completed by over half of participants (63.8%) an average of 5.7 times, and social service referrals, completed by 77.7 percent of participants an average of 4.7 times.

3. **Healthier people.**

   Goal: Improve chronic disease-related health outcomes by 5 percent over 1 year.

   Findings: Overall, the data suggest that the innovation did not affect measured health outcomes during the innovation period, as the rates have fluctuated over time for all participants and those participants with specific conditions.

Overall, MPHI successfully implemented 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 and the hubs had strong leadership and overcame challenges relating to organizational capacity.

MPHI and the hubs have tried to sustain the pathways program after HCIA funding. MPHI and its partners are working to sustain the program through Medicaid Managed Care Payers and the Michigan Association of Health Plans, as well as through private foundations and grants. The innovation will be partially sustained, each site finding different avenues of funding.

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, rather than 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.

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)15–16 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through June 30, 2016.

Table 2. Summary of Updates as of Quarter 16, June 30, 2016: MPHI

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2016)
Innovation Components	No changes occurred in MPHI's innovation components: community-hubs, CHWs, and a transitional payment model.
Program Participant Characteristics	Majority of participants (72.3%) were from 25 to 64 years of age, and more than one half (60.8%) were female. Over 45% were covered by Medicaid; 17.5% were covered by Medicare, including Medicare Advantage, and 21.6% were covered by both Medicare and Medicaid.
Workforce Development	
Hiring and retention	During Q16, the innovation was staffed with 11 management or administrative personnel. Between Q15 (January 2016) and Q16 (June 2016) no separations occurred.
Skills, knowledge, and training	MPHI provided 243 individual trainings totalling 852 hours of training in Q15 and no training in Q16.
Context	
Award execution	MPHI spent 98% of its Year 3 budget, which is on target with projections.
Leadership	Leadership at MPHI and partnering hubs remained constant, engaged, and committed to successful implementation during the reporting period.
Organizational capacity	MPHI's structure and available resources facilitated implementation of the Pathways innovation and creation of the MiPathways database.
	Although organizations affiliated with the Ingham hub were siloed, the three hubs generally overcame organizational issues and challenges unique to each location.
Innovation adoption and workflow integration	MPHI successfully adapted and implemented Pathways at all three sites.
Implementation Effectiveness	
Innovation reach	MPHI enrolled an additional 511 participants in the innovation and an additional 497 participants were considered active since the 2016 annual report. Overall reach increased from 76.3% to 78.3% for those enrolled and from 68.9% to 70.6% for those considered active.
Innovation dose	The most common Pathways were medical referrals, completed by over half of participants (63.2%) an average of 5.7 times, and social service referrals, completed by 77.7% of participants an average of 4.7 times.
Sustainability	Pathways innovation will be partially sustained at each of the three sites. Each site and MPHI continue to seek additional funding to ensure sustainability. MPHI worked with each of the sites during Q15 and Q16 to secure funding to sustain the innovation.

Notes:

- **Sources***: Q15–Q16 Narrative Progress Report; Q15–Q16 Quarterly Awardee Performance Report*.
- Patient-level data: Provided to RTI.
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions

- FTE = full-time equivalent; CHW = community health worker; MPHI = Michigan Public Health Institute.

Table 3 summarizes findings based on Medicare claims collected 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 and ED visits was insignificant overall;

however, the innovation had statistically significant effects on ED visits in Year 1 (increase) and Year 2 (decrease). A significant increase in readmissions occurred but these events are rare and wide variability can be expected. Increased spending among Medicare beneficiaries is plausible because MPHI targeted patients who were high spenders and worked to connect them to care, which may increase spending in the short term. Greater use of primary care among Medicare beneficiaries suggests that the innovation may have increased spending by changing participants' utilization of appropriate care.

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

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$7.702	$3.161, $12.243	$4.164, $11.240	$4.156	$1.435, $6.877	$2.902	$0.672, $5.131	$0.658	−$0.599, $1.914
Acute care inpatient stays	−35	−189, 119	−155, 85	8	−107, 123	−6	−95, 83	−35	−87, 16
Hospital-wide all-cause unplanned readmissions	50	10, 91	19, 82	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	65	−264, 394	−192, 321	376	140, 612	−202	−397, −6	−96	−216, 23
Average impact per quarter									
Spending per participant	$502	$206, $798	$272, $733	$483	$167, $799	$571	$132, $1,010	$408	−$371, $1,187
Acute care inpatient stays (per 1,000 participants)	−2	−12, 8	−10, 6	1	−12, 14	−1	−19, 16	−22	−54, 10
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	39	8, 70	14, 63	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	4	−17, 26	−12, 21	44	16, 71	−40	−78, −1	−60	−134, 14

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2011 to June 2016.
- **Sample size:** 2,416 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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.
- **PC visits (per 1,000 participants)** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of PC utilization in the innovation group against the comparison group. The PC visits variable is the product of PC 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; PC = primary care; N/A = not applicable due to small sample size; MPHI = Michigan Public Health Institute.

Table 4 summarizes findings based on Medicaid claims collected during the innovation period. Although we found increases in inpatient stays in Year 2 and ED visits in Year 3, the innovation did not have a significant impact on any outcome overall, including spending. The goal of the innovation was to reduce spending and utilization among all beneficiaries in the long term; therefore, we would have expected to see some significant findings.

Table 4. Summary of Medicaid Claims-Based Findings: MPHI

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$0.07	−$0.90, $0.75	−$0.72, $0.57	−$0.14	−$0.77, $0.49	$0.04	−$0.19, $0.27	$0.03	−$0.02, $0.07
Acute care inpatient stays	6	−28, 40	−21, 32	−13	−44, 19	16	4, 28	2	−1, 5
Hospital-wide all-cause unplanned readmissions	7	−3, 18	−1, 16	N/A	N/A	N/A	N/A	N/A	N/A
ED visits	−11	−207, 185	−164, 142	−40	−225, 145	6	−55, 68	23	1, 45
Average impact per quarter									
Spending per participant	−$54	−$675, $567	−$911, $34	−$431	−$1,037, $176	−$535	−$1,364, $294	$46	−$1,137, $1,229
Acute care inpatient stays (per 1,000 participants)	4	−21, 30	−16, 24	−12	−43, 19	59	16, 103	85	−29, 199
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	86	−38, 210	−11, 183	N/A	N/A	N/A	N/A	N/A	N/A
ED visits (per 1,000 participants)	−8	−155, 139	−123, 107	24	−270, 254	24	−207, 254	618	20, 1,216

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2011 to June 2016.
- **Sample size:** 482 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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 (per 1,000 participants)** is 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 are the product of ED visits (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; MPHI = Michigan Public Health Institute.

2.1.1 Innovation Components

The Pathways innovation was implemented in three sites in Michigan, mainly the counties of Ingham, Muskegon, and Saginaw, and entailed 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 second annual report and reported changes in the second and third annual reports.[2,3] No additional changes took place.

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 third annual report, based on data through Q14. The distribution of patient characteristics is similar to that in the third annual report. More specifically, a majority of participants (72.3%) were from 25 to 64 years of age and more than half (60.8%) were female. Most participants (56.8%) were white, and nearly one-third (28.2%) 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.

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[2] Holden, D. J., Rojas Smith, L., Hoerger, T., Renaud, J., and Council, M.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring Annual Report 2014. 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. Centers for Medicare & Medicaid Services, 2015, December.

[3] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf.

Table 5. Characteristics of All Participants Ever Enrolled in the Innovation through June 2016: MPHI

Characteristic	Number of Participants[1]	Percentage of Participants
Total	8,812	100.0
Age		
< 18	0	0.0
18–24	435	4.9
25–44	2,277	25.8
45–64	4,091	46.5
65–74	1,097	12.4
75–84	604	6.9
85+	306	3.5
Missing	2	0.0
Sex		
Female	5,360	60.8
Male	3,436	39.0
Missing	16	0.2
Race/ethnicity		
White	5,004	56.8
Black	2,482	28.2
Hispanic	422	4.8
Asian	41	0.5
American Indian or Alaska Native	45	0.5
Native Hawaiian or other Pacific Islander	47	0.5
Other	211	2.4
Missing/refused	560	6.3
Payer category		
Dual	1,900	21.6
Medicaid[2]	4,093	46.4
Medicare	1,207	13.7
Medicare Advantage	335	3.8
Other	0	0.0
Uninsured	0	0.0
Missing[3]	1,277	14.5

[1] Enrollment is based on completion of an 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.

Notes:

- **Source:** Patient-level data provided to RTI.
- **Period of activity:** April 2013 to June 2016

Terms and Definitions.

- 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, ED visits that do not lead to a hospitalization, and primary care (PC) visits. 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, PC 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 third annual report addendum.

Table 6. Claims-Based Outcome Measures: MPHI

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

Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare and Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- ED = emergency department; PC = primary care; MPHI = Michigan Public Health Institute.

2.3 Medicare Comparison Group

We include patients in the claims analysis who were enrolled in the innovation before the end of the innovation, and we present Medicare claims data through June 30, 2016. This includes two additional quarters (Jan-June 2016) of Medicare claims data than the third annual report, resulting in an increase of 152 innovation participants to the analysis sample. The Medicare claims analysis focuses on 2,416 MPHI 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 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. 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 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. 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: MPHI (Medicare)

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	$9,243	$15,057	$2,159	$7,126	0.601	$9,168	$14,941	$8,669	$19,416	0.029
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$20,177	$33,968	$7,679	$18,114	0.459	$19,920	$33,454	$18,840	$43,002	0.028
Age	61.60	14.36	68.46	14.26	0.479	61.60	14.32	61.18	16.22	0.028
Percentage male	37.95	48.53	44.63	49.71	0.136	37.75	48.48	37.57	48.43	0.004
Percent white	65.31	47.60	80.00	40.00	0.334	65.44	47.56	63.87	48.04	0.033
Percentage disabled	71.54	45.12	35.97	47.99	0.764	71.48	45.15	75.08	43.25	0.082
Percentage ESRD	4.07	19.76	1.09	10.40	0.189	4.10	19.82	3.99	19.58	0.005
Number of dual eligible months in the previous calendar year	6.96	5.57	2.70	4.89	0.811	6.95	5.57	7.35	5.66	0.072
Number of chronic conditions	8.32	4.02	6.26	4.06	0.512	8.31	4.00	8.51	4.43	0.049
Number of outpatient ED visits in calendar quarter prior to enrollment	0.85	1.93	0.14	0.54	0.501	0.82	1.75	0.56	1.48	0.160
Number of inpatient stays in calendar quarter prior to enrollment	0.48	0.85	0.07	0.32	0.628	0.47	0.83	0.41	0.91	0.072
Number of beneficiaries	2,456	—	1,055,016	—	—	2,416	—	7,226	—	—
Number of unique beneficiaries[1]	—	—	101,796	—	—	2,416	—	6,979	—	—
Number of weighted beneficiaries	—	—	—	—	—	2,416	—	2,416	—	—

[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).

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

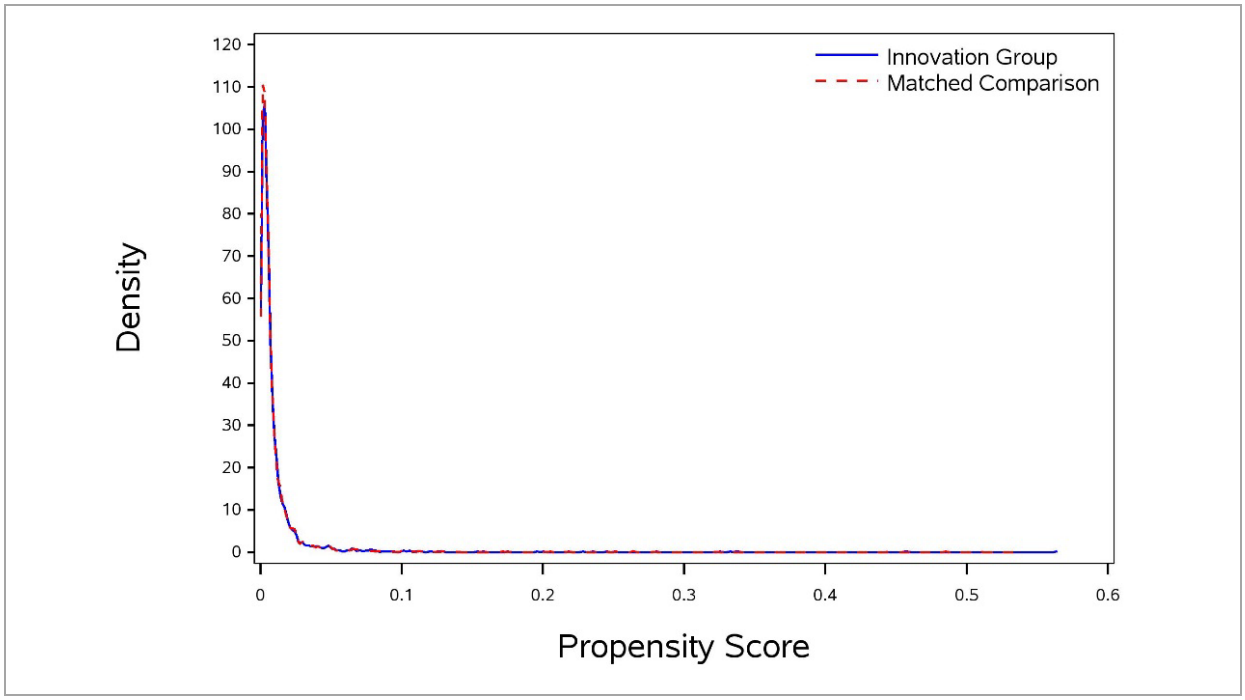
Terms and Definitions

- ED = emergency department; ESRD = end-stage renal disease; MPHI = Michigan Public Health Institute.
- — Data not 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.[4] 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 most variables except for the number of ED visits in calendar quarter before enrollment, which had a standardized difference of 0.16.

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 (Medicare)



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

[4] 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 8 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.

Similar to trends in the third annual report, the per-participant Medicare spending rates for the innovation and comparison groups follow very similar trends in both the baseline and innovation periods. Both groups have a spending 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. Spending for the comparison group is lower in almost all quarters, but spending for the innovation group dips in one of the last quarters of the innovation period. We will explore this question further in the regression analysis section below.

Table 8. Medicare Spending per Participant: MPHI

Awardee Number: 1C1CMS331013
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	$3,549	$3,795	$4,629	$4,655	$4,583	$5,168	$6,476	$9,168	$6,885	$6,542	$6,114	$6,037	$6,182	$6,119	$6,376	$6,262	$6,384	$4,830	$5,913	$6,400
Std dev	$8,663	$8,112	$11,777	$10,773	$11,415	$12,122	$13,941	$14,941	$13,247	$13,043	$12,880	$13,079	$13,089	$13,393	$15,333	$13,090	$14,362	$10,659	$17,505	$21,812
Unique patients	2,101	2,148	2,181	2,226	2,281	2,320	2,366	2,416	2,416	2,282	2,052	1,860	1,660	1,390	1,141	888	662	462	306	182
Comparison Group																				
Spending rate	$4,024	$3,925	$4,004	$4,285	$4,514	$4,826	$5,643	$8,669	$5,918	$5,442	$5,260	$5,179	$5,093	$4,975	$4,449	$4,663	$4,252	$4,108	$4,917	$4,978
Std dev	$11,300	$11,072	$10,739	$11,306	$10,787	$11,858	$24,483	$19,416	$14,194	$12,604	$12,663	$11,951	$12,809	$12,043	$10,575	$11,671	$9,710	$9,993	$11,698	$11,327
Weighted patients	2,219	2,251	2,279	2,310	2,342	2,377	2,406	2,416	2,416	2,310	2,085	1,894	1,689	1,422	1,173	914	664	465	308	178
Savings per Patient																				
	$475	$131	−$625	−$370	−$69	−$342	−$832	−$498	−$967	−$1,100	−$855	−$858	−$1,089	−$1,143	−$1,927	−$1,599	−$2,131	−$722	−$996	−$1,422

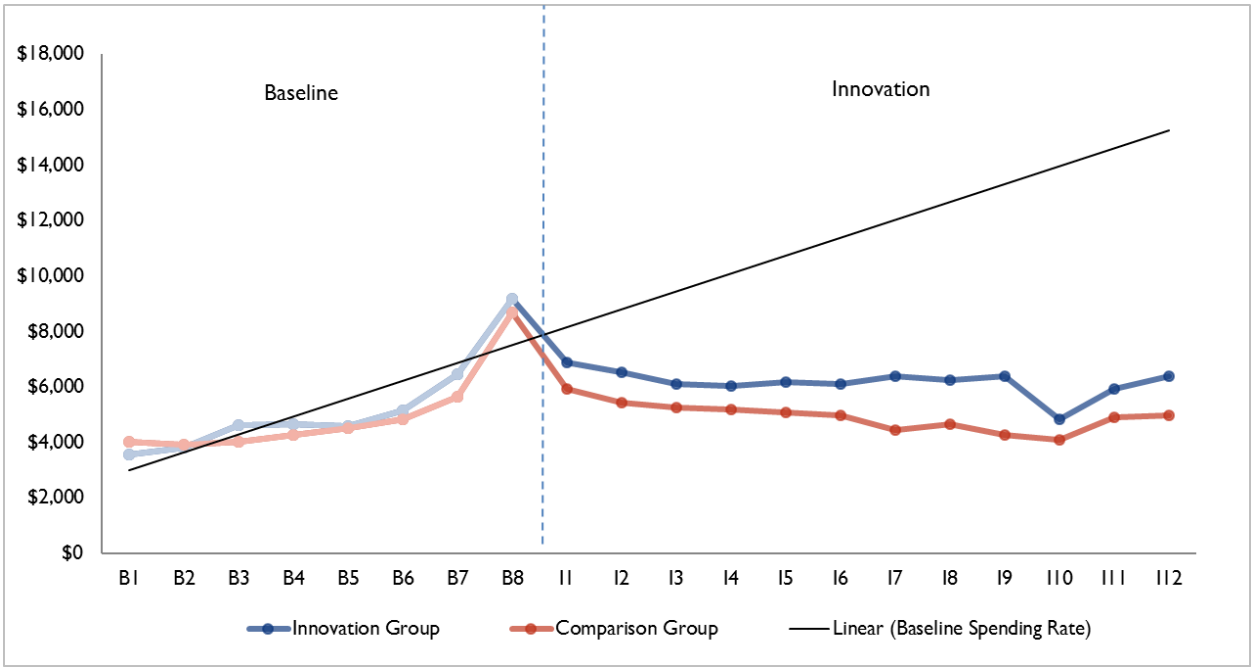
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 2. Medicare Spending per Participant: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 $502 (90% CI: $206, $798). This effect is statistically significant. This is consistent with the findings in the third annual report. 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 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. We found significant losses in 4 of 12 innovation quarters, which are spread over the 3 years of the innovation (with 2 in Year 1). The overall effect and the effects in Years 1 and 2 show significant losses (positive expenditures).

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

Quarter	Coefficient	Standard Error	P-Values
I1	$679	$265	0.011
I2	$649	$285	0.023
I3	$250	$310	0.420
I4	$282	$312	0.367
I5	$427	$347	0.218
I6	$410	$380	0.281
I7	$987	$465	0.034
I8	$559	$448	0.212
I9	$1,027	$558	0.066
I10	−$294	$513	0.567
I11	−$88	$1,021	0.931
I12	$772	$1,567	0.622
Overall average	$502	$180	0.005
Overall aggregate	$7,702,055	$2,760,357	0.005
Overall aggregate (IY1)	$4,156,186	$1,653,903	0.012
Overall aggregate (IY2)	$2,901,580	$1,355,244	0.032
Overall aggregate (IY3)	$657,573	$763,661	0.389

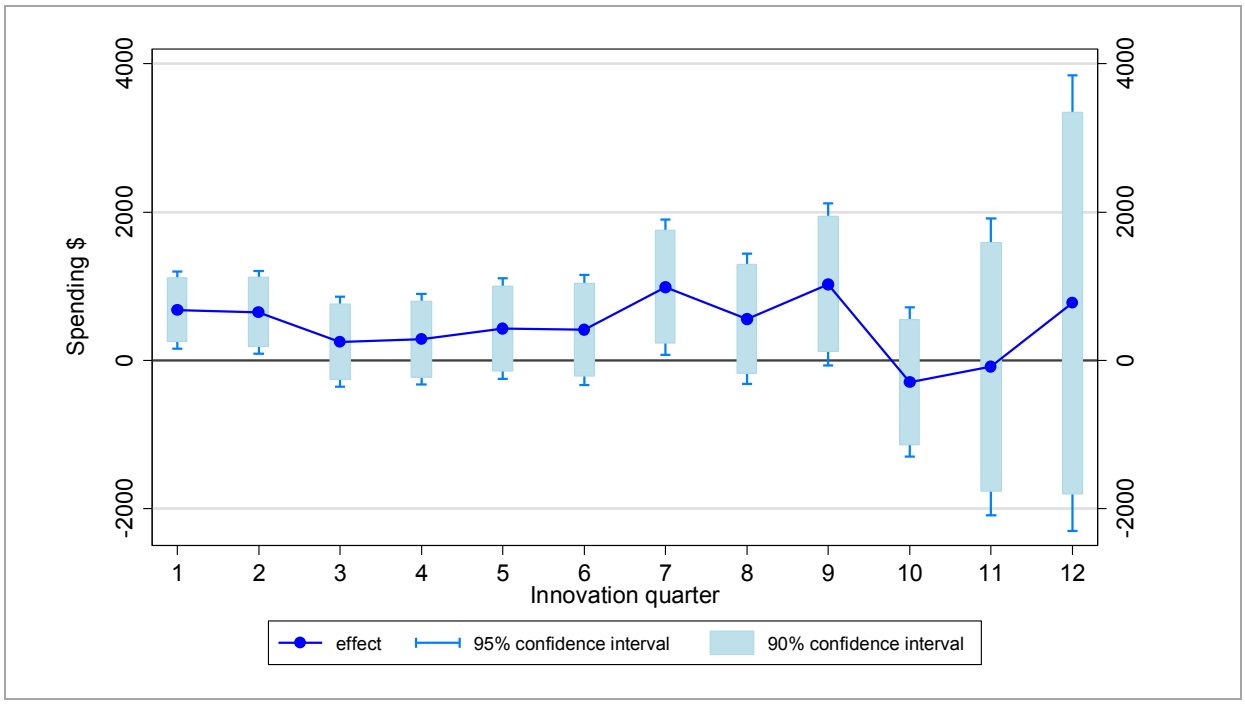
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Average:** 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; MPHI = Michigan Public Health Institute.

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



Notes:

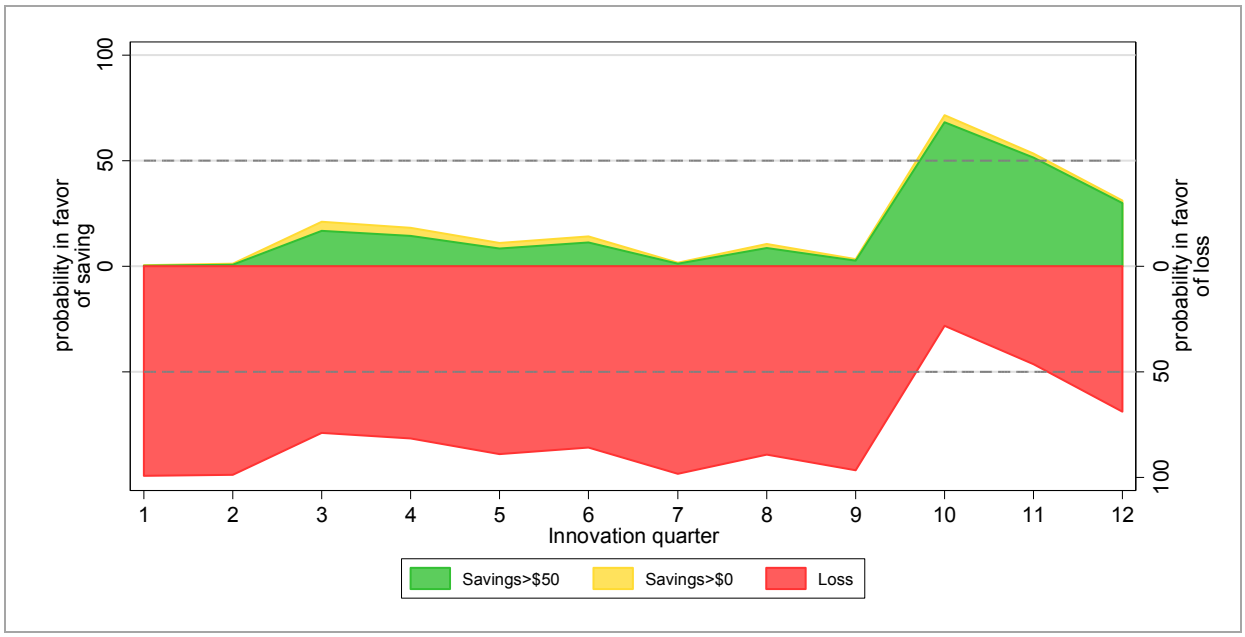
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 for saving or losing money on this initiative. 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. In I10 the probability of savings is greater than the probability of loss, but the probability of loss is higher again in I11 and I12. Overall, the probability of a loss is 99.7 percent over the innovation period.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 one Pathway beyond the adult intake checklist (but less than six), and (3) individuals who completed six or more Pathways beyond the adult intake checklist (six is the average number of Pathways completed). Results for groups 2 and 3 are presented in ***Table 10***.

The innovation had no significant impact on spending for individuals enrolled in the program but who completed no Pathways (not shown), in line with our expectation in that these individuals did not utilize more services than they would have absent the program. Additionally, no significant effect on spending occurs for individuals who completed one to five Pathways.

Individuals who completed six or more Pathways incur higher costs overall in the innovation period. This finding is consistent with the findings in the third annual report. Some quarters had significant decreased spending (I6 and I8) but overall, increased spending occurred for the whole innovation period ($7,475,865), and in Years 1 ($3,255,898), and 2 ($3,344,069), and these were all significant (P<0.1).

Patients who completed six or more Pathways are the subgroup that is driving the increased cost estimates of the innovation overall (Table 10). 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.

Table 10. 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	$44	$479	0.927	$1,059	$828	0.201
I2	$395	$589	0.503	$608	$350	0.083
I3	$320	$593	0.590	$751	$363	0.039
I4	$227	$633	0.721	$628	$397	0.114
I5	−$113	$670	0.867	$386	$387	0.319
I6	−$762	$642	0.235	$1,035	$461	0.025
I7	$1,298	$1,099	0.238	$1,079	$533	0.043
I8	−$831	$734	0.258	$1,081	$551	0.050
I9	$802	$882	0.364	$1,321	$651	0.043
I10	−$1,119	$840	0.183	$1,656	$769	0.031
I11	−$708	$1,073	0.510	$445	$850	0.601
I12	$378	$1,612	0.815	$611	$1,886	0.746
Overall average	$77	$362	0.832	$808	$237	0.001
Overall aggregate	$314,061	$1,481,826	0.832	$7,475,865	$2,193,226	0.001
Overall aggregate (IY1)	$522,137	$813,800	0.521	$3,255,898	$1,322,687	0.014
Overall aggregate (IY2)	−$144,803	$748,286	0.847	$3,344,069	$1,078,350	0.002
Overall aggregate (IY3)	−$63,272	$388,015	0.871	$875,898	$634,432	0.168

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **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; MPHI = Michigan Public Health Institute.

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***. The per-participant inpatient admissions rates for the innovation and comparison groups follow 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. This finding is consistent with the findings in the third annual report. Although inpatient admissions rates are nearly the same in the first quarter of the baseline period, the admissions rate for the innovation group is higher in all other quarters. We test for differences between the innovation and comparison groups in the regression analysis section below.

Table 11. All-Cause Inpatient Admissions Rate per 1,000 Participants: MPHI

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	132	169	177	179	176	195	284	421	233	236	225	226	220	214	205	221	208	171	199	220
Std dev	439	507	540	542	546	588	686	771	661	607	651	637	654	616	622	641	581	561	747	660
Unique patients	2,101	2,148	2,181	2,226	2,281	2,320	2,366	2,416	2,416	2,282	2,052	1,860	1,660	1,390	1,141	888	662	462	306	182
Comparison Group																				
Admit rate	128	138	135	147	157	161	176	313	181	175	167	170	157	151	142	154	145	139	158	175
Std dev	462	473	478	498	514	538	556	819	591	536	538	539	518	510	468	531	477	483	526	557
Weighted patients	2,219	2,251	2,279	2,310	2,342	2,377	2,406	2,416	2,416	2,310	2,085	1,894	1,689	1,422	1,173	914	664	465	308	178
Innovation − Comparison Rate																				
	4	31	42	33	18	33	108	109	52	61	58	56	64	64	63	67	64	32	42	45

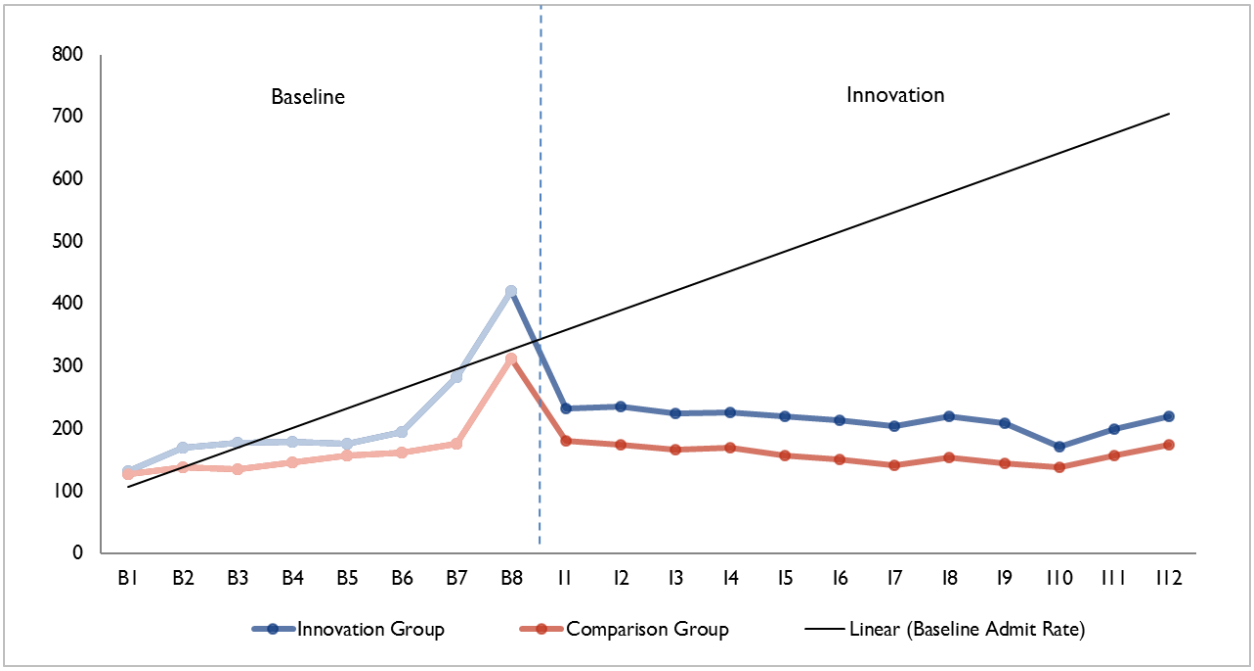
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.5.2 Regression Results

As shown in ***Table 12***, the average quarterly difference-in-differences estimate for inpatient admissions is a decrease 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: −12, 8).

We also present quarterly effects 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. As in the third annual report, the innovation had no statistically significant effect on inpatient admissions.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−5	16	0.767
I2	11	15	0.458
I3	3	16	0.865
I4	−7	18	0.704
I5	−3	19	0.855
I6	1	20	0.963
I7	−2	22	0.913
I8	1	27	0.972
I9	−11	30	0.722
I10	−39	31	0.205
I11	−28	52	0.596
I12	−10	57	0.864
Overall average	−2	6	0.710
Overall aggregate	−35	94	0.710
Overall aggregate (IY1)	8	70	0.914
Overall aggregate (IY2)	−6	54	0.908
Overall aggregate (IY3)	−35	31	0.254

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; MPHI = Michigan Public Health Institute.

Inpatient Dose Analysis

Table 13 presents results of a dose analysis that stratified regressions by the number of Pathways a patient received (one to five Pathways and six or more Pathways). Overall, we found very few significant findings for inpatient visits within the dose analysis. We describe results for the group of individuals who completed no Pathways, but do not present them in Table 13. For individuals who were enrolled in the program but completed no Pathways, no significant effect occurred in any given quarter. However, a statistically significant decrease occurred in Year 2 (−28, P=0.080). There was no effect in Years 1 or 3 nor for the innovation period overall.

For those who completed one to five Pathways, the innovation had no significant impact on inpatient admissions overall; however, a statistically significant decrease occurred in innovation Q1 (−49, P=0.061). Similar to the group overall, we found no significant effects of the innovation on inpatient visits for individuals who completed six or more Pathways.

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission 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	−49	26	0.061	7	20	0.707
I2	3	32	0.923	11	18	0.540
I3	10	30	0.749	12	19	0.536
I4	−15	34	0.650	5	21	0.805
I5	5	34	0.877	22	22	0.330
I6	−26	32	0.422	13	25	0.607
I7	−1	39	0.987	22	29	0.457
I8	−1	49	0.984	29	37	0.426
I9	−13	49	0.791	41	40	0.309
I10	−68	46	0.143	−9	48	0.846
I11	−8	104	0.942	−71	63	0.257
I12	−2	81	0.977	−56	91	0.542
Overall average	−13	11	0.247	12	8	0.125
Overall aggregate	−53	46	0.247	108	70	0.125
Overall aggregate (IY1)	−31	33	0.350	48	52	0.357
Overall aggregate (IY2)	−8	26	0.770	62	41	0.130
Overall aggregate (IY3)	−14	17	0.408	−3	22	0.898

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **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; 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 14*** and ***Figure 6***. During the baseline period, the comparison group's readmissions rate is higher than the innovation group's. During the intervention period the two rates converge and the innovation group's rate is sometimes above the comparison group's. This finding is consistent with the findings in the third annual report. 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 wide variability in these descriptive statistics.

Table 14. Hospital Unplanned Readmissions Rates per 1,000 Admissions: MPHI

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	70	118	100	81	101	127	131	128	157	119	151	173	234	178	171	127	133	269	190	67
Std dev	255	323	300	272	302	332	337	334	364	324	358	378	423	383	376	333	340	444	393	249
Total admissions	86	144	130	149	138	166	245	421	217	202	172	179	137	118	82	63	60	26	21	15
Comparison Group																				
Readmit rate	100	116	128	125	154	195	154	202	211	153	153	168	169	153	123	158	148	122	107	61
Std dev	299	320	334	331	361	396	361	401	408	360	360	374	375	360	328	365	356	328	309	239
Total admissions	117	134	123	163	168	184	204	432	222	177	153	140	127	84	73	51	43	25	19	11
Innovation − Comparison Rate																				
	−30	2	−28	−45	−53	−68	−23	−73	−54	−34	−2	5	65	25	48	−31	−15	147	83	6

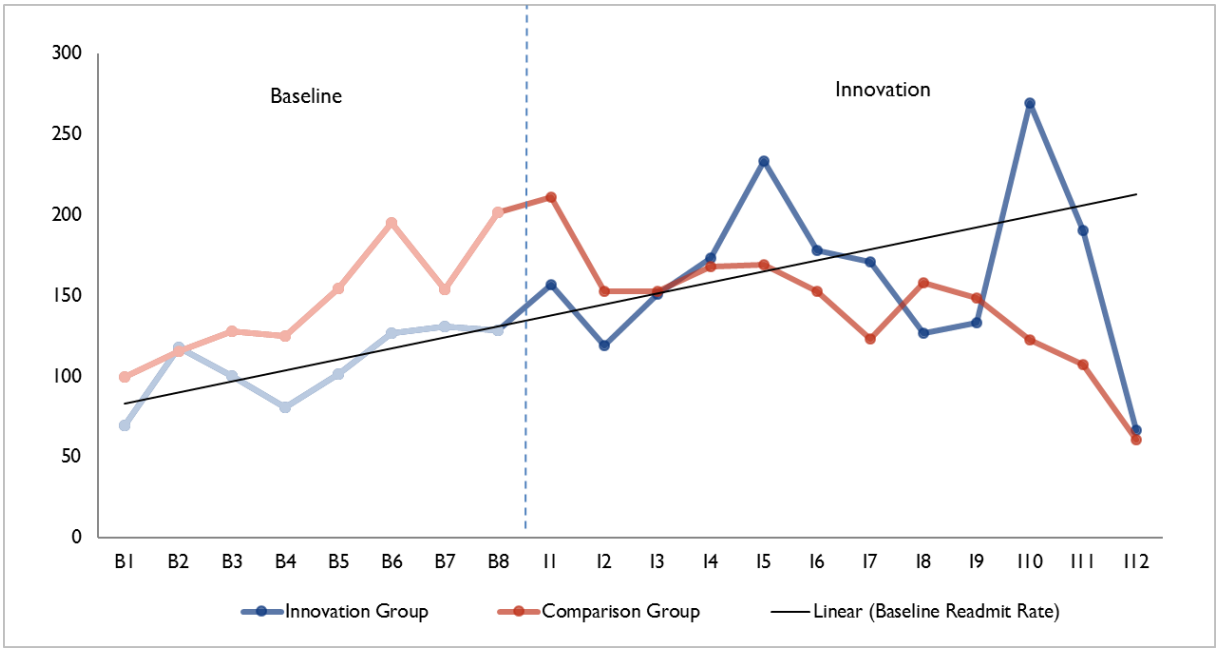
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.6.2 Regression Results

Table 15 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, indicating that the innovation-comparison difference is higher for the innovation group during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 8, 70).

Table 15. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Inpatient Admissions: MPHI

Quarter	Coefficient	Standard Error	P-Values
Overall average	39	19	0.042
Overall aggregate	50	25	0.042

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- 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 one to five Pathways, and individuals who were active and completed six or more Pathways). This finding is consistent with the findings in the third annual report. However, these results 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 16*** 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 somewhat before flattening out for most of the innovation period. After a small spike in the first quarter of innovation Year 3 (I9), the ED rate for the innovation group drops to a level more in line with the general rate for the second year of the innovation period. This finding is consistent with the findings in the third annual report.

Table 16. ED Visits per 1,000 Participants: MPHI

Awardee Number: 1C1CMS331013
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																				
ED rate	479	506	481	572	582	649	718	820	667	641	602	603	580	577	572	622	674	604	578	511
Std dev	1,267	1,329	1,273	1,494	1,583	1,711	1,759	1,781	1,651	1,562	1,504	1,622	1,653	1,733	1,790	1,847	2,167	1,788	2,081	1,007
Unique patients	2,101	2,148	2,181	2,226	2,281	2,320	2,366	2,416	2,416	2,282	2,052	1,860	1,660	1,390	1,141	888	662	462	306	182
Comparison Group																				
ED rate	405	420	398	433	422	427	415	556	438	418	400	393	412	398	419	457	435	416	448	382
Std dev	839	880	827	915	787	754	701	879	768	731	771	626	695	658	866	866	708	689	714	733
Weighted patients	2,219	2,251	2,279	2,310	2,342	2,377	2,406	2,416	2,416	2,310	2,085	1,894	1,689	1,422	1,173	914	664	465	308	178
Innovation – Comparison Rate																				
	75	85	83	139	159	222	303	263	230	223	202	210	168	179	154	164	239	188	131	129

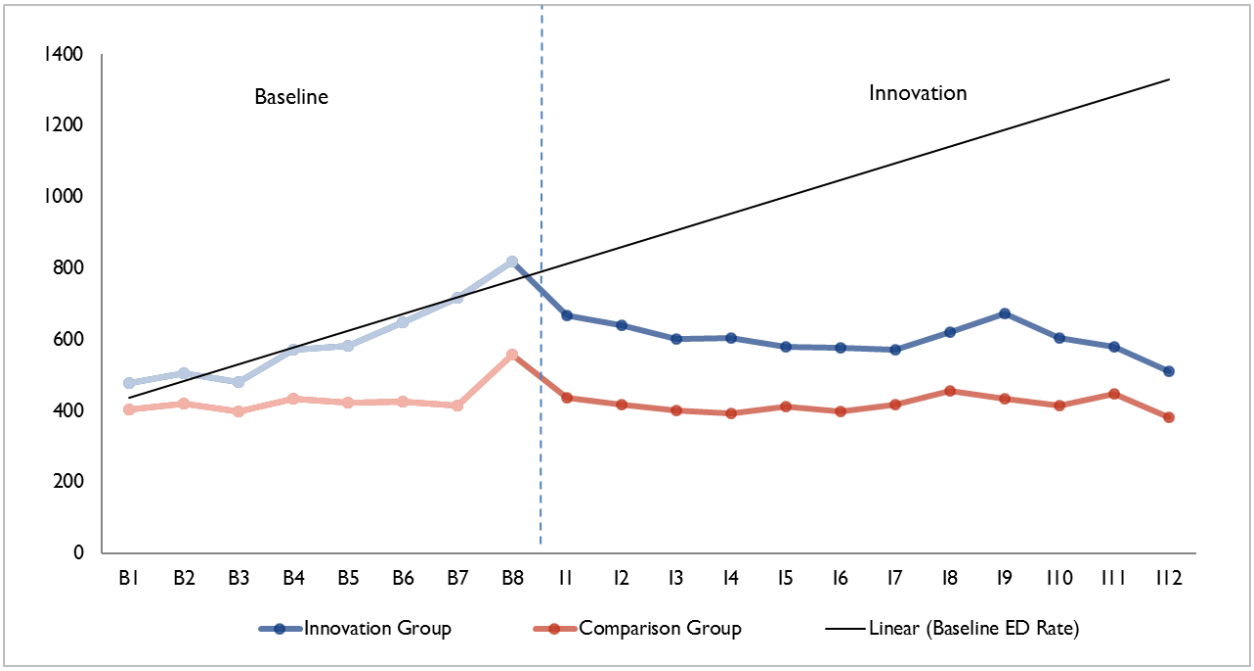
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly ED visits and observation stays /number of unique or weighted patients)*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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- ED = emergency department.
- MPHI = Michigan Public Health Institute.

2.7.2 Regression Results

As shown in ***Table 17***, 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 (90% CI: −17, 26). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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 first two quarters of the innovation period show significant increases in the ED visits rate but no other individual quarter is significant. There is a significant increase in aggregate ED visits for Year 1 of the innovation (376, P=0.009), and a significant decrease in aggregate ED visits for Year 2 of the innovation (−202, P=0.089), but overall, we found no significant effect of the innovation on ED visits.

Table 17. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	57	30	0.062
I2	64	32	0.048
I3	36	33	0.278
I4	10	38	0.793
I5	−27	41	0.499
I6	−33	44	0.460
I7	−38	48	0.432
I8	−76	59	0.198
I9	−68	74	0.358
I10	−39	81	0.627
I11	−75	106	0.478
I12	−57	111	0.612
Overall average	4	13	0.746
Overall aggregate	65	200	0.746
Overall aggregate (IY1)	376	144	0.009
Overall aggregate (IY2)	−202	119	0.089
Overall aggregate (IY3)	−96	72	0.183

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

ED Visits Dose Analysis

For individuals who were enrolled in the program but completed no Pathways, a significant increase occurred in the second quarter of the innovation period (248, P=0.063) but no effect took place in any other quarter. However, overall, a significant increase in ED visits occurred overall for this group (161 ED visits in aggregate and 82 on average; P=0.057). We also found a significant increase in Year 1 (192 ED visits in aggregate and 182 on average; P=0.005) but not in Years 2 or 3. Enrollment into the program was often associated with ED utilization and individuals who accessed no Pathways were never affected by the community hub intervention; therefore, we might expect their ED use to continue.

Table 18 presents results of a negative binomial count model for individuals who completed one to five Pathways and individuals who completed six or more Pathways. No significant effect of the innovation on ED use occurred in any quarter, or overall, for either subgroup. Patients who completed six or more Pathways had a statistically significant increase in ED visits during Year 1 (105, P=0.010).

Table 18. 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	24	55	0.660	56	35	0.109
I2	−17	54	0.754	63	37	0.089
I3	−33	58	0.574	49	40	0.226
I4	31	59	0.599	27	44	0.546
I5	−35	71	0.628	1	49	0.986
I6	−33	76	0.658	−7	58	0.908
I7	−14	65	0.829	−68	69	0.330
I8	−103	83	0.219	−19	84	0.823
I9	−24	106	0.821	−17	108	0.875
I10	116	128	0.366	−146	124	0.241
I11	−77	141	0.587	−172	185	0.353
I12	−185	229	0.421	60	173	0.731
Overall average	−15	21	0.473	16	16	0.325
Overall aggregate	−63	88	0.473	149	152	0.325
Overall aggregate (IY1)	3	61	0.962	269	105	0.010
Overall aggregate (IY2)	−60	52	0.244	−59	94	0.526
Overall aggregate (IY3)	−6	36	0.870	−60	57	0.294

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **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; MPHI = Michigan Public Health Institute.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

PC visits per 1,000 participants are shown in ***Table 19*** and ***Figure 8.*** The PC visit rate for the innovation and comparison groups spikes in the last baseline quarter—similar to the other outcomes. Although very similar for most of the baseline and innovation periods, the PC visit rate is constantly higher for the comparison group than the innovation group.

Table 19. PC Visits per 1,000 Participants: MPHI

Awardee Number: 1C1CMS331013
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																				
PC rate	1,263	1,382	1,336	1,402	1,384	1,433	1,555	1,914	1,813	1,731	1,645	1,677	1,595	1,648	1,703	1,642	1,596	1,501	1,493	1,427
Std dev	1,808	2,003	1,930	1,968	1,997	2,054	2,026	2,312	2,471	2,446	2,260	2,429	2,366	2,665	2,938	2,674	2,546	2,134	2,214	1,824
Unique patients	2,101	2,148	2,181	2,226	2,281	2,320	2,366	2,416	2,416	2,282	2,052	1,860	1,660	1,390	1,141	888	662	462	306	182
Comparison Group																				
PC rate	1,534	1,556	1,546	1,618	1,608	1,663	1,721	1,946	1,908	1,853	1,792	1,807	1,803	1,750	1,775	1,774	1,760	1,706	1,813	1,798
Std dev	2,210	2,246	2,138	2,280	2,298	2,403	2,325	2,569	2,648	2,537	2,517	2,411	2,478	2,402	2,440	2,381	2,518	2,346	2,754	2,315
Weighted patients	2,219	2,251	2,279	2,310	2,342	2,377	2,406	2,416	2,416	2,310	2,085	1,894	1,689	1,422	1,173	914	664	465	308	178
Innovation − Comparison Rate																				
	−271	−173	−210	−216	−225	−231	−166	−33	−95	−122	−147	−130	−208	−102	−72	−132	−165	−205	−320	−371

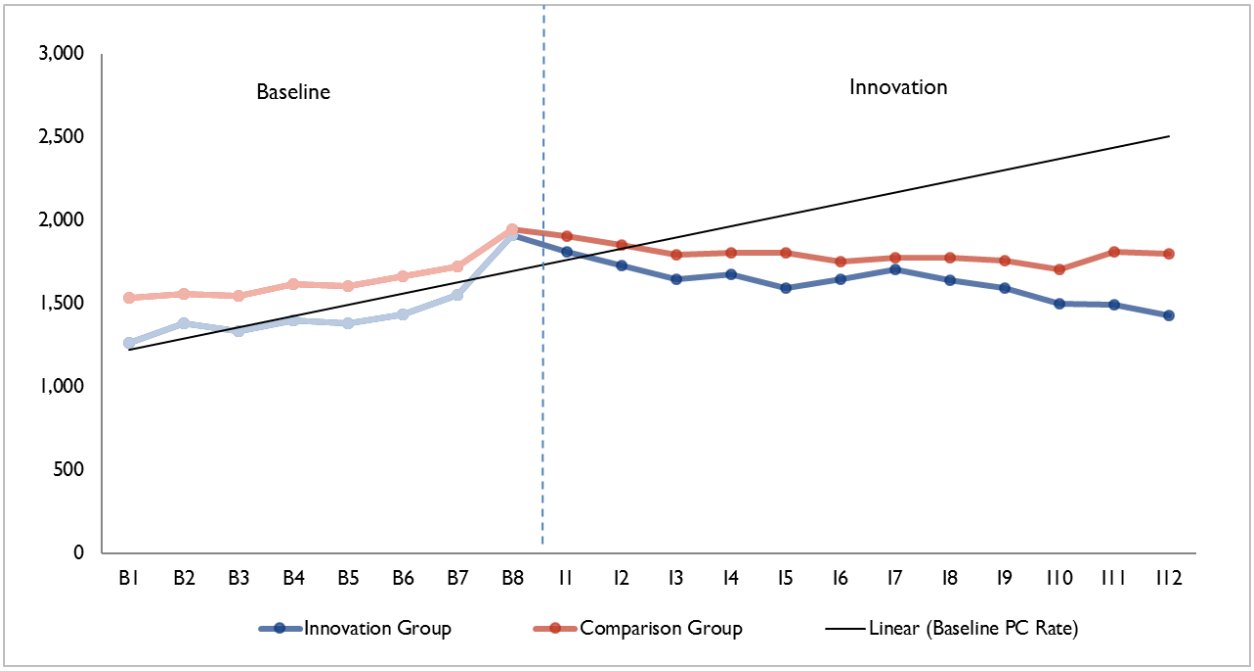
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **PCP rate:** (Total quarterly PCP visits and observation stays /number of unique or weighted patients)*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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1 I1 = Innovation Q1; PC = primary care visits; MPHI = Michigan Public Health Institute.

Figure 8. PC Visits per 1,000 Participants: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- PC = primary care; MPHI = Michigan Public Health Institute.

2.8.2 Regression Results

As shown in ***Table 20***, the average quarterly difference-in-differences estimate for PC visits is an increase of 45 PC visits per 1,000 participants relative to the comparison group. This is the average difference in PC visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 10, 80).

We also present quarterly effects with the dependent variable set to the number of PC 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 PC visits per 1,000 participants. We find a significant increase in the PC visits rate in the first quarter of the innovation (114, P=0.022) but not significant effect in any other quarter. However, the Year 1 effect and the overall effect of the innovation on PC visits are statistically significant increases (696, P=0.033 overall and 716, P=0.002 in Year 1).

Table 20. Difference-In-Differences Negative Binomial Count Model Regression Estimates for PC Visit per 1,000 Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	114	50	0.022
I2	86	55	0.120
I3	48	56	0.388
I4	78	60	0.188
I5	−34	64	0.590
I6	47	74	0.523
I7	95	88	0.277
I8	15	97	0.877
I9	−61	109	0.576
I10	−51	112	0.650
I11	−176	149	0.238
I12	−225	159	0.159
Overall average	45	21	0.033
Overall aggregate	696	326	0.033
Overall aggregate (IY1)	716	236	0.002
Overall aggregate (IY2)	131	198	0.508
Overall aggregate (IY3)	−158	104	0.127

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; MPHI = Michigan Public Health Institute.

PC Visits Dose Analysis

Overall, the innovation had limited impact on PC visits for individuals who were enrolled in the program but completed no Pathways. Significant decreases occurred for two quarters at the end of the innovation period (I11 and I12, −817, P =0.008 and −555, P=0.104, respectively) and for Year 3 overall (aggregate = −97, average = −378, P=0.014). However, the innovation had no statistically significant effect in any other year or overall.

Table 21 presents results of a model for individuals who completed one to five Pathways and individuals who completed 6 or more Pathways. Individuals who completed one to five Pathways had only one quarter where PC visits were statistically significant (I2, increase of 196, P=0.067). Overall,

individuals who completed one to five Pathways had higher PC visits in the innovation period (96 on average, P=0.019) and higher PC visits in Year 1 (258, P=0.030).

For individuals who completed six or more Pathways, two quarters of Year 3 showed a statistically significant decrease in PC visits (I10 and I12). For this group, annual estimates reach statistical significance. PC visits increased in Year 1 (331, P=0.063) and decreased in Year 3 (−214, P=0.004).

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for PC 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	163	105	0.121	73	57	0.202
I2	196	106	0.067	62	69	0.364
I3	15	106	0.889	67	69	0.334
I4	84	122	0.492	39	70	0.576
I5	−39	117	0.740	7	80	0.934
I6	51	141	0.716	24	95	0.803
I7	88	161	0.584	50	112	0.656
I8	137	172	0.426	−103	129	0.426
I9	46	185	0.804	−138	150	0.361
I10	309	199	0.123	−354	152	0.021
I11	14	301	0.963	−277	206	0.182
I12	81	291	0.783	−494	225	0.031
Overall average	96	41	0.019	14	26	0.604
Overall aggregate	391	167	0.019	127	245	0.604
Overall aggregate (IY1)	258	119	0.030	331	178	0.063
Overall aggregate (IY2)	69	100	0.494	10	151	0.946
Overall aggregate (IY3)	65	61	0.294	−214	74	0.004

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **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.
- PC = primary care; I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

2.9 Discussion: Medicare Results

The MPHI innovation showed increased spending but has no effect on inpatient stays or ED visits (overall) for innovation participants. We examined the effect of the innovation on PC visits and find a statistically significant increase in PC visits overall during the innovation period.

The number of Pathways utilized appeared to have an impact on health care used: individuals who did not access any Pathways continue to visit the ED at a higher rate; those who accessed one to five Pathways had no significant change in ED visits but had higher PC visits. These results shift over time. Individuals who accessed six or more Pathways have higher ED and PC visits in Year 1, probably because these individuals were not as healthy. However, the innovation has no effect on ED visits in later quarters and PC visits decrease in Year 3 of the innovation.

The results are consistent with MPHI's theory of action. Pathways aimed to enroll high utilizers of the ED and those with a recent inpatient admission; therefore, increased spending among Medicare beneficiaries in the short term is plausible because MPHI targeted patients who were high spenders and worked to connect them to care. Over the longer term, entry into routine PC care would be expected to lead to fewer unplanned admissions, ED visits, and unplanned readmissions.

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.

2.10 Medicaid Comparison Group

We include patients in the claims analysis who were enrolled in the innovation prior to the end of the innovation, and we present Medicaid claims data through April 2016. The Medicaid claims analysis focuses on 482 MPHI 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, 18 years or older, with fee-for-service Medicaid living in Saginaw, Muskegon, or Ingham Counties. These are new data not presented in the third annual report

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 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 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 22 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 9*** 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 22. Mean Values and Standardized Differences of Variables in Propensity Score Model: MPHI (Medicaid)

	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	46.64	13.45	49.22	19.75	0.153	46.42	13.47	46.86	15.49	0.031
Percentage adult	93.62	24.49	75.62	42.94	0.515	93.48	24.69	91.55	27.82	0.073
Percentage disabled	31.21	46.42	48.64	49.98	0.362	31.52	46.46	30.62	46.09	0.020
Percentage female	58.16	49.42	64.90	47.73	0.139	59.06	49.17	60.93	48.79	0.038
Percentage white	51.42	50.07	59.96	49.00	0.173	50.72	49.99	51.15	49.99	0.008
Percentage black	29.43	45.65	28.13	44.97	0.029	30.07	45.86	30.43	46.01	0.008
Percentage dual eligible	25.53	43.68	70.70	45.51	1.013	26.09	43.91	26.57	44.17	0.011
Number of months of Medicaid eligibility in second, third, fourth, and fifth calendar quarters prior to enrollment	6.82	5.26	11.15	2.34	1.065	6.92	5.25	6.66	5.07	0.051
Payments in calendar quarter prior to enrollment	2,717.23	7,242.72	432.50	1,650.89	0.435	2,311.80	6,646.03	2,227.61	9,207.63	0.010
Number of ED visits in calendar quarter prior to enrollment	1.29	2.62	0.11	0.60	0.620	1.13	2.26	0.99	3.00	0.053
Number of inpatient stays in calendar quarter prior to enrollment	0.18	0.53	0.01	0.11	0.450	0.14	0.43	0.12	0.51	0.036
Number of beneficiaries	282	—	204,557	—	—	276	—	822	—	—
Number of unique beneficiaries[1]	—	—	32,026	—	—	276	—	750	—	—
Number of weighted beneficiaries	—	—	—	—	—	276	—	276	—	—
No Medicaid in previous quarter										
Age	42.43	12.54	29.57	11.02	1.089	42.43	12.51	42.08	12.76	0.027
Percentage disabled	13.59	34.35	6.86	25.28	0.224	13.59	34.27	11.33	31.69	0.069
Percentage female	58.74	49.35	74.45	43.62	0.338	58.74	49.23	56.47	49.58	0.046
Percentage white	59.71	49.17	50.34	50.00	0.189	59.71	49.05	65.86	47.42	0.127
Percentage black	22.33	41.75	33.40	47.17	0.249	22.33	41.65	20.07	40.05	0.055
Percentage dual eligible	5.83	23.48	5.08	21.97	0.033	5.83	23.42	5.50	22.80	0.014
Number of beneficiaries	206	—	38,094	—	—	206	—	617	—	—
Number of unique beneficiaries[1]	—	—	25,788	—	—	206	—	529	—	—
Number of weighted beneficiaries	—	—	—	—	—	206	—	206	—	—

[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).

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

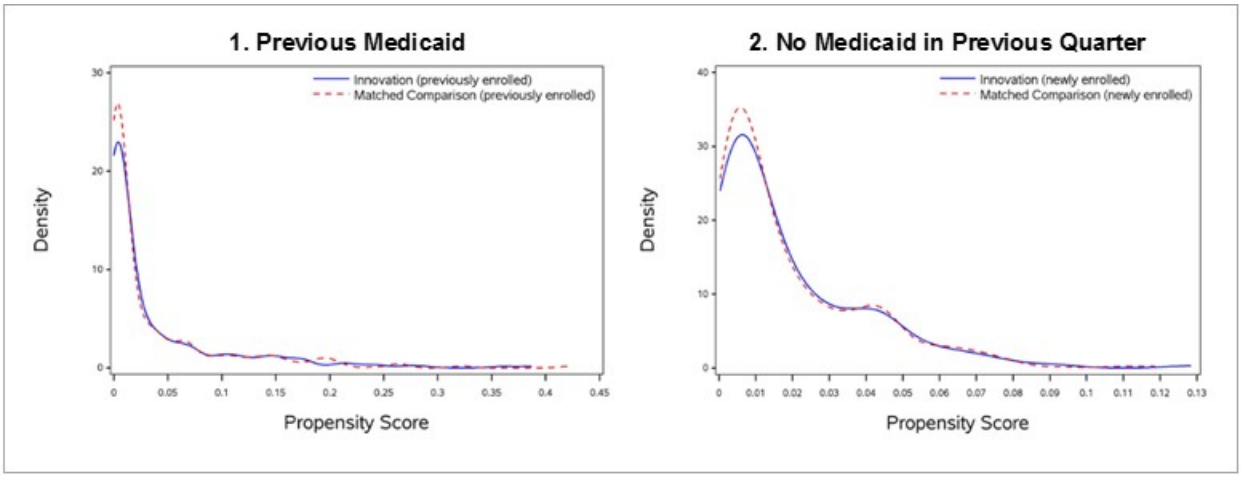
Terms and Definitions

- ED = emergency department; SD = standard deviation; MPHI = Michigan Public Health Institute.
- — 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 22. The results in Table 22 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. For those without Medicaid in the previous quarter, one variable (Percent white) was above the 0.1 threshold. The small sample size and limited data available for this group contribute to the higher standardized differences.

Figure 9 shows the distribution of the propensity scores for both the innovation and comparison groups. 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 9. Distribution of Propensity Scores for Comparison and Innovation Groups: MPHI (Medicaid)



Notes:

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

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 23 reports Medicaid spending per patient in the 8 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 10*** illustrates the Medicaid spending per beneficiary in Table 23 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 is more variable than comparison group spending but remains above comparison group spending. We test for statistically significant differences in spending due to the innovation in the regression analysis section below.

Table 23. Medicaid Spending per Participant: MPHI

Awardee Number: 1C1CMS331025
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters									
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**
Innovation Group																		
Spending rate	$1,144	$1,111	$1,272	$1,341	$1,828	$3,891	$3,261	$2,312	$1,475	$2,133	$1,995	$1,017	$1,408	$2,043	$1,421	$980	$1,470	$1,698
Std dev	$1,485	$2,248	$1,761	$1,906	$2,459	$3,401	$2,847	$3,323	$2,449	$2,510	$2,940	$1,868	$2,089	$2,487	$2,191	$1,427	$2,165	$1,351
Unique patients	111	101	112	128	148	143	179	277	483	234	165	146	107	74	48	39	27	10
Comparison Group																		
Spending rate	$692	$671	$780	$823	$850	$914	$1,133	$1,097	$759	$801	$655	$699	$770	$571	$627	$546	$300	$153
Std dev	$1,215	$1,109	$1,162	$1,305	$1,478	$1,613	$2,016	$1,939	$1,499	$1,677	$1,296	$1,425	$1,316	$1,152	$1,095	$979	$589	$164
Weighted patients	181	178	168	163	160	159	179	276	482	258	176	139	111	83	58	48	34	10
Savings per Patient																		
	−$452	−$440	−$491	−$518	−$978	−$2,978	−$2,128	−$1,215	−$716	−$1,332	−$1,340	−$317	−$637	−$1,472	−$794	−$434	−$1,170	−$1,545

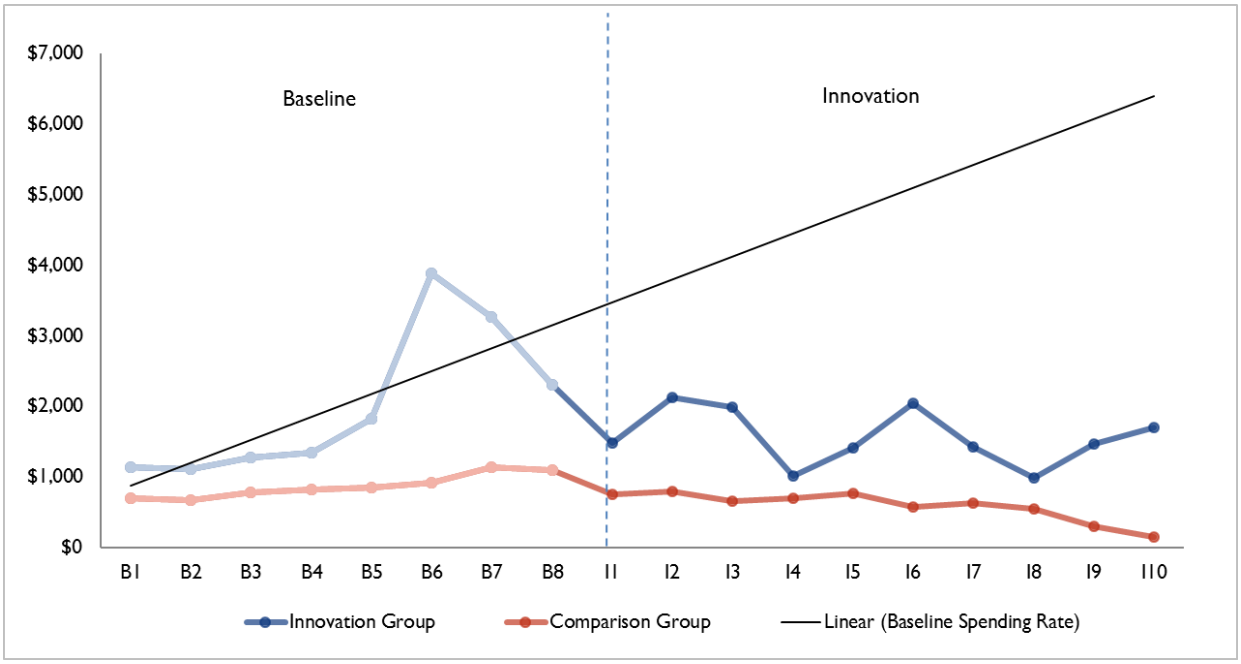
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 10. Medicaid Spending per Participant: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.11.2 Regression Results

We present in ***Table 24*** 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 −$54 (90% CI: −$675, $567). 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 quarterly effects derived from 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 11*** illustrates these quarterly difference-in-differences estimates. No significant effects of the innovation are evident for savings overall (or for any given year of the innovation).

Table 24. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−$364	$326	0.264
I2	$256	$729	0.725
I3	$396	$504	0.432
I4	−$611	$465	0.189
I5	−$184	$505	0.715
I6	$730	$708	0.302
I7	$202	$604	0.739
I8	−$110	$563	0.845
I9	$854	$860	0.321
I10	$485	$901	0.591
Overall average	−$54	$377	0.886
Overall aggregate	−$71,982	$501,974	0.886
Overall aggregate (IY1)	−$139,574	$383,557	0.716
Overall aggregate (IY2)	$39,687	$138,991	0.775
Overall aggregate (IY3)	$27,905	$27,985	0.319

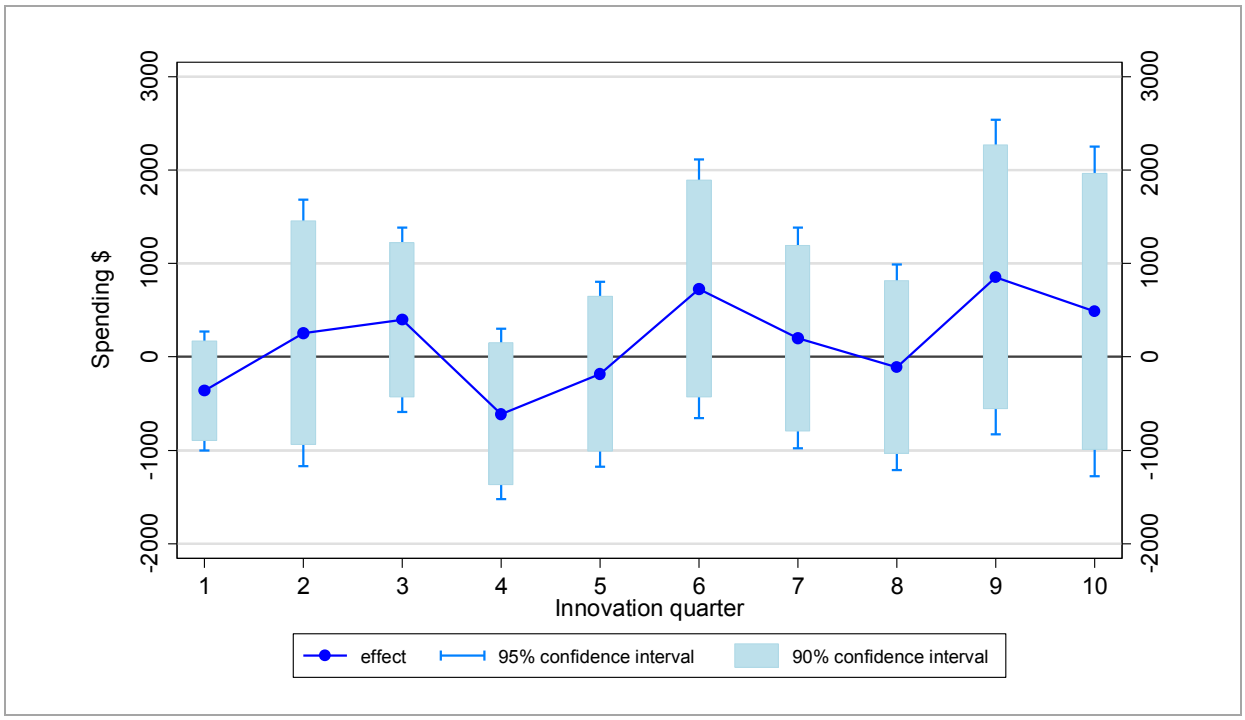
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions:

- **Regression coefficients:** 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 a dummy variable indicating Medicaid fee-for-service enrollment in the quarter 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.
- **Overall average:** 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; MPHI = Michigan Public Health Institute.

Figure 11. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: MPHI



Notes:

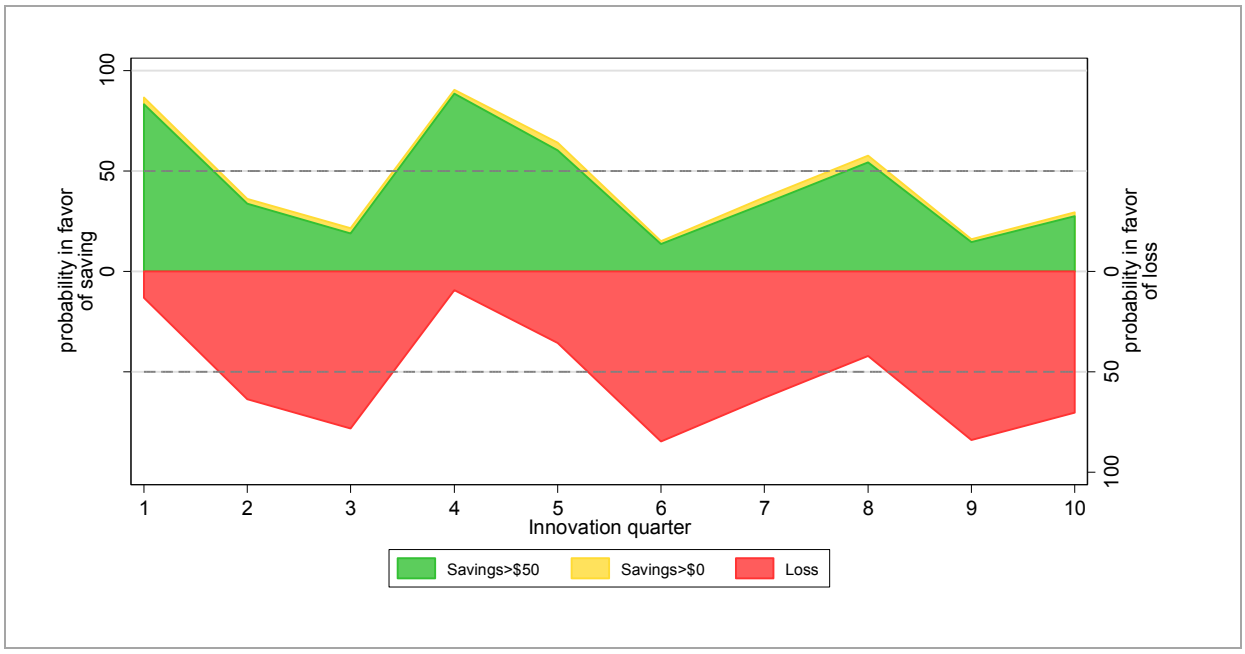
- Source: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- Period of activity: April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute; OLS = ordinary least squares.

Figure 12 presents the strength of evidence in favor of savings or loss. The strength of evidence is quantified by the probability of the observed estimate for saving or losing money on this initiative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Overall, we see the probability of savings and the probability of loss is almost equal. There is a 56 percent chance that overall savings are greater than $0.

Figure 12. Quarterly Strength of Evidence in Favor of Savings/Loss: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 25*** and ***Figure 13***. The inpatient admissions rate slopes up for the comparison group in the baseline period, though the slope for the innovation group also slopes up. It begins with a dip and remains higher than the comparison group throughout the baseline period. In the first quarter of the innovation period, the inpatient admissions rate decreases for both the innovation and comparison groups. Whereas the rate for the comparison group slopes slightly down during the innovation period, the rate for the innovation group is almost always above that for the comparison group and is highly variable with a large spike in quarter 6. We report results of statistical tests for differences between the innovation and comparison group in the regression analysis section below.

Table 25. All-Cause Inpatient Admissions Rate per 1,000 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	I6	I7	I8	I9	I10
Innovation Group																		
Admit rate	81	69	63	70	88	119	145	141	87	86	127	48	103	162	83	51	111	100
Std dev	360	430	362	286	328	384	475	433	377	406	496	244	411	550	347	223	424	316
Unique patients	111	101	112	128	148	143	179	277	483	234	165	146	107	74	48	39	27	10
Comparison Group																		
Admit rate	18	24	28	41	46	63	89	124	61	55	30	62	30	16	37	53	10	0
Std dev	87	99	104	191	173	206	286	310	212	187	130	191	133	74	128	196	57	0
Weighted patients	181	178	168	163	160	159	179	276	482	258	176	139	111	83	58	48	34	10
Innovation − Comparison Rate																		
	63	45	35	29	42	56	57	17	26	31	97	−14	73	146	46	−1	101	100

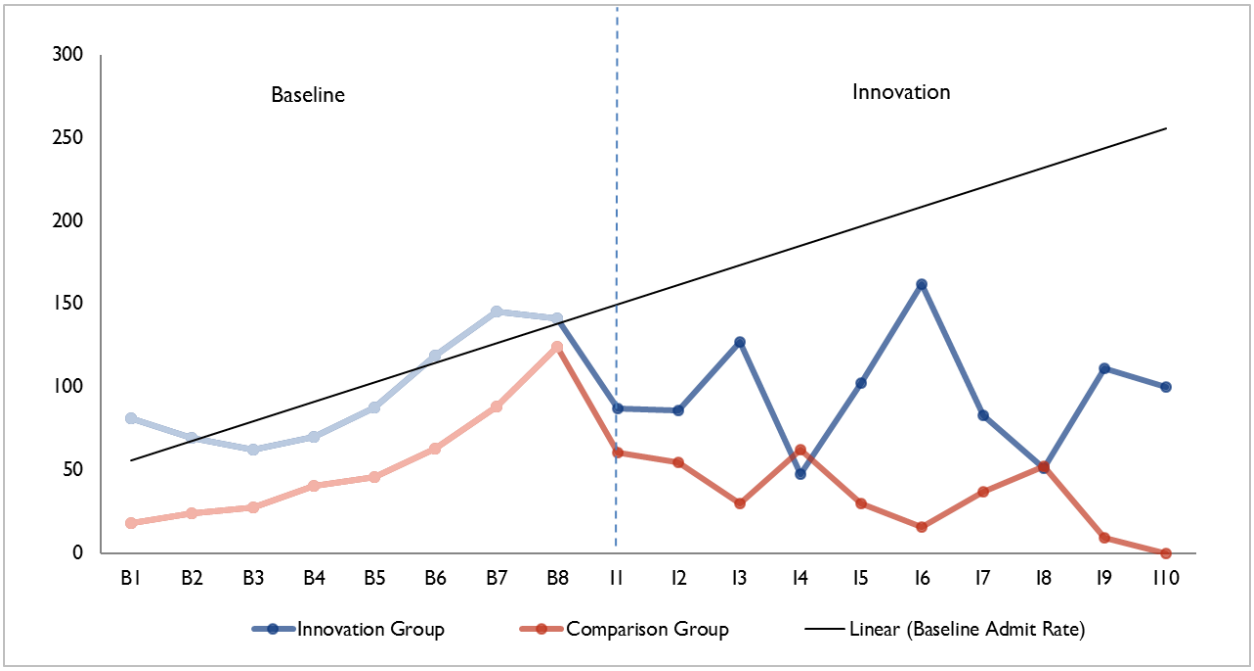
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions:

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 13. All-Cause Inpatient Admissions Rate per 1,000 Participants: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.12.2 Regression Results

As shown in ***Table 26,*** 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 probability for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −21, 30). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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. We see a large statistically significant effect of the innovation on inpatient visits in quarter 6 of the innovation (P=0.022). The increase in quarter 6 contributed to an increase in aggregate inpatient visits for the innovation group in Year 2, but we find no statistically significant effect on inpatient visits in any other year or overall. There were not enough inpatient admissions to generate a regression estimate of the innovation's impact on admissions in innovation quarter 10.

Table 26. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−19	30	0.520
I2	−15	35	0.664
I3	57	37	0.126
I4	−63	53	0.232
I5	54	39	0.174
I6	146	62	0.022
I7	15	57	0.790
I8	−34	52	0.523
I9	85	69	0.232
I10	—	—	—
Overall average	4	16	0.784
Overall aggregate	6	21	0.784
Overall aggregate (IY1)	−13	19	0.514
Overall aggregate (IY2)	16	79	0.026
Overall aggregate (IY3)	2	2	0.232

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions:

- **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 a dummy variable indicating Medicaid fee-for-service enrollment in the quarter 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.
- **Overall average:** 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; MPHI = Michigan Public Health Institute.
- — Data not yet available.

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 27*** and ***Figure 14***. 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 27. Hospital Unplanned Readmissions Rates per 1,000 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	I6	I7	I8	I9	I10
Innovation Group																		
Readmit rate	429	333	333	0	0	167	350	172	194	400	250	250	167	333	333	0	0	0
Std dev	495	471	471	0	0	373	477	378	395	490	433	433	373	471	471	0	0	0
Total admissions	7	6	6	8	8	12	20	29	31	15	16	4	6	9	3	2	3	1
Comparison Group																		
Readmit rate	0	222	0	385	353	455	449	393	355	448	200	333	143	0	0	200	0	0
Std dev	0	416	0	487	478	498	497	488	479	497	400	471	350	0	0	400	0	0
Total admissions	7	9	8	13	15	20	31	63	45	25	13	13	6	2	3	6	1	0
Innovation – Comparison Rate																		
	429	111	333	−385	−353	−288	−99	−221	−162	−48	50	−83	24	333	333	−200	0	0

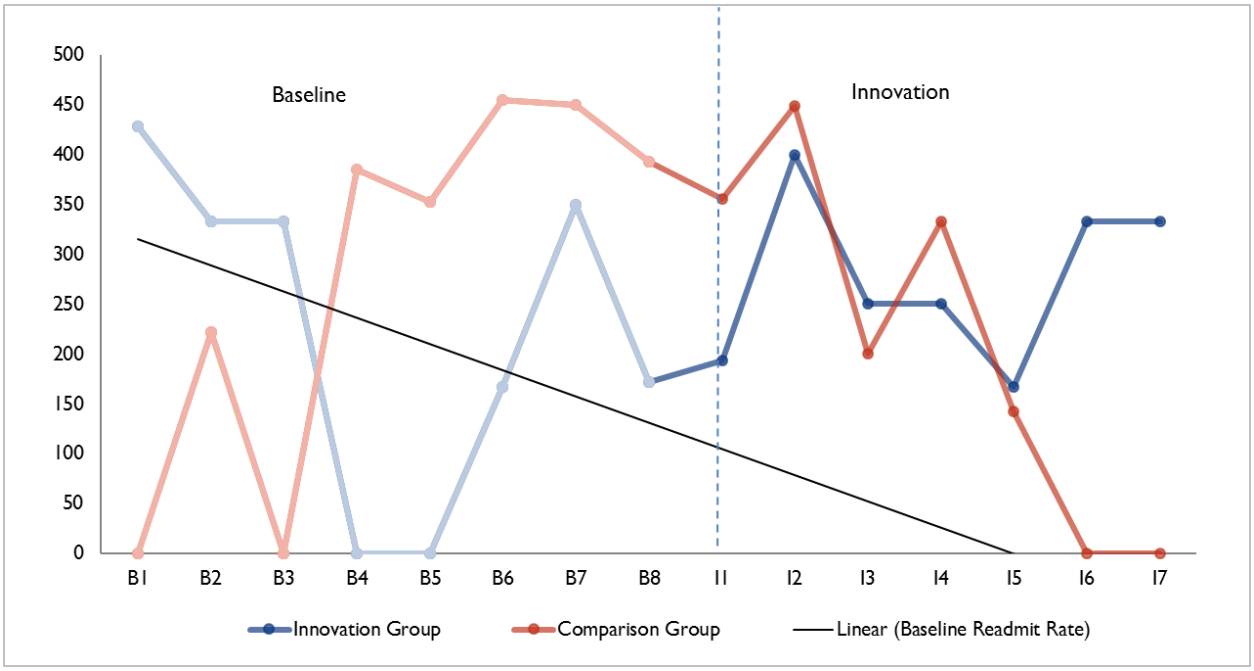
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; MPHI = Michigan Public Health Institute

Figure 14. Hospital Unplanned Readmissions Rates per 1,000 Admissions: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.13.2 Regression Results

Table 28 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 86 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is higher for the innovation group 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: −38, 210). This finding is consistent with the findings in the third annual report.

Table 28. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions: MPHI

Quarter	Coefficient	Standard Error	P-Values
Overall average	86	75	0.257
Overall aggregate	7	6	0.257

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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 a dummy variable indicating Medicaid fee-for-service enrollment in the quarter 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.
- MPHI = Michigan Public Health Institute.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 29*** and ***Figure 15.*** Both innovation and comparison groups have a spike in the ED rate in the last quarter of the baseline period. The ED trend for the comparison group is below the trend for the innovation group for most of the innovation period, except for quarter 4 when the comparison group rate is higher than the innovation group rate. Both groups spike in the final quarter of the innovation period, but the number of beneficiaries in that quarter is small. 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 groups in the regression analysis section below.

Table 29. ED Visits per 1,000 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	I6	I7	I8	I9	I10
Innovation Group																		
ED rate	496	460	487	488	642	962	891	1129	892	609	564	360	458	696	573	385	630	1300
Std dev	1694	1833	1656	1371	1808	3115	2202	2266	2222	1662	1728	1017	1208	1918	1288	1115	1149	2058
Unique patients	111	101	112	128	148	143	179	277	483	234	165	146	107	74	48	39	27	10
Comparison Group																		
ED rate	286	338	405	351	393	484	532	988	583	340	249	553	420	157	209	235	117	516
Std dev	778	694	984	828	1035	1042	1536	1821	1212	789	493	1614	982	364	450	433	281	1253
Weighted patients	181	178	168	163	160	159	179	276	482	258	176	139	111	83	58	48	34	10
Innovation – Comparison Rate																		
	209	122	81	137	249	477	359	141	309	270	315	−193	38	539	364	150	513	784

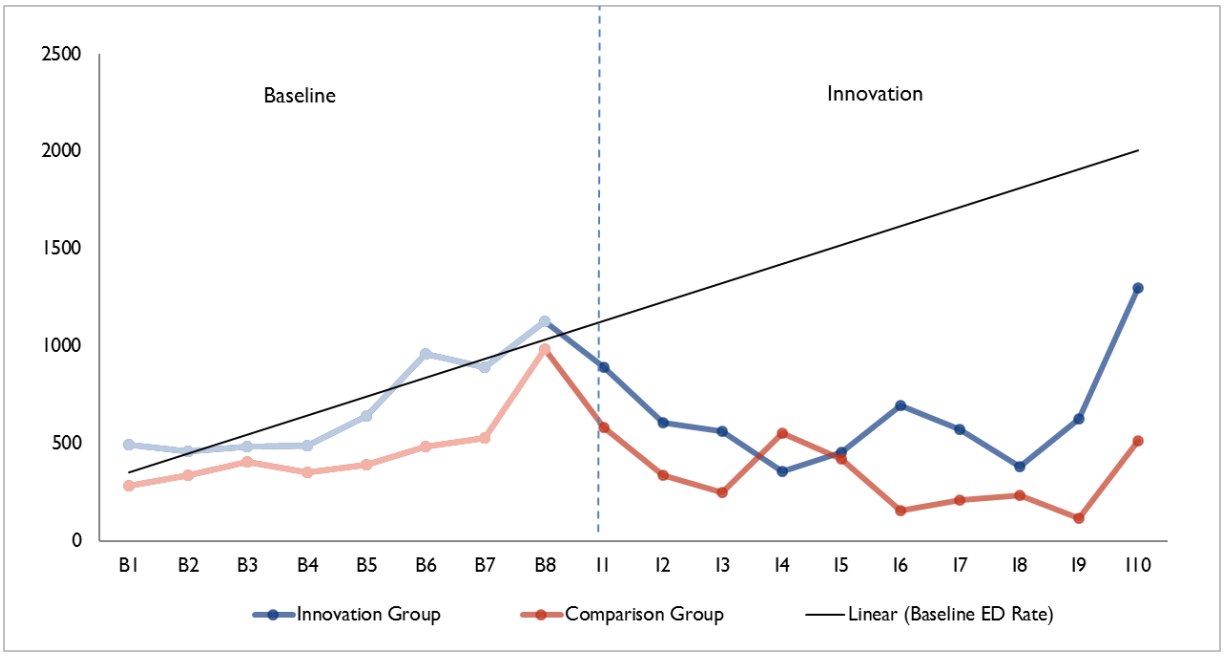
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; MPHI = Michigan Public Health Institute.

Figure 15. ED Visits per 1,000 Participants: MPHI



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute; ED = emergency department.

2.14.2 Regression Results

As shown in ***Table 30***, the average quarterly difference-in-differences estimate for ED visit admissions is a decrease of 8 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: −155, 139). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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. We see a large increase in ED visits in quarter 9 of the innovation period and in Year 3; however, the sample size in Year 3 is very small. In quarter 6 the effect is close to significance (P=0.100). There is no statistically significant effect of the innovation on ED visits in any other year or overall.

Table 30. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: MPHI

Quarter	Coefficient	Standard Error	P-Values
I1	−4	176	0.983
I2	70	153	0.646
I3	116	211	0.582
I4	−505	372	0.176
I5	−291	288	0.316
I6	387	232	0.100
I7	267	210	0.211
I8	−103	193	0.598
I9	749	356	0.045
I10	263	940	0.786
Overall average	−8	90	0.927
Overall aggregate	−11	119	0.927
Overall aggregate (IY1)	−40	112	0.721
Overall aggregate (IY2)	6	37	0.867
Overall aggregate (IY3)	23	13	0.098

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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 a dummy variable indicating Medicaid fee-for-service enrollment in the quarter 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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; MPHI = Michigan Public Health Institute.

2.15 Discussion: Medicaid Results

On the whole, we found few statistically significant effects of the innovation and Medicaid spending, indicating that the innovation did not have an impact on spending or utilization. We did find an increase in inpatient stays in Year 2 and ED visits in Year 3 of the innovation. The sample size is small, especially in the later quarters of the innovation period, which could have impacted the ability to detect significant effects, especially with rare events such as inpatient stays, readmissions, and ED visits.

As discussed with the Medicare findings, given that participants may initially be accessing additional health services, we may expect spending to increase in the shorter-term, but would expect a decrease over time as patients avoid admissions, using the ED, and readmissions. The results shown

here, thus, do not support the Pathways innovation's theory of change, because we observe no effect of the innovation on spending and increases in inpatient stays during Year 2 and ED visits in Year 3. Because the Pathways innovation provided care coordination services to reduce unnecessary ED visits and hospitalizations, these results are unlikely to be due to the innovation.

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 5 percent of the overall population reached by the innovation.

2.16 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 questions.

Table 31 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 have been received from MPHI and are included in this third annual report addendum.

Table 31. 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

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions

- BMI = body mass index; LDL-C = low-density lipoprotein cholesterol; MPHI = Michigan Public Health Institute.

Clinical effectiveness measures for MPHI include the percentage of participants with diabetes who received an HbA1c test and/or a 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.

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 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. The subsections below describe the results of each of the clinical effectiveness and health outcome measures.

Table 32 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 (41.0%), although 26.0 percent had six to eight chronic conditions, and 16.5 percent had nine or more chronic conditions. Hypertension (47.3%), depression (49.2%), arthritis (35.1%), diabetes (28.4%), anxiety (34.5%), and hyperlipidemia (25.1%) were the most prevalent conditions among participants. This table shows that MPHI is indeed serving a population with many chronic illnesses.

Table 32. Number and Percentage of Active Participants by Type and Number of Health Conditions for Those Enrolled through June 2016: MPHI

Type and Number of Health Conditions	All Active Patients[1] (N = 7,951)	
	Number	Percentage
Specific Health Condition		
Hypertension	3,757	47.3
Depression	3,914	49.2
Arthritis	2,794	35.1
Diabetes type II	2,255	28.4
Anxiety disorder	2,746	34.5
Hyperlipidemia	1,999	25.1
Other[2]	4,352	54.7
Number of Health Conditions		
≤2 conditions reported	1,309	16.5
3–5 conditions reported	3,263	41.0
6–8 conditions reported	2,068	26.0
≥9 conditions reported	1,311	16.5

[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).

Notes:
- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions
- MPHI = Michigan Public Health Institute.

2.17 Diabetes

We received data on whether patients with diabetes received an HbA1c test and/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?

2.17.1 Descriptive Results

Table 33 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 and/or an LDL-C test (31.7% and 21.1%, respectively).

Table 33. Percentage of Patients with Diabetes who Received Clinical Services

	Percentage of Patients Receiving Clinical Services
Diabetes (n=2,404)	
Percentage of patients with diabetes who received an HbA1c test	31.7
Percentage of patients with diabetes who received an LDL-C test	21.1

Notes:

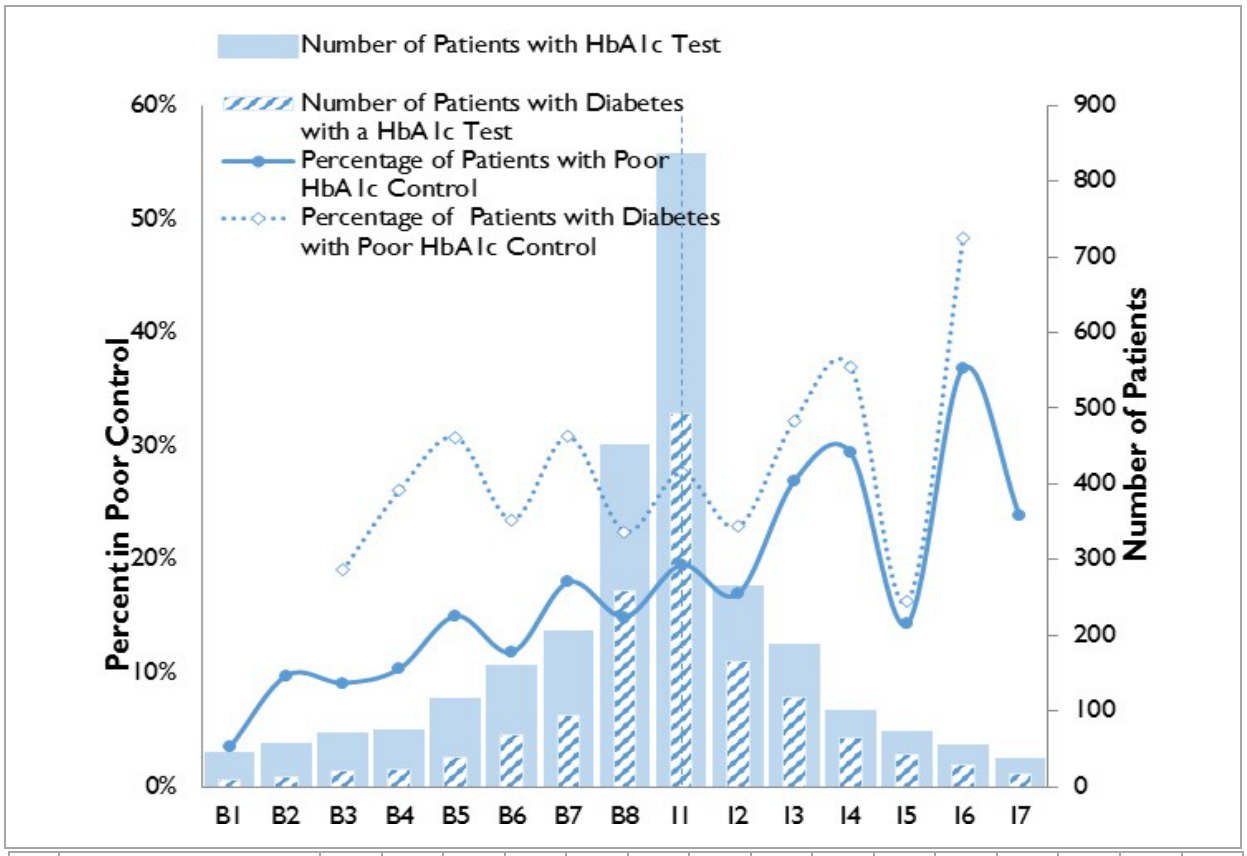
- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions

- LDL-C = low-density lipoprotein cholesterol; MPHI = Michigan Public Health Institute.

Figure 16 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 represent 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 14.3 percent and 16.3 percent, respectively. In I6, however, the percentages increase to 36.8 percent and 48.3 percent, respectively, although the number of patients with a test does decline.

Figure 16. Percentage of Patients with Diabetes with Poor HbA1c Control over Time



	Quarter	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6	I7
●	Percentage of patients with poor HbA1c control	3.4	9.8	9.1	10.3	15.0	11.8	18.0	14.9	19.5	16.9	26.9	29.4	14.3	36.8	23.8
◊	Percentage of patients with diabetes with poor HbA1c control	—	—	19.0	26.1	30.8	23.5	30.9	22.5	27.6	22.9	32.2	36.9	16.3	48.3	—
	Number of patients with HbA1c test	29	41	55	58	100	144	189	435	820	248	171	85	56	38	21
	Number of patients with diabetes with an HbA1c test	9	12	21	23	39	68	94	258	492	166	118	65	43	29	17

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

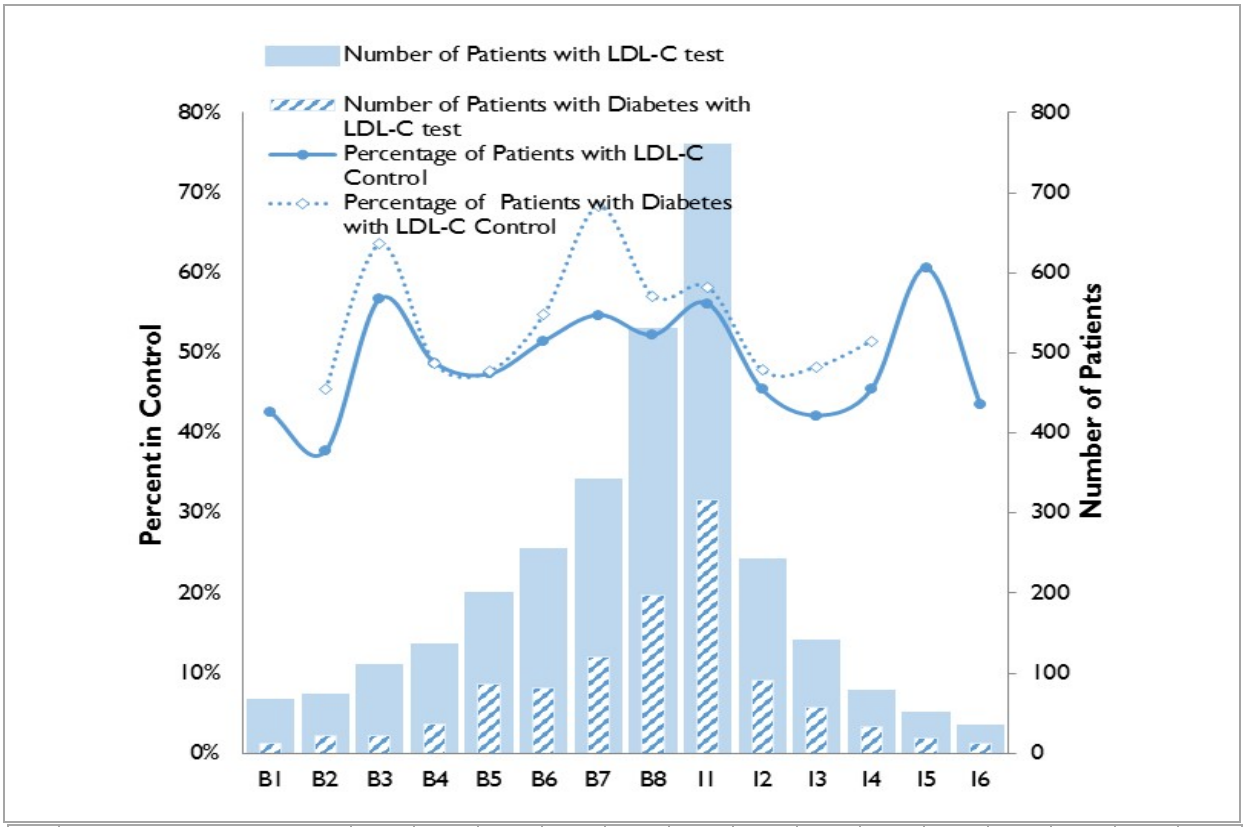
Terms and Definitions

- MPHI = Michigan Public Health Institute; ED = emergency department.
- — Data not applicable.

Figure 17 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 among patients with diabetes until I5. 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 significantly over time.

Figure 17. Percentage of Diabetes Patients with LDL-C Control over Time



	Quarter	B1	B2	B3	B4	B5	B6	B7	B8	I1	I2	I3	I4	I5	I6
●	Percentage of patients with LDL-C control	42.6	37.7	56.7	48.8	47.3	51.4	54.7	52.2	56.1	45.4	42.2	45.5	60.5	43.5
◊	Percentage of patients with diabetes with LDL-C control	—	45.5	63.6	48.6	47.7	54.9	68.3	57.1	58.2	47.8	48.3	51.5	—	—
	Number of patients with LDL-C test	54	61	97	123	188	243	329	517	748	229	128	66	38	23
	Number of patients with diabetes with LDL-C test	13	22	22	37	86	82	120	198	316	92	58	33	19	13

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions

- LDL-C = low-density lipoprotein cholesterol; ED = emergency department; MPHI = Michigan Public Health Institute.
- — Data not applicable.

2.18 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. We also received outcome data for BMI among all active patients, which allowed us to address whether the percentage of obese and overweight participants decreased during the innovation.

Evaluation Question

- What percentage of patients received a body mass index (BMI) assessment during the innovation period?
- Has the percentage of overweight patients decreased over time?
- Has the percentage of obese patients decreased over time?

2.18.1 Descriptive Results

Table 34 shows that over one-third of active patients (35.3%) received a BMI assessment during the innovation period.

Table 34. Percentage of Patients Who Received Clinical Services: MPHI

	Percentage of Patients Receiving Clinical Services
Active Patients (n =7,951)	
Percentage of patients who received a BMI assessment	35.3

Notes:
- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions
- BMI = body mass index; MPHI = Michigan Public Health Institute.

Table 35 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 20.0 percent to 21.2 percent before dropping in I6 through I9. Fewer than 10 patients, however, received a BMI assessment in these quarters. The percentage of overweight patients fluctuates over the course over the innovation, ranging from 48.3 percent in B7 to 79.1 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 35. 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	I8	I9	I10	I11	I12
Percentage of patients who are overweight: 25 < BMI < 29.9	50.0	59.4	55.8	55.6	54.3	54.6	48.3	56.8	52.6	57.5	61.8	61.8	59.6	68.1	79.1	54.2	78.6	100	83.3	100
Number of patients who are overweight: 25 < BMI < 29.9	7	19	24	35	57	83	117	370	1,096	355	251	131	90	49	34	13	11	4	5	2
Percentage of patients who are obese: BMI > 30	35.7	12.5	14.0	17.5	16.2	21.1	22.7	21.7	20.7	19.9	20.0	19.8	21.2	11.1	11.6	16.7	7.1	—	—	—
Number of patients who are obese: BMI > 30	5	4	6	11	17	32	55	141	430	123	81	42	32	8	5	4	1	0	0	0

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions

- BMI = body mass index; MPHI = Michigan Public Health Institute.
- — Data not applicable.

2.19 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?

2.19.1 Descriptive Results

Table 36 shows the percentage of patients with hypertension who received a blood pressure reading during the innovation period. Slightly less than one-half of patients with hypertension received a blood pressure reading during the innovation (42.6%).

Table 36. Percentage of Patients with Hypertension who Received Clinical Services: MPHI

	Percentage of Patients Receiving Clinical Services
Hypertension (n=3,757)	
Percentage of patients with hypertension who received a blood pressure reading	42.6

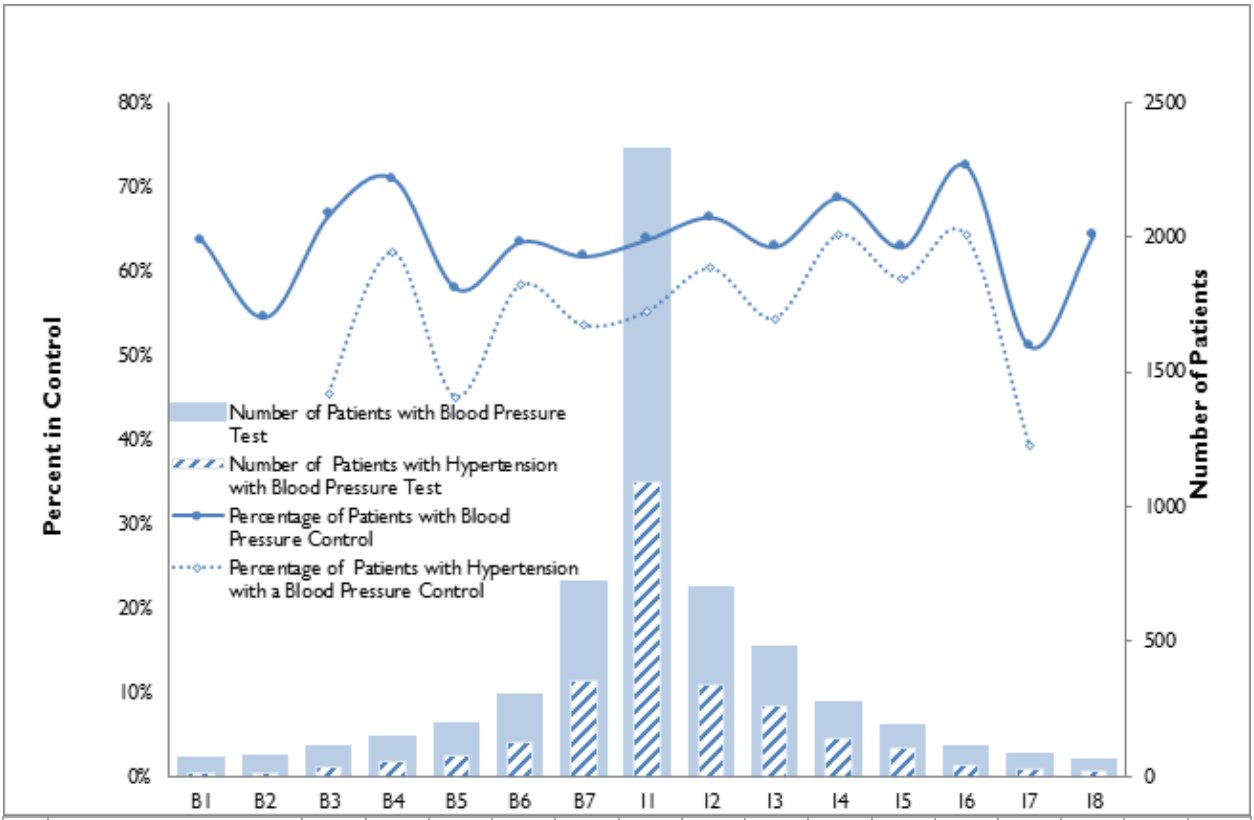
Notes:
- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions
- MPHI = Michigan Public Health Institute.

Figure 18 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 51.1 percent

in I7 to 72.4 percent in I6, while the percentage of hypertensive patients with good control ranges from 39.3 percent in I7 to 64.3 percent in I4 and I6.

Figure 18. Percentage of Patients with Blood Pressure Control over Time: MPHI



	Quarter	B1	B2	B3	B4	B5	B6	B7	I1	I2	I3	I4	I5	I6	I7	I8
●	Percentage of patients with blood pressure control	63.6	54.5	66.7	70.9	57.9	63.4	61.7	63.7	66.3	62.9	68.6	62.8	72.4	51.1	64.3
◊	Percentage of patients with hypertension with blood pressure control	—	—	45.5	62.3	45.0	58.3	53.5	55.2	60.3	54.4	64.3	59.0	64.3	39.3	—
	Number of patients with blood pressure test	33	44	75	110	159	268	687	2,289	665	447	239	156	76	47	28
	Number of patients with hypertension with blood pressure test	16	16	33	53	80	127	355	1,095	340	263	140	105	42	28	18

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.
- — Data not applicable.

2.20 Discussion: Awardee-Specific Data

The awardee-specific outcome data indicate that MPHI recruited a chronically ill population, although that does not necessarily mean that MPHI reached with the highest ED use. The findings are descriptive and therefore cannot assess the impact of the innovation on health outcomes relative to a comparison group. The trends show that health outcomes rates fluctuated over time.

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 did not provide direct clinical services to patients, but relied on clinical-based data systems such as electronic health records (EHRs) from many different providers to capture and report these data to MPHI. Therefore, the clinical assessments used to calculate health outcomes were not taken at any specific intervals or with the goal of demonstrating improved outcomes; rather, they are administered by the health care provider whenever a patient happened 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.

2.21 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 37*** lists the quantifiable measures of implementation and their status as of June 30, 2016 that RTI obtained from MPHI *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 Q15 and Q16 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 37. 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 staff in Q16	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q15 and Q16	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q15 and Q16	*Quarterly Awardee Performance Reports*
		Cumulative number of trainees since inception	*Quarterly Awardee Performance Reports*
Implementation effectiveness	Reach	Number/percentage of participants 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

Notes:

- **Source**: *Quarterly Awardee Performance Reports;* Patient-level data provided to RTI by MPHI.
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions

- FTE = full-time equivalent; MPHI = Michigan Public Health Institute; ROI = release of information

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. We present here any changes in workforce development occurring in the last six months of operation not reported in the Third Annual Report.

2.22.1 Hiring and Retention

MPHI trained and deployed 106 CHWs in the community. These CHWs operated out of CCAs in each of the three counties: Saginaw, Muskegon, and Ingham. At the end of Q16 (June 2016), the innovation was staffed with 11 staff members, which was much lower than the 59 staff members reported at the end of Q14 (December 2015) in the third annual report. As noted previously, MPHI expected

turnover to increase as the grant period ended as staff sought permanent employment elsewhere. CHW turnover throughout the rest of the award remained low.

During the NCE, maintaining the innovation was a challenge due to the lack of additional funding. As a result, MPHI experienced a reduction in staffing and infrastructure. For example, the lead agencies retained fewer Care Coordination Agencies (CCAs) and therefore fewer CHWs. MPHI reported that the HCIA funding supported 26 CHWs in Q15 but 0 in Q16. Of the three lead agencies, only Muskegon maintained staff close to Year 3 levels throughout the entire grant period as they drew staff from Mercy Health Community Benefit and Trinity Health.

2.22.2 Skills, Knowledge, and Training

For those CHWs hired to replace staff that left, MPHI conducted training in Q15. Newly hired CHWs continued to receive a 1-week intensive CHW training. By the end of Q16 (June 2016), MPHI provided 16,413.75 total hours of training to 2,833 total individuals (***Table 38***). CHWs received about 150 hours of continuing education each year. Many of the CCAs also conducted Personal Action Toward Health (PATH) classes. These trainings included motivational interviewing, learning to identifying hoarding habits, smoking cessation counseling, and fall prevention.

MPHI reported that *"more thorough training in the beginning"* for CHWs would have facilitated implementation of the Pathways model. The Minnesota CHW training program used as a model for the 1-week intensive CHW training lasts 6 weeks, for example. Due to the limited time awardees had to provide training before implementation, MPHI reduced training to a week.

In Year 2 MPHI discovered CHWs and supervisors did not fully understand when or when not to use a Pathway. Often CHWs would either not fully record a Pathway or chose a Pathway that required less time or less burden on the CHW to implement. MPHI provided additional trainings to CHWs on proper use of the Pathways.

Table 38. Training Provided to Staff: MPHI

Time Frame	Number of Training Hours	Number of Trainees
Q15 & Q16 (January–June 2016)	852	243
Since inception	16,413.75	2,833

Notes:
- **Source:** *Q15–Q16 Quarterly Awardee Performance Report*.
- **Trainees are counted** more than once of they participated in more than one HCIA training course.
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions
- Q = quarter; MPHI = Michigan Public Health Institute.

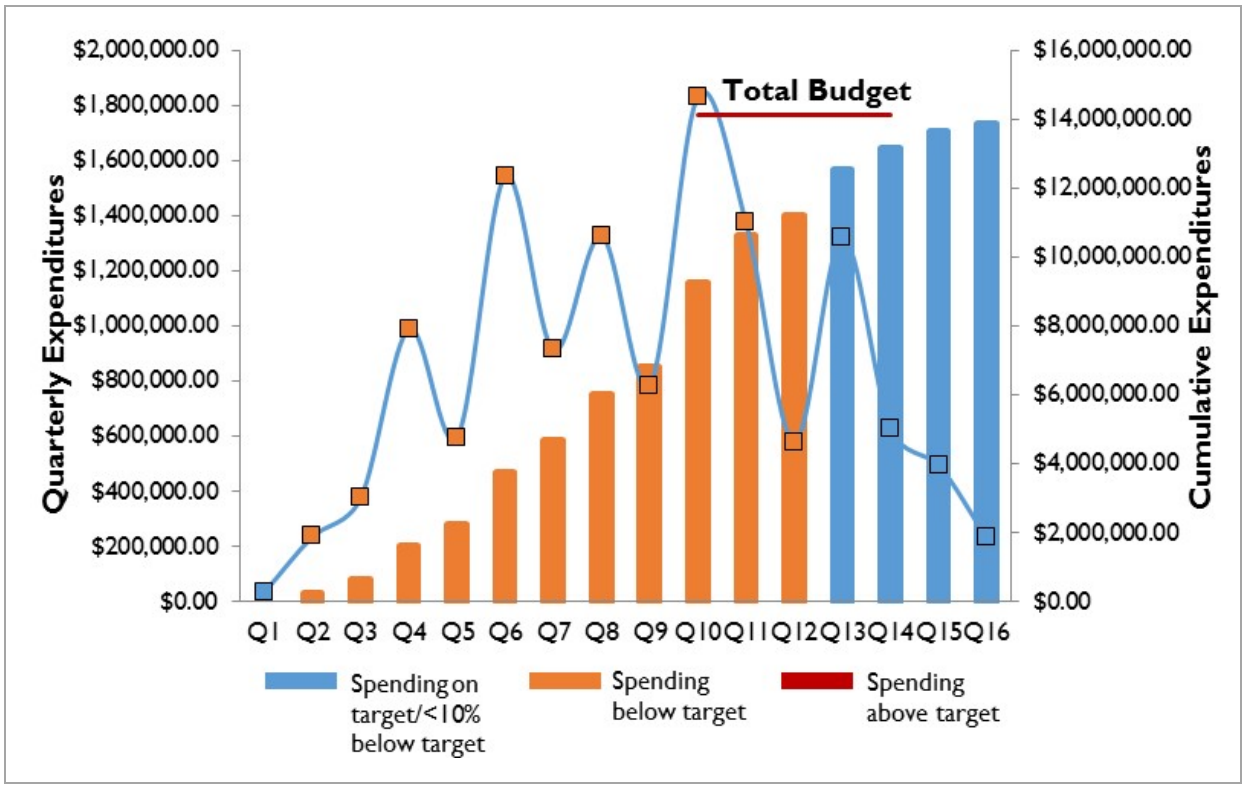
2.23 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. This section provides updates to three contextual factors—award execution, leadership, and organizational capacity.

2.23.1 Award Execution

The annual report highlights the significance of MPHI's expenditure rates on implementation. As of June 2016 (Q16), MPHI spent 98 percent of its total budget, which is at the projected target given the end of the grant period (see ***Figure 19***).

Figure 19. Cumulative Spend Rate from Q1 (June 1, 2012) to Q16 (June 30, 2016): MPHI



Notes:

- **Source:** *Quarterly Awardee Performance Report*.
- **Period of activity:** June 2012 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.23.2 Leadership

As discussed in the third annual report, support from project leadership was high at MPHI and the three implementing sites throughout the award. MPHI and the Pathways project directors have

experience conducing similar federal and state-funded innovations that address health disparities in Michigan. During the beginning of the award MPHI hired a new Chief Executive Officer (CEO), formerly of a partnering organization. The newly hired CEO brought new opportunities and partnerships to MPHI and the Pathways innovation. No changes in leadership occurred since last reported.

2.23.3 Organizational Capacity

No changes in MPHI's organizational capacity occurred since the last annual report. As reported, MPHI's organizational structure and available resources facilitated implementation of the Pathways innovation. MPHI offered fiduciary and federal compliance support, multisite project management expertise, collaboration and subrecipient contracting with lead agencies, and technical assistance. MPHI also created and managed the MiPathways data system and training to sites and staff.

During Year 3 and the NCE, one hub, however, continued to face challenges. In Ingham, MPHI reported that collaboration between the hub and the county health department continued to be challenging. As reported in previous annual reports, many key organizations in Ingham are siloed in their activities, making collaboration difficult. To solve these issues and others that arose with smaller community organizations, MPHI focused additional efforts and resources toward these organizations. MPHI staff considered the collaboration across all sites to be sufficient, and overall implementation effectiveness was not limited by organizational capacity issues. However, according to one key informant, the NCE period revealed that implementation of the Pathways model "in the real world" will require more flexibility in how the model would be implemented.

2.23.4 Innovation Adoption and Workflow Integration

Minimal changes occurred during implementation of the Pathways innovation. During the NCE period, the hubs developed and strengthened partnerships, thereby increasing innovation adoption and integration. One of the hubs established a new relationship with a local hospital, and a CHW dedicated part of her time to recruiting clients in the ED. In addition to gathering referrals in the ED, CHWs continued to work with PC practices and community agencies.

> ***We had a CHW working 4 hours a week in the emergency rooms, and they were making 'rounds.' They would do screening to see if any patients were eligible for the Pathways and they could go directly into the room and talk to the client and make a referral.***

By the end of the Q16, all three hubs achieved level 1 certification through the Pathways Community Hub Certification Program.[5] Overall, MPHI successfully adapted and implemented Pathways at all three sites.

[5] https://pchcp.rockvilleinstitute.org/program-overview/

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 have 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). This section provides an update to the reach measures presented in the third annual report.

2.24.1 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 39***, 8,812 participants were enrolled across the three sites, but only 7,951 (approximately 90 percent) were considered active through June 2016 (Q16).

During the NCE, MPHI continued to enroll participants, but at slower rate. MPHI continued to encourage enrollment of high utilizers.

> ***We were really putting emphasis on recruiting high utilizers, those people who represent the greatest savings and doing the most good. So, we're not changing the population but emphasized recruitment within a particular characteristic.***

The number of enrolled and active participants reported vary across the three sites. Although Muskegon had the largest number of enrollees (3,552) only 84 percent of their enrollees were active (i.e., signed a ROI and completed an adult checklist) compared to Ingham where over 95 percent of enrollees were active and 93 percent of Saginaw enrollees were active. Differences across sites 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, thereby facilitating enrollment. A key informant attributed Saginaw's enrollment to warm handoffs.

> ***We had people who were on the frontlines and engaged in social marketing. It was transformative for people we served. We made new friends, established collaborative partnerships, and created a new profession.***

CHWs were also key to enrolling participants, especially CHWs working with providers to facilitate warm handoffs. In contrast, engaging patients through cold calling resulted in low enrollment. A key informant reported one hospital cold-called 175 eligible patients, only enrolling 12.

Table 39. MPHI Enrolled and Active Participants as of June 2016: MPHI

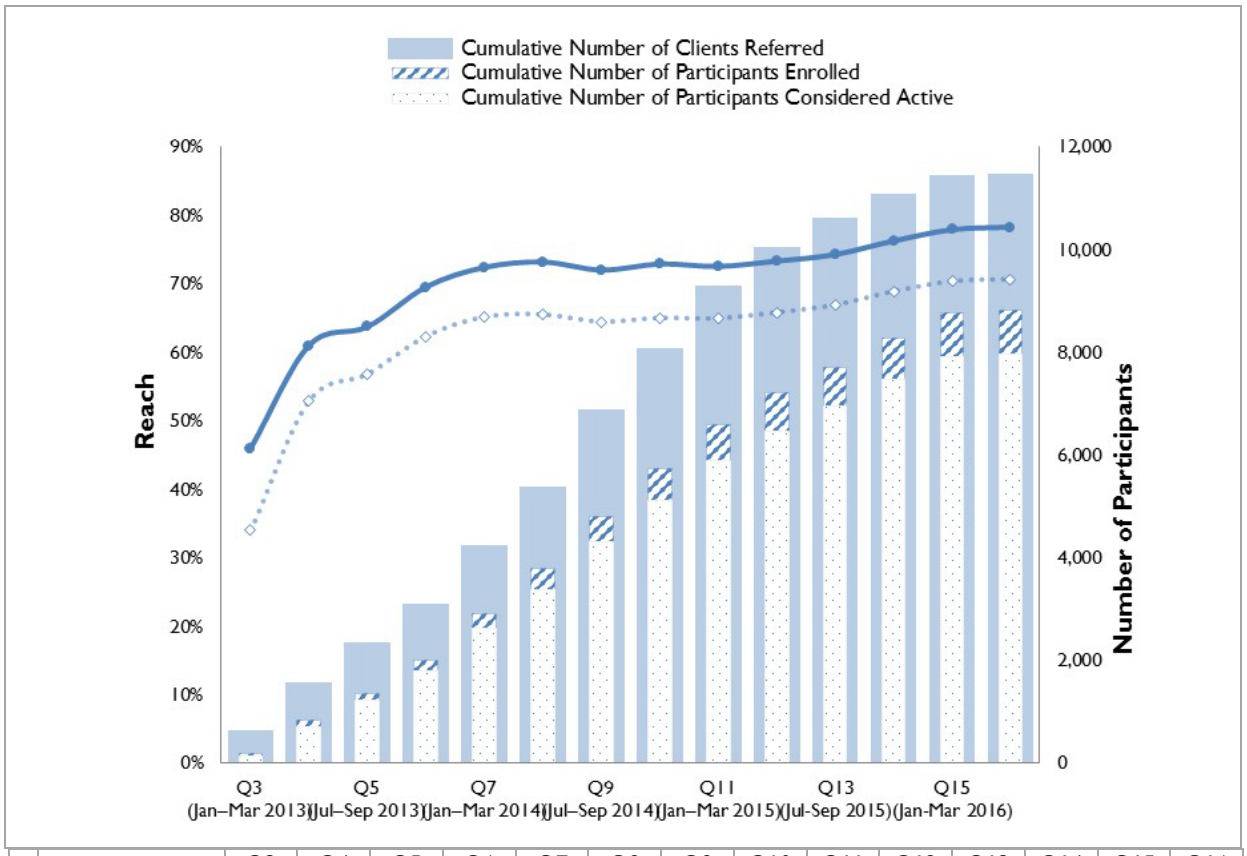
Participants	Saginaw	Muskegon	Ingham	Total
Number enrolled: ROI signed	2,022	3,552	3,238	8,812
Number active: ROI signed + adult checklist	1,881	2,989	3,081	7,951
Difference in participants: ROI signed but no adult checklist	141	563	157	861

Notes:
- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions
- ROI = release of information; MPHI = Michigan Public Health Institute.

Figure 20 shows reach by quarter since the launch of the innovation. We last reported reach in the third annual report, based on data through Q14. Since the third annual report, MPHI enrolled an additional 511 patients, and an additional 497 participants are considered active. Reach increased from 76.3 percent in Q14 to 78.3 percent in Q16 for those enrolled, and 68.9 percent in Q14 to 70.6 percent in Q16 for those considered active. These numbers vary slightly from what was reported in the third annual report, as MPHI provided new cumulative data that contain slight modifications in previously reported quarters. MPHI successfully enrolled and engaged 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 would greatly benefit from the program and were likely to stay engaged and complete the relevant Pathways.

Figure 20. Participant Enrollment and Reach for Each Quarter since Project Launch: MPHI



	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)	Q15 (Jan-Mar 2016)	Q16 (Apr-Jun 2016)[1]
●	Cumulative enrolled reach per quarter (%)	45.9	61.0	63.7	69.5	72.4	73.2	72.2	72.9	72.5	73.3	74.3	76.3	77.9	78.3
◊	Cumulative active reach per quarter (%)	34.0	52.9	56.8	62.3	65.1	65.5	64.1	65.0	64.9	65.8	66.9	68.9	70.3	70.6
	Cumulative number of clients referred	429	1,353	2,141	2,888	4,034	5,168	6,675	7,862	9,069	9,830	10,387	10,862	11,237	11,258
	Cumulative number of participants enrolled	197	825	1,364	2,008	2,920	3,781	4,817	5,730	6,577	7,206	7,714	8,283	8,754	8,812
	Cumulative number of participants considered active	146	716	1,217	1,800	2,628	3,385	4,282	5,110	5,890	6,468	6,949	7,480	7,904	7,951

[1] Includes one patient with missing enrollment dates.

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- MPHI = Michigan Public Health Institute.

2.24.2 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 third annual report. ***Table 40*** shows the number of Pathways provided across 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 (63.2%) an average of 5.7 times, and social service referrals, completed by 77.7 percent of participants an average of 4.7 times. In addition, half (50.7%) of all participants completed the Medication Assessment Pathway an average of 1.3 times and two-fifths (43.1%) of all participants complete the Education Pathway. All Pathways retained a similar percentage of patients completing the Pathway as the third annual report. Fewer than 30 percent of participants completed the remaining Pathways. Overall, participants completed an average of approximately three Pathways.

Table 40. Number and Types of Services 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	28,828	5,023 (63.2)	5.7
Social service referral	29,236	6,175 (77.7)	4.7
Medication assessment	5,085	4,033 (50.7)	1.3
Education	11,974	3,430 (43.1)	3.5
Health insurance	1,502	1,339 (16.8)	1.1
Medical home	1,961	1,526 (19.2)	1.3
PHQ-9 screening tool	3,704	2,364 (29.7)	1.6
Fall prevention tool	2,389	1,798 (22.6)	1.3
Medication management	694	577 (7.3)	1.2
Healthy changes plan	1,328	769 (9.7)	1.7
Healthy home checklist	575	496 (6.2)	1.2
Tobacco cessation	255	246 (3.1)	1.0
CAGE AID	302	221 (2.8)	1.4
Family planning	60	53 (0.7)	1.1
Pregnancy	76	72 (0.9)	1.1
Postpartum	38	37 (0.5)	1.0
Total number completed	88,007	28,159	3.1

[1] Individuals may have completed Pathways multiple times.
[2] Counts only one completed Pathway per participant.

Notes:

- **Source:** Patient-level data provided to RTI by MPHI.
- **Period of activity:** April 2013 to June 2016.

Terms and Definitions

- CAGE AID = CAGE Questionnaire Adapted to Include Drugs; PHQ-9 = Patient Health Questionnaire; MPHI = Michigan Public Health Institute.

2.25 Qualitative Findings: Sustainability

The Pathways innovation will be partially sustained. As on key informant described, each community hub is working towards sustainability.

> ***The hubs have looked for other funders, the state of Michigan Medicaid, application for payers… Ingham has one contract, Saginaw is trying, Muskegon is entirely different, they are part of the Trinity health system and Trinity's CEO was very interested in this project since he was running the office of CMMI at the time of the grant award.***

Muskegon is currently funded by Trinity Health. This partnership will continue after the NCE ends, July 1, 2016. Trinity Health has piloted the Pathways innovation in some hospital systems nationally, having Muskegon consult. In addition, the Muskegon was chosen as one of the State Innovation Model (SIM) pilot counties in Michigan. Muskegon will be implementing the pathways innovation as part of SIM. In addition, the pathways innovation in Muskegon has expanded to serve additional populations.

Ingham County government provided funding support for the pathways innovation in Ingham. Ingham CHWs will continue to serve patients at Ingham FQHCs and will continue to use the MiPathways data system. The Ingham County Health Department and MPHI are drafting a contract allowing changes to and the ability to sustain the MiPathways data system for use by the Ingham hub. The Ingham hub will continue to provide services to the other non-HCIA funded Care Coordination Agencies (CCAs), the Mid-Michigan District Health Department, and the Barry-Eaton District Health Department.

Saginaw community hub will also continue using MiPathways and provide services to women and children. Two CCAs will sustain staff previously supported by HCIA funds following the end of the NCE period. Another CCA secured funding to keep serving their patients. Saginaw continues to seek additional funding sources, including foundation funders and from contracts with Medicaid Managed Care Payers.

> ***The innovation ended on March 31 [for the three communities]. We have been focusing on sustainability and creating a sustainability plan. We have state initiatives played in our favor as it relates to our sustainability. […]. We have some health plans that wanted to hire their own CHWs, but others were willing to contract with the Pathways, because we already had CHWs on the ground. This gave us a bit of a leg up on sustainability options.***

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 63.2 percent of participants an average of 5.7 times. Social service referrals were completed by 77.7 percent of participants an average of 4.7 times.	***Innovation reach:***	Overall reach increased from 76.3 percent to 78.3 percent for those enrolled and from 68.9 percent to 70.6 percent 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 by facilitating access to care Pathways (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 60.8 percent were female. Over 45 percent were covered by Medicaid; 17.5 percent were covered by Medicare, including Medicare Advantage, and 21.6 percent were covered by both Medicare and Medicaid.
Sustainability:	The Pathways innovation will be partially sustained at each of the three sites. Each site and MPHI continue to seek additional funding to ensure sustainability. MPHI worked with each of the sites during Q15 and Q16 to secure funding to sustain the innovation.		
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 ($502; 90% CI: $206, $798). The innovation had no statistically significant effects on average quarterly Medicaid spending (−$54; 90% CI: −$675, $567). The increase in Medicare spending may result from the innovation's focus on improving beneficiaries' use of appropriate services. On average, there was only a 0.3 percent chance of overall Medicare savings greater than 0 but a 56 percent chance of overall Medicaid savings greater than 0.

Better care. The innovation had no effect on inpatient admissions (−2; 90% CI: −12, 8) or ED visits (4; 90% CI: −17, 26) per 1,000 participants per quarter for Medicare beneficiaries. ED visits did statistically significantly increase in Year 1 (44; 90% CI: 16, 71) and significantly decreased in Year 2 (−40; 90% CI: −78, −1). Inpatient admissions per 1,000 admissions per quarter increased overall (39: 90% CI: 8, 70). Changes in inpatient stays (4; 90% CI: −21, 30), ED visits (−8; 90% CI: −155, 139), and unplanned readmissions (86; 90% CI: −38, 210) 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. Although levels of LDL-C control among patients with diabetes fluctuates, there was a steady increase from 47.8 percent in the second innovation quarter to 51.5 percent in the fourth 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 Addendum 2017

Awardee-Level Findings:

Mineral Regional 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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Mineral Regional

Data Source	Period Covered
Medicare claims data	November 2012–June 2016
Terms and Definitions • Mineral Regional Mineral Regional Health Center.	

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. Below we present the goals as well as the findings for this innovation.

1. **Smarter spending.**

   Goal: Lower total expenditures by 7 to 15 percent over 3 years for frontier and rural populations, patients, and communities.

   Findings: The probability of savings over the full innovation period is 21 percent. Savings were much more likely in the first six quarters of the innovation period as quarterly spending per patient decreased in innovation CAHs. In quarters 7 through 13, losses occurred in the innovation period as quarterly spending per patient increased. Because of the indirect design of the innovation and focus on process improvement, RTI cannot conclude that the innovation caused these changes in spending.

2. **Better care.**

   Goal: Increase patients' satisfaction and improve their experience by 30 percent over 3 years for frontier and rural populations, patients, and communities.

   Findings: For beneficiaries who visited innovation CAHs, readmissions increased during the innovation period but the impact of the innovation on ED visits and inpatient admissions was mixed. Compared to beneficiaries who visited comparison CAHs, beneficiaries in innovation CAHs had fewer ED visits in the first year of the innovation with higher ED visits in Years 2 through 4. For inpatient admissions, beneficiaries who visited comparison CAHs had fewer inpatient admissions in the first 2 years of the innovation with higher inpatient admissions in Years 3 through 4. These results may reflect the focus of the innovation: to improve processes, increase efficiency, and manage the cost of care in areas such as supply chain enhancements.

3. **Healthier people**.

   Goal: Improve outcomes by 10 percent over 3 years for frontier and rural populations, patients, and communities.

   Findings: No health outcomes data were received so no results are available to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected during the innovation period. Total spending increased over the 4 years of innovation in participating CAHs by $4.8 million. In the first year after the innovation (Year 1) total spending significantly decreased by $5.9 million (p=0.02). In subsequent years, compared to beneficiaries who visited comparison CAHs, total spending for beneficiaries in innovation CAHs increased by $4.2 million in Year 2, $5.9 million in Year 3 (p=0.02), and $612,000 in Year 4. Calculating the average impact per quarter per participant, participating CAHs had a nonsignificant increase in spending of $28 per participant per quarter over the 4 years of the innovation, with −$106 (p=0.02), $77, $113 (p=0.02) and $69 changes in average quarterly spending in Years 1, 2, 3, and 4, respectively. Because of the indirect design of the innovation and focus on process improvement, RTI cannot conclude that the innovation caused these changes in spending.

Except for Year 4, acute inpatient stays were significantly lower for beneficiaries who visited innovation CAHs throughout the innovation period. Readmissions, on the other hand, were significantly higher. ED visits for beneficiaries who visited innovation CAHs were significantly lower in Year 1 (−26 ED visits per 1,000 patients, $p < 0.01$) but significantly higher in Years 2 through 4. Most of the projects implemented as part of the overall innovation focused on process improvements within the participating CAHs rather than direct service delivery changes relevant to quality of care. Consequently, it is unlikely that the innovation is the source of changes in utilization.

Table 2. Summary of Medicare Claims-Based Findings: Mineral Regional

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI	Year 4	90% CI
Aggregated results											
Total spending (in millions)	$4.801	−$4.970, $14.572	−$2.802, $12.405	−$5.888	−$10.070, −$1.702	$4.199	−$0.066, $8.463	$5.878	$1.570, $10.186	$0.612	−$0.664, $1.887
Acute care inpatient stays	−1,187	−1,886, −488	−1732, −643	−483	−892, −75	−423	−823, −23	−300	−676, 76	19	−121, 159
Hospital-wide all-cause unplanned readmissions	172	59, 284	84, 260	—	—	—	—	—	—	—	—
ED visits not leading to a hospitalization	3,008	1,461, 4,555	1803, 4213	−1,427	−2,336, −519	2,062	1,186, 2,937	1,778	939, 2,616	596	285, 907
Average change per quarter											
Spending per participant	$28	−$29, $85	−$16, $73	−$106	−$181, −$31	$77	−$1, $156	$113	$30, $196	$69	−74, $212
Acute care inpatient stays (per 1,000 participants)	−7	−11, −3	−10, −4	−9	−16, −1	−8	−15, 0	−6	−13, 1	2	−14.18
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	11	4, 18	5, 16	—	—	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	18	9, 27	11, 25	−26	−42, −9	38	22, 54	34	18, 50	67	32,102

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** January 2010 to June 2016.
- **Sample:** Critical access hospitals in Montana.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and Definitions

- **Spending per participant** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential spending by beneficiaries who visit innovation and comparison CAHs. 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) is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of inpatient utilization by beneficiaries who visit innovation and comparison CAHs. Acute care inpatient stays is 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) is the average quarterly effect from a simple difference-in-differences model, indicating the differential rate of unplanned readmissions utilization by beneficiaries who visit innovation and comparison CAHs. 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) is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization by beneficiaries who visit innovation and comparison CAHs. ED visits not leading to a hospitalization is 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.
- CAH = critical access hospital; CI = confidence interval; ED = emergency department; Mineral Regional = Mineral Regional Health Center.
- — Not applicable due to small sample size.

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 3 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 3. Claims-Based Outcome Measures: Mineral Regional

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

Notes

- Medicaid data were not updated for this third annual report addendum. Medicaid results are unchanged from the third annual report and, thus, not included here.

Terms and Definitions

- ED = emergency department; Mineral Regional = Mineral Regional Health Center.

2.3 Medicare Comparison Group

We report health care utilization and costs for patients who were admitted to 25 CAHs participating in the Mineral Regional innovation before and after the innovation period (innovation group), as well as individuals admitted to any of the 23 nonparticipating CAHs in Montana (comparison group). In this report, we compare differences in health care utilization and costs for patients who visit innovation and comparison CAHs. In the innovation period, patients had 170,976 and 157,160 visits to innovation and comparison CAHs, respectively. ***Table 4*** describes patient characteristics by innovation and comparison CAHs in the first quarter of innovation. See the third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 4 reports Medicare spending per patient in the 8 quarters before and the 13 quarters after the innovation began. Savings per patient reflect the spending differential between beneficiaries who visits comparison and innovation CAHs, not controlling for other factors. ***Figure 1*** illustrates Medicare spending per beneficiary. The blue line represents values for beneficiaries visiting an innovation CAH and is darker in innovation quarters. The red line represents values for beneficiaries visiting a comparison CAH is darker in innovation quarters. The graph includes a trend line for innovation beneficiaries based on linear regression for baseline quarters. Average spending for beneficiaries visiting an innovation CAH is very similar to beneficiaries visiting a comparison CAH in the baseline period. These trends are similar to the third annual report. In the innovation period, beneficiaries visiting an innovation CAH (innovation group) have lower spending than beneficiaries visiting a comparison CAH (comparison group) in the first 2 quarters of the innovation period. From quarters 3 through 13, the innovation group spends more than the comparison group.

Table 4. 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	$956	$925	$941	$968	$1,025	$1,095	$1,100	$1,174	$1,215	$1,190	$1,188	$1,242	$1,224	$1,298	$1,272	$1,326	$1,342	$1,359	$1,250	$1,299
Std dev	$1,317	$1,425	$1,308	$1,468	$1,400	$1,420	$1,549	$1,647	$1,802	$1,797	$1,732	$1,863	$1,886	$1,709	$1,915	$1,854	$1,922	$1,971	$1,956	$1,822	$1,837
Unique patients	11,023	11,493	12,108	12,493	12,350	12,583	13,184	13,872	13,823	13,654	13,953	14,174	13,507	13,065	13,842	14,012	13,509	12,926	12,698	12,897	8,916
Comparison Group																					
Spending rate	$877	$926	$897	$953	$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	$1,223	$1,109	$1,223
Std dev	$1,316	$1,469	$1,382	$1,432	$1,391	$1,579	$1,637	$1,849	$2,067	$2,020	$1,716	$1,942	$1,790	$1,881	$1,742	$1,725	$1,856	$1,931	$2,016	$1,752	$1,900
Weighted patients	9,588	9,710	10,646	10,870	10,743	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	12,624	12,756	12,343
Savings per Patient																					
	−$24	−$30	−$28	$12	−$24	$31	−$78	−$11	$41	$101	−$35	$26	−$81	−$24	−$185	−$147	−$170	−$57	−$136	−$141	−$76

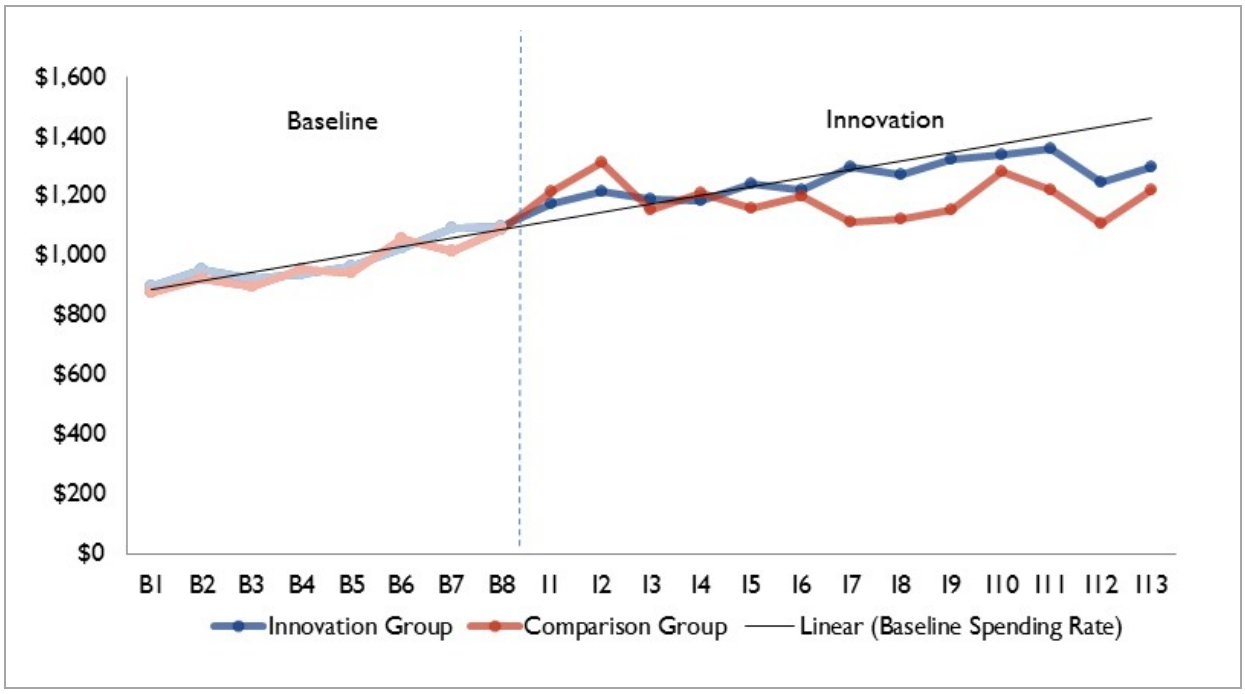
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 1. Medicare Spending per Participant: Mineral Regional



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- Mineral Regional = Mineral Regional Health Center.

2.4.2 Regression Results

In ***Table 5,*** we present the weighted average treatment effect per quarter during the innovation period for beneficiaries visiting innovation CAHs compared to beneficiaries visiting the comparison CAHs. The weighted average quarterly spending difference in the innovation period is $28 (90% CI: −$29, $85), indicating a loss. The effect is not statistically significant. This finding is consistent with the finding in the third annual report. Beneficiaries visiting innovation CAHs spend $28 more than beneficiaries visiting comparison CAHs in the innovation period. This estimate represents the differential spending per quarter in the innovation period between individuals visiting 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.

We also present quarterly effects derived from 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 beneficiaries who visit innovation and comparison CAHs. ***Figure 2*** illustrates these quarterly difference-in-differences estimates. The evidence on savings is mixed. In the first six quarters after innovation the program shows savings with significant evidence for savings in quarters 1 (−$139, p=0.07) and 2 (−$182, p=0.03). In quarters 7 through 13, losses occur with significant

evidence for losses in quarters 7 ($198, p=0.01), 8 ($145, p=0.05), 11 ($149, p=0.07), and 12 ($165, p=0.02)

Table 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−$139	$77	0.070
I2	−$182	$82	0.025
I3	$19	$71	0.791
I4	−$123	$78	0.114
I5	−$2	$78	0.981
I6	−$43	$81	0.601
I7	$198	$77	0.010
I8	$145	$74	0.050
I9	$132	$80	0.102
I10	$5	$86	0.950
I11	$149	$82	0.068
I12	$165	$72	0.022
I13	$69	$87	0.430
Overall average	$28	$35	0.419
Overall aggregate	$4,801,154	$5,940,160	0.419
Overall aggregate (IY1)	−$5,887,502	$2,544,557	0.021
Overall aggregate (IY2)	$4,198,681	$2,592,714	0.105
Overall aggregate (IY3)	$5,878,301	$2,619,108	0.025
Overall aggregate (IY4)	$611,674	$775,292	0.430

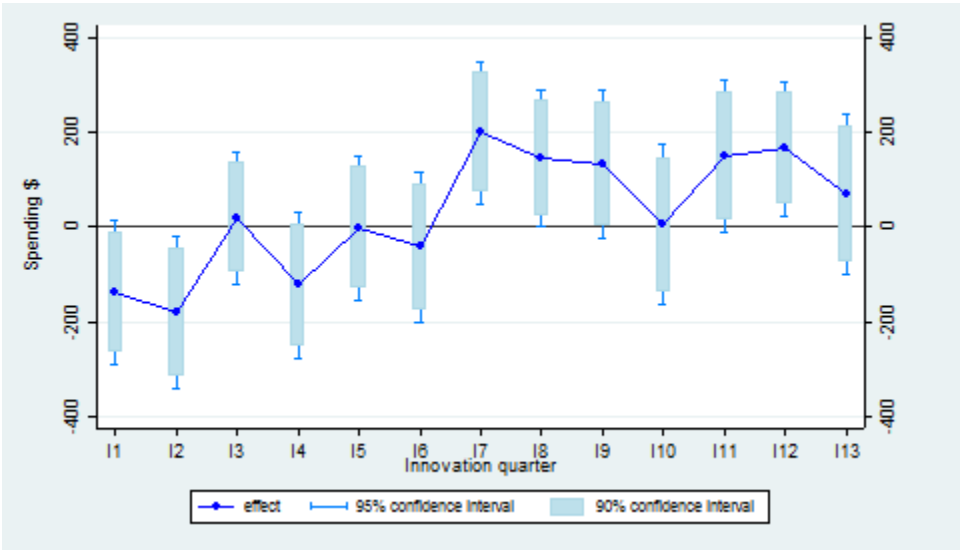
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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 who visit innovation CAHs compared to beneficiaries who visit comparison CAHs.
- I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; Mineral Regional = Mineral Regional Health Center.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Mineral Regional



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** January 2010 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; Mineral Regional = Mineral Regional Health Center.

Figure 3 presents the probabilities in favor of savings or loss. The larger the probability, the more convincing the evidence is for saving or losing money on this initiative. Overall, the figure shows a high probability of savings greater than $50 in the first six quarters of program implementation and a high probability of loss in later quarters. The probability of savings over the entire innovation period is estimated as 21 percent.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Mineral Regional

Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- 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 6*** and ***Figure 4***. Beneficiaries who visit innovation CAHs have lower inpatient admission than beneficiaries who visit comparison CAHs in both the baseline and innovation period. These trends are similar to the third annual report.

Table 6. 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

	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																					
Admit rate	50	53	52	49	50	53	55	53	61	67	63	61	63	64	63	57	63	63	62	54	64
Std dev	126	130	131	131	126	129	135	135	145	151	147	146	146	145	149	137	146	147	148	141	150
Unique patients	11,023	11,493	12,108	12,493	12,350	12,583	13,184	13,872	13,823	13,654	13,953	14,174	13,507	13,065	13,842	14,012	13,509	12,926	12,698	12,897	8,916
Comparison Group																					
Admit rate	67	67	58	59	58	64	58	58	71	87	75	80	79	80	71	67	71	84	71	63	72
Std dev	154	156	142	147	139	146	144	145	164	174	162	179	169	163	160	152	159	169	163	154	165
Weighted patients	9,588	9,710	10,646	10,870	10,743	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	12,624	12,756	12,343
Innovation − Comparison Rate																					
	−17	−14	−6	−10	−9	−11	−3	−5	−10	−20	−11	−19	−16	−15	−8	−10	−8	−21	−9	−8	−8

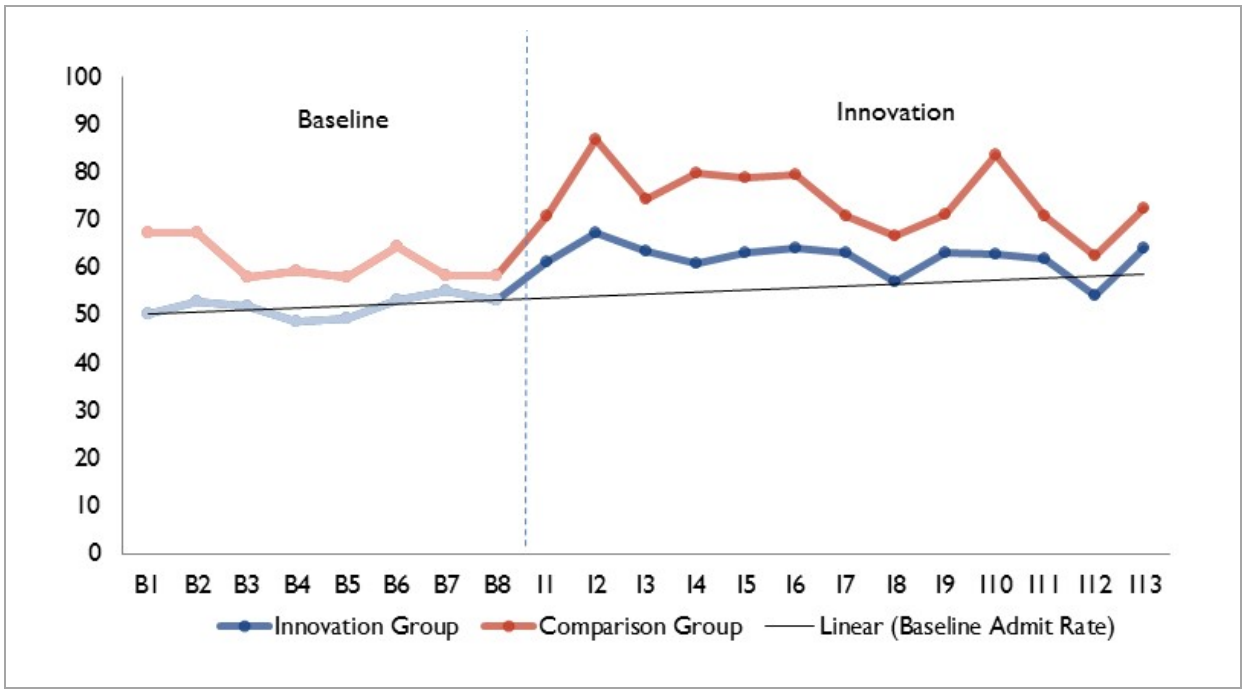
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Mineral Regional



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- Mineral Regional = Mineral Regional Health Care.

2.5.2 Regression Results

As shown in ***Table 7***, 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 for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −11, −3). This finding is consistent with the finding in the third annual report.

We also present quarterly effects with the dependent variable equal to the number of inpatient admissions 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. Relative to the comparison group (beneficiaries who visit comparison CAHs), the innovation group (beneficiaries who visit innovation CAHs) saw less inpatient admissions after program implementation. Significant evidence for reduced inpatient admissions were observed in quarters 4 (−143, p=0.10) and 10 (−210, p=0.03).

Table 7. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Admissions per 1,000 Participants: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−13	85	0.883
I2	−119	97	0.221
I3	−72	88	0.414
I4	−143	87	0.099
I5	−126	94	0.179
I6	−101	93	0.280
I7	−5	86	0.952
I8	−81	84	0.334
I9	−52	90	0.568
I10	−210	97	0.031
I11	58	84	0.490
I12	−26	78	0.744
I13	22	96	0.822
Overall average	−7	2	0.005
Overall aggregate	−1187	425	0.005
Overall aggregate (IY1)	−483	249	0.052
Overall aggregate (IY2)	−423	243	0.082
Overall aggregate (IY3)	−300	229	0.190
Overall aggregate(IY4)	19	85	0.82

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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 in the innovation group as compared to the matched comparison group.
- B1 = Baseline Q1; I1 = Innovation Q1; 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 8*** and ***Figure 5***. Readmissions rates were computed as a 30-day rehospitalization within the same CAH only, since rehospitalizations at other hospital facilities following a CAH visit are often scheduled for patients to receive additional services not available at the CAH. Unplanned readmissions are lower for beneficiaries who visit innovation CAHs as compared to beneficiaries who visit comparison CAHs in both the baseline and innovation periods. These trends are similar to the third annual report.

Table 8. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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																					
Readmit rate	42	62	66	44	36	30	62	70	68	77	69	81	73	48	55	43	68	77	75	65	82
Std dev	200	240	249	206	187	170	241	255	253	267	254	273	260	214	227	203	251	267	264	246	274
Total admissions	431	455	499	473	494	540	582	588	672	728	710	665	656	625	658	607	649	624	611	509	439
Comparison Group																					
Readmit rate	80	102	76	68	62	59	71	70	81	83	77	108	74	88	65	70	70	90	75	70	74
Std dev	272	303	266	251	241	236	257	255	273	275	267	310	262	284	247	255	255	286	264	255	261
Total admissions	511	527	497	518	503	560	535	556	693	787	701	781	731	680	675	632	644	790	718	613	719
Innovation − Comparison Rate																					
	−38	−41	−10	−23	−25	−29	−9	0	−12	−6	−8	−26	−1	−40	−10	−27	−2	−13	0	−5	8

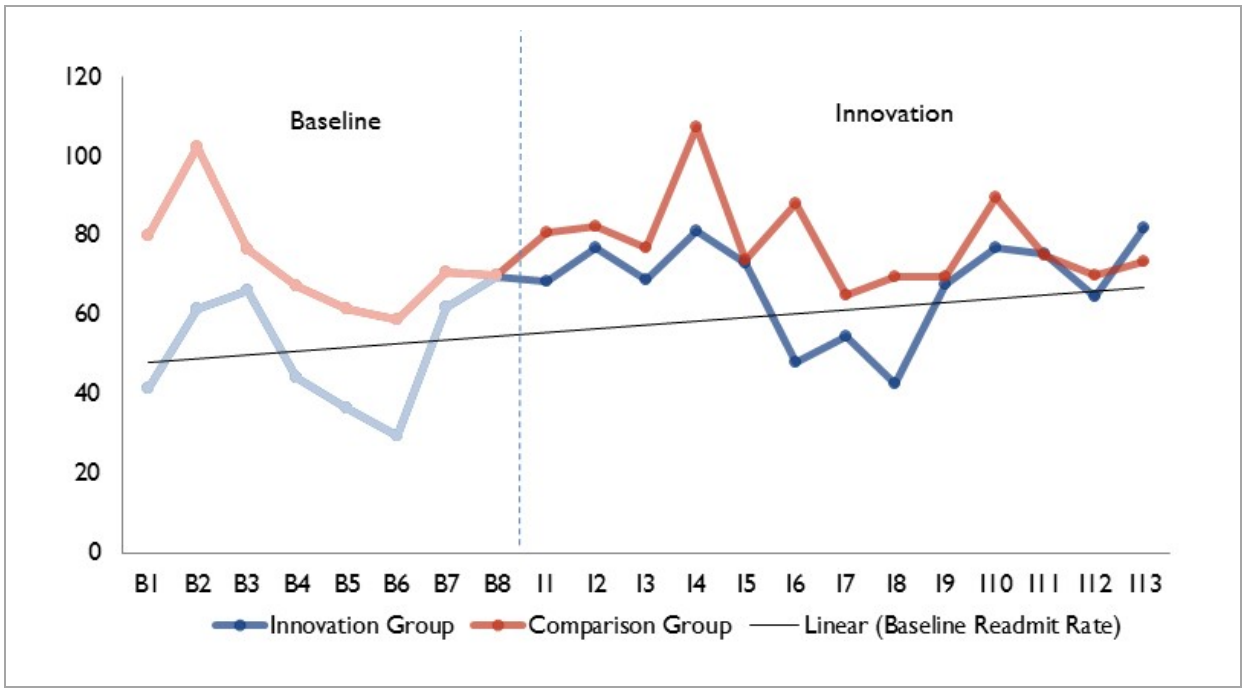
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Mineral Regional



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 and June 2016.

Terms and Definitions

- Mineral Regional = Mineral Regional Health Center.

2.6.2 Regression Results

Table 9 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 11 per 1,000 inpatient admissions indicating that the innovation-comparison difference is higher beneficiaries who visit innovation CAHS during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 3.7, 17.9).

Table 9. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
Overall average	11	4	0.01
Overall aggregate	172	69	0.01

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **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.
- 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 10*** and ***Figure 6.*** ED visit rates are, on average, lower for beneficiaries who visit innovation CAHs in the baseline period. In the innovation period, differences in ED visits between beneficiaries who visit innovation and comparison CAHs decline over time. These trends are similar to the third annual report.

Table 10. ED Visits per 1,000 Medicare Participants: 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																					
ED rate	59	61	66	68	63	63	71	76	74	77	80	77	76	76	80	82	77	78	83	84	78
Std dev	359	382	389	355	335	346	397	391	431	379	385	365	383	377	368	395	388	358	372	407	399
Unique patients	11,023	11,493	12,108	12,493	12,350	12,583	13,184	13,872	13,823	13,654	13,953	14,174	13,507	13,065	13,842	14,012	13,509	12,926	12,698	12,897	8,916
Comparison Group																					
ED rate	67	63	73	79	71	73	77	88	82	83	81	90	77	76	83	83	80	79	86	90	80
Std dev	344	323	354	355	344	352	362	396	383	379	365	547	397	359	375	377	352	360	378	378	368
Weighted patients	9,588	9,710	10,646	10,870	10,743	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	12,624	12,756	12,343
Innovation − Comparison Rate																					
	−7	−3	−7	−12	−8	−10	−6	−12	−8	−7	−1	−13	−1	0	−2	−2	−2	−1	−3	−5	−1

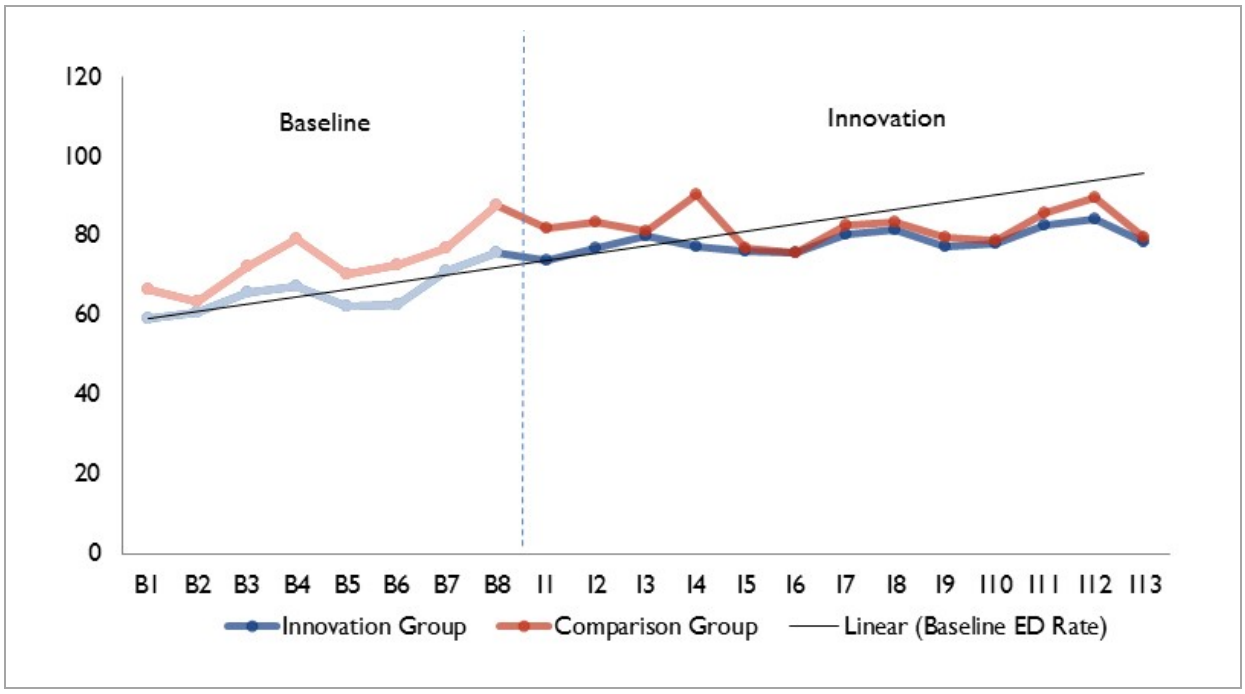
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Mineral Regional = Mineral Regional Health Center.

Figure 6. ED Visits per 1,000 Medicare Participants: Mineral Regional



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- ED = emergency department; Mineral Regional = Mineral Regional Health Center.

2.7.2 Regression Results

As shown in ***Table 11,*** the average quarterly difference-in-differences estimate for ED visits is an increase 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 (90% CI: 9, 27). This finding is consistent with the finding in the third annual report.

We also present quarterly effects 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 four quarters of the innovation period, ED visits are lower for the innovation group (beneficiaries who visit innovation CAHs). Significant decreases in ED visits for the innovation group occur in quarter 1 (−68, $p < 0.01$). From quarters 5 through 13, ED visits are higher for the innovation group. ED visits for the innovation group increase significantly in quarters 5 (34, $p=0.08$), 6 (44, $p=0.03$), 7 (56, $p < 0.01$), 9 (43, $p=0.03$), 11 (56, $p < 0.01$), 12 (31, $p=0.10$), and 13 (67, $p < 0.01$).

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visits per 1,000 Medicare Participants: Mineral Regional

Quarter	Coefficient	Standard Error	P-Values
I1	−68	20	0.001
I2	−7	20	0.735
I3	−3	20	0.895
I4	−25	19	0.185
I5	34	20	0.083
I6	44	20	0.026
I7	56	19	0.003
I8	17	20	0.388
I9	43	19	0.029
I10	7	21	0.753
I11	56	19	0.003
I12	31	19	0.095
I13	67	21	0.002
Overall average	18	5	0.001
Overall aggregate	3,008	940	0.001
Overall aggregate (IY1)	−1427	552	0.010
Overall aggregate (IY2)	2,062	532	0.000
Overall aggregate (IY3)	1,778	510	0.001
Overall aggregate (IY4)	596	189	0.002

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2010 to June 2016.

Terms and Definitions

- **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.
- ED = emergency department; Mineral Regional = Mineral Regional Health Center.

2.8 Discussion: Medicare Results

Relative to beneficiaries who visit comparison CAHs, beneficiaries who visit innovation CAHs increased spending by $28 per person per quarter over the innovation period, though this was not statistically significant. The impact of the innovation on spending differed over time. In Year 1, spending significantly decreased by $106 per participant. In contrast, in Years 2 and 3 spending per participant increased by $77 and $113, respectively. These results indicate that, in the short term, the initiatives

appear to produce savings. However, these results did not hold true in the long term. In a similar pattern, the innovation's impact on ED visits and inpatient admissions appears to be positive in the early quarters of the innovation, but not in the long run. Readmissions, however, increased during the innovation period.

These Medicare results cannot be directly attributed to the innovation, because spending and utilization outcomes are only weakly aligned to the innovation's theory of change. Mineral Regional implemented an innovation focused primarily on improving workforce development, community engagement, and connections between providers through the application of LEAN quality improvement principles. As the third annual report describes, most of the projects completed at the CAHs as part of the overall innovation focused on strategic planning, community resources, data, and relationship building.[1] These innovation activities aimed to reduce CAH operational costs through process improvements rather than direct service delivery changes that would lower patient-level spending or decrease inappropriate service utilization.

The results may not fully represent the overall population served by the innovation. Results presented here are only for Medicare beneficiaries we matched with the identifiers provided by the site. Mineral Regional CAHs also serve privately insured, Medicaid and uninsured patients.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

National Health Care for the Homeless Council

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RTI INTERNATIONAL

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 in 12 locations nationwide. This project was completed in September 2015 and the final data were included in the third annual report.[1] No new data were available for inclusion in the third annual report addendum.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

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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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: NEU

Data Source	Period Covered
Medicare claims data	November 2012–June 2016

Terms and Definitions
- NEU = Northeastern University.

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. Below we present the goals as well as the findings for the innovation.

1. **Smarter spending.**

   Goal: 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.

   Findings:

   – For Medicare patients enrolled in the Cambridge Health Alliance (CHA) innovation, we found no statistically significant impact on total spending during the innovation period. On the other hand, we found statistically significant savings for Medicaid patients ($348 per member per quarter).

   – Medicare patients enrolled in the Lahey Health System–Congestive Heart Failure (Lahey–CHF (Lahey–CHF) innovation had a higher spending rate in Year 1, with no significant overall effect on spending across the 3 years of the innovation. Spending differences between the innovation and comparison groups were not statistically significant during Years 2 or 3. The overall probability of savings was 15 percent.

2. **Better care.**

   Goal: Improve care by applying ISyE methods to health care systems in Years 1–3 and developing a workforce of health systems engineers.

   Findings: CHA focused on improving patients' access to primary care providers. Better access to primary care may have contributed to the decline in ED visits among Medicaid beneficiaries. The Lahey innovation targeted CHF patients' post-discharge care to avoid preventable readmissions. The estimated regression coefficient on readmissions was negative, implying a reduction among the innovation group; however, these negative estimates were not statistically significant.

   – In the Medicare sample, the CHA innovation only impacted ED visits favorably. Innovation group individuals were significantly less likely to have an ED visit (21 less ED visits per 1,000 participants per quarter) on average across the 3 innovation years. We found no statistically significant impacts on readmissions for Medicare patients enrolled in the CHA innovation. Among Medicaid beneficiaries, the CHA innovation led to reduced inpatient and ED visits over the innovation period.

- In the Medicare sample, the Lahey–CHF innovation had an increase in inpatient admissions overall and in Year 1. We found no significant impact on ED visits or readmissions, even though the negative sign on readmission estimates were encouraging.

3. **Healthier people**.

   Goal: Improve health outcomes through more effective and efficient processes of care and service delivery.

   Findings: 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.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected during the innovation period for the CHA innovation. Over the entire innovation period, there was a significant reduction in ED visits. Innovation group individuals were significantly less likely to have an ED visit (21 less ED visits per 1,000 participants per quarter) on average. The decline in ED visits may have resulted from increased access to primary care, but we do not find a statistically significant difference between the innovation and comparison groups in this respect.Over the 3 innovation years examined, there was no evidence that the CHA innovation had any statistically significant impact on spending or hospital readmissions. A significant increase occurred in inpatient admissions overall across the 3 years (8 more hospitalizations per 1,000 participants per quarter).

Table 2. Summary of Medicare Claims-Based Findings: CHA

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$2.052	−$1.104, $5.208	−$0.407, $4.511	$1.530	−$0.020, $3.081	$0.043	−$1.405, $1.491	$0.479	−$0.853, $1.811
Acute care inpatient stays	78	0, 156	18, 139	26	−21, 72	25	−22, 72	27	−13, 68
Hospital-wide all-cause unplanned readmissions	−7	−33, 19	−28, 13	—	—	—	—	—	—
ED visits not leading to a hospitalization	−197	−374, −20	−335, −59	−32	−138, 74	−102	−214, 10	−63	−149, 24
Average impact per quarter									
Spending per participant	$219	−$118, $555	−$43, $481	$416	−$5, $837	$13	−$430, $456	$197	−$352, $746
Acute care inpatient stays (per 1,000 participants)	8	0, 17	2, 15	7	−6, 20	8	−7, 22	11	−6, 28
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−17	−78, 44	−65, 31	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	−21	−40, −2	−36, −6	−9	−38, 20	−31	−65, 3	−26	−62, 10

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** Jan 2011 to June 2016.
- **Sample size**: 950 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; CHA = Cambridge Health Alliance.
- — Data not yet available.

Table 3 summarizes Medicare claims-based findings during the innovation period for Lahey–CHF. Significant spending losses occurred in Year 1, with no significant overall effect on spending across the 3 years. Significant increases occurred in inpatient admissions in Year 1 and overall. Over the 3 innovation years examined, the Lahey-CHF innovation had no statistically significant impact on hospital readmissions or ED visits, even though the negative sign on the readmission estimates were encouraging and consistent with the project's theory of action.

Table 3. Summary of Medicare Claims-Based Findings: Lahey–CHF

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$1.344	−$0.772, $3.461	−$0.304, $2.993	$1.330	$0.051, $2.610	$0.099	−$0.851, $1.049	−$0.085	−$0.595, $0.424
Acute care inpatient stays	130	75, 185	88, 173	81	41, 121	30	−2, 62	19	0, 38
Hospital-wide all-cause unplanned readmissions	−31	−64, 3	−57, −4	—	—	—	—	—	—
ED visits not leading to a hospitalization	37	−11, 85	0, 74	23	−8, 54	17	−16 51	−3	−19, 12
Average impact per quarter									
Spending per participant	$996	−$572, $2,564	−$225, $2,217	$2,034	$78, $3,991	$214	−$1,837, $2,265	−$365	−$2,552, $1,821
Acute care inpatient stays (per 1,000 participants)	96	56, 137	65, 128	124	63, 184	65	−5, 134	82	0, 164
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−62	−129, 6	−114, −9	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	27	−8, 63	0, 55	35	−13, 83	38	−34, 109	−15	−80, 51

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** Jan 2011 to June 2016.
- **Sample size**:177 unique Medicare fee-for-service beneficiaries with matched claims data included in innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is the weighted average quarterly effect from the quarterly fixed effects model, indicating the differential rate of ED utilization in the innovation group against comparison group. ED visits not leading to a hospitalization is the product of ED visits not leading to a hospitalization (per 1,000 participants) and the number of person quarters. Estimates are derived using negative binomial count model.
- CI = confidence interval; ED = emergency department; Lahey–CHF = Lahey Health System–Congestive Heart Failure.
- — Data not yet available.

No new updates were made to the Medicaid claims-based analysis and findings for the CHA innovation since the third annual report.[1]

Table 4 summarizes Medicaid claims-based findings during the innovation period for the CHA innovation. We have six quarters of data on Medicaid enrollees. In the six quarters of the innovation period with available data, we saw a statistically significant decrease in spending, hospitalizations and ED visits. ***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] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 4. Summary of Medicaid Claims-Based Findings: CHA

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$1.760	−$2.372, −$1.148	−$2.237, −$1.283	−$1.344	−$1.902, −$0.786	−$0.417	−$0.531, −$0.302	N/A	N/A
Acute care inpatient stays	−72	−123, −20	−112, −32	−64	−114, −13	−8	−17, 0	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−10	−22, 2	−19, −1	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−561	−668, −454	−645, −477	−462	−565, −359	−99	−129, −69	N/A	N/A
Average impact per quarter									
Spending per participant	−$348	−$469, −$227	−$442, −$254	−$308	−$435, −$180	−$602	−$767, −$437	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−15	−25, −4	−23, −7	−15	−26, −3	−17	−33, 0	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−91	−198, 17	−175, −7	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−111	−132, −90	−127, −94	−106	−129, −82	−144	−187, −100	N/A	N/A

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** Jan 2011 to June 2014.
- **Sample size**: 1,463 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

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.

2.2 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 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: NEU

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

Notes:

- 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.

Terms and Definitions

- ED = emergency department; NEU = Northeastern University.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. This includes two additional quarters of Medicare claims data than the Third Annual Report. The Medicare claims analysis focuses on Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. 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 Lahey analysis focuses on 177 beneficiaries impacted by the Lahey innovation who were fee-for-service Medicare Part A and Part B beneficiaries. We used the first date of hospitalization for CHF after the innovation launch date as the innovation start date for each patient in the Lahey innovation. 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. For CHA, this report includes the same matching strategy and same comparison group as used in the third annual report. See the third annual report for additional details.

For Lahey, we used propensity score matching (PSM) to select comparison group beneficiaries. However, in this report, we made minor improvements to the third annual report matching strategy to select a comparison group that is more representative of the innovation group. Specifically, we made two minor improvements to our previous matching strategy in the third annual report. First, we added 90 days (one quarter) to each 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. We made this adjustment for Lahey because the original enrollment date coincided with the hospitalization for CHF, creating a spike in spending and utilization during the first innovation quarter in previous reports. This spike in spending and utilization was an artifact of enrollment co-occurring with the hospitalization for CHF. To select a comparison group with a similar spike, we added 90 days to the original enrollment date and required the comparison beneficiaries to have a prior hospitalization. These two improvements allowed the comparison group to match the innovation group's spike prior to enrollment.

Table 6 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 6. 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	$20,094	$22,630	$28,394	$25,489	0.344	$20,101	$22,693	$20,162	$16,351	0.003
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$40,038	$53,499	$35,980	$47,887	0.080	$37,593	$42,591	$38,837	$49,950	0.027
Age	81.24	8.69	76.25	12.45	0.464	81.31	8.67	81.19	10.12	0.012
Percentage male	52.25	49.95	44.75	49.72	0.150	51.98	49.96	53.86	49.85	0.038
Percentage white	95.51	20.72	87.58	32.98	0.288	95.48	20.77	95.48	20.77	0.000
Percentage disabled	11.24	31.58	28.28	45.03	0.438	10.73	30.96	10.92	31.19	0.006
Percentage ESRD	4.49	20.72	5.49	22.79	0.046	4.52	20.77	2.45	15.45	0.113
Number of dual eligible months in the previous calendar year	1.38	3.76	3.88	5.44	0.534	1.39	3.76	1.46	3.78	0.018
Number of chronic conditions	12.12	2.68	11.62	3.04	0.173	12.10	2.68	12.11	2.98	0.004
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	1.69	2.10	1.39	2.00	0.145	1.62	1.89	1.55	2.06	0.031
Number of beneficiaries	178	—	149,670	—	—	177	—	524	—	—
Number of unique beneficiaries[1]	—	—	72,944	—	—	177	—	524	—	—
Number of weighted beneficiaries	—	—	—	—	—	177	—	177	—	—

[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).

Notes:

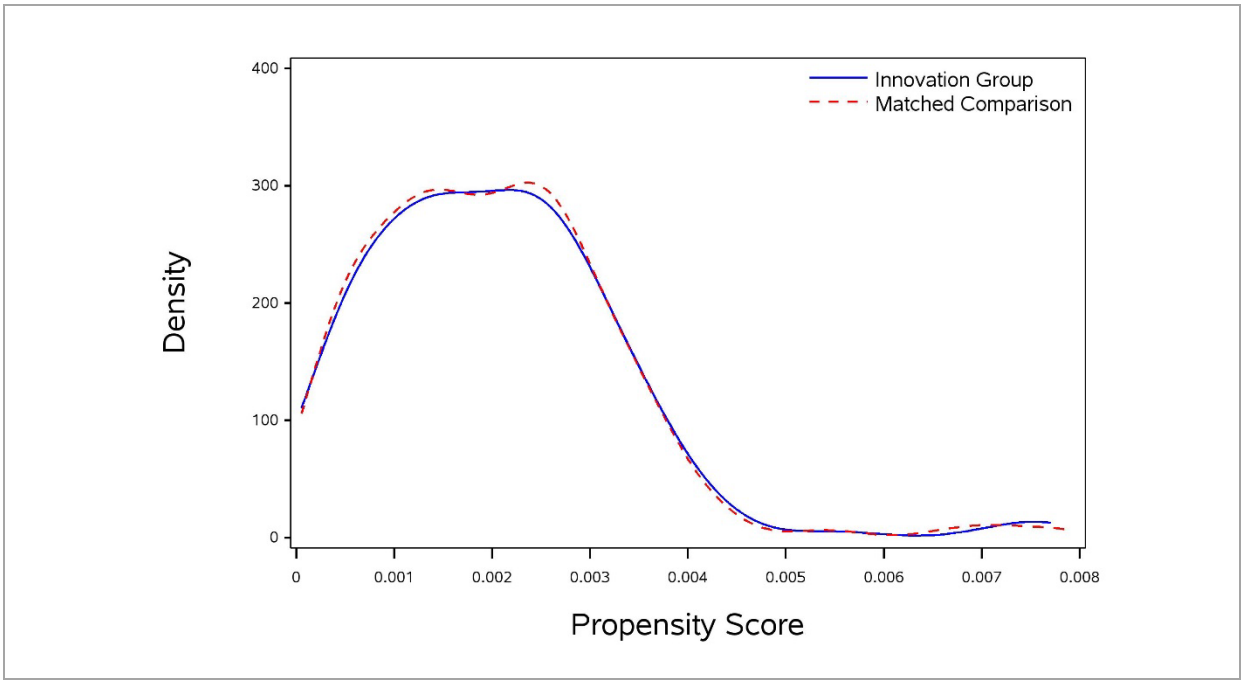
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Terms and Definitions

- ESRD = end-stage renal disease; Lahey–CHF = Lahey Health System–Congestive Heart Failure.
- — Data not yet available.

The results in Table 6 show that matching reduced the absolute standardized differences and achieved adequate balance for all variables except for the end-stage renal disease status. 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: Lahey–CHF



Notes:

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

Terms and Definitions

- Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.4 Medicare Spending: CHA

2.4.1 Descriptive Results

Table 7 reports Medicare spending per patient in the 8 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.

Spending per patient for the innovation group is similar to the comparison group rate in baseline quarters. These trends are similar to the third annual report. After a minor spike in I3, the spending rate of the innovation group remains close to the comparison group rate until the final quarters examined. In the final three quarters, I10-I12, spending for the innovation group is higher than the comparison group. Further statistical testing on the impact of the innovation is performed in the regression analysis section that follows.

Table 7. 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**	**I12**
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	$3,319	$3,536	$3,429	$3,620	$4,025	$3,571	$3,925
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	$9,314	$10,767	$9,712	$11,345	$10,658	$8,809	$12,229
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	809	788	728	666	581	452
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	$3,534	$3,641	$3,215	$3,442	$3,786	$3,210	$3,246	$3,265
Std dev	$8,162	$7,659	$8,329	$11,213	$8,474	$9,331	$10,300	$13,430	$9,618	$9,722	$9,853	$11,756	$10,512	$13,304	$9,304	$14,348	$21,181	$9,822	$9,031	$9,145
Weighted patients	813	836	857	877	900	920	941	950	950	946	920	888	869	844	829	813	753	680	593	475
Savings per Patient																				
	−$272	−$174	$163	−$150	−$234	−$281	$844	$143	−$160	−$374	−$1,014	−$66	−$348	$322	−$320	$13	$166	−$815	−$326	−$660

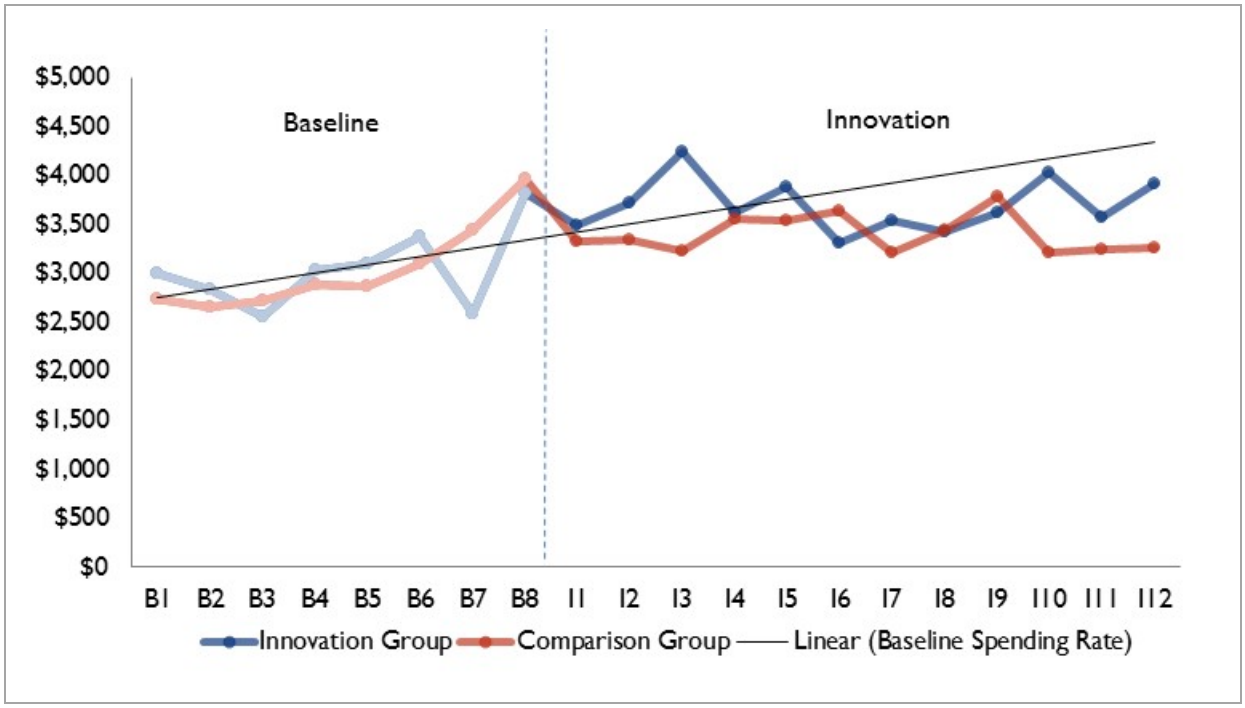
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; CHA = Cambridge Health Alliance.

Figure 2. Medicare Spending per Participant: CHA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- CHA = Cambridge Health Alliance.

2.4.2 Regression Results

As shown in ***Table 8,*** 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 $219 (90% CI: −$118, $555). This effect is not statistically significant. which is consistent with the findings in the third annual report. 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 quarterly effects derived from 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. Overall, the difference-in-differences quarterly results are inconclusive because the estimates change from positive to negative, and only 1 of the 12 quarterly effects was statistically significant (I3). The overall aggregate results, in any one year of the innovation or

all together, were also not statistically significant (even though the Year 1 estimate was very close to significance at the 10 percent level).

Table 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	$218	$368	0.552
I2	$416	$379	0.273
I3	$981	$409	0.017
I4	$41	$373	0.912
I5	$315	$385	0.412
I6	−$367	$396	0.354
I7	$217	$386	0.573
I8	−$124	$432	0.775
I9	−$293	$609	0.630
I10	$709	$448	0.113
I11	$151	$415	0.716
I12	$294	$605	0.627
Overall average	$219	$205	0.285
Overall aggregate	$2,052,205	$1,918,210	0.285
Overall aggregate (IY1)	$1,530,402	$942,335	0.104
Overall aggregate (IY2)	$42,992	$880,119	0.961
Overall aggregate (IY3)	$478,810	$809,625	0.554

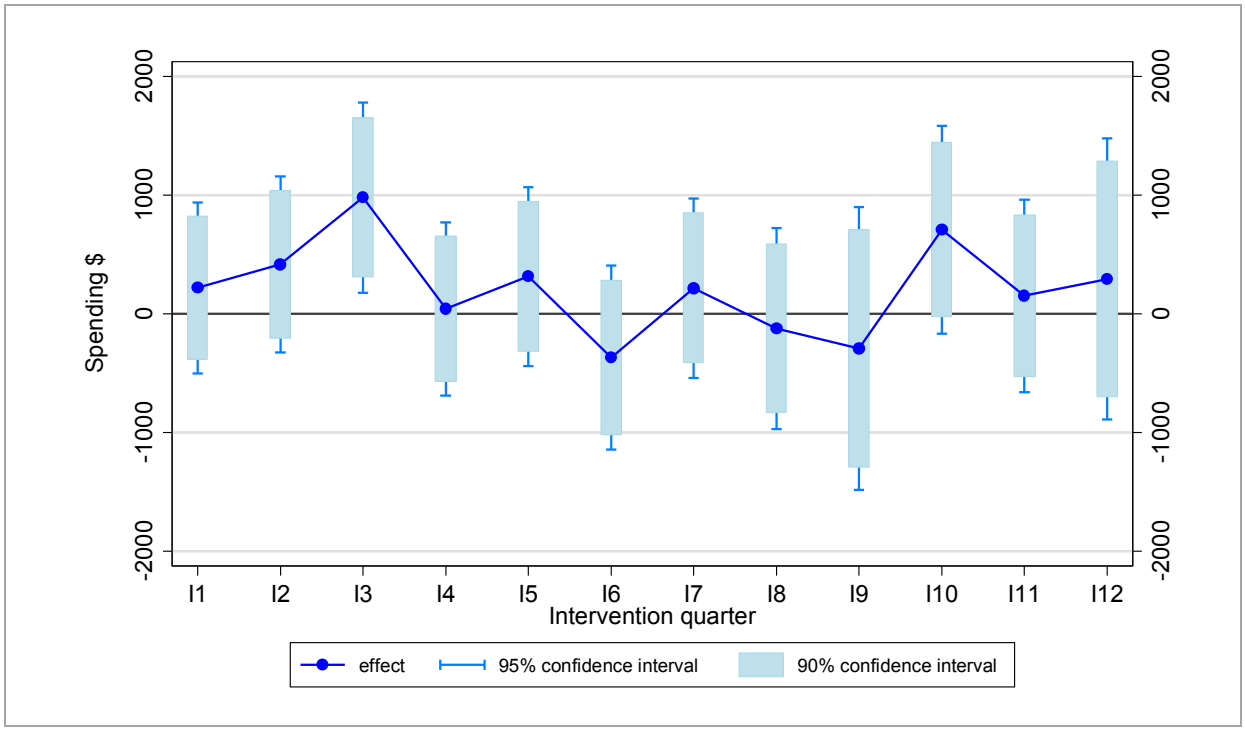
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; CHA = Cambridge Health Alliance.

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



Notes:

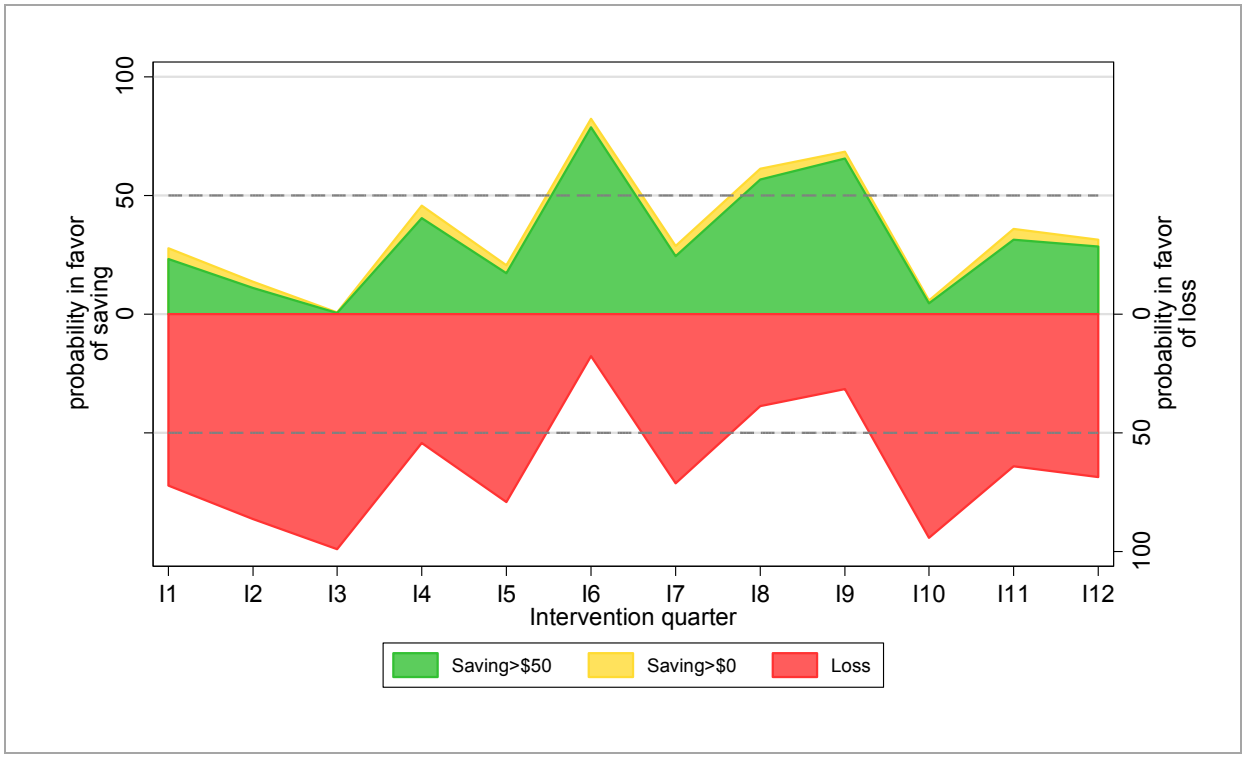
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** Jan 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; CHA = Cambridge Health Alliance.

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 for saving or losing money on this initiative. Because we observe quarterly spending estimates that flip from positive to negative throughout the innovation period, we observe a higher probability of loss in some quarters and a higher probability of savings in others. Overall, the average probability of savings over 3 years is 14 percent.

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



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- CHA = Cambridge Health Alliance.

2.5 Medicare Spending: Lahey–CHF

2.5.1 Descriptive Results

Table 9 reports Medicare spending per patient in the 8 quarters before and 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 5*** illustrates the Medicare spending per beneficiary in Table 8 for innovation and comparison group beneficiaries.

The spending trend for Lahey–CHF increases in the baseline quarters with a spike in B8 which represents the hospitalization for CHF. The spike occurs because the first date of hospitalization for CHF was used as the innovation start date for the innovation group. After the improvements to the AR3 matching strategy to select the comparison group, comparison group now matches the innovation group's spike prior to enrollment in B8. Spending for both groups falls below the trend line starting in I1 and remains at that level for all innovation quarters. Spending for the comparison group follows a similar trend with the innovation group throughout the innovation. These statistics are descriptive; we will explore any statistically significant effects of the innovation in the regression analysis section below.

Table 9. 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	$7,390	$5,001	$6,667	$5,953	$8,079	$10,320	$13,752	$20,101	$14,634	$13,016	$14,325	$9,731	$10,824	$11,630	$9,229	$9,446	$9,258	$7,534	$9,254	$11,419
Std dev	$13,340	$9,032	$13,578	$12,740	$15,185	$19,325	$21,092	$22,693	$17,717	$15,554	$27,396	$14,672	$17,503	$15,322	$15,611	$16,724	$12,557	$12,391	$12,412	$13,341
Unique patients	166	168	171	173	173	175	176	177	177	170	162	145	136	122	109	96	86	64	50	33
Comparison Group																				
Spending rate	$6,026	$6,523	$6,938	$7,747	$9,109	$10,724	$11,492	$20,162	$12,793	$11,587	$10,722	$9,106	$10,833	$10,847	$10,889	$10,315	$10,101	$10,029	$9,114	$8,106
Std dev	$12,701	$13,932	$14,546	$15,297	$16,670	$18,581	$21,465	$16,351	$17,478	$17,560	$18,087	$16,109	$18,805	$19,264	$19,224	$19,936	$22,497	$16,575	$15,196	$17,183
Weighted patients	171	172	173	174	175	177	177	177	177	177	166	154	142	134	125	115	104	84	69	45
Savings per Patient																				
	−$1,365	$1,523	$271	$1,794	$1,030	$404	−$2,260	$61	−$1,842	−$1,429	−$3,603	−$625	$9	−$783	$1,660	$869	$843	$2,495	−$140	−$3,313

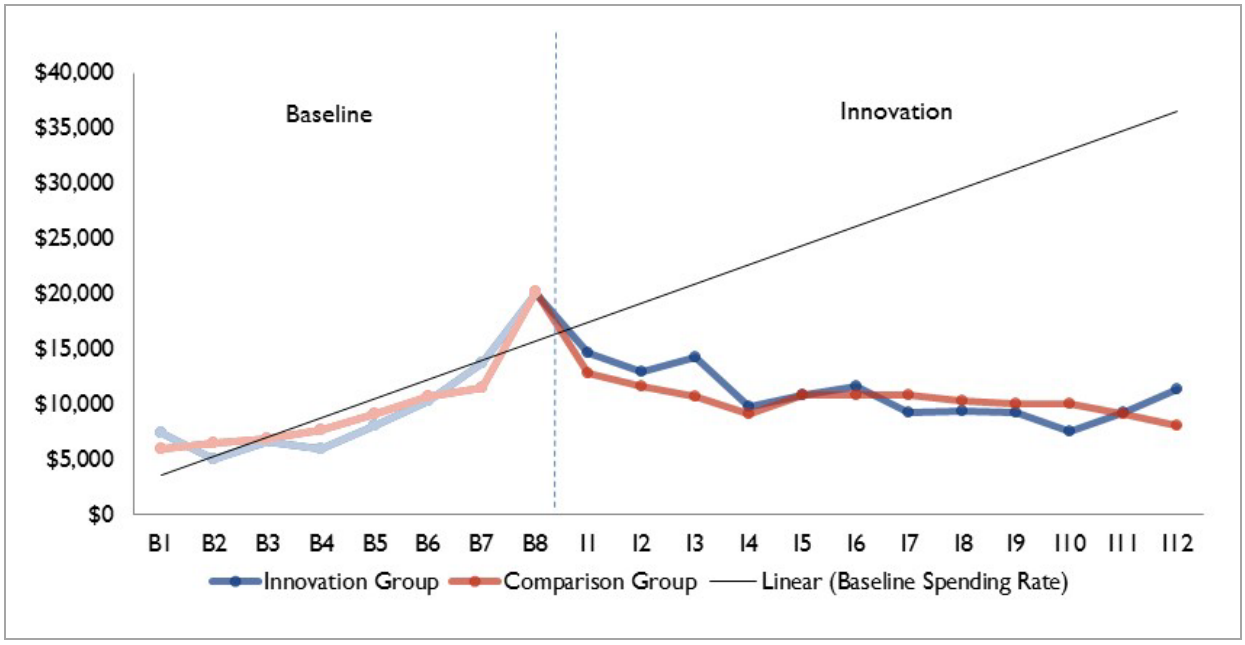
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 5. Medicare Spending per Participant: Lahey–CHF



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.5.2 Regression Results

As shown in ***Table 10,*** 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 $996 (90% CI: −$572, $2,564). 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. In AR3 analysis, the average quarterly spending estimate indicated a larger loss in spending ($26,99) which was significant. AR4 estimates are slightly more promising.

We also present quarterly effects derived from 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 6*** illustrates these quarterly difference-in-differences estimates. Similar to AR3 estimates, quarterly estimates are positive in first six innovation quarters (I1-I6), indicating a loss. However, unlike AR3, none of these estimates are statistically significant (even though the I3 estimate comes close to significance at the 10 percent level). Negative estimates in I7-I10 suggest savings; however, these results are also not significant. In Year 1 of the innovation as a whole, we observe losses that are statistically significant.

Table 10. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
I1	$1,689	$1,506	0.262
I2	$1,503	$1,558	0.335
I3	$3,804	$2,345	0.105
I4	$1,102	$1,418	0.438
I5	$528	$1,740	0.762
I6	$1,241	$1,737	0.475
I7	−$923	$1,781	0.605
I8	−$246	$2,035	0.904
I9	−$670	$1,800	0.710
I10	−$1,756	$1,842	0.341
I11	$157	$2,050	0.939
I12	$2,331	$2,893	0.421
Overall average	$996	$952	0.296
Overall aggregate	$1,344,342	$1,285,122	0.296
Overall aggregate (IY1)	$1,330,480	$777,008	0.087
Overall aggregate (IY2)	$99,021	$576,658	0.864
Overall aggregate (IY3)	−$85,159	$309,307	0.783

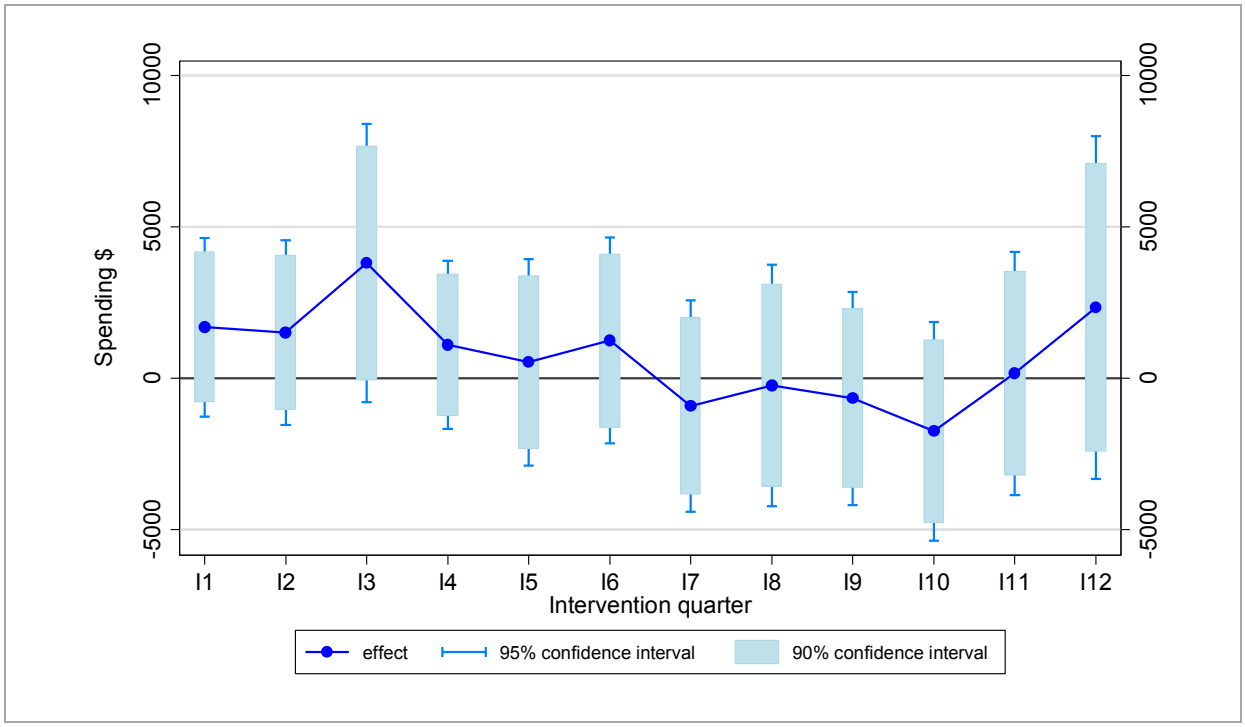
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Lahey–CHF



Notes:

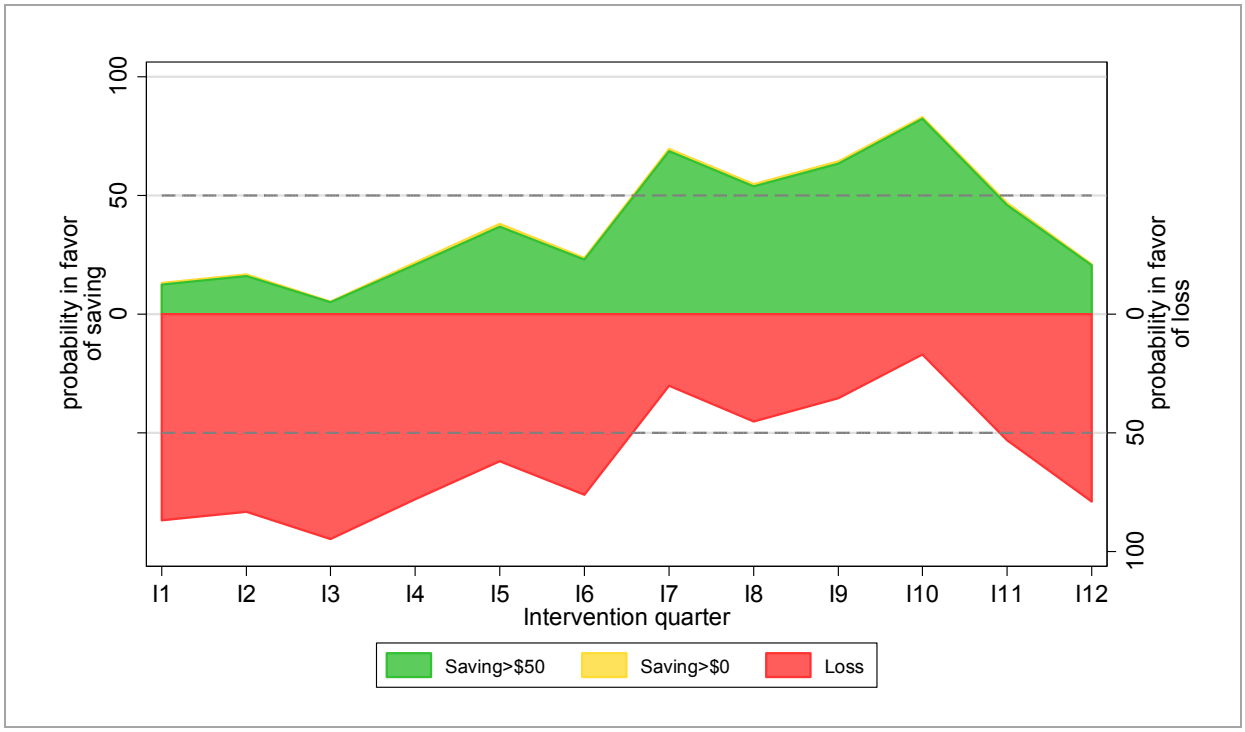
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** Jan 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 7 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 for saving or losing money on this initiative. The results mostly show high probability of losses, represented by the red areas. Because we observe negative quarterly spending estimates in I7–I10, we observe slight probability of savings in these quarters. Overall, the average probability of savings over 3 years is 15 percent.

Figure 7. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Lahey–CHF



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- 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 11*** and ***Figure 8***. In the baseline period, both the innovation and comparison group inpatient admission rates are similar and trend slightly upward, although the innovation group rate fluctuates more. 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, which is consistent with the findings in the third annual report. Further statistical testing on the impact of the innovation is performed in the regression analysis section that follows.

Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Admit rate	100	92	85	96	85	90	85	134	104	102	129	101	128	76	104	117	96	123	110	115
Std dev	388	409	380	435	342	366	362	527	480	443	482	413	486	327	421	461	405	471	425	426
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	809	788	728	666	581	452
Comparison Group																				
Admit rate	91	90	89	94	93	106	102	119	104	103	100	103	104	98	89	96	95	88	101	89
Std dev	403	360	429	423	420	471	401	467	459	409	456	445	446	445	388	414	418	382	402	347
Weighted patients	813	836	857	877	900	920	941	950	950	946	920	888	869	844	829	813	753	680	593	475
Innovation − Comparison Rate																				
	10	2	−4	3	−7	−16	−16	15	0	−1	29	−2	24	−21	14	21	1	35	9	26

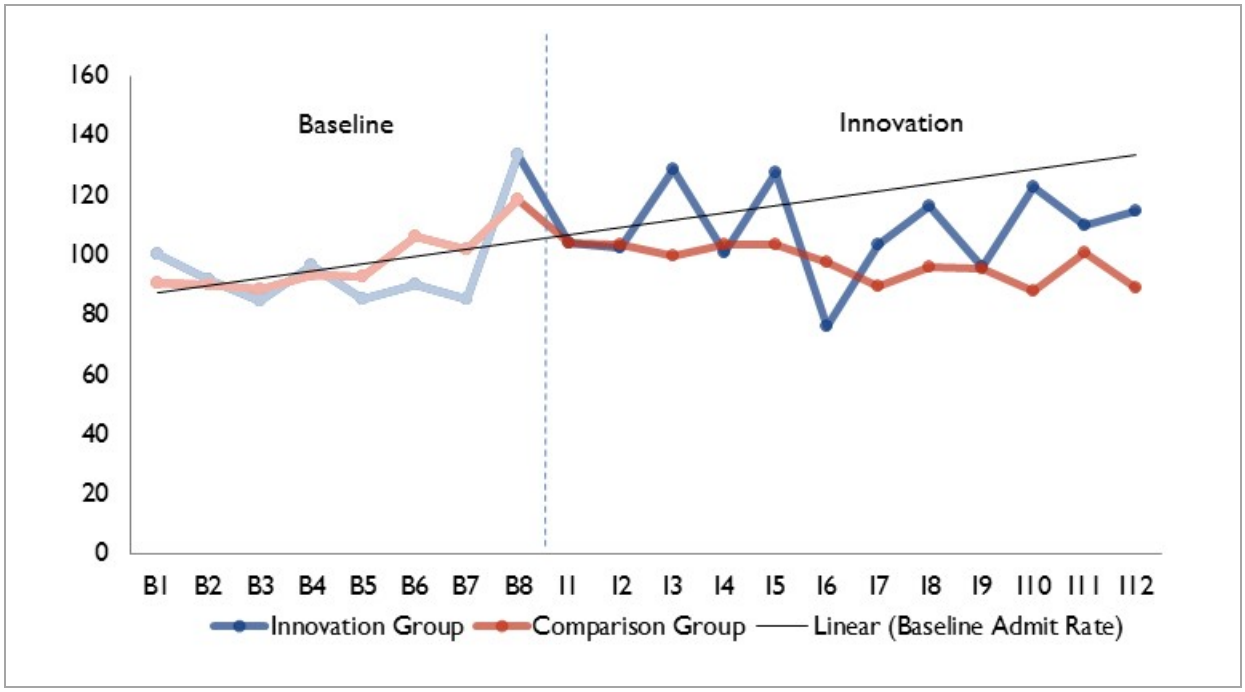
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Cambridge Health Alliance.

Figure 8. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: CHA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- CHA = Cambridge Health Alliance

2.6.2 Regression Results

As shown in ***Table 12,*** the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 8 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, which is consistent with the findings in the third annual report. The effect is statistically significant (90% CI: 0, 17).

We also present quarterly effects with the dependent variable equal to the number of hospital visits for each individual during the quarter. Only two of the quarterly effects was statistically significant, and the significant effects were positive. In I3 and I10, the innovation group had 30 and 36 more inpatient admissions per 1,000 beneficiaries, respectively. Even though the estimate was negative in a few quarters, these estimates were not statistically significant.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	0	15	0.990
I2	−4	15	0.762
I3	30	16	0.060
I4	3	16	0.854
I5	23	18	0.201
I6	−21	16	0.180
I7	10	17	0.543
I8	19	19	0.336
I9	−9	18	0.613
I10	36	20	0.070
I11	4	22	0.851
I12	17	24	0.465
Overall average	8	5	0.098
Overall aggregate	78	47	0.098
Overall aggregate (IY1)	26	28	0.363
Overall aggregate (IY2)	25	29	0.381
Overall aggregate (IY3)	27	25	0.270

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; CHA = Cambridge Health Alliance.

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 13*** and ***Figure 9***. The inpatient admissions rates for the innovation and comparison groups are similar in the baseline period with a spike in B8 representing the hospitalization for CHF. After the improvements to the AR3 matching strategy to select the comparison group, comparison group admission rate now matches the innovation group's spike prior to enrollment in B8. In all innovation quarters, the admissions rate for the innovation group drops below the trend line and remains slightly higher than the comparison group rate in most quarters.

Table 13. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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																				
Admit rate	325	238	269	214	341	354	619	910	599	565	444	379	500	500	312	385	360	281	380	545
Std dev	754	610	619	584	692	828	897	922	885	907	762	734	1000	704	659	769	697	649	690	742
Unique patients	166	168	171	173	173	175	176	177	177	170	162	145	136	122	109	96	86	64	50	33
Comparison Group																				
Admit rate	247	248	252	299	324	405	366	1,149	403	412	367	338	392	370	373	375	266	301	279	284
Std dev	637	644	611	688	752	745	705	523	774	786	782	707	765	762	715	768	545	640	771	665
Weighted patients	171	172	173	174	175	177	177	177	177	177	166	154	142	134	125	115	104	84	69	45
Innovation − Comparison Rate																				
	78	−9	17	−85	17	−50	253	−239	196	152	77	42	108	130	−61	11	95	−20	101	262

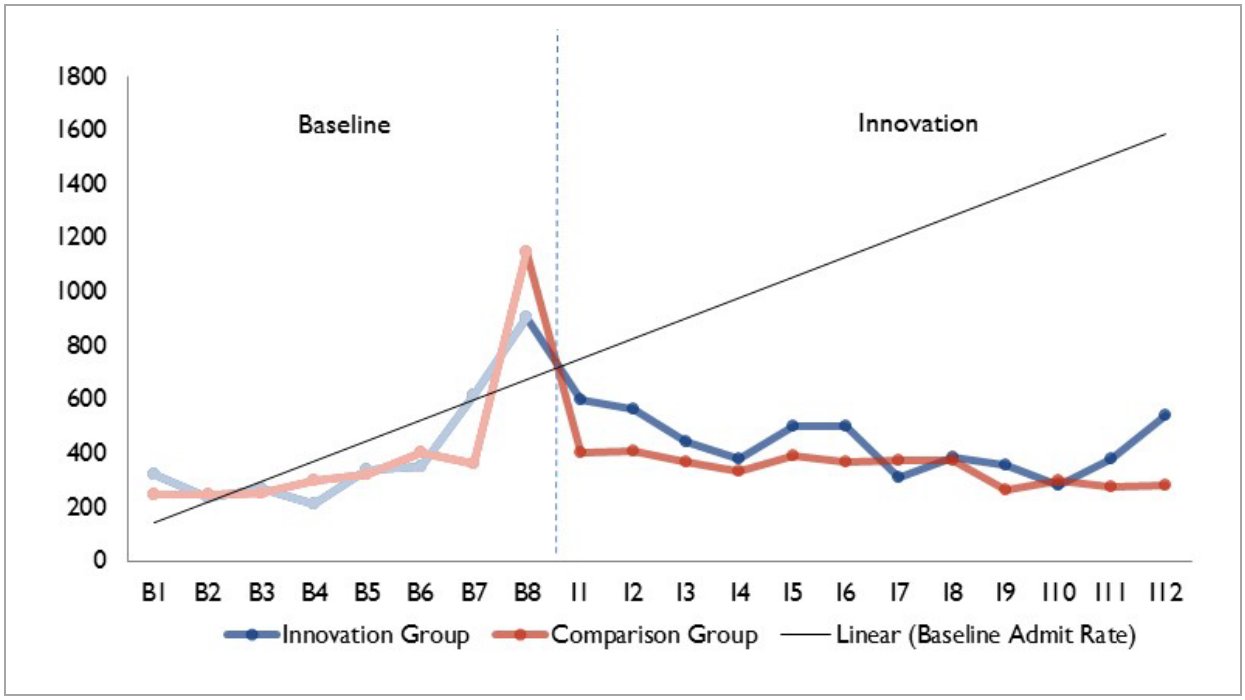
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 9. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Lahey–CHF



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- Lahey–CHF = Lahey Health System–Congestive Heart Failure

2.7.2 Regression Results

As shown in ***Table 14***, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 96 inpatient admissions per 1,000 participants relative to the comparison group. This is consistent with the findings in the third annual report. This figure 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: 56, 137).

We also present quarterly effects with the dependent variable equal to the number of hospital visits for each individual during the quarter. The innovation group had a statistically significantly higher inpatient admissions rate in the first two quarters. The estimates in the remaining quarters were mostly positive except for I7 and I10, but none of them were significant. The innovation group had a significantly higher admission rate overall and in Year 1 of the innovation.

Table 14. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
I1	188	74	0.012
I2	161	82	0.051
I3	77	67	0.249
I4	54	69	0.429
I5	116	93	0.212
I6	145	77	0.062
I7	−48	72	0.502
I8	19	90	0.837
I9	96	80	0.234
I10	−12	85	0.885
I11	74	116	0.527
I12	242	152	0.120
Overall average	96	25	0.000
Overall aggregate	130	33	0.000
Overall aggregate (IY1)	81	24	0.001
Overall aggregate (IY2)	30	20	0.126
Overall aggregate (IY3)	19	12	0.102

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.8 Medicare Unplanned Readmissions – CHA

2.8.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 15*** and ***Figure 10***. The readmission rate varies widely in all baseline and innovation quarters for both groups, although the variability is more pronounced for the innovation group. This is consistent with the third annual report. Overall, the comparison group rate is relatively flatter while the innovation group rate fluctuates widely 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 15. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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**	**I12**
Innovation Group																				
Readmit rate	83	87	77	67	128	294	27	167	136	143	230	105	149	38	115	152	40	257	87	111
Std dev	276	282	267	249	334	456	162	373	343	350	421	307	356	192	320	359	196	437	282	314
Total admissions	36	23	26	30	39	34	37	60	44	49	61	38	47	26	26	33	25	35	23	18
Comparison Group																				
Readmit rate	72	87	91	92	63	142	95	77	60	95	64	147	146	174	158	110	75	165	125	70
Std dev	259	281	288	289	242	349	293	267	237	293	244	354	353	379	365	313	264	371	331	255
Total admissions	32	35	29	33	32	45	49	56	39	46	37	48	41	36	38	33	31	28	27	19
Innovation − Comparison Rate																				
	11	0	−14	−25	66	152	−68	90	77	48	166	−42	3	−136	−43	42	−35	92	−38	41

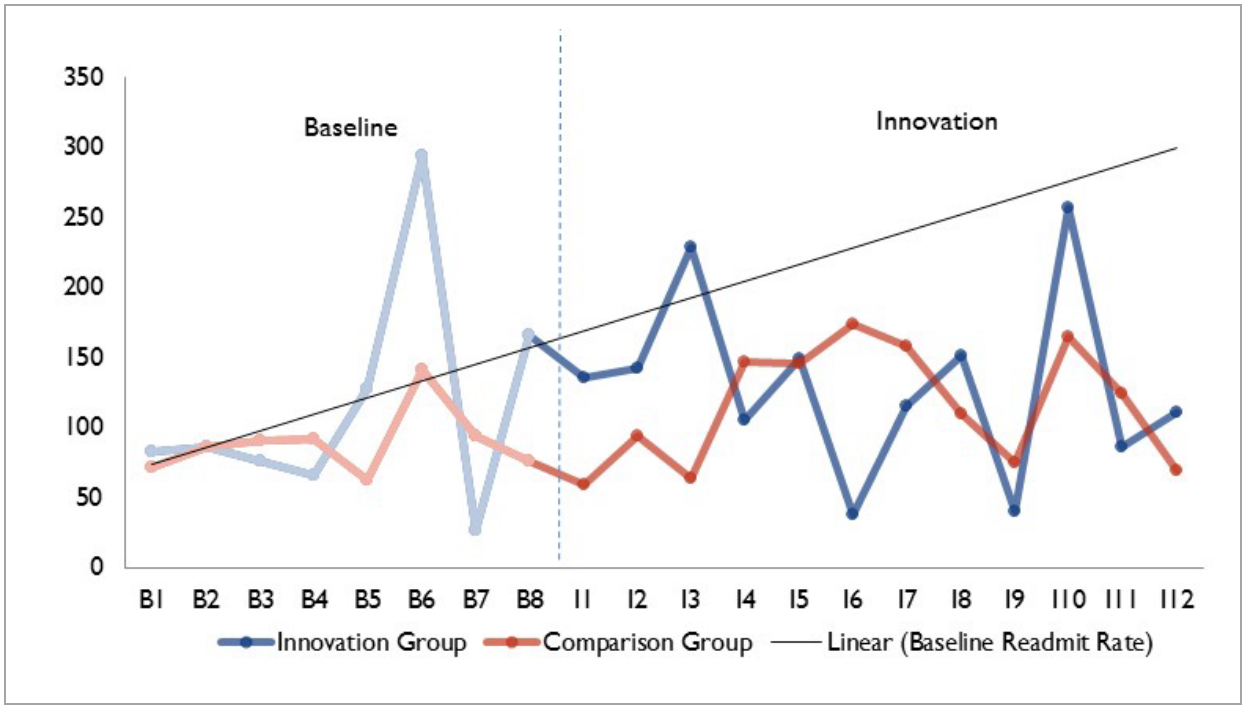
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; CHA = Cambridge Health Alliance.

Figure 10. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: CHA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 and June 2016.

Terms and Definitions

- CHA = Cambridge Health Alliance.

2.8.2 Regression Results

Table 16 presents the results of a logistic regression model with the dependent variable set to 1 for hospitalized patients who had an unplanned readmission within 30 days. The average quarterly difference-in-differences estimate for unplanned readmissions is −17 per 1,000 inpatient admissions, indicating that the innovation−comparison difference is lower for the innovation group during the innovation period. This is consistent with the findings in the third annual report. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −78, 44).

Table 16. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: CHA

Quarter	Coefficient	Standard Error	P-Values
Overall average	−17	37	0.646
Overall aggregate	−7	16	0.646

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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.
- 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 17*** and ***Figure 11***. The readmissions rate varies somewhat in all baseline and innovation periods for both groups, although the innovation group is more variable. The changes in the readmission rate should be interpreted with caution because the total number of readmissions is relatively low for both groups, especially in the final quarters (15 and 7 in I12). This is consistent with the findings in the third annual report. Further statistical testing on the impact of the innovation on the readmissions rates is provided in the regression analysis section.

Table 17. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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																				
Readmit rate	146	281	154	235	149	154	173	188	128	184	109	190	286	120	120	333	182	71	200	0
Std dev	353	450	361	424	356	361	379	391	334	387	312	393	452	325	325	471	386	258	400	0
Total admissions	48	32	39	34	47	52	98	149	86	87	55	42	56	50	25	30	22	14	15	15
Comparison Group																				
Readmit rate	180	140	142	107	224	194	160	108	228	215	215	178	148	265	158	147	88	94	243	48
Std dev	384	347	349	309	417	396	367	310	420	411	411	383	355	441	365	355	283	292	429	213
Total admissions	37	36	35	44	49	60	58	183	61	60	48	39	45	39	38	32	19	18	12	7
Innovation − Comparison Rate																				
	−34	141	12	128	−76	−41	13	80	−100	−32	−106	13	138	−145	−38	186	94	−23	−43	−48

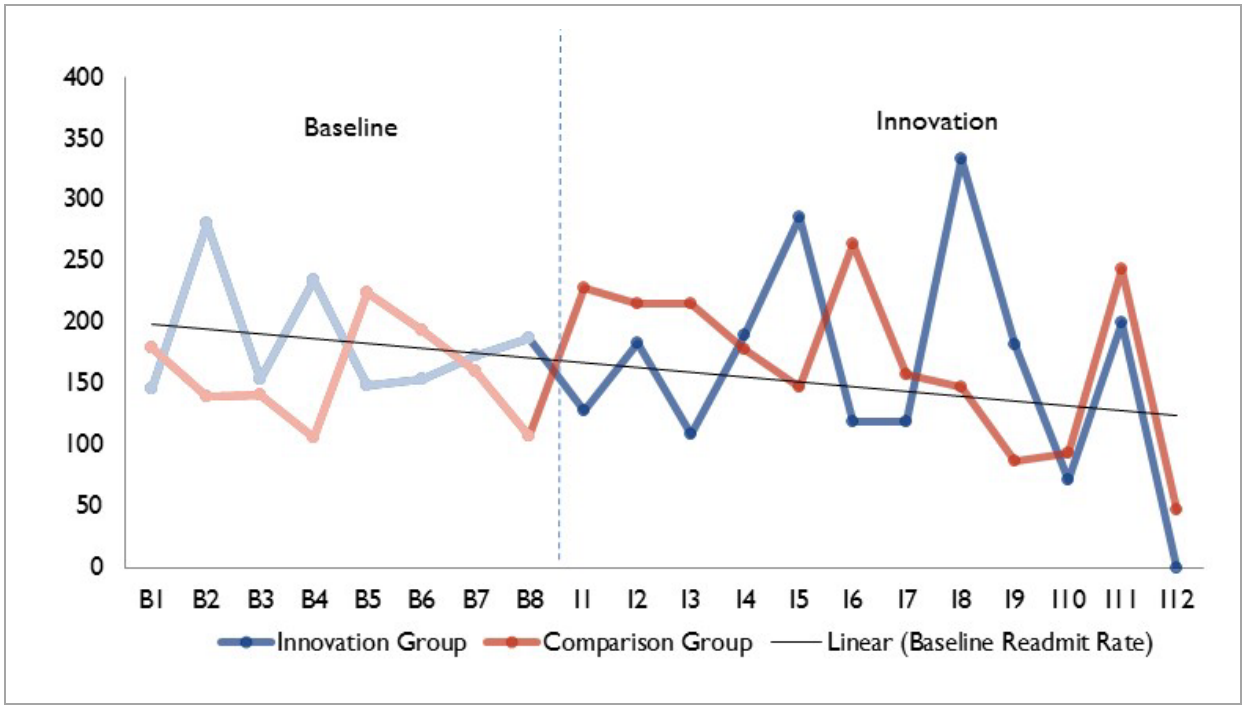
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Lahey–CHF



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 and June 2016.

Terms and Definitions

- Lahey–CHF = Lahey Health System–Congestive Heart Failure

2.9.2 Regression Results

Table 18 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 −62 per 1,000 inpatient admissions, indicating that the innovation−comparison difference lower for the innovation group during the innovation period. This is consistent with the findings in the third annual report. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is not statistically significant (90% CI: −129, 6).

Table 18. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
Overall average	−62	41	0.135
Overall aggregate	−31	20	0.135

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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.
- 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 19*** and ***Figure 12.*** The ED visit rate for the innovation group is relatively flat in the baseline period, followed by a gradual decrease after the second innovation quarter. The comparison group ED visit rate follows a similar trend but is consistently lower than the innovation group in all quarters. This is consistent with the findings in the third annual report. Further statistical testing on the impact of the innovation is discussed in the next section.

Table 19. ED Visits per 1,000 Medicare Participants: 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	I12
Innovation Group																				
ED rate	338	334	305	330	364	323	321	374	347	366	338	296	301	275	294	294	280	297	310	272
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	1,042	1,083	748	1,133	1,086	1,080
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	809	788	728	666	581	452
Comparison Group																				
ED rate	209	189	201	205	231	246	233	225	242	211	203	227	230	225	189	200	211	182	173	196
Std dev	407	394	405	443	503	487	471	487	551	431	443	635	483	497	377	400	423	392	337	377
Weighted patients	813	836	857	877	900	920	941	950	950	946	920	888	869	844	829	813	753	680	593	475
Innovation − Comparison Rate																				
	128	146	103	125	133	78	88	149	105	155	135	70	72	50	105	94	69	115	137	76

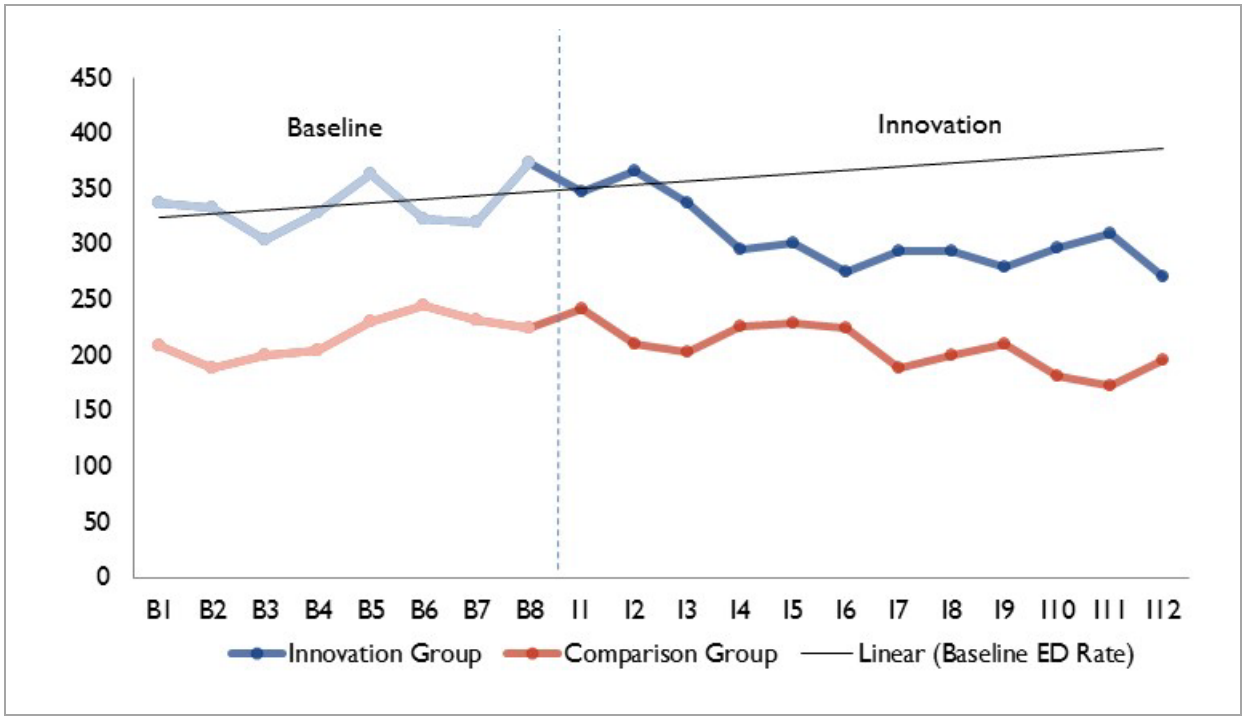
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Cambridge Health Alliance.

Figure 12. ED Visits per 1,000 Medicare Participants: CHA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- ED = emergency department; CHA = Cambridge Health Alliance.

2.10.2 Regression Results

As shown in ***Table 20***, the average quarterly difference-in-differences estimate for ED visits is a decrease of 21 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: −40, −2). These findings are similar to AR3 in terms of direction and magnitude. However, the effect is now significant, whereas it wasn't in AR3.

We also present quarterly effects 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. Although most quarterly effects are negative, we found no statistically significant quarterly estimated coefficients.

Table 20. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	−33	34	0.342
I2	29	34	0.391
I3	13	32	0.695
I4	−45	40	0.255
I5	−38	43	0.378
I6	−58	42	0.175
I7	0	40	0.996
I8	−29	41	0.484
I9	−54	40	0.182
I10	−7	40	0.870
I11	24	42	0.562
I12	−74	55	0.179
Overall average	−21	11	0.068
Overall aggregate	−197	108	0.068
Overall aggregate (IY1)	−32	64	0.618
Overall aggregate (IY2)	−102	68	0.135
Overall aggregate (IY3)	−63	53	0.233

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: Jan 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; CHA = Cambridge Health Alliance.

2.11 Medicare Emergency Department Visits—Lahey–CHF

2.11.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 21*** and ***Figure 13.*** Overall, the ED visit rate for the innovation and comparison groups follow similar trends in both the baseline and innovation periods. After the improvements to the AR3 matching strategy to select the comparison group, comparison group ED rate in B8 now matches the innovation group's rate considerably better. The innovation group rate has minor fluctuations throughout, and they become more prominent in the innovation period. Further statistical testing on the impact of the innovation is discussed in the next section.

Table 21. ED Visits per 1,000 Medicare Participants: 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																				
ED rate	187	167	193	127	202	234	273	384	249	324	241	317	301	295	220	323	233	172	340	212
Std dev	500	433	464	351	539	544	560	761	495	782	532	714	930	626	583	1252	477	521	626	545
Unique patients	166	168	171	173	173	175	176	177	177	170	162	145	136	122	109	96	86	64	50	33
Comparison Group																				
ED rate	195	182	185	224	255	218	264	290	243	258	252	255	262	272	223	267	241	278	248	224
Std dev	282	306	311	329	364	332	351	376	327	351	344	342	374	405	350	355	382	351	343	329
Weighted patients	171	172	173	174	175	177	177	177	177	177	166	154	142	134	125	115	104	84	69	45
Innovation − Comparison Rate																				
	−8	−16	8	−97	−53	16	9	94	6	66	−11	62	39	23	−3	56	−9	−106	92	−12

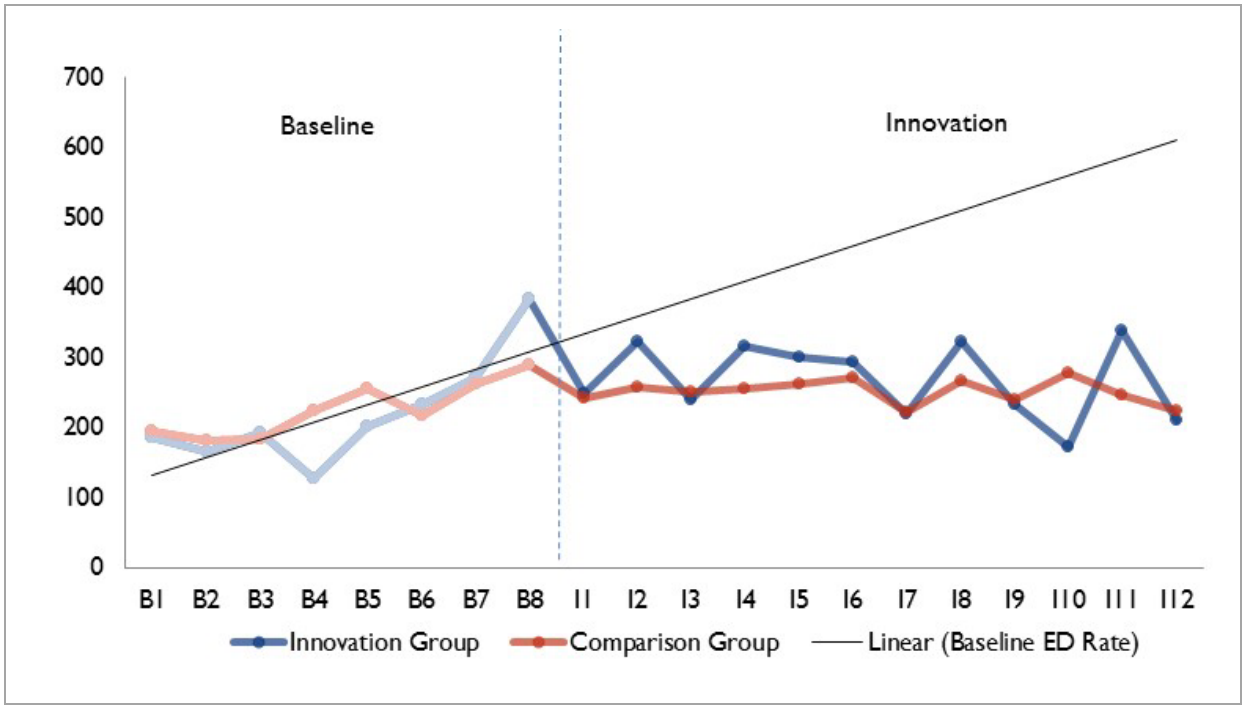
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

Figure 13. ED Visits per 1,000 Medicare Participants: Lahey–CHF



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- ED = emergency department; Lahey–CHF = Lahey Health System–Congestive Heart Failure.

2.11.2 Regression Results

As shown in ***Table 22***, 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 increase 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: −8, 63).In AR3, the estimates also showed an increase in average quarterly ED visits (87 per 1000), however, the effect was statistically significant in AR3.

We also present quarterly effects 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 estimates vary between positive and negative values, and none of them are statistically significant.

Table 22. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Lahey–CHF

Quarter	Coefficient	Standard Error	P-Values
I1	8	47	0.869
I2	74	64	0.249
I3	−8	51	0.877
I4	71	70	0.309
I5	49	87	0.573
I6	38	68	0.574
I7	9	63	0.892
I8	53	127	0.676
I9	−4	66	0.952
I10	−105	72	0.150
I11	87	93	0.353
I12	−21	105	0.843
Overall average	27	22	0.205
Overall aggregate	37	29	0.205
Overall aggregate (IY1)	23	19	0.226
Overall aggregate (IY2)	17	20	0.388
Overall aggregate (IY3)	−3	9	0.718

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: Jan 2011 to June 2016.

Terms and Definitions

- **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 as 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 Medicare Primary Care Visits – CHA

2.12.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 23*** and ***Figure 14***. The primary care visit rate for the comparison group is similar to the innovation group in the baseline period. In the innovation period, innovation group rate is consistently higher than the primary care visit rate. High primary care visit rates among participants during the innovation period are consistent with CHA innovation's focus on continuity of care. We present regression results from difference-in-difference regressions in the next section.

Table 23. Primary Care Visits per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Primary care rate	1,154	1,086	1,077	1,185	1,168	1,192	1,105	2,063	1,546	1,563	1,476	1,460	1,524	1,395	1,344	1,303	1,370	1,484	1,549	1,520
Std dev	1,627	1,576	1,506	1,724	1,655	1,756	1,757	1,859	1,950	2,030	2,185	2,229	2,259	2,034	2,205	2,193	2,427	2,450	2,508	2,253
Unique patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	809	788	728	666	581	452
Comparison Group																				
Primary care rate	1,154	1,086	1,077	1,185	1,168	1,192	1,105	2,063	1,546	1,563	1,476	1,460	1,524	1,395	1,344	1,303	1,370	1,484	1,549	1,520
Std dev	1,627	1,576	1,506	1,724	1,655	1,756	1,757	1,859	1,950	2,030	2,185	2,229	2,259	2,034	2,205	2,193	2,427	2,450	2,508	2,253
Weighted patients	767	784	811	840	867	888	913	950	950	937	914	881	846	824	809	788	728	666	581	452
Innovation − Comparison Rate																				
	1,154	1,086	1,077	1,185	1,168	1,192	1,105	2063	1,546	1,563	1,476	1,460	1,524	1,395	1,344	1,303	1,370	1,484	1,549	1,520

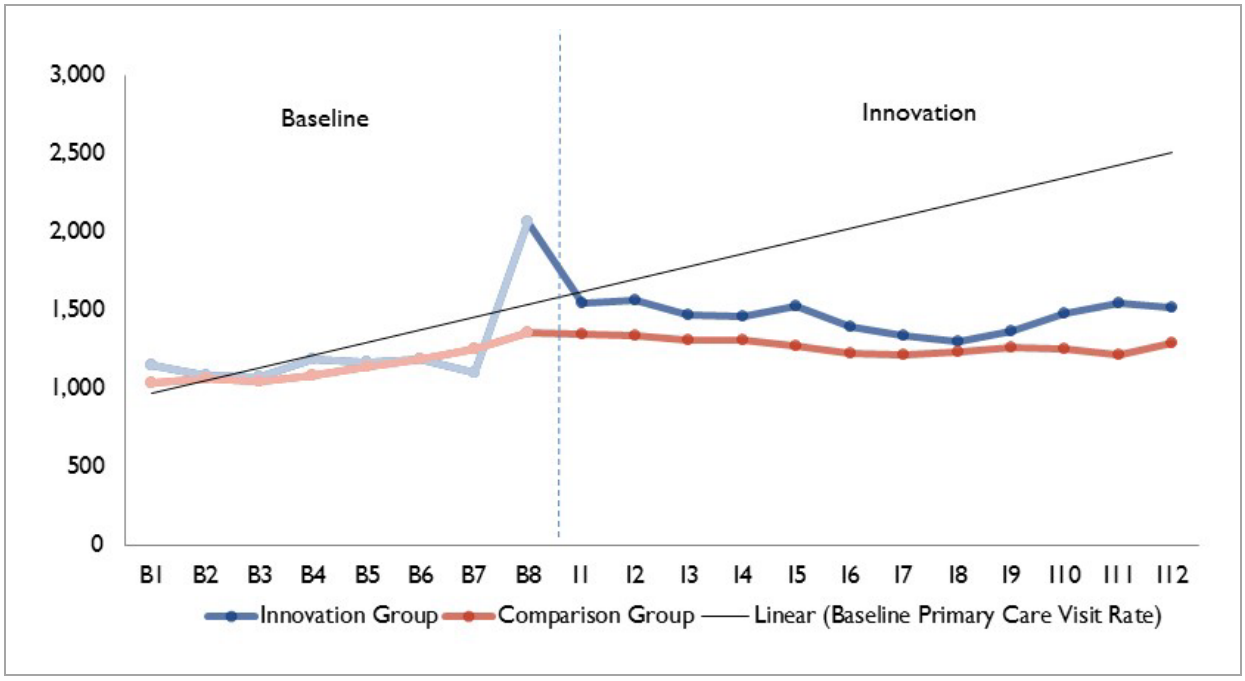
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; Cambridge Health Alliance.

Figure 14. Primary Care Visits per 1,000 Medicare Participants: CHA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- CHA= Cambridge Health Alliance.

2.12.2 Regression Results

As shown in ***Table 24***, the average quarterly difference-in-differences estimate for primary care visits is an increase of 29 primary care visits per 1,000 participants relative to the comparison group. This figure is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is not statistically significant (90% CI: −12, 71).

We also present quarterly effects with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. None of the quarterly estimates are statistically significant. The estimates for Year 1, 2 and 3 of the innovation are also not statistically significant.

Table 24. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicare Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	55	66	0.404
I2	101	73	0.167
I3	−2	78	0.983
I4	−10	82	0.902
I5	123	82	0.133
I6	58	80	0.470
I7	−26	88	0.764
I8	−103	91	0.259
I9	−67	95	0.481
I10	49	99	0.622
I11	165	108	0.128
I12	24	132	0.857
Overall average	29	25	0.239
Overall aggregate	276	234	0.239
Overall aggregate (IY1)	136	137	0.322
Overall aggregate (IY2)	49	139	0.724
Overall aggregate (IY3)	90	129	0.484

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** Jan 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; CHA=Cambridge Health Alliance.

2.13 Discussion: Medicare Results

In the 12 innovation quarters we examined, we found no evidence that the CHA project had a statistically significant impact on reducing spending. The spending increase in Year 1 was on the margin of statistical significance. Significant increases occurred in inpatient admissions across the 3 years (8 more hospitalizations per 1,000 participants per quarter). We found no statistically significant difference between the innovation and comparison groups in probability of a hospital readmission or counts of primary care visits. The innovation only impacted ED visits favorably. Innovation group individuals were significantly less likely to have an ED visit (21 less ED visits per 1,000 participants per quarter) on average across the 3 innovation years.

The Medicare results for the CHA project are mostly inconsistent with the innovation's theory of change, because the CHA project intended to improve scheduling processes to increase patients' access to primary care. Through the CHA project, patients were assigned to primary care teamlets that enabled them to see their personal primary care physician, or if unavailable, another provider within the teamlet. The CHA project would be expected to increase use of primary care, decrease inpatient admissions, and decrease ED visits. We find evidence of only the final outcome.

In the Lahey–CHF innovation, significant losses occurred in Year 1, with no significant overall effect on spending across the 3 years. Increases occurred in inpatient admissions in Year 1 and overall across the 3 years, with no significant impact on ED visits or readmissions.

The Lahey project focused on helping CHF patients access needed post-discharge care, and as such, we expected to see a reduction in readmissions. However, we do not observe a significant impact on readmissions, implying that either the project was not effective in reaching its goal or that unrelated factors had a negating impact.

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. In addition, the sample size for the Lahey project was small, which can hinder the detection of changes in spending and utilization.

2.14 Medicaid Comparison Group—CHA

We present Medicaid claims data for the CHA innovation through June 30, 2014. The Medicaid claims analysis focuses on 1,463 Medicaid beneficiaries enrolled in fee-for-service Medicaid 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 and a group of statistically matched comparison beneficiaries with fee-for-service Medicaid living in the Boston area. We used the same PSM methods to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries as those reported in the third annual report. 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 25 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 25. 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	
Previous Medicaid										
Age	31.35	23.80	36.48	25.48	0.208	31.35	23.78	32.96	23.82	0.068
Percentage adult	50.22	50.02	50.71	49.99	0.010	50.22	50.00	51.38	49.98	0.023
Percentage dual	7.04	25.59	32.97	47.01	0.685	7.04	25.58	7.44	26.25	0.016
Payments in calendar quarter prior to enrollment	$565	$1,953	$1,562	$4,983	0.264	$565	$1,952	$461	$1,630	0.058
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$2,003	$5,447	$5,807	$17,711	0.290	$2,003	$5,445	$1,725	$4,969	0.053
Percentage female	57.95	49.39	55.80	49.66	0.043	57.95	49.36	55.11	49.74	0.057
Percentage white	14.34	35.06	34.20	47.44	0.476	14.34	35.04	16.88	37.46	0.070
Percentage disabled	11.64	32.09	37.03	48.29	0.619	11.64	32.07	11.99	32.48	0.011
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.10	0.36	0.12	0.56	0.048	0.10	0.36	0.08	0.44	0.039
Number of ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	0.43	1.14	0.64	2.00	0.125	0.43	1.14	0.38	1.17	0.043
Number of ED visits in calendar quarter prior to enrollment	0.14	0.50	0.17	0.67	0.041	0.14	0.50	0.11	0.44	0.069
Number of inpatient stays in calendar quarter prior to enrollment	0.02	0.17	0.03	0.22	0.050	0.02	0.17	0.02	0.13	0.048
Number of beneficiaries	1,151	—	1,857,210	—	—	1,151	—	3,453	—	—
Number of unique beneficiaries[1]	—	—	361,499	—	—	1,151	—	3,234	—	—
Number of weighted beneficiaries	—	—	—	—	—	1,151	—	1,151	—	—
No Medicaid in Previous Quarter										
Age	22.60	24.13	18.91	19.28	0.169	22.60	24.09	22.30	23.83	0.013
Percentage dual	1.92	13.76	6.37	24.42	0.224	1.92	13.73	1.82	13.35	0.008
Percentage female	56.41	49.67	54.68	49.78	0.035	56.41	49.59	55.66	49.68	0.015
Percentage white	11.54	32.00	21.06	40.77	0.260	11.54	31.95	11.11	31.43	0.013
Percentage disabled	3.53	18.47	8.88	28.45	0.223	3.53	18.44	3.42	18.17	0.006
Number of beneficiaries	312	—	94,216	—	—	312	—	936	—	—
Number of unique beneficiaries[1]	—	—	91,121	—	—	312	—	600	—	—
Number of weighted beneficiaries	—	—	—	—	—	312	—	312	—	—

[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).

Notes:

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

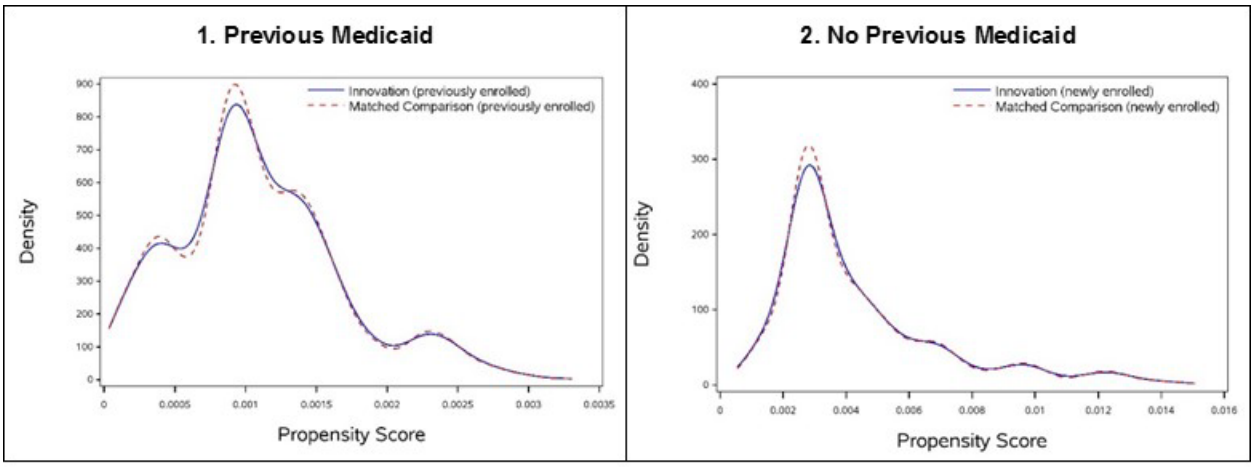
Terms and Definitions

- 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 25). The results in Table 25 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



Notes:

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

Terms and Definitions

- CHA= Cambridge Health Alliance.

2.15 Medicaid Spending—CHA

2.15.1 Descriptive Results

Table 26 reports Medicaid spending per patient in the 8 quarters before and 6 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 26 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 rates are parallel for the two groups in the baseline period where spending is relatively higher for the innovation group. The innovation group's spending spikes in the first innovation quarter, possibly due to the increased utilization of services. The spending rate for the innovation group drops noticeably in the remaining innovation quarters. Unlike AR3, In I2 through I6, innovation group spending rate is noticeably lower than the comparison group rate, possibly suggesting savings in the long run. These trends differ from those in the third annual report because the innovation group increased by more than 1,000 participants. We explore the differences between the two groups further in the regression analysis section.

Table 26. 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	I4	I5	I6
Innovation Group														
Spending rate	$775	$715	$821	$957	$764	$776	$746	$565	$957	$497	$429	$331	$336	$325
Std dev	$2,234	$2,046	$2,740	$3,127	$2,129	$2,472	$2,229	$1,953	$2,713	$1,784	$1,737	$1,623	$1,423	$1,396
Unique patients	367	457	527	591	691	778	903	1,151	1,463	1,256	937	711	498	194
Comparison Group														
Spending rate	$541	$547	$543	$539	$528	$569	$540	$461	$666	$602	$609	$913	$681	$739
Std dev	$1,101	$1,084	$1,230	$1,146	$1,085	$1,412	$1,177	$973	$1,411	$1,238	$1,254	$2,235	$1,457	$1,776
Weighted patients	935	1,010	1,036	1,034	1,045	1,036	1,067	1,151	1,463	1,204	925	726	513	206
Savings per Patient														
	−$234	−$168	−$278	−$418	−$236	−$207	−$206	−$104	−$291	$105	$180	$582	$345	$414

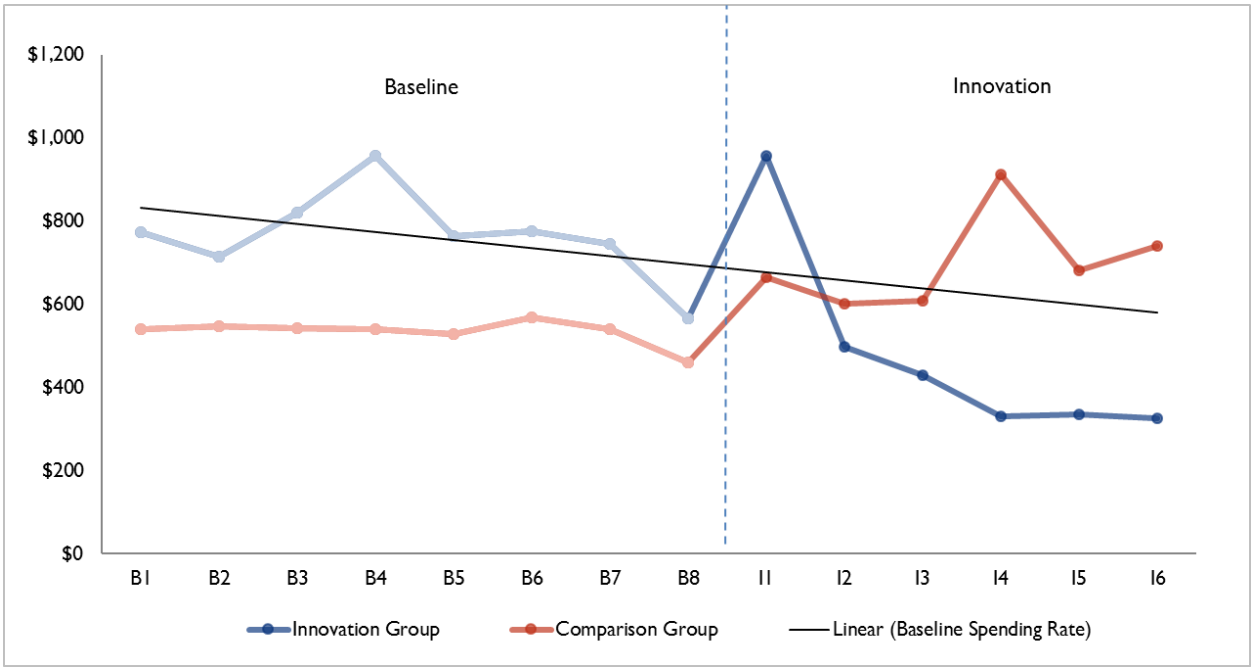
Notes:

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

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 16. Medicaid Spending per Participant: CHA



Notes:

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

Terms and Definitions

- 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 −$348 (90% CI: −$469, −$227). This effect is statistically significant and is larger in magnitude than the estimated savings in the third annual report. These estimates differ from those in the third annual report because the innovation group increased by more than 1,000 participants.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 quarterly effects. ***Table 27*** 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 quarters 2 through 6, indicating that the program led to decreased spending among the innovation group. The decrease is also significant overall in Year 1 and Year 2.

Table 27. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	$54	$99	0.588
I2	−$348	$71	<.0001
I3	−$422	$74	<.0001
I4	−$829	$228	0.000
I5	−$583	$92	<.0001
I6	−$649	$159	<.0001
Overall average	−$348	$74	<.0001
Overall aggregate	−$1,760,245	$372,131	<.0001
Overall aggregate (IY1)	−$1,343,715	$339,148	<.0001
Overall aggregate (IY2)	−$416,530	$69,373	<.0001

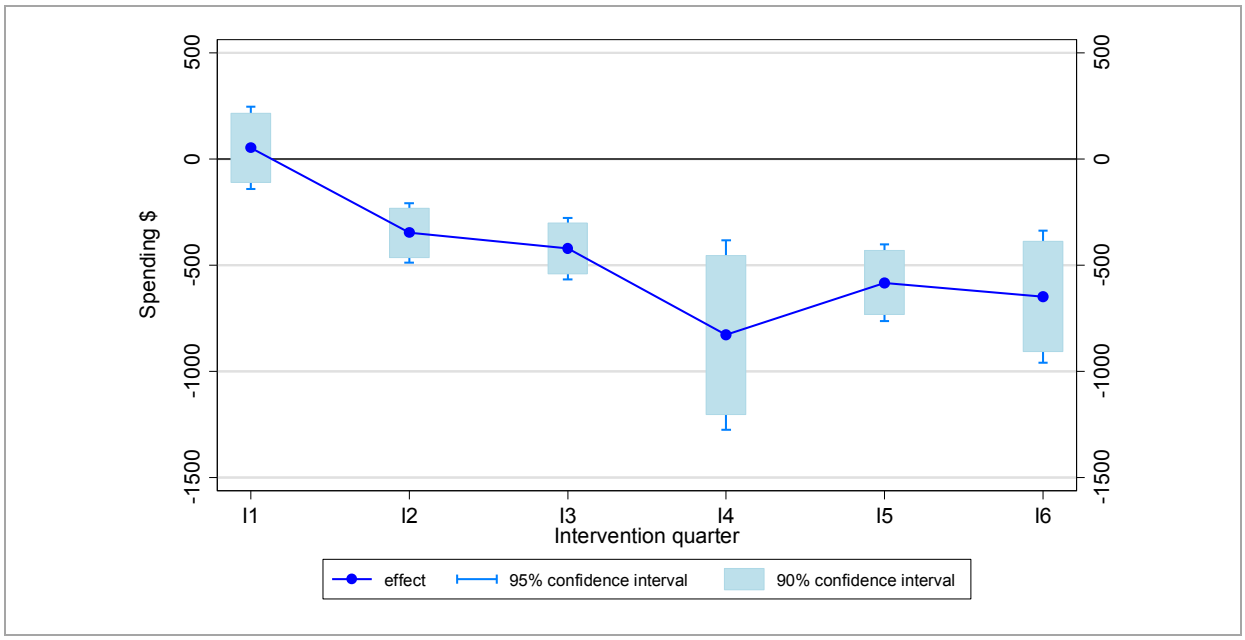
Notes:

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

Terms and Definitions

- **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.
- **Overall average:** 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.

Figure 17. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: CHA



Notes:

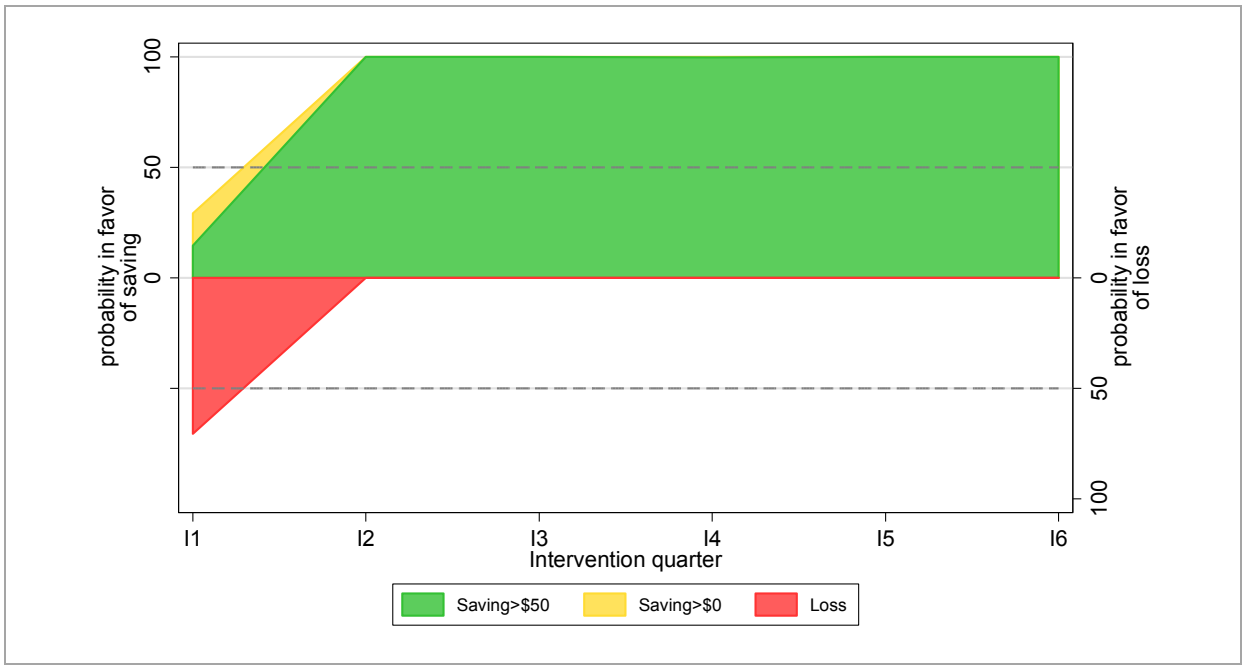
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.

Terms and Definitions

- 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 for saving or losing money on this initiative. The larger the probability, the more convincing the evidence is in favor of savings or loss. This figure shows a very high probability of savings in I2 to I6 (100%), represented by the green area in this figure. Potential losses are indicated in I1.

Figure 18. Quarterly Strength of Evidence in Favor of Savings/Loss: CHA



Notes:

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

Terms and Definitions

- CHA= Cambridge Health Alliance.

2.16 Medicaid Inpatient Admissions—CHA

2.16.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 28*** and ***Figure 19***. Similar to the spending rate, the inpatient admissions rate for the innovation group is higher in than the comparison group rate in the baseline period. The innovation group's rate spikes in I1. For the rest of the innovation period, the admissions rate for the innovation group drops below the comparison group rate, possibly suggesting long-run improvements in utilization. These trends differ from those in the third annual report because the sample size increased. We will explore the differences between the two groups further in the regression analysis section.

Table 28. 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	I4	I5	I6
Innovation Group														
Admit rate	49	22	40	44	36	41	40	23	64	14	14	11	14	0
Std dev	310	146	223	213	194	211	207	170	256	119	142	118	161	0
Unique patients	367	457	527	591	691	778	903	1,151	1,463	1,256	937	711	498	194
Comparison Group														
Admit rate	21	20	25	30	26	26	27	15	32	18	18	29	18	13
Std dev	97	88	113	120	118	110	114	79	122	93	97	127	94	76
Weighted patients	935	1,010	1,036	1,034	1,045	1,036	1,067	1,151	1,463	1,204	925	726	513	206
Innovation − Comparison Rate														
	28	2	15	14	10	15	13	7	32	−4	−4	−18	−4	−13

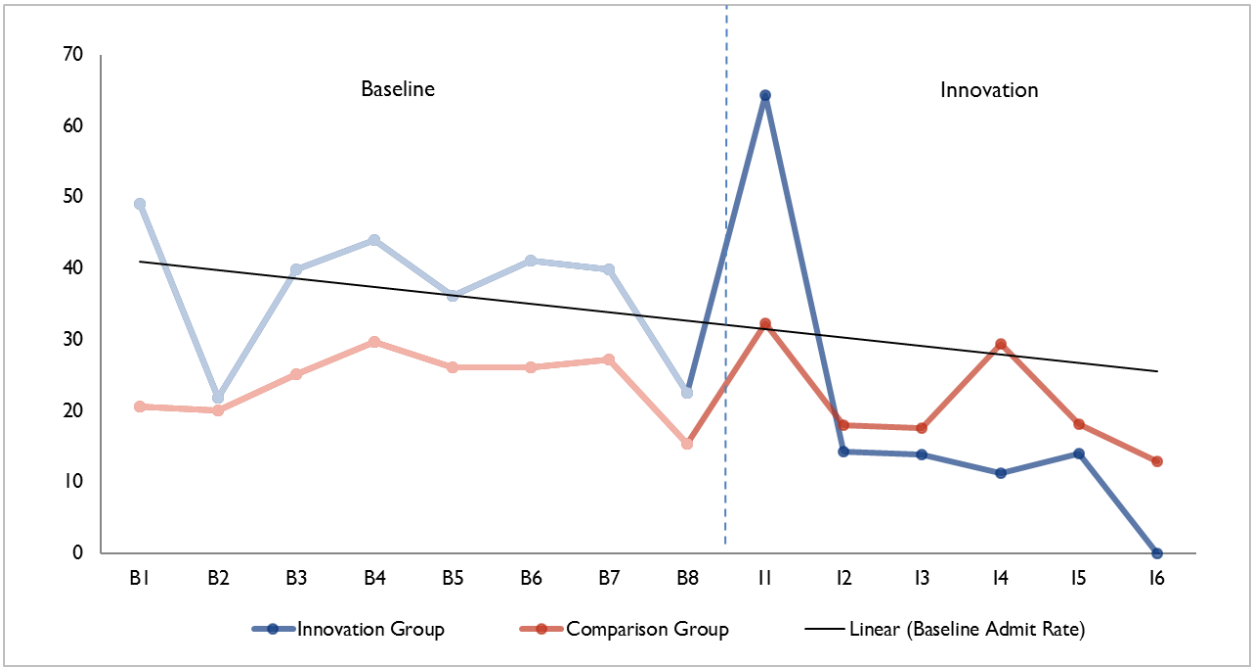
Notes:

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

Terms and Definitions

- **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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 19. All-Cause Inpatient Admissions Rate per 1,000 Participants: CHA



Notes:

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

Terms and Definitions

- CHA= Cambridge Health Alliance.

2.16.2 Regression Results

The average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 15 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: −25, −4). These results are similar to the results in the third annual report, with the decrease in inpatient admissions becoming slightly smaller (decrease of 27 in AR3).

We also present quarterly effects for five innovation quarters (we are not able to present the estimated effect for the sixth innovation quarter due to convergence problems). ***Table 29*** presents the results 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. Except for I1, the innovation group's inpatient admissions are lower than the comparison group's and estimates are statistically significant at the 10 percent level in I2, I3, and I4. The estimate in I5 is nearly significant.

Table 29. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Participants: CHA

	Coefficient	Standard Error	P-Values
I1	2	16	0.884
I2	−17	6	0.009
I3	−16	7	0.029
I4	−43	24	0.074
I5	−17	10	0.109
Overall average	−15	6	0.022
Overall aggregate	−72	31	0.022
Overall aggregate (IY1)	−64	31	0.039
Overall aggregate (IY2)	−8	5	0.109

Notes:

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

Terms and Definitions

- **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.

2.17 Medicaid Unplanned Readmissions—CHA

2.17.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 30*** and ***Figure 20***. Similar to AR3, the readmissions rate varies extremely for both innovation and comparison groups. The fluctuations in the readmissions rate are mostly due to the small number of total admissions in a given quarter. The frequent fluctuations in the observed readmissions rates among both groups make comparing trends between the two groups and changes since the third annual report difficult. We will further explore the differences between the two groups in the regression analysis section.

Table 30. 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	I4	I5	I6
Innovation Group														
Readmit rate	200	0	0	87	50	69	71	150	25	0	222	200	167	0
Std dev	400	0	0	282	218	253	258	357	156	0	416	400	373	0
Total admissions	15	9	15	23	20	29	28	20	80	11	9	5	6	0
Comparison Group														
Readmit rate	116	106	136	160	118	141	101	93	128	122	176	91	100	200
Std dev	321	308	342	367	322	348	302	290	334	327	381	287	300	400
Total admissions	14	16	20	25	23	21	23	14	42	14	11	15	7	2
Innovation − Comparison Rate														
	84	−106	−136	−73	−68	−72	−30	57	−103	−122	46	109	67	−200

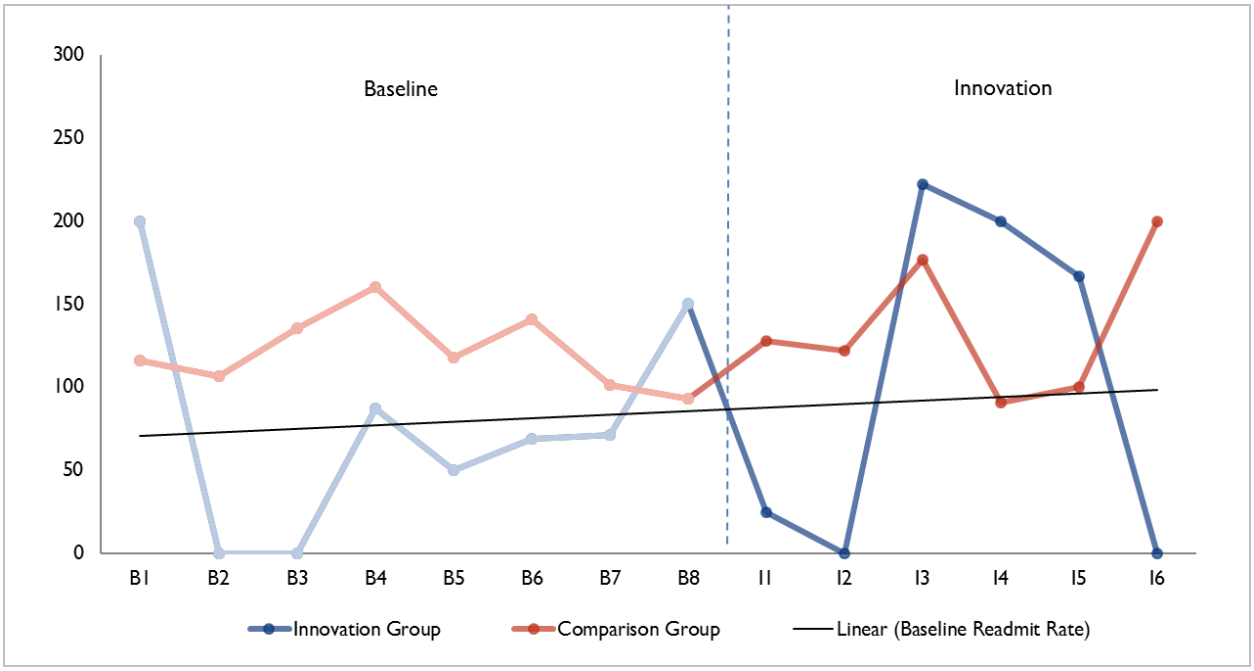
Notes:

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

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; CHA = Cambridge Health Alliance; I1 = Innovation Q1.

Figure 20. Hospital Unplanned Readmissions Rates per 1,000 Admissions: CHA



Notes:

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

Terms and Definitions

- CHA = Cambridge Health Alliance.

2.17.2 Regression Results

Table 31 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 −91 per 1,000 inpatient admissions. This is the average difference in the probability of unplanned readmissions for all innovation quarters. The effect is not statistically significant (90% CI: −198, 17) and is similar to the result in the third annual report.

Table 31. 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	−91	65	0.167
Overall aggregate	−10	7	0.167

Notes:

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

Terms and Definitions

- **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.

2.18 Medicaid Emergency Department Visits—CHA

2.18.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 32*** and ***Figure 21.*** The ED visit rate for the two groups follow a similar trend in the baseline period, even though the innovation group rate is higher. Throughout the innovation period, however, the ED visit rate for the innovation group decreases noticeably and drops below the comparison group rate, possibly suggesting long-run improvements in ED utilization. These trends differ from those in the third annual report because of the large increase in the sample size. Throughout the innovation period, the ED visit rate for the innovation group is now noticeably lower than the comparison group rate. We will further explore the differences between the two groups in the regression analysis section.

Table 32. 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	I4	I5	I6
Innovation Group														
ED rate	169	154	150	162	185	183	163	144	134	103	72	70	57	62
Std dev	629	530	549	497	590	588	524	500	515	407	340	352	268	299
Unique patients	367	457	527	591	691	778	903	1,151	1,463	1,256	937	711	498	194
Comparison Group														
ED rate	130	131	127	124	117	119	109	111	149	145	130	156	138	157
Std dev	302	299	298	323	273	288	261	261	349	307	299	315	301	324
Weighted patients	935	1,010	1,036	1,034	1,045	1,036	1,067	1,151	1,463	1,204	925	726	513	206
Innovation − Comparison Rate														
	39	23	23	38	68	64	54	33	−15	−42	−58	−86	−81	−95

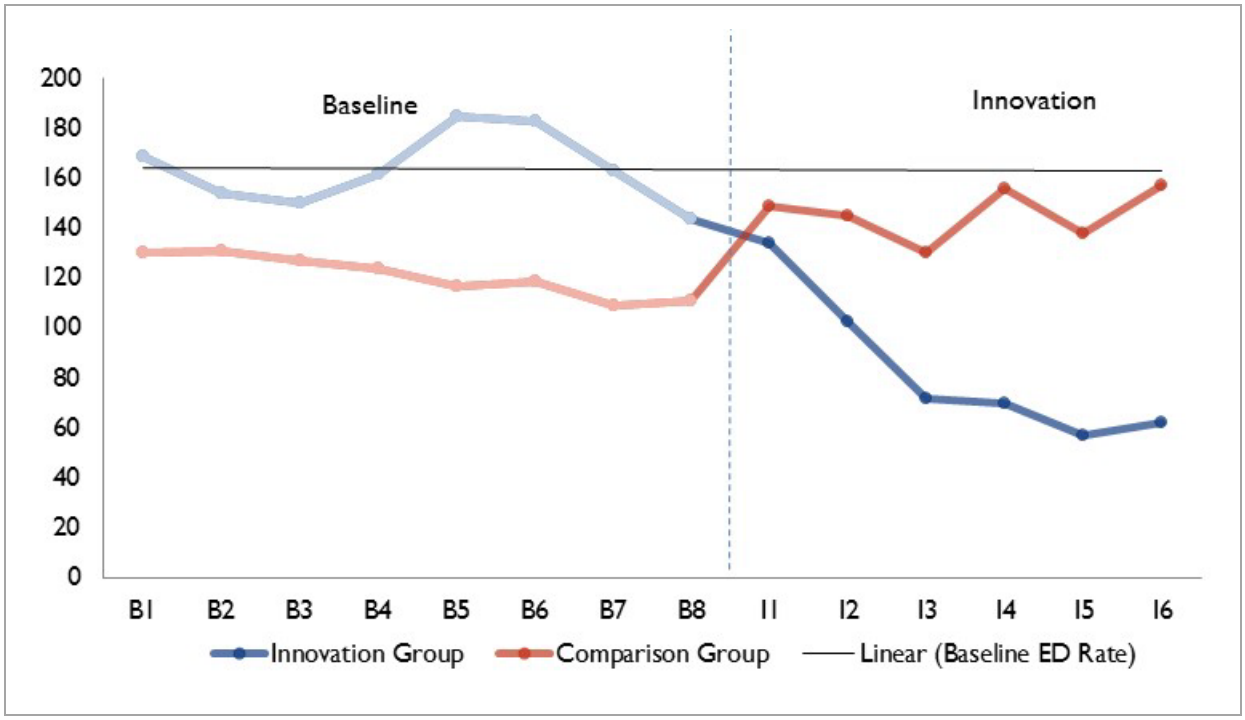
Notes:

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

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; CHA = Cambridge Health Alliance; ED = emergency department; I1 = Innovation Q1.

Figure 21. ED Visits per 1,000 Participants: CHA



Notes:

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

Terms and Definitions

- CHA = Cambridge Health Alliance; ED = emergency department.

2.18.2 Regression Results

The average quarterly difference-in-differences estimate for ED visits is a decrease of 111 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: −132, −90). In the third annual report, the decrease in ED visits was not statistically significant.

We also present quarterly effects. ***Table 33*** presents results 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 significantly lower ED visits in each quarter compared with the comparison group. In total, the innovation decreased ED visits by 462 in Year 1 and by 99 visits in Year 2. 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 33. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Participants: CHA

Quarter	Coefficient	Standard Error	P-Values
I1	−72	28	0.010
I2	−105	25	0.000
I3	−108	21	0.000
I4	−174	40	0.000
I5	−138	32	0.000
I6	−159	46	0.001
Overall average	−111	13	0.000
Overall aggregate	−561	65	0.000
Overall aggregate (IY1)	−462	63	0.000
Overall aggregate (IY2)	−99	18	0.000

Notes:

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

Terms and Definitions

- **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.

2.19 Discussion: Medicaid Results—CHA

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 spending, inpatient admissions and ED visits on average. Despite an initial increase in these measures in the first innovation quarter, overall on average, the innovation led to $348 of quarterly savings, 15 fewer inpatient admissions and 111 fewer ED visits per 1000 participants compared to the comparison group.

The overall findings do not support NEU's theory of action because the aim of the innovation was primarily to improve system processes not to reduce spending and utilization. The changes to systems at CHA might have led to reductions; however the scope of our evaluation did not include assessing these system changes at CHA.

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 10 percent of the overall population reached by the innovation. After matching the awardee-provided IDs to the Chronic Conditions Data Warehouse, and subsetting to individuals with fee-for-service Medicaid, the final sample was 1,463.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

Prosser Public Hospital District

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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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: Prosser

Data Source	Period Covered
Medicare claims data	January 2013–June 2016

Terms and Definitions

- Prosser = Prosser Public Hospital District.

Prosser Public Hospital District (Prosser)

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. Below we present the goals, as well as the findings, for this innovation which began enrolling participants on January 1, 2013.

1. **Smarter spending.**

   Goal: 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.

   Findings: The Prosser innovation has no statistically significant decreases or increases in total spending for Medicare beneficiaries who participated compared to those who were eligible, but did not participate in the innovation. Overall, Medicare beneficiaries have a 68 percent probability of incurring a loss. This might simply reflect sample composition among those who opted in. For example, individuals in Cohort 3 are less likely opt into the program than those in Cohorts 2 and 3.

2. **Better care.**

   Goal: Improve care by increasing the number of patients who understand their discharge instructions, attend follow-up appointments, and fill prescriptions according to discharge instructions.

   Findings: Although CP visits were specifically designed to reduce ED visits, inpatient admissions, and readmissions, we find statistically significant higher readmission rates and ED visits among those who select into the program compared to those who do not. Results, however, may depend heavily on the distribution of self-selection into the program across the three cohorts. The type of and frequency of services that CPs provided may not have been enough to change utilization behavior.

3. **Healthier people**.

   Goal: Improve health by reducing the number of unexpected encounters for targeted patients.

   Findings: None to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected during the innovation period. The weighted average quarterly impact in spending, representing an increase in spending, was $1,030 (90% CI: −$465, $2,515) per participant per quarter. This effect is not statistically significant. Increases in unplanned readmissions and ED visits are statistically significant over the entire innovation period, and amount to 88 more readmissions and 99 more ED visits per 1,000 participants per quarter. We also see an increase in inpatient visits of 44 visits per 1,000 beneficiaries per quarter. This increase is not statistically significant. Because Prosser developed the CPP to reduce utilization among high-risk patients and the eligible nonparticipants who were not randomized may not have been as high risk, these findings are inconsistent with the innovation's theory of change. However, we are not able to match beneficiaries due to the small sample size so the comparison group consists of eligible nonparticipants. Medicaid results are not presented and have not changed since the third annual report.[1]

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 2. Summary of Medicare Claims-Based Findings: Prosser

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$2.417	−$1.070, $5.903	−$0.298, $5.131	$0.585	−$1.474, $2.643	$1.757	$0.382, $3.132	$0.075	−$0.920, $1.070
Acute care inpatient stays	103	−17, 223	9, 196	9	64, 1	−62	125, 49	25	91, 17
Hospital-wide all-cause unplanned readmissions	37	14, 60	19, 55	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	231	53, 410	92, 370	60	−73, 192	112	30, 194	60	−27, 147
Average impact per quarter									
Spending per participant	$1,030	−$456, $2,515	−$127, $2,186	$547	−$1,380, $2,475	$2,029	$441, $3,617	$182	−$2,228, $2,591
Acute care inpatient stays (per 1,000 participants)	44	−7, 95	4, 84	4	60, 1	−58	117, 57	25	105, 19
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	88	32, 144	45, 132	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	99	23, 175	39, 158	39	75, 0	−68	152, 129	57	224, 56

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** January 2013 to June 2016.
- **Sample size**: 275 unique Medicare fee-for-service beneficiaries included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Prosser = Prosser Public Hospital District.

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 3 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 3. Claims-Based Outcome Measures: Prosser

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

Terms and Definitions

- Note: New Medicaid data are not available for the State of Washington; therefore, we do not include Medicaid results in this third annual addendum report.
- ED = emergency department; Prosser = Prosser Public Hospital District.

2.3 Medicare Comparison Group

The Medicare claims analysis focuses on 275 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. We present Medicare claims data through June 30, 2016. This analysis includes two additional quarters (Jan-June 2016) of Medicare claims data since the third annual report. 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). This report includes the same comparison group as used in the third annual report except for two individuals who had a change in their recorded fee-for-service eligibility status and two additional beneficiaries enrolled, for a total of 97 individuals. See the third annual report for additional details.

Table 4 is an update of the data presented in the third annual report. 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 4. Mean Values and Standardized Differences of Variables in Propensity Score Model: 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 enrolment	$6,544	$23,641	$5,898	$13,652	0.033
Total payments in second, third, fourth, and fifth calendar quarters prior to enrolment	$11,556	$25,524	$12,828	$25,921	0.049
Age	74.79	11.58	72.32	13.16	0.056
Percentage male	47.58	50.03	50	50.28	0.048
Percentage white	71.75	45.11	75.56	43.22	0.087
Percentage disabled	25.65	43.75	31.11	46.55	0.121
Number of dual-eligible months in the previous calendar year	3.31	5.14	3.09	5.16	0.013
Number of chronic conditions	8.54	4	8.06	4.15	0.017
Percentage with chronic kidney disease ever	30.86	46.28	32.22	46.99	0.029
Percentage with COPD ever	38.66	48.79	35.56	48.14	0.064
Percentage with heart failure ever	37.17	48.42	27.78	45.04	0.202
Percentage with diabetes ever	42.01	49.45	40	49.26	0.041
Percentage with asthma ever	20.82	40.68	21.11	41.04	0.007
Percentage with hypertension ever	81.41	38.97	73.33	44.47	0.194
Number of outpatient ED visits in calendar quarter prior to enrollment	0.5	1.12	0.54	1.38	0.032
Number of outpatient ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.69	3.53	1.68	3.1	0.003
Number of inpatient stays in calendar quarter prior to enrollment	0.19	0.51	0.19	0.52	0.000
Number of inpatient stays in second, third, fourth, and fifth calendar quarters prior to enrollment	0.35	1.06	0.47	1.26	0.019
Percentage with surgical event in calendar quarter prior to enrollment	10.78	35.55	12.22	44.54	0.045
Percentage in Cohort 1	13.38	34.11	6.67	25.08	0.225
Percentage in Cohort 2	19.7	39.85	10	30.17	0.275
Percentage in Cohort 3	75.46	43.11	85.56	35.35	0.257
Number of beneficiaries	269	—	90	—	—

[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).

Notes:

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

Terms and Definitions

- ED = emergency department; COPD = chronic obstructive pulmonary disease; ESRD = end-stage renal disease; SD = standard derivation; Prosser = Prosser Public Hospital District.
- — Data not yet available.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 5 reports Medicare spending per patient in the 8 quarters before and the 12 quarters after enrolling in the innovation. Savings per patient reflect the spending differential between the comparison group and the innovation group, not controlling for other factors. ***Figure 1*** illustrates the Medicare spending 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 spike during the first innovation quarter occurs as a result of the selection criteria. Individuals are eligible to obtain a Community Paramedic (CP) visit after being admitted to Prosser Hospital. 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. Between quarters 4 and 7, participants have higher spending than nonparticipants. The results in this addendum are consistent with the results in the third annual report.

Table 5. 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**	**I12**
Innovation Group																				
Spending rate	$2,587	$3,347	$2,237	$2,879	$2,815	$3,541	$2,986	$6,544	$16,404	$7,103	$5,649	$5,759	$4,734	$5,709	$4,593	$5,698	$6,295	$6,046	$4,845	$5,065
Std dev	$7,000	$10,703	$4,725	$10,266	$8,301	$10,321	$7,342	$23,597	$22,822	$18,908	$12,294	$12,740	$10,544	$13,069	$10,219	$11,812	$16,301	$13,742	$9,509	$11,315
Unique patients	233	237	239	244	255	260	268	269	275	272	264	257	257	234	203	172	144	113	86	70
Comparison Group																				
Spending rate	$2,483	$2,735	$3,453	$3,414	$5,143	$2,742	$5,084	$6,014	$18,051	$6,686	$5,849	$3,695	$3,139	$4,064	$2,935	$6,477	$5,839	$7,047	$4,640	$4,612
Std dev	$5,958	$8,186	$9,249	$9,534	$13,405	$7,399	$15,179	$13,571	$21,348	$11,501	$10,599	$6,543	$8,072	$8,144	$4,217	$13,163	$11,707	$14,831	$9,697	$8,823
Weighted patients	84	86	87	89	90	94	96	98	97	96	91	84	81	64	56	47	44	37	29	21
Savings per Patient																				
	−$104	−$612	$1,216	$535	$2,327	−$799	$2,098	−$530	$1,647	−$418	$200	−$2,064	−$1,596	−$1,646	−$1,658	$780	−$456	$1,000	−$205	−$452

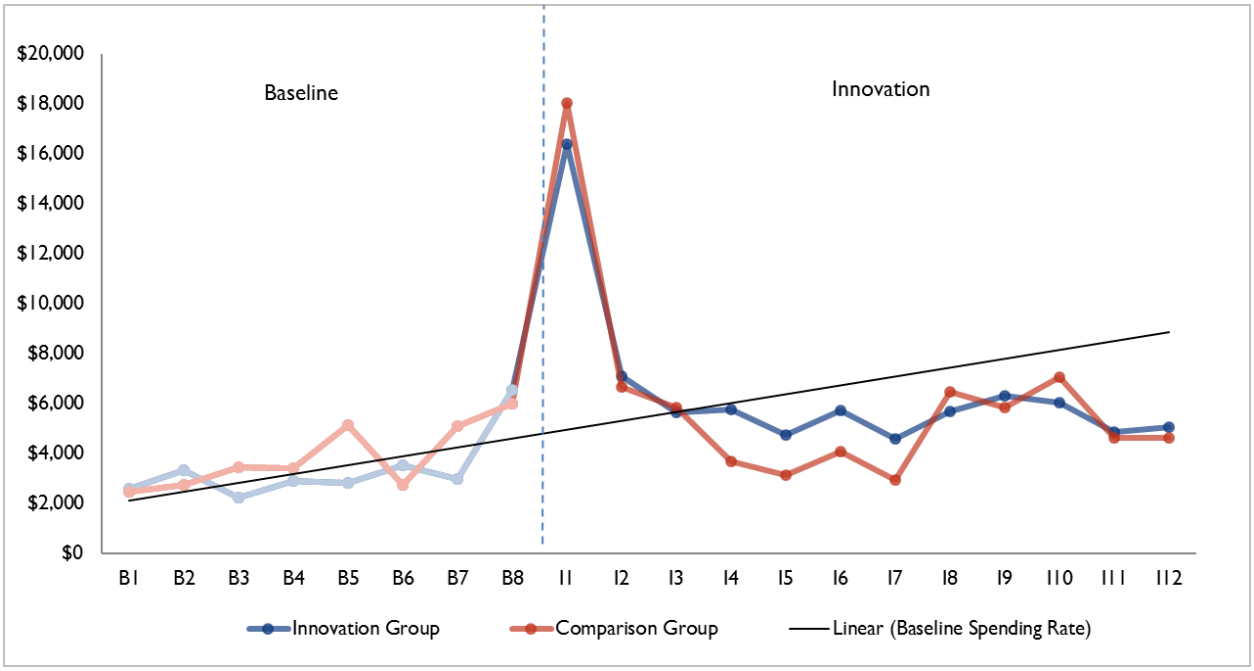
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.

Figure 1. Medicare Spending per Participant: Prosser



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- Prosser = Prosser Public Hospital District.

2.4.2 Regression Results

As shown in ***Table 6,*** we compare the weighted average treatment effect per quarter for beneficiaries during the innovation period to a matched comparison group. The weighted average quarterly spending differential in the innovation period, indicating a loss, is $1,030 (90% CI: −$456, $2,515). This effect is not statistically significant and is comparable to the finding from the third annual report. This estimate represents the innovation group's increased spending relative to the comparison group each quarter. The 90 percent confidence interval is the range in which the true parameter estimate falls, with 90 percent confidence.

We also present quarterly effects derived from 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 estimates. In 9 out of 12 quarters, we find higher spending for participants relative to the comparison group; however, after controlling for participants' characteristics, only 1 of 12 quarters is statistically significant. Differences between individuals who opted in and those who opted out could reflect sample characteristics rather than innovation-driven outcomes.

Table 6. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	−$1,207	$2,536	0.634
I2	$851	$1,644	0.605
I3	$206	$1,492	0.891
I4	$2,455	$1,255	0.051
I5	$2,076	$1,204	0.085
I6	$2,598	$1,361	0.057
I7	$2,791	$1,097	0.011
I8	$285	$2,157	0.895
I9	$640	$2,236	0.775
I10	−$621	$2,702	0.818
I11	$630	$1,935	0.745
I12	−$15	$2,139	0.995
Overall average	$1,030	$901	0.254
Overall aggregate	$2,416,608	$2,115,095	0.254
Overall aggregate (IY1)	$584,526	$1,248,776	0.640
Overall aggregate (IY2)	$1,756,998	$834,158	0.036
Overall aggregate (IY3)	$75,084	$603,764	0.901

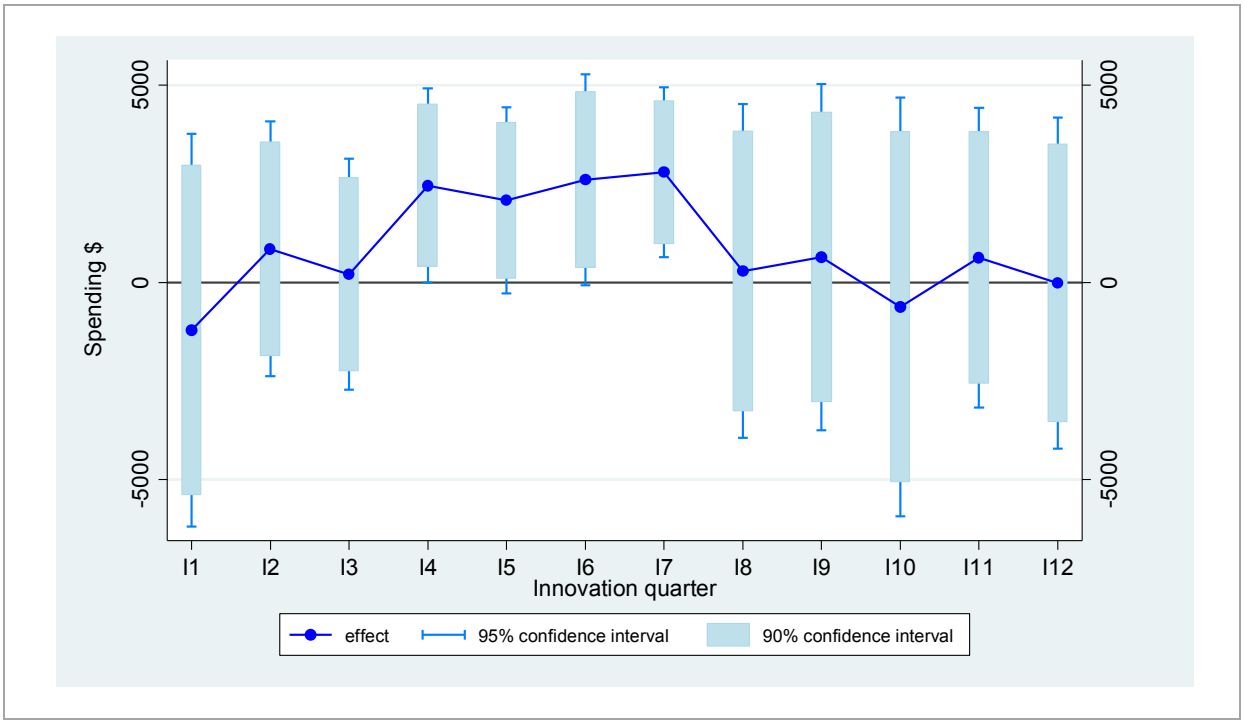
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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, 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 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; Prosser = Prosser Public Hospital District.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Prosser



Notes:

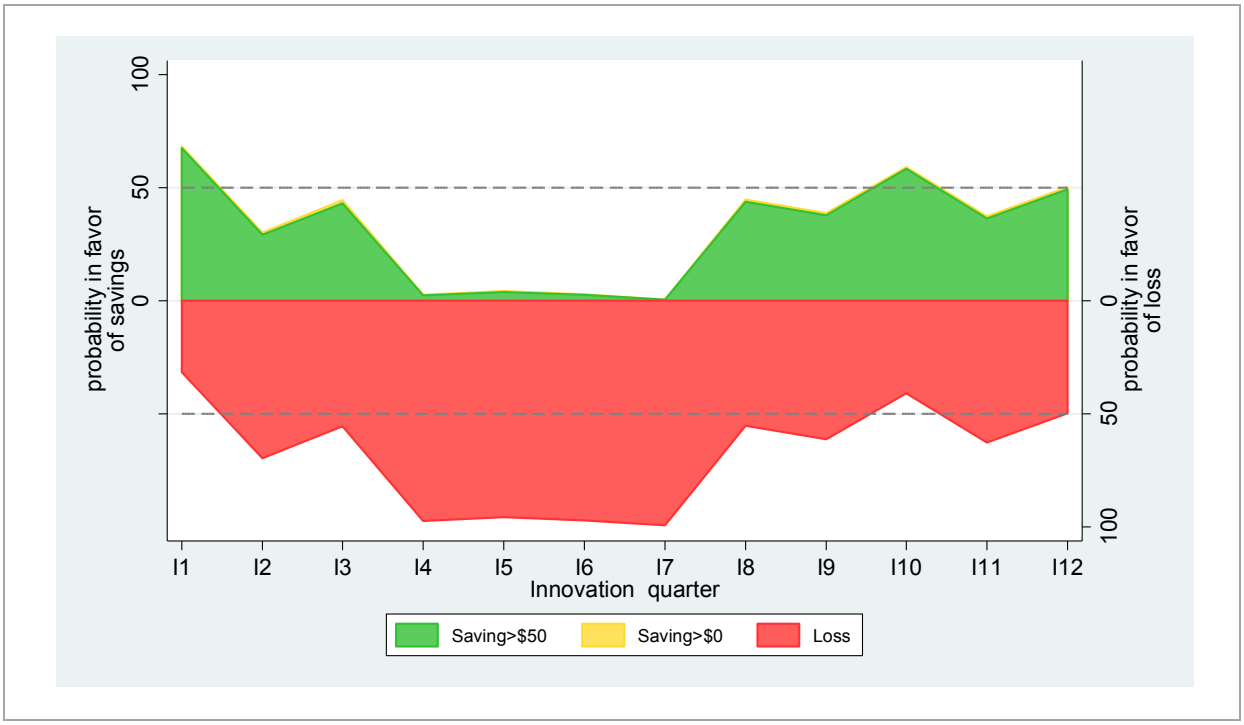
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** January 2013 to June 2016.

Terms and Definitions

- 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 for saving or losing money on this initiative. The larger the probability, the more convincing the evidence is against the null and in favor of the alternative hypothesis. Results show that in 4 out of 12 quarters, the probability of a loss is more likely than the probability of savings. In all other quarters, spending is comparable between participants and nonparticipants. Overall, Medicare beneficiaries had a 68 percent probability of incurring a loss.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Prosser



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- 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 7*** 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. These trends are consistent with those in the third annual report.

Table 7. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Admit rate	82	97	75	98	78	85	108	186	687	199	178	191	167	171	153	209	229	230	128	229
Std dev	317	394	308	486	378	329	480	498	820	526	525	521	514	603	667	573	674	729	426	740
Unique patients	233	237	239	244	255	260	268	269	275	272	264	257	257	234	203	172	144	113	86	70
Comparison Group																				
Admit rate	119	70	92	124	189	74	146	173	804	156	187	95	111	125	89	298	136	216	207	286
Std dev	625	334	326	419	594	300	500	495	857	441	467	332	351	331	285	650	404	621	760	628
Weighted patients	84	86	87	89	90	94	96	98	97	96	91	84	81	64	56	47	44	37	29	21
Innovation − Comparison Rate																				
	−38	27	−17	−25	−110	10	−38	12	−117	42	−9	95	56	46	63	−89	93	14	−79	−57

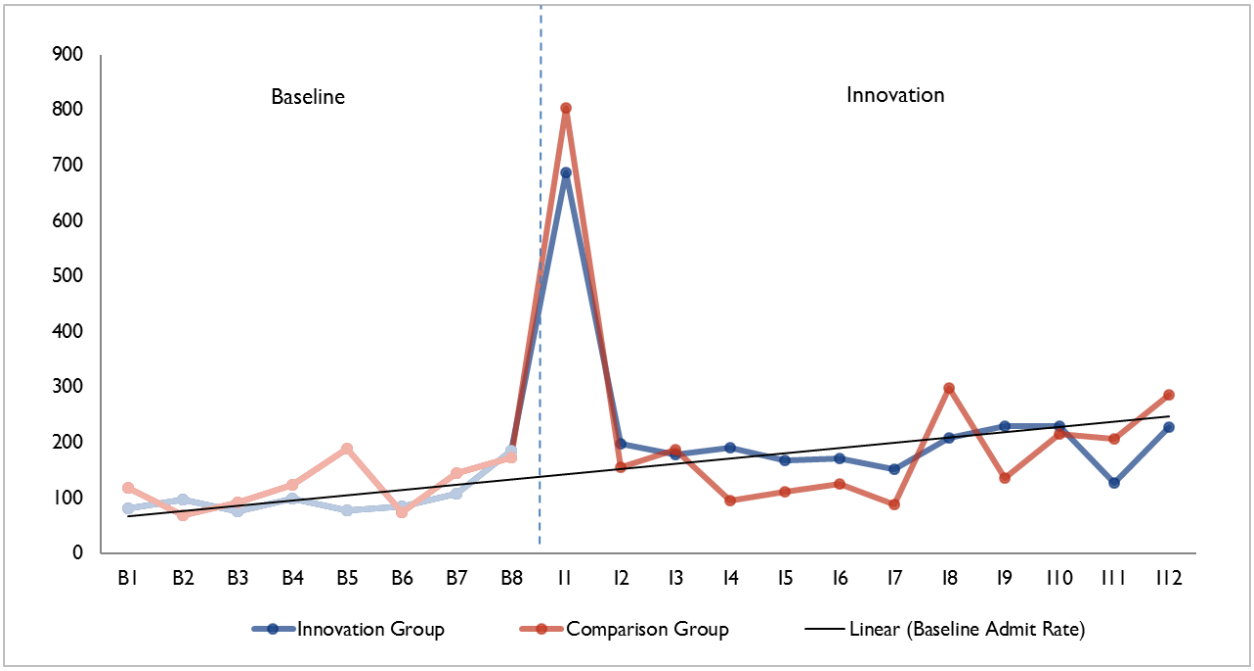
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Prosser



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- Prosser = Prosser Public Hospital District.

2.5.2 Regression Results

As shown in ***Table 8***, the average quarterly difference-in-differences estimate for inpatient admissions is an increase of 44 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: −7, 95). Since the third annual report, the regression estimate for the difference between the innovation and comparison group moved closer to zero and was not statistically significant.

We also present quarterly effects 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. No statistically significant differences in hospital admissions are evident between the innovation and the comparison groups except for one (innovation quarter 4) of 12 quarters.

Table 8. 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	−18	213	0.933
I2	65	57	0.254
I3	12	64	0.849
I4	105	49	0.032
I5	72	48	0.137
I6	70	50	0.160
I7	86	53	0.109
I8	−19	88	0.829
I9	100	90	0.271
I10	38	107	0.721
I11	−22	92	0.807
I12	−87	202	0.668
Overall average	44	31	0.159
Overall aggregate	103	73	0.159
Overall aggregate (IY1)	9	196	42.990
Overall aggregate (IY2)	−62	148	−39.134
Overall aggregate (IY3)	25	0	7.548

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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, 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 treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- B1 = Baseline Q1; I1 = Innovation Q1; 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 9*** and ***Figure 5***. Readmissions rates vary widely, and the trends are consistent with the third annual report.

Table 9. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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**	**I12**
Innovation Group																				
Readmit rate	0	77	0	71	250	111	56	79	79	95	114	51	36	280	318	136	294	389	125	364
Std dev	0	267	0	258	433	314	229	270	271	294	318	221	186	449	466	343	456	488	331	481
Total admissions	18	13	17	14	16	18	18	38	151	42	35	39	28	25	22	22	17	18	8	11
Comparison Group																				
Readmit rate	400	0	0	0	308	0	222	0	97	91	83	125	0	0	0	0	0	250	333	0
Std dev	490	0	0	0	462	0	416	0	296	288	276	331	0	0	0	0	0	433	471	0
Total admissions	5	3	3	5	13	4	9	14	62	11	12	8	8	6	3	11	3	4	3	2
Innovation − Comparison Rate																				
	−400	77	0	71	−58	111	−167	79	−17	4	31	−74	36	280	318	136	294	139	−208	364

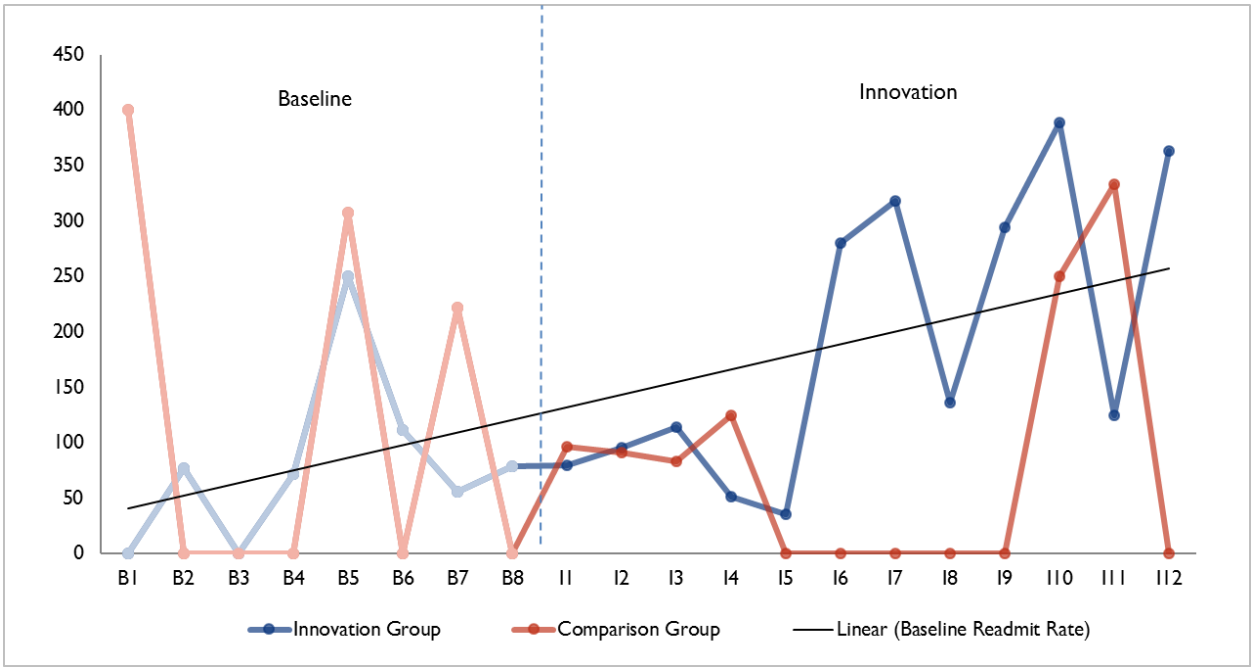
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Prosser Public Hospital District.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Prosser



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 and June 2016.

Terms and Definitions

- Prosser = Prosser Public Hospital District.

2.6.2 Regression Results

Table 10 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 88 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 32, 144) and is consistent with the results from the third annual report. Differences between participants and controls might be driven by cohort composition effects. We tested this hypothesis but did not have enough power to identify three-way interaction terms among cohorts, pre- and post-period of enrollment, and participation.

Table 10. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: Prosser

Quarter	Coefficient	Standard Error	P-Values
Overall average	88	34	0.010
Overall aggregate	37	14	0.010

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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, 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 11*** and ***Figure 6.*** Throughout the baseline period, the ED visit rate is similar in the treatment innovation and comparison groups. In the first innovation quarter, a spike in ED utilization occurs for both participants and nonparticipants, which is dominated by the eligibility criteria of individuals in Cohort 3. The ED visit rate is higher in the comparison group than in the innovation group in the first quarter and in six other subsequent quarters. These findings are consistent with the third annual report.

Table 11. ED Visits per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
ED rate	270	245	280	357	369	338	448	468	1400	482	496	471	471	410	424	471	569	442	651	643
Std dev	749	559	789	930	917	751	1,472	1,035	1,687	1,009	955	893	1,012	895	1,066	958	1,255	855	1,754	1,786
Unique patients	233	237	239	244	255	260	268	269	275	272	264	257	257	234	203	172	144	113	86	70
Comparison Group																				
ED rate	440	302	437	258	500	340	469	520	1649	427	516	417	284	484	446	532	477	649	345	857
Std dev	998	753	1246	613	1,368	770	1,314	1,379	1,899	1,093	1,109	1,020	746	1,069	851	1,158	1,439	1,783	857	1,711
Weighted patients	84	86	87	89	90	94	96	98	97	96	91	84	81	64	56	47	44	37	29	21
Innovation − Comparison Rate																				
	−170	−58	−156	98	−131	−2	−21	−52	−249	55	−20	54	187	−74	−23	−61	92	−206	306	−214

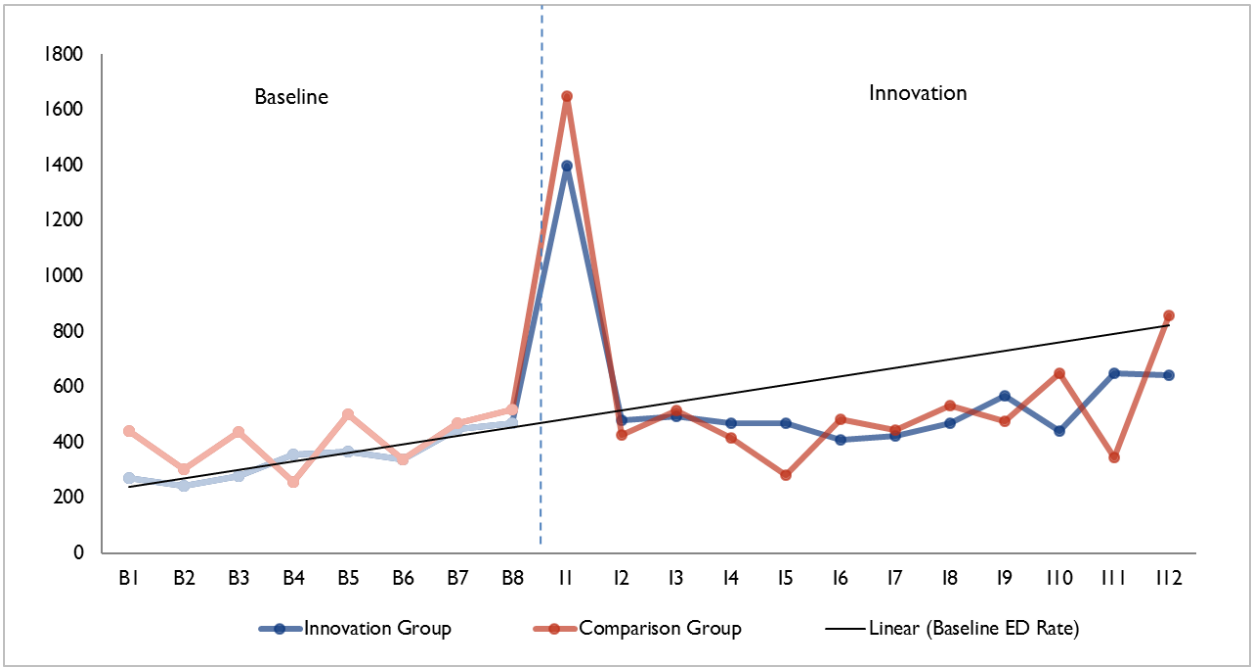
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; Prosser = Prosser Public Hospital District.

Figure 6. ED Visits per 1,000 Medicare Participants: Prosser



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- ED = emergency department; Prosser = Prosser Public Hospital District.

2.7.2 Regression Results

As shown in ***Table 12***, the average quarterly difference-in-differences estimate for ED visits is an increase of 99 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: 23, 175) and is comparable to the findings from the third annual report.

We also present quarterly effects 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. Although the cumulative estimates are statistically significant, the higher number of ED visits in the post-innovation period for those who self-select into the program is statistically significant in only 2 of 12 quarters.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Prosser

Quarter	Coefficient	Standard Error	P-Values
I1	−19	248	0.938
I2	78	83	0.348
I3	24	106	0.821
I4	145	90	0.107
I5	246	84	0.004
I6	50	123	0.683
I7	112	117	0.339
I8	82	145	0.571
I9	260	174	0.137
I10	8	215	0.971
I11	404	202	0.048
I12	−189	514	0.714
Overall average	99	46	0.033
Overall aggregate	231	108	0.033
Overall aggregate (IY1)	60	80	0.459
Overall aggregate (IY2)	112	50	0.025
Overall aggregate (IY3)	60	53	0.259

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: January 2013 to June 2016.

Terms and Definitions

- **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, 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 treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; Prosser = Prosser Public Hospital District.

2.8 Discussion: Medicare Results

No statistically significant changes occur in spending or inpatient stays; however, readmissions and ED visits were higher among those who selected into the program compared to those who opted out. A relatively small number of high users appears to drive effects on readmissions and ED visits.

The number of observations in the sample is insufficient to perform separate analyses for the three Prosser cohorts. We investigated using interaction terms between the innovation effect and each

cohort to determine whether the CP had different impacts across different cohorts, but we did not have enough observations for the analysis.

The Medicare results are inconsistent with the innovation's theory of change, because Prosser intended for CP visits to prevent inappropriate utilization and reduce spending among high-risk patients. However, these results are based on the three pooled cohorts and the eligible nonparticipants who were not randomized, therefore there may be a selection issue with the sample. Elevated ED visits and readmissions among members of the innovation group may suggest that high-risk patients were more likely to opt into the innovation than lower-risk patients. Innovation participants received only one CP visit by design, and CPs helped make PCP appointments, fill prescriptions, review discharge instructions (see the third annual report), One visit may not have been sufficient to reduce ED visits and readmissions of high risk patients facing complex health needs.

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 27 percent of the overall population reached by the innovation. In addition, the small sample size can hinder detection of changes in spending.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

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 interviews through the 15th or 16th and final 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 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 Addendum: REMSA

Data Source	Period Covered
Awardee Narrative Progress Report	December 2012–Q16 (June 2016)
Quarterly Awardee Performance Report	December 2012–Q16 (June 2016)
Medicare	December 2012–June 2016
Awardee-specific data	December 2012–June 2016

Terms and Definitions
- Q = quarter.
- REMSA = Regional Emergency Medical Services Authority.

Regional Emergency Medical Services Authority (REMSA)

2.1 Introduction

The Regional Emergency Medical Services Authority (REMSA), a nonprofit emergency medical services (EMS) provider in Reno, Nevada, is the exclusive provider of ground transport services for cities of Reno and Sparks and for Washoe County. REMSA received an award of $10,824,025, beginning December 10, 2012 and completed its project June 30, 2016. Below we present the goals, as well as the findings, of the innovation, which aimed to implement programs to promote appropriate utilization of health care services.

1. **Smarter spending.**

   Goal: 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 service.

   Findings: The Ambulance Transport Alternatives (ATA) and Community Paramedic 30-day enrollment program (CP)-30 Days innovations had significant Year 1 savings of $2,139 and $2,520 per participant per quarter, respectively. Although savings were not significant when measured over a 3-year period, these innovations focused primarily on avoiding ED visits and readmissions during the first year. For the Nurse Health Line (NHL) innovation, savings were not significant over the 3-year period or during the first year. These findings are consistent with the goals of these innovation components.

2. **Better care.**

   Goal: 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.

   Findings: The ATA program reduced unplanned inpatient admissions for the innovation group during the innovation period. We found no statistically significant effects for ED utilization and unplanned readmissions during the 3 years of the innovation. However, fewer ED visits occurred in the first quarter of the innovation period, which corresponds to the quarter of ATA. The ATA program diverted less urgent patients from the ED to more appropriate care: it had 1,436 transports to alternative locations that were not relocated to the ED during the innovation.

   For the CP-30 Days enrollment program, we found no statistically significant effects for ED utilization whereas differences in unplanned readmissions were slightly higher but significant for the innovation group. Enrollment in CP-30 Days significantly reduced inpatient admissions among Medicare beneficiaries. This result is consistent with the goals of the CP-30 Days component. CP home visits involved reviewing post-discharge instructions, identifying needs or problems, and intensely engaging patients, which may have reduced unplanned inpatient admissions. The reach of the CP-30 Days enrollment components remained relatively stable potentially because it had specific target populations. Paramedics in the CP component of the innovation continued to

provide home visits for enrolled participants; they performed at total of 6,934 home visits, an average of 4.5 visits per patient during the 30-day enrollment.

The NHL innovation showed no statistically significant differences in readmissions and ED visits. Participants using the service had significantly higher unplanned inpatient admissions in the innovation period relative to the comparison sample. The increase in inpatient admissions may be attributed to medical events that prompted Medicare beneficiaries to call the NHL. The observation that inpatient care increases with the NHL innovation suggests that the NHL innovation encouraged individuals who needed care to get it. The NHL showed increasing participation/usage each quarter, with a continually increasing reach.

3. **Healthier people**.

   Goal: 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.

   Findings: REMSA has not provided data on health outcomes to RTI.

   REMSA received statewide and national attention for its innovation. 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 also achieved successes with its programs, based on increases in enrollment and encounters. 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.[1] The ATA component successfully diverted over 1,500 911 callers (who normally would have been taken to the ED) to a more appropriate facility. The CP 30-day enrollment program and Evaluate and Refer (E&R) component's success is evidenced by the providers' willingness to continually recommend their patients for program services.

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)15–16 Narrative Progress Reports, Quarterly Awardee Performance Reports*, and secondary data received through June 30, 2016.

[1] Welcome to the Academy. (n.d.). Retrieved June 08, 2016, from http://www.emergencydispatch.org/

Table 2. Summary of Updates as of Quarter 16, June 30, 2016 (REMSA)

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2016)
Innovation Components	
	REMSA's Community Health Program had four unique components: CP (two subcomponents), ATA, and NHL.
	CP program had two parts, the 30-day enrollment program and the E&R program.
Program Participant Characteristics	
	Across the innovation's four components, 27,454 individuals enrolled or had an encounter. Almost one-third (29.8%) of participants were younger than 18 years of age; 60.4% were female; over 10% were covered by Medicare including Medicare Advantage, and 26% by Medicaid.
Workforce Development	
Hiring and retention	At the end of Q16, REMSA had 16 staff and 1 separation.
Skills, knowledge, and training	From start through Q16, REMSA provided 19,974 hours of training to 179 people.
	REMSA provided 1,104 total hours of nurse navigator training to 3 staff in Q15 and no training in Q16.
Context	
Award execution	Through Q16, spending was at 83.8% of the full award period amount.
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	The CP 30-day enrollment program reached 65.1% of the target population, CP E&R program reached 95.9% of the target population, ATA reached 14.6% of the target population, and NHL enrolled a total of 45,065 people.
Innovation dose	Dose is only relevant to the CP 30-day enrollment program. Patients enrolled received on average 4.5 home visits during the 30 days of their enrollment.
Sustainability	
	REMSA worked with local health systems and key clinical partners to identify funding from other sources (e.g., state, private, etc.).
	REMSA worked with the Nevada legislature to successfully pass a bill that authorizes, regulates, and supports reimbursement for community paramedicine services beginning in July 2016.

Notes:

- **Sources**: *Q15–Q16 Narrative Progress Report; Q15–Q16 Quarterly Awardee Performance Report*; Patient-level data provided to RTI from REMSA
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions

- ATA = Ambulance Transport Alternatives; CP = Community Paramedics; E&R = Evaluate and Refer; FTE = full-time equivalent; NHL = Nurse Health Line; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

2.1.1 Spending and Utilization Overview

Tables 3 through ***5*** summarize Medicare claims-based findings during the innovation period for three distinct components: ATA, CP-30 Days, and NHL. The E&R component of CP was not included in the summary because only 66 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. With few fee-for-service beneficiaries linked to claims data, we did not have enough participants to support a meaningful comparison group for CPs.

Total Medicare spending decreased over the 3 years of ATA innovation by $1,102,000 (Table 3). In Year 1 of the innovation, total spending decreased significantly by $845,000. In subsequent years, spending differences between the innovation and comparison groups were statistically insignificant. The innovation groups spent $1,430 less per quarter per person over the 3 years of the innovation with a change in spending of −$2,150 in Year 1, −$1,332 in Year 2 and $506 in Year 3. Only spending changes in Year 1 were statistically significant. Relative to the comparison group, acute inpatient stays and hospital readmissions were lower for the innovation group throughout the innovation period. ED visits, on the other hand, were significantly lower in the first year for the innovation group and higher in Years 2 and 3 of the innovation period. Lower ED visits in Year 1 of the innovation period is consistent with the theory of change for this awardee since this is the year in which alternative ambulance transports occurred. The Year 1 reductions in spending, inpatient stays, and ED visits are consistent with the intent of the ATA component, which entailed transporting low-acuity patients who call 911 to a more appropriate location than the ED. ATA encounters are brief, one-time innovations; therefore, the effect of the innovation is concentrated and may occur exclusively in the first year after the innovation. Thus, declines in the savings and significance are expected.

Table 3. Summary of Medicare Expenditures Claims-Based Findings: REMSA-ATA

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$1.102	−$2.305, $0.101	−$2.036, −$0.169	−$0.845	−$1.603, −$0.087	−$0.325	−$0.862, $0.212	$0.068	−$0.284, $0.420
Acute care inpatient stays	−162	−245, −79	−226, −97	−122	−196, −47	−29	−59, 0	−11	−31, 10
Hospital-wide all-cause unplanned readmissions	−19	−50, 13	−43, 6	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	185	−32, 402	16, 355	−15	−208, 179	63	−10, 136	137	70, 204
Average change per quarter									
Spending per participant	−$1,430	−$2,990, $131	−$2,640, −$219	−$2,150	−$4,079, −$221	−$1,332	−$3,535, $870	$506	−$2,121, $3,133
Acute care inpatient stays (per 1,000 participants)	−210	−317, −102	−294, −126	−310	−500, −120	−120	−240, 1	−81	−233, 71
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−202	−542, 138	−467, 63	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	240	−41, 522	21, 460	−37	−529, 455	258	−40, 557	1,021	522, 1521

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** January 2013 to June 2016.
- **Sample size:** 115 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternative.

Total Medicare spending decreased over the 3 years of the CP-30 Days program by $1,197,000 (***Table 4***). In Year 1 of the innovation, total spending decreased significantly by $1,683,000. In subsequent years, spending differences between the innovation and comparison groups were statistically insignificant. The innovation groups spent $1,070 less per quarter per participant over the 3 years of the innovation with a change in spending of −$2,520 in Year 1, $493 in Year 2, and $3,842 in Year 3. Only spending changes in Year 1 were statistically significant. Relative to the comparison group, acute

inpatient stays were significantly lower for the innovation group over the 3 years of the innovation period. Differences in ED visits between the innovation and comparison groups were not statistically significant whereas unplanned readmissions were significantly higher for the innovation group. The CP 30-day enrollment program provided short-term support (over 30 days) to at risk-patients discharged from the hospital, so the reductions in spending and inpatient stays during Year 1 are consistent with the innovation's design.

Table 4. Summary of Medicare Claims-Based Findings: REMSA-CP 30 Days

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$1.197	−$3.026, $0.633	−$2.618, $0.225	−$1.683	−$2.865, −$0.502	$0.183	−$0.607, $0.973	$0.303	−$0.245, $0.852
Acute care inpatient stays	−426	−539, −312	−514, −337	−362	−469, −254	−45	−75, −14	−19	−42, 3
Hospital-wide all-cause unplanned readmissions	34	16, 52	20, 48	—	—	—	—	—	—
ED visits not leading to a hospitalization	31	−25, 87	−13, 74	32	−10, 74	11	−22, 43	−12	−30, 5
Average impact per quarter									
Spending per participant	−$1,070	−$2,707, $566	−$2,342, $201	−$2,520	−$4,289, −$751	$493	−$1,637, $2,623	$3,842	−$3,106, $10,789
Acute care inpatient stays (per 1,000 participants)	−381	−482, −279	−460, −301	−541	−702, −381	−120	−203, −38	−247	−527, 34
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	112	51, 172	64, 159	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	27	−23, 77	−12, 66	48	−15, 111	29	−59, 117	−157	−383, 68

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates derived using differences-in-differences methodology. More details are described in the chapter.
- **Period of activity:** June 2013 to June 2016.
- **Sample size:** 183 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; REMSA CP-30 Days = Regional Emergency Medical Services Authority-Community Paramedic.

Total Medicare spending increased over the 3 years of the NHL component by $1,961,000 (***Table 5***). The increase in spending was not statistically significant. The innovation groups spent $245 more per quarter per participant over the 3 years of the innovation with a change in spending of $347 in Year 1, −$31 in Year 2, and $562 in Year 3. Relative to the comparison group, acute inpatient stays were significantly higher for the innovation group in the innovation period (98, 90% CI: 11,185). Differences in ED visits and hospital readmissions between the innovation and comparison groups were not statistically significant. Patients called the NHL to solicit medical advice from a health professional for low-acuity problems, which often culminated in a recommendation to seek care. The increase in inpatient visits and lack of other results is thus plausible and could ultimately lead to better care and reduced spending.

Table 5. Summary of Medicare Claims-Based Findings: REMSA-NHL

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	$1.961	−$0.767, $4.689	−$0.161, $4.084	$1.905	−$0.089, $3.899	−$0.072	−$1.390, $1.245	$0.129	−$0.225, $0.482
Acute care inpatient stays	98	11, 185	30, 166	93	19, 168	10	−34, 53	−5	−17, 8
Hospital-wide all-cause unplanned readmissions	−8	−35, 20	−29, 14	—	—	—	—	—	—
ED visits not leading to a hospitalization	54	−191, 300	−137, 246	4	−208, 215	44	−76, 165	6	−25, 38
Average change per quarter									
Spending per participant	$245	−$96, $586	−$20, $510	$347	−$16, $711	−$31	−$605, $542	$562	−$982, $2,107
Acute care inpatient stays (per 1,000 participants)	12	1, 23	4, 21	17	3, 31	4	−15, 23	−20	−76, 35
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−11	−50, 28	−41, 20	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	7	−24, 37	−17, 31	1	−38, 39	19	−33, 72	28	−108, 165

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** August 2013 to June 2016.
- **Sample size:** 1,775 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; REMSA-= Regional Emergency Medical Services Authority-Nurse Health Line.
- — Not applicable due to small sample size.

2.1.2 Innovation Components

The components of this innovation remain the same as reported in the third annual report.[2] The first component uses CPs to reduce avoidable hospital admissions and patients with COPD, MI, who had open heart surgery, or are readmissions. The CP component had two subcomponents: the 30-day enrollment program, and the E&R program. The next 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 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.

The partners for this innovation changed since last reported in the third annual report as illustrated in ***Table 6.*** By the end of Q16, four new partners were providing health information technology and electronic medical records (HIT EMR), clinical, and data analysis services: Zoll, WestCare, Northern Nevada HOPES, and Barnard Volger & Co. These partners were added to aid in sustainability efforts.

Table 6. HCIA Partners, Role, and Location: REMSA

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
Zoll	HIT EMR vendor	Broomfield, CO
WestCare	Clinical services provider	Henderson, NV
Northern Nevada HOPES	Clinical provider	Reno, NV
Barnard Vogler & Co.	Data analytics	Reno, NV

Notes:
- **Source**: Quarterly Awardee Performance Reports
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions
- ATA = Ambulance Transport Alternatives; CP = Community Paramedics; EMR = electronic medical records; HIT = health information technology; NHL = Nurse Health Line; REMSA-= Regional Emergency Medical Services Authority.

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

2.1.3 Program Participant Characteristics

Table 7 provides the demographic characteristics of all participants ever enrolled in the innovation. We last reported patient demographic characteristics in the third annual report, based on data through Q14. The distribution of patient characteristics is similar to that in the third annual report. Demographic data are separated below by program component, showing the different distribution of characteristics for participants in all 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 or re-enrollees) to avoid counting patients multiple times. Thus, the numbers in Table 7 will differ from the number of encounters presented in the reach tables for all components.

Participants in each component increased steadily since the third annual report. The majority of the ATA participants (41.7%) were 45 to 64 years old and more than half (64.5%) were male. Almost one-third of CP E&R component (30.4%) participants were 85 years or older, and the majority were female (59.7%). Almost one-fourth of CP 30-Days participants (24.8%) were 45 to 64 years old. Almost one-third of NHL participants were children under 18 (32.5%), probably because of the high volume of calls from parents; and more than half (62.7%) were female. Across all components, more than 10 percent of participants were covered by Medicare or Medicare Advantage (10.8%), 26.0 percent by Medicaid, and 35.5 percent were uninsured.

Table 7. Characteristics of All Participants Ever Enrolled in the Innovation through June 2016: REMSA[1]

Characteristic	ATA Participants		CP-30 Days Participants		CP E&R Patients Referred		NHL Participants		Participants in All Components	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Total Number	Percentage
Total	986	100	1,208	100	191	100	25,069	100	27,454	100
Age										
<18	36	3.7	2	0.2	2	1.0	8,139	32.5	8,179	29.8
18–24	77	7.8	4	0.3	0	0.0	2,712	10.8	2,793	10.2
25–44	314	31.8	44	3.6	4	2.1	6,159	24.6	6,521	23.8
45–64	411	41.7	299	24.8	3	1.6	4,683	18.7	5,396	19.7
65–74	93	9.4	277	22.9	18	9.4	1,875	7.5	2,263	8.2
75–84	30	3.1	230	19.0	30	15.7	992	4.0	1,282	4.7
85+	13	1.3	170	14.1	58	30.4	509	2.0	750	2.7
Missing	12	1.2	182	15.1	76	39.8	0	0.0	270	1.0
Sex										
Female	276	28.0	457	37.8	114	59.7	15,724	62.7	16,571	60.4
Male	636	64.5	551	45.6	69	36.1	9,345	37.3	10,601	38.6
Missing	74	7.5	200	16.6	8	4.2	0	0.0	282	1.0
Payer Category[2]										
Dual	0	0.0	6	0.5	0	0.0	0	0.0	6	0.0
Medicaid	146	14.8	133	11.1	2	1.0	6,849	27.3	7,130	26.0
Medicare	16	1.6	410	33.9	52	27.2	2,256	9.0	2,734	10.0
Medicare Advantage	0	0.0	195	16.1	12	6.3	0	0.0	207	0.8
Other	190	19.3	49	4.1	9	4.7	2,494	9.9	2,742	10.0
Uninsured	223	22.6	81	6.7	18	9.4	9,434	37.6	9,756	35.5
Missing	411	41.7	334	27.6	98	51.4	4,036	16.1	4,879	17.7

[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.

[2] REMSA provided 22 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.

Notes:

- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity:** January 2013 to June 2016.
- Due to long-standing EMS operating procedures, REMSA does not collect data regarding race/ethnicity; therefore, RTI cannot provide these data.

Terms and Definitions

- 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.

2.2 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 third annual report addendum. Additional Medicaid data have not become available since the third annual report. Consequently, Medicaid claims data are not included in this addendum report.

Table 8. Claims-Based Outcome Measures: REMSA

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

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- ED = emergency department; REMSA = Regional Emergency Medical Services Authority.

2.3 Medicare Comparison Group: Community Paramedics 30-Day Enrollment Program (CP-30 Days)

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. This includes two additional quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 183 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. The CP-30 Days innovation's eligibility criteria is to enroll individuals previously admitted to the hospital with CHF, MI, or COPD. 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 cities of Reno and Sparks and Washoe County.

We use propensity score matching (PSM) to select comparison group beneficiaries who were hospitalized in the innovation period for CHF, MI, or COPD. I1 is determined by the date of the inpatient visit. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary enrolls into 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, 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 the first quarter of 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 current matches differ slightly from the matches in the third annual report; for this third annual report addendum, we reran the matching process to incorporate the data from additional beneficiaries.

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.

Table 9. Mean Values and Standardized Differences of Variables in Propensity Score Model: REMSA CP-30 Days (Medicare)

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	$7,191	$13,354	$4,014	$9,635	0.27	$6,729	$13,210	$4,266	$11,244	0.20
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$18,470	$28,992	$14,559	$23,724	0.15	$17,732	$27,593	$13,039	$25,563	0.18
Age	70.45	13.15	74.92	11.13	0.37	71.35	11.99	70.94	11.73	0.03
Percentage male	57.89	49.37	48.32	49.97	0.19	58.47	49.28	61.29	48.71	0.06
Percentage white	80	40	86.32	34.37	0.17	80.87	39.33	75.96	42.73	0.12
Percentage disabled	35.79	47.94	24.55	43.04	0.25	33.8	47.33	33.24	47.11	0.01
Percentage ESRD	4.74	21.24	4.71	21.19	<0.01	4.92	21.62	3.73	18.96	0.06
Number of dual-eligible months in the previous calendar year	2.10	4.40	2.25	4.51	0.03	1.92	4.23	1.75	3.99	0.04
Number of chronic conditions	9.78	3.52	10.20	3.36	0.12	9.87	3.49	9.13	3.59	0.21
Number of ED visits in calendar quarter prior to enrollment	0.80	2.03	0.35	0.98	0.28	0.58	1.04	0.40	1.00	0.18
Number of inpatient stays in calendar quarter prior to enrollment	0.39	0.77	0.13	0.45	0.42	0.37	0.75	0.13	0.53	0.37
Percentage hospitalized in the enrollment quarter for MI	47.89	49.96	46.42	49.87	0.03	48.63	49.98	46.45	49.87	0.04
Percentage hospitalized in the enrollment quarter for CHF	66.84	47.08	50.89	49.99	0.33	67.21	46.94	70.58	45.57	0.07
Percentage hospitalized in the enrollment quarter for COPD	27.37	44.58	40.86	49.16	0.29	28.42	45.10	30.15	45.89	0.04
Number of beneficiaries	190	—	3,311	—	—	183	—	455	—	—
Number of unique beneficiaries	190	—	3,311	—	—	183	—	455	—	—
Number of weighted beneficiaries[1]	—	—	—	—	—	183	—	183	—	—

[1] 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).

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

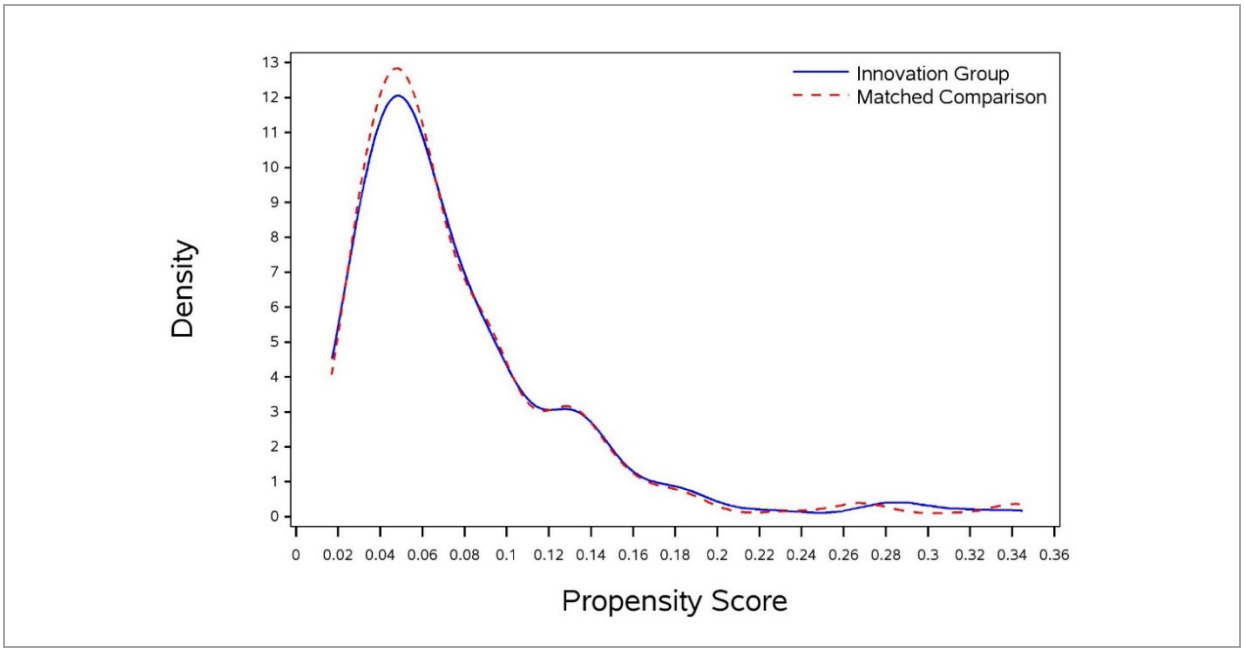
Terms and Definitions

- CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; ED = emergency department; ESRD = end-stage renal disease; SD = standard derivation; REMSA CP-30 Days= Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.
- — 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 9). 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 9 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. Variables with absolute standardized differences greater than 0.10 are number of chronic conditions, percentage white, number of ED visits and number of inpatient stays. The higher mean values for number of chronic conditions, number of ED visits and number of inpatient stays in the innovation group suggest that the innovation has sicker participants. Thus, we expect to underestimate the effects of the innovation.

Figure 1 shows the distribution of the propensity scores for both the innovation and comparison groups. The distribution of propensity scores is similar with good overlap, which ensures that for every person in the innovation group we are likely to find a match in the comparison group.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: REMSA CP-30 Days (Medicare)



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA CP-30 Days= Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

[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 10 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 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. Spending is slightly higher for the innovation group in the baseline period. After enrolling in the innovation, beneficiaries in the innovation group spends less than the comparison group in quarter 2. The innovation group, in quarter 1 and quarters 3 through 11, has similar spending to the comparison group. Spending is high in I1 and I2 because these quarters include the inpatient hospital visit that triggered eligibility. These trends are similar to those reported in the third annual report.

Table 10. 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**	**I10**	**I11**
Innovation group																			
Spending rate	$3,290	$3,358	$3,044	$4,109	$4,485	$4,993	$4,819	$6,729	$23,014	$10,338	$7,514	$5,278	$8,952	$6,274	$8,045	$5,116	$15,358	$7,608	$5,510
Std dev	$7,091	$6,402	$5,624	$11,112	$1,0847	$11,711	$11,170	$13,210	$20,337	$21,522	$14,904	$10,693	$29,487	$12,380	$17,570	$7,728	$50,888	$11,057	$6,721
Unique patients	161	164	167	169	176	178	181	183	183	175	160	150	134	103	79	55	42	25	12
Comparison group																			
Spending rate	$3,033	$2,851	$2,955	$2,863	$3,199	$3,279	$4,379	$4,266	$23,546	$15,827	$8,084	$6,275	$7,326	$6,133	$4,652	$6,756	$6,703	$6,526	$7,903
Std dev	$8,143	$6,999	$7,814	$8,884	$8,690	$8,875	$12,459	$11,244	$23,183	$26,090	$14,261	$13,168	$20,425	$10,944	$10,407	$14,037	$12,243	$11,259	$13,369
Weighted patients	158	158	162	166	171	174	182	183	183	183	167	157	142	118	93	70.5	53	37	19
Savings per patient																			
	−$257	−$508	−$89	−$1,247	−$1,287	−$1,714	−$440	−$2,463	$532	$5,489	$570	$997	−$1,626	−$141	−$3,393	$1,641	−$8,655	−$1,083	$2,393

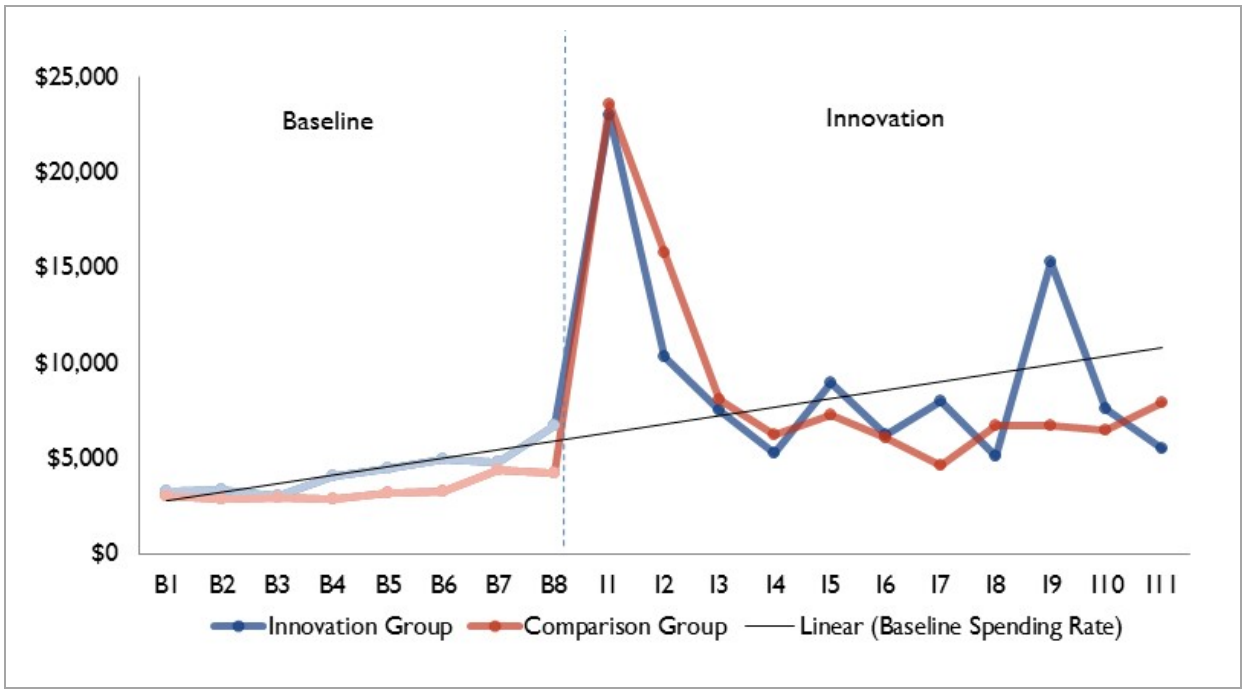
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP-30 Days= Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

Figure 2. Medicare Spending per Participant: REMSA CP-30 Days



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA CP-30 Days= Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

2.4.2 Regression Results

We present in ***Table 11*** 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, indicates an average savings of −$1,070 (90% CI: −$2,707, $566). 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. These findings differ from those in the third annual report, in which the decrease in spending was larger and statistically significant.

We also present quarterly effects derived from 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 the first quarter of innovation, spending is similar for the innovation and comparison groups with no significant differences. In the second quarter (I2), the innovation group spent $6,020 less than the comparison group ($p < 0.005$) with no other significant

differences observed in quarters 3 through 11. In Year 1 (quarters I1 through I4), the innovation group's spending was $1,683,253 less than the comparison group's (p=0.019).

Table 11. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA CP-30 Days

Quarter	Coefficient	Standard Error	P-Values
I1	−$1,256	$1,965	0.523
I2	−$6,028	$2,128	0.005
I3	−$1,103	$1,423	0.439
I4	−$1,479	$1,092	0.176
I5	$938	$2,725	0.731
I6	−$470	$1,364	0.731
I7	$2,857	$2,038	0.161
I8	−$2,183	$1,499	0.146
I9	$7,904	$7,871	0.316
I10	$454	$2,481	0.855
I11	−$3,320	$2,643	0.210
Overall average	−$1,070	$993	0.282
Overall aggregate	−$1,196,762	$1,110,612	0.282
Overall aggregate (IY1)	−$1,683,253	$717,296	0.019
Overall aggregate (IY2)	$182,996	$479,708	0.703
Overall aggregate (IY3)	$303,494	$333,189	0.363

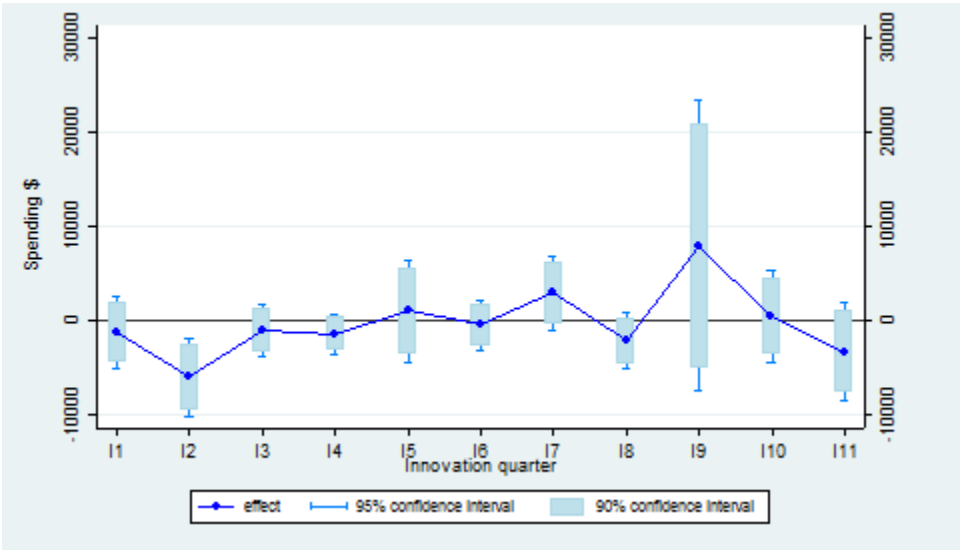
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **The regression coefficients** are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables age, gender, race, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- Average**:** 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; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

Figure 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA CP-30 Days



Notes:

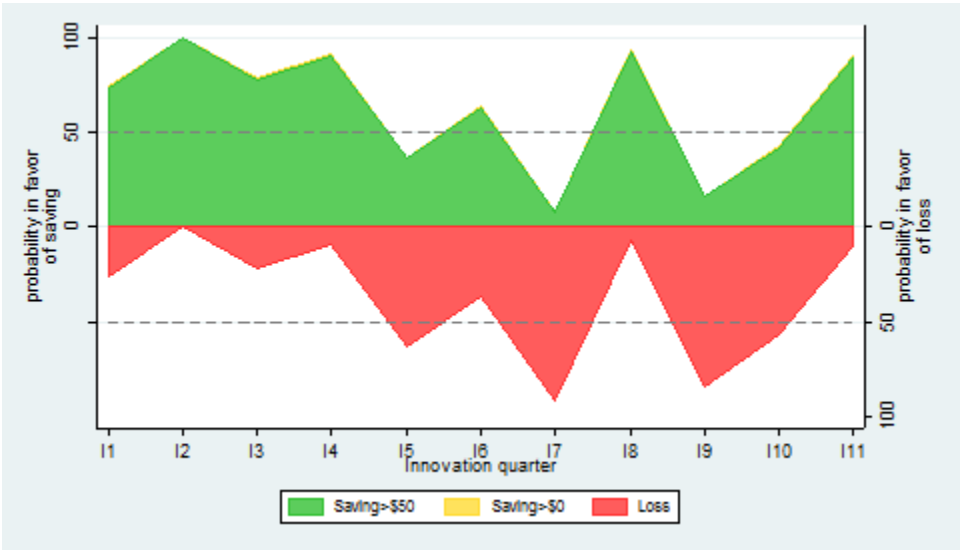
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

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 for saving money on this initiative. Figure 4 supports the finding that the innovation generated savings during its first year (I1 through I4). Thereafter, the probability of savings and losses is comparable. The overall probability of savings over the entire innovation period is 85 percent.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: REMSA CP-30 Days



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

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***. Compared to the comparison group, the innovation group has higher inpatient admission rates in baseline quarters and similar inpatient admission rates to the comparison group in innovation quarters. This finding is consistent with the findings in the third annual report.

Table 12. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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**	**I10**	**I11**
Innovation Group																			
Admit rate	137	171	138	166	210	197	160	350	1148	354	256	180	231	282	316	200	333	280	83
Std dev	343	463	393	417	472	551	448	715	914	778	551	417	502	674	772	482	777	601	276
Unique patients	161	164	167	169	176	178	181	183	183	175	160	150	134	103	79	55	42	25	12
Comparison Group																			
Admit rate	118	138	98	72	84	80	95	119	1141	434	273	242	255	223	124	225	252	165	192
Std dev	388	403	399	346	337	291	333	471	652	881	581	566	580	522	380	580	938	436	556
Weighted patients	158	158	162	166	171	174	182	183	183	183	167	157	142	118	93	71	53	37	19
Saving per patient																			
	19	33	40	94	126	117	65	231	7	−80	−17	−62	−24	59	192	−25	81	115	−109

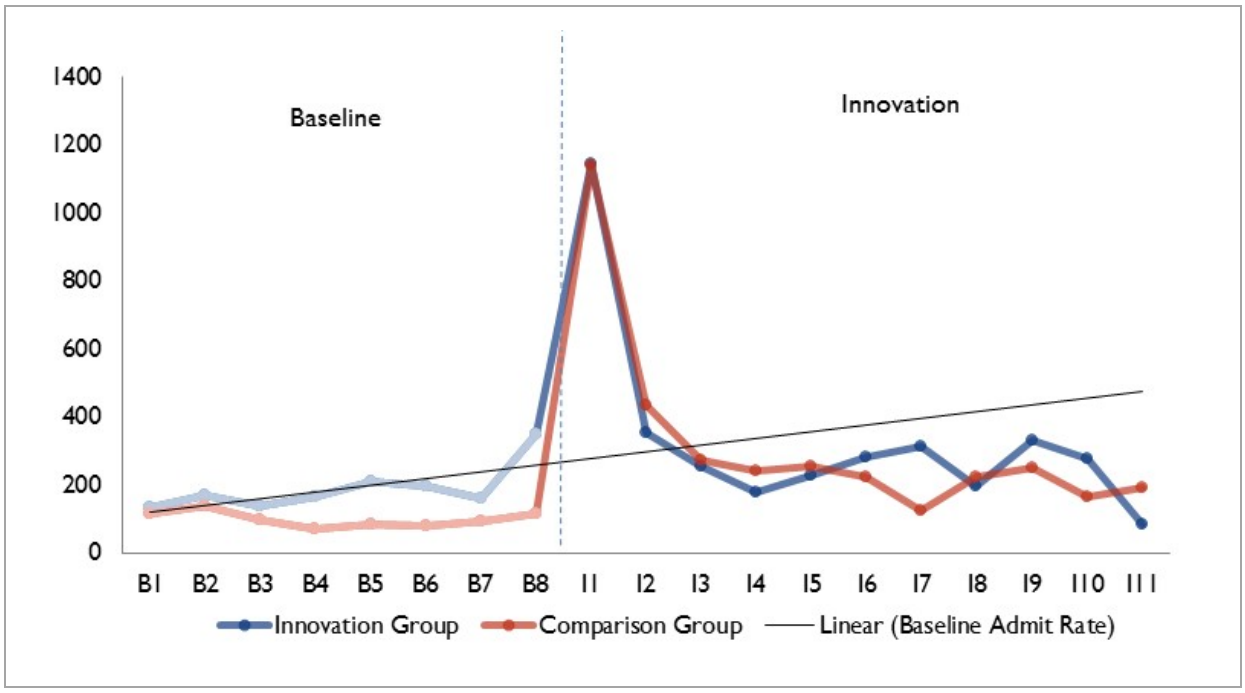
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

Figure 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: REMSA CP-30 Days



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

2.5.2 Regression Results

As shown in ***Table 13***, the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 426 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: −539, −312) and comparable to the findings in the third annual report. In Years 1 and 2, relative to the comparison group, the innovation group had 361 ($p<0.01$) and 45 ($p=0.02$) fewer inpatient hospital admissions, respectively.

We also present quarterly effects derived from a 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 reduces inpatient hospital admissions in quarters 1 through 5 in the innovation period. From quarters 6 through 11, the results are mixed: quarters 8 and 11 show significant reductions in inpatient admissions while quarters 6, 7, 9, and 10 have insignificant differences.

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: REMSA CP-30 Days

Quarter	Coefficient	Standard Error	P-Values
I1	−1086	313	0.001
I2	−521	143	0.000
I3	−235	93	0.012
I4	−226	76	0.003
I5	−178	83	0.033
I6	−149	105	0.158
I7	99	982	0.316
I8	−239	123	0.058
I9	−379	305	0.221
I10	6	145	0.968
I11	−309	170	0.097
Overall average	−426	69	<0.01
Overall aggregate	−381	62	<0.01
Overall aggregate (IY1)	−361	65	<0.01
Overall aggregate (IY2)	−45	19	0.017
Overall aggregate (IY3)	−19	13	0.152

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** 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; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 14*** and ***Figure 6***. With a small sample size the variations in readmissions over time across innovation and comparison groups are large. Similar rates of readmissions are observed between the innovation and comparison groups in both the baseline and innovation period. These trends are consistent with the findings in the third annual report.

Table 14. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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**	**I10**	**I11**
Innovation Group																			
Readmit rate	0	91	67	56	138	83	0	56	144	378	214	59	125	261	200	143	0	0	0
Std dev	0	288	249	229	345	276	0	229	351	485	410	235	331	439	400	350	0	0	0
Total admissions	14	22	15	18	29	24	21	36	160	37	28	17	16	23	10	7	4	3	0
Comparison Group																			
Readmit rate	88	100	65	91	30	73	77	159	67	131	217	32	266	48	53	156	118	200	0
Std dev	284	300	246	288	171	260	267	365	250	337	412	175	442	213	223	363	322	400	0
Total admissions	11	13	10	7	11	9	9	14	149	43	28	21	21	14	6	11	9	2	1
Savings per patient																			
	−88	−9	2	−35	108	11	−77	−103	77	248	−3	27	−141	213	147	−13	−118	−200	0

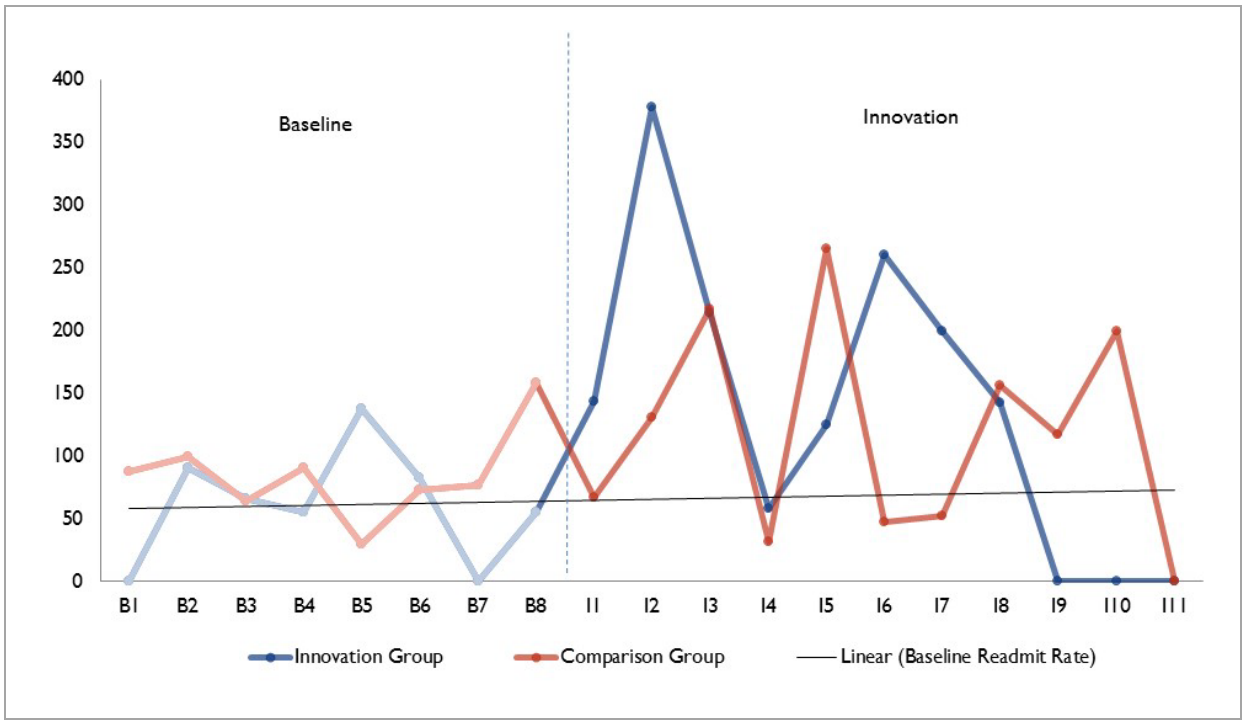
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: REMSA CP-30 Days



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

2.6.2 Regression Results

Table 15 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 112 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: 0.51,172). This result is different from the insignificant increase in unplanned readmissions in the third annual report.

Table 15. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Admissions: REMSA CP-30 Days

Quarter	Coefficient	Standard Error	P-Values
Overall average	112	37	0.003
Overall aggregate	34	11	0.003

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions
- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** 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; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 16*** and ***Figure 7.*** In the baseline period the innovation group has systematically higher ED visits than the comparison group. In the innovation period, we found similar rates of ED visits for the innovation and control groups. This finding is consistent with the findings in the third annual report.

Table 16. ED Visits per 1,000 Medicare Participants: 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**	**I10**	**I11**
Innovation Group																			
ED rate	124	201	180	172	205	219	221	262	530	314	363	267	321	272	443	564	310	480	583
Std dev	415	578	507	488	527	804	573	709	850	710	872	662	752	629	916	1561	680	918	669
Unique patients	161	164	167	169	176	178	181	183	183	175	160	150	134	103	79	55	42	25	12
Comparison Group																			
ED rate	185	156	154	122	189	180	183	293	362	348	267	238	313	315	297	397	473	376	566
Std dev	384	358	324	285	399	398	368	551	451	508	439	441	461	527	464	582	629	542	565
Weighted patients	158	158	162	166	171	174	182	183	183	183	167	157	142	118	93	71	53	37	19
Savings per patient																			
	−61	45	26	50	15	39	38	−31	168	−33	96	28	8	−43	146	166	−164	104	17

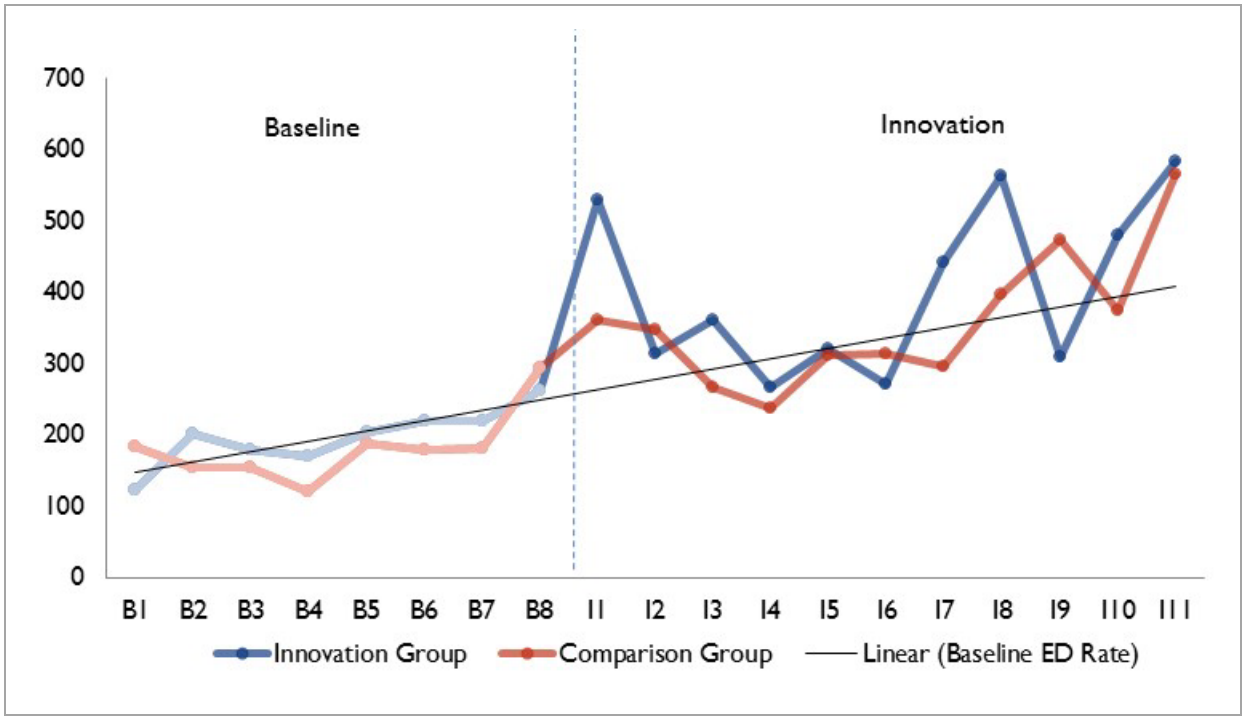
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

Figure 7. ED Visits per 1,000 Medicare Participants: REMSA CP-30 Days



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- ED = emergency department; REMSA CP-30 Days = Regional Emergency Medical Services Authority, Community Paramedics 30-Day Enrollment Program.

2.7.2 Regression Results

As shown in ***Table 17***, the average quarterly difference-in-differences estimate for ED visits is an increase 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 not statistically significant (90% CI: −25, 87). This finding is comparable to the finding in the third annual report.

We also present quarterly effects derived from a 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 quarter of the innovation period we observe higher ED visits in the innovation group. No other significant differences in ED visits between the innovation and control group are observed in later quarters.

Table 17. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: REMSA CP-30 Days

Quarter	Coefficient	Standard Error	P-Values
I1	154	83	0.064
I2	−65	82	0.426
I3	91	70	0.198
I4	5	63	0.934
I5	−11	74	0.884
I6	−68	87	0.435
I7	131	107	0.221
I8	161	217	0.461
I9	−320	206	0.129
I10	29	206	0.890
I11	23	328	0.945
Overall average	27	30	0.369
Overall aggregate	31	34	0.369
Overall aggregate (IY1)	32	25	0.207
Overall aggregate (IY2)	11	20	0.586
Overall aggregate (IY3)	−12	11	0.254

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as 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-Day Enrollment Program.

2.8 Discussion: Medicare Results—REMSA Community Paramedics 30-Day Enrollment Program

Relative to the comparison group, the innovation group decreases spending by $1,070 per quarter per participant over the innovation period. The impact of the innovation on spending differs over time. In Year 1, we observed a significant reduction in spending of $2,520 per participant. In contrast, in Years 2 and 3 spending differences between the innovation and comparison groups are not statistically

significant. Regression results show that much of the savings observed in Year 1 can be attributed to reductions in inpatient admissions in the first five quarters of the innovation period.

The Medicare results are consistent with the innovation's theory of change, because we would expect to see significant cost savings in the short-term due to reductions in readmissions or inpatient admissions as the goal of the program was to keep patients from going or returning to the hospital in the 30 days post-discharge. Based on the type and dose of services that patients typically received, the innovation should have resulted in cost savings and a reduction in utilization.

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 12 percent of the overall population reached by the CP-30 Days component. In addition, our sample size is small, which can hinder detection of changes in spending.

2.9 Medicare Comparison Group: Community Paramedics-Evaluate and Refer (CP-E&R)

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. This includes two additional quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 66 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. With few fee-for-service beneficiaries linked to claims data, we do not have enough participants to support a meaningful comparison group for Community Paramedics—Evaluate and Refer (CP-E&R).

2.10 Medicare Spending

2.10.1 Descriptive Results

Table 18 reports Medicare spending per patient in the 8 quarters before and the 10 quarters after enrolling in the innovation. ***Figure 8*** illustrates the Medicare spending per beneficiary in Table 18 for innovation beneficiaries only. 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 a linear regression model using baseline quarters. In the innovation period spending increases above baseline trend for the first 4 quarters of the innovation and returns to trend from quarters 5 through 10.

Table 18. Medicare Spending per Participant: REMSA CP-E&R

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**
Innovation Group																		
Spending rate	$3,605	$3,673	$3,444	$5,033	$3,259	$4,197	$4,688	$6,111	$10,361	$10,426	$7,852	$13,564	$6,935	$7,353	$7,515	$7,281	$4,869	$5,888
Std dev	$8,133	$7,931	$4,994	$10,773	$5,404	$8,074	$,8237	$9,765	$12,991	$15,500	$12,033	$37,480	$10,998	$9,076	$15,381	$14,611	$8,600	$10,167
Unique patients	61	61	61	62	64	64	64	65	66	63	50	37	28	26	25	21	19	12
Comparison Group																		
Spending rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Savings per patient																		
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

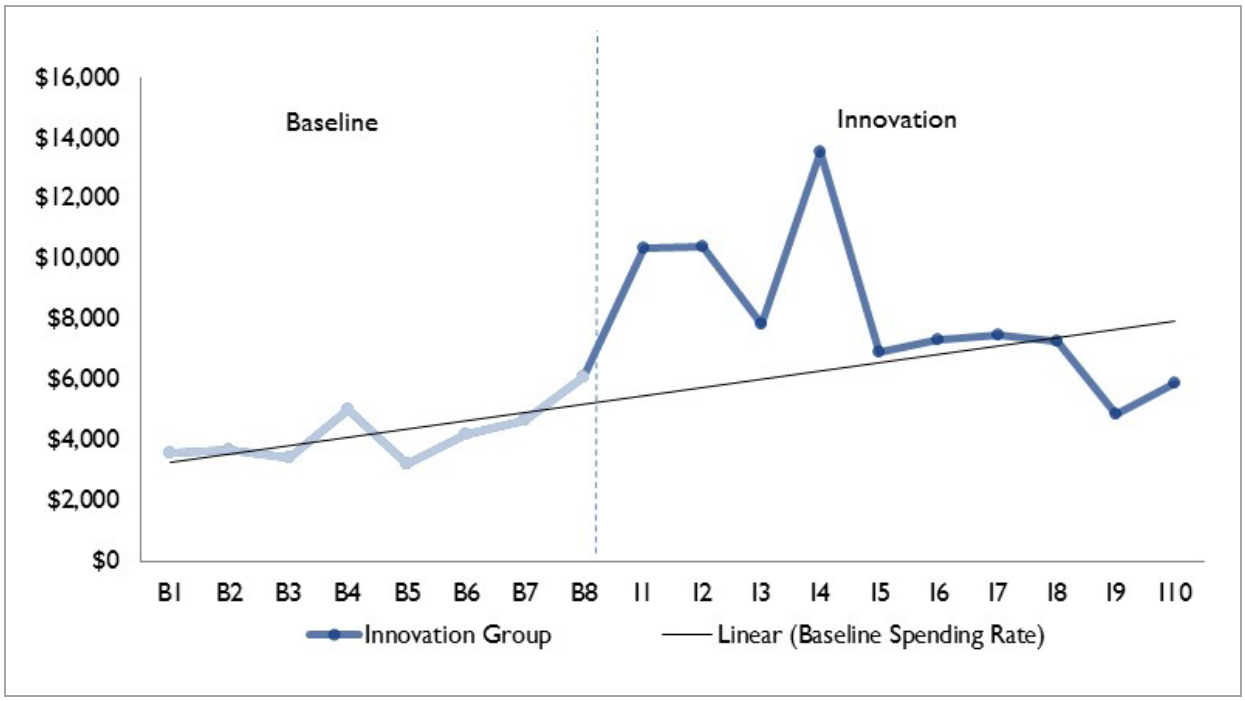
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.
- — Data not yet available.

Figure 8. Medicare Spending per Participant: REMSA CP-E&R



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.

2.11 Medicare Inpatient Admissions

2.11.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 19*** and ***Figure 9***. In the innovation period, inpatient admissions are above the trend line in the first 3 quarters and consistently stay below the trend line in quarters 4 through 10.

Table 19. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: REMSA CP-E&R

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**
Innovation Group																		
Admit rate	49	82	164	129	188	156	172	262	364	444	360	270	143	192	160	48	105	250
Std dev	216	329	370	457	609	404	417	589	594	850	742	501	440	394	367	213	307	595
Unique patients	61	61	61	62	64	64	64	65	66	63	50	37	28	26	25	21	19	12
Comparison Group																		
Admit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation – Comparison Rate																		
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

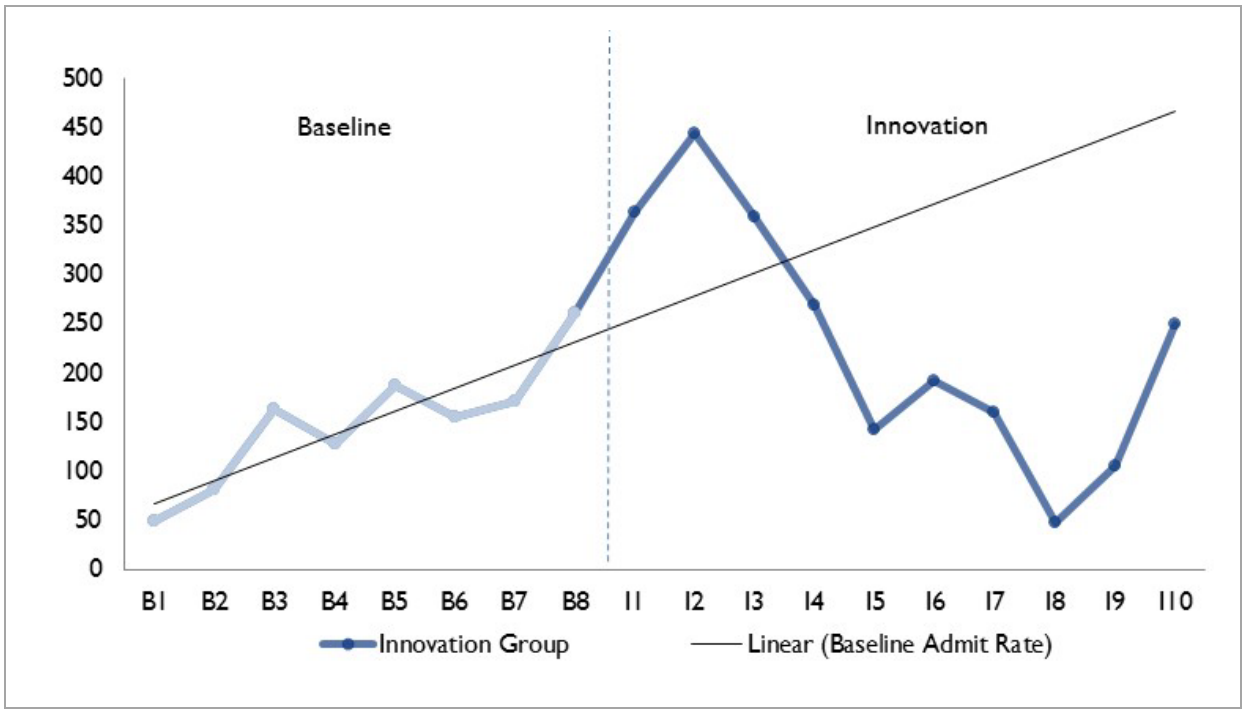
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.
- — Data not yet available.

Figure 9. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: REMSA CP-E&R



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.

2.12 Medicare Unplanned Readmissions

2.12.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 20*** and ***Figure 10***. We observe no discernible patterns for unplanned readmissions rates in the innovation period, which can be attributed to the small sample size.

Table 20. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: REMSA CP-E&R

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**
Innovation Group																		
Readmit rate	0	0	0	286	364	111	100	154	48	364	300	200	250	0	0	0	0	0
Std dev	0	0	0	452	481	314	300	361	213	481	458	400	433	0	0	0	0	0
Total admissions	3	5	10	7	11	9	10	13	21	22	10	5	4	5	1	1	0	2
Comparison Group																		
Readmit rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total admissions	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation-Comparison Rate																		
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

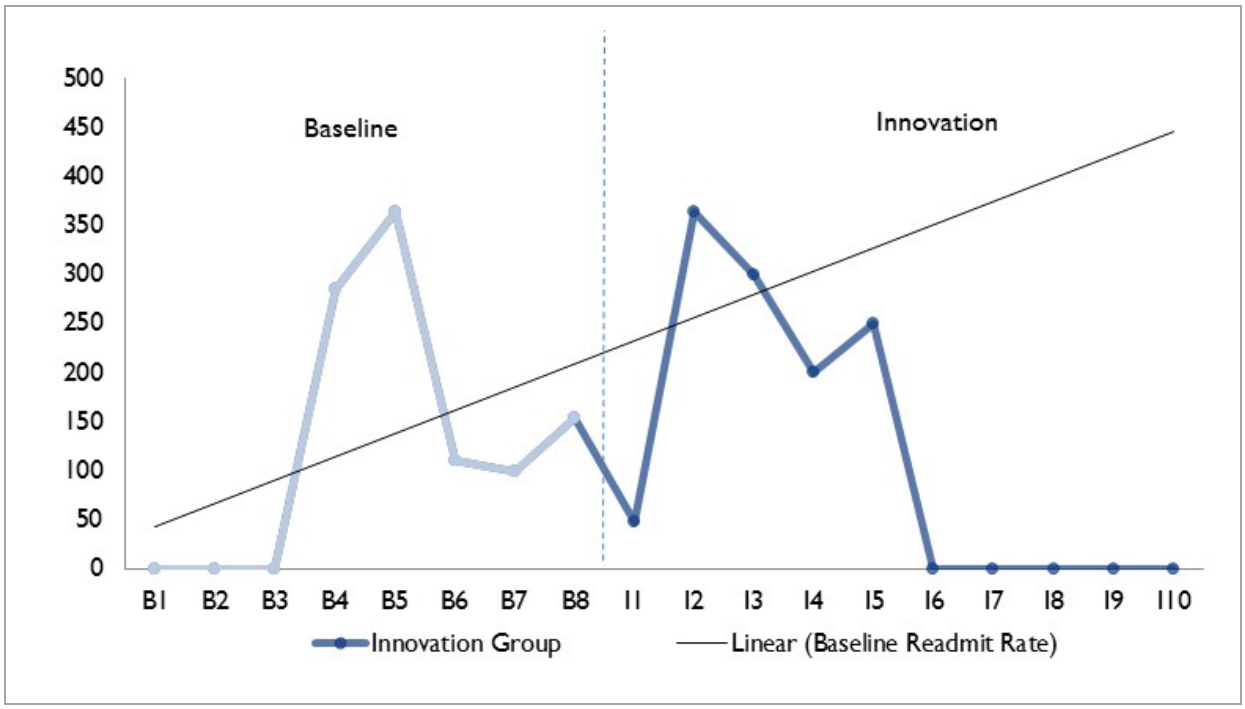
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.
- — Data not yet available.

Figure 10. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: REMSA CP-E&R



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.

2.13 Medicare Emergency Department Visits

2.13.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 21*** and ***Figure 11.*** In the innovation period, ED visits for the innovation group fluctuate around the baseline trend for quarters 1 through 5 and remain below the baseline linear trend from quarters 6 through 10.

Table 21. ED Visits per 1,000 Medicare Participants: REMSA CP-E&R

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**
Innovation Group																		
ED rate	262	213	197	210	328	344	297	508	636	317	600	351	571	346	360	190	316	417
Std dev	681	636	477	517	757	739	706	1,276	1,076	779	1088	857	1069	745	810	680	671	900
Unique patients	61	61	61	62	64	64	64	65	66	63	50	37	28	26	25	21	19	12
Comparison Group																		
ED rate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Std dev	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weighted patients	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Innovation-Comparison Rate																		
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

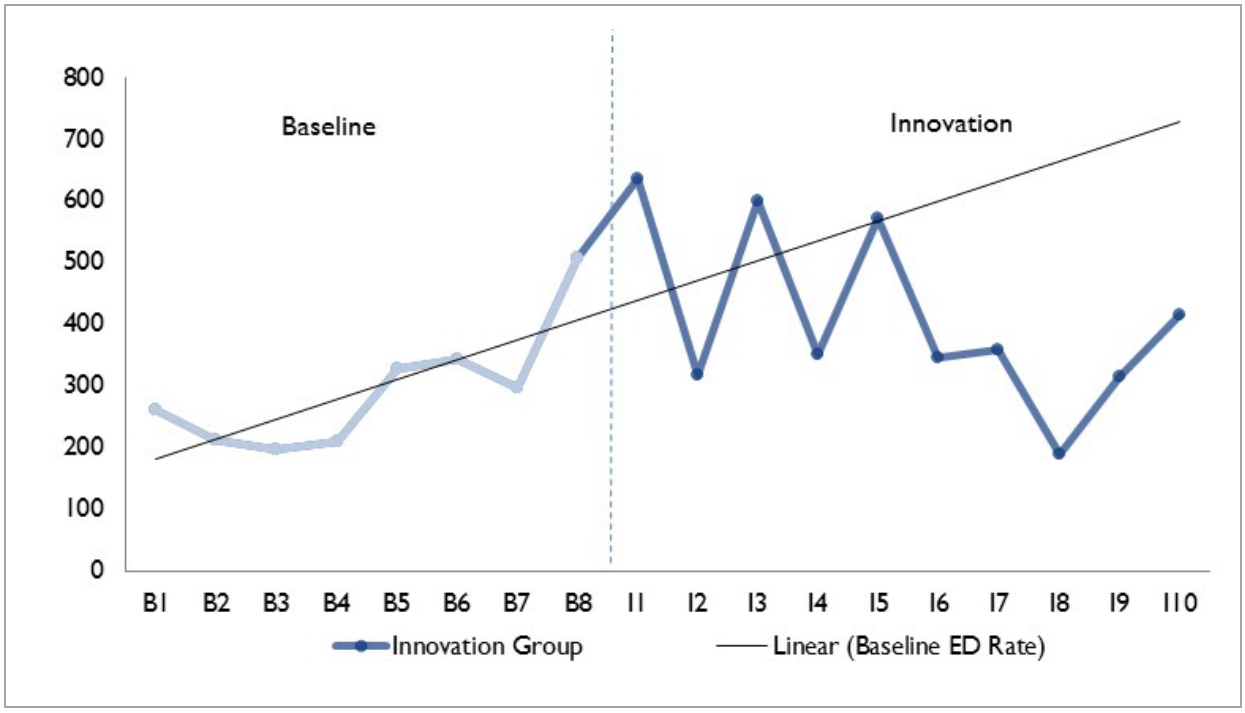
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.
- — Data not yet available.

Figure 11. ED Visits per 1,000 Medicare Participants: REMSA CP-E&R



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions

- ED = emergency department; REMSA CP-E&R = Regional Emergency Medical Services Authority, Community Paramedics-Evaluate and Refer.

2.14 Discussion: Medicare Results—REMSA Community Paramedics-E&R

ED visits and inpatient admissions consistently fall below the baseline trend line in the first 5 quarters after entry into the innovation. Medicare spending and readmissions, on the other hand, do not deviate from the baseline trend in the innovation period. Because we do not have enough observations to support a meaningful comparison group or regression analysis, we cannot make conclusions about the impact of the CP-E&R innovation.

2.15 Medicare Comparison Group: REMSA-Ambulance Transport Alternatives (ATA)

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through June 30, 2016. This analysis includes two more quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 115 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. In this report, we use a revised

comparison group that better matches the innovation group than the comparison group we used in the third annual report. 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 cities of Reno and Sparks and in Washoe County.

We use propensity score matching (PSM) to select comparison group beneficiaries who called for an ambulance transport on the same date as the innovation group. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary enrolls in the innovation as a function of age, gender, race, end-stage renal disease status, dual Medicare-Medicaid status, years since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders, and a binary variable flagging ED visits in the year prior to the innovation. We also include total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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. Prior to matching, we excluded innovation beneficiaries who were not enrolled in fee-for-service, newly enrolled in Medicare, or did not have Medicare claims in the year of ambulance transport.

Table 22 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 both the comparison and innovation groups.

Table 22. Mean Values and Standardized Differences of Variables in Propensity Score Model: REMSA-ATA (Medicare)

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	59.37	16.93	71.95	11.97	0.86	59.57	16.87	61.52	18.24	0.12
Percentage male	70.70	45.70	46.00	49.80	0.52	70.40	45.80	61.80	48.70	0.18
Percentage white	75.00	43.50	85.30	35.40	0.26	74.80	43.60	73.60	44.20	0.03
Percentage ESRD	1.70	13.10	1.90	13.60	0.01	1.70	13.10	0.00	0.00	0.19
Number of chronic conditions	0.72	1.42	0.88	1.32	0.12	0.72	1.42	0.66	1.05	0.05
Years of Medicare enrollment	11.10	8.99	10.84	8.34	0.03	11.15	9.01	11.64	9.52	0.06
Medicare payments in the year preceding innovation	$20,093	$36,631	$5,170	$11,365	0.55	$19,779	$36,635	$13,259	$20,562	0.22
Percentage dual-eligible months in the previous calendar year	56.00	49.80	18.00	38.40	0.86	55.70	49.90	42.80	49.60	0.26
Had ED visit in calendar year prior to enrollment	75.00	43.50	21.10	40.80	1.28	74.80	43.60	64.40	48.00	0.23
Percentage with Medicare claim for inebriation in calendar year prior to enrollment	51.70	50.20	2.30	14.90	1.34	51.30	50.20	48.90	50.10	0.05
Percentage with Medicare claim for substance abuse in calendar year prior to enrollment	62.90	48.50	9.80	29.70	1.32	62.60	48.60	57.50	49.60	0.10
Percentage with Medicare claim for psychological disorders in calendar year prior to enrollment	81.90	38.70	30.20	45.90	1.22	81.70	38.80	80.70	39.50	0.02
Number of beneficiaries	116	—	21,538	—	—	115	—	186	186	—
Number of unique beneficiaries[1]	116	—	21,538	—	—	115	—	186	186	—
Number of weighted beneficiaries	—	—	—	—	—	115	—	115	115	—

[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).

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- ESRD = end-stage renal disease; SD = standard derivation; REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.
- — Data not yet available.

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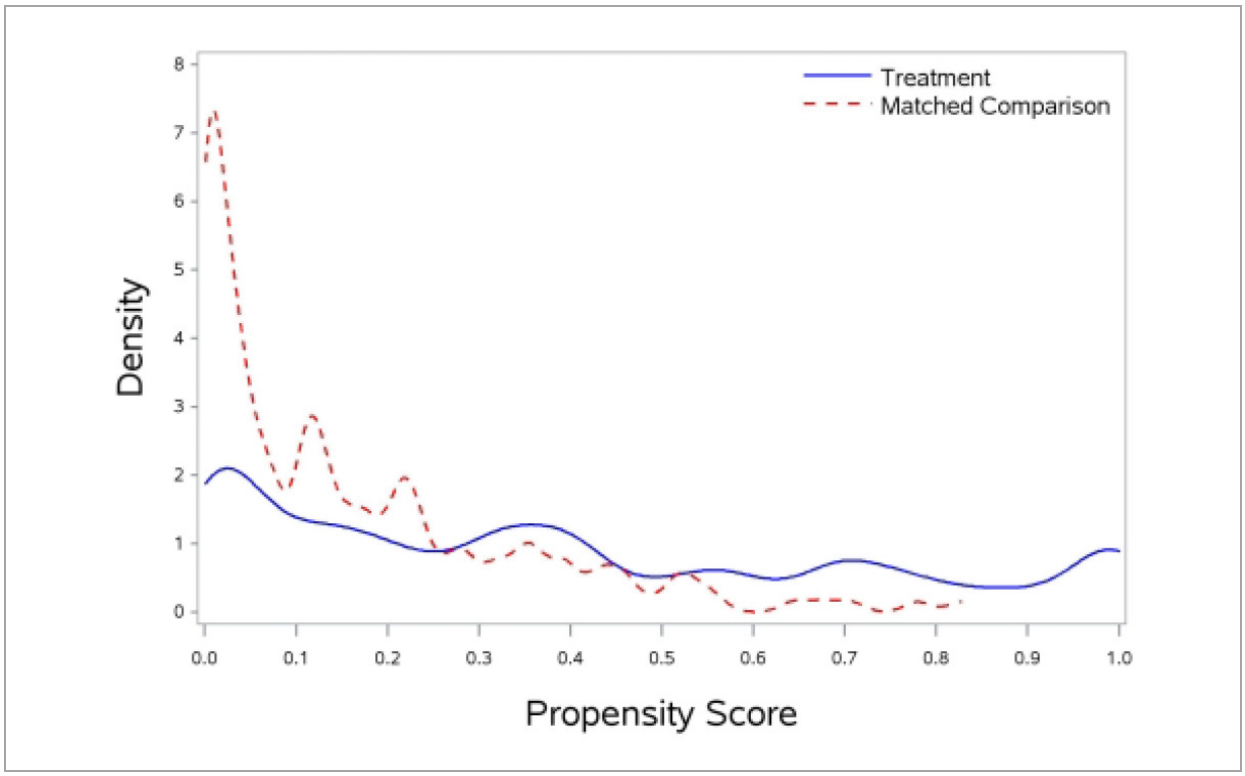
After performing PSM, we calculate absolute standardized differences between the innovation group and both the unmatched and matched comparison groups and check whether matching decreases the absolute standardized differences and achieves acceptable balance (Table 22). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[4] 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 22 show that matching reduced the absolute standardized differences and achieved adequate balance for about half of the variables. Age, males, ESRD, Medicare payments in the year preceding innovation, Dual eligible and ED visits in the prior calendar year to enrollment had absolute standardized differences that exceeded 0.10. Except for age, the innovation group had higher mean values for all variables that exceeded the 0.10. standardized difference threshold. The higher mean values suggest that participants in the ATA innovation may be sicker. Notably, however, the matching process substantially improved the balance on variables related to inebriation, substance abuse, and psychological disorders, conditions that may be especially good candidates for alternative transport.

Figure 12 shows the distribution of the propensity scores for both the innovation and comparison groups. The distribution of propensity scores has good overlap, which ensures that for every person in the innovation group, we are likely to find a match in the comparison group.

[4] 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 12. Distribution of Propensity Scores for Comparison and Innovation Groups: REMSA-ATA (Medicare)



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.16 Medicare Spending

2.16.1 Descriptive Results

Table 23 reports Medicare spending per patient in the 8 quarters before and 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 13*** illustrates the Medicare spending per beneficiary in Table 23 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. In the baseline period, spending is higher for the innovation group compared to the comparison group. In the innovation period, Medicare spending for the innovation and comparison groups are similar. These trends are different from those in the third annual report due to the increased sample size, additional quarters of data, and new comparison group.

Table 23. 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	I12
Innovation Group																				
Spending rate	$4,075	$4,717	$5,138	$3,715	$5,061	$4,967	$5,267	$5,640	$9,544	$7,231	$4,557	$6,454	$4,292	$3,972	$4,717	$5,803	$5,123	$6,406	$6,816	$9,339
Std dev	$8,439	$20,300	$13,280	$8,296	$14,335	$12,378	$13,275	$11,415	$15,558	$13,382	$7,970	$16,093	$8,789	$8,053	$7,386	$11,345	$11,626	$10,119	$13,558	$17,664
Unique patients	96	99	104	101	102	103	107	114	115	104	90	84	71	61	58	54	47	38	27	22
Comparison Group																				
Spending rate	$1,326	$1,834	$3,012	$2,037	$1,407	$3,585	$2,973	$4,294	$11,148	$7,404	$3,622	$3,909	$5,572	$3,830	$3,676	$5,106	$4,872	$2,793	$3,963	$7,695
Std dev	$3,058	$3,067	$7,427	$5,133	$2,943	$9,640	$7,975	$11,314	$18,585	$18,120	$10,048	$15,560	$17,297	$9,338	$8,587	$9,171	$11,532	$8,766	$7,722	$15,635
Weighted patients	87	93	95	99	99	100	103	113	115	114	97	89	79	64	59	53	44	36	27	20
Savings per patient																				
	−$2,749	−$2,882	−$2,126	−$1,678	−$3,654	−$1,382	−$2,295	−$1,346	$1,604	$173	−$935	−$2,546	$1,281	−$143	−$1,040	−$697	−$251	−$3,613	−$2,854	−$2,244

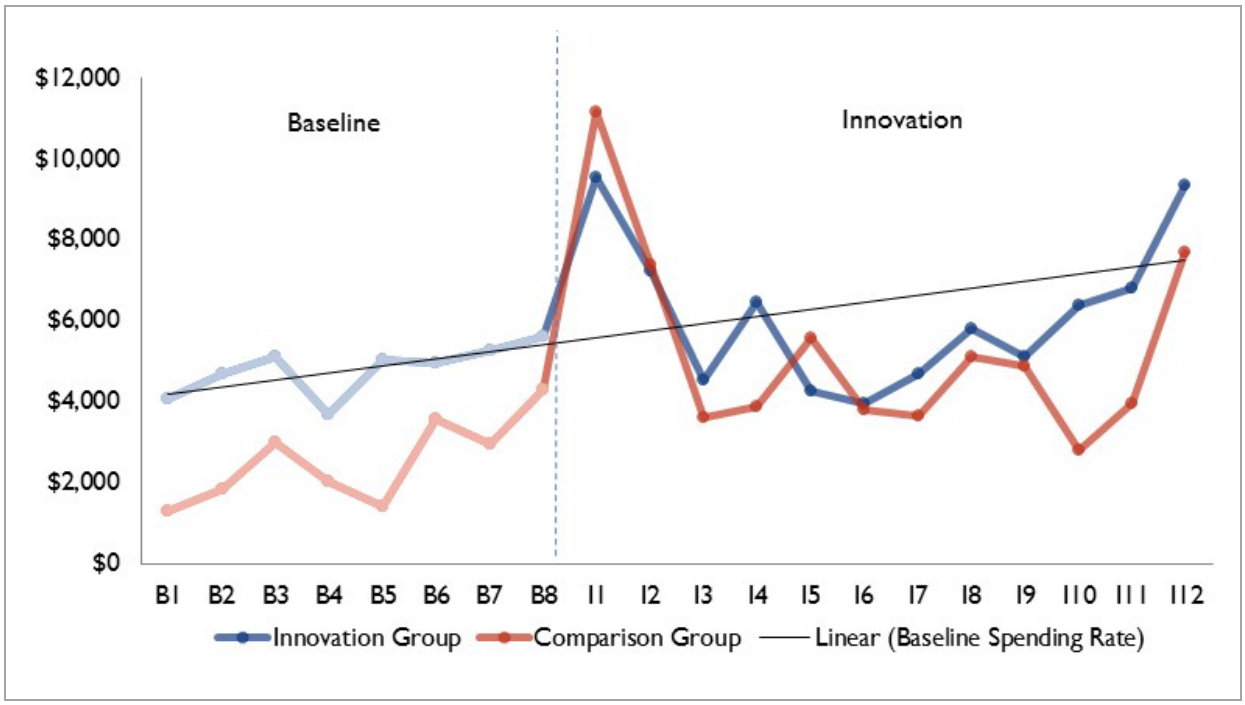
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

Figure 13. Medicare Spending per Participant: REMSA-ATA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.16.2 Regression Results

We present In ***Table 24*** 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 −$1,430 (90% CI: −$2,990, $131). 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 quarterly effects derived from 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 14*** illustrates these quarterly difference-in-differences estimates. In the first quarter of the innovation period, the innovation group spends $3,916 less than the comparison group. After the first quarter, we observe no significant differences in spending. The innovation group in Year 1 spent $845,026 less than the control group. This difference was statistically significant (p=0.067).

Table 24. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA-ATA

Quarter	Coefficient	Standard Error	P-Values
I1	−$3,916	$2,111	0.065
I2	−$2,703	$1,981	0.173
I3	−$1,639	$1,257	0.193
I4	$406	$1,764	0.818
I5	−$2,978	$2,204	0.178
I6	−$1,053	$1,521	0.489
I7	−$175	$1,577	0.912
I8	−$727	$2,074	0.726
I9	−$1,140	$2,446	0.642
I10	$2,015	$1,986	0.311
I11	$1,139	$2,900	0.695
I12	$639	$4,870	0.896
Overall average	−$1,430	$946	0.132
Overall aggregate	−$1,102,327	$729,047	0.132
Overall aggregate (IY1)	−$845,026	$459,512	0.067
Overall aggregate (IY2)	−$325,101	$325,668	0.319
Overall aggregate (IY3)	$67,801	$213,348	0.751

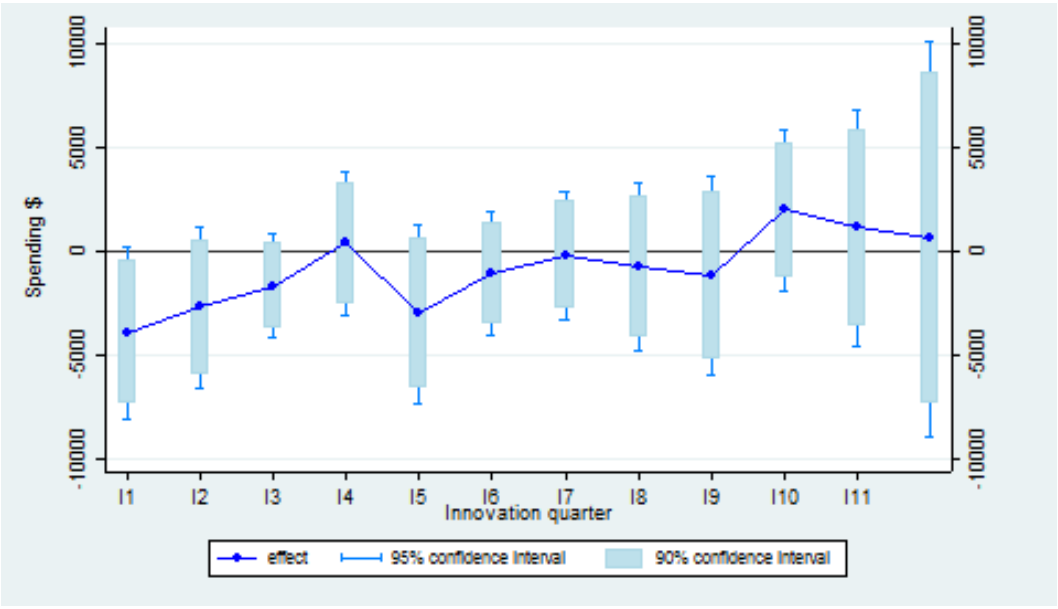
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **The regression coefficients** are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables age, gender, race, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Average:** 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; REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

Figure 14. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA-ATA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives; OLS = ordinary least squares.

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 for saving or losing money on this initiative. Figure 15 supports the finding that the innovation generated savings in the first quarter of the innovation period. From quarters 4 through 11, the probability of savings and losses is comparable. The overall probability of savings over the entire innovation period is 93 percent.

Figure 15. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: REMSA-ATA

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.17 Medicare Inpatient Admissions

2.17.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 25*** and ***Figure 16***. Compared to the comparison group, the innovation group has higher inpatient admissions in baseline quarters. In the innovation period, the rates for inpatient admission for both the innovation and comparison groups are similar. These results are different from those in the third annual report due to the sample size increase and two additional quarters of available Medicare data.

Table 25. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
Admit rate	115	111	221	168	98	223	234	254	435	231	156	298	127	164	86	296	170	158	185	364
Std dev	378	447	650	509	357	590	635	646	979	576	576	1021	373	412	337	1065	429	431	474	710
Unique patients	96	99	104	101	102	103	107	114	115	104	90	84	71	61	58	54	47	38	27	22
Comparison Group																				
Admit rate	21	20	32	56	49	91	47	117	484	193	108	87	119	100	119	134	133	58	109	200
Std dev	107	156	200	241	252	377	215	378	683	653	348	345	353	329	373	476	399	210	367	618
Weighted patients	87	93	95	99	99	100	103	113	115	114	97	89	79	64	59	53	44	36	27	20
Innovation-Comparison Rate																				
	94	91	189	112	49	132	187	138	−49	37	48	211	8	64	−33	162	38	100	76	164

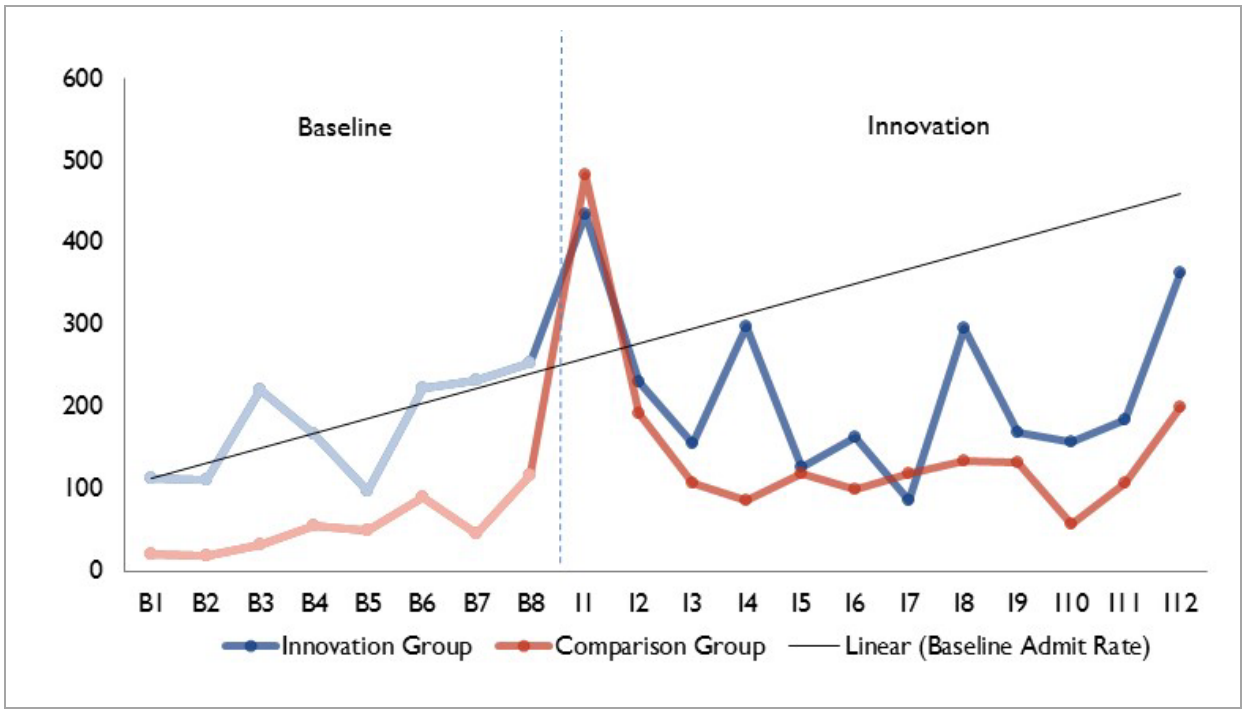
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

Figure 16. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: REMSA-ATA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.17.2 Regression Results

As shown in ***Table 26,*** the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 210 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: −226, −97).

We also present quarterly effects derived from a 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 significantly reduces inpatient hospital admissions in the first 2 quarters of the innovation period. Differences in inpatient hospital admissions between the innovation and comparison groups are insignificant in quarters 3 through 11. The innovation group in Year 1 had 122 fewer inpatient admissions in aggregate than the control group. This difference was statistically significant (p=0.008).

Table 26. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: REMSA-ATA

Quarter	Coefficient	Standard Error	P-Values
I1	−649	316	0.042
I2	−424	215	0.052
I3	−93	124	0.457
I4	63	131	0.632
I5	−108	104	0.302
I6	−53	115	0.646
I7	−154	990	0.124
I8	−173	252	0.494
I9	−143	156	0.364
I10	66	94	0.484
I11	−111	206	0.595
I12	−165	341	0.632
Overall average	−210	50	0.001
Overall aggregate	−162	65	0.001
Overall aggregate (IY1)	−122	45	0.008
Overall aggregate (IY2)	−29	18	0.104
Overall aggregate (IY3)	−11	12	0.384

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** 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; REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.18 Medicare Unplanned Readmissions

2.18.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 27*** and ***Figure 17***. Due to the small sample size, the variations in readmissions over time across innovation and comparison groups are large. No systematic differences in readmissions are observed between the innovation and comparison groups in both the baseline and innovation periods. In both this report and the third annual report, the unplanned readmissions rate varies widely.

Table 27. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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**	**I12**
Innovation Group																				
Readmit rate	0	333	111	0	0	0	286	67	367	267	0	333	250	0	200	0	0	0	250	167
Std dev	0	471	314	0	0	0	452	249	482	442	0	471	433	0	400	0	0	0	433	373
Total admissions	6	3	9	6	2	10	14	15	30	15	4	9	4	4	5	5	2	4	4	6
Comparison Group																				
Readmit rate	0	0	0	0	0	0	0	34	165	349	56	0	167	200	0	0	0	0	0	83
Std dev	0	0	0	0	0	0	0	183	371	477	229	0	373	400	0	0	0	0	0	276
Total admissions	1	2	3	1	2	3	3	10	26	14	6	4	2	2	2	3	2	0	1	4
Innovation-Comparison Rate																				
	0	333	111	0	0	0	286	32	202	-82	-56	333	83	-200	200	0	0	0	250	83

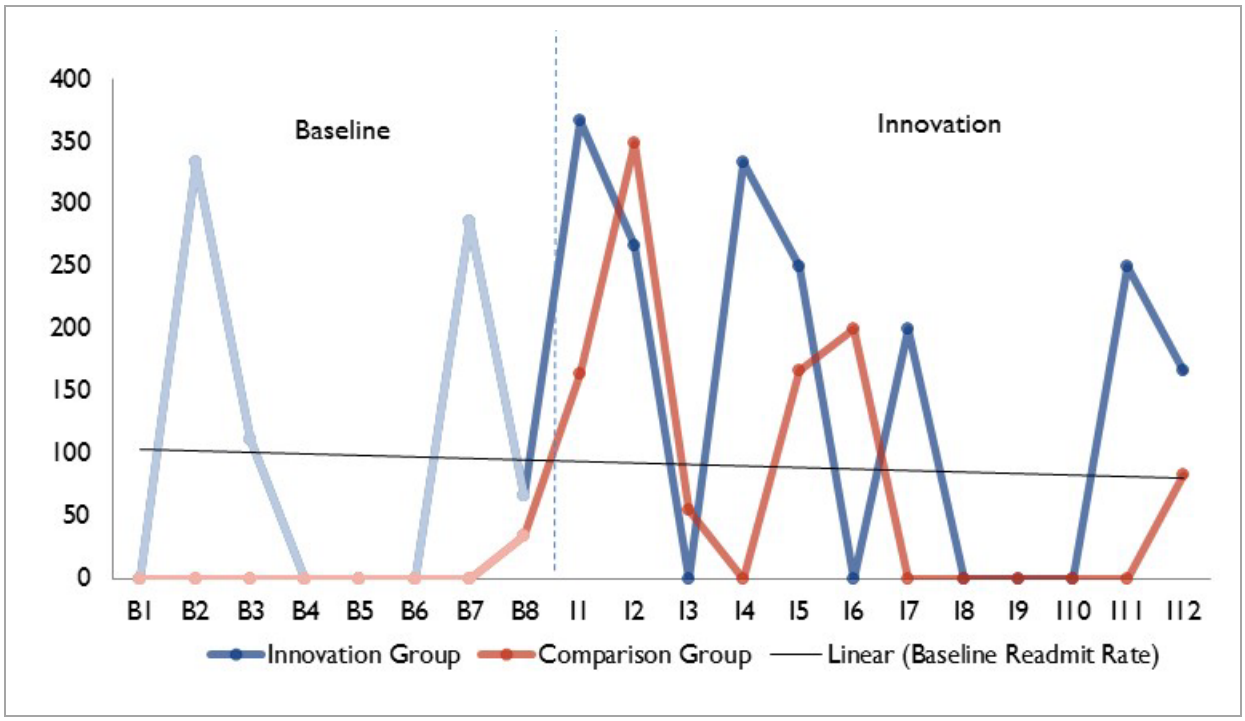
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA-ATA= Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

Figure 17. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: REMSA-ATA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.18.2 Regression Results

Table 28 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 −202 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: −541,138).

Table 28. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Admissions: REMSA-ATA

Quarter	Coefficient	Standard Error	P-Values
Overall average	−202	207	0.33
Overall aggregate	−19	19	0.33

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions
- REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.19 Medicare Emergency Department Visits

2.19.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 29*** and ***Figure 18.*** In the baseline period the innovation group has systematically higher ED visits than the comparison group. In the innovation period these differences persist. This result is different from the findings in the third annual report.

Table 29. ED Visits per 1,000 Medicare Participants: 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**	**I12**
Innovation Group																				
ED rate	760	717	952	842	755	631	1,075	1,342	2,061	1,942	1,000	1,202	1,056	1,279	1,155	1,278	1,106	1,237	1,667	2,636
Std dev	1,799	1,578	2,120	2,331	1,947	1,455	1,999	2,713	3,409	3,285	1,799	2,429	2,177	3,028	2,412	2,936	2,003	2,307	3,913	4,885
Unique patients	96	99	104	101	102	103	107	114	115	104	90	84	71	61	58	54	47	38	27	22
Comparison Group																				
ED rate	346	389	210	186	172	279	301	303	1,000	335	315	340	418	262	278	369	152	269	313	295
Std dev	661	718	436	405	442	487	397	704	773	648	446	533	698	624	469	569	306	539	539	428
Weighted patients	87	93	95	99	99	100	103	113	115	114	97	89	79	64	59	53	44	36	27	20
Innovation-Comparison Rate																				
	414	328	742	656	583	352	774	1,039	1,061	1,607	685	863	639	1,017	877	909	955	968	1,354	2,341

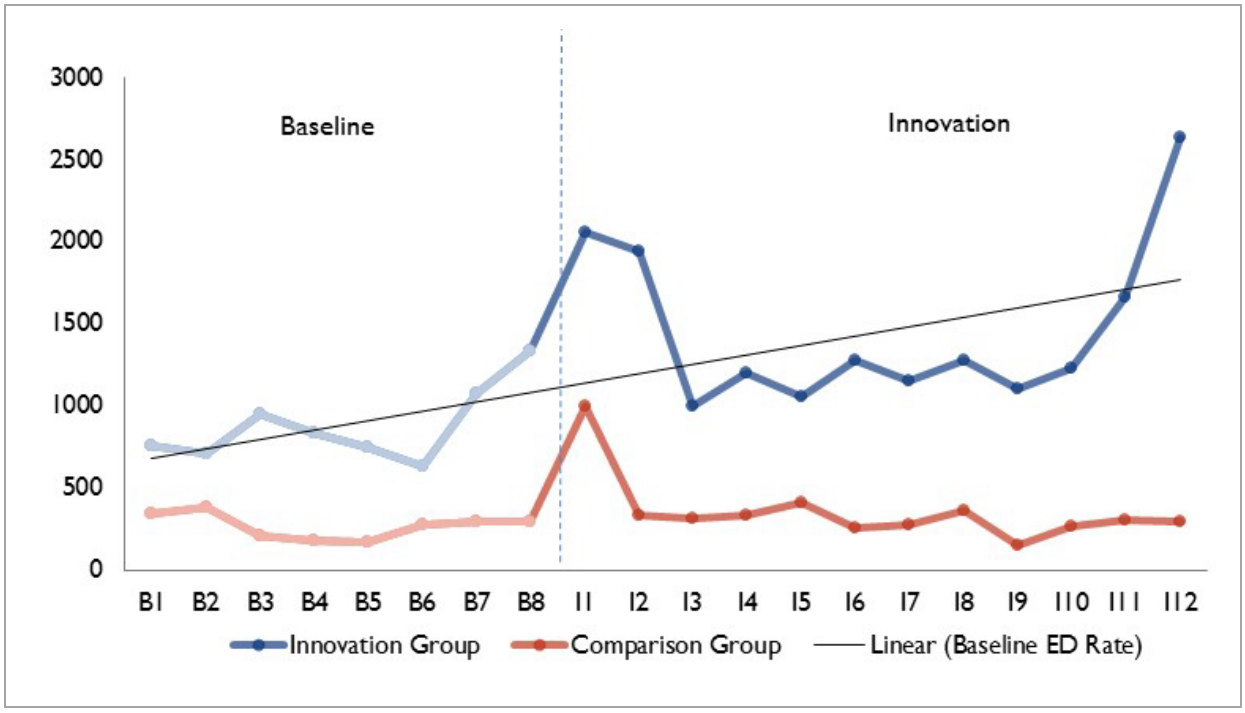
Notes:

- **Source: RTI analysis of Chronic** Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

Figure 18. ED Visits per 1,000 Medicare Participants: REMSA-ATA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- ED = emergency department; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.19.2 Regression Results

As shown in ***Table 30,*** the average quarterly difference-in-differences estimate for ED visits is an increase of 240 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: −41, 522).

We also present quarterly effects derived from a 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 quarter of the innovation a reduction in ED visits occurs, −1,317 per 1,000. Reductions in ED visits in the first quarter of the innovation period correspond to the quarter of alternative ambulance transports. In the second through last quarter of the innovation period, higher ED visits occur in the innovation group. Significant increases are observed in quarters 2, 9, and 12 in the innovation period. Due to the small number of observations in I12, coefficients in quarter 12 are unusually large because the estimates are

sensitive to outliers. Significant increases are thus also observed for innovation Year 3, which aggregates ED visits in quarters 9 through 12

Table 30. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: REMSA-ATA (Average Treatment Effect on Treated)

Quarter	Coefficient	Standard Error	P-Values
I1	−1,317	858	0.127
I2	1110	515	0.033
I3	22	254	0.932
I4	233	313	0.459
I5	73	332	0.827
I6	417	333	0.216
I7	342	341	0.320
I8	232	454	0.610
I9	844	339	0.017
I10	775	471	0.108
I11	740	815	0.372
I12	2,171	1,110	0.064
Overall average	240	171	0.161
Overall aggregate	185	132	0.161
Overall aggregate (IY1)	−15	117	0.902
Overall aggregate (IY2)	63	44	0.156
Overall aggregate (IY3)	137	41	0.001

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; REMSA-ATA = Regional Emergency Medical Services Authority-Ambulance Transport Alternatives.

2.20 Discussion: Medicare Results—REMSA-ATA

Relative to the comparison group, the innovation group decreases spending by $1,430 per quarter per participant over the innovation period. The impact of the innovation on spending differs over time. In Year 1, we observe a significant reduction in spending of $2,150 per participant. In contrast, in Years 2 and 3 spending differences between the innovation and comparison groups are not statistically significant. In the quarter in which beneficiaries were transported to alternative sites, regression results show that savings were significant. Savings in the quarter of transport alone (the first quarter) are −$3,916 with no other quarter showing significant savings.

Relative to the comparison group, acute inpatient stays and hospital readmissions are lower for the innovation group throughout the innovation period. ED visits, on the other hand, are lower in the first quarter of the innovation period for the innovation group and higher in subsequent quarters. Reductions in spending in the first year of the ATA innovation may be attributed to reductions in acute inpatient stays, hospital readmissions, and reductions in ED visits in the first quarter of the innovation period.

The Medicare results are consistent with the innovation's theory of change, because we would expect to see cost savings attributed to reductions in ED visits as patients accessed care elsewhere. Based on the type and dose of services that patients typically received, the innovation possibly resulted in cost savings and reduced ED visits in the first innovation quarter.

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 less than 10 percent of the overall population reached by the innovation. In addition, the sample size is small, which can hinder detection of changes in spending. Finally, PSM does not achieve balance on all variables. In particular, good balance is achieved on previous quarter spending and ED visits; on the other hand, much better balance is achieved on inebriation, substance abuse, and psychological conditions that were possible candidates for alternative transport.

2.21 Medicare Comparison Group: REMSA-Nurse Health Line (NHL)

We include patients who were enrolled prior to June 30, 2016, and we present Medicare claims data through March 30, 2016. This includes one more quarter of Medicare claims data than the third annual report. We were not able to include a second quarter of data due to small sample size. The Medicare claims analysis focuses on 1,775 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. Compared to AR3, this report adds 618 new Medicare 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 the cities of Reno and Sparks and in Washoe County.

NHL calls often coincided with receipt of care, such an inpatient hospitalization or ED visits. In previous reports, this receipt of care created a spike in spending and utilization during the first innovation quarter, an artifact of NHL calls 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 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 use PSM to select comparison group beneficiaries with similar characteristics to innovation beneficiaries. Innovation and comparison beneficiaries are matched using a logit model predicting the likelihood that a beneficiary enrolls into the innovation. Covariates used in the logit model to predict entry into the innovation are payments in calendar quarter prior to enrollment, total payments in calendar quarter prior to enrollment, age, gender, race, disability, end-stage renal disease status, number of dual eligible months in the previous calendar year, number of chronic conditions, percentage with chronic kidney disease, percentage with COPD ever, percentage with heart failure ever, percentage with diabetes ever, percentage with asthma ever. 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 31 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 19*** shows the distribution of the propensity scores for both the comparison and innovation groups.

Table 31. Mean Values and Standardized Differences of Variables in Propensity Score Model: REMSA-NHL (Medicare)

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	$5,878	$12,959	$2,125	$7,747	0.352	$5,906	$1,2983	$6,005	15686	0.007
Total payments in second, third, fourth, and fifth calendar quarters prior to enrollment	$12,727	$22,067	$7,404	$19,100	0.258	$12,576	$21,971	$11,449	$22,741	0.050
Age	66.71	14.21	70.12	10.89	0.270	66.68	14.22	66.33	13.93	0.025
Percentage male	34.16	47.43	48.93	49.99	0.303	33.75	47.28	32.92	46.99	0.018
Percentage white	84.38	36.31	76.1	42.65	0.209	84.28	36.4	84.71	35.99	0.012
Percentage disabled	43.78	49.61	20.9	40.66	0.505	43.89	49.62	48.65	49.98	0.096
Percentage ESRD	1.46	11.99	1.14	10.62	0.028	1.46	12.01	1.69	12.89	0.018
Number of dual eligible months in the previous calendar year	3.09	5.08	1.5	3.85	0.355	3.09	5.08	3.48	5.3	0.076
Number of chronic conditions	7.01	3.94	5.44	3.98	0.396	7.03	3.94	7.24	4.05	0.053
Percentage with chronic kidney disease ever	29.89	45.78	21.34	40.97	0.197	30.2	45.91	30.3	45.96	0.002
Percentage with COPD ever	39.3	48.84	21.45	41.05	0.396	39.15	48.81	35.63	47.89	0.073
Percentage with heart failure ever	23.51	42.41	15.91	36.57	0.192	23.77	42.57	26.65	44.21	0.066
Percentage with diabetes ever	31.62	46.5	29.64	45.67	0.043	31.66	46.52	38.6	48.68	0.146
Percentage with asthma ever	22.81	41.96	11.45	31.84	0.305	22.48	41.74	22.77	41.93	0.007
Percentage with hypertension ever	72.92	44.44	64.99	47.7	0.172	73.3	44.24	76.3	42.52	0.069
Number of outpatient ED visits in calendar quarter prior to enrollment	0.72	1.46	0.09	0.43	0.585	0.73	1.44	0.36	1.3	0.264
Number of outpatient ED visits in second, third, fourth, and fifth calendar quarters prior to enrollment	1.76	4.21	0.45	1.37	0.418	1.76	4.26	1.1	2.97	0.181
Number of beneficiaries	1,850	—	2,261,216	—	—	—	—	—	—	—
Number of unique beneficiaries	—	—	259,140	—	—	1,775	—	5,271	—	—
Number of weighted beneficiaries	—	—	—	—	—	1,775	—	1,775	—	—

[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).

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016

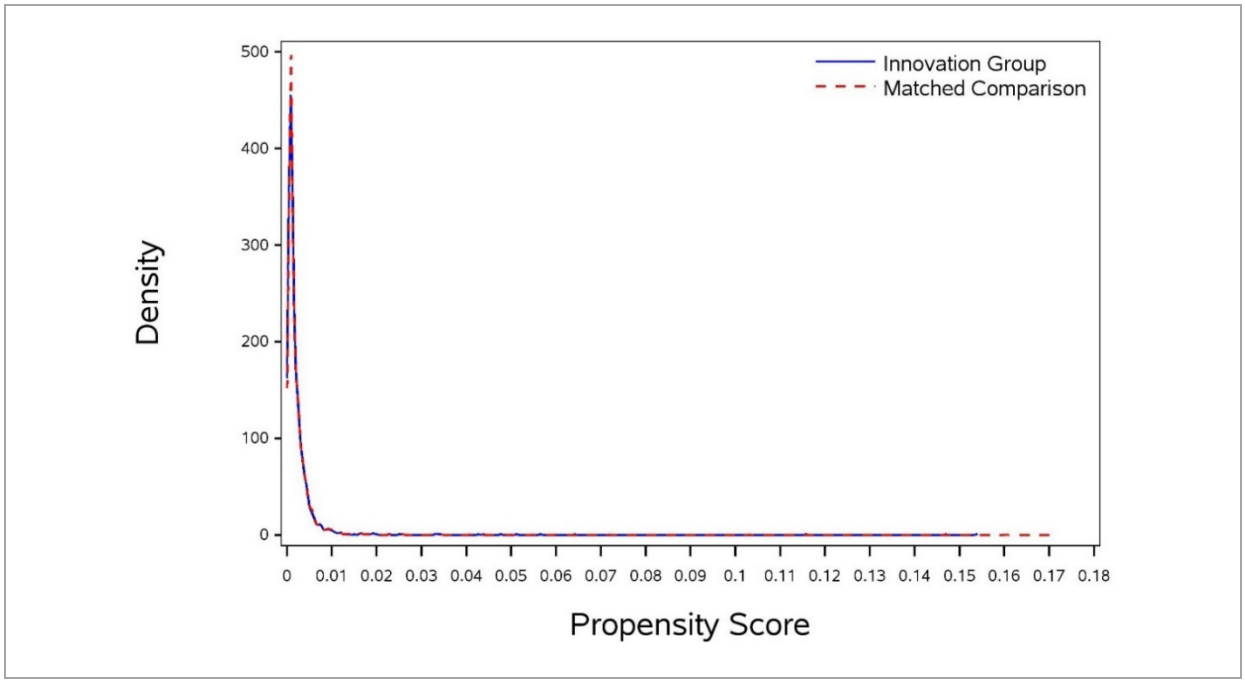
Terms and Definitions

- COPD = chronic obstructive pulmonary disease; ED = emergency department; ESRD = end-stage renal disease; SD = standard derivation; REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line.
- — 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 31). Many researchers consider that an absolute standardized difference ≤ 0.10 indicates acceptable balance.[5] 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 31 show that matching reduced the absolute standardized differences and achieved adequate balance for most variables. These variables—number of outpatient ED visits in calendar quarter prior to enrollment, number of outpatient ED visits in second, third, fourth, and fifth calendar quarter prior to enrollment and percentage with diabetes ever—are exceptions because they had absolute standardized differences after matching that exceeded 0.10.

Figure 19 shows the distribution of the propensity scores for both the innovation and comparison groups. The distribution of propensity scores has good overlap, which ensures that for every person in the innovation group, we are likely to find a match in the comparison group.

Figure 19. Distribution of Propensity Scores for Comparison and Innovation Groups: REMSA-NHL (Medicare)



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line.

[5] 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.

2.22 Medicare Spending

2.22.1 Descriptive Results

Table 32 reports Medicare spending per patient in the 8 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 20*** illustrates Medicare spending per beneficiary in Table 32 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. In the baseline and innovation periods, Medicare spending for the innovation and comparison groups is similar. This finding is consistent with the findings in the third annual report.

Table 32. 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	I10
Innovation Group																		
Spending rate	$2,773	$2,898	$3,054	$2,867	$3,540	$3,209	$3,569	$5,906	$6,173	$4,851	$4,498	$4,746	$4,537	$4,471	$4,563	$4,738	$5,112	$4,993
Std dev	$7,271	$7,652	$7,684	$7,564	$8,607	$8,418	$8,664	$12,983	$13,546	$10,870	$10,647	$11,143	$9,665	$9,683	$14,850	$11,084	$11,370	$12,321
Unique patients	1,524	1,559	1,604	1,636	1,676	1,706	1,744	1,775	1,775	1,573	1,168	968	748	609	589	350	169	60
Comparison Group																		
Spending rate	$3,051	$2,798	$2,818	$2,814	$2,781	$2,847	$3,448	$6,005	$4,816	$4,705	$4,593	$4,315	$4,207	$4,653	$4,476	$4,406	$4,240	$4,711
Std dev	$11,615	$7,598	$7,934	$7,863	$7,657	$7,555	$10,300	$15,686	$13,028	$15,618	$12,314	$12,776	$11,150	$13,390	$13,011	$13,075	$11,254	$13,712
Weighted patients	1,556	1,586	1,615	1,654	1,690	1,724	1,758	1,775	1,775	1,582	1,166	970	750	606	582	356	176	65
Savings per patient																		
	$277	−$100	−$236	−$53	−$759	−$362	−$120	$99	−$1,357	−$146	$95	−$430	−$330	$182	−$87	−$332	−$873	−$282

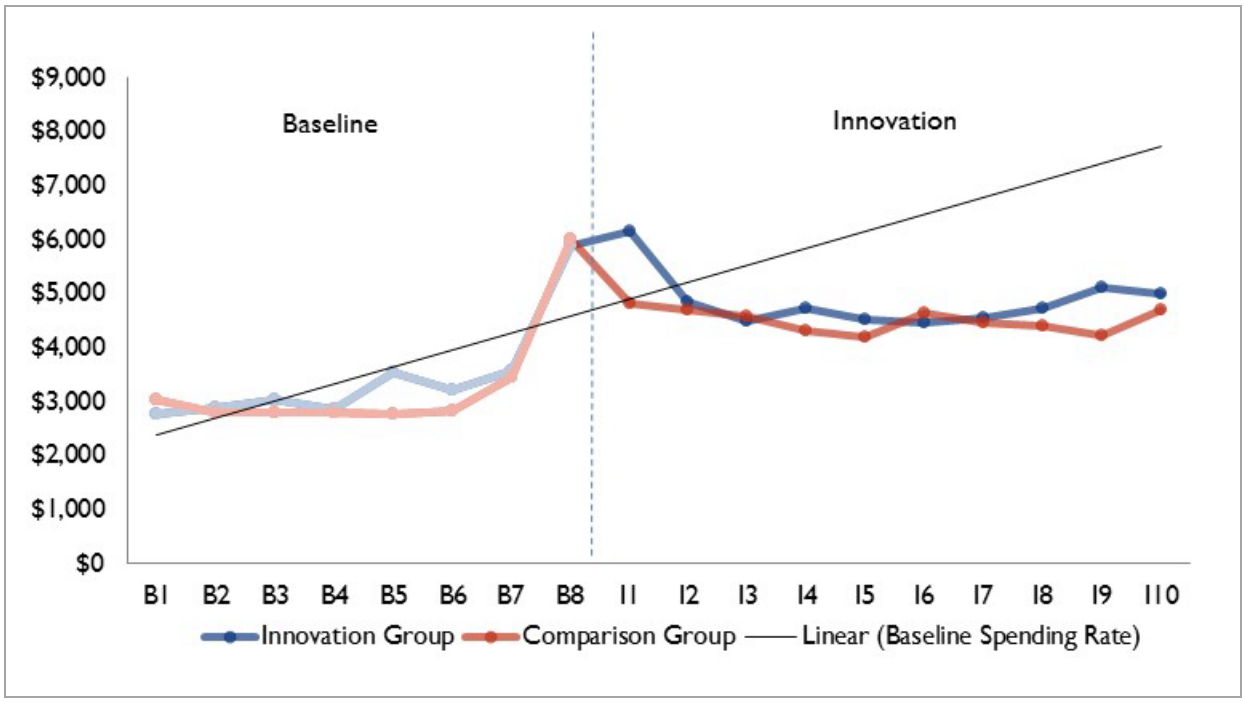
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 20. Medicare Spending per Participant: REMSA-NHL



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line

2.22.2 Regression Results

We present in ***Table 33*** 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, shows a loss of 245 (90% CI: −96, 586). This effect is not statistically significant. The finding in the third annual report was a small savings estimate; however, it was also 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 quarterly effects derived from 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 21*** illustrates these quarterly difference-in-differences estimates. In quarter 1 of the innovation period, there is a significant increase in spending of $1,180 per person. No other significant differences in spending between the innovation and comparison groups are observed in later quarters.

The increase in spending in quarter 1 of the innovation period can be attributed to an increase in follow-up care for participants who were recommended to seek care after calling the Nurse Hot Line. Over the entire 3 years of the innovation, spending for the innovation group is not significantly different from the comparison group. This suggests that the increase in spending in I1 offsets reductions in later quarters.

Table 33. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA-NHL

Quarter	Coefficient	Standard Error	P-Values
I1	$1,180	$342	0.001
I2	−$61	$336	0.855
I3	−$295	$355	0.405
I4	$260	$404	0.519
I5	$174	$398	0.662
I6	−$331	$470	0.481
I7	−$78	$679	0.909
I8	$129	$689	0.852
I9	$715	$964	0.458
I10	$131	$1,758	0.940
Overall average	$245	$207	0.237
Overall aggregate	$1,961,420	$1,658,325	0.237
Overall aggregate (IY1)	$1,904,905	$1,212,140	0.116
Overall aggregate (IY2)	−$72,239	$800,756	0.928
Overall aggregate (IY3)	$128,754	$214,994	0.549

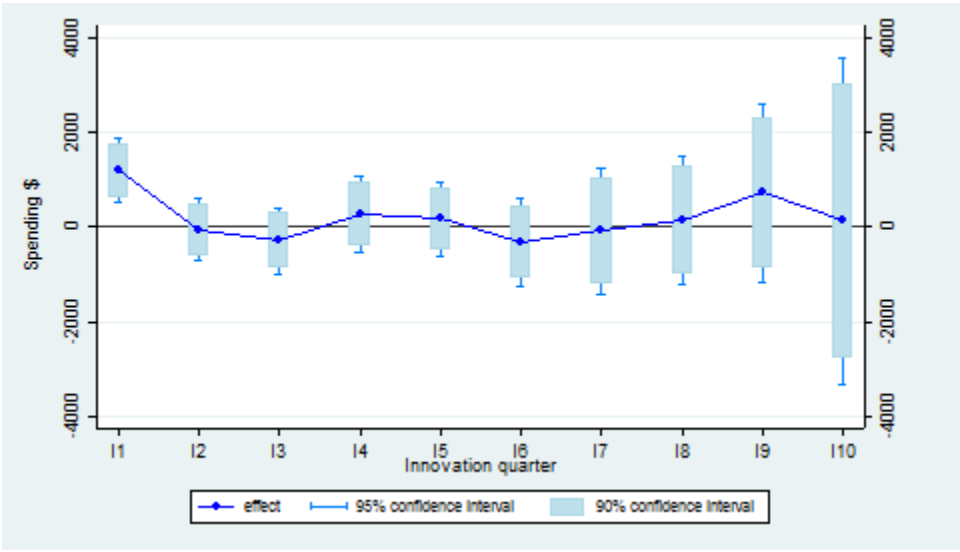
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **The regression coefficients** are the quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for the following variables age, gender, race, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Average:** 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; REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 21. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: REMSA-NHL



Notes:

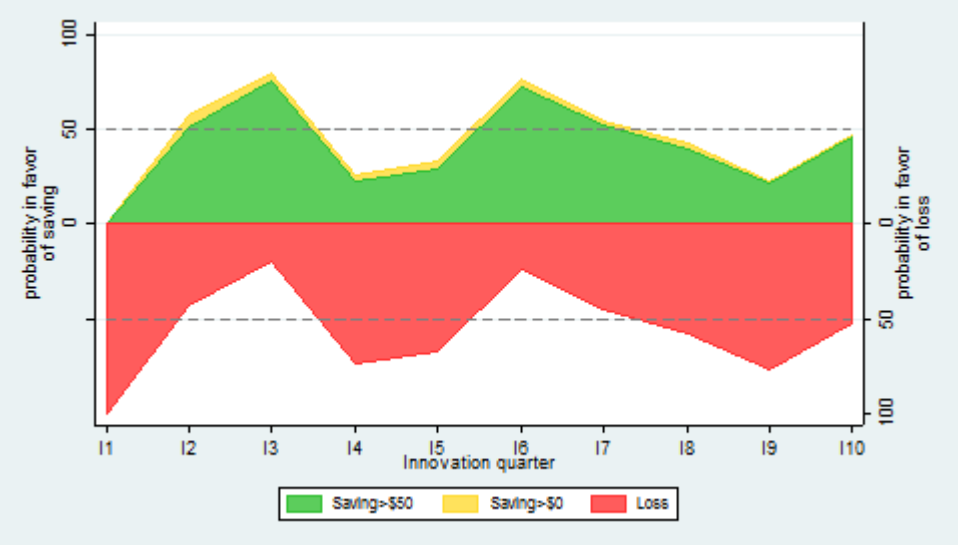
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of** activity: August 2013 to March 2016.

Terms and Definitions

- OLS = ordinary least squares; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 22 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 for savings or losses on this initiative. The overall probability of savings over the entire innovation period is 12 percent.

Figure 22. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: REMSA-NHL



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line.

2.23 Medicare Inpatient Admissions

2.23.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 34*** and ***Figure 23***. Compared to the comparison group, the innovation group has higher inpatient admissions in both baseline and innovation quarters. This finding is comparable to the finding in the third annual report.

Table 34. All-Cause Inpatient Admissions Rate per 1,000 Medicare 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	I10
Innovation Group																		
Spending rate	92	96	97	89	118	103	117	248	213	161	139	143	150	151	126	149	130	83
Std dev	367	352	364	321	404	369	402	602	551	501	451	446	458	469	379	485	386	276
Unique patients	1,524	1,559	1,604	1,636	1,676	1,706	1,744	1,775	1,775	1,573	1,168	968	748	609	589	350	169	60
Comparison Group																		
Spending rate	77	71	78	79	75	84	98	207	127	123	129	107	115	122	121	98	109	108
Std dev	344	322	339	327	324	351	410	638	492	435	469	416	423	461	465	385	439	468
Weighted patients	1,556	1,586	1,615	1,654	1,690	1,724	1,758	1,775	1,775	1,582	1,166	970	750	606	582	356	176	65
Innovation-Comparison Rate																		
	15	25	19	10	42	19	19	41	86	39	10	36	35	29	5	51	22	−24

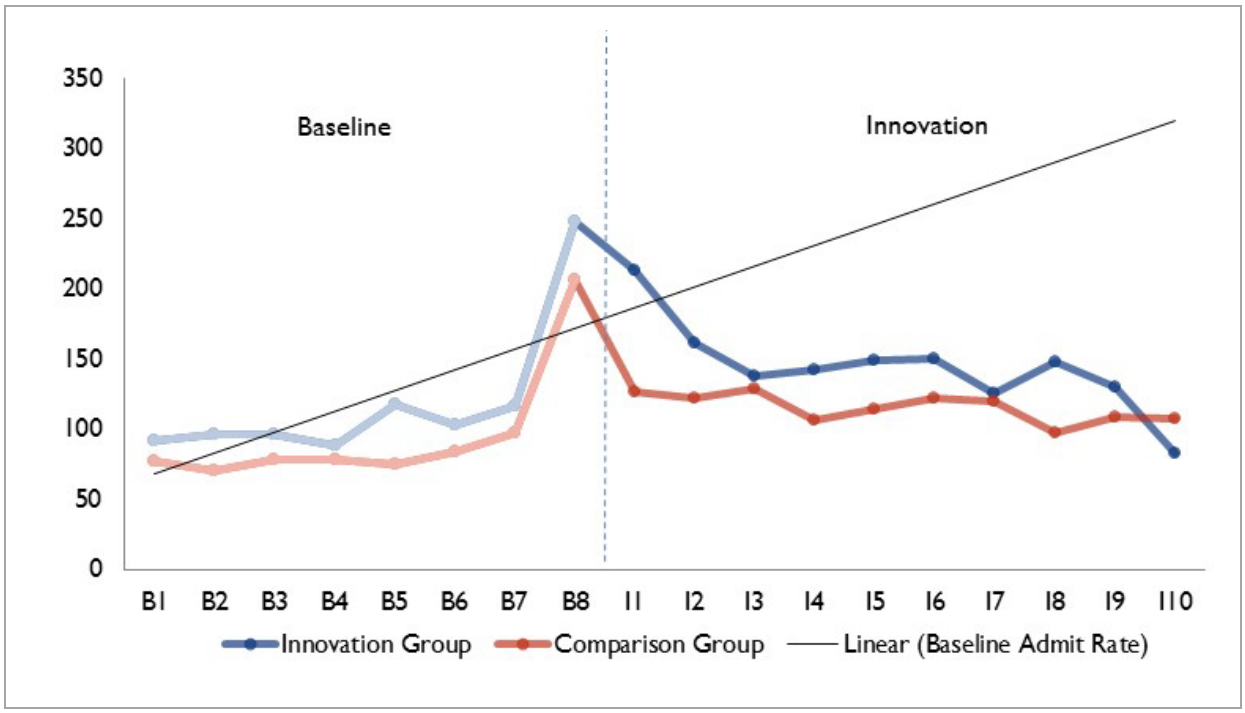
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 23. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: REMSA-NHL



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.23.2 Regression Results

As shown in ***Table 35***, 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 is statistically significant (90% CI: 1, 23).

We also present quarterly effects derived from a model with the dependent variable equal to the number of hospital visits for each person per 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. A significant increase in inpatient admissions occurs in quarter 1, 596 per 1,000 as well as significant decrease in quarter 3, −291 per 1,000. Differences in inpatient admissions for all other quarters are not statistically significant. The innovation group in Year 1 had 93 more inpatient admissions in aggregate than the control group. This difference was statistically significant (p=0.039)

Table 35. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: REMSA-NHL

Quarter	Coefficient	Standard Error	P-Values
I1	596	159	0.000
I2	75	151	0.621
I3	−291	174	0.095
I4	102	169	0.544
I5	122	198	0.539
I6	94	235	0.688
I7	−234	213	0.273
I8	243	314	0.439
I9	−99	424	0.816
I10	−501	502	0.322
Overall average	12	7	0.0633
Overall aggregate	98	53	0.063
Overall aggregate (IY1)	93	45	0.039
Overall aggregate (IY2)	10	27	0.717
Overall aggregate (IY3)	−5	8	0.548

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** 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; REMSA-NHL= Regional Emergency Medical Services Authority-Nurse Health Line.

2.24 Medicare Unplanned Readmissions

2.24.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 36*** and ***Figure 24***. Due to the small sample size, the variations in readmissions over time across innovation and comparison groups are large. No systematic differences in readmissions are observed between the innovation and comparison groups in both the baseline and innovation periods. This finding is consistent with the finding in the third annual report.

Table 36. Hospital Unplanned Readmissions Rates per 1,000 Medicare 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	I10
Innovation Group																		
Spending rate	72	121	143	25	117	115	134	149	154	86	143	104	125	21	109	188	0	0
Std dev	259	326	350	155	321	320	341	356	361	280	350	306	331	144	311	390	0	0
Unique patients	69	91	84	81	120	104	127	302	227	128	98	67	56	47	46	16	8	0
Comparison Group																		
Spending rate	102	115	41	49	82	93	71	147	111	68	135	147	94	147	109	140	87	0
Std dev	303	319	199	217	275	291	257	354	314	251	342	354	292	354	312	347	282	0
Weighted patients	69	61	57	61	69	77	85	186	105	84	72	50	43	34	34	17	8	2
Innovation-Comparison Rate																		
	−29	6	102	−25	34	22	63	2	43	18	8	−42	31	−126	0	48	−87	0

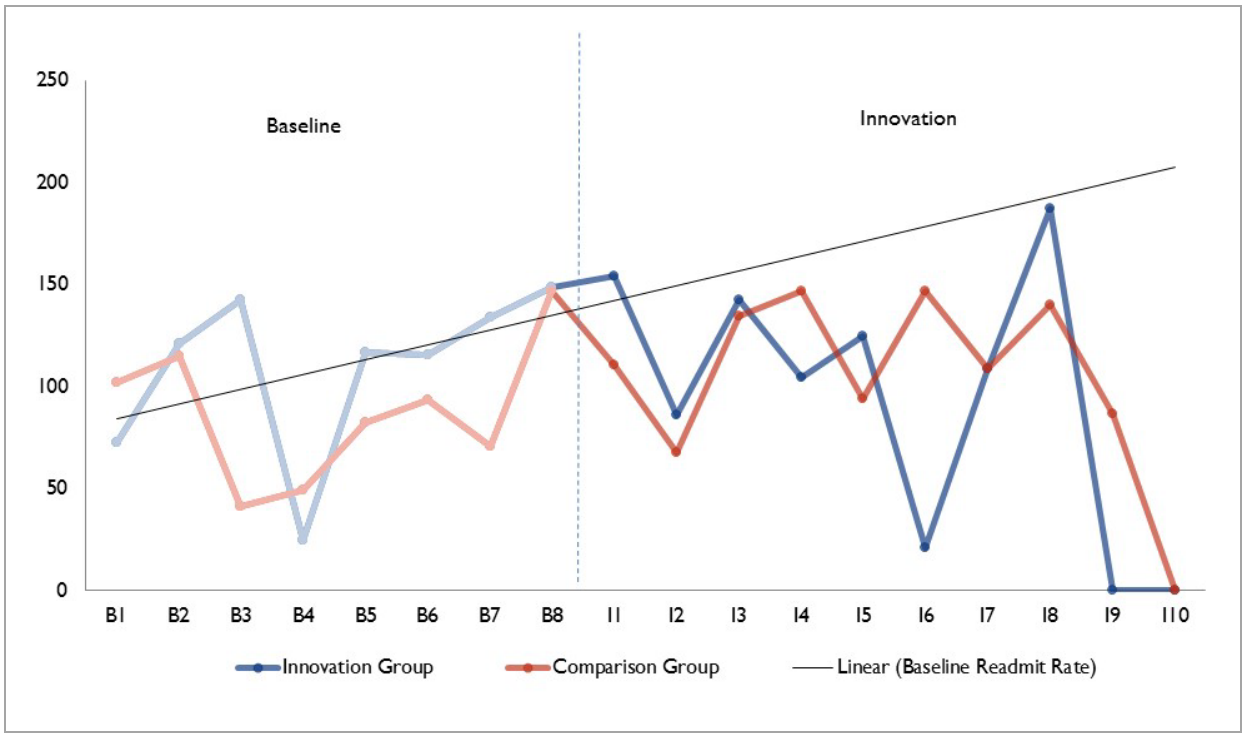
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 24. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: REMSA-NHL



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.24.2 Regression Results

Table 37 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 −11 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: −50, 28). This finding is similar to the finding in the third annual report.

Table 37. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Admissions: REMSA-NHL

Quarter	Coefficient	Standard Error	P-Values
Overall average	−11	24	0.65
Overall aggregate	−8	16	0.65

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** 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; REMSA CP-30= Regional Emergency Medical Services Authority-Community Paramedics (30 Days).

2.25 Medicare Emergency Department (ED) Visits

2.25.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 38*** and ***Figure 25.*** In the baseline and innovation period the innovation group is observed to have higher ED visits.

Table 38. ED Visits per 1,000 Medicare 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	I10
Innovation Group																		
Spending rate	319	343	342	358	387	359	386	727	558	448	408	470	445	470	411	323	462	283
Std dev	1,080	1,286	1,080	1,199	1,190	1,246	1,160	1,461	1,343	1,232	1,213	1,357	1,317	1,391	1,183	955	1,155	666
Unique patients	1,524	1,559	1,604	1,636	1,676	1,706	1,744	1,775	1,775	1,573	1,168	968	748	609	589	350	169	60
Comparison Group																		
Spending rate	188	188	197	185	198	213	256	358	275	266	276	236	239	224	222	271	189	174
Std dev	431	423	417	384	438	463	625	796	667	677	762	494	499	525	596	800	358	305
Weighted patients	1,556	1,586	1,615	1,654	1,690	1,724	1,758	1,775	1,775	1,582	1,166	970	750	606	582	356	176	65
Innovation-Comparison Rate																		
	131	155	146	174	188	146	131	369	284	182	132	234	206	245	188	51	272	109

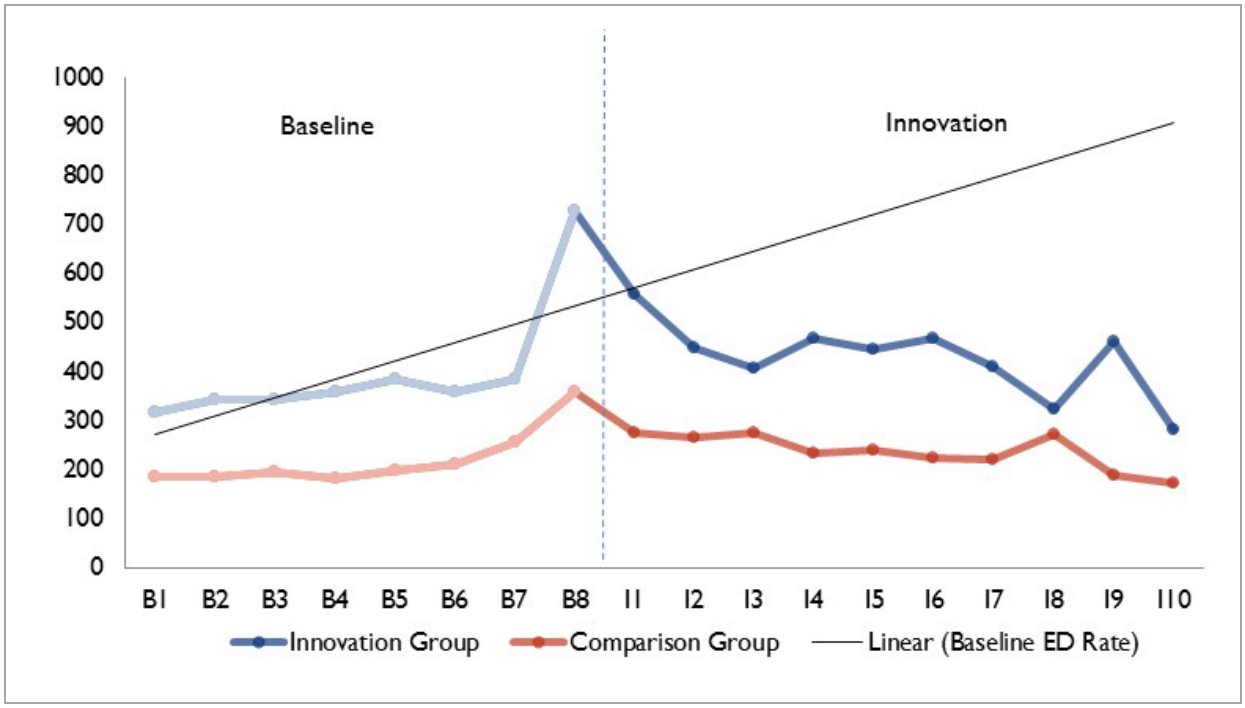
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

Figure 25. ED Visits per 1,000 Medicare Participants: REMSA-NHL



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- ED = emergency department; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.25.2 Regression Results

As shown in ***Table 39***, 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 not statistically significant (90% CI: −24, 37). This finding is different from the statistically significant increase in ED visits in the third annual report.

We also present quarterly effects, derived from a model with the dependent variable set to the number of ED visits per person per 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 quarters 1 and 3 in the innovation period, differences in ED visits between the innovation and comparison groups are insignificant. A significant increase in ED visits occurs in quarter 1, 73 per 1,000 as well as a significant decrease in quarter 3, −117 per 1,000.

Table 39. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: REMSA-NHL

Quarter	Coefficient	Standard Error	P-Values
I1	73	42	0.082
I2	−27	41	0.515
I3	−117	59	0.050
I4	53	45	0.241
I5	27	52	0.601
I6	107	58	0.068
I7	34	60	0.565
I8	−175	104	0.092
I9	79	99	0.427
I10	−115	147	0.439
Overall average	7	19	0.716
Overall aggregate	54	149	0.716
Overall aggregate (IY1)	4	129	0.978
Overall aggregate (IY2)	44	73	0.545
Overall aggregate (IY3)	6	19	0.733

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** August 2013 to March 2016.

Terms and Definitions

- **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, end-stage renal disease status, dual Medicare-Medicaid status, days since Medicaid enrollment, number of chronic conditions, history of inebriation, substance abuse, psychological disorders and a binary variable flagging ED visits in the year prior to the innovation. We also included total Medicare payments in the year preceding innovation entry to capture unexpected health events leading up 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.
- **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- ED = emergency department; I = Innovation Quarter; IY = Innovation Year; REMSA-NHL = Regional Emergency Medical Services Authority-Nurse Health Line.

2.26 Discussion: Medicare REMSA-NHL Results

Relative to the comparison group, spending, inpatient admissions, and ED visits in the first quarter of the innovation period are significantly higher for the innovation group. The increase in inpatient admissions and ED visits in the first quarter of the innovation period can be attributed to medical events that prompted Medicare beneficiaries to call the NHL. The observation that inpatient care increases with participation in the NHL innovation suggests that the NHL innovation is successful in encouraging individuals who needed care to get it. Delaying care can be costly since patients would have engaged with the health care system at advanced stages of disease. Thus, increases in spending in the first quarter of the innovation period may be offset in later quarters because costly care is avoided.

Three years into the innovation, we find evidence for this hypothesis since the NHL innovation did not significantly impact spending, ED visits, and readmissions. However, the NHL innovation does significantly increase inpatient admissions. The insignificant effects on spending suggest that the increased expenditure from inpatient care may have been offset by reductions in other forms of care including reductions in unplanned readmissions.

One limitation of our propensity score match is that we can match innovation and comparison group individuals on the basis of observable characteristics, but we may not achieve good matches on unobservable factors. Individuals who call the NHL presumably do so based on a health event or concern. We do not observe these events or concerns in the comparison group. Some events or concerns may appropriately lead to ED visits or inpatient admissions, even in the counterfactual absence of a call to the NHL, but the actual call may have prevented some inpatient admissions and ED visits. Based on data reported by REMSA, 11.2 percent and 2.6 percent of NHL callers indicated that an ER visit and an ambulance trip, respectively, were avoided as a result of the NHL call. Our matching approach may not be able to distinguish between additional necessary care prompted by the health event or concern, and unnecessary care prevented due to a call.

The results may not fully represent the overall population served by the innovation. The results presented here are only for Medicare beneficiaries we could match with the identifiers provided by the site. These beneficiaries represent 6 percent of the overall population reached by the innovation.

2.27 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 questions.

REMSA submitted data to RTI current through June 2016. ***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 addendum. The results of analyses for all of these measures are included in this annual report addendum.

Table 40. Awardee-Specific Outcome Measures: REMSA

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

Notes:
- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions
- ED = emergency department; REMSA = Regional Emergency Medical Services Authority.

2.28 Health Care Outcomes: Utilization

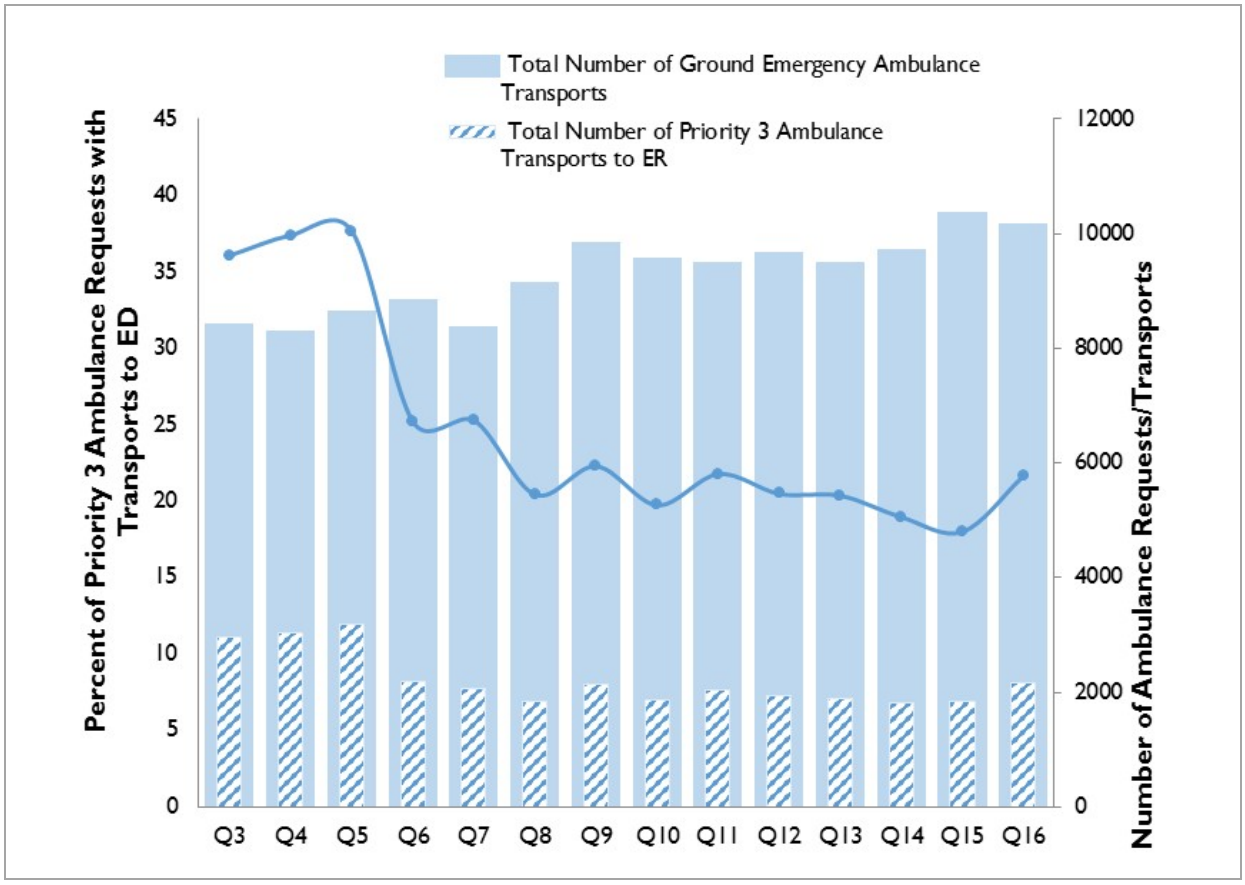
REMSA provided health care utilization data to RTI related to REMSA's goals of improving appropriate care and reducing costs. The source is aggregated data provided in REMSA's self-monitoring plan. REMSA provided patient-level data on the rate of total hospital readmissions for participants in the CP-30 Days program by quarter through Q16, as well as the rate of individual hospital readmissions for participants enrolled in the 30-day enrollment program. 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.

Evaluation Questions
- Has the number/percentage of Priority 3/low-priority transports to the ED decreased over time?
- Have the number/percentage of total and individual hospital readmissions for patients enrolled in the CP-30 Days program decreased over time?

2.28.1 Descriptive Results

Figure 26 show the number of Priority 3/low-priority transports to the ED during the innovation for the ATA component as a percentage of all emergency ambulance transports. In general, the percentage of Priority 3/low-priority transports to the ED decreases over time although it increases slightly in the last quarter of the innovation. The percentage of transports ranges from 37.7 percent in Q5 to 18 percent in Q15. Overall, the average percentage of Priority 3/low-priority transports to the ED is 24.7 percent.

Figure 26. Priority 3 Transports to ED—Percentage of Priority 3/Low-Priority Transports to the ED though Q16: REMSA



	Quarter	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
●	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	18.0	21.7
	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	10,176	9,973
	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	1,835	2,164

Notes:

- **Source:** Aggregate data provided in self-monitoring plan.
- **Period of activity:** January 2013 to June 2016.

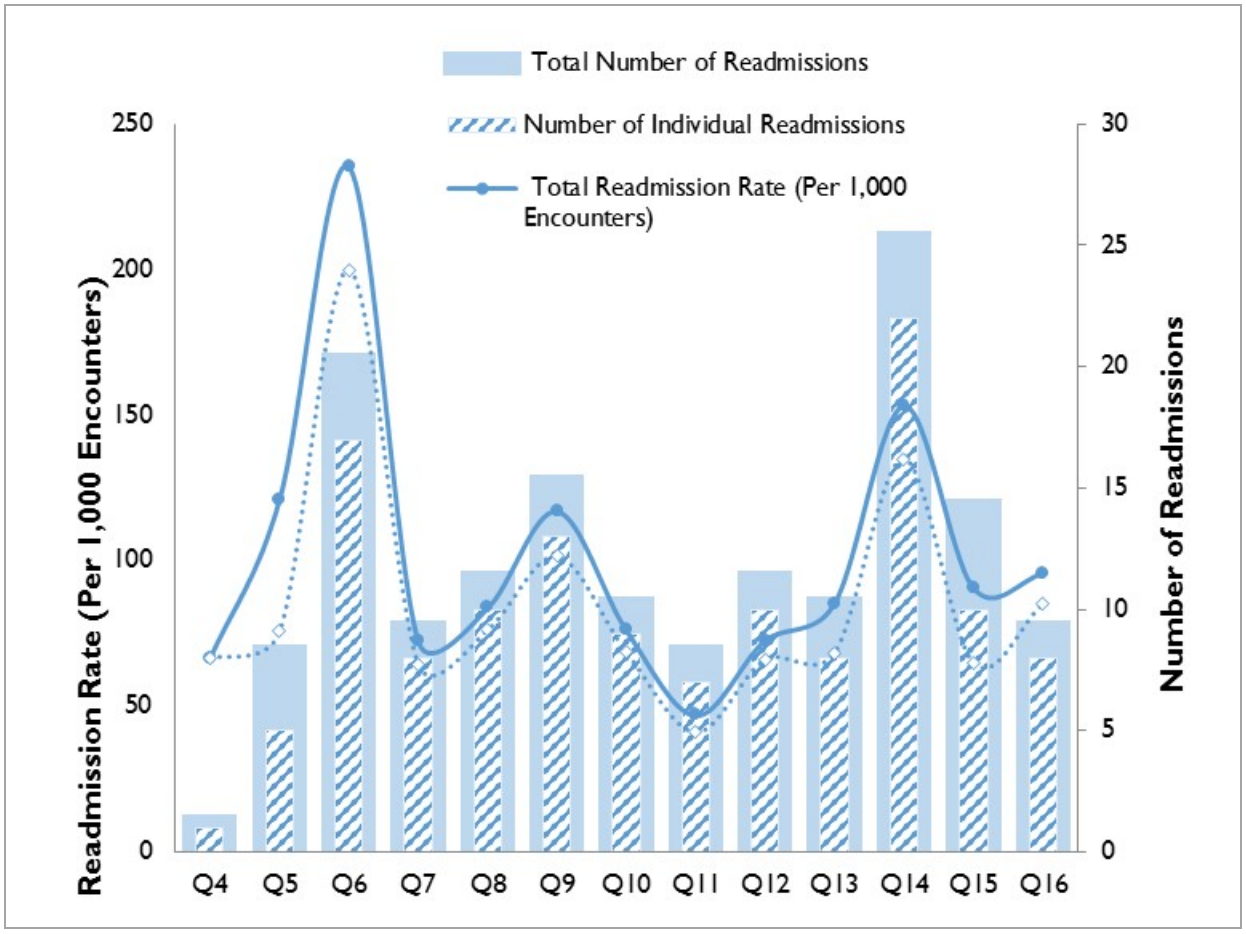
Terms and Definitions

- ED = emergency department; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

Figure 27 shows that for every 1,000 participants enrolled in the CP-30 Days program in Q16, 95.7 total participants are readmitted to the hospital during their enrollment. This rate decreases to 85.1 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 innovation began in Q4, the average rate of readmission for individuals in the 30-day enrollment program is 101.4 for every 1,000 participants, and the individual rate of readmission for those in the 30-day enrollment program is 85.7 for every 1,000 participants.

These rates vary slightly from the third annual report due to updated data REMSA provided in June 2016.

Figure 27. 30-Day Enrollment Program Readmissions—Rate of Total and Individual Hospital Readmissions for Patients Enrolled in the CP-30 Days Program: REMSA



(continued)

Figure 27. 30-Day Enrollment Program Readmissions—Rate of Total and Individual Hospital Readmissions for Patients Enrolled in the CP-30 Days Program: REMSA (continued)

	Quarter	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
●	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	153.4	90.9	95.7
◊	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	135.0	64.9	85.1
	Total number of readmissions	1	8	20	9	11	15	10	8	11	10	25	14	9
	Number of individual readmissions	1	5	17	8	10	13	9	7	10	8	22	10	8

Notes:

- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- CP = Community Paramedic; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

2.29 Discussion: Awardee-Specific Data

REMSA focused on 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-30 Days program. Data provided by REMSA indicate that, overall, the CP-30 Days enrollment program may contribute to a decrease in readmission rates although they fluctuate over time. Also, based on the data provided for the ATA program, the percentage of low-priority ambulance transports to ED have generally decreased over time, although they increased slightly in Q16.

2.30 Awardee-Specific Measures of Implementation

The evaluation focuses on the components of implementation—workforce, context, innovation adoption and workflow, implementation effectiveness, and sustainability. ***Table 41*** lists the quantifiable measures of implementation and their status as of June 30, 2016 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 Q15 and Q16 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 41. Measures of Implementation: REMSA

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 (FTE) staff in Q16	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q15 and Q16	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q15 and Q16	*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-30 Days 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 Days 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

Notes:

- **Source**: Quarterly Awardee Performance Reports, data received from REMSA.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- 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.

2.31 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 can carry out new and enhanced models of care. RTI examined these workforce factors to better understand their role in innovation implementation. We present any changes in workforce development in the last 6 months of operation not reported in the third annual report.

2.31.1 Hiring and Retention

At the end of Q16 (June 2016), the innovation was staffed with 16.0 full-time equivalent (FTE) staff members, and 1 separation occurred. REMSA specifically faced challenges in staffing the CP (30 Days enrollment program and E&R) and NHL components of the innovation throughout the innovation. Staffing challenges in both components were due to unclear expectations of the hired staff about their jobs and duties. During the 2016 end-of-year interviews, staff members reiterated that staffing was a main challenge in the NHL component because of its nature and workflow culture. One person said, "*The NHL is an emergency environment but providing a non-emergent service."* To determine the skills best suited for the positions and ensure that job seekers' expectations were met, nurses took a test during the interview to assess their abilities to multitask. In addition, they were asked to shadow a nurse in the NHL for 4 hours to better understand the workflow process; they reported that this practice was very helpful.

REMSA noted that no changes occurred in staffing and retention for these components since the third annual report. In Q16 a REMSA staff member reported stability among personnel in the CP component: "*No staff turnover in over 6 months meant that all of the paramedics were comfortable treating patients outside the hospital environment and communicating with other providers."*

REMSA staff shared several lessons learned about staffing and retention during end-of year interviews (see box).

KEY INSIGHTS

- Too many staff were hired initially: *"That would be my advice to anyone else doing this: start small and aim at building relationships."*
- REMSA did not have sufficient networking and partnerships*: "It would have been way more successful to have a few community medics really targeted in building relationships with community partners"*
- Character profile of a successful paramedic in this program is not the same as a ground paramedic: *"Only one paramedic is still there from the original group. I believe people become paramedics because they are kind of adrenaline junkies, emergent, that kind of personality is not necessarily what you need for a CP. You need people who are not adrenaline junkies, have a lot of skill at talking to patients, going into patient's homes, being non-threatening, being able to treat everyone with respect. Over time, we've really seasoned that in the people that are here. Gone through two hiring rounds. Our questions have changed every time. People need to slow down from what they do as ground paramedics."*

2.31.2 Skills, Knowledge, and Training

By the end of Q16 (June 2016), REMSA provided 19,974 total hours of training to 179 individuals. This training was composed of 368 hours of nurse navigator training during Q15 through online/webinar, classroom, discussion, text, or clinical instruction (***Table 42***). In the Q16 progress report we learned that this training was prompted when analysis of the NHL Protocol Compliance illustrated a downward trend of completed Emergency Care Nurse System (ECNS) protocols. REMSA noted that following this training in Q15, an increase in completed protocols was noted in Q16.

Table 42. Training Provided to Staff: REMSA

Time Frame	Number of Training Hours	Number of Trainees
Q15 & Q16 (January–June 2016)	368	3
Since inception	19,974	179

Notes:
- **Source:** Quarterly Awardee Performance Reports, data received from REMSA.
- **Period of activity** January 2013 to June 2016.
- Trainees are counted more than once of they participated in more than one HCIA training course.

Terms and Definitions
- Q = quarter; REMSA = Regional Emergency Medical Services Authority.

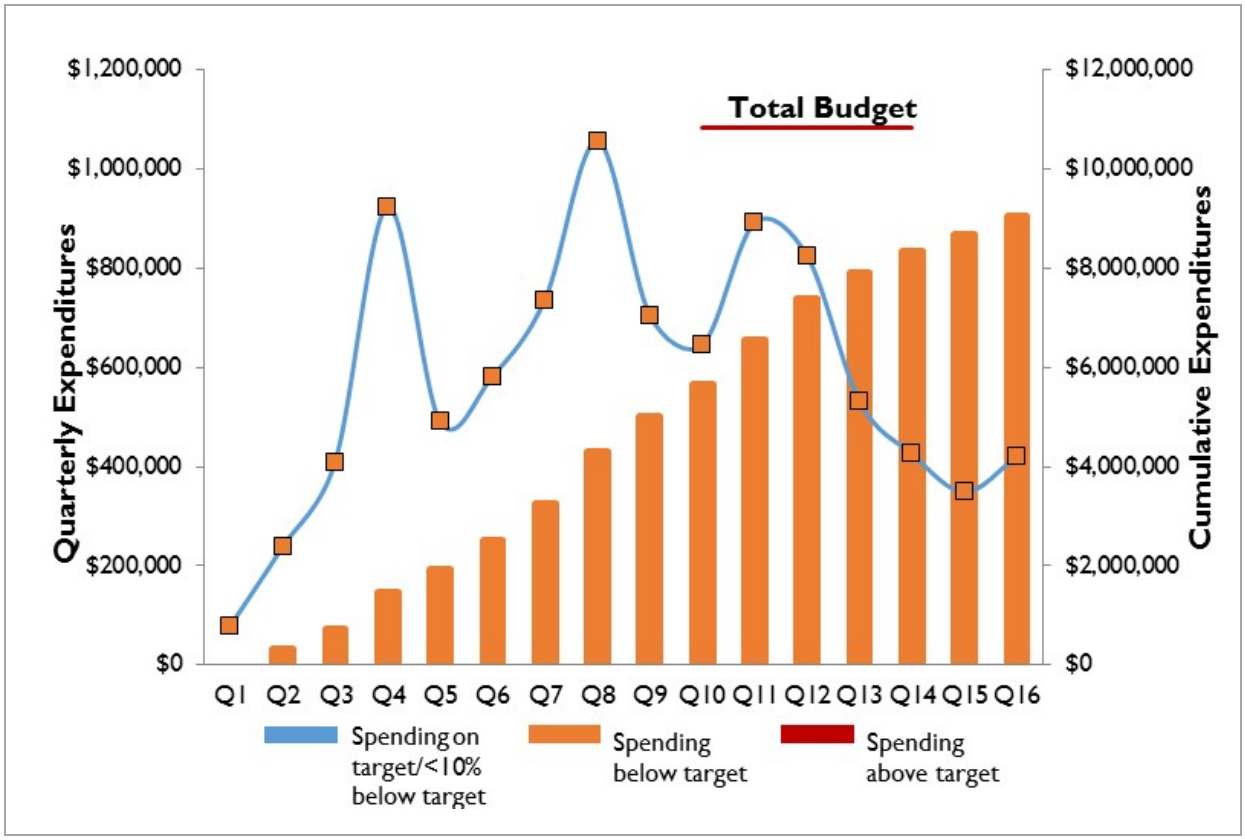
2.32 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. This section provides updates to three contextual factors—award execution, leadership, and organizational capacity.

2.32.1 Award Execution

The annual report highlights the significance of REMSA's expenditure rates on implementation. As of June 2016 (Q16), REMSA spent 83.8 percent of its total budget (***Figure 28***).

Figure 28. Cumulative Spend Rate from Q1 (June 1, 2012) to Q16 (June 30, 2016): REMSA



Notes:

- **Source:** Quarterly Awardee Performance Reports, data received from REMSA.
- **Period of activity:** January 2013 to June 2016.

Terms and Definitions

- Q = quarter; REMSA = Regional Emergency Medical Services Authority.

2.32.2 Leadership

The innovation remained a priority for REMSA across all levels of the organization, and the innovation continued to benefit from this support. In Q16, REMSA reported a key factor in achieving quality of care outcomes was the commitment of executive leadership: *"REMSA's executive leadership team has made a commitment to quality in all arenas. This commitment, led by REMSA's medical director, has been a key factor in achieving quality goals."*

2.32.3 Organizational Capacity

As described in the third annual report, REMSA had adequate capacity to operate this program (i.e., physical space, equipment, technology and staffing structure), although leadership noted that, "A *lean operation is cost competitive. I should have doubled administrative, business development, legal, and analytical support but you can't sustain it when you are pricing permanent solutions. That could have killed sustainability, but we are doing better. Lessons learned; I didn't have enough support."*

In Q16, REMSA reported that the CP program launched a quality improvement software, First Pass, to strengthen documentation by automatically checking EMRs for completeness and care delivery patterns. Additionally, REMSA's capacity to complete ECNS protocols increased after the nurse navigators were given additional training in Q15.

2.32.4 Innovation Adoption and Workflow Integration

As reported in the third annual report, the multiple components of REMSA's innovation (ATA, NHL, CP 30-Days, and CP E&R)—and the different stakeholders and partners for each component—made innovation adoption and integration complex. REMSA consistently took action to address challenges and remediate problems. For example, in Q15, REMSA reported quality improvements to increase the percentage of calls to the NHL that started an ECNS protocol. Furthermore, workflow changes were made to integrate the NHL into the 9-1-1 dispatch center and to ensure that nurse navigators or emergency medical dispatchers answered calls to the NHL.

REMSA reported that in June 2016, the CP medical record information was integrated into the state-wide health information exchange (HIE) system. Now providers and hospitals who are members can view patients' information after their CP visits. REMSA is planning additional integration of ground ambulance patient care record (EPCR) into the HIE.

2.33 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). This section provides an update to the reach measures presented in the third annual report.

2.33.1 Innovation Reach

Figure 29 shows reach by quarter since the launch of the innovation by each component of the innovation. We last reported reach in the third annual report, based on data through Q14.

For the ATA component, REMSA completed 1,511 transports to alternative destinations other than the ED through Q16, which equates to 14.6 percent of its eligible target population. These transports occurred for 986 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

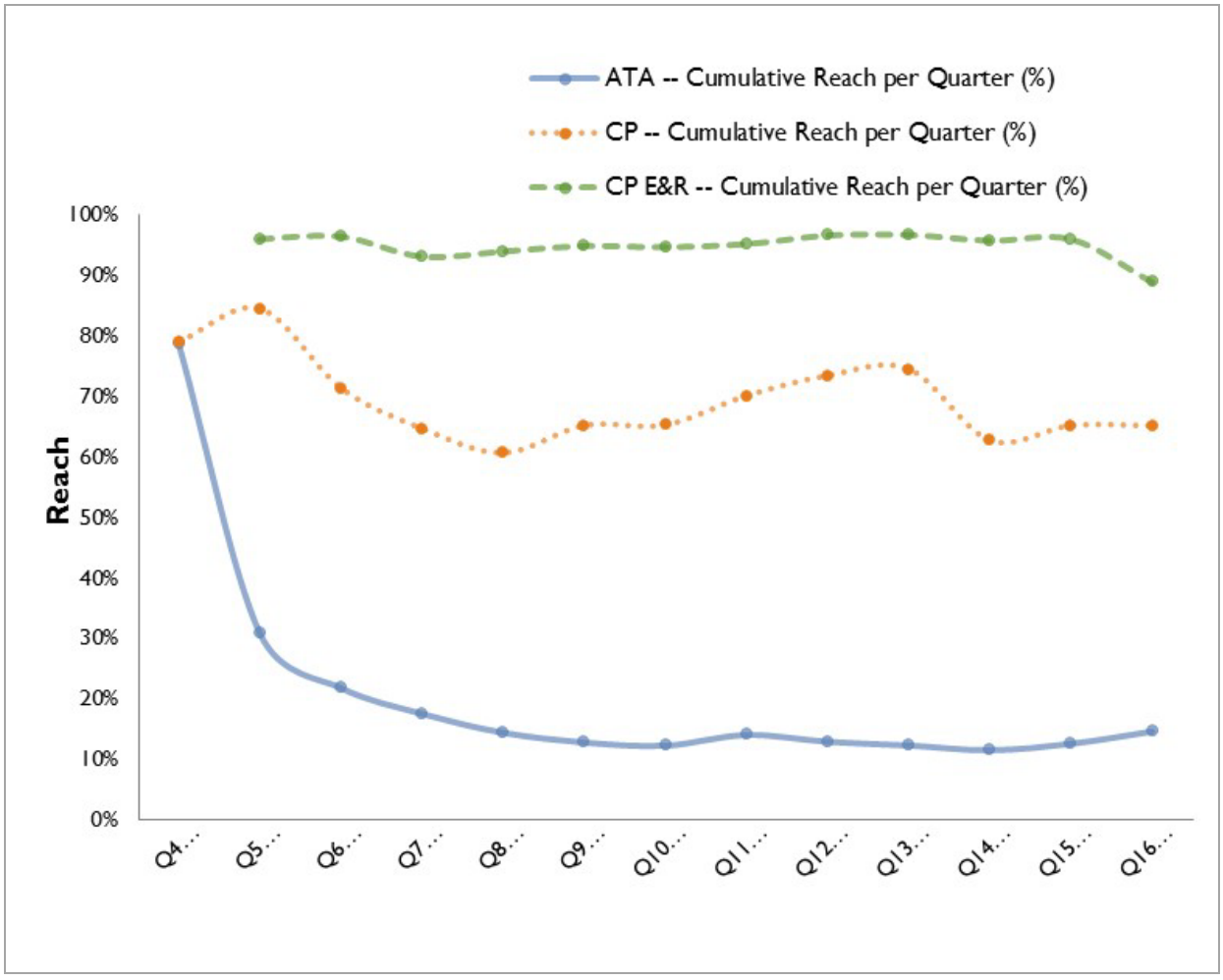
alternative location. If any of these factors is not aligned, the patient may refuse transport anywhere or be taken to the ED.

As of Q16, 1,529 total patients enrolled in the CP 30-day enrollment program (including re-enrollment of patients), or 65.1 percent of those referred to the CP-30 Days component. Reach slightly decreased over time for the CP-30 Days component, from 78.9 percent in Q4 to 60.6 percent in Q8.

As of Q16, for the CP E&R component, REMSA reached 95.9 percent of its target population, or 330 E&R encounters with 191 unique patients. 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 of the innovation.

As of the end of Q16, the NHL fielded 45,065 calls. We do not provide a percentage of those reached for the NHL component because there is no appropriate denominator.

Figure 29. Participant Enrollment and Reach for Each Quarter since Project Launch: REMSA



(continued)

Figure 29. Participant Enrollment and Reach for Each Quarter since Project Launch: REMSA (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)	Q15 (Jan-Mar 2016)	Q16 (Apr-Jun 2016)
●	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	12.6	14.6
	ATA—Cumulative number enrolled	12	44	132	244	337	424	537	636	773	900	1,020	1,172	1,280	1,379	1,511
●	CP—Cumulative reach per quarter (%)	—	—	78.9	84.4	71.2	64.6	60.6	65.1	65.2	70.0	73.3	74.4	62.6	65.1	65.1
	CP—Cumulative number enrolled	—	—	15	81	166	290	421	549	680	850	1001	1,118	1,281	1,435	1,529
●	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	90.1	95.9
	CP E&R—Cumulative number enrolled	—	—	—	24	27	68	94	130	143	159	229	265	293	310	330
	NHL --Cumulative number enrolled	—	—	—	29	1,303	3,634	8,460	11,912	17,809	23,323	25,892	30,835	35,001	38,931	45,065

[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 hotline.

Notes:

- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity:** October 2012 to June 2016.

Terms and Definitions

- CP = Community Paramedic; NHL = Nurse Health Line; Q = quarter; REMSA = Regional Emergency Medical Services Authority.
- — Data not available.

2.33.2 Innovation Dose

Table 43 shows the number of services provided across participants in the CP-30 Days component, the number of participants receiving services, and the average number of services per participant through Q16. Dose is not calculated for other components of the innovation because they are encounter-based services, and each participant receives one encounter per visit.

We last reported dose in the third annual report based on data through Q14. As expected, the number of services provided and the percentage of participants receiving those services increased from Q14 to Q16. As the table shows, 100 percent of participants received home visits from CPs, but 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 throughout the 30-day period. The average number of home visits per participant is 4.5.

Table 43. Number and Types of Services Provided to Participants: REMSA

Services	Number of Services Provided Across Patients	Number (Percentage) of Participants Receiving Service	Average Number of Services per Participant
Home Visits Made by CPs	6,934	1,529 (100)	4.5

Notes:
- **Source:** Patient-level data provided to RTI.
- **Period of** activity**:** January 2013 to June 2016.

Terms and Definitions
- CP = Community Paramedic; REMSA = Regional Emergency Medical Services Authority.

2.33.3 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 330 encounters with E&R patients; n=191 E&R patients); therefore, this program avoided 310 ED visits that otherwise would likely have occurred at this time (***Table 44***). 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 44. ED Visits by E&R Patient Encounters: REMSA[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
Q15 (Jan-Mar 2016)	17	0	0.0
Q16 (Apr-Jun 2016)	20	0	0.0
Total	330	20	6.1

[1] These data represent 191 patients.

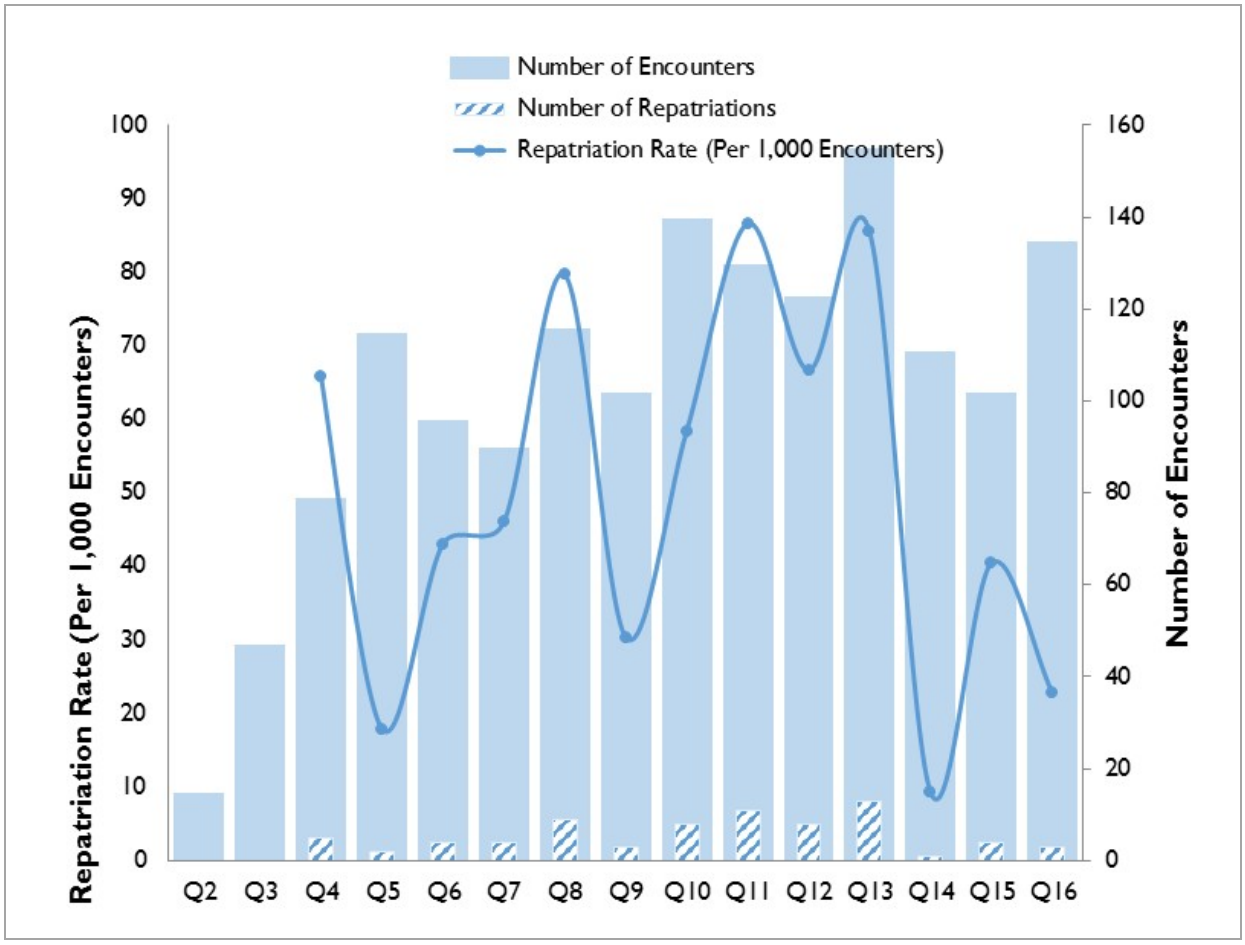
Notes:
- **Source:** Patient-level data provided to RTI.
- **Period of** activity**:** July 2013 to June 2016.

Terms and Definitions
- ED = emergency department; E&R = Evaluate and Refer; REMSA = Regional Emergency Medical Services Authority.

For the ATA component of the innovation, repatriations are monitored to ensure that REMSA 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 the facility capacity or resources changed, the patient withdrew his/her consent, the patient's condition changed, or the initial assessment was inaccurate, which may explain why repatriations decreased over time. 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.*[6] As shown in ***Figure 30,*** repatriations ranged from a high of 86.6 per 1,000 patients (8.7%) 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 overall rate of repatriation was 43.5 per 1,000 patients (4.4%) transported to an alternative location. A total of 75 out of 1,511 ATA encounters who were transported to an alternative location were repatriated (5.0%).

[6] *Q13 Awardee Narrative Progress Report.*

Figure 30. ATA Repatriation Rate since Project Launch: REMSA



	Quarter	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
●	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	40.4	22.7
	Number of encounters	12	44	76	112	93	87	113	99	137	127	120	152	108	99	132
	Number of repatriations	0	0	5	2	4	4	9	3	8	11	8	13	1	4	3

Notes:

- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity:** October 2012 to June 2016.

Terms and Definitions

- ATA = Ambulance Transport Alternatives; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

As shown in ***Table 45***, approximately 57 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 43 percent of calls to the NHL did not complete a protocol for various reasons (e.g., wrong number/hang-ups, caller terminated the call).

Table 45. Number and Percentage of NHL Protocols Completed: REMSA[1]

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%
Q15 (Jan-Mar 2016)	2,803	3,930	71.3%
Q16 (Apr-Jun 2016)	3,049	6,134	49.7%
Total	25,448	45,036	56.5%

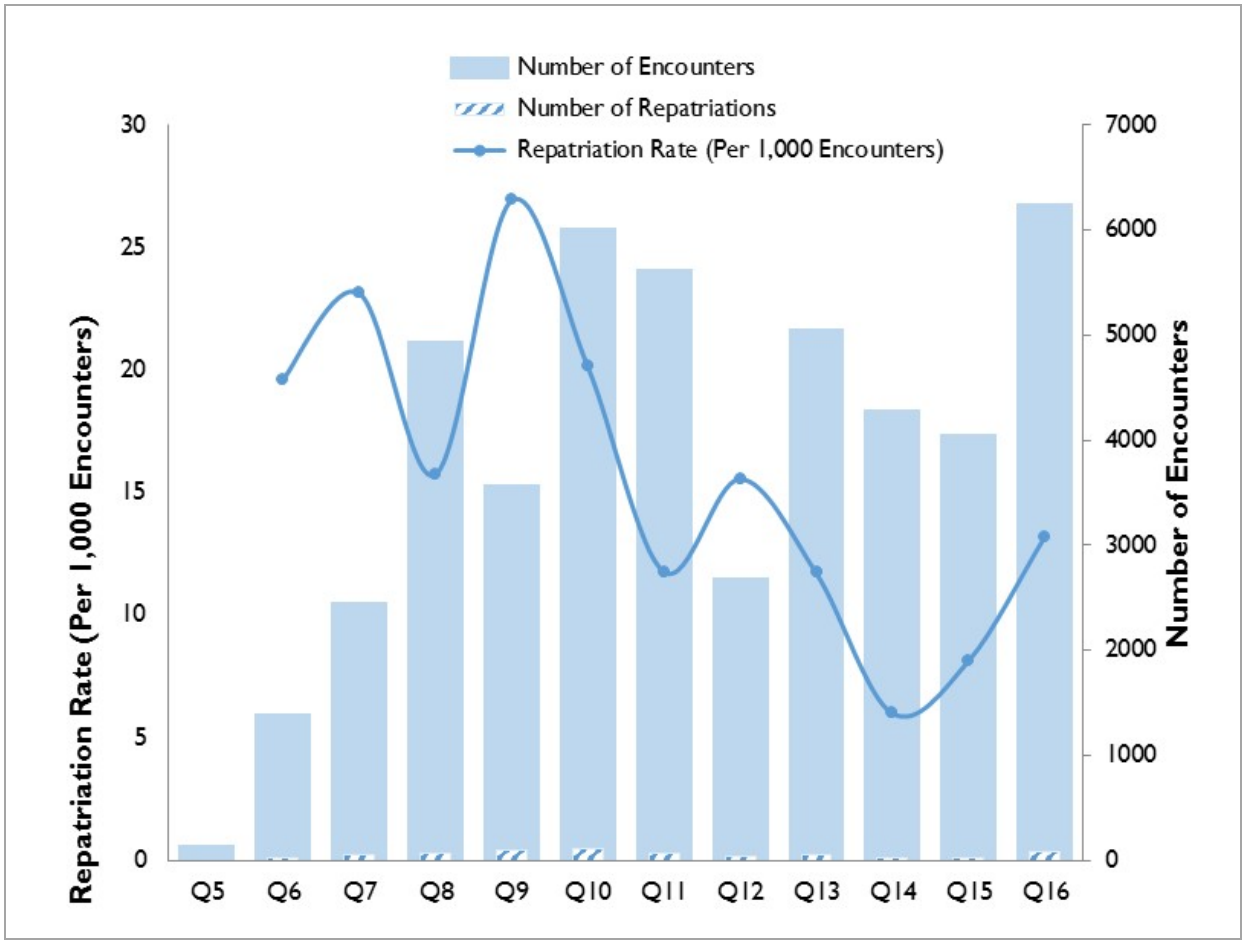
[1] Not included in the total because data regarding the number of protocols completed was not recorded at this stage of the innovation.

Notes:
- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity:** July 2013 to June 2016.

Terms and Definitions
- NHL = Nurse Health Line; Q = quarter; REMSA = Regional Emergency Medical Services Authority.

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 31***, 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 average rate of repatriation was 14.3 per 1,000 patients. Overall, 1.5 percent or 668 calls were transferred to 911 from 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 45,000 encounters, an emergency call or dispatch was not required when the situation might have otherwise resulted in a call to 911. Data is limited to the specific call to the NHL component and if a repatriation occurred following that specific call, however. Therefore, these results should be interpreted with caution, as we are unable to tell, whether after being transferred to 911 or if after the call to the NHL, the patient decided to then call 911 or to the ED on own.

Figure 31. Rate or Repatriation in the NHL (Calls Transferred from NHL to 911): REMSA



	Quarter	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
●	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	8.1	13.2
	Number of encounters	29	1,274	2,331	4,826	3,452	5,897	5,514	2,569	4,943	4,166	3,930	6,134
	Number of repatriations	0	25	54	76	93	119	65	40	58	25	32	81

Notes:

- **Source:** Patient-level data provided to RTI by REMSA.
- **Period of activity** January 2013 to June 2016.

Terms and Definitions

- NHL = Nurse Health Line; REMSA = Regional Emergency Medical Services Authority.

2.34 Qualitative Findings: Sustainability

During Q15 and Q16, REMSA's main focus was to secure the sustainability of all components of the innovation. In the Q15 REMSA reported that, "*All three of the innovations [ATA, CP, NHL] are continuing without interruption. Some nurse and paramedic positions lost to attrition will not be replaced*

until outside funding is secured." During an end-of-year interview we learned that REMSA had a transition plan for the end of the grant funding period that included activities to bridge the gap in program costs and continuing business development work with clinical partners and insurers to secure reimbursement for services.

To sustain the program during the shift from the end of the funding period to a self-sufficient program, REMSA covered some program costs and conducted business development activities. An agreement with Carson Tahoe Health was extended in February 2016, to serve as gap funding until REMSA secured government and commercial funding. In Q15, REMSA hired a professional business development representative to help with the process of prospecting, negotiating, and closing contracts with clinical partners. An end-of-year interviewee noted,

> ***We have a proactive business development function: we are meeting with clinical partners interested in sustaining and providing reimbursement to us through contracts, and also meeting with insurers to receive reimbursement.***

During the same interview, we learned that Hometown Health Insurance would be hiring REMSA's NHL as the guideline system for the insurer, covering any patient in northern Nevada.

In Q15 REMSA reported that due to the passage of legislation and Nevada's revised code, all commercial insurers and Nevada Medicaid are reimbursing REMSA for transport to alternative destinations. Medicare payment policy remains a barrier in reimbursement; as one interviewee noted,

> ***The significant majority of the commercial insurers in addition to Medicaid pay an FFS for transport to alternative destination. The only payor that is not paying for transport to alternative destinations is Medicare and we are meeting with them in June to seek a waiver so we can continue this innovation and to demonstrate that this policy that should be adopted nationally by Medicare.***

Finally, a service agreement that REMSA described as the *"largest sustainability success to date"* was the strategic partnership agreement that REMSA signed with Renown Health in April 2016 after a 1.5 year of negotiations. Renown Health is the largest integrated health system in northern Nevada and has been REMSA's largest clinical partner since 2012, referring patients to both the NHL and CP programs, and providing three locations for the ATA program. The objectives of Renown's new Population Health Management Organization and REMSA's Community Health Programs are directly aligned, which facilitates integration of innovation components into Renown's physician support, care management, and remote health monitoring programs. REMSA is very positive about this partnership and reported that,

> ***Services are reimbursed on an FFS basis with data exchange and quality reporting mechanisms. There are no shared savings or performance bonuses, but some services are bundled, such as a single bundled payment for a 30-day hospital admission avoidance enrollment. The parties envision a strategic partnership that grows beyond the current service agreement.***

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, 4.5 home visits during the 30 days of their enrollment.	***Innovation reach:***	The CP 30 Days enrollment component reached 65.1 percent of the target population, CP E&R reached 95.9 percent, ATA reached 14.6 percent, and NHL enrolled a total of 45,065 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, 27,454 individuals enrolled or had an encounter. 29.8 percent of participants were under 18 years of age; 60.4 percent were female; over 10 percent were covered by Medicare including Medicare Advantage, and 26 percent by Medicaid.
Sustainability:	REMSA worked with local health systems and key clinical partners to identify funding from other sources (e.g., state, private, etc.). REMSA worked with the Nevada legislature to successfully pass a bill that authorizes, regulates, and supports reimbursement for community paramedicine services beginning in July 2016.		
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 ($245; 90% CI: −$96, $586). The average quarterly impact on spending per person for the CP 30 Days enrollment (−$1,070; 90% CI: −$2,707, $566) and ATA (−$1,430; 90% CI: −$2,990, $131) innovations declined for both arms of the innovation, but not significantly.

Better care. The NHL innovation showed no statistically significant differences in unplanned readmissions (−11; 90% CI: −50, 28) or ED visits per 1,000 patients per quarter (7; 90% CI: −24, 37). Participants using the NHL service had significantly higher inpatient admissions per 1,000 patients per quarter in the innovation period (12; 90% CI: 1, 23) relative to the comparison group. For the CP-30 Days enrollment program, we found no statistically significant effects for ED utilization (27; 90% CI: −23, 77) whereas differences in unplanned readmissions per 1,000 admissions per quarter were slightly higher but significant for the innovation group (112; 90% CI: 51, 172). Enrollment in CP-30 Days significantly reduced inpatient admissions per 1,000 patients per quarter among Medicare beneficiaries (−381; 90% CI: −482, −279). The ATA program reduced inpatient admissions for the innovation group during the innovation period (−210; 90% CI: −317, −102). We found no statistically significant effects for ED utilization (240; 90% CI: −41, 522) and unplanned readmissions (−202; 90% CI: −542, 138) during the 3 years of the innovation.

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 Addendum 2017

Awardee-Level Findings:

South County Community 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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum

Data Source	Period Covered
Medicare claims data	January 2013–June 2016
Medicaid claims data	January 2013–September 2015

Terms and Definitions

- South County = South County Community Health Center.

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. Below we present the goals, as well as the findings, of the South County's innovation which began enrolling patients in January 2013.

1. **Smarter spending.**

   Goal: 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.

   Findings: Limited claims data were available for assessing Medicare spending during the innovation. The impact of the innovation on Medicaid spending among individuals enrolled in the innovation was not statistically significant.

2. **Better care.**

   Goal: 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.

   Findings: Because of the small number of patients in the Medicare claims samples, RTI cannot form any conclusions on the impact of the innovation on hospital inpatient admissions, hospital unplanned readmissions, and ED visits measures at this time. For Medicaid, on average, the innovation group had a higher number of hospital admissions and a lower number of ED visits relative to the comparison group, but results did not achieve statistical significance. Competing obligations at South County, including implementation of a new electronic health record (EHR) system and movement to a new physical location, delayed changes to care delivery and may explain the lack of findings reported here. The results reported reflect only 5 percent of the overall population reached by the innovation.

3. **Healthier people**.

   Goal: Improve health outcomes for patients with chronic disease (e.g., hypertension and diabetes).

   Findings: None to report.

[1] Also referred to as Ravenswood in some documents, but South County is the organization's legal name.

The South County innovation was primarily aimed at Medicaid beneficiaries. We did not have enough Medicare participants to perform regression analysis of Medicare claims.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on fee-for-service Medicaid claims collected during the innovation period. The overall impact of the innovation on spending, hospital admissions and ED visits among individuals enrolled in the innovation is not statistically significant. Other organizational changes at South County during the implementation period, including the introduction of a new electronic health records (EHR) system and moving to a new location, required the attention of innovation staff, contributed to low reach (54.1 percent), and may have delayed care transformation.[2] The low number of hospital admissions and readmissions precluded a regression analysis for readmissions.

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 2. Summary of Medicaid Claims-Based Findings: South County

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI
Aggregated results							
Total spending (in millions)	$0.058	−$0.030, $0.146	−$0.011, $0.126	$0.029	−$0.043, $0.101	$0.029	−$0.001, $0.058
Acute care inpatient stays	0.944	−8.269, 10.157	−6.236, 8.124	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
ED visits	−38.314	−97.276, 20.648	−84.265, 7.637	N/A	N/A	N/A	N/A
Average impact per quarter							
Spending per participant	$146	−$77, $368	−$28, $319	$91	−$133, $315	$376	−$16, $769
Acute care inpatient stays (per 1,000 participants)	2.384	−20.881, 25.649	−15.747, 20.515	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
ED visits (per 1,000 participants)	−96.752	−245.646, 52.141	−212.79, 19.285	N/A	N/A	N/A	N/A

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** October 2011 to September 2015.
- **Sample size**: 167 unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is the average quarterly effect from a negative binomial count model, indicating the differential rate of inpatient utilization in the innovation group against the comparison group. Acute care inpatient stays is the product of acute care inpatient stays (per 1,000 participants) and the number of person quarters.
- **Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)** no regression analysis possible due to low number of hospital admissions and readmissions.
- **ED visits (per 1,000 participants)** is the average quarterly effect from a negative binomial count model, indicating the differential rate of ED utilization in the innovation group against the comparison group. ED visits is the product of ED visits (per 1,000 participants) and the number of person quarters.
- CI = confidence interval; ED = emergency department; N/A = not applicable due to small sample size; South County = South County Community Health Center.

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?
- Has the innovation increased primary care visits?

Table 3 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 3. Claims-Based Outcome Measures: South County

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

Terms and Definitions

- ED = emergency department; South County = South County Community Health Center.

2.3 Medicare Comparison Group

We include patients in the claims analysis who were enrolled in the innovation prior to the end of the innovation, and we present Medicare claims data through June 30, 2016. This includes two additional quarters (Jan-June 2016) of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 53 SC Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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 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. See the third annual report for additional details.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 4 reports Medicare spending per patient in the 8 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 1*** illustrates the Medicare spending per beneficiary in Table 4 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, meaning the data points tend to be spread over a wide range of values rather than at the mean. These trends are similar to the third annual report. 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 4. 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	$7,137	$5,507	$10,305	$4,409	$2,444
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	$18,750	$11,783	$20,929	$7,500	$3,902
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	25	23	20	17	15
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	$2,596	$1,553	$2,578	$2,789	$3,253	$1,537
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	$9,958	$4,698	$9,069	$9,514	$8,059	$5,940
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	35	29	27	22	18
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	−$5,415	−$5,584	−$2,928	−$7,516	−$1,156	−$907

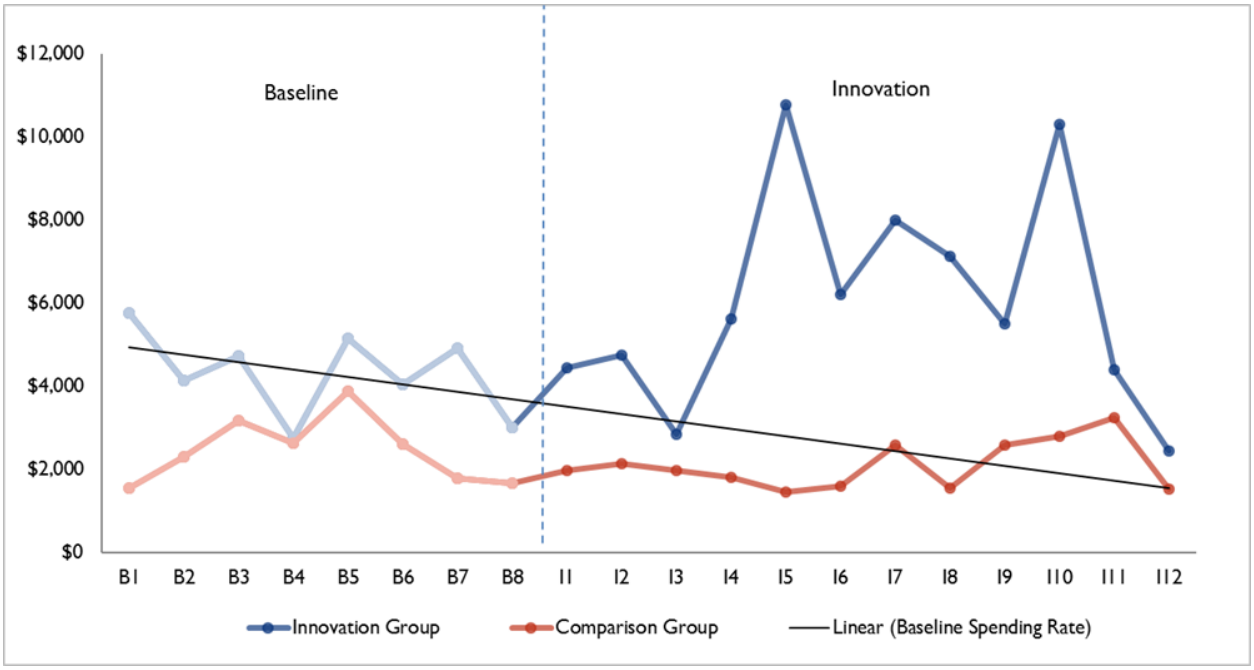
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 1. Medicare Spending per Participant: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- 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 5*** and ***Figure 2***. 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. These trends are similar to the third annual report. However, as shown in Table 5, the standard deviation is high for all periods, the data points tend to be spread over a wide range of values rather than at the mean. The sample size is too small to support regression analysis.

Table 5. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: 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																				
Admit rate	156	88	143	79	128	171	160	75	75	120	22	93	179	200	192	120	130	100	59	0
Std dev	712	373	487	270	463	537	504	264	328	325	147	421	549	693	785	431	337	300	235	0
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	25	23	20	17	15
Comparison Group																				
Admit rate	26	49	40	92	118	71	19	19	51	38	33	35	23	26	45	10	47	62	91	19
Std dev	157	215	195	377	382	255	137	136	292	191	178	216	149	204	207	97	260	241	287	136
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	35	29	27	22	18
Innovation − Comparison Rate																				
	130	39	103	−13	11	100	141	56	25	82	−11	58	156	174	147	110	84	38	−32	−19

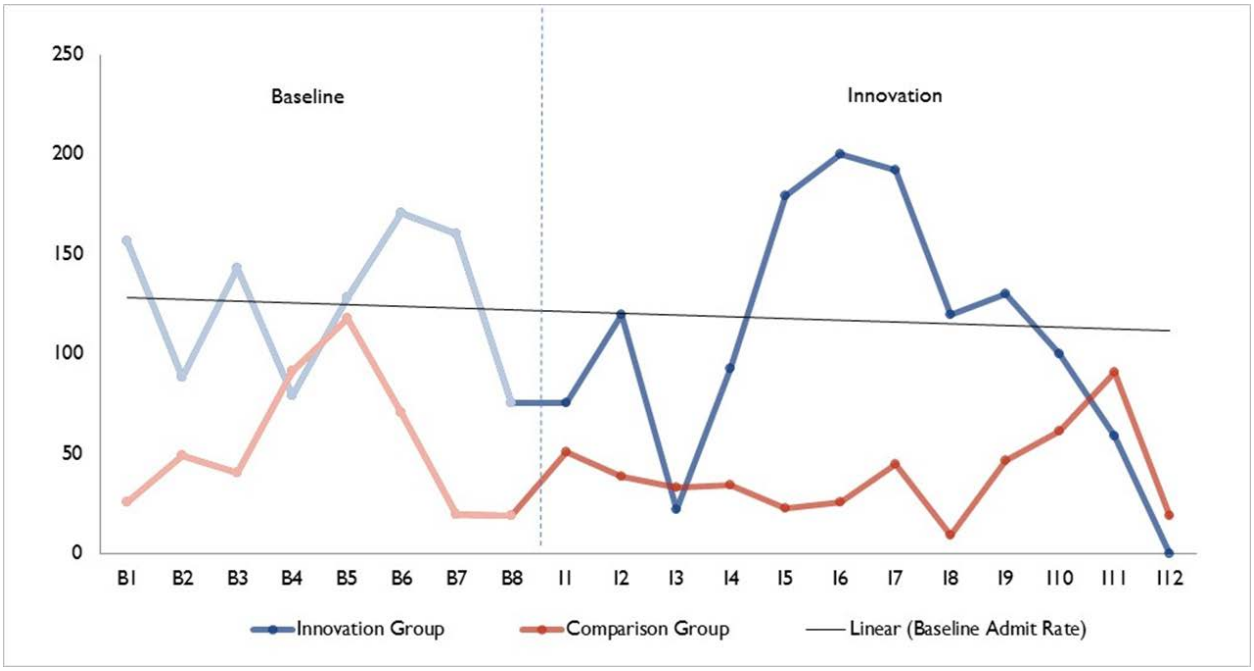
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 2. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- 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 6*** and ***Figure 3***. 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. These trends are similar to the third annual report.

Table 6. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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																				
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	167	154	0	0	0	0	0	0	0	0	0	0	0	0	0	200	0
Std dev	0	0	0	373	361	0	0	0	0	0	0	0	0	0	0	0	0	0	400	0
Total admissions	1	1	1	2	4	2	1	0	1	1	1	1	1	0	1	0	1	1	2	0
Innovation − Comparison Rate																				
	800	500	0	−167	−154	250	500	0	250	0	0	0	400	500	750	500	0	0	−200	0

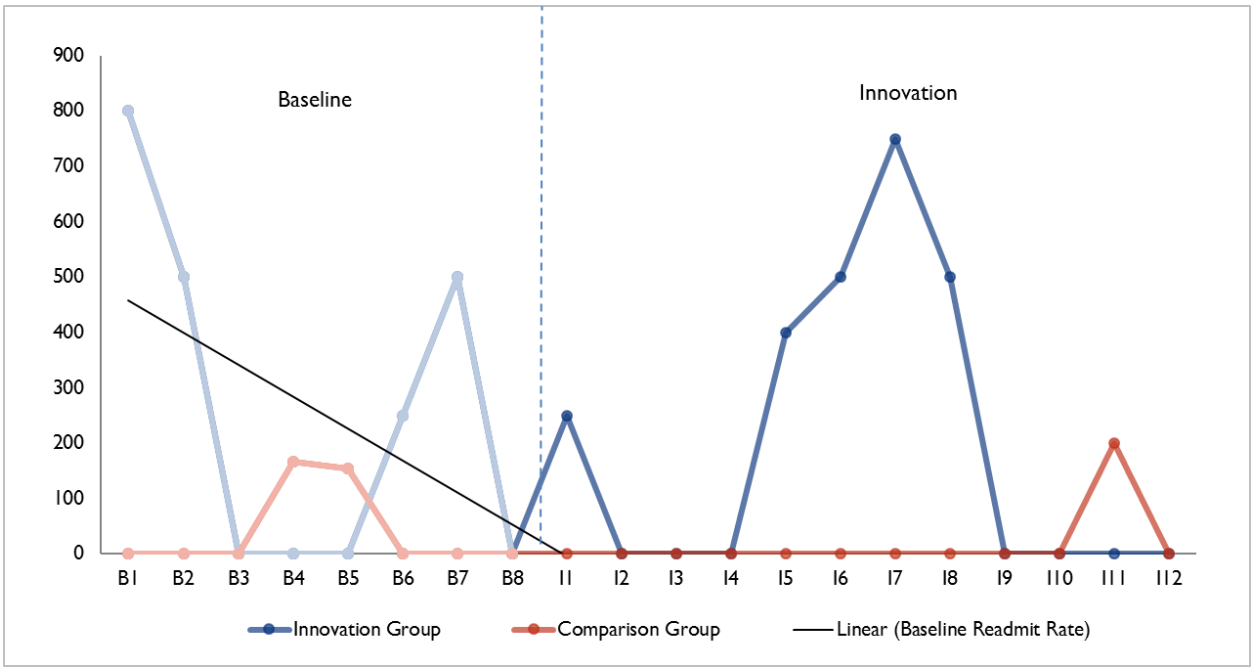
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 3. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 and June 2016.

Terms and Definitions

- 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 7*** and ***Figure 4***. ED visits trend downward during the baseline period. The ED visit rate varies somewhat before and after patient enrollment in the innovation. These trends are similar to the third annual report. The ED visit rate for the innovation group remains higher than the rate for the comparison group for all innovation quarters. As with the other measures, ED visits have a high standard deviation, the data points tend to be spread over a wide range of values rather than at the mean. In spring 2015, which corresponds to innovation quarter I9 in the figure, South County allocated a nurse to begin working directly with patients 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 7. ED Visits per 1,000 Medicare Participants: 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																				
ED rate	531	382	314	289	385	341	440	264	472	300	333	465	462	480	423	880	87	400	118	267
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	1,943	288	681	485	594
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	25	23	20	17	15
Comparison Group																				
ED rate	25	105	79	128	51	133	90	63	82	44	132	68	76	119	63	95	81	37	45	19
Std dev	120	295	203	231	128	310	232	181	196	211	238	162	170	242	179	317	202	110	121	79
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	35	29	27	22	18
Innovation − Comparison Rate																				
	506	278	235	162	334	209	350	201	390	256	202	397	386	361	361	785	6	363	72	248

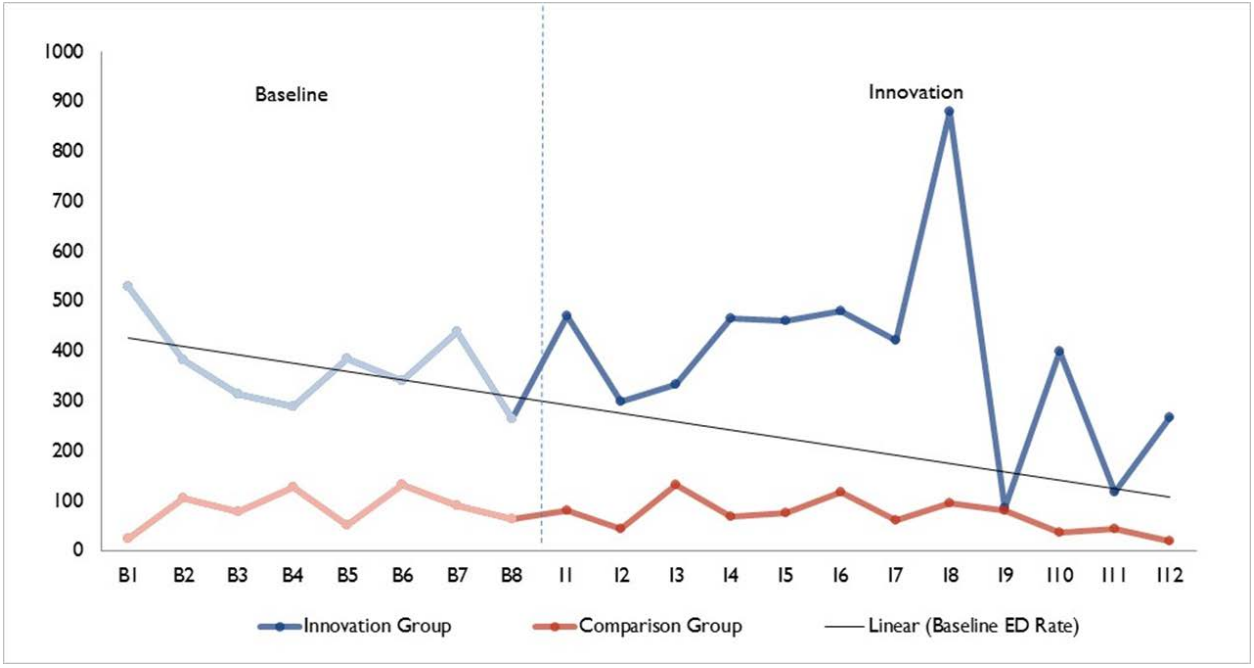
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 4. ED Visits per 1,000 Medicare Participants: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- ED = emergency department; South County = South County Community Health Center.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

South County's innovation aimed to provide care coordination, which might have increased the number of primary care visits. Primary care visits per 1,000 participants are shown in ***Table 8*** and ***Figure 5.*** The baseline period trend line shows a stable primary care visit rate prior to enrollment. The rate of primary care visits for the innovation group is below the comparison group rates for all quarters. After the innovation begins, primary care visits for the innovation group fluctuate around the baseline trend line, with peaks in intervention quarters I1, I5, and I10. However, as shown in Table 9, there is a high standard deviation for all periods, meaning the data points tend to be spread over a wide range of values rather than at the mean. The sample size is too small to support regression analysis.

Table 8. Primary Care Visits per 1,000 Medicare Participants: 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																				
Primary care rate	103	200	119	159	118	94	132	189	264	132	132	226	302	170	151	132	154	245	116	189
Std dev	303	781	498	562	471	446	515	551	731	477	584	816	860	795	684	515	533	770	537	608
Unique patients	32	34	35	38	39	41	50	53	53	50	45	43	39	25	26	25	23	20	17	15
Comparison Group																				
Primary care rate	586	748	685	638	628	616	547	805	830	667	620	584	696	641	559	464	445	406	500	426
Std dev	1,115	1,382	1,161	1,160	1,247	1,202	936	1,353	1,603	1,247	1,117	1,273	1,375	1,331	1,312	1,097	1,153	887	1,403	1,213
Weighted patients	39	41	42	44	46	48	52	53	53	53	51	49	44	39	37	35	29	27	22	18
Innovation − Comparison Rate																				
	−483	−548	−566	−478	−511	−522	−415	−616	−566	−535	−488	−358	−394	−471	−408	−332	−291	−161	−384	−237

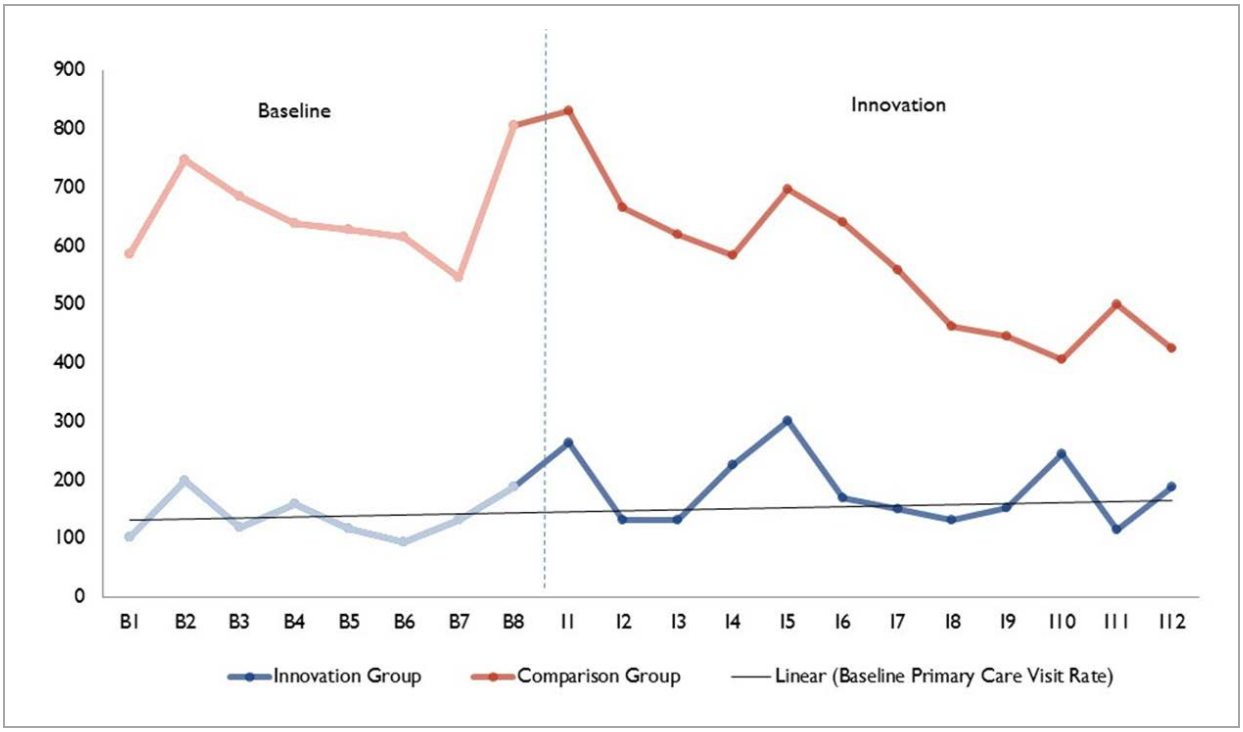
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 5. Primary Care Visits per 1,000 Medicare Participants: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- South County = South County Community Health Center.

2.9 Discussion: Medicare Results

The South County innovation was primarily aimed at Medicaid beneficiaries. The results presented here are only for dually eligible Medicare beneficiaries whom 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 measures, we found considerable variability and high standard deviations, the data points tend to be spread over a wide range of values rather than at the mean, with a very small sample size of Medicare beneficiaries. The sample size was too small to support regression analysis.

2.10 Medicaid Comparison Group

We include patients who were enrolled prior to July 31, 2015, and we present Medicaid claims data through September 30, 2015. The Medicaid claims analysis focuses on 167 Medicaid beneficiaries enrolled in fee-for-service 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 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. These are updated data from those presented in the third annual report.

We use PSM to select comparison group beneficiaries with similar characteristics as innovation group beneficiaries. From the 3,341 patients enrolled in the innovation, only 169 (5%) 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, race, disability, dual Medicare-Medicaid status, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Of the 169 beneficiaries, 92 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, race, disability and 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 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 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 treatment beneficiaries who did not have Medicaid in the calendar quarter before enrollment 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: South County (Medicaid)

Variable	Before Matching				Standardized Difference	After Matching				Standardized Difference
	Treatment Group		Comparison Group			Treatment Group		Comparison Group		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Previous Medicaid										
Age	27.40	24.27	35.71	25.70	0.33	27.40	24.11	24.98	22.74	0.10
Percentage female	55.84	49.98	57.04	49.51	0.02	55.84	49.66	57.14	49.49	0.03
Percentage non-white	92.21	26.98	91.87	27.33	0.01	92.21	26.81	93.07	25.39	0.03
Percentage disabled	7.79	26.98	5.12	22.04	0.11	7.79	26.81	6.93	25.39	0.03
Percentage dual eligibility	11.69	32.34	24.59	43.07	0.34	11.69	32.13	11.26	31.60	0.01
Payments in calendar quarter prior to enrolment	186	626	289	1,490	0.09	186	622	223	1,048	0.04
Total payments in year prior to enrolment	27	126	625	3,411	0.25	27	125	32	149	0.04
Number of beneficiaries	77	—	2,891	—	—	77	—	231	—	—
Number of unique beneficiaries[1]	—	—	982	—	—	77	—	198	—	—
Number of weighted beneficiaries	—	—	—	—	—	77	—	77	—	—
No Medicaid in Previous Quarter										
Age	25.58	22.48	19.28	20.52	0.29	24.47	21.30	24.82	24.64	0.02
Percentage female	51.09	50.26	53.40	49.90	0.05	51.11	49.99	44.07	49.65	0.14
Percentage non-white	96.74	17.86	95.35	21.06	0.07	96.67	17.95	97.41	15.89	0.04
Percentage disabled	2.17	14.66	2.96	16.96	0.05	2.22	14.74	4.07	19.77	0.11
Percentage dual eligibility	10.87	31.30	9.29	29.04	0.05	11.11	31.43	13.15	33.79	0.06
Number of beneficiaries	92	—	1,485	—	—	90	—	254	—	—
Number of unique beneficiaries[1]	—	—	1,238	—	—	90	—	212	—	—
Number of weighted beneficiaries	—	—	—	—	—	90	—	90	—	—

[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).

Notes:

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

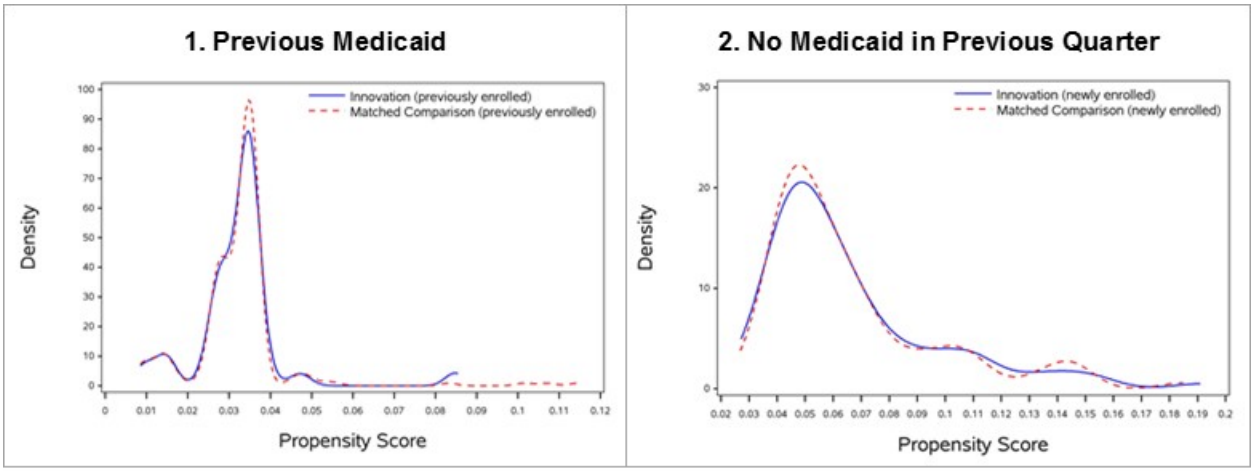
Terms and Definitions

- 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 10). The results in Table 10 show that matching 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, standardized differences were slightly above 0.1 for percentage female and percentage disabled; none of those variables had significant effects 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 (Medicaid)



Notes:

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

Terms and Definitions

- South County = South County Community Health Center.

2.11 Medicaid Spending

2.11.1 Descriptive Results

Table 10 reports Medicaid spending per patient in the 8 quarters before and the 9 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 11 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 in all periods there is a high standard deviation, meaning the data points tend to be spread over a wide range of values rather than at the mean. These trends are similar to the third annual report. The innovation group spending rate is above the comparison group rate for all innovation quarters but I3. The extremely small sample for most quarters of both groups 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. The next section assesses the impact of the innovation in the difference in spending between treatment and comparison groups.

Table 10. 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	I4	I5	I6	I7	I8	I9
Innovation Group																	
Spending rate	$362	$342	$1,176	$89	$32	$100	$35	$186	$542	$288	$238	$513	$290	$966	$523	$731	$917
Std dev	$810	$701	$3,566	$230	$151	$324	$144	$626	$1,362	$1,172	$585	$1,778	$730	$2,844	$1,035	$1,493	$2,451
Unique patients	18	20	21	22	22	31	35	77	167	84	41	28	25	23	28	13	16
Comparison Group																	
Spending rate	$194	$239	$147	$128	$342	$138	$36	$223	$275	$246	$287	$184	$176	$49	$47	$58	$46
Std dev	$598	$1,042	$559	$352	$1,003	$780	$78	$655	$814	$820	$1,265	$817	$807	$104	$104	$110	$112
Weighted patients	29	36	38	38	38	40	40	77	167	80	45	40	34	30	27	19	18
Savings per Patient																	
	−$168	−$103	−$1,028	$39	$309	$38	$2	$37	−$267	−$42	$49	−$329	−$113	−$917	−$477	−$674	−$872

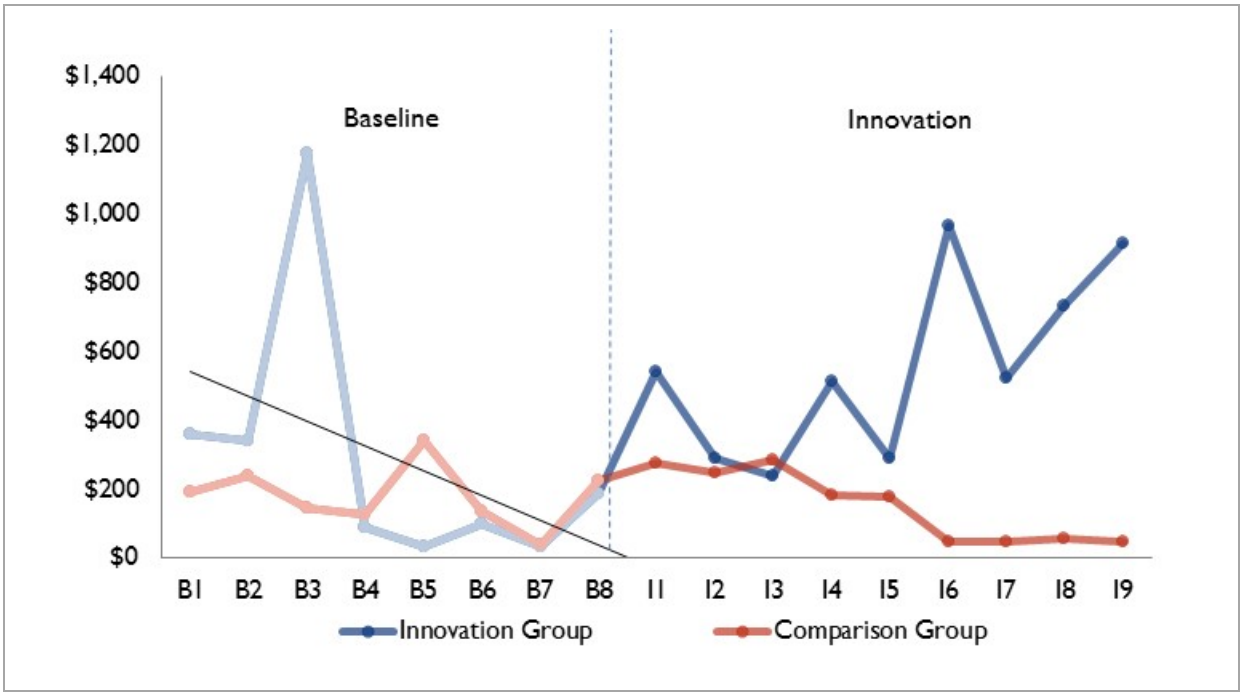
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011to September 2015.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 7. Medicaid Spending per Participant: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011to September 2015.

Terms and Definitions

- South County = South County Community Health Center.

2.11.2 Regression Results

In ***Table 11*** 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 $146 (90% CI: −$77, $368). 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 quarterly effects derived from 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 8*** illustrates these quarterly difference-in-differences estimates. Except for innovation quarters I2, I3, and I5, the change in spending among the innovation group is higher than the change in spending for comparison group individuals. However, the only statistically significant difference occurs in I7 where the innovation leads to a loss of $370 per participant.

Table 11. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant

Quarter	Coefficient	Standard Error	P-Values
I1	$194	$149	0.192
I2	−$38	$176	0.827
I3	−$161	$219	0.464
I4	$232	$362	0.522
I5	−$16	$204	0.938
I6	$811	$567	0.153
I7	$370	$208	0.076
Overall average	$146	$135	0.281
Overall aggregate	$57,691	$53,457	0.281
Overall aggregate (IY1)	$29,078	$43,494	0.504
Overall aggregate (IY2)	$28,613	$18,106	0.115

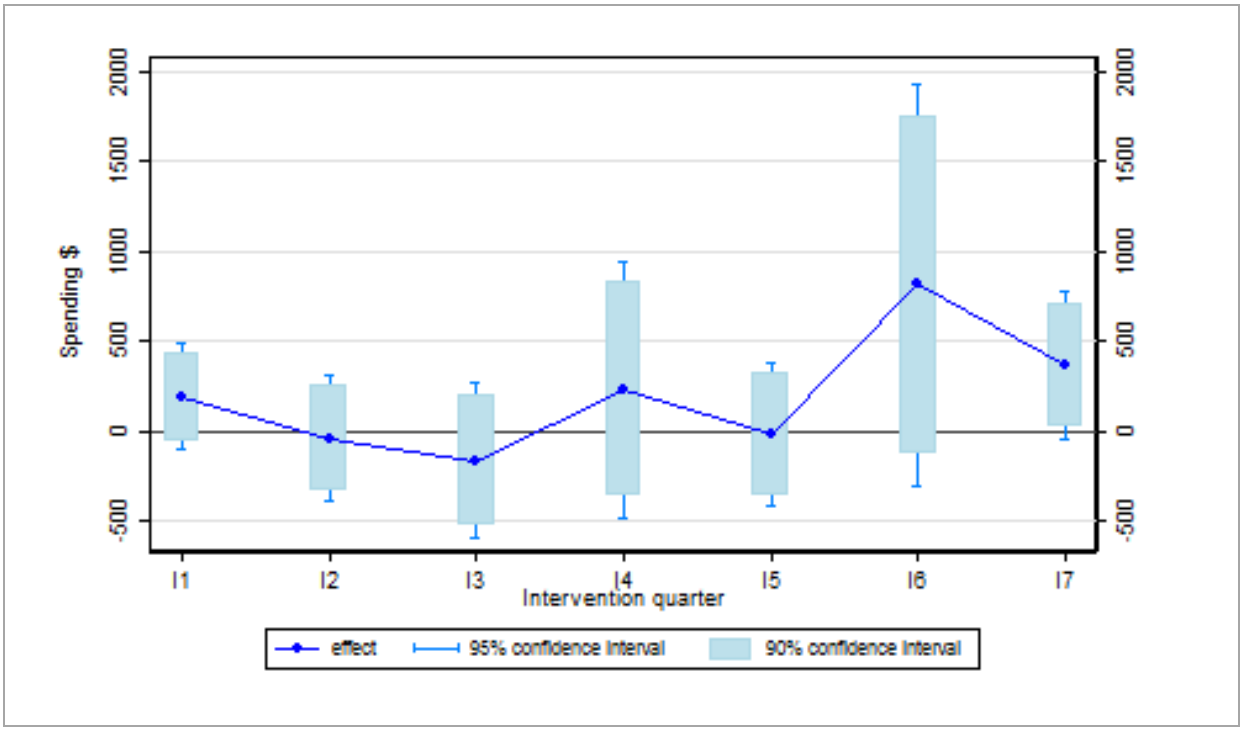
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011to September 2015.

Terms and Definitions

- **The regression coefficients** are quarterly difference-in-differences estimates. Besides the innovation quarters, the regression controls for 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; OLS = ordinary least squares; South County = South County Community Health Center.

Figure 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicaid Spending per Participant: South County



Notes:

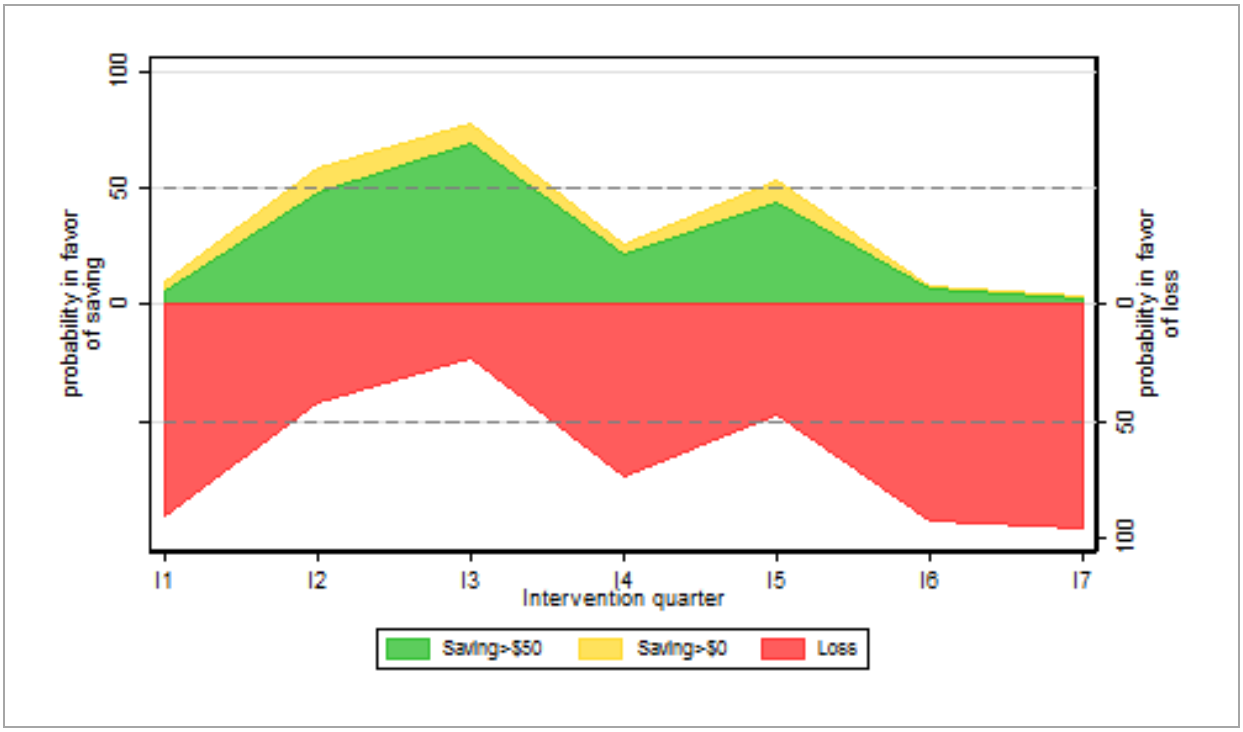
- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- OLS = ordinary least squares; South County = South County Community Health Center.

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 for saving or losing money on this initiative. Figure 9 illustrates that, except for I2, I3, and I5, the innovation has a higher probability of generating losses rather than savings. The innovation has a 14 percent overall probability of generating savings.

Figure 9. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: South County



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- South County = South County Community Health Center.

2.12 Medicaid Inpatient Admissions

2.12.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 12*** and ***Figure 10***. Admission rates vary considerably for both the comparison and innovation groups. For several baseline and innovation quarters, both groups have no recorded inpatient admissions. These trends are similar to the third annual report. The next section describes the regression analysis we conducted to assess the impact of the innovation on inpatient admissions.

Table 12. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters								
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**
Innovation Group																	
Admit rate	0	0	95	0	0	0	0	13	18	12	0	36	0	43	36	0	63
Std dev	0	0	301	0	0	0	0	114	133	109	0	189	0	209	189	0	250
Unique patients	18	20	21	22	22	31	35	77	167	84	41	28	25	23	28	13	16
Comparison Group																	
Admit rate	12	9	0	9	53	0	0	13	27	8	7	0	0	0	0	0	0
Std dev	68	62	0	57	197	0	0	71	103	59	55	0	0	0	0	0	0
Weighted patients	29	36	38	38	38	40	40	77	167	80	45	40	34	30	27	19	18
Innovation − Comparison Rate																	
	−12	−9	95	−9	−53	0	0	0	−9	4	−7	36	0	43	36	0	63

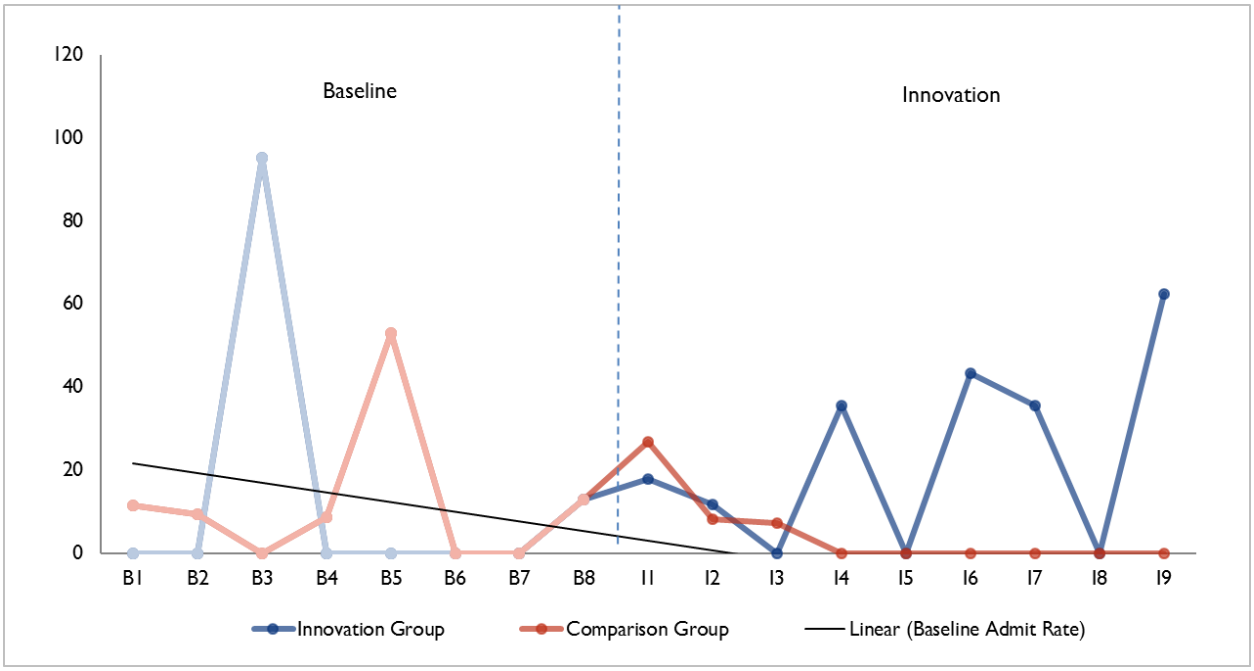
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011to September 2015.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 10. All-Cause Inpatient Admissions Rate per 1,000 Medicaid Participants: South County



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- South County = South County Community Health Center.

2.12.2 Regression Results

Table 13 presents the results of a model with the dependent variable set to the number of hospital visits for each individual. Because of the infrequency of inpatient visits together with very small sample sizes in most quarters, we could not estimate separate quarterly fixed effects for the innovation effects; instead we estimated a single, constant innovation effect for all innovation quarters. The average 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 the number of inpatient admissions for all innovation quarters. The effect is not statistically significant (90% CI: −21, 26).

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: South County

	Coefficient	Standard Error	P-Values
Overall average	2.384	14.143	0.866
Overall aggregate	0.944	5.601	0.866

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- **The overall average** is the weighted average treatment effect for all quarters during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- **The negative binomial count model regression coefficients** are the difference-in-differences estimates. The regression controls for age, gender, race, disability, and dual eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups that have the same impact on the innovation and comparison groups.
- South County = South County Community Health Center.

2.13 Medicaid Unplanned Readmissions

2.13.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 14*** and ***Figure 11***. Readmissions rates are zero for most innovation quarters, reflecting the extremely small number of hospital admissions for both groups during each quarter. With few admissions (the denominator in the readmissions rate) and a relatively low underlying percentage of readmissions, the readmissions rate varies widely over time. These trends are similar to the third annual report. The low number of readmissions precluded the assessment of the impact of the innovation on readmissions through regression analysis.

Table 14. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	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																				
Readmit rate	0	0	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	0	0	—	—	—
Total admissions	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	—	—	—
Comparison Group																				
Readmit rate	0	0	0	0	333	0	0	0	0	1,000	0	0	0	0	0	0	0	—	—	—
Std dev	0	0	0	0	471	0	0	0	0	0	0	0	0	0	0	0	0	—	—	—
Total admissions	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	—	—	—
Innovation − Comparison Rate																				
	0	0	0	0	−333	0	0	0	0	−1000	0	0	0	0	0	0	0	—	—	—

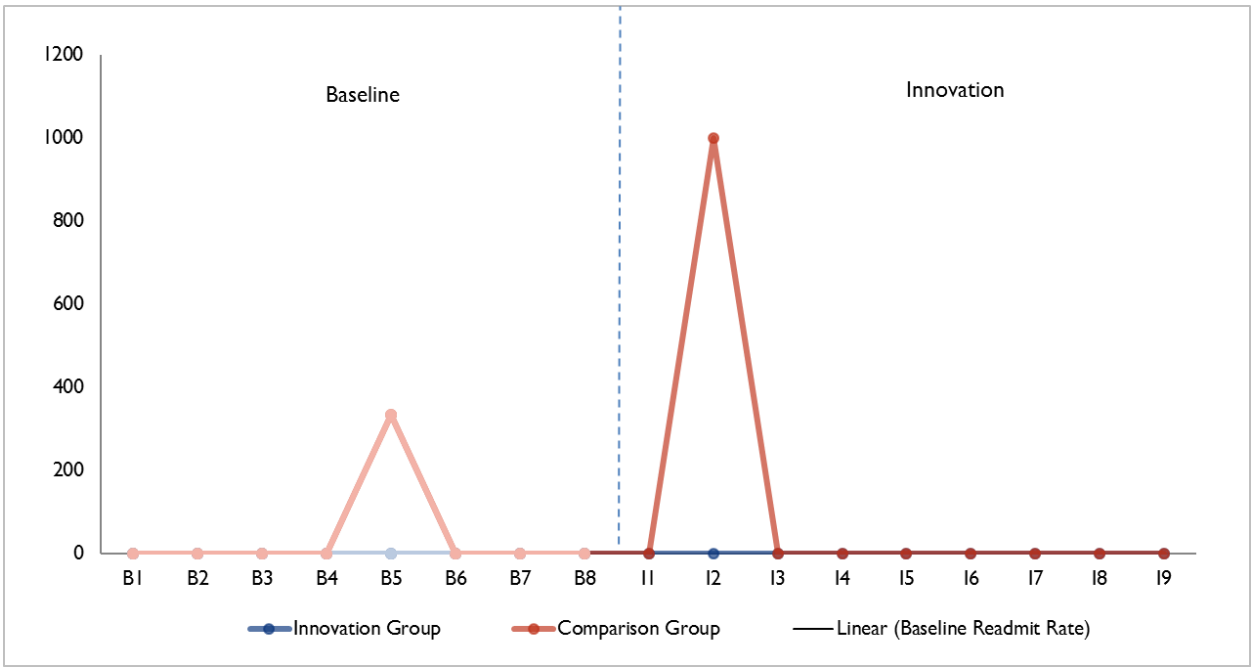
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011to September 2015.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; South County = South County Community Health Center.
- — Data not yet available.

Figure 11. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: South County



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- South County = South County Community Health Center.

2.14 Medicaid Emergency Department Visits

2.14.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 15*** and ***Figure 12.*** ED visits trend downward during the baseline period. The ED visit rate varies before and after patient enrollment, particularly for the innovation group, which has several quarters with no ED visits. The ED visit rate for the innovation group is above the rate for the comparison group for all innovation quarters except I2, I4, and I5, where the rate is very low or zero for the innovation group. These trends are similar to the third annual report. In the next section we examine regression results to assess whether differences in ED visit rates between the innovation and comparison groups were impacted by the innovation.

Table 15. ED Visits per 1,000 Medicaid Participants: South County

Awardee Number: 1C1CMS330972
Evaluation Group: RTI International (Community Resource Planning)
Payer Group: Medicaid

	Baseline Quarters								Innovation Quarters								
Description	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**
Innovation Group																	
ED rate	306	525	0	159	0	0	0	123	156	12	122	0	0	87	161	115	281
Std dev	1,073	1,313	0	419	0	0	0	527	696	109	510	0	0	288	624	416	632
Unique patients	18	20	21	22	22	31	35	77	167	84	41	28	25	23	28	13	16
Comparison Group																	
ED rate	58	28	26	44	106	21	92	56	115	77	93	120	109	22	75	52	36
Std dev	201	137	129	165	328	102	254	211	391	522	360	398	294	93	240	136	169
Weighted patients	29	36	38	38	38	40	40	77	167	80	45	40	34	30	27	19	18
Innovation − Comparison Rate																	
	248	497	−26	115	−106	−21	−92	67	40	−65	29	−120	−109	65	86	64	245

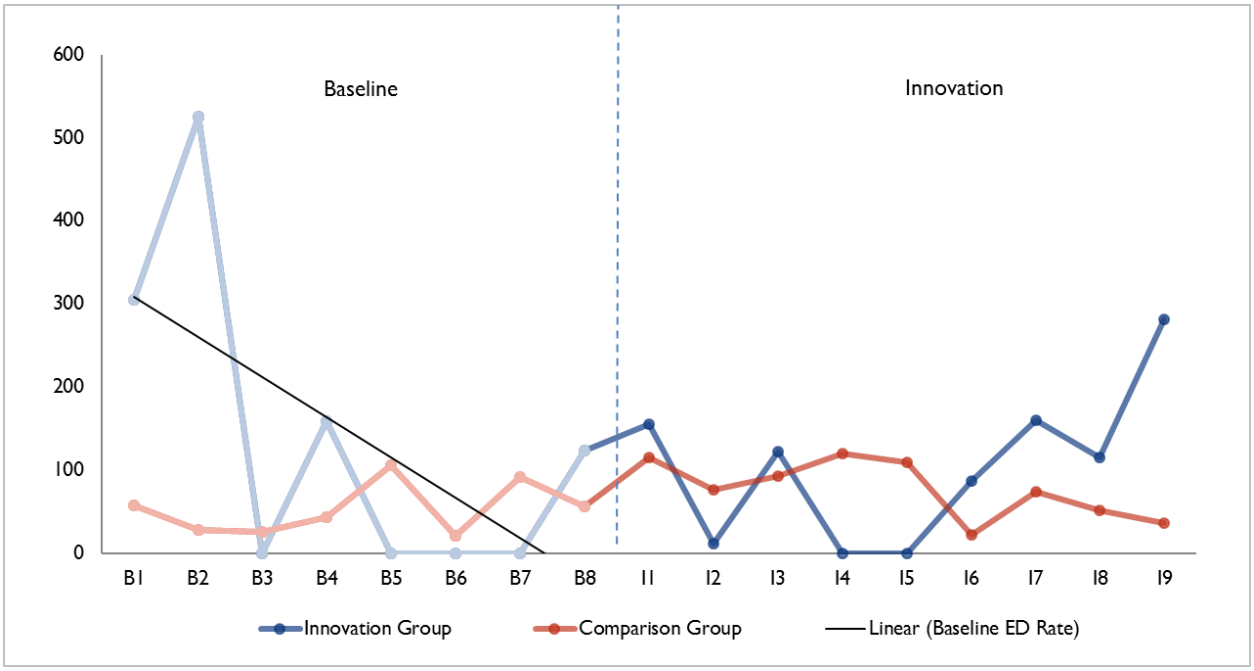
Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to July 2015.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; South County = South County Community Health Center.

Figure 12. ED Visits per 1,000 Medicaid Participants: South County



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015.

Terms and Definitions

- ED = emergency department; South County = South County Community Health Center.

2.14.2 Regression Results

Table 16 presents the results of a model with the dependent variable set to the number of ED visits for each individual. Because of the infrequency of ED visits together with very small sample sizes in most quarters, we could not estimate separate quarterly fixed effects for the innovation effects; instead we estimated a single, constant innovation effect for all innovation quarters. The average difference-in-differences estimate for ED visits is a decrease of 97 ED 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. The effect is not statistically significant (90% CI: −246, 52).

Table 16. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: South County

	Coefficient	Standard Error	P-Values
Overall average	−96.752	90.513	0.286
Overall aggregate	−38.314	35.843	0.286

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to September 2015

Terms and Definitions

- **The negative binomial count model regression coefficients** are the difference-in-differences estimates. The regression controls for age, gender, race, disability, and dual eligibility. The difference-in-differences specification also controls for fixed differences between the innovation and comparison groups 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.
- ED = emergency department; South County = South County Community Health Center.

2.15 Discussion: Medicaid Results

The overall impact of the innovation on spending among fee-for-service beneficiaries enrolled in the innovation is not statistically significant. We do not observe any statistically significant differences in the number of hospital admissions and ED visits.

The Medicaid results do not support the innovation's theory of change because South County's innovation aimed to better address the needs of its highest-risk patients, who have comorbidities and face social and economic barriers to health. Using care coordination, population-based panel management, and intensified care management services, South County envisioned that its highest-risk patients would better control chronic conditions and decrease service utilization, thereby reducing spending. South County ultimately designated only 23.4 percent of its innovation participants as high risk, and a little less than half of the innovation participants (44.8 percent) had contact with health coaches. Qualitative findings described in detail in the third annual report suggest that, due to competing priorities, innovation staff did not fully transform care processes until the third year of the award.[3]

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 5 percent of the overall population reached by the innovation. In addition, Medicaid beneficiaries in San Mateo County are enrolled in managed care, and the claims analysis is constrained to fee-for-service data available in the CMS Alpha-MAX files. This explains the low spending values and extremely low number of hospital admissions and ED visits.

[3] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

Southeast Mental Health Services

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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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: SEMHS

Data Source	Period Covered
Medicare claims data	September 2012–June 2016
Terms and Definitions • SEMHS = Southeast Mental Health Services.	

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. Below we present the goals, as well as the findings, of the innovation.

1. **Smarter spending.**

   Goal: 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.

   Findings: We did not observe any significant changes in spending among fee-for-services Medicare beneficiaries. The overall probability of savings was 19 percent.

2. **Better care.**

   Goal: Increase access to primary and secondary prevention by connecting high-risk patients with primary care through patient navigation (i.e., health navigators) services.

   Findings: Among Medicare fee-for-service beneficiaries, no change in inpatient stays was detected. Significant changes were found for readmissions, ED visits, and primary care visits. On a per-beneficiary per quarter basis, readmissions were reduced by 273 (90% CI: −489, −57), ED visits rose by 93 (90% CI: 19, 166), and primary care visits fell by 251 (90% CI: −401, −101).

3. **Healthier people**.

   Goal: Improve health status through care coordination and appropriate primary and follow-up care to high users of the system.

   Findings: None to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected during the innovation period. Overall, no statistically significant changes in spending or inpatient stays took place during the first 4 years of the innovation. Primary care visits fell (results presented in Section 2.8), readmissions fell and ED visits rose for participants during the innovation period. These Medicare results are inconsistent with the innovation's theory of change: we did not expect the innovation to have an impact because the intensity and frequency of outreach and support services were unlikely to affect ED visits or readmissions. SEMHS did not specifically focus on discharged patients for reductions in unplanned readmissions.

Table 2. Summary of Medicare Claims-Based Findings: SEMHS

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI	Year 4	90% CI
Aggregated results											
Total spending (in millions)	$0.494	−$0.426, $1.413	−$0.223, $1.210	$0.314	−$0.146, $0.773	$0.103	−$0.212, $0.418	$0.031	−$0.413, $0.476	$0.045	−$0.142, $0.233
Acute care inpatient stays	18	−12, 48	−5, 41	6	−12, 24	6	−11, 22	9	−6, 24	−3	−11, 6
Hospital-wide all-cause unplanned readmissions	−16	−29, −3	−26, −6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	90	19, 160	34, 145	22	−21, 66	42	−2, 85	19	−12, 49	7	−9, 23
Average impact per quarter											
Spending per participant	$511	−$441, $1,463	−$230, $1,252	$743	−$345, $1,832	$344	−$706, $1,393	$173	−$2,295, $2,642	$712	−2,220, 3,643
Acute care inpatient stays (per 1,000 participants)	19	−12, 50	−6, 43	15	−28, 58	19	−37, 75	48	−36, 133	−43	−173, 87
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−273	−489, −57	−441, −105	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)	93	19, 166	36, 150	53	−50, 156	139	−8, 285	103	−67, 273	109	−143, 362

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** February 2014 to March 2015.
- **Sample size**: 106 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; SEMHS = Southeast Mental Health Services.

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 3 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 3. Claims-Based Outcome Measures: SEMHS

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

Notes:

- We do not report Medicaid results in this report because no new Medicaid data have been provided by SEMHS. We refer readers to the third annual report for the evaluation of this innovation's impact on Medicaid beneficiaries.[1]

Terms and Definitions

- ED = emergency department; SEMHS = Southeast Mental Health Services.

2.3 Medicare Comparison Group

We include patients in the claims analysis who were enrolled in the innovation before the end of the innovation, and we present Medicare claims data through June 30, 2016. The Medicare claims analysis focuses on 106 SEMHS 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 in Prowers, Kiowa, Bent, or Baca Counties in southeastern Colorado. See the third annual report for additional details.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 4 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 1*** illustrates the Medicare spending per beneficiary in Table 4 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 groups. This trend is consistent with the third annual report.

Table 4. Medicare Spending per Participant: SEMHS

Awardee Number: 1C1CMS331013
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**	**I14**
Innovation Group																						
Spending rate	$2,147	$3,686	$2,970	$3,846	$2,899	$4,371	$3,558	$2,856	$3,959	$4,293	$5,113	$4,496	$3,544	$3,719	$4,864	$3,958	$5,722	$4,698	$4,270	$1,822	$3,606	$5,444
Std dev	$3,790	$7,130	$6,206	$7,535	$5,946	$8,475	$7,827	$5,263	$9,150	$8,136	$9,928	$10,105	$7,286	$7,191	$8,850	$6,225	$13,811	$11,461	$9,651	$3,185	$8,882	$9,933
Unique patients	93	94	96	95	99	103	103	106	106	106	106	104	100	72	68	60	52	46	43	39	35	29
Comparison Group																						
Spending rate	$2,405	$3,246	$3,539	$3,085	$2,952	$3,604	$4,907	$3,323	$3,370	$3,304	$4,237	$4,081	$3,897	$3,912	$3,166	$4,213	$4,710	$6,703	$4,910	$3,377	$6,195	$3,716
Std dev	$5,999	$8,731	$9,938	$8,317	$6,624	$13,044	$12,611	$6,375	$8,908	$6,821	$14,814	$9,592	$10,053	$8,012	$5,701	$10,738	$12,868	$27,674	$13,852	$6,558	$13,856	$5,663
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	103	102	74	68	59	51	44	40	35	30	26
Savings per Patient																						
	$259	−$440	$568	−$760	$53	−$767	$1,349	$468	−$589	−$989	−$876	−$415	$353	$193	−$1,698	$255	−$1,012	$2,006	$640	$1,554	$2,589	−$1,728

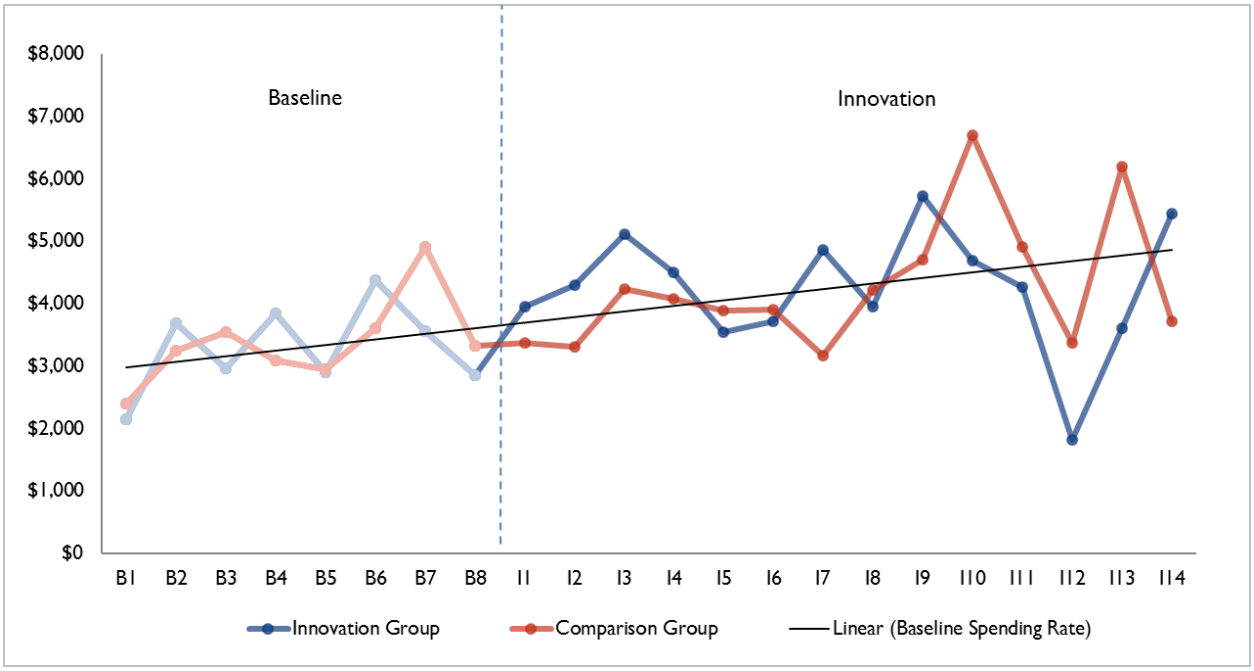
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.
- — Data not yet available.

Figure 1. Medicare Spending per Participant: SEMHS



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- SEMHS = Southeast Mental Health Services.

2.4.2 Regression Results

In ***Table 5***, 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 $511 for SEMHS (90% CI: −$441, $1,463). This effect is not statistically significant. This finding is consistent with the findings in the third annual report. 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 quarterly effects. derived from 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. Twelve of the 14 coefficients are not statistically significant. In I7 and I14, the coefficients are positive and significant at the 10 percent levels. Overall and annual savings/loss estimates are not statistically different from zero.

Table 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	$600	$981	0.541
I2	$1,000	$870	0.251
I3	$922	$1,215	0.448
I4	$445	$1,080	0.681
I5	−$300	$866	0.729
I6	−$31	$988	0.975
I7	$1,957	$1,120	0.081
I8	$38	$1,109	0.973
I9	$1,583	$2,291	0.490
I10	−$1,153	$3,051	0.706
I11	$398	$2,236	0.859
I12	−$390	$948	0.681
I13	−$1,440	$2,342	0.539
I14	$3,308	$1,853	0.075
Overall average	$511	$578	0.377
Overall aggregate	$493,557	$557,904	0.377
Overall aggregate (IY1)	$313,674	$278,561	0.261
Overall aggregate (IY2)	$103,120	$190,998	0.590
Overall aggregate (IY3)	$31,223	$269,531	0.908
Overall aggregate (IY4)	$45,540	$113,800	0.689

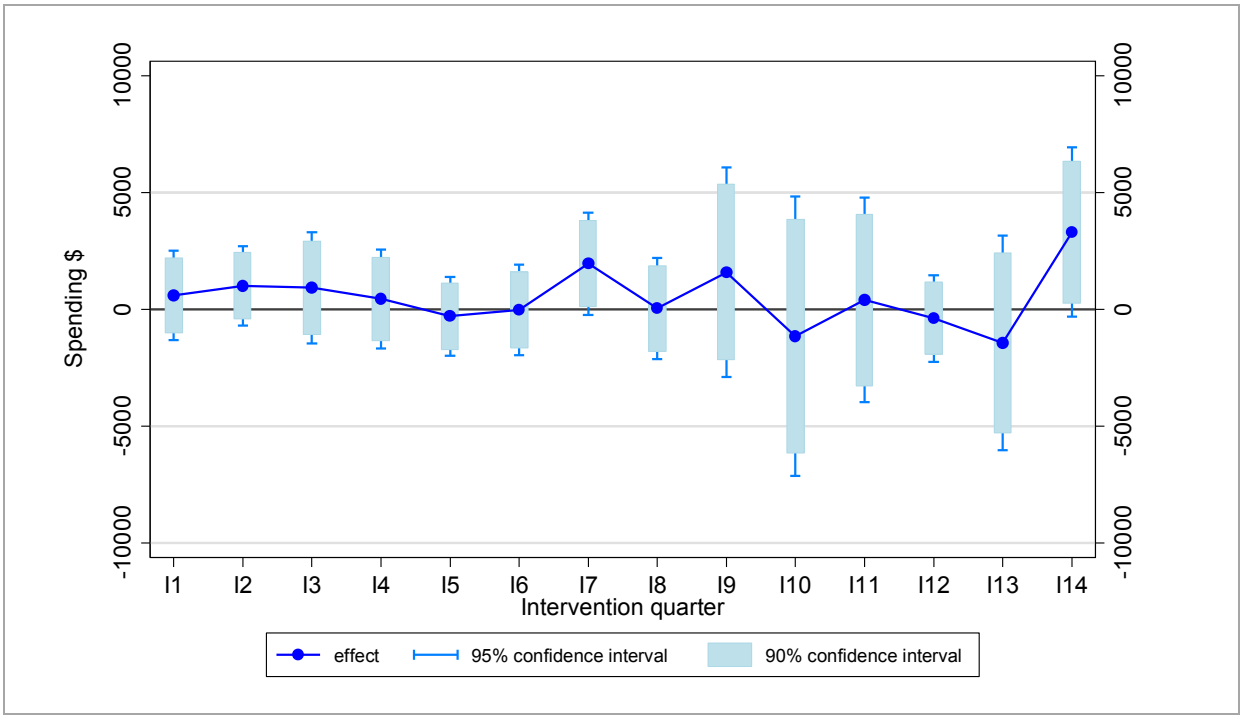
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; SEMHS = Southeast Mental Health Services.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: SEMHS



Notes:

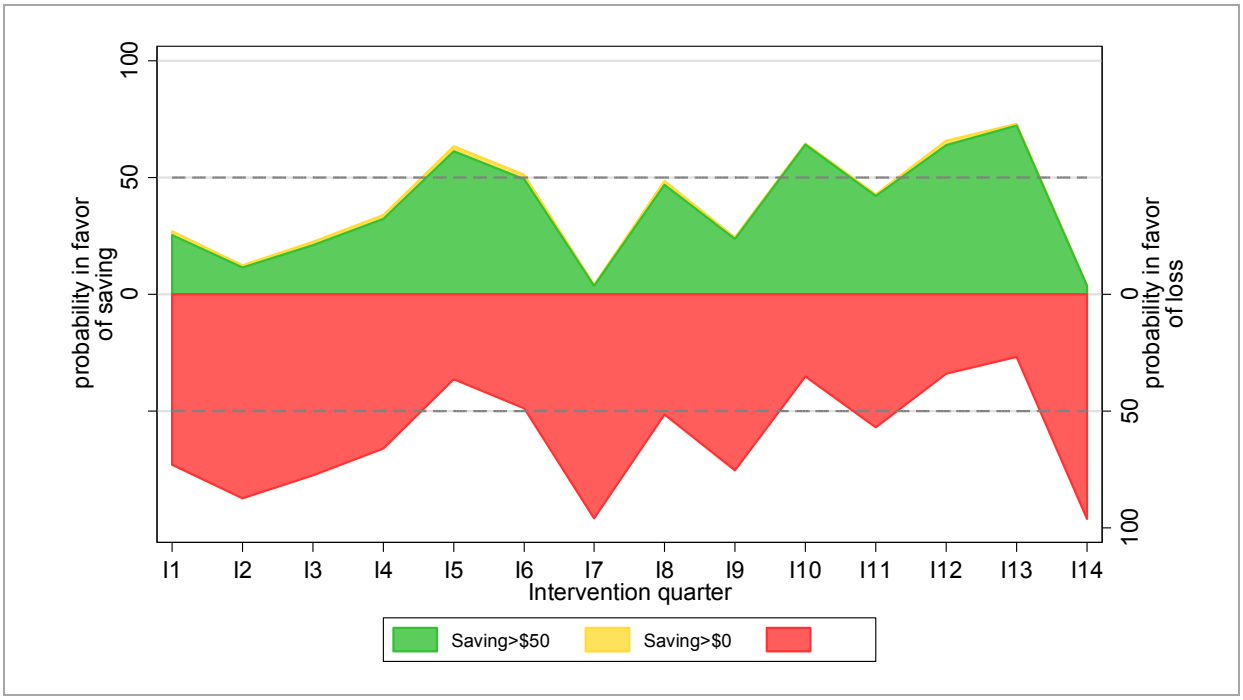
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** July 2010 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; SEMHS = Southeast Mental Health Services.

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 for saving or losing money on this initiative. In most quarters, the probability of a loss is greater than the probability of savings. Overall for the entire 12-quarter innovation period, the probability of a loss is 81 percent.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: SEMHS



Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- 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 6*** and ***Figure 4***. Due to the small number of patients and the relative infrequency of hospitalization, the inpatient admissions rate has a large standard deviation, the data points tend to be spread over a wide range of values rather than at the mean. During the baseline period, the all-cause admissions rate is very similar for the innovation and comparison groups. During the innovation period, the all-cause admissions rate is similar for the innovation and comparison groups between I1 and I5 and the innovation group's admissions rate rises between I6 and I12. These trends are consistent with the findings in the third annual report.

Table 6. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: SEMHS

Awardee Number: 1C1CMS331013
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**	**I14**
Innovation Group																						
Admit rate	54	191	83	95	101	155	126	85	113	142	132	163	120	139	176	150	250	152	140	103	171	172
Std dev	226	511	312	327	389	478	476	340	419	399	414	441	431	732	418	401	676	550	510	496	446	460
Unique patients	93	94	96	95	99	103	103	106	106	106	106	104	100	72	68	60	52	46	43	39	35	29
Comparison Group																						
Admit rate	81	106	114	97	67	133	139	136	102	108	139	150	138	127	111	110	151	137	65	88	228	106
Std dev	385	385	514	421	287	557	490	442	390	385	555	455	509	428	377	435	655	468	369	455	1058	374
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	103	102	74	68	59	51	44	40	35	30	26
Innovation − Comparison Rate																						
	−27	86	−30	−2	34	22	−13	−51	12	33	−7	14	−18	12	65	40	99	15	74	15	−56	66

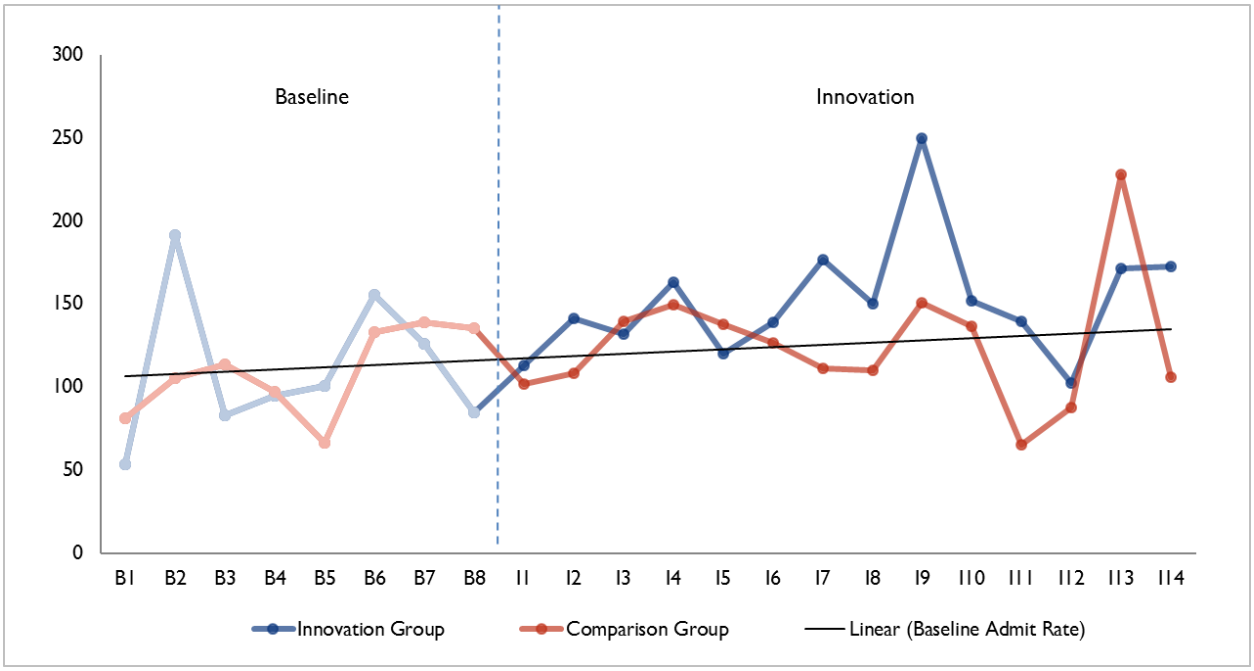
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: SEMHS



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- SEMHS = Southeast Mental Health Services.

2.5.2 Regression Results

As shown in ***Table 7***, 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: −12, 50). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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 and changes to inpatient admissions are, therefore, difficult to detect statistically, there is no evidence that the innovation had any impact on inpatient admissions.

Table 7. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	16	47	0.729
I2	47	51	0.356
I3	−20	56	0.718
I4	18	54	0.745
I5	−10	62	0.868
I6	10	76	0.897
I7	62	65	0.342
I8	30	65	0.644
I9	74	108	0.495
I10	−1	109	0.995
I11	65	95	0.497
I12	53	88	0.551
I13	−125	127	0.332
I14	56	84	0.505
Overall average	19	19	0.325
Overall aggregate	18	18	0.325
Overall aggregate (IY1)	6	11	0.562
Overall aggregate (IY2)	6	10	0.574
Overall aggregate (IY3)	9	9	0.378
Overall aggregate (IY4)	−3	5	0.591

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; 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 8*** and ***Figure 5***. 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. These trends are consistent with the findings in the third annual report.

Table 8. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: SEMHS

Awardee Number: 1C1CMS331013
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**	**I14**
Innovation Group																						
Readmit rate	0	300	0	0	600	231	143	0	125	0	0	167	0	0	0	0	125	0	0	0	0	333
Std dev	0	458	0	0	490	421	350	0	331	0	0	373	0	0	0	0	331	0	0	0	0	471
Total admissions	3	10	2	6	5	13	7	5	8	7	8	6	3	2	3	5	8	1	3	0	3	3
Comparison Group																						
Readmit rate	0	65	77	100	0	182	147	0	167	188	108	174	154	0	0	0	286	0	0	500	250	0
Std dev	0	246	267	300	0	386	354	0	373	390	311	379	361	0	0	0	452	0	0	500	433	0
Total admissions	3	5	4	7	3	6	6	5	4	5	6	8	4	3	1	3	2	2	1	2	3	1
Innovation − Comparison Rate																						
	0	235	−77	−100	600	49	−4	0	−42	−188	−108	−7	−154	0	0	0	−161	0	0	−500	−250	333

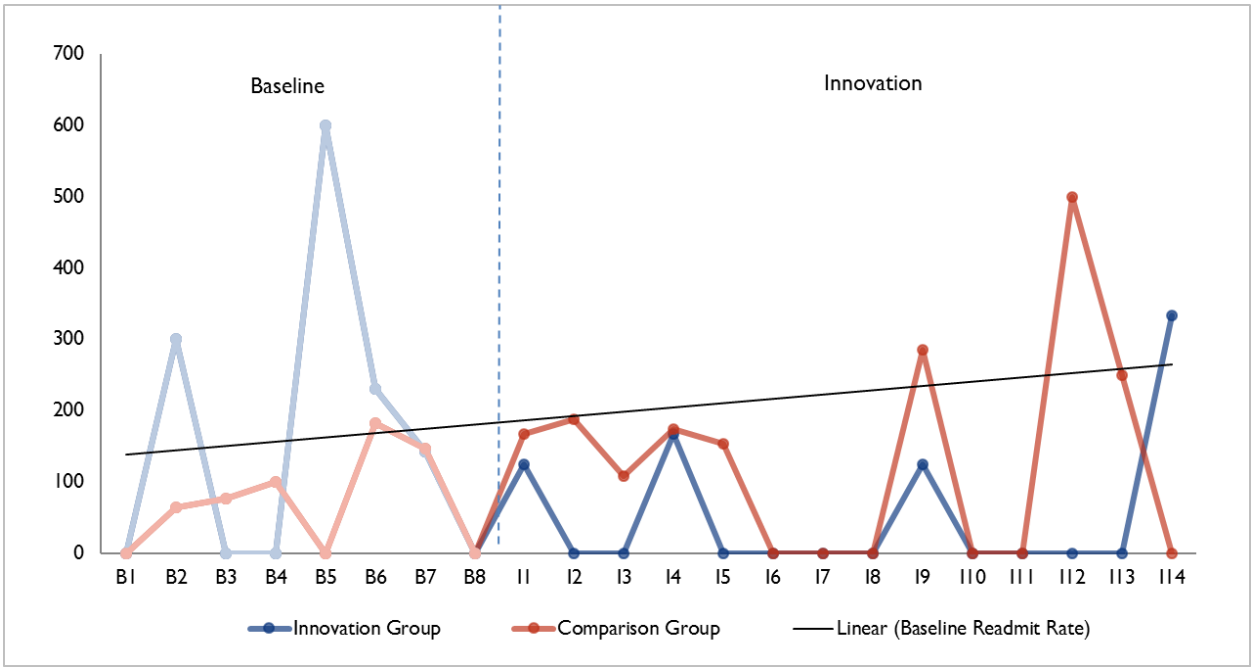
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: SEMHS



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 and June 2016.

Terms and Definitions

- SEMHS = Southeast Mental Health Services.

2.6.2 Regression Results

Table 9 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 −273 per 1,000 inpatient admissions indicating that the innovation-comparison difference is lower for the innovation group during the innovation period. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −489, −57). This finding is consistent with the findings in the third annual report.

Table 9. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: SEMHS

Quarter	Coefficient	Standard Error	P-Values
Overall average	−273	131	0.042
Overall aggregate	−16	8	0.042

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **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.
- 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 10*** and ***Figure 6.*** During the baseline period, the ED visit rate trends upward for the innovation and comparison groups. During the innovation period, the gap in the ED visit rate widens between the innovation and comparison groups. These trends are consistent with the findings in the third annual report. However, the standard deviation in ED visits is large, meaning the data points tend to be spread over a wide range of values rather than at the mean, and differences are not statistically different between the groups.

Table 10. ED Visits per 1,000 Medicare Participants: SEMHS

Awardee Number: 1C1CMS331013
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**	**I14**
Innovation Group																						
ED rate	355	404	260	400	343	524	534	538	736	604	321	442	440	611	662	667	596	522	558	513	571	552
Std dev	829	1,019	585	1,046	758	1,074	1,127	1,025	1,260	1,135	931	964	770	1,145	1,154	1,052	1,107	1,410	1,259	1,073	1,290	910
Unique patients	93	94	96	95	99	103	103	106	106	106	106	104	100	72	68	60	52	46	43	39	35	29
Comparison Group																						
ED rate	255	311	320	334	309	327	401	470	373	357	390	398	459	351	305	377	326	506	411	357	370	490
Std dev	378	446	478	437	430	557	676	798	760	661	648	522	702	510	474	671	583	728	701	523	631	676
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	103	102	74	68	59	51	44	40	35	30	26
Innovation − Comparison Rate																						
	100	93	−59	66	34	197	133	68	363	247	−69	44	−19	260	357	289	270	16	147	155	201	62

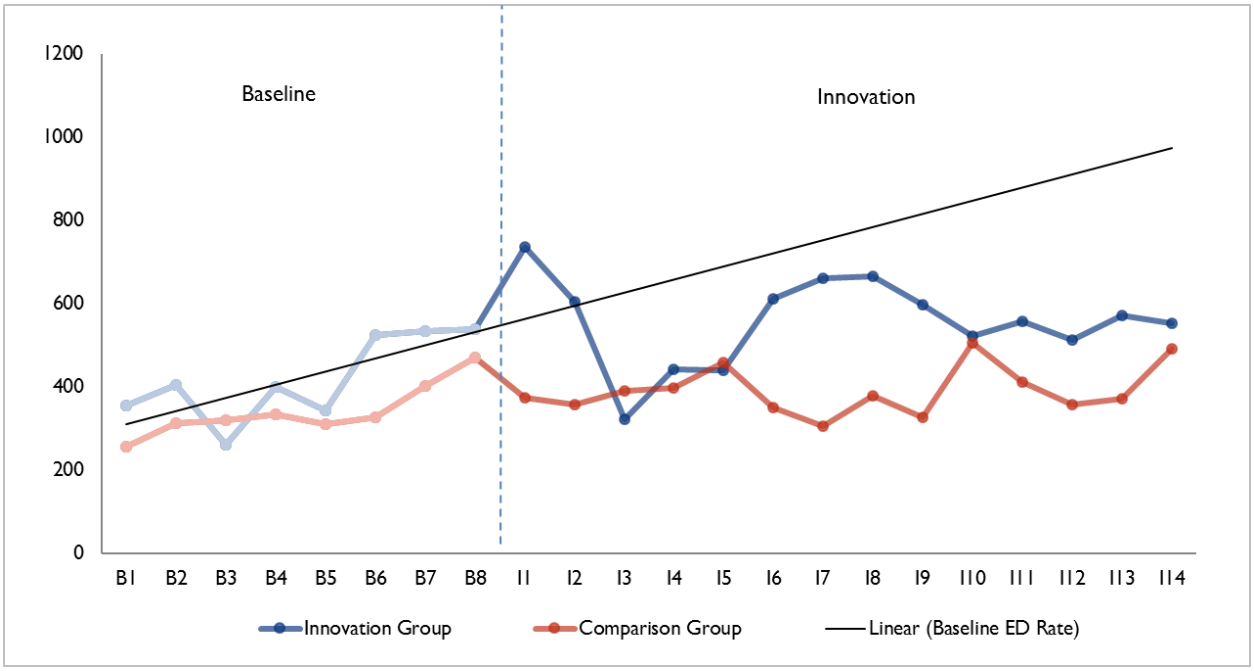
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 6. ED Visits per 1,000 Medicare Participants: SEMHS



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse (CCW) Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- ED = emergency department; SEMHS = Southeast Mental Health Services.

2.7.2 Regression Results

As shown in ***Table 11***, the average quarterly difference-in-differences estimate for ED visits is an increase of 93 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: 19, 166). This finding is consistent with the findings in the third annual report.

We also present quarterly effects 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. Differences between the innovation and comparison groups are statistically significant in I1, I3, and I7. The impact of the innovation is significant overall: the innovation group has 93 more ED visits per quarter than the comparison group (90% CI: 19, 166).

Table 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	277	136	0.043
I2	190	121	0.121
I3	−196	107	0.071
I4	−62	135	0.648
I5	−160	166	0.335
I6	212	164	0.201
I7	376	168	0.029
I8	280	216	0.200
I9	250	199	0.215
I10	−107	227	0.638
I11	119	210	0.574
I12	139	176	0.437
I13	155	219	0.485
I14	55	210	0.796
Overall average	93	45	0.038
Overall aggregate	90	43	0.038
Overall aggregate (IY1)	22	26	0.398
Overall aggregate (IY2)	42	27	0.120
Overall aggregate (IY3)	19	19	0.318
Overall aggregate (IY4)	7	10	0.478

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: July 2010 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- I = Innovation Quarter; IY = Innovation Year.
- SEMHS = Southeast Mental Health Services.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 12*** and ***Figure 7.*** During the baseline period, the rate of primary care visits is similar in the innovation and comparison groups. The primary care visit rate falls during I1 and I2 for innovation participants before returning to an upward trend.

Table 12. Primary Care Visits per 1,000 Medicare Participants: SEMHS

Awardee Number: 1C1CMS331013
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	I14
Innovation Group																						
Primary care rate	361	253	402	667	583	396	679	660	462	208	217	308	380	319	618	433	615	783	698	538	371	517
Std dev	1,114	880	1,996	4,861	3,784	1,546	4,134	4,518	3,401	697	752	856	1,056	796	1,839	1,865	2,086	2,283	2,318	1,317	1,071	1,380
Unique patients	93	94	96	95	99	103	103	106	106	106	106	104	100	72	68	60	52	46	43	39	35	29
Comparison Group																						
Primary care rate	286	302	377	572	479	457	569	528	506	520	495	597	559	778	693	961	619	556	685	527	392	399
Std dev	915	1,398	1,906	3,527	3,155	2,987	2,908	3,132	2,998	2,778	2,571	2,786	2,478	3,613	3,767	3,229	1,401	1,111	2,123	1,361	1,017	1,087
Weighted patients	94	96	99	100	103	103	106	106	106	106	106	103	102	74	68	59	51	44	40	35	30	26
Innovation − Comparison Rate																						
	75	−49	25	95	103	−61	110	132	−44	−313	−278	−289	−179	−459	−75	−527	−4	227	13	12	−21	119

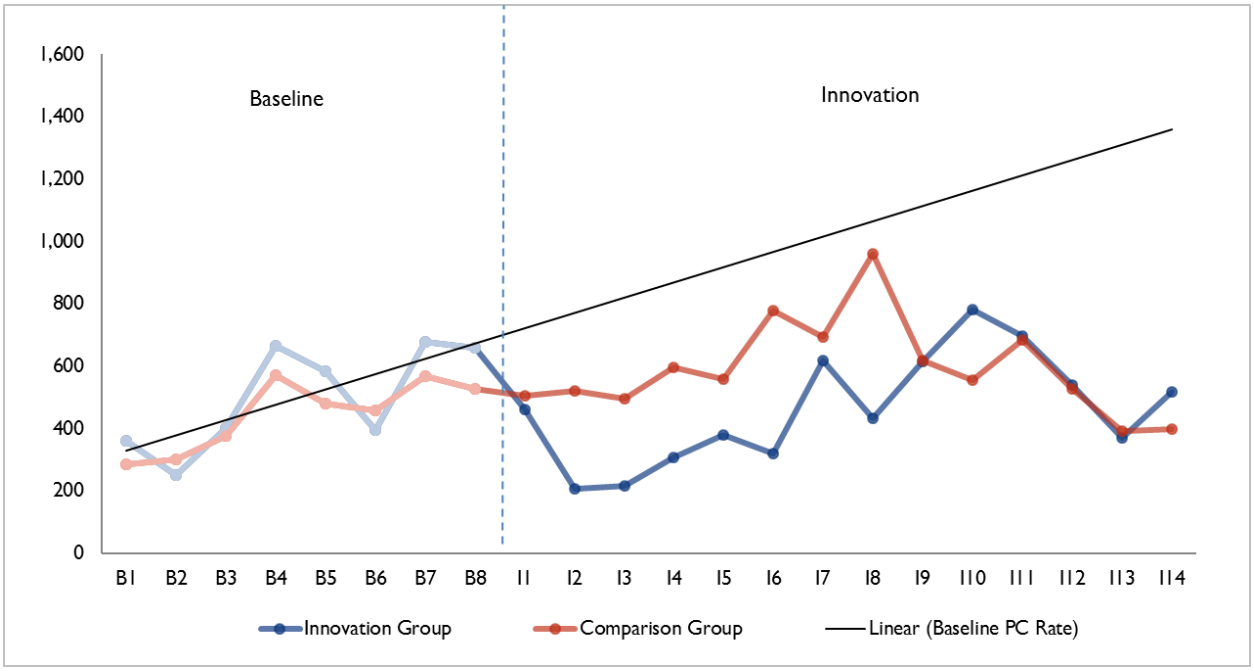
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; SEMHS = Southeast Mental Health Services.

Figure 7. Primary Care Visits per 1,000 Medicare Participants: SEMHS



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- SEMHS = Southeast Mental Health Services.

2.8.2 Regression Results

As shown in ***Table 13***, the average quarterly difference-in-differences estimate for primary care visits is a decrease of 251 primary care visits per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: −401, −101).

We also present quarterly effects with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. Quarterly estimates for primary care visits are all negative except for 14, indicating that primary care visits decreased in the innovation group. Although none of the quarterly estimates are statistically significant, the cumulative estimate of −251 for the entire innovation period is statistically significant (90% CI: −401, −101). The estimates for Years 1 and 2 are also statistically significant, indicating fewer primary care visits for innovation participants.

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicare Participants: SEMHS

Quarter	Coefficient	Standard Error	P-Values
I1	−146	97	0.135
I2	−261	165	0.117
I3	−248	156	0.114
I4	−256	247	0.302
I5	−43	204	0.832
I6	−612	548	0.269
I7	−178	344	0.606
I8	−975	718	0.180
I9	−358	462	0.442
I10	−17	378	0.965
I11	−71	355	0.842
I12	−249	614	0.687
I13	−17	407	0.967
I14	192	432	0.661
Overall average	−251	91	0.006
Overall aggregate	−242	88	0.006
Overall aggregate (IY1)	−96	37	0.009
Overall aggregate (IY2)	−119	66	0.073
Overall aggregate (IY3)	−32	41	0.435
Overall aggregate (IY4)	5	19	0.795

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** July 2010 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; SEMHS = Southeast Mental Health Services.

2.9 Discussion: Medicare Results

The claims analysis found no impact of the innovation on spending or inpatient stays. Relative to the comparison group, innovation participants experienced a reduction in hospital readmissions, an increase in ED visits, and a decrease in primary care use. SEMHS did not provide services targeted at recently hospitalized patients and were thus not likely to prevent readmissions; the reductions identified in the claims analysis were not expected.

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 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.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:
University of Chicago

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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 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. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: U-Chicago

Data Source	Period Covered
Medicare claims data	March 2013–June 2016
Terms and Definitions • U-Chicago = University of Chicago.	

University of Chicago (U-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) but expended only 97% of this award. This innovation uses 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. Below we present the goals, as well as the findings, for the innovation which launched on March 21, 2013.

1. **Smarter spending.**

   Goal: 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.

   Findings: The regression results suggest that Medicare beneficiaries incurred similar spending rates to their respective comparisons in the innovation period. The overall probability of savings was 60 percent.

2. **Better care.**

   Goal: 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.

   Findings: Medicare beneficiaries had significantly fewer inpatient stays and unplanned readmissions during the innovation, but similar ED visits as the comparison beneficiaries. Medicare beneficiaries also evidenced increased use of primary care. The increase in primary care is plausible on the basis of the innovation design, but it is difficult to isolate the effects of the CommRx innovation given cooccurring innovations and the lack of data on beneficiaries' use of services identified in the HealtheRx.

3. **Healthier people**.

   Goal: Improve health by providing information on local community programs and services available to residents for health maintenance and disease management.

   Findings: No changes are available to report.

2.1.1 Spending and Utilization Overview

Table 2 summarizes findings based on Medicare claims collected during the innovation period. The innovation group that received the HealtheRx has lower spending overall, but the estimate is not statistically significant, indicating no significant difference between the innovation and comparison groups in Medicare spending. On the other hand, after learning about the resources for community health and social services, the innovation group has more primary care visits and fewer inpatient admissions and unplanned readmissions than the comparison group, and the results are statistically significant. However, the overall impact of the innovation on ED visits was not statistically significant. Updated Medicaid claims data are not available; therefore, we do not report Medicaid outcomes in this addendum. See the third annual report for previous Medicaid results.[1]

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 2. Summary of Medicare Claims-Based Findings: U-Chicago

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$1.636	−$12.350, $9.074	−$9.981, $6.709	−$5.000	−$10.920, $0.917	$2.463	−$2.685, $7.611	$0.901	−$2.603, $4.405
Acute care inpatient stays	−1092	−1,375, −809	−1,312, −871	−695	−898, −492	−283	−449, −118	−113	−221, −6
Hospital-wide all-cause unplanned readmissions	−86	−173, 1	−154, −19	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	183	−225, 592	−135, 502	199	−86, 484	−94	−339, 152	79	−82, 239
Average impact per quarter									
Spending per participant	−$25	−$191, $141	−$155, $104	−$159	−$347, $29	$110	−$120, $340	$85	−$244, $413
Acute care inpatient stays (per 1,000 participants)	−17	−21, −13	−20, −14	−22	−29, −16	−13	−20, −5	−11	−21, −1
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−18	−37, 0	−33, −4	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	3	−3, 9	−2, 8	6	−3, 15	−4	−15, 7	7	−8, 22

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** April 2011 to June 2016.
- **Sample size**: 8,381 unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; U-Chicago = University of Chicago.

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 3 lists the claims-based outcome measures with an indication of the status of the data requested and whether the data are presented in this addendum to the third annual report. The Medicare data analysis uses data from the CMS Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Table 3. Claims-Based Outcome Measures: U-Chicago

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

Terms and Definitions

- ED = emergency department.
- U-Chicago = University of Chicago.

2.3 Medicare Comparison Group

We include patients who were enrolled prior to June 30, 2016 (more specifically from March 21, 2013 to June 30, 2015), and we present Medicare claims data through June 30, including two more quarters of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 8,381 Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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.

2.4 Medicare Spending

2.4.1 Descriptive Results

Table 4 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 1*** illustrates the Medicare spending per beneficiary in Table 4 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 trends in Medicare spending are the same as in the third annual report. As shown by the baseline trend line for innovation enrollees, spending trends upward in the baseline quarters for both 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, we cannot draw conclusions about the impact of the innovation on spending. As shown in Table 4, the standard deviation for spending is very high, meaning that the data points tend to be spread over a wide range of values rather than at the mean. We will estimate the statistical impact of the innovation in the difference-in-differences analyses that follow.

Table 4. Medicare Spending per Participant: U-Chicago

Awardee Number: 1C1CMS330997
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	$3,780	$3,812	$3,961	$3,989	$4,267	$4,247	$4,692	$5,781	$5,816	$5,397	$5,249	$5,121	$5,246	$5,160	$5,435	$5,236	$5,094	$4,873	$5,614	$5,259
Std dev	$9,792	$10,548	$13,262	$10,964	$11,419	$11,420	$12,286	$12,773	$14,479	$12,893	$12,487	$12,674	$12,702	$12,423	$13,632	$13,700	$12,372	$11,413	$16,852	$12,952
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,664	7,283	6,627	5,888	5,220	4,682	4,112	3,486	2,463	594
Comparison Group																				
Spending rate	$3,961	$4,021	$4,142	$4,239	$4,144	$4,342	$4,744	$6,155	$5,898	$5,978	$5,694	$5,429	$5,472	$5,201	$5,040	$5,127	$5,159	$4,965	$5,011	$5,958
Std dev	$9,574	$10,020	$10,055	$10,770	$10,398	$11,620	$12,384	$15,561	$14,284	$15,150	$14,369	$13,488	$13,847	$12,864	$12,189	$12,179	$13,134	$13,102	$12,708	$14,431
Weighted patients	7,260	7,368	7,505	7,663	7,831	8,015	8,267	8,381	8,381	8,228	7,521	6,868	6,003	5,136	4,436	3,880	3,349	2,790	1,899	489
Savings per Patient																				
	$181	$209	$181	$251	-$122	$95	$53	$374	$83	$581	$445	$307	$226	$42	-$394	-$110	$65	$92	-$603	$699

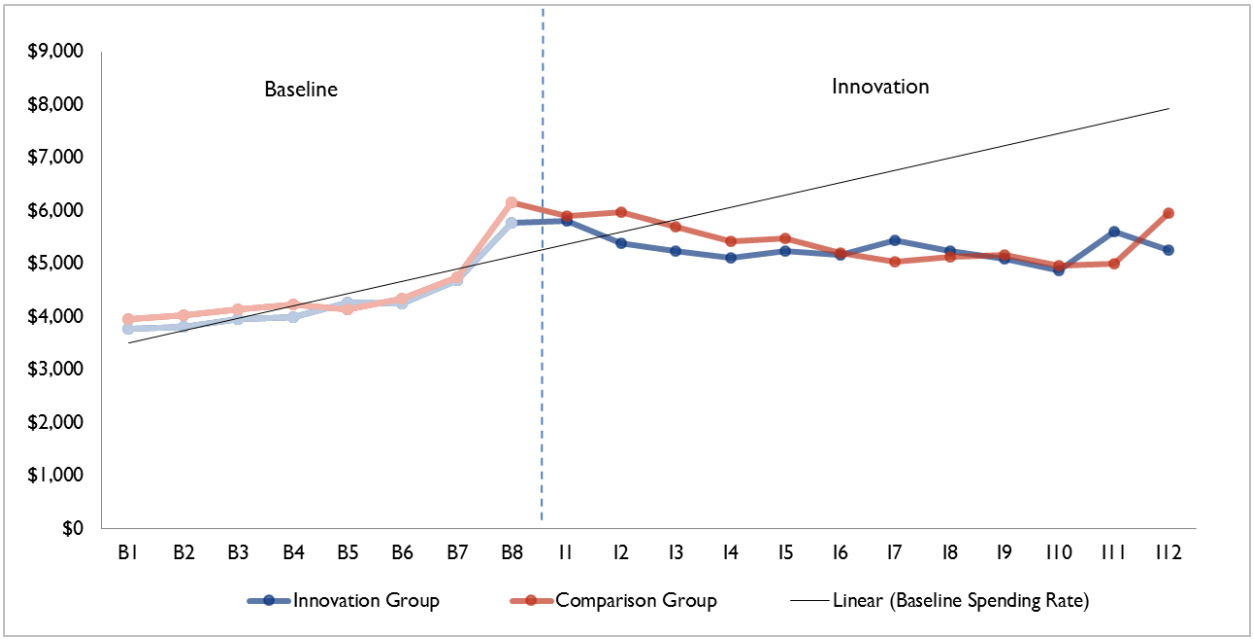
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 1. Medicare Spending per Participant: U-Chicago



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- U-Chicago = University of Chicago.

2.4.2 Regression Results

In ***Table 5,*** 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 −$25 (90% CI: −$191, $141). This effect is not statistically significant and is comparable to the finding in the third annual report. 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 quarterly effects. derived from 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 quarterly estimates fluctuate above and below zero over time, and most of them are not statistically significant.

Table 5. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	$123	$175	0.482
I2	−$344	$174	0.048
I3	−$267	$172	0.122
I4	−$164	$177	0.355
I5	−$134	$194	0.489
I6	$16	$192	0.935
I7	$484	$216	0.025
I8	$156	$231	0.500
I9	−$46	$240	0.848
I10	−$15	$252	0.954
I11	$570	$386	0.139
I12	−$445	$698	0.524
Overall average	−$25	$101	0.802
Overall aggregate	−$1,636,436	$6,511,525	0.802
Overall aggregate (IY1)	−$4,999,933	$3,597,004	0.165
Overall aggregate (IY2)	$2,462,851	$3,129,714	0.431
Overall aggregate (IY3)	$900,646	$2,130,294	0.673

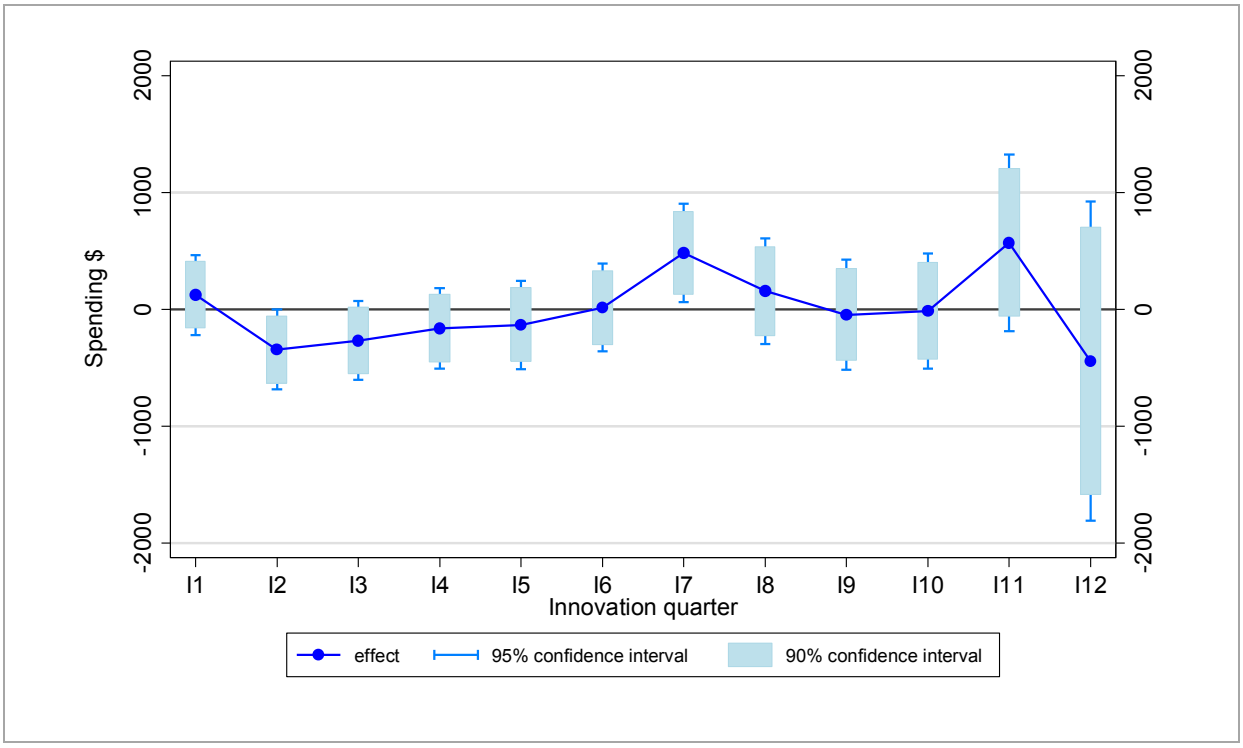
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **The regression coefficients** are 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; U-Chicago = University of Chicago.

Figure 2. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: U-Chicago



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of Activity:** April 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; U-Chicago = University of Chicago.

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 for saving or losing money on this initiative. Because the quarterly spending estimates are not statistically significant in the entire innovation period, we observe a 60 percent chance of savings during the innovation period. Earlier innovation quarters demonstrate a higher probability of savings and later innovation quarters demonstrate a higher probability of losses.

Figure 3. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: U-Chicago

Notes:

- **Source**: RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- 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 6*** and ***Figure 4***. Consistent with the trends in the third annual report, 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, we cannot conclude that the innovation caused the increase; we examine this question in the difference-in-differences analyses that follow.

Table 6. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: U-Chicago

Awardee Number: 1C1CMS330997
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																				
Admit rate	114	114	112	113	123	117	133	176	156	144	144	130	134	137	140	128	132	122	136	120
Std dev	478	484	450	461	479	465	503	579	551	512	534	474	473	510	527	460	463	438	466	423
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,664	7,283	6,627	5,888	5,220	4,682	4,112	3,486	2,463	594
Comparison Group																				
Admit rate	118	118	126	111	108	111	123	152	162	165	157	151	148	140	139	145	135	133	143	155
Std dev	470	477	486	470	449	451	480	548	592	569	561	530	520	514	505	496	502	482	496	495
Weighted patients	7,260	7,368	7,505	7,663	7,831	8,015	8,267	8,381	8,381	8,228	7,521	6,868	6,003	5,136	4,436	3,880	3,349	2,790	1,899	489
Innovation − Comparison Rate																				
	−4	−4	−14	2	15	5	10	24	−6	−21	−12	−21	−14	−3	1	−16	−3	−11	−6	−36

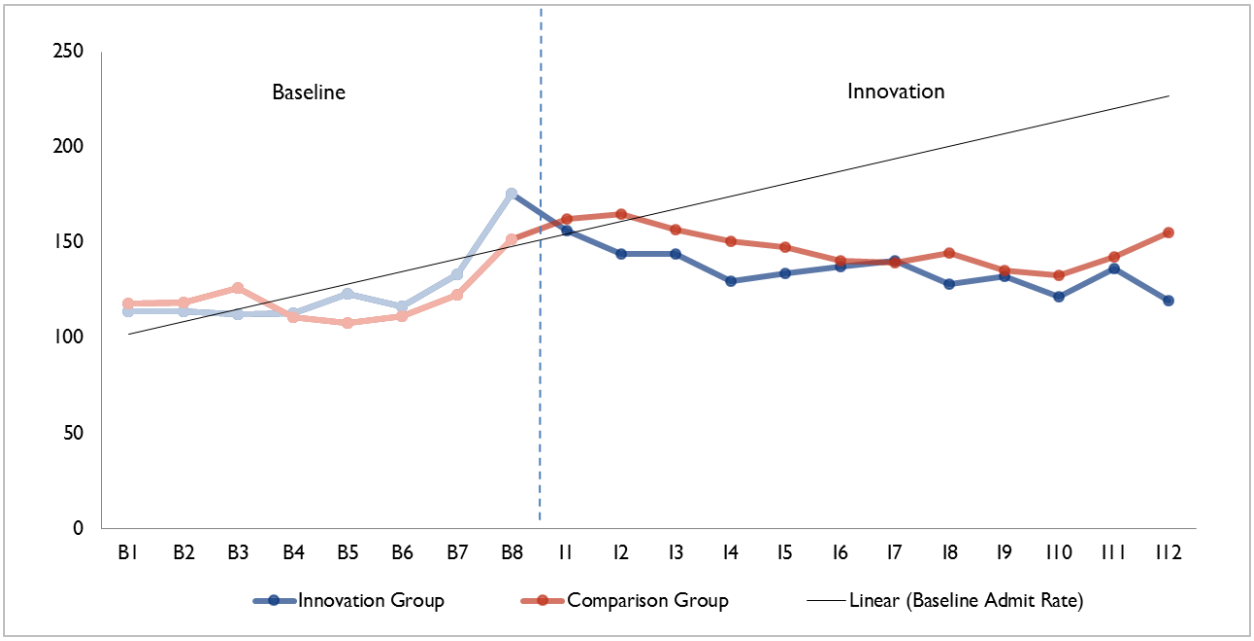
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.
- — Data not yet available.

Figure 4. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: U-Chicago



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- U-Chicago = University of Chicago.

2.5.2 Regression Results

As shown in ***Table 7***, the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 17 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: −21, −13) and is comparable to the result in the third annual report.

We also present quarterly effects from a 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 7. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	−19	8	0.018
I2	−23	8	0.002
I3	−22	8	0.005
I4	−24	8	0.002
I5	−16	8	0.044
I6	−15	9	0.105
I7	−1	9	0.876
I8	−17	9	0.069
I9	−5	10	0.595
I10	−16	10	0.123
I11	−10	13	0.460
I12	−19	22	0.384
Overall average	−17	3	<0.001
Overall aggregate	−1,092	172	<0.001
Overall aggregate (IY1)	−695	123	<0.001
Overall aggregate (IY2)	−283	101	0.005
Overall aggregate (IY3)	−113	65	0.083

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **The negative binomial count model regression coefficients** are 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.
- B1 = Baseline Q1; I1 = Innovation Q1; 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 8*** and ***Figure 5***. Hospital unplanned readmissions rates fluctuate around the trend line prior to the innovation's launch, and the trend line slopes slightly upward. The readmissions rates for the innovation group are close to or lower than the comparison group for most of the innovation period except for the eighth innovation quarter (I8). The sample size in the last two quarters (I11 and I12) is small because only a small number of index admissions are included. These trends are comparable to the findings in the third annual report. 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 8. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: U-Chicago

Awardee Number: 1C1CMS330997
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																				
Readmit rate	127	109	95	108	116	105	124	134	149	135	165	126	109	151	103	154	128	127	70	129
Std dev	333	312	294	310	321	306	330	340	357	341	371	332	311	358	304	361	334	332	255	335
Total admissions	378	402	420	408	473	468	547	794	689	565	553	506	478	423	387	325	343	245	158	31
Comparison Group																				
Readmit rate	118	121	103	101	117	101	95	127	156	167	160	162	132	155	158	139	129	138	123	174
Std dev	323	327	304	301	322	301	293	333	363	373	367	369	339	362	365	346	335	345	329	380
Total admissions	493	507	530	475	483	526	607	794	878	799	733	629	543	453	389	348	271	208	130	29
Innovation − Comparison Rate																				
	9	−12	−7	7	−1	4	30	6	−6	−33	4	−36	−24	−3	−55	15	−1	−11	−53	−45

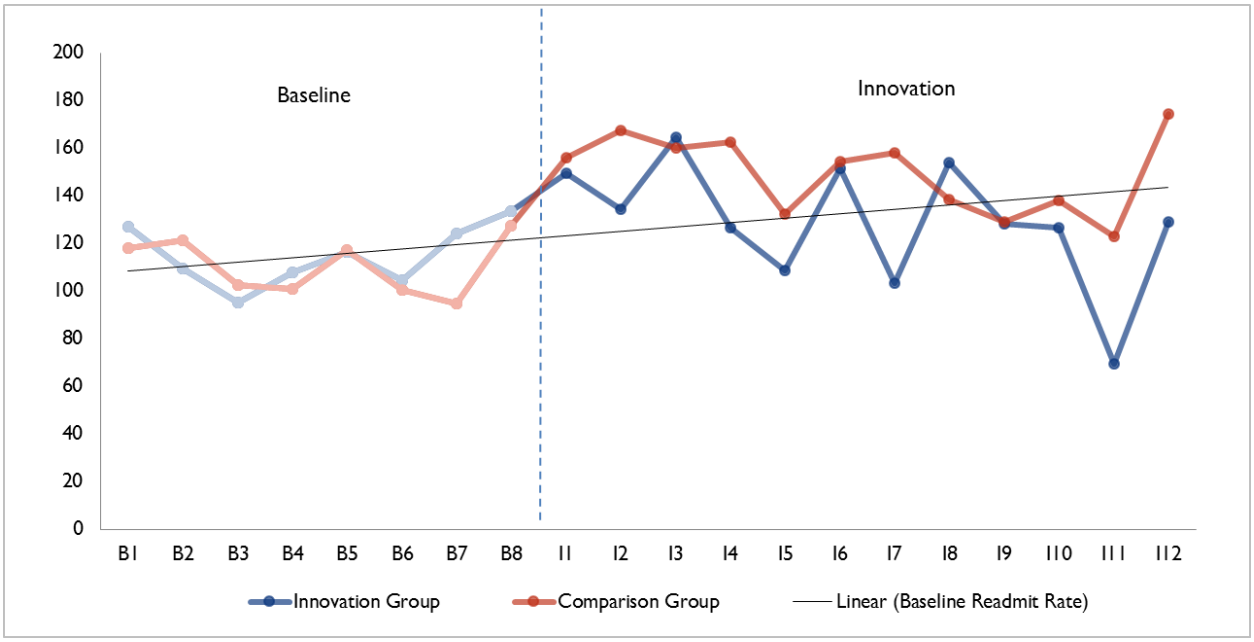
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.
- — Data not yet available.

Figure 5. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: U-Chicago



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 and June 2016.

Terms and Definitions

- U-Chicago = University of Chicago.

2.6.2 Regression Results

Table 9 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. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is marginally statistically significant (90% CI: −37, 0). This result is comparable to the finding in the third annual report.

Table 9. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Admissions: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
Overall average	−18	11	0.102
Overall aggregate	−86	53	0.102

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- 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 10*** and ***Figure 6.*** 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. The trends in ED visits are similar in the third annual report. As with the other variables, we will include statistical tests on the ED visit rate in the following section.

Table 10. ED Visits per 1,000 Medicare Participants: U-Chicago

Awardee Number: 1C1CMS330997
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																				
ED rate	226	233	240	225	213	215	210	723	284	269	247	243	239	231	245	246	220	219	221	300
Std dev	958	939	842	938	827	929	812	1121	962	928	818	869	814	781	831	816	846	684	692	1224
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,664	7,283	6,627	5,888	5,220	4,682	4,112	3,486	2,463	594
Comparison Group																				
ED rate	201	198	205	170	175	165	186	668	237	220	221	217	205	208	229	217	209	200	199	226
Std dev	419	418	461	396	442	383	415	701	476	463	444	435	420	420	481	450	448	441	407	412
Weighted patients	7,260	7,368	7,505	7,663	7,831	8,015	8,267	8,381	8,381	8,228	7,521	6,868	6,003	5,136	4,436	3,880	3,349	2,790	1,899	489
Innovation − Comparison Rate																				
	25	36	35	55	39	50	24	55	47	50	26	26	34	22	16	29	10	19	22	74

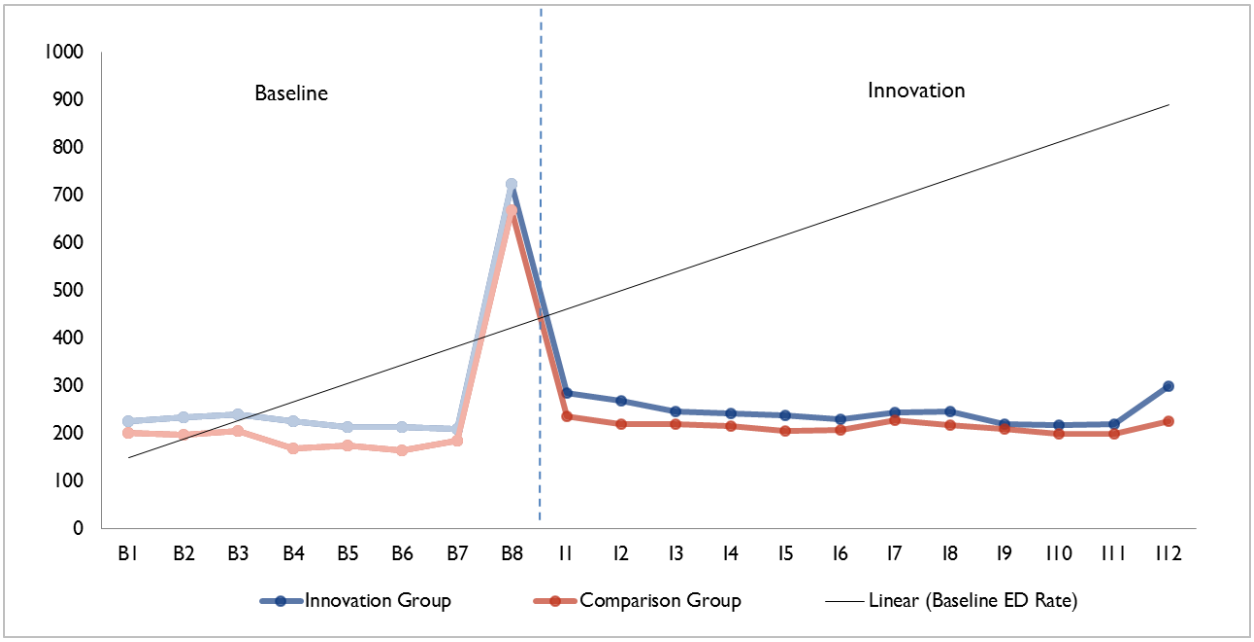
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED = emergency department; I1 = Innovation Q1; U-Chicago = University of Chicago.
- — Data not yet available.

Figure 6. ED Visits per 1,000 Medicare Participants: U-Chicago



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- ED = emergency department; U-Chicago = University of Chicago.

2.7.2 Regression Results

As shown in ***Table 11,*** the average quarterly difference-in-differences estimate for ED visits is an increase of three 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: −3, 9) and is comparable to the finding in the third annual report.

We also present quarterly effects derived from a 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 11. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	14	11	0.192
I2	23	10	0.027
I3	−7	11	0.505
I4	−7	12	0.555
I5	2	12	0.842
I6	−5	12	0.717
I7	−17	14	0.236
I8	1	15	0.930
I9	−7	15	0.668
I10	7	15	0.647
I11	17	18	0.343
I12	66	47	0.158
Overall average	3	4	0.461
Overall aggregate	183	248	0.461
Overall aggregate (IY1)	199	173	0.251
Overall aggregate (IY2)	−94	149	0.529
Overall aggregate (IY3)	79	97	0.420

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity**: April 2011 to June 2016.

Terms and Definitions

- **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 as compared to their matched comparison group.
- I = Innovation Quarter; IY = Innovation Year; U-Chicago = University of Chicago.

2.8 Medicare Primary Care Visits

2.8.1 Descriptive Results

Primary care visits per 1,000 participants are shown in ***Table 12*** and ***Figure 7.*** The primary care visit rate fluctuates around an increasing trend prior to innovation launch for the innovation group, and the trend is steadily increasing for the comparison group. After the innovation starts, the rate falls below the trend line during all innovation quarters for the innovation group, and it surpasses the primary care visit rate of the comparison group starting in innovation quarter four (I4). As with the other variables, we will include statistical tests on the primary care visit rate in the following section.

Table 12. Primary Care Visits per 1,000 Medicare Participants: U-Chicago

Awardee Number: 1C1CMS330997
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																				
Primary care rate	1,271	1,323	1,328	1,375	1,404	1,414	1,383	1,864	1,636	1,614	1,567	1,516	1,501	1,460	1,406	1,429	1,369	1,335	1,456	1,300
Std dev	1,760	1,802	1,826	1,877	1,947	1,918	2,076	2,133	2,277	2,289	2,277	2,351	2,420	2,460	2,335	2,486	2,220	2,216	2,553	2,019
Unique patients	7,385	7,506	7,611	7,748	7,889	8,026	8,189	8,381	8,381	8,119	7,664	7,283	6,627	5,888	5,220	4,682	4,112	3,486	2,463	594
Comparison Group																				
Primary care rate	1,346	1,364	1,422	1,448	1,456	1,509	1,586	1,752	1,750	1,681	1,620	1,515	1,423	1,300	1,264	1,232	1,178	1,160	1,156	1,257
Std dev	1,866	1,887	1,960	1,985	2017	2048	2,169	2,369	2,430	2,465	2,453	2,435	2,544	2,2,40	2,2,43	2,178	2,2,03	2,212	2,227	2,497
Weighted patients	7,260	7,368	7,505	7,663	7,831	8,015	8,267	8,381	8,381	8,228	7,521	6,868	6,003	5,136	4,436	3,880	3,349	2,790	1,899	489
Innovation − Comparison Rate																				
	−75	−41	−94	−72	−52	−94	−203	112	−114	−66	−53	1	78	159	142	197	191	175	300	42

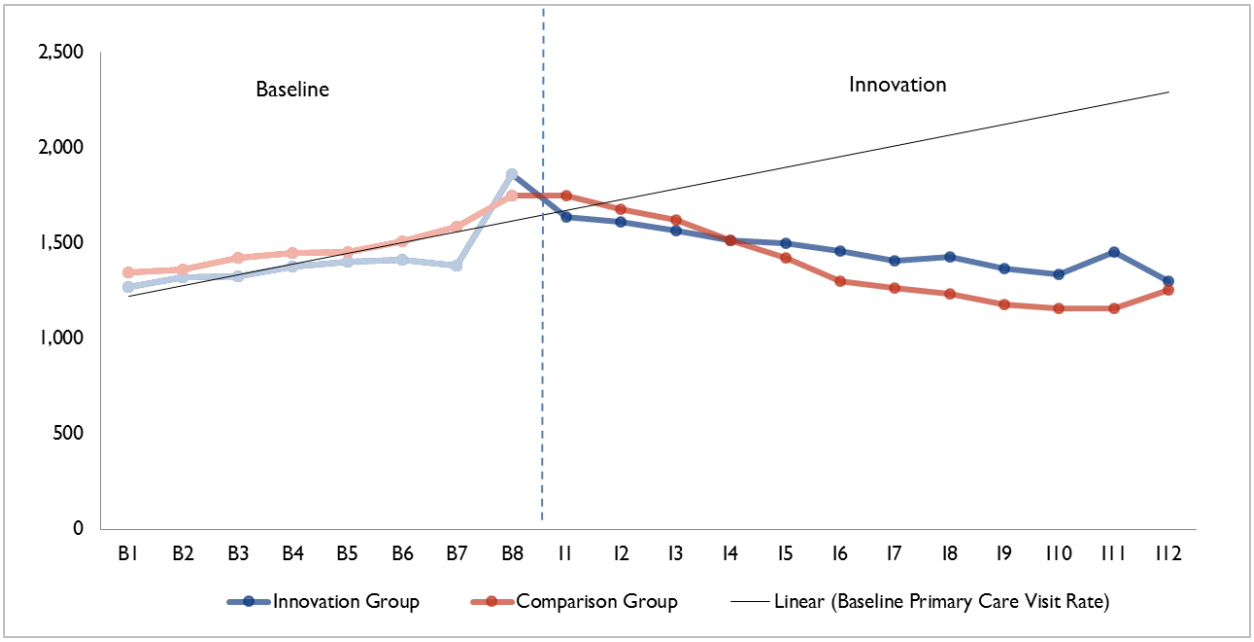
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **Primary care rate:** (Total quarterly primary care visits /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. Negative value indicates fewer primary care visits while a positive value indicates more primary care visits.
- B1 = Baseline Q1; I1 = Innovation Q1; U-Chicago = University of Chicago.

Figure 7. Primary Care Visits per 1,000 Medicare Participants: U-Chicago



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- U-Chicago = University of Chicago.

2.8.2 Regression Results

As shown in ***Table 13,*** the average quarterly difference-in-differences estimate for primary care visits is an increase of 23 primary care visits per 1,000 participants relative to the comparison group. This is the average difference in primary care visits for all innovation quarters, weighted by the number of beneficiaries in the quarter. The effect is statistically significant (90% CI: 4, 42).

We also present quarterly effects derived from a model with the dependent variable set to the number of primary care 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 primary care visits per 1,000 participants. In the innovation period, most of the quarterly difference-in-differences estimates for primary care visits are positive; a few are statistically significant.

Table 13. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Primary Care Visit per 1,000 Medicare Participants: U-Chicago

Quarter	Coefficient	Standard Error	P-Values
I1	−29	28	0.303
I2	67	30	0.024
I3	4	33	0.911
I4	15	33	0.640
I5	22	41	0.592
I6	93	39	0.017
I7	40	41	0.330
I8	63	45	0.162
I9	12	45	0.788
I10	−51	50	0.303
I11	24	68	0.726
I12	−101	119	0.395
Overall average	23	12	0.042
Overall aggregate	1,511	743	0.042
Overall aggregate (IY1)	444	486	0.361
Overall aggregate (IY2)	1,198	467	0.010
Overall aggregate (IY3)	−130	312	0.677

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** April 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; U-Chicago = University of Chicago.

2.9 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 could 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, similar to results in the third annual report. We also find a statistically significant increase in primary care visits for the innovation group, especially in the second innovation year.

The Medicare results are somewhat consistent with the innovation's theory of change because U-Chicago aimed to connect patients to social and health services in their communities, which could account for increased use of primary care. However, U-Chicago did not directly target patients with high admissions or readmissions, and it is unlikely that the innovation would have reduced these measures in the short-term. The U-Chicago CommRx innovation offered potential benefits to all enrollees, but 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.

Furthermore, U-Chicago did not track whether patients used the services on their tailored HealtheRx, so we cannot be certain that changes in primary care visits, admissions, or readmissions were related to the innovation. Since over 89 percent of the Medicare beneficiaries came from the U-Chicago clinical sites, where other health care innovations such as the State Innovation Model and the University of Chicago community programs[2] operated simultaneously, it is difficult to isolate the impact of the U-Chicago CommRx innovation.

The results may not fully represent the overall population that the innovation served. 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 6.7 percent of the overall population the innovation reached.

[2] For more information, see http://www.idph.state.il.us/ship/icc/SIM.htm and http://www.uchospitals.edu/about/community/programs/index.html.

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:
University of Miami

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RTI INTERNATIONAL

University of 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. This project was completed in June 2015, and the final data were included in the third annual report.[1] No new data were available for inclusion in the third annual report addendum.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring, Third Annual Report Addendum 2017

Awardee-Level Findings:

Women and Infants Hospital of Rhode Island

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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 presents claims-based data analyses for those awardees that provide patient identifiers for enrolled participants who are Medicare and/or Medicaid beneficiaries. RTI has obtained patient identifiers for 23 of the 24 awardees. ***Table 1*** presents the reporting periods for each of the data sources.

Table 1. Reporting Periods for Third Annual Report Addendum: W&I

Data Source	Period Covered
Medicaid claims data	October 2012–December 2014
Terms and Definitions • W&I = Women and Infants Hospital of Rhode Island.	

Women and Infants Hospital of Rhode Island (W&I)

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. Below we present the goals, as well as the findings, for the innovation.

1. **Smarter spending.**

   Goal: Reduce health spending for families of high-risk preterm and full-term infants in Rhode Island by 25 percent.

   Findings: The innovation group incurred lower spending in all innovation quarters than the comparison group. The overall probability of savings was 98 percent. To qualify for this innovation, infants were required to spend a minimum of 5 days in the NICU, and enrollment began at birth. The estimate for the difference in quarterly spending is statistically significant, indicating significant difference between the innovation and comparison groups in Medicaid spending. The reduction in spending is plausible, given the innovation's focus on reducing readmissions and ED visits.

2. **Better care.**

   Goal: 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.

   Findings: Regression results for the Medicaid recipients indicate that the infants in the innovation group had fewer hospital readmissions and ED visits than the comparison group, and these decreases were statistically significant. The innovation group also had fewer inpatient admissions than the comparison group, although the estimate was not statistically significant at the 10 percent level. The declines in readmissions and ED visits may be attributed to education, transitional services, and navigation support provided by family resource specialists.

3. **Healthier people**.

   Goal: Reduce all-cause mortality among medically fragile infants.

   Findings: None to report.

Table 2 summarizes findings based on Medicaid claims collected from 2011 to 2014. In the 2 years following the innovation launch in October 2012, the innovation group of PWP participants incurred lower spending than the comparison group of infants born in calendar year 2011. The overall estimate for the difference in quarterly spending is negative and statistically significant, indicating significant savings from the innovation group in Medicaid spending. Overall, the innovation group had significantly fewer hospital readmissions and ED visits than the comparison group, whereas the decrease in inpatient stays was not statistically significant at the 10 percent level.

Table 2. Summary of Medicaid Claims-Based Findings: W&I

Outcome	Total	90% CI	80%CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−5.578	−10.200, −0.954	−9.180, −1.977	−3.168	−7.900, 1.564	−2.411	−3.944, −0.877	N/A	N/A
Acute care inpatient stays	−30	−61, 2	−54, −5	−26	−57, 5	−4	−11, 4	N/A	N/A
Hospital-wide all-cause unplanned readmissions	−29	−46, −11	−42, −15	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−406	−472, −340	−458, −354	−322	−384, −261	−83	−109, −58	N/A	N/A
Average change per quarter									
Spending per participant	−4,591	−8,397, −785	−7,556, −1,627	−3,447	−8,596, 1,702	−8,144	−13,325, −2,964	N/A	N/A
Acute care inpatient stays (per 1,000 participants)	−24	−51, 2	−45, −4	−21	−47, 4	−3	−9, 3	N/A	N/A
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−76	−123, −29	−113, −40	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−334	−389, −279	−377, −292	−265	−316, −215	−69	−90, −47	N/A	N/A

Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Methodology:** Estimates are derived using a simple difference methodology. Additional details are described in the chapter.
- **Period of activity:** January 2011 to December 2014.
- **Sample size**: 321 unique Medicaid fee-for-service and managed care beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is the average quarterly effect from a simple difference 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)** is 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 is 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; W&I = Women and Infants Hospital of Rhode Island.

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 3 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 3. Claims-Based Outcome Measures: W&I

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

Terms and Definitions

- ED = emergency department; W&I = Women and Infants Hospital of Rhode Island.

2.3 Medicaid Comparison Group

We originally planned to use Medicaid data from the Centers for Medicare & Medicaid Services (CMS) Alpha-MAX data files. However, Medicaid claims for Rhode Island are currently available in Alpha-MAX only 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.

Since the third annual report, we revised the propensity score model to include more patient characteristics to improve the similarity of the innovation and comparison participants across more dimensions. Additionally, one infant participating in the innovation was dropped due to inadequate data.

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 compare the innovation infants with a group of comparison infants born prior to the innovation start in Rhode Island. Before the innovation, W&I treated high-risk infants through a similar program, Transition Home Plus (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 321 Medicaid newborn beneficiaries enrolled in fee-for-service or managed care Medicaid during the innovation launch, and we use both the fee-for-service and 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 365 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 enrolled in fee-for-service or managed care Medicaid in Rhode Island from a prior period. There are notable differences between the innovation group and the comparison group. For example, the innovation newborns on average had lower birth weight, spent more days in the NICU, and had a higher percentage of births at less than 32 weeks of gestation than the comparison group (27% versus 22%).

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 gender, race, gestational age, mother's age, birth weight (in kilograms), morbidity count,[1] days in the NICU, whether the delivery was a Caesarean section, whether it was a multiple birth, and whether the infant was discharged on oxygen. 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 comparison beneficiaries by the inverse of their 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

[1] The morbidity count refers to a count of the following four conditions in the high-risk infant: bronchopulmonary dysplasia, intraventricular hemorrhage Grade 3 or 4, necrotizing enterocolitis (Bell's stage II), and sepsis.

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 4 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 comparison and innovation groups.

Table 4. Mean Values and Standardized Differences of Variables in Propensity Score Model: W&I (Medicaid)

	Before Weighting					After Weighting				
	Innovation Group		Comparison Group		Standardized	Innovation Group		Comparison Group		Standardized
Variable	Mean	SD	Mean	SD	Difference	Mean	SD	Mean	SD	Difference
Female	0.45	0.50	0.46	0.50	0.02	0.45	0.50	0.45	0.50	0.01
White	0.40	0.49	0.45	0.50	0.10	0.40	0.49	0.41	0.49	0.01
Black	0.20	0.40	0.19	0.39	0.03	0.20	0.40	0.19	0.39	0.02
Less than 32 weeks of gestation	0.27	0.44	0.22	0.41	0.11	0.27	0.44	0.27	0.44	0.00
Between 32 to 34 weeks of gestation	0.15	0.36	0.18	0.39	0.08	0.15	0.36	0.16	0.36	0.01
Between 34 to 36.6 weeks of gestation	0.37	0.48	0.29	0.45	0.18	0.37	0.48	0.37	0.48	0.01
Mother's age between 20 to 25	0.35	0.48	0.37	0.48	0.05	0.35	0.48	0.36	0.48	0.02
Mother's age between 25 to 35	0.43	0.50	0.36	0.48	0.13	0.43	0.50	0.41	0.49	0.02
Mother's age greater than 35	0.11	0.32	0.11	0.31	0.01	0.11	0.32	0.12	0.32	0.02
Caesarean section	0.45	0.50	0.46	0.50	0.02	0.45	0.50	0.45	0.50	0.00
Birth weight (kg)	2.09	0.87	2.29	0.93	0.22	2.09	0.87	2.10	0.89	0.01
Multiple birth	0.18	0.38	0.12	0.32	0.17	0.18	0.38	0.16	0.37	0.04
Morbidity count	0.20	0.55	0.12	0.40	0.18	0.20	0.55	0.18	0.50	0.04
Days in the NICU	35.11	41.38	27.24	28.59	0.22	35.11	41.38	33.68	35.10	0.04
Discharged on oxygen	0.06	0.24	0.02	0.16	0.19	0.06	0.24	0.06	0.23	0.02
Number of beneficiaries	321	—	365	—	—	321	—	365	—	—

Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.

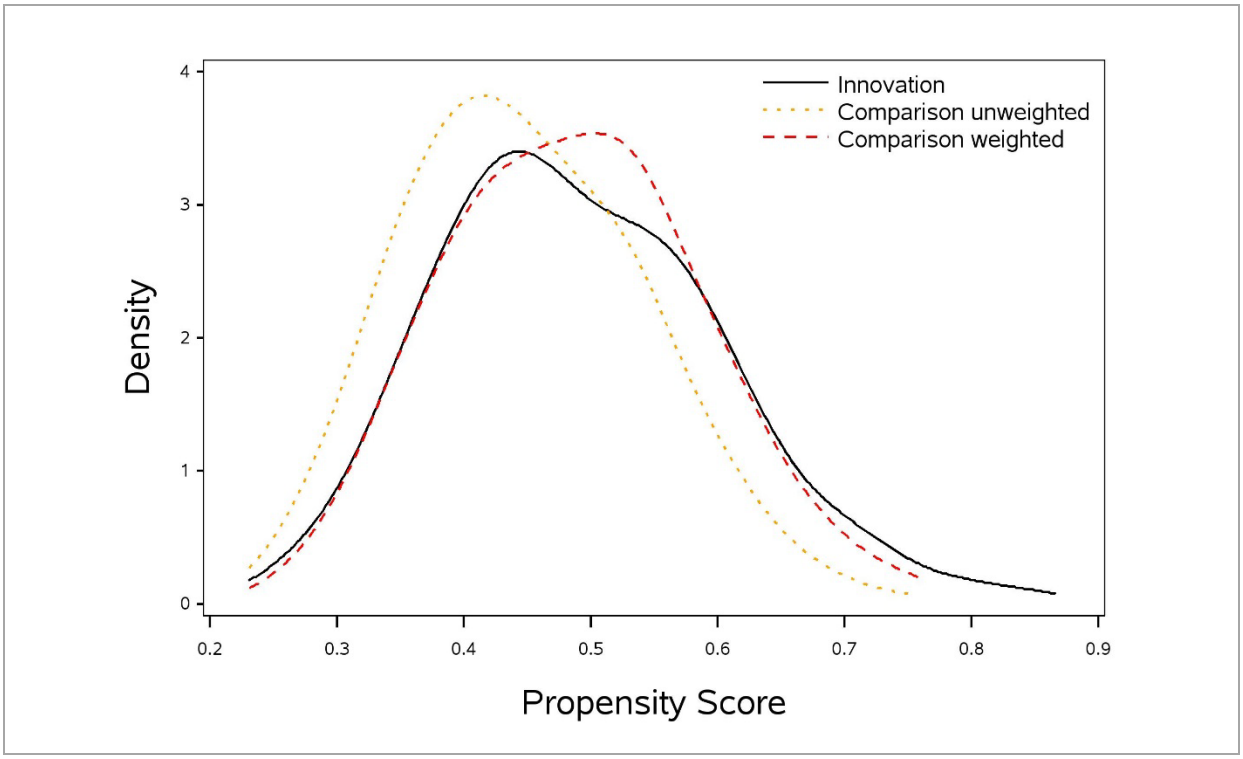
Terms and Definitions

- NICU = neonatal intensive care unit; SD = standard deviation; W&I = Women and Infants Hospital of Rhode Island; kg = Kilograms.
- — Data not yet available.

After performing propensity score weighting, we calculate absolute standardized differences between the innovation group and the comparison group, and check whether the weights decrease the absolute standardized differences and achieves acceptable balance (Table 4). The results in Table 4 show that propensity score weighting 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 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.

Figure 1. Distribution of Propensity Scores for Comparison and Innovation Groups: W&I (Medicaid)



Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.

Terms and Definitions

- W&I = Women and Infants Hospital of Rhode Island.

2.4 Medicaid Spending

2.4.1 Descriptive Results

Table 5 reports Medicaid spending per patient in the 8 quarters after enrolling in the innovation (i.e., after birth) for the innovation group, as well as Medicaid spending per patient in the 8 quarters after birth for the comparison group in a previous 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 weighted comparison group and the innovation group, not controlling for other factors. ***Figure 2*** illustrates the Medicaid spending per

beneficiary in Table 5 for innovation and comparison group beneficiaries, first using all eight innovation quarters, and then using quarters from the second innovation quarter onward. Medicaid spending in the first quarter is much higher than the other quarters because of high costs of delivery and NICU stay. We present a second Medicaid spending figure containing data from the second quarter onward, which is scaled to allow for a better comparison between the innovation and comparison group trends. The blue line represents values for beneficiaries enrolled in the innovation. The red line represents values for comparison group beneficiaries. These trends are consistent with those in the third annual report.

Table 5. Medicaid Spending per Participant: 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	$90,780	$2,631	$2,508	$2,298	$1,220	$1,171	$1,541	$1,041
Std dev	$139,552	$5,312	$8,955	$7,681	$2,207	$2,084	$3,335	$1,581
Unique patients	321	255	186	157	122	94	56	24
Comparison Group								
Spending rate	$90,826	$7,584	$3,314	$2,818	$3,043	$2,134	$1,872	$1,978
Std dev	$129,557	$38,692	$13,439	$12,017	$17,554	$9,697	$7,501	$8,796
Unique patients	364	357	348	342	336	324	323	320
Savings per Patient								
	$45	$4,953	$806	$520	$1,822	$963	$331	$937

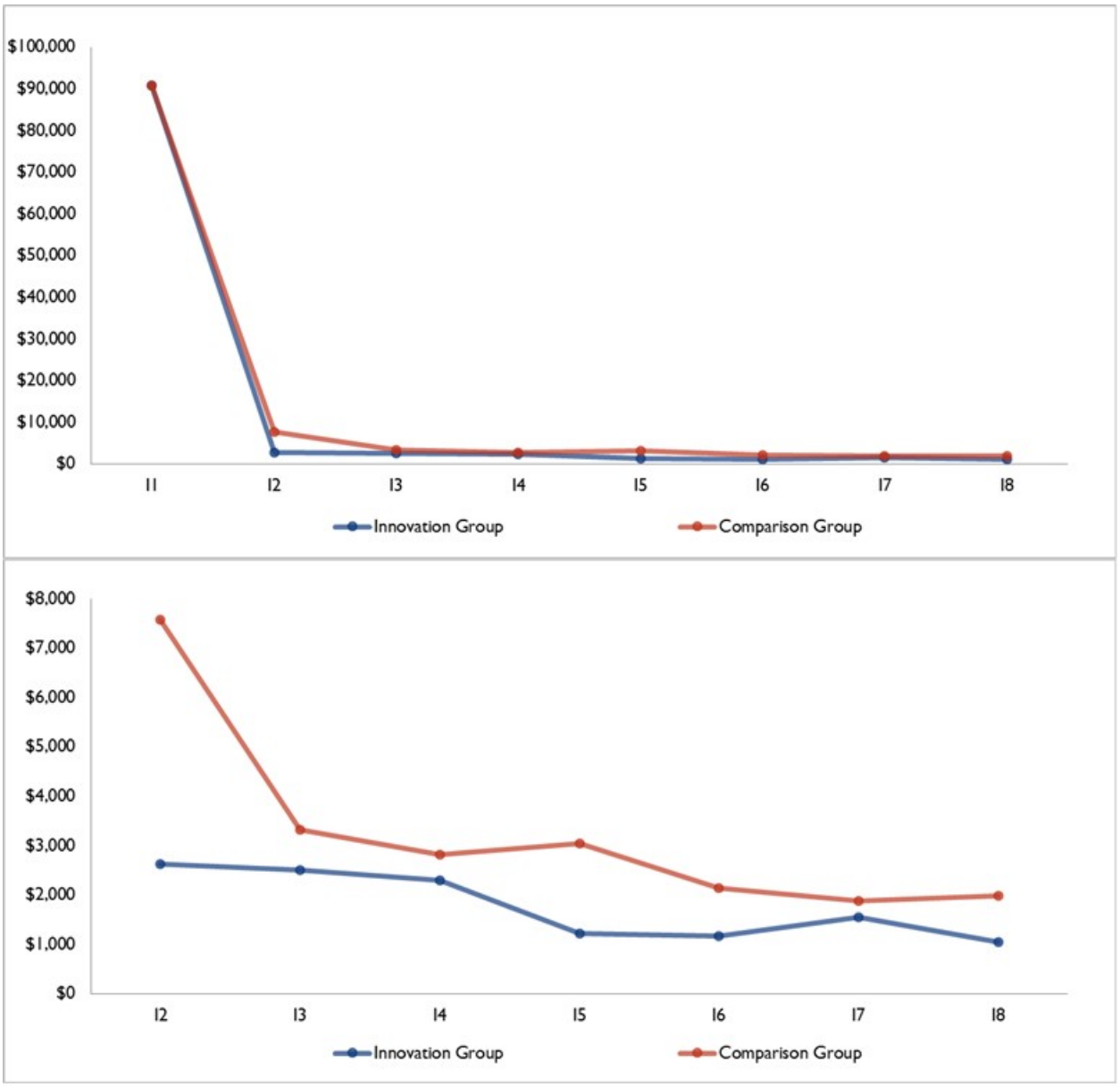
Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **Spending rate**: Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- 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



Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- W&I = Women and Infants Hospital of Rhode Island.

2.4.2 Regression Results

In ***Table 6,*** we present the weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation compared to their comparison group. The weighted average quarterly spending differential in the innovation period, indicating savings, is −$4,591 (90% CI:

−$8,397, −$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. This finding is different from the third annual report, which reported a nonsignificant result. The change in findings is due to the revised comparison group.

We also present quarterly effects. derived from 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 estimates. The quarterly effects show savings in all of the innovation quarters, after controlling for a number of covariates.

Table 6. OLS Regression Estimates for Quarterly Medicaid Spending per Participant: W&I

Quarter	Coefficient	Standard Error	P-Values
I1	−944	10,543	0.929
I2	−6,324	2,922	0.031
I3	−3,237	2,275	0.155
I4	−4,141	2,561	0.106
I5	−6,762	3,071	0.028
I6	−8,415	3,230	0.009
I7	−6,319	3,467	0.069
I8	−18,369	6,727	0.007
Overall average	−4,591	2,311	0.047
Overall aggregate	−5,578,491	2,807,533	0.047
Overall aggregate (IY1)	−3,167,776	2,873,097	0.271
Overall aggregate (IY2)	−2,410,715	931,043	0.010

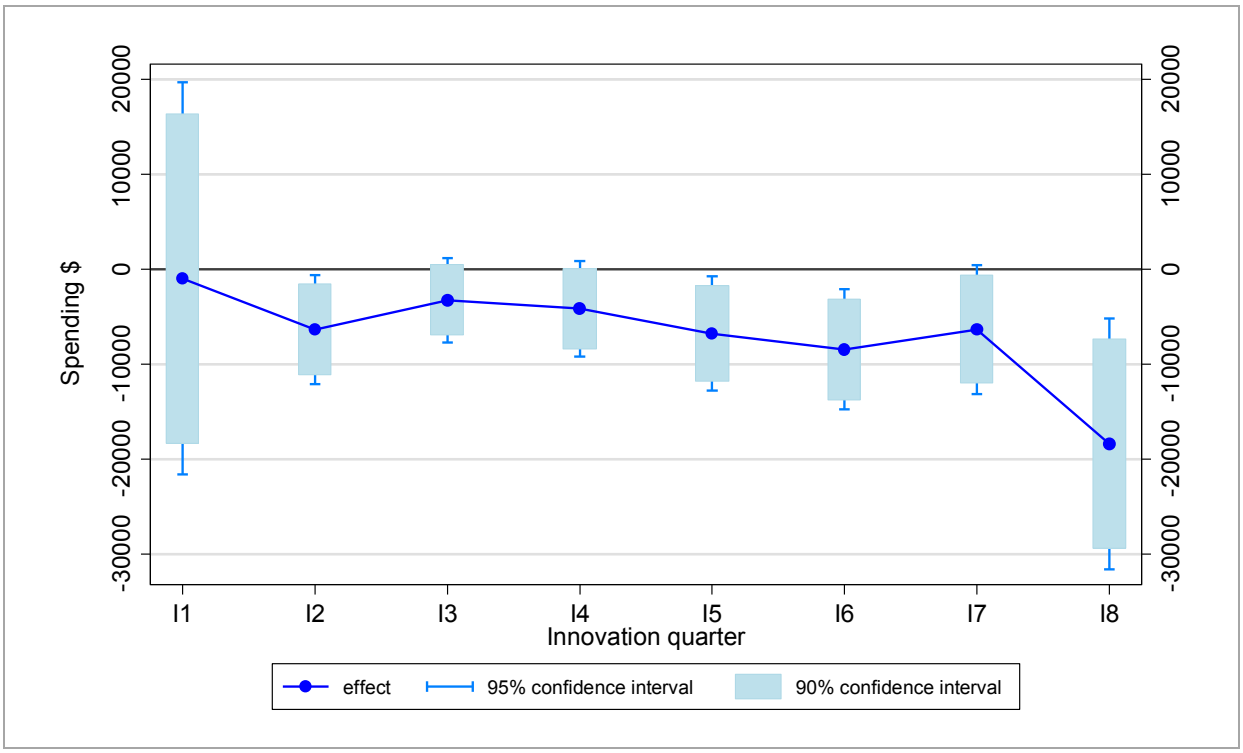
Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **The regression coefficients** are quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, gestational age, mother's age, birth weight, morbidity count, days in the NICU, whether the delivery was a Caesarean section, whether it was a multiple birth, and whether the infant was discharged on oxygen. 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 as compared to their comparison group
- I = Innovation Quarter; IY = Innovation Year; OLS = ordinary least squares; W&I = Women and Infants Hospital of Rhode Island.

Figure 3. OLS Regression Estimates for Quarterly Medicaid Spending per Participant: W&I



Notes:

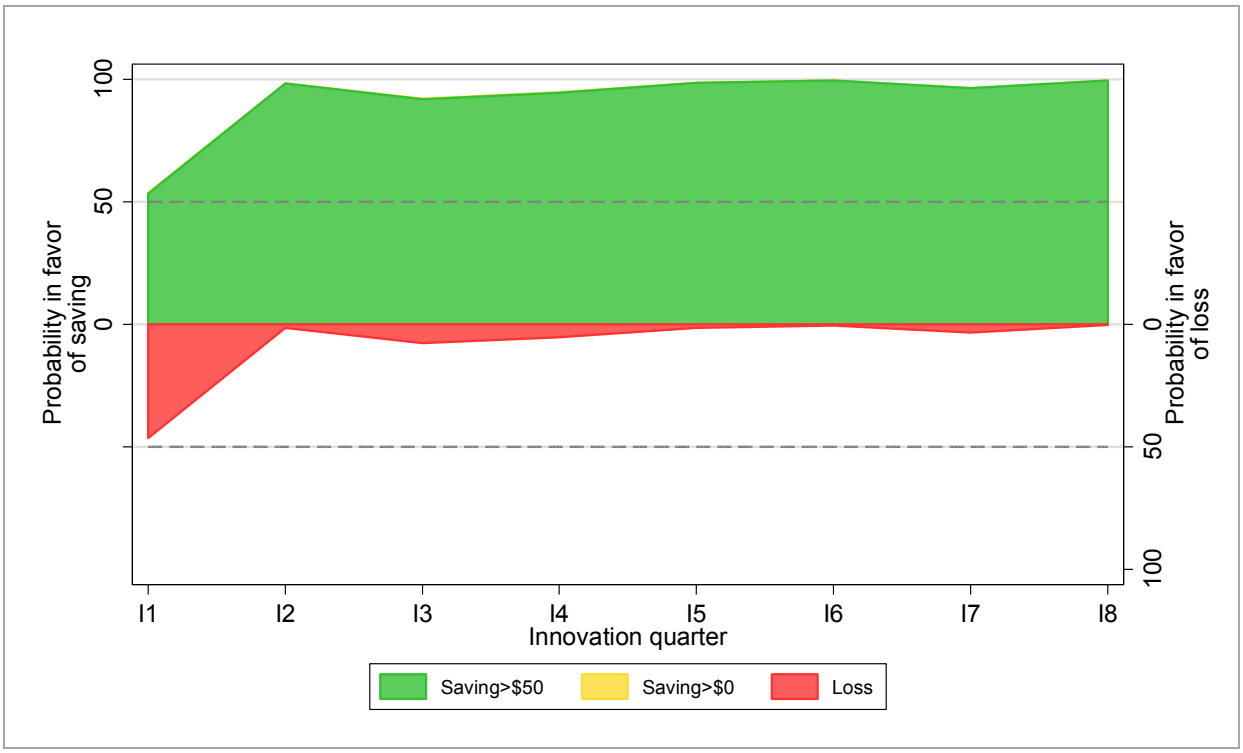
- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- OLS = ordinary least squares; W&I = Women and Infants Hospital of Rhode Island.

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 for saving or losing money on this initiative. 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 in all the innovation quarters, the current result suggests that the innovation has a 98 percent probability of generating savings in the innovation quarters.

Figure 4. Quarterly Strength of Evidence in Favor of Medicaid Savings/Loss: W&I



Notes:

- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- W&I = Women and Infants Hospital of Rhode Island.

2.5 Medicaid Inpatient Admissions

2.5.1 Descriptive Results

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 7*** 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. These trends are consistent with the trends from the third annual report. We examine the inpatient admissions rate further in the regression analysis section below.

Table 7. 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	71	70	38	41	11	54	0
Std dev	300	369	345	192	198	103	225	0
Unique patients	321	255	186	157	122	94	56	24
Comparison Group								
Admit rate	1,000	109	98	76	56	38	30	19
Std dev	354	369	492	436	406	275	221	197
Unique patients	364	357	348	342	336	324	323	320
Innovation–Comparison Rate								
	−21	−39	−28	−37	−15	−28	23	−19

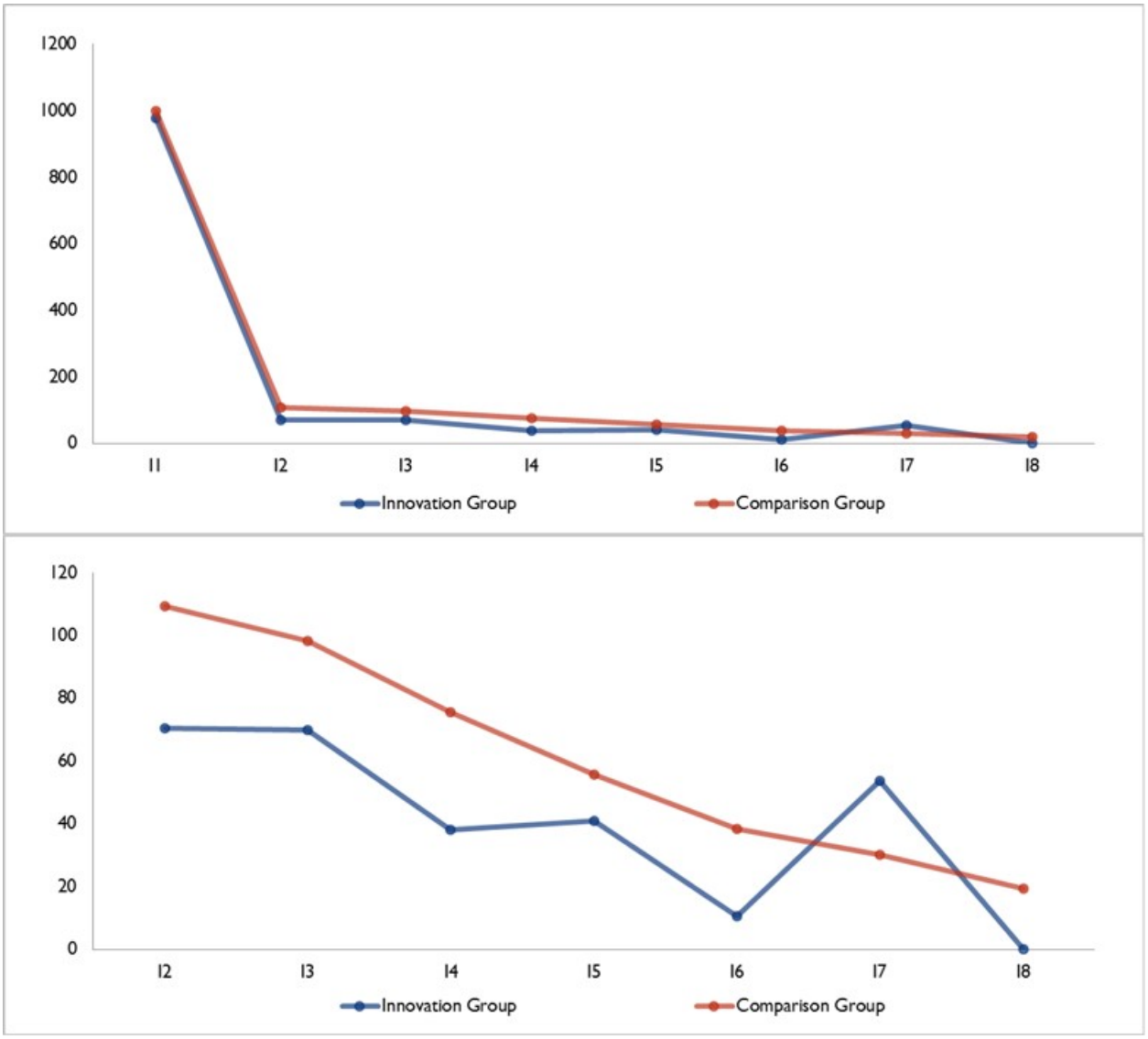
Notes:

- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- 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



Notes:

- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- W&I = Women and Infants Hospital of Rhode Island.

2.5.2 Regression Results

As shown in ***Table 8,*** the average quarterly difference estimate for inpatient admissions is a decrease of 24 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: −51, 2). This finding is similar to the finding in the third annual report; however, the result is no longer statistically significant.

We also present quarterly effects derived from a 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. 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 8. Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicaid Participants: W&I

Quarter	Coefficient	Standard Error	P-Values
I1	−15	44	0.733
I2	−38	31	0.225
I3	−28	43	0.509
I4	−38	34	0.256
I5	−16	30	0.603
I6	−29	20	0.145
I7	23	32	0.489
I8	−21	13	0.116
Overall average	−24	16	0.127
Overall aggregate	−30	19	0.127
Overall aggregate (IY1)	−26	19	0.172
Overall aggregate (IY2)	−4	5	0.396

Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **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 comparison group.
- **The negative binomial count model regression coefficients** are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, gestational age, mother's age, birth weight, morbidity count, days in the NICU, whether the delivery was a Caesarean section, whether it was a multiple birth, and whether the infant was discharged on oxygen. The regression specification also controls for quarterly effects that have the same impact on the innovation and comparison groups.
- I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island.

2.6 Medicaid Unplanned Readmissions

2.6.1 Descriptive Results

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 9*** 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 because of incomplete Medicaid claims data for the innovation group instead of a true decline in the unplanned readmissions rates. These findings are consistent with the third annual report. As with the other variables, we include statistical tests on the unplanned readmissions rate in the regression analyses that follow.

Table 9. Hospital Unplanned Readmissions Rates per 1,000 Medicaid 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	159	370	456	0	0	0	0	0
Total admissions	271	49	17	6	5	1	2	1
Comparison Group								
Readmit rate	54	203	308	350	500	417	167	500
Std dev	225	403	462	477	500	493	373	500
Total admissions	336	59	26	20	18	12	6	8
Innovation–Comparison Rate								
	−28	−40	−14	−350	−500	−417	−167	−500

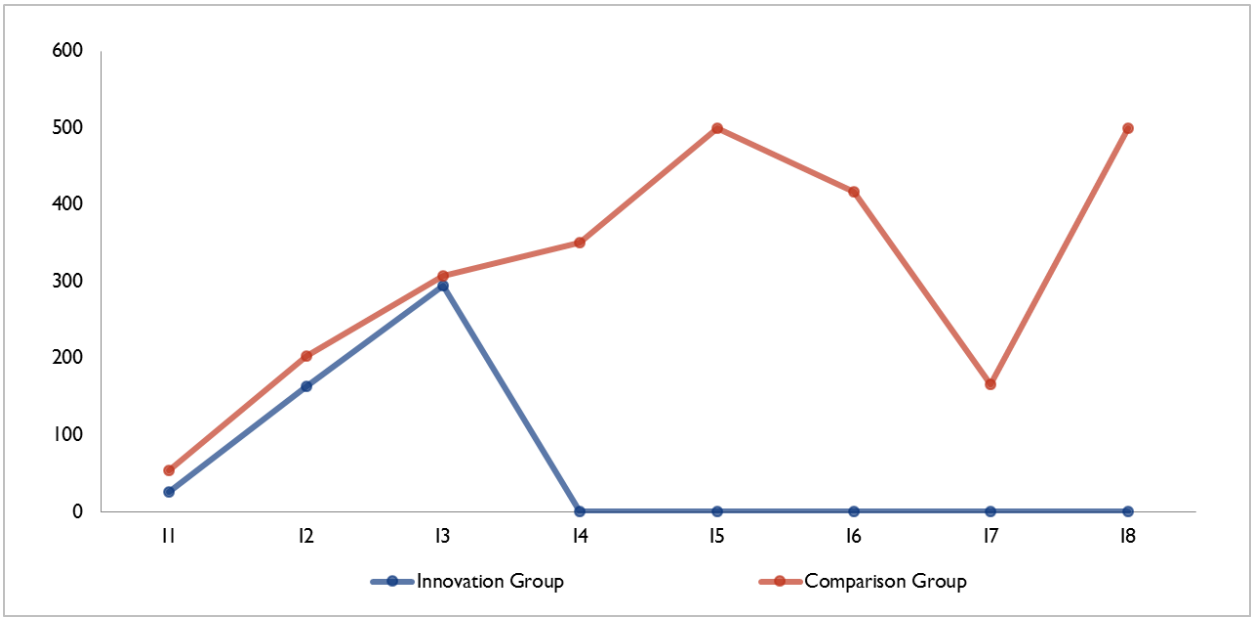
Notes:

- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 6. Hospital Unplanned Readmissions Rates per 1,000 Medicaid Admissions: W&I



Notes:

- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- W&I = Women and Infants Hospital of Rhode Island.

2.6.2 Regression Results

Table 10 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 −76 per 1,000 inpatient admissions. This is the average difference in unplanned readmissions probability for all innovation quarters. The effect is statistically significant (90% CI: −123, −29). These findings are consistent with those in the third annual report.

Table 10. Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicaid Admissions: W&I

Quarter	Coefficient	Standard Error	P-Values
Overall average	−76	29	0.008
Overall aggregate	−29	11	0.008

Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **The logistic regression model regression coefficient** is the simple difference estimate. Besides the innovation indicator, the regression controls for the following variables: gender, race, gestational age, mother's age, birth weight, morbidity count, days in the NICU, whether the delivery was a Caesarean section, whether it was a multiple birth, and whether the infant was discharged on oxygen.
- W&I = Women and Infants Hospital of Rhode Island.

2.7 Medicaid Emergency Department Visits

2.7.1 Descriptive Results

ED visits per 1,000 participants are shown in ***Table 11*** 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 stays high during most of the innovation quarters. These trends are consistent with those in the third annual report. As with the other variables, we will include statistical tests on the ED visit rate in the regression analysis section.

Table 11. 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	109	302	290	274	270	223	357	83
Std dev	457	863	673	560	587	509	666	276
Unique patients	321	255	186	157	122	94	56	24
Comparison Group								
ED rate	441	536	695	640	544	495	517	292
Std dev	1,071	1,168	1,392	1,351	1,064	1,230	1,099	764
Unique patients	364	357	348	342	336	324	323	320
Innovation–Comparison Rate								
	−332	−234	−404	−366	−274	−272	−160	−209

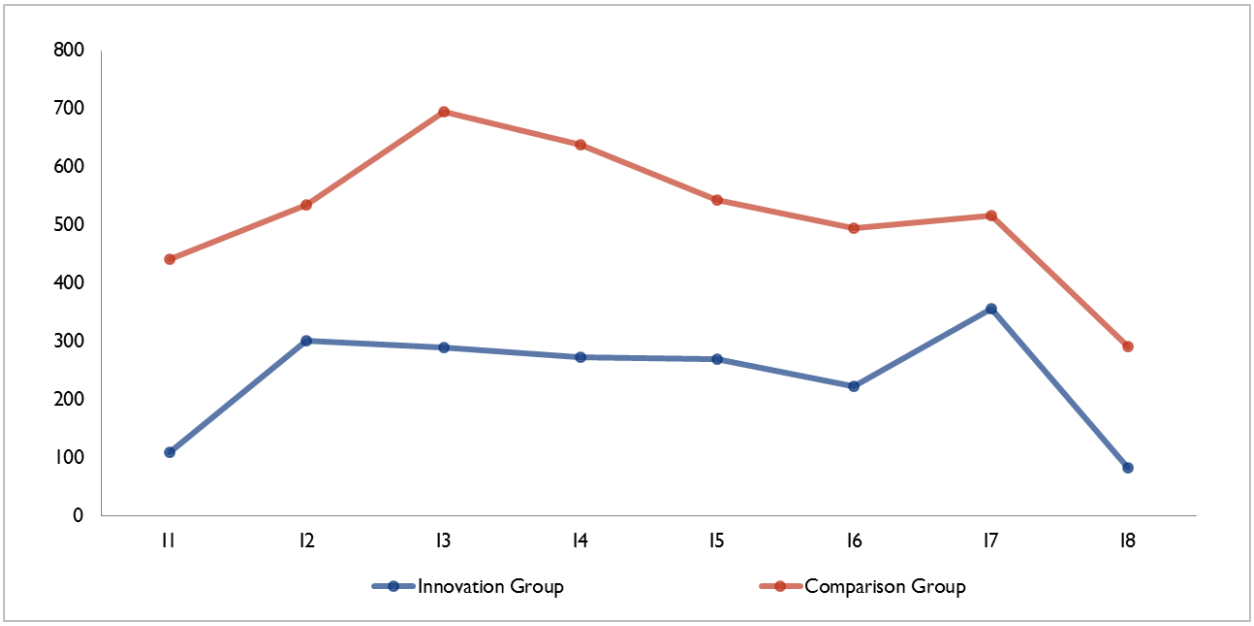
Notes:

- **Source**: RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity**: January 2011 to December 2014.

Terms and Definitions

- **ED rate**: (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- ED = emergency department; I1 = Innovation Q1; W&I = Women and Infants Hospital of Rhode Island.

Figure 7. ED Visits per 1,000 Medicaid Participants: W&I



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- ED = emergency department; W&I = Women and Infants Hospital of Rhode Island.

2.7.2 Regression Results

As shown in ***Table 12***, the average quarterly difference estimate for ED visits is a decrease of 334 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 (90% CI: −389, −279) and is consistent with the finding in the third annual report.

We also present quarterly effects derived from 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 statistically significant at the 10 percent level.

Table 12. Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicaid Participants: W&I

Quarter	Coefficient	Standard Error	P-Values
I1	−360	64	<0.001
I2	−260	83	0.002
I3	−414	92	<0.001
I4	−404	95	<0.001
I5	−300	93	0.001
I6	−325	96	0.001
I7	−191	105	0.070
I8	−239	77	0.002
Overall average	−334	33	<0.001
Overall aggregate	−406	40	<0.001
Overall aggregate (IY1)	−322	37	<0.001
Overall aggregate (IY2)	−83	16	<0.001

Notes:

- **Source:** RTI analysis of Rhode Island Medicaid fee-for-service and managed care claims.
- **Period of activity:** January 2011 to December 2014.

Terms and Definitions

- **The negative binomial count model regression coefficients** are the quarterly difference estimates. Besides the innovation quarters, the regression controls for the following variables: gender, race, gestational age, mother's age, birth weight, morbidity count, days in the NICU, whether the delivery was a Caesarean section, whether it was a multiple birth, and whether the infant was discharged on oxygen. 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 as compared to their comparison group.
- I = Innovation Quarter; IY = Innovation Year; W&I = Women and Infants Hospital of Rhode Island.

2.8 Discussion: Medicaid Results

This report describes findings drawn from claims-based measures for newborn and infant 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 lower spending in all innovation quarters. The overall estimate for the difference in quarterly spending is statistically significant, indicating significant savings from the innovation group in Medicaid spending. Overall, the regression results suggest that the innovation group has fewer hospital readmissions and ED visits than the comparison group. We also conducted a subgroup analysis that focuses on late preterm and full-term infants who had more than 34 weeks of gestation, and found 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 quarters of 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 Medicaid results are consistent with the innovation's theory of action. W&I deployed Family Resource Specialists to help the families of medically fragile high-risk preterm and full-term infants manage the transition out of the NICU and into infants' homes. Innovation staff refined protocols aiming to reduce readmissions and ED visits over the course of the implementation process. Based on the type and dose of services that patients typically received, and the results of an anonymous satisfaction survey administered to participating families, the innovation possibly resulted in reduced spending and utilization.

The results may not fully represent the overall population that the innovation served. 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 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 inpatient admissions.

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 statistically significant, indicating a reduction in Medicaid spending for the innovation participants.

Better care. Overall, the regression results for the Medicaid recipients indicate that the infants in the innovation group had significantly fewer hospital readmissions per 1,000 admissions per quarter (−76; 90% CI: −123, −29), and significantly fewer emergency department (ED) visits per 1,000 participants per quarter (−3334; 90% CI: −389, −279) than the comparison group.

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 Addendum 2017

Awardee-Level Findings:
YMCA of the USA

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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 interviews through the 15th or 16th and final 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 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 Addendum: Y-USA

Data Source	Period Covered
Awardee Narrative Progress Report	February 2013–Q16 (June 2016)
Quarterly Awardee Performance Report	February 2013–Q16 (June 2016)
Medicare	February 2013–June 2016
Awardee-specific data	February 2013–June 2016
Terms and Definitions • Q = quarter; Y-USA = YMCA of the USA,	

YMCA of the 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. Below, we present Y-USA's HCIA goals along with the associated findings:

1. **Smarter spending.**

   Goal: Reduce health care expenditures by $3.3 million by June 2015. This goal was revised from a previous target of $1.8 million.

   Findings: The Y-USA diabetes prevention model has resulted in significant reductions in Medicare spending ($246 per person per quarter across 3 years) relative to the comparison group. On average, over 3 years the strength of evidence in favor of savings is 77.4 percent. Savings are greater among program completers than among noncompleters.

2. **Better care.**

   Goal: 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.

   Findings: Innovation participants are significantly less likely to be hospitalized or have an ED visit during the innovation period. The innovation did not affect readmissions, likely because that outcome is relatively rare in this population. These reductions are highest in the first year of the innovation. Reductions in hospitalizations and ED visits are consistent with the program's goals of preventing diabetes and promoting weight loss.

   In total, Y-USA enrolled 6,947 participants in the program (i.e., completed at least 4 sessions), and nearly 90% of the enrolled participants completed at least nine sessions.

3. **Healthier people.**

   Goal: 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.

   Findings: The innovation has an impact on participants' weight loss. Each additional 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 (6.23%) than those who attended fewer than nine sessions. 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 cannot assess this goal, however, because 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 engaging individuals older than 65 years in an innovation to address prediabetes. Although the preexisting National DPP provided some organizational infrastructure for the innovation, the most significant challenges were finding the most efficient, effective ways to recruit a senior population. Staff reported one of their greatest achievements was creating effective marketing and enrollment procedures for older adults, partly through strong referral processes with primary care providers.

Y-USA was successful because participants completed the program. On average, recruited participants attended 14.4 sessions, compared to those enrolled who attended 16.1 sessions, and completers who attended 17.3 sessions. Retention is critical because the average effect of attending one additional session is a 0.42 percentage point increase in weight loss. Participants who attended nine or more sessions experienced a 6.15 percentage point average increase in weight loss compared to participants attending fewer than nine sessions.

A multicomponent program like the National DPP requires financial resources and staffing to ensure that the innovation maintains programmatic fidelity. Y-USA successfully obtained a CPT code that allows providers to bill for reimbursement for participation in the National 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 preventive services under the Medicare benefit will certainly add to the sustainability of the National DPP for the Y-USA sites. Finally, Y-USA's official contract with Aetna Health will allow program data to be part of the participant health records, enabling better care coordination for individuals and more efficient population health management overall.

2.1.1 Spending and Utilization Overview

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) 15–16 Narrative Progress Reports, Quarterly Awardee Performance Reports*, end-of-year interviews, and secondary data received through June 30, 2016.

Table 2. Summary of Updates as of Quarter 16, June 30, 2016: Y-USA[1]

Evaluation Domains and Subdomains	Updated Information as of Current Report (through 6/30/2016)
Innovation Components	No changes. Hired and trained lifestyle coaches to conduct diabetes prevention program (National DPP) for eligible participants.
Program Participant Characteristics	Enrollment ceased July 31, 2015. Therefore, no changes in demographic characteristics were found since those reported in the third annual report (https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf). 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 Q14 to Q16. Project ended with 6 staff.
Skills, knowledge, and training	As of Q16, innovation had a cumulative 4,382 trainees and 39,148 training hours.
Context	
Award execution	Expended 94.4% of budget by the end of Q16.
Leadership	Y-USA leadership remains committed to the innovation beyond the end of the grant period.
Organizational capacity	Used internal and external resources to develop capacity in reaching and engaging their target population
Innovation adoption and workflow integration	National DPP is integrated as part of Y-USA's broader strategic plan to address chronic diseases and promote healthy living.
Implementation Effectiveness	
Innovation reach	Y-USA stopped enrolling in July 2015. Therefore, reach did not change. A total of 7,832 participants were recruited (attended at least 1 session). The total enrolled number was 6,947 (88.7% of total recruited).
Innovation dose	Recruited participants attended an average 14.4 sessions, compared to those enrolled who attended an average 16.1 sessions, and completers who attended an average 17.3 sessions.
Sustainability	Focused on quality improvement by securing additional funding and engaging health care systems for reimbursement. Funding secured through the John A. Hartford Foundation to work on diabetes prevention and scaling through EMR integration, and the Robert Wood Johnson Foundation (RWJF) for a community health integration project. Successfully contracted with Aetna Health.
	In November 2016, HHS finalized the rule establishing the expansion of Medicare DPP. Beginning in January 2018, Medicare will provide reimbursement for eligible beneficiaries enrolling in the program.
	Continued work on the innovation based on completed sustainability plan that guides all activities.
	Completed community profiles for all 17 sites for scaling and replication.

[1] Press release. Medicare Diabetes Prevention Program (MDPP) Expanded Model. 2016, November: Centers for Medicare & Medicaid Services. https://www.cms.gov/newsroom/mediareleasedatabase/fact-sheets/2016-fact-sheets-items/2016-11-02-2.html

Notes:

- **Sources**: *Q15–Q16 Narrative Progress Report; Q15–Q16 Quarterly Awardee Performance Report*.
- **Patient-level data:** Provided to RTI.
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions

- DPP = Diabetes Prevention Program; EMR = electronic medical record; FTE = full-time equivalent; HHS = US Department of Health and Human Services; Y-USA = YMCA of the USA.

Table 3 summarizes findings based on Medicare claims collected during the innovation period. The weighted average quarterly saving differential over 3 years of the innovation period was $246 (90% CI: $136, $357) per member per quarter. This effect is statistically significant and translates into savings of $5,975,284 generated by the program over 3 years of the program. Savings were highest in the first year, and equal to $347 (90% CI: $228, $466) 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 8 fewer inpatient stays and 7 fewer ED visits per 1,000 participants per quarter. The impact on inpatient stays and ED visits was also highest in the first year (10 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. These results are consistent with the goals of the innovation: to help prevent participants from developing Type 2 diabetes, thereby reducing the need for treatment and associated spending.

Table 3. Summary of Medicare Claims-Based Findings: Y-USA (Full Sample)

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$5.975	−$8.663, −$3.288	−$8.069, −$3.882	−$4.554	−$6.122, −$2.987	−$1.486	−$2.853, −$0.118	$0.064	−$0.757, $0.886
Acute care inpatient stays	−183	−250, −115	−235, −130	−136	−182, −90	−21	−65, 22	−25	−50, −1
Hospital-wide all-cause unplanned readmissions	−6	−23, 12	−19, 8	—	—	—	—	—	—
ED visits not leading to a hospitalization	−166	−263, −69	−242, −91	−143	−211, −75	25	−34, 84	−48	−83, −14
Average change per quarter									
Spending per participant	−$246	−$357, −$136	−$333, −$160	−$347	−$466, −$228	−$175	−$337, −$14	$24	−$285, $334
Acute care inpatient stays (per 1,000 participants)	−8	−10, −5	−10, −5	−10	−14, −7	−3	−8, 3	−10	−19, 0
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−7	−30, 15	−25, 10	—	—	—	—	—	—
ED visits not leading to a hospitalization (per 1,000 participants)	−7	−11, −3	−10, −4	−11	−16, −6	3	−4, 3	−18	−31, −5

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** January 2011 to June 2016.
- **Sample size:** 3,317, unique Medicare fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Y-USA = YMCA of the USA.

Table 4 summarizes findings based on Medicare claims collected 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 slightly bigger savings compared to the full sample. The program for individuals who did not have diabetes-related claims generated $272 in savings (90% CI: $151, $392) per member per quarter. Inpatient stays and ED visits decreased over the entire innovation period by 7 and 6, respectively, per 1,000 participants per quarter. The innovation had no statistically significant effects on readmissions.

Table 4. Summary of Medicare Claims-Based Findings: Y-USA (No Diabetes Subsample Analysis)

Outcome	Total	90% CI	80% CI	Year 1	90% CI	Year 2	90% CI	Year 3	90% CI
Aggregated results									
Total spending (in millions)	−$4.456	−$6.431, −$2.481	−$5.994, −$2.918	−$3.189	−$4.257, −$2.120	−$1.229	−$2.317, −$0.141	−$0.038	−$0.658, $0.581
Acute care inpatient stays	−118	−170, −66	−159, −77	−69	−105, −33	−31	−65, 2	−18	−35, 0
Hospital-wide all-cause unplanned readmissions	−8	−20, 4	−18, 1	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization	−102	−176, −27	−160, −44	−87	−139, −35	16	−30, 61	−30	−57, −4
Average change per quarter									
Spending per participant	−$272	−$392, −$151	−$366, −$178	−$350	−$468, −$233	−$217	−$409, −$25	−$23	−$403, $356
Acute care inpatient stays (per 1,000 participants)	−7	−10, −4	−10, −5	−8	−11, −4	−6	−11, 0	−11	−22, 0
Hospital-wide all-cause unplanned readmissions (per 1,000 admissions)	−18	−45, 9	−39, 3	N/A	N/A	N/A	N/A	N/A	N/A
ED visits not leading to a hospitalization (per 1,000 participants)	−6	−11, −2	−10, −3	−10	−15, −4	3	−5, 3	−19	−35, −2

Notes:

- **Methodology:** Estimates are derived using a differences-in-differences methodology. Additional details are described in the chapter.
- **Period of activity:** January 2011 to June 2016.
- **Sample size:** 2,300, unique Medicaid fee-for-service beneficiaries with matched claims data included in the innovation group.
- **Disclaimer:** Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes only.

Terms and 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)** is 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 is 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)** is 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)** is 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 is 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; Y-USA = YMCA of the USA.

2.1.2 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. Y-USA's program expanded the National DPP from working and young adults to prediabetic Medicare beneficiaries. 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.

No changes were made to the innovation's components since their initial presentation in the 2014 annual report. 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.

2.1.3 Program Participant Characteristics

We last reported patient demographic characteristics in the third annual report.[1] No new patients have been enrolled since then, so the patient characteristics remain the same.

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.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table 5. Claims-Based Outcome Measures: Y-USA

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
	Spending	Spending per patient	Yes	N/A
		Estimated cost savings	Yes	N/A

Terms and Definitions

- Notes: We do not report Medicaid results in this report because no new Medicaid data are available for Y-USA during the reporting period. We refer readers to the third annual report for the evaluation of this innovation's impact on Medicaid beneficiaries.[2]
- ED = emergency department; N/A = not applicable; Y-USA = YMCA of the USA.

2.3 Medicare Comparison Group

We include patients in the claims analysis who were enrolled in the innovation prior to the end of the intervention, and we present Medicare claims data through June 30, 2016. This includes two additional quarters (Jan-June2016) of Medicare claims data than the third annual report. The Medicare claims analysis focuses on 3,317 YMCA Medicare beneficiaries enrolled in fee-for-service Medicare Parts A and B during the innovation period. This report includes the same comparison group as used in the third annual report. 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 same zip codes as the participating YMCAs as well as the zip codes of participants. See the third annual report for additional details.

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

2.4 Medicare Spending

2.4.1 Descriptive Results (Using the Full Innovation Sample)

Table 6 reports Medicare spending per patient in the eight quarters before and the 12 quarters after enrolling in the innovation. Compared with the third annual report, two individuals were eliminated due to an eligibility reclassification in the Master Beneficiary Summary File; the total sample is 3,317 individuals. Overall, we analyzed a maximum of 12 quarters, but we have added two more quarters of data for individuals who enrolled in years 2 and 3 of the innovation. Innovation quarters are numbered based on when a participant enrolls in the program. The enrollment quarter is I1, the quarter after enrollment is I2, and so on. Thus, only participants who enrolled early in the program are observed long enough to reach I12. Savings per patient reflect the spending differential between the matched comparison group and the innovation group, not controlling for other factors. ***Figure 1*** illustrates Medicare spending per beneficiary. 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. These trends are similar to the third annual report.

Table 6. 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	$1,714	$1,704	$1,609	$1,790	$1,404	$1,526	$1,564	$1,347	$1,285	$1,614	$1,584	$1,822	$2,021	$1,959	$2,123	$2,090	$2,291	$2,177	$2,499	$3,415
Std dev	$5,367	$5,504	$4,129	$5,408	$3,615	$4,235	$5,417	$3,474	$3,478	$7,051	$4,560	$5,554	$6,807	$5,213	$6,423	$6,027	$7,084	$5,162	$6,256	$10,868
Unique patients	2,651	2,748	2,834	2,922	3,038	3,139	3,235	3,317	3,317	3,302	3,274	3,231	3,007	2,474	1,615	1,373	1,090	736	490	337
Comparison Group																				
Spending rate	$1,667	$1,598	$1,620	$1,561	$1,511	$1,594	$1,730	$1,404	$1,840	$2,059	$1,956	$1,991	$2,203	$2,186	$2,132	$2,388	$2,280	$2,313	$2,634	$2,442
Std dev	$5,659	$4,807	$5,056	$4,598	$4,526	$4,696	$5,183	$4,143	$5,287	$6,210	$5,940	$6,582	$7,058	$6,497	$6,195	$7,944	$6,446	$7,501	$6,993	$7,579
Weighted patients	2,693	2,796	2,888	2,993	3,088	3,184	3,274	3,319	3,319	3,303	3,261	3,218	2,999	2,455	1,609	1,362	1,080	729	487	342
Savings per Patient																				
	−$47	−$106	$11	−$230	$106	$68	$166	$57	$556	$445	$372	$169	$181	$227	$9	$298	−$11	$136	$135	−$972

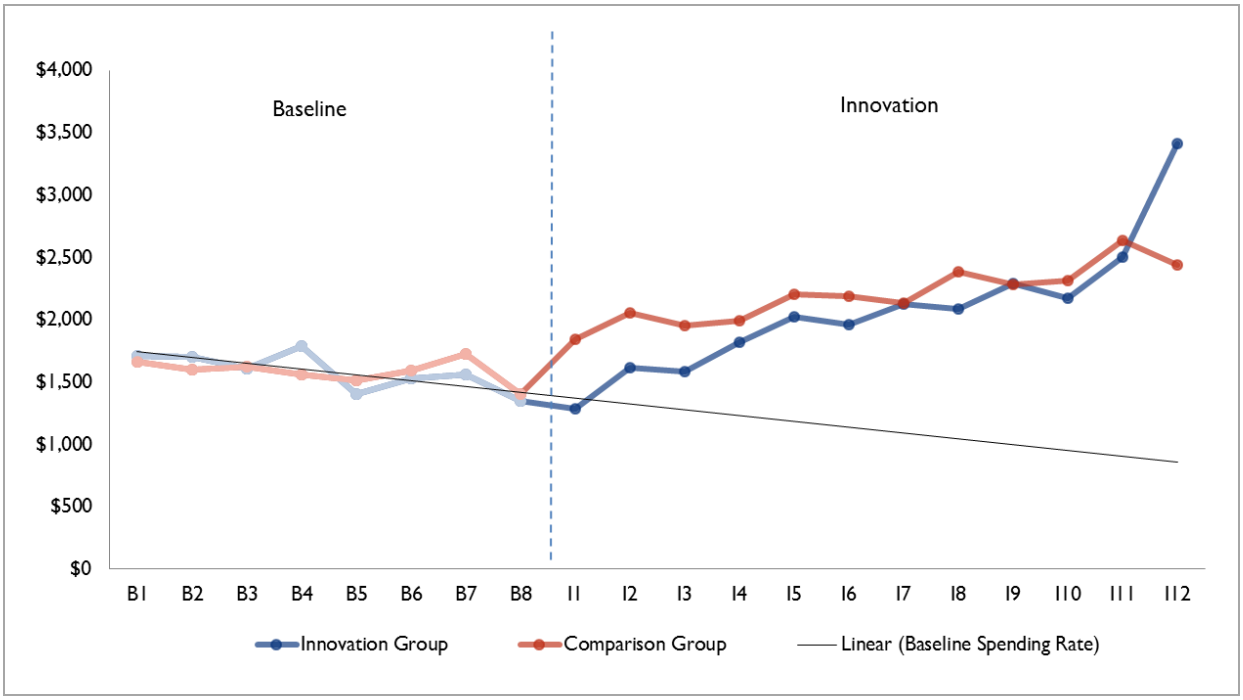
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 1. Medicare Spending per Participant: Y-USA (Full Sample)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.4.2 Descriptive Results (No-Diabetes Subsample Analysis)

In the subsample of individuals without a diabetes diagnosis, comparison group individuals have higher spending in the first four innovation quarters. ***Table 7*** reports Medicare spending per patient in the eight quarters before and the 12 quarters after enrolling in the innovation. ***Figure 2*** illustrates the Medicare spending per beneficiary in Table 9 for innovation and comparison group beneficiaries. This is similar to the finding in the third annual report.

Table 7. 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	$1,416	$1,450	$1,412	$1,655	$1,188	$1,372	$1,429	$1,215	$1,148	$1,396	$1,461	$1,620	$1,801	$1,752	$2,025	$2,048	$1,994	$1,932	$2,184	$3,122
Std dev	$4,886	$3,947	$3,919	$5,288	$2,860	$4,050	$5,923	$3,256	$2,597	$3,836	$3,862	$5,192	$6,779	$4,461	$6,420	$6,715	$6,760	$4,908	$5,772	$10,838
Unique patients	1,759	1,833	1,893	1,969	2,056	2,140	2,222	2,300	2,300	2,289	2,271	2,242	2,069	1,678	1,042	875	683	461	281	206
Comparison Group																				
Spending rate	$1,242	$1,402	$1,371	$1,315	$1,272	$1,355	$1,413	$1,218	$1,504	$1,733	$1,738	$1,884	$1,821	$2,156	$2,051	$2,190	$1,892	$2,069	$2,373	$2,388
Std dev	$3,835	$4,800	$4,489	$3,914	$3,985	$4,037	$4,386	$3,525	$4,822	$5,701	$5,511	$6,340	$5,646	$8,052	$6,957	$7,851	$5,636	$5,724	$8,332	$7,588
Unique patients	1,822	1,883	1,957	2,034	2,104	2,176	2,254	2,302	2,302	2,296	2,272	2,244	2,072	1,672	1,046	877	682	463	287	210
Savings per Patient																				
	−$174	−$48	−$41	−$340	$85	−$17	−$16	$3	$356	$337	$277	$264	$20	$404	$26	$142	−$102	$137	$188	−$734

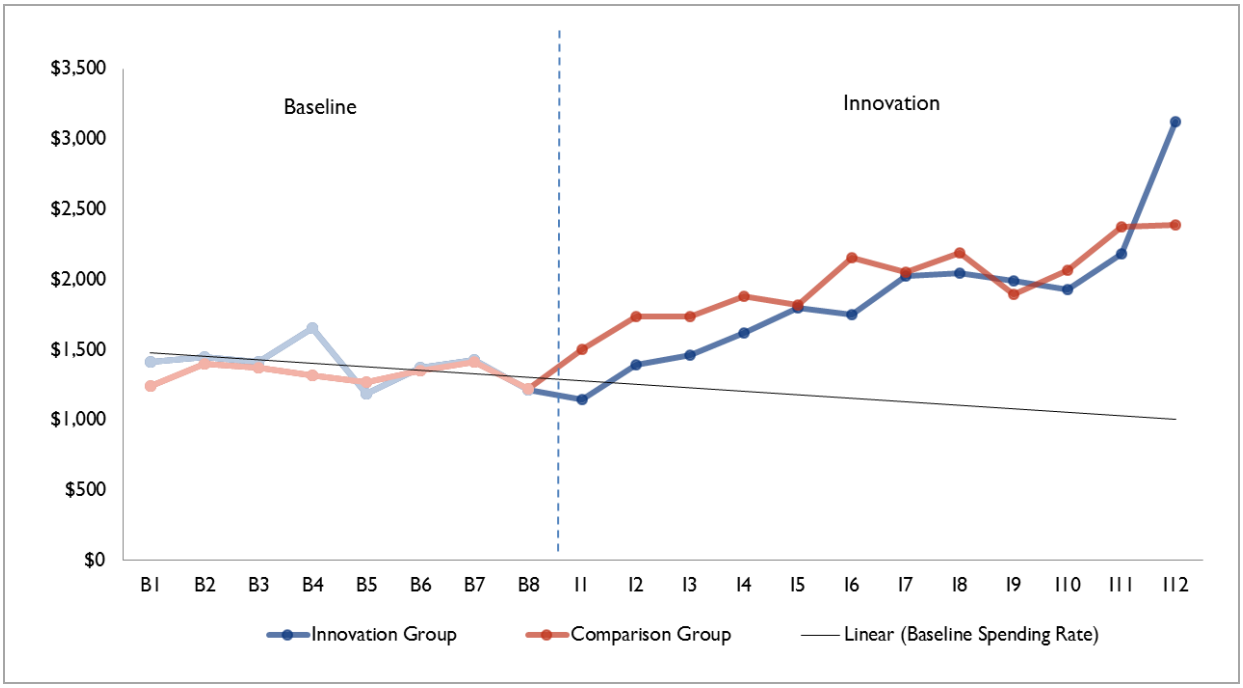
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 2. Medicare Spending per Participant: Y-USA (No-Diabetes Subsample Analysis)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.4.3 Regression Results

We present in ***Table 8*** 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 −$246 (90% CI: −$136, −$357). This effect is statistically significant and consistent with the findings in the third annual report. 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 quarterly effects. derived from 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. We found significant differences in per participant spending between the innovation and comparison groups in the first three innovation quarters. These savings became insignificant in subsequent quarters, except for the sixth quarter. The confidence intervals become wider in later innovation periods because fewer and fewer participants are in the data long enough to reach these periods. Only about 10 percent of the original participants are observed

through I12, and this may explain why the I12 coefficient has such a wide confidence interval. The quarterly savings estimates are largest during the periods when participants are enrolled in the 16 core sessions (I1 and the beginning of I2) and the 8 monthly maintenance periods (the rest of I2, I3, and I4).

Table 8. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
I1	−$513	$82	<.0001
I2	−$397	$139	0.004
I3	−$335	$102	0.001
I4	−$138	$118	0.244
I5	−$157	$146	0.283
I6	−$216	$129	0.092
I7	−$22	$181	0.902
I8	−$323	$202	0.109
I9	−$15	$238	0.949
I10	−$163	$244	0.503
I11	−$244	$332	0.462
I12	$949	$629	0.131
Overall average	−$246	$67	0.000
Overall aggregate	−$5,975,284	$1,633,699	0.000
Overall aggregate (IY1)	−$4,554,146	$952,844	<.0001
Overall aggregate (IY2)	−$1,485,522	$831,055	0.074
Overall aggregate (IY3)	$64,383	$499,380	0.897

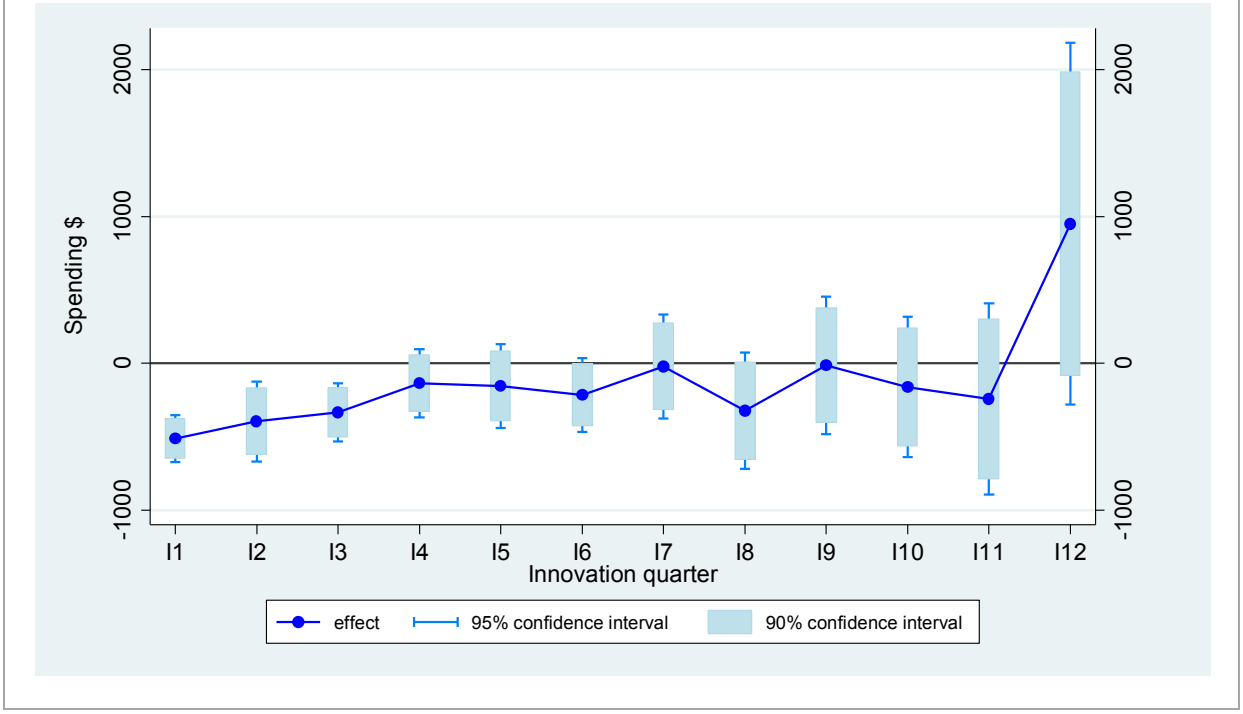
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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.
- **Average:** 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 3. Difference-In-Differences OLS Regression Estimates for Quarterly Medicare Spending per Participant: Y-USA (Full Sample)



Notes:

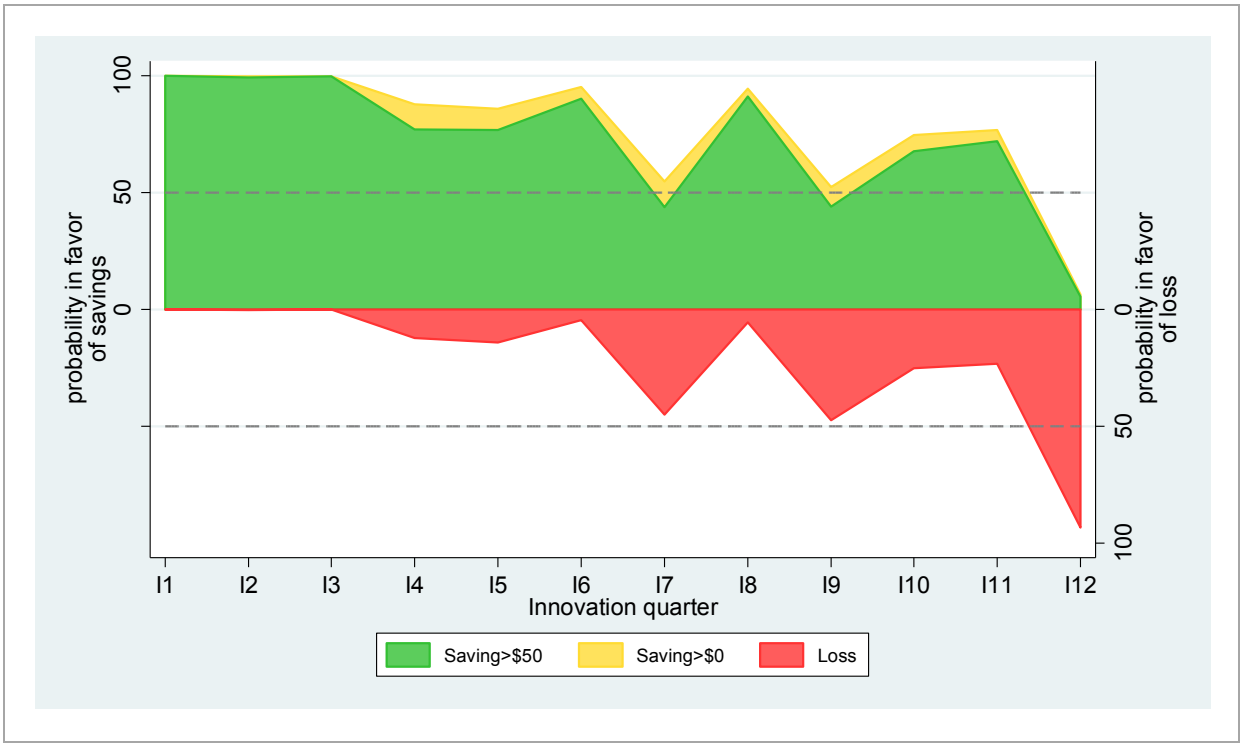
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- OLS = ordinary least squares; Y-USA = YMCA of the USA.

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 for saving or losing money on this initiative. Because the quarterly spending estimates were negative throughout 11 of 12 quarters, we observed a higher probability of savings throughout the 3 years of the innovation period, except for the last quarter. In two quarters (I7 and I9) only the probability of savings is nearly equivalent to the probability of losses. The average probability of savings over 3 years is 77.4 percent. The probability of savings during the first year is 98.7 percent.

Figure 4. Quarterly Strength of Evidence in Favor of Medicare Savings/Loss: Y-USA (Full Sample)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.4.4 Regression Results (No-Diabetes Subsample Analysis)

Table 9 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 5*** 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 −$272 (90% CI: −$151, −$392). This effect is statistically significant. This is consistent with the findings in the third annual report. 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 9. 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	−$391	$82	<.0001
I2	−$374	$107	0.001
I3	−$321	$106	0.003
I4	−$314	$135	0.020
I5	−$77	$167	0.645
I6	−$465	$157	0.003
I7	−$93	$231	0.686
I8	−$220	$268	0.412
I9	−$1	$280	0.997
I10	−$205	$272	0.451
I11	−$264	$433	0.542
I12	$638	$805	0.428
Overall average	−$272	$73	0.000
Overall aggregate	−$4,455,978	$1,200,394	0.000
Overall aggregate (IY1)	−$3,188,782	$649,477	<.0001
Overall aggregate (IY2)	−$1,229,123	$661,210	0.063
Overall aggregate (IY3)	−$38,073	$376,565	0.920

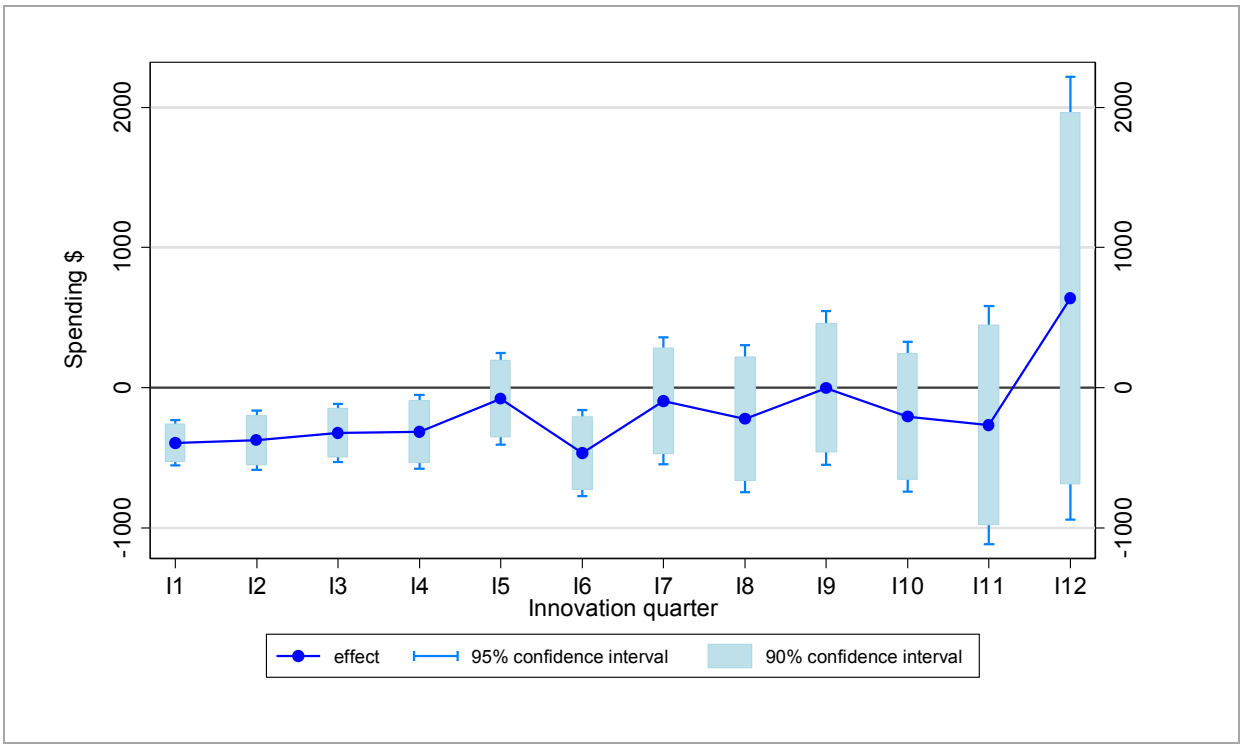
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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.
- **Average:** 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 (No-Diabetes Subsample Analysis)



Notes:

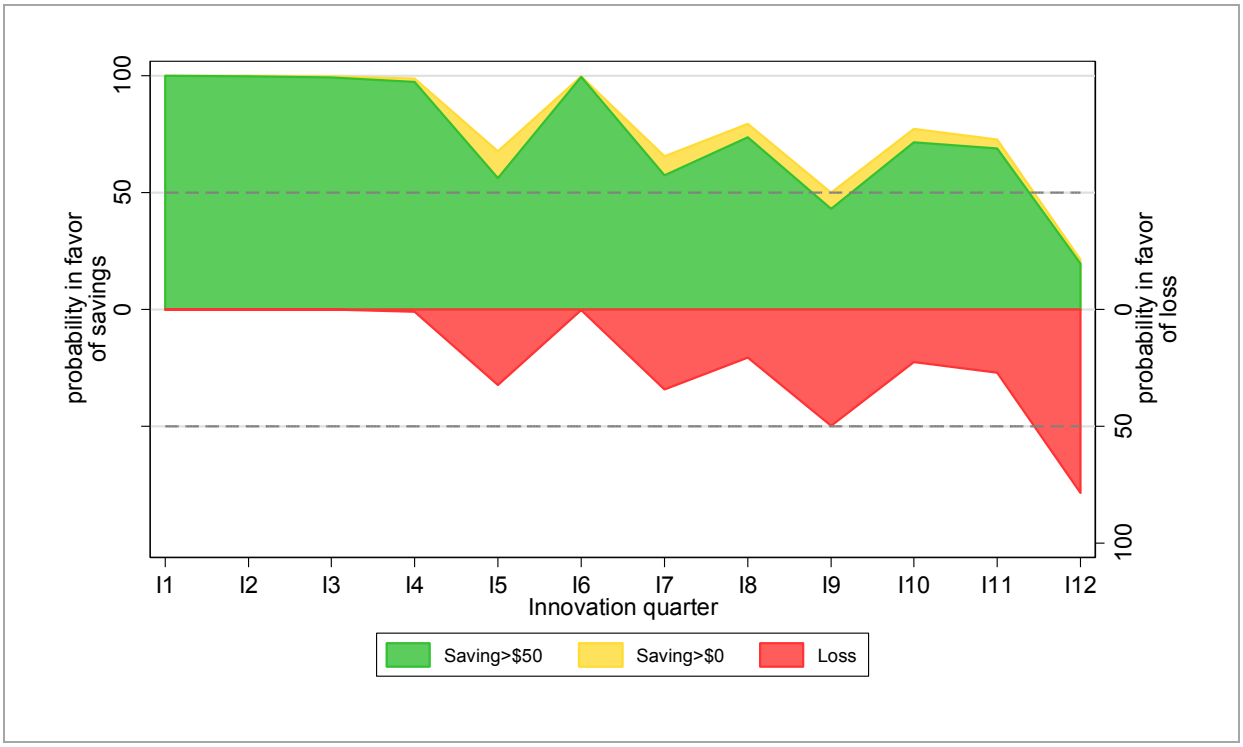
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

Figure 6 shows that the strength of evidence shows savings for the first 2 years of the innovation. Thereafter, the innovation shown no impact on savings. Across 10 of 12 quarters, the probability of savings is higher than 50 percent. In one quarter (I9) the probability of savings equals the probability of losses, and in the final quarter the probability of a loss is marginally higher than the probability in favor of savings. The average probability of savings over 3 years is 77.8 percent. The probability of savings during the first year is 99.7 percent.

Figure 6. Quarterly Strength of Evidence in Favor of Savings/Loss: Y-USA (No-Diabetes Subsample Analysis)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.5 Medicare Inpatient Admissions

2.5.1 Descriptive Results (Using the Full Innovation Sample)

All-cause inpatient admissions rates per 1,000 participants are shown in ***Table 10*** and ***Figure 7***. The comparison group has slightly higher inpatient admission rates than the innovation group in several baseline quarters; this difference widens during all but one innovation quarter. These trends are similar to the third annual report.

Table 10. All-Cause Inpatient Admissions Rate per 1,000 Medicare 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**
Innovation Group																				
Admit rate	39	34	34	40	28	29	32	20	20	29	31	38	45	46	43	40	44	46	41	59
Std dev	224	196	192	220	174	176	202	157	150	181	185	216	241	259	224	221	238	234	208	260
Unique patients	2,651	2,748	2,834	2,922	3,038	3,139	3,235	3,317	3,317	3,302	3,274	3,231	3,007	2,474	1,615	1,373	1,090	736	490	337
Comparison Group																				
Admit rate	43	38	38	37	34	39	41	22	48	51	45	46	54	52	51	57	56	63	73	58
Std dev	224	212	223	217	212	220	222	164	244	263	240	255	281	273	265	272	263	315	338	296
Weighted patients	2,693	2,796	2,888	2,993	3,088	3,184	3,274	3,319	3,319	3,303	3,261	3,218	2,999	2,455	1,609	1,362	1,080	729	487	342
Innovation − Comparison Rate																				
	−4	−4	−4	3	−7	−10	−9	−2	−28	−22	−13	−8	−10	−6	−8	−17	−12	−17	−32	1

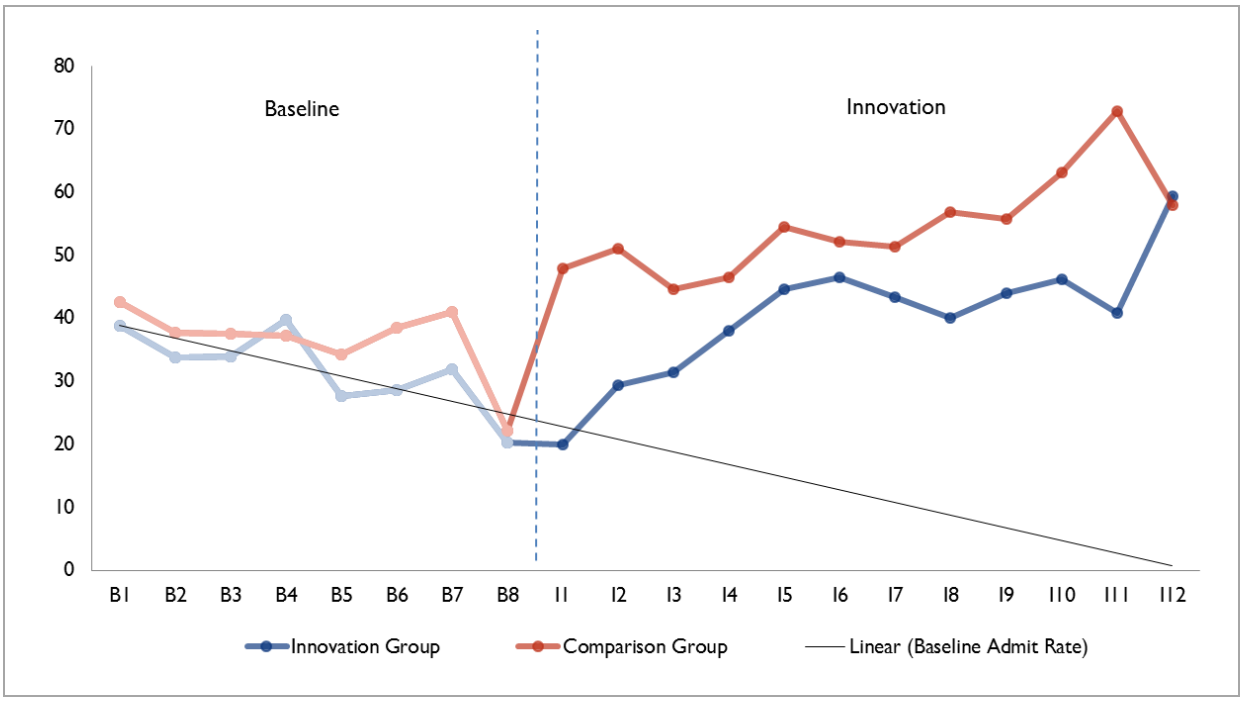
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 7. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Y-USA (Full Sample)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- 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 innovation and comparison groups are shown in ***Table 11*** and ***Figure 8***. 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. This is consistent with the trend observed in the third annual report.

Table 11. All-Cause Inpatient Admissions Rate per 1,000 Medicare 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**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**	**I11**	**I12**
Innovation Group																				
Admit rate	31	26	32	37	23	25	26	15	17	26	30	33	39	35	42	38	35	39	32	58
Std dev	200	166	188	213	153	171	189	133	137	168	184	194	220	198	219	224	214	215	195	254
Unique patients	1,759	1,833	1,893	1,969	2,056	2,140	2,222	2,300	2,300	2,289	2,271	2,242	2,069	1,678	1,042	875	683	461	281	206
Comparison Group																				
Admit rate	29	30	33	29	33	26	30	16	30	37	36	44	42	48	45	50	41	47	59	62
Std dev	183	192	205	192	206	171	195	129	191	222	216	247	239	264	248	265	229	260	293	272
Weighted patients	1,822	1,883	1,957	2,034	2,104	2,176	2,254	2,302	2,302	2,296	2,272	2,244	2,072	1,672	1,046	877	682	463	287	210
Innovation − Comparison Rate																				
	2	−4	0	8	−10	−1	−4	−1	−13	−10	−6	−12	−3	−13	−2	−13	−6	−8	−27	−4

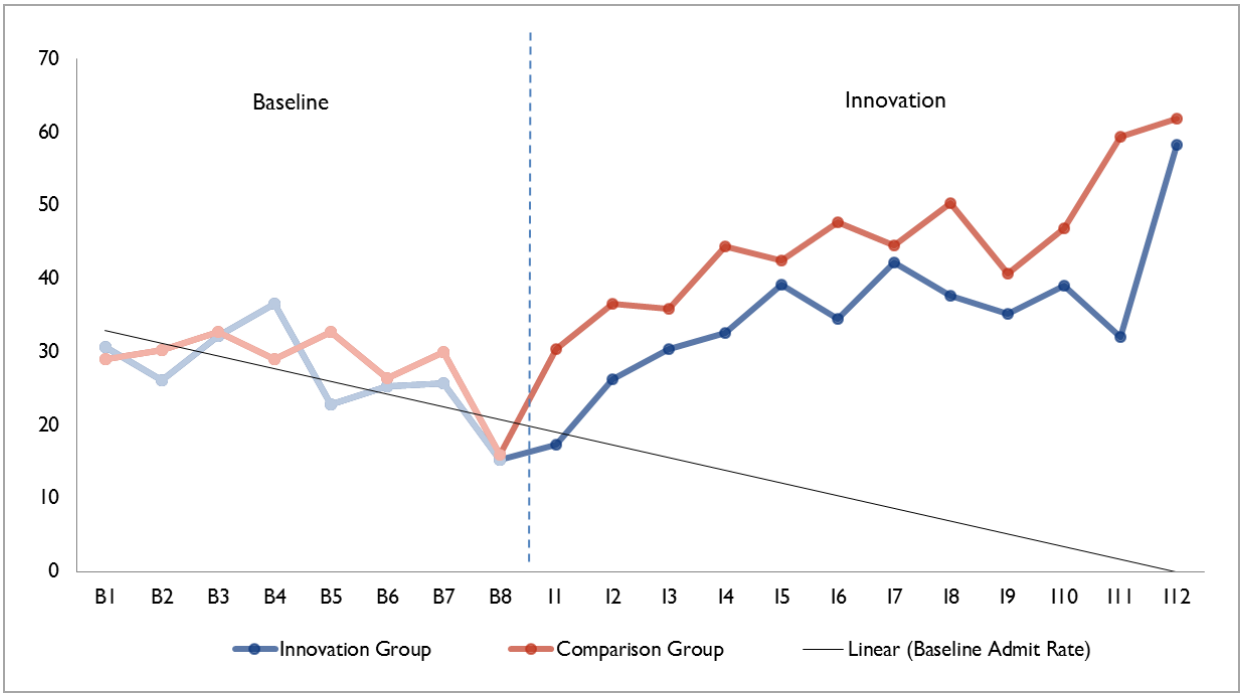
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Admit rate:** (Total quarterly 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. Negative value indicates fewer admissions while a positive value indicates more admissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 8. All-Cause Inpatient Admissions Rate per 1,000 Medicare Participants: Y-USA (No-Diabetes Subsample Analysis)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.5.3 *Regression Results*

As shown in ***Table 12,*** the average quarterly difference-in-differences estimate for inpatient admissions is a decrease of 8 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: −5, −10). This is consistent with the findings in the third annual report.

We also present quarterly effects 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. Statistically significant differences in hospital admissions between the innovation and the comparison groups occur only in three innovation quarters; two occur immediately after patients enrolled in the program.

Table 12. Difference-In-Differences Negative Binomial Count Model Regression Estimates for Inpatient Hospital Admission per 1,000 Medicare Participants: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
I1	−21	4	0.000
I2	−13	4	0.003
I3	−6	4	0.147
I4	−1	5	0.859
I5	−2	5	0.748
I6	1	6	0.886
I7	−2	7	0.711
I8	−10	7	0.161
I9	−6	9	0.521
I10	−7	10	0.527
I11	−35	14	0.011
I12	7	16	0.651
Overall average	−8	2	0.000
Overall aggregate	−183	41	0.000
Overall aggregate (IY1)	−136	28	0.000
Overall aggregate (IY2)	−21	27	0.423
Overall aggregate (IY3)	−25	15	0.088

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Y-USA = YMCA of the USA.

2.5.4 Regression Results (No-Diabetes Subsample Analysis)

Table 13 represents the difference-in-differences inpatient admissions per 1,000 participants without diabetes. The average quarterly difference-in-differences estimate is −7 inpatient admissions per 1,000 and is lower during the 3 years following participation in the program. This finding is statistically significant. This is consistent with the findings in the third annual report.

Table 13. 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	0.005
I2	−8	5	0.090
I3	−3	5	0.539
I4	−8	5	0.136
I5	−1	6	0.815
I6	−10	6	0.113
I7	−2	8	0.850
I8	−11	9	0.232
I9	−7	10	0.500
I10	−5	12	0.672
I11	−33	16	0.037
I12	−7	20	0.711
Overall average	−7	2	0.000
Overall aggregate	−118	32	0.000
Overall aggregate (IY1)	−69	22	0.002
Overall aggregate (IY2)	−31	20	0.123
Overall aggregate (IY3)	−18	11	0.098

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Y-USA = YMCA of the USA.

2.6 Medicare Unplanned Readmissions

2.6.1 Descriptive Results (Using the Full Innovation Sample)

Hospital unplanned readmissions rates per 1,000 admissions are shown in ***Table 14*** and ***Figure 9***. Index admissions are low in this population; consequently, the unplanned readmissions rate is highly variable for both innovation and comparison groups. This is consistent with the variability in the third annual report.

Table 14. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: 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																				
Readmit rate	42	35	11	47	13	24	21	33	0	34	21	27	80	63	48	21	57	40	0	0
Std dev	200	184	105	211	115	153	144	180	0	182	143	162	271	242	215	144	232	196	0	0
Total admissions	96	86	89	107	75	83	94	60	62	88	96	111	113	96	62	47	35	25	14	14
Comparison Group																				
Readmit rate	23	40	49	35	36	52	39	59	30	58	54	74	78	55	78	55	92	91	69	140
Std dev	150	195	217	183	187	223	194	236	171	235	227	262	269	229	269	229	288	288	253	347
Total admissions	102	92	94	96	92	108	120	67	144	148	123	128	132	96	68	66	51	37	29	14
Innovation − Comparison Rate																				
	19	−5	−38	12	−23	−28	−18	−26	−30	−24	−33	−47	1	7	−30	−34	−34	−51	−69	−140

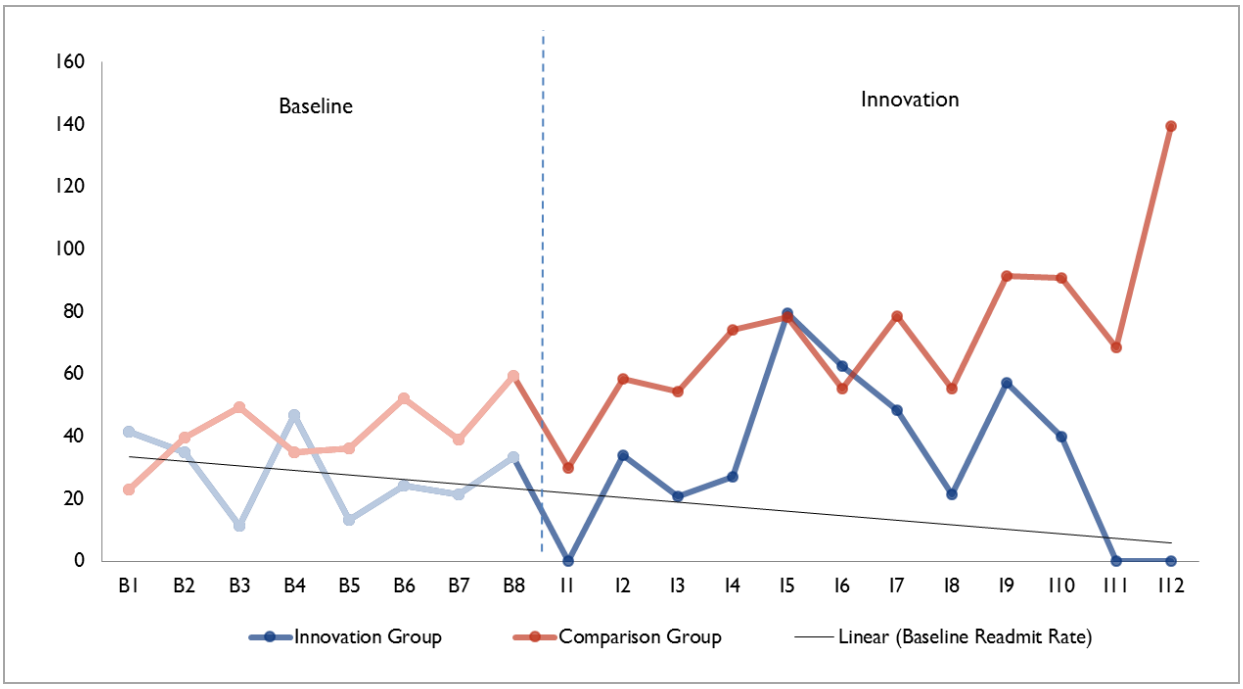
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 9. Hospital Unplanned Readmissions Rates per 1,000 Medicare Admissions: Y-USA (Full Sample)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- 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 15*** and ***Figure 10.*** This is consistent with the variability in the third annual report.

Table 15. 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	45	24	41	19	30	26	18	16	30	70	0	0	40	0	0	0	0
Std dev	196	0	131	207	153	198	137	171	160	131	124	170	256	0	0	196	0	0	0	0
Total admissions	50	47	57	67	42	49	52	33	38	57	64	67	71	47	38	25	18	11	7	10
Comparison Group																				
Readmit rate	30	52	36	18	59	25	44	10	26	43	38	90	55	37	26	38	16	96	71	40
Std dev	171	223	185	134	237	158	205	98	160	202	191	286	228	189	158	191	125	295	258	196
Total admissions	44	51	56	55	62	52	61	34	64	78	70	89	73	63	39	35	21	17	14	8
Innovation – Comparison Rate																				
	10	−52	−18	26	−36	15	−24	21	0	−25	−22	−60	15	−37	−26	2	−16	−96	−71	−40

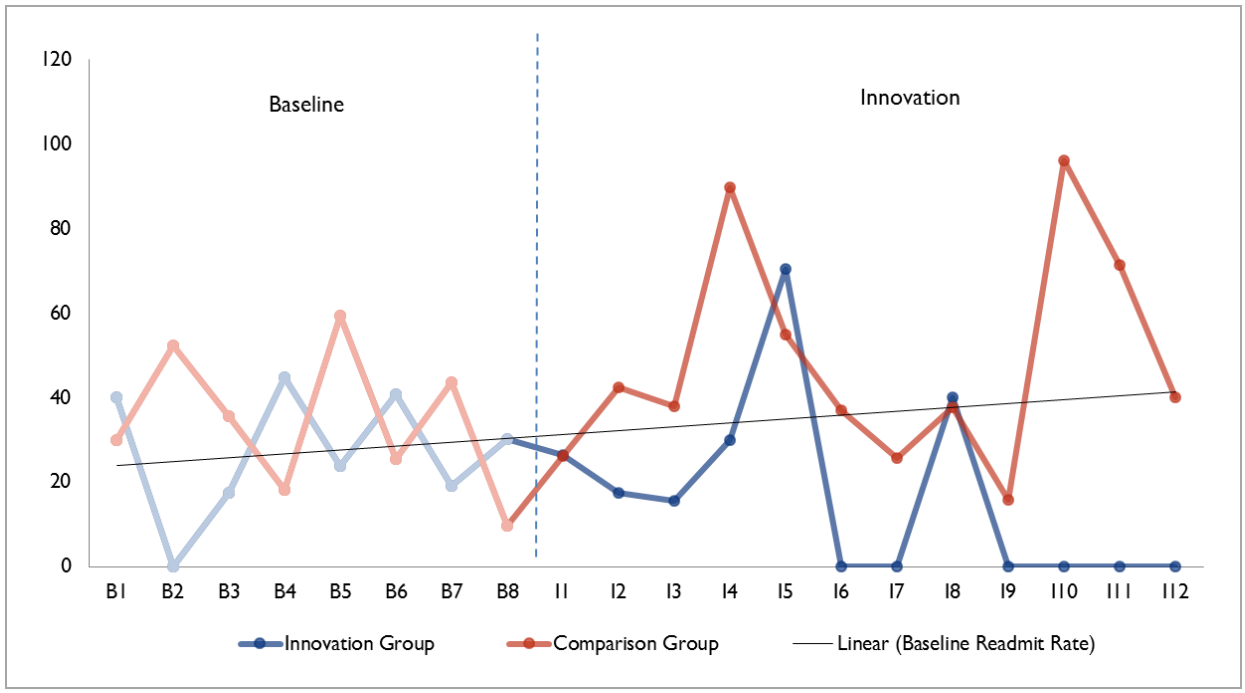
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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. Negative value indicates fewer readmissions while a positive value indicates more readmissions.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 10. Hospital Unplanned Readmissions Rates per 1,000 Admissions: Y-USA (No-Diabetes Subsample Analysis)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.6.3 Regression Results (Using the Full Innovation Sample)

Table 16 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 lower for the innovation group 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: −30, 15). These results are consistent with the findings in the third annual report.

Table 16. Difference-In-Differences Logistic Regression Estimates for Hospital Unplanned Readmission per 1,000 Medicare Admissions: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
Overall average	−9	14	0.590
Overall aggregate	−6	11	0.590

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- **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. **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- 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 −18 per 1,000 inpatient admissions, indicating that the innovation-comparison difference is lower in the innovation group during the innovation period (see ***Table 17***). The effect is still not statistically significant (90% CI: −45; 9). These results are consistent with the findings in the third annual report.

Table 17. 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	−18	16	0.274
Overall aggregate	−8	7	0.274

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- **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. **Overall average:** The weighted average treatment effect per quarter during the innovation period for beneficiaries enrolled in the innovation as compared to their matched comparison group.
- Y-USA = YMCA of the USA

2.7 Medicare Emergency Department Visits

2.7.1 Descriptive Results (Using the Full Innovation Sample)

ED visits per 1,000 participants are shown in ***Table 18*** and ***Figure 11.*** Throughout the baseline period, the ED visit rate is similar in the innovation and comparison groups. In the first four innovation periods, the ED visit rate is higher in the comparison group than in the innovation group. This trend is consistent with the findings in the third annual report.

Table 18. ED Visits per 1,000 Medicare 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**
Innovation Group																				
ED rate	65	64	65	67	62	68	65	64	60	69	66	68	77	87	75	94	75	88	90	86
Std dev	292	312	279	294	284	306	288	312	279	301	272	295	305	321	319	361	332	349	326	417
Unique patients	2,651	2,748	2,834	2,922	3,038	3,139	3,235	3,317	3,317	3,302	3,274	3,231	3,007	2,474	1,615	1,373	1,090	736	490	337
Comparison Group																				
ED rate	67	67	64	68	64	67	73	65	77	84	77	84	72	82	85	91	98	83	112	95
Std dev	177	185	170	174	167	172	183	174	198	198	195	211	179	197	244	207	220	192	259	200
Weighted patients	2,693	2,796	2,888	2,993	3,088	3,184	3,274	3,319	3,319	3,303	3,261	3,218	2,999	2,455	1,609	1,362	1,080	729	487	342
Innovation − Comparison Rate																				
	−2	−3	0	−1	−2	0	−8	−1	−18	−14	−11	−16	5	5	−10	3	−23	5	−22	−9

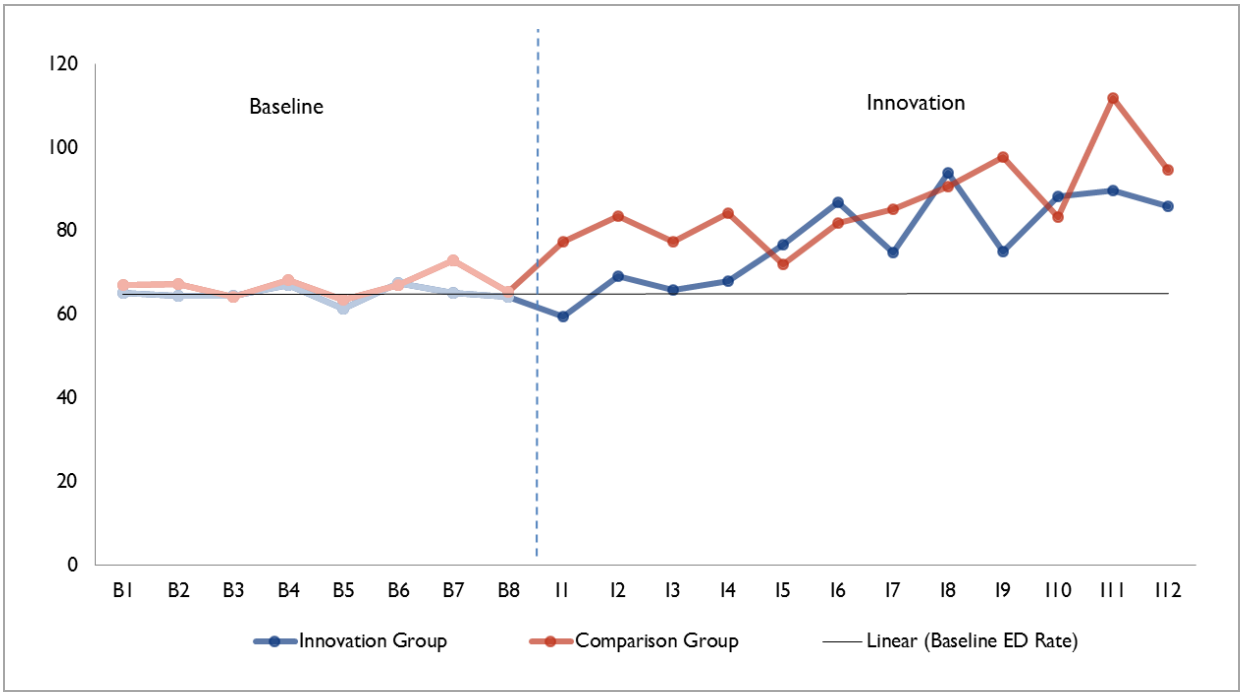
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 11. ED Visits per 1,000 Medicare Participants: Y-USA (Full Sample)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- 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 19*** and ***Figure 12.*** Throughout the baseline and innovation periods, the ED visit rate varies among the innovation and comparison groups. The ED rate is higher among the innovation group in quarters 1 and 9, and the ED rate is higher among the comparison group in innovation quarters 8 and 12. Throughout all other quarters, the ED visit rate is similar in the innovation and comparison groups. This is consistent with the findings in the third annual report.

Table 19. ED Visits per 1,000 Medicare 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**	**I5**	**I6**	**I7**	**I8**	**I9**	**I10**	**I11**	**I12**
Innovation Group																				
ED rate	57	53	60	62	53	62	57	51	50	64	54	61	68	78	71	87	60	85	57	102
Std dev	270	250	275	293	243	270	273	235	244	290	243	286	283	308	317	357	322	354	274	478
Unique patients	1,759	1,833	1,893	1,969	2,056	2,140	2,222	2,300	2,300	2,289	2,271	2,242	2,069	1,678	1,042	875	683	461	281	206
Comparison Group																				
ED rate	51	57	52	55	47	50	63	54	68	65	64	61	65	65	71	69	82	77	73	79
Std dev	149	149	150	153	134	144	167	161	185	171	168	162	164	176	181	180	200	190	177	187
Weighted patients	1,822	1,883	1,957	2,034	2,104	2,176	2,254	2,302	2,302	2,296	2,272	2,244	2,072	1,672	1,046	877	682	463	287	210
Innovation − Comparison Rate																				
	6	−3	8	7	6	11	−6	−3	−18	−1	−10	0	3	13	0	18	−22	8	−16	23

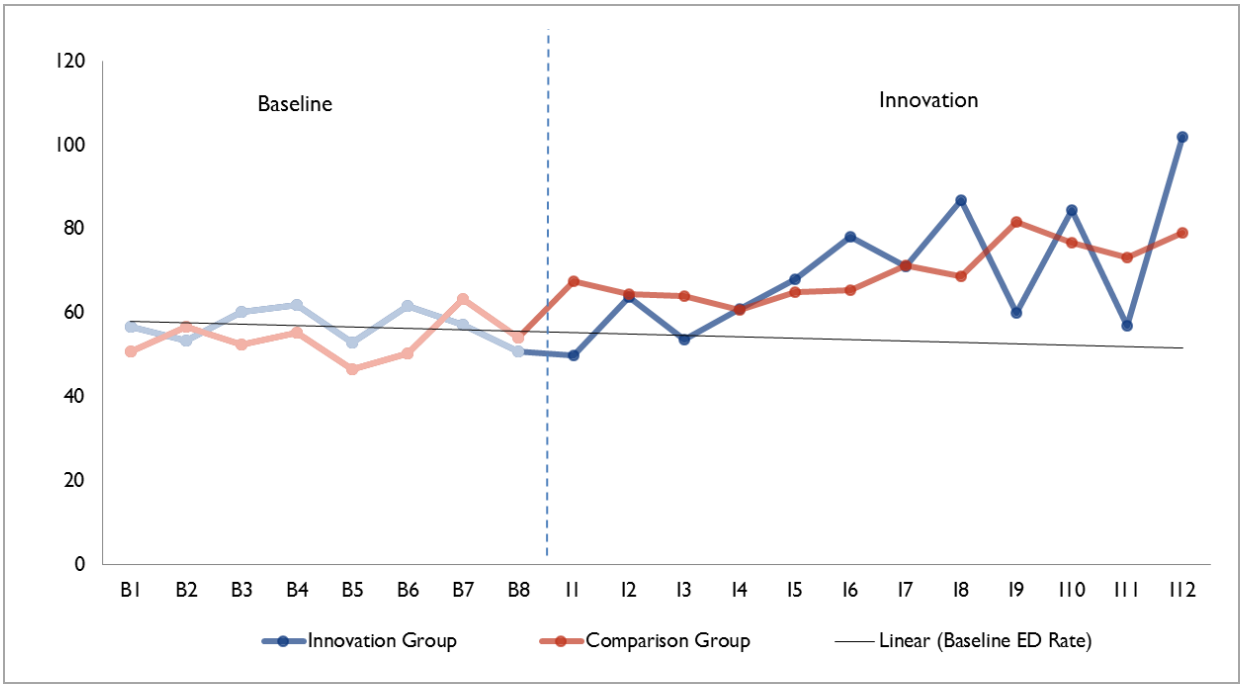
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **ED rate:** (Total quarterly 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. Negative value indicates fewer ED visits while a positive value indicates more ED visits.
- B1 = Baseline Q1; ED – emergency department; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 12. ED Visits per 1,000 Medicare Participants: Y-USA (No-Diabetes Subsample Analysis)



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- ED = emergency department; Y-USA = YMCA of the USA.

2.7.3 Regression Results

As shown in ***Table 20***, the average quarterly difference-in-differences estimate for ED visits is a decrease 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, −11). This is consistent with the finding in the third annual report.

We also present quarterly effects 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 impact is both significant and greatest during the first year of the innovation. Quarters 9 and 11 are also significant at the 10% level.

Table 20. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Y-USA (Full Sample)

Quarter	Coefficient	Standard Error	P-Values
I1	−14	6	0.023
I2	−10	6	0.138
I3	−8	6	0.197
I4	−12	7	0.067
I5	8	7	0.233
I6	6	8	0.463
I7	−10	10	0.320
I8	2	11	0.874
I9	−24	11	0.034
I10	2	15	0.867
I11	−37	20	0.067
I12	−16	25	0.534
Overall average	−7	2	0.005
Overall aggregate	−166	59	0.005
Overall aggregate (IY1)	−143	42	0.001
Overall aggregate (IY2)	25	36	0.488
Overall aggregate (IY3)	−48	21	0.022

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Y-USA = YMCA of the USA.

2.7.4 Regression Results (No-Diabetes Subsample Analysis)

Table 21 presents results for the subsample of individuals without diabetes. Participants in the innovation had on average 6 fewer ED visits per 1,000 than the comparison group. This effect is statistically significant (90% CI: −2, −11). This is consistent with the findings in the third annual report.

Table 21. Difference-In-Differences Negative Binomial Count Model Regression Estimates for ED Visit per 1,000 Medicare Participants: Y-USA (Subsample Analysis)

Quarter	Coefficient	Standard Error	P-Values
I1	−20	7	0.003
I2	−3	7	0.695
I3	−13	7	0.052
I4	−2	7	0.759
I5	0	8	0.978
I6	8	9	0.352
I7	−6	12	0.589
I8	10	13	0.456
I9	−34	14	0.017
I10	1	19	0.975
I11	−32	20	0.111
I12	9	37	0.815
Overall average	−6	3	0.024
Overall aggregate	−102	45	0.024
Overall aggregate (IY1)	−87	32	0.006
Overall aggregate (IY2)	16	28	0.571
Overall aggregate (IY3)	−30	16	0.061

Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **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.
- **Overall average:** 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; Y-USA = YMCA of the USA.

2.8 Differences in Spending by Innovation Dose

Dose is defined as the number of National DPP sessions completed during the program. This section examines whether 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,[3] 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.

[3] 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

All participants are in the sample for at least a year after beginning the innovation. Of the 3,317 individuals analyzed in the regressions, 2,653 completed the program (80%).

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 such as the National DPP.

Table 22 shows summary statistics to illustrate the differences in mean spending per quarter for completers and noncompleters. ***Figure 13*** illustrates these data. 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 is 25% larger after the innovation begins. In the post innovation period, medical spending is lower for individuals that complete the program compared to those who did not complete the program. This difference in mean spending between groups was statistically significant in five out of 12 innovation quarters (calculations not shown). This is consistent with the findings in the third annual report, except for later quarters for which we have more data.

Table 22. Medicare Spending per Patient for Completers and Noncompleters: Y-USA

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
Completers																				
Spending rate	$1,594	$1,641	$1,522	$1,613	$1,366	$1,432	$1,519	$1,233	$1,122	$1,469	$1,437	$1,768	$1,925	$1,878	$2,035	$2,123	$2,142	$1,991	$1,979	$2,296
Std dev	$4,751	$4,818	$4,070	$4,884	$3,644	$3,891	$5,753	$3,216	$2,521	$7,360	$4,093	$5,619	$6,484	$5,240	$6,233	$6,404	$6,603	$4,631	$5,132	$6,452
Unique patients	2,119	2,196	2,264	2,337	2,427	2,506	2,587	2,653	2,653	2,642	2,621	2,589	2,401	1,983	1,309	1,123	885	592	399	273
Noncompleters																				
Spending rate	$2,188	$1,956	$1,957	$2,500	$1,557	$1,898	$1,743	$1,800	$1,933	$2,196	$2,174	$2,040	$2,402	$2,290	$2,498	$1,940	$2,931	$2,983	$4,784	$8,253
Std dev	$7,302	$7,643	$4,337	$7,082	$3,495	$5,369	$3,786	$4,325	$5,874	$5,612	$6,045	$5,276	$7,950	$5,096	$7,166	$3,907	$8,839	$7,008	$9,426	$20,407
Unique patients	532	552	570	585	611	633	648	664	664	660	653	642	606	491	306	250	205	144	91	64
Difference																				
	$594	$315	$435	$887	$191	$466	$223	$567	$810	$727	$737	$272	$477	$411	$463	-$183	$788	$992	$2,806	$5,957

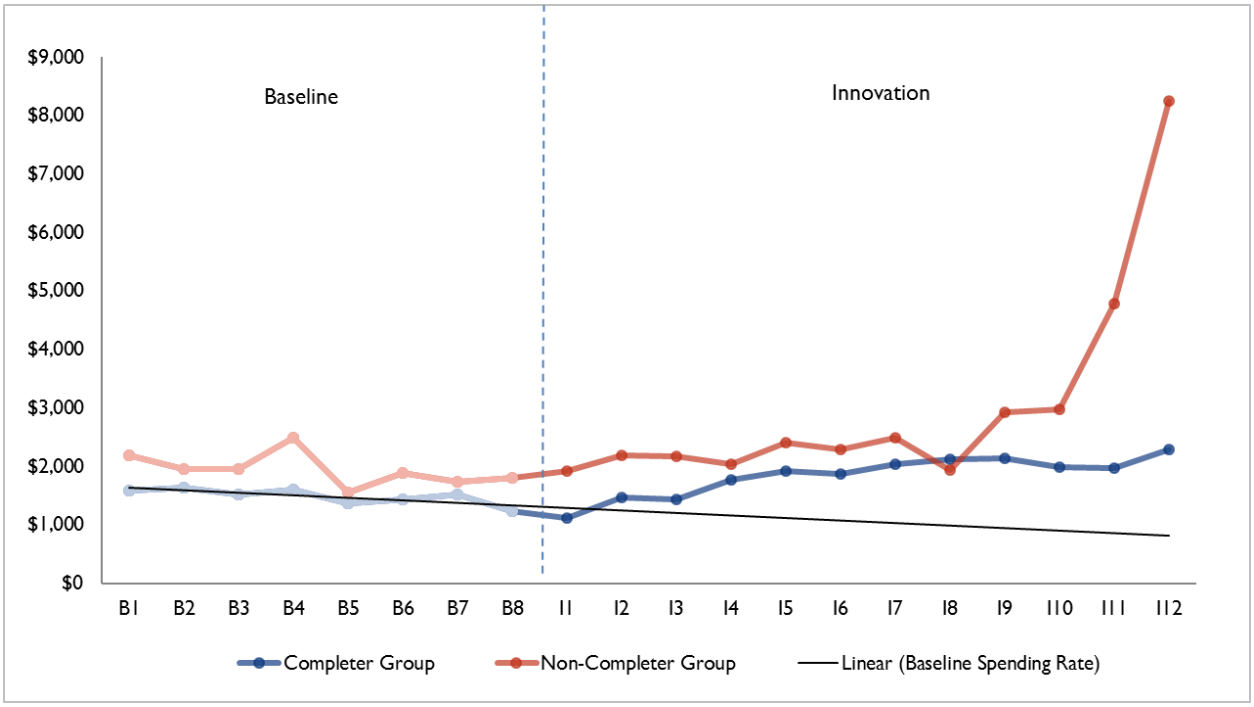
Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- **Spending rate:** Total quarterly 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. Positive values indicate savings and negative values indicate increased spending.
- B1 = Baseline Q1; I1 = Innovation Q1; Y-USA = YMCA of the USA.

Figure 13. Medicare Spending per Patient for Completers and Noncompleters: Y-USA



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.9 Discussion: Medicare Results

Results are similar to those reported in the third annual report. The weighted average quarterly spending results are slightly lower, as expected, because more data are available from quarters in years 2 and 3, when the savings are smaller. The analysis now includes individuals with at least a full year of innovation data. The significant average quarterly reduction in spending for the full sample ($246) is lower than the average quarterly savings we reported in the 2015 annual report ($278), but is still statistically significant. 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 typically occurs during the first 3 to 6 months in weight loss programs. Cost savings may also occur initially due to a reduction in outpatient spending and/or an increase in participants' physical activity. The overall first year savings per member per quarter equals $347 (in the third annual report these were $364). We found marginally greater savings for the subset of healthier people without a diabetes diagnosis than for the full innovation group. For healthier people, the model generated $272 in savings per member per quarter for the entire innovation period and $350 for the first year.

The Medicare results are consistent with the innovation's theory of change, because the goals of the program are to promote weight loss and prevent diabetes and, in turn, reduce spending through

reduced utilization. The prevention of diabetes is a longer-term goal that cannot be examined in this report. To this end, Y-USA's lifestyle coaches hosted sessions to help participants lose weight and increase their physical activity. Results show that cost savings were greater among participants who completed the program (i.e., attended more sessions) than among participants who did not. Based on the evidence supporting the National DPP program and findings reported here, the program likely resulted in overall savings.

The results may not, however, 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 approximately 40 percent of the overall population reached by the innovation. A large share of participants in this sample were enrolled in Medicare managed care programs for which we had no claims data available. In addition, 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.

2.10 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 questions. ***Table 23*** lists the awardee-specific outcome measures selected for the innovation's evaluation with an indication of the status of the data requested.

Table 23. Awardee-Specific Outcome Measures: Y-USA

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

Notes:
- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- BMI = body mass index; HbA1c = glycated hemoglobin; Y-USA = YMCA of the USA.

The subsections below describe the results of each of the clinical effectiveness and health outcome measures.

2.11 Diabetes

The National DPP requires a minimum of 50 percent of participants be eligible for the lifestyle innovation 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. We received data from Y-USA on participants' pre-enrollment blood glucose values allowing us to address the question of whether initial values varied for those recruited (attended at least 1 session), compared to those enrolled (attended at least 4 sessions), and program completers (attended at least 9 sessions).

Evaluation Question

- Did initial blood glucose values vary for participants based on the number of sessions attended?

2.11.1 Descriptive Results

As shown in ***Table 24***, on average, initial blood glucose levels were similar among those recruited (attending at least 1 session), those enrolled (attending at least 4 sessions), and completers (those attending 9 or more sessions). Among participants with a glycated HbA1c test, levels were on average 6 percent for all three groups, which is in the prediabetic range (5.7% to 6.4 %) according to the American Diabetes Association.[4] The results for the other tests used to identify prediabetes indicate that on the FPG test, participants had an average level of approximately 109 mg/dL, which is in the prediabetic range (100 mg/dL to 125 mg/dL).[5] For the OGTT, participants attending at least 1 session had a slightly higher average level of 161 mg/dL, compared to participants attending 4 or more sessions who had an average level of 160 mg/dL and those attending at least 9 sessions who had an average level of 159.0 mg/dL, which also falls in the prediabetic range (140 mg/dL to 199 mg/dL).[6] 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.

[4] American Diabetes Association: Diagnosing Diabetes and Learning about Prediabetes. 2014, September 22. Available at: http://www.diabetes.org/diabetes-basics/diagnosis.
[5] Ibid.
[6] Ibid.

Table 24. Average Initial Blood Glucose Results for Participants through June 2016

Health Outcome	Number of Sessions		
	1+ Sessions (Recruited) (Avg (Min, Max)) n=7,832	4+ Sessions (Enrolled) (Avg (Min, Max)) n=6,947	9+ Sessions (Completers) (Avg (Min, Max)) n=6,199
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)	159.0 (140.0, 196.0)

Notes:
- **Source:** Patient-level data provided to RTI by Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- FPG = fasting plasma glucose; OGTT = oral glucose tolerance test; Y-USA = YMCA of the USA.

2.12 Weight Loss

We received data from Y-USA on starting weight and end weight allowing us to address the question of whether weight loss varied for those recruited (attended at least 1 session), compared to those enrolled (attended at least 4 sessions), and program completers (attended at least 9 sessions). We could also calculate starting and ending body mass index (BMI) for participants.

Evaluation Questions
- Did weight loss vary for participants based on the number of sessions attended?
- Did the percent overweight and obese vary based on the number of sessions attended?

2.12.1 Descriptive Results

Table 25 provides data on average starting and ending weight, starting and ending BMI, and average weight loss for participants through June 2016. Results were very similar to 2016 annual report. As shown in the table, on average, participants who attended at least one session in months 1-6 lost 9.3 pounds on average (4.6% of starting weight) at 1 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.

We also examined weight loss in pounds and average percent weight loss by YMCA site. Both showed little variation across the 17 YMCA sites. The maximum average weight loss, by YMCA site, was 11.5 pounds and the minimum was 6 pounds. The maximum average percent weight loss at a YMCA site was 6.6 percent and the minimum was 3.1 percent.

Table 25. Weight Management Outcomes for Recruited, Enrolled, and Completer Participants through June 2016

Health Outcome	1+ Sessions (Recruited) [Avg (Min, Max] n=7,832	4+ Sessions (Enrolled) [Avg (Min, Max)] n=6,947	9+ Sessions (Completers) [Avg (Min, Max)] n=6,199
Weight Management			
Starting weight (lbs)	200.3 (95.4, 463.0)	200.6 (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, 98.4)	10.4 (−27.5, 98.4)	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)

Notes:
- **Source:** Patient-level data provided to RTI by Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- BMI = body mass index

Table 26 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). Similarly, to findings in the 2016 annual report, for all groups, the percentage of participants who were obese after the innovation was less than the percentage at baseline. The percentage of overweight participants increased from baseline levels as expected, given a significant proportion of participants lost weight and went from obese to overweight.

Table 26. Frequencies of Obese or Overweight Participants for Recruited, Enrolled, and Completer Participants through June 2016: Y-USA

Health Outcome	1+ Sessions (Recruited) Freq (number) n=7,832	4+ Sessions (Enrolled) Freq (number) n=6,947	9+ Sessions (Completers) Freq (number) n=6,199
Obesity and Overweight Innovation			
Obese[1] baseline	63.8% (4998)	64.1% (4454)	63.9% (3960)
Obese[1] after innovation	51.9% (4063)	50.7% (3524)	49.5% (3067)
Overweight[2] baseline	33.8% (2646)	33.7% (2342)	33.9% (2103)
Overweight[2] after innovation	38.8% (3038)	39.3% (2733)	39.9% (2475)

[1] Obese: body mass index (BMI) =>30.
[2] Overweight: BMI = 25–29.9.

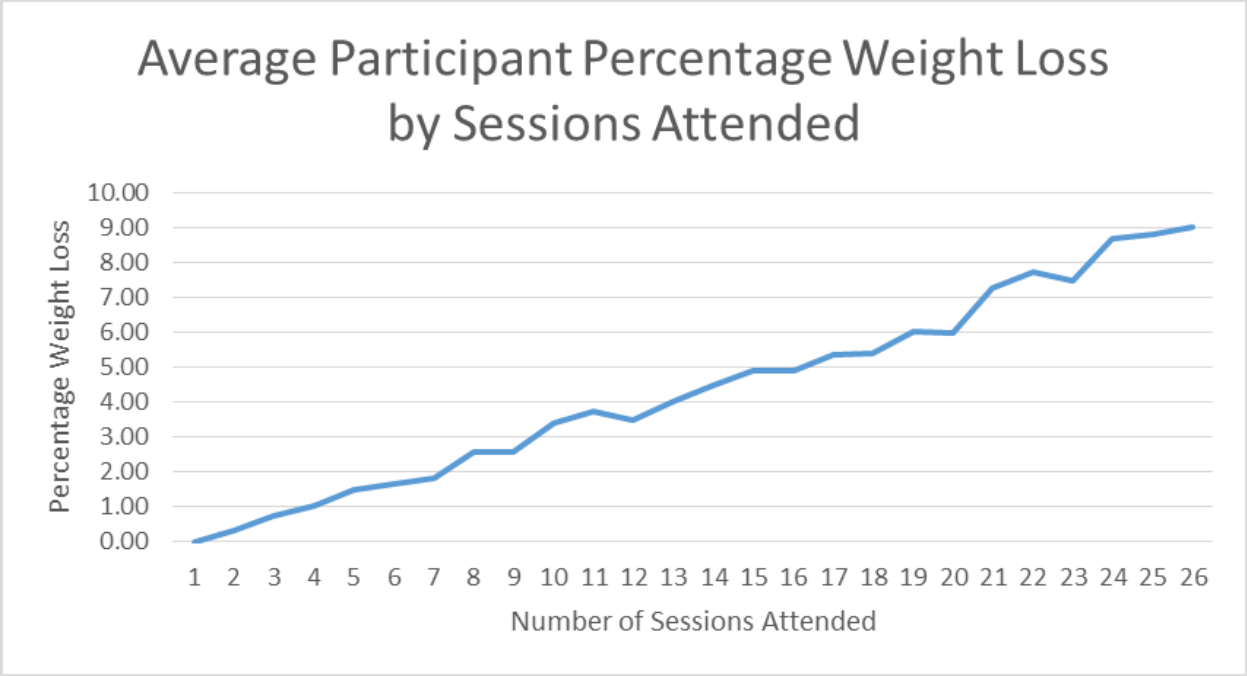
Notes:
- **Source:** Patient-level data provided to RTI by Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- BMI = body mass index; Y-USA = YMCA of the USA.

We also examined the average percent participant weight loss by the number of sessions attended to determine whether average weight loss continued to increase or whether it plateaued after a

certain number of sessions. As shown in ***Figure 14***, the percent average weight loss steadily increases over time. Average percent weight loss starts to plateau around 24 sessions, the suggested number of sessions in the National DPP program.

Figure 14. Average Percent Weight Loss by Number of National DPP Sessions Attended



2.12.2 Regression Results

To assess the effectiveness of Y-USA's innovation, we examined the percent weight loss among participants by dose of the innovation using OLS regressions. We examined percent weight loss change in two separate regression analyses. The first examined the marginal effect of the number of 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, baseline weight, and diabetic condition in each regression.

Table 27 presents the results from both regressions. As shown in the first row of Table 27, the number of sessions attended has a statistically significant marginal effect on percent weight loss. Specifically, the average effect of attending one additional session is a 0.42 percentage point increase in weight loss. The second row in Table 27 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 6.15 percentage point increase in weight loss compared to participants attending fewer than nine sessions. These results are consistent with those reported in the third annual report.

Table 27. Impact of Innovation Dose on Percent Weight Loss: Y-USA

Predictor	Coefficient	Standard Error	P-Value
Number of sessions	0.42	0.03	0.00
Completers: (9+ sessions)	6.15	1.74	0.00

Notes:
- **Source:** Patient-level data provided to RTI by Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- Y-USA = YMCA of the USA.

2.13 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 individual session, but also demonstrate that 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 demonstrate percent weight loss, a key National DPP programmatic outcome, can be achieved with an older Medicare-based population.

2.14 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, 2016 that RTI obtained from Y-USA *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 Q15 and Q16 and may incorporate qualitative and performance monitoring data obtained in the earlier phases of this evaluation to provide context.

Table 28. Measures of Implementation: Y-USA

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 Q16	*Quarterly Awardee Performance Reports*
	Training hours	Number of training hours in Q15 and Q16	*Quarterly Awardee Performance Reports*
		Cumulative number of training hours since inception	*Quarterly Awardee Performance Reports*
	Trainees	Number of trainees in Q15 and Q16	*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 participant who enrolled in the National DPP (i.e., completed at least four sessions in months 1-6)	Data received from Y-USA
	Dose	Average number of sessions attended by each participant category (recruited, enrolled, completed)	Data received from Y-USA

Notes:

- **Source:** *Quarterly Awardee Performance Reports*; data from Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- FTE = full-time equivalent; DPP = diabetes prevention program; Q = quarter; Y-USA = YMCA of the USA.

2.15 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. We present here any changes in workforce development occurring in the last 6 months of operation not reported in the third annual report.

2.15.1 Hiring and Retention

At the end of Q16 (June 2016), the innovation was staffed with 6 staff members; no change in hiring and retention occurred since results was reported in the third annual report. One end-of- year

interviewee noted, "Our workforce development work has come to a close, now [that] we are doing more in quality improvement, so the components of work have shifted as the project evolves."

2.15.2 Skills, Knowledge, and Training

Since the third 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 Q15 and Q16. By the end of Q16 (June 2016), Y-USA provided a 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 29***).

Table 29. Training Provided to Staff: Y-USA

Time Frame	Number of Training Hours	Number of Trainees
Q15 & Q16 (January–June 2016)	0	0
Since inception	39,148	4,382

Notes:
- **Source:** *Quarterly Awardee Performance Reports.*
- **Trainees are counted** more than once if they participated in more than one HCIA training course.
- **Period of activity:** January 2016 to June 2016.

Terms and Definitions
- Q = quarter; Y-USA = YMCA of the USA.

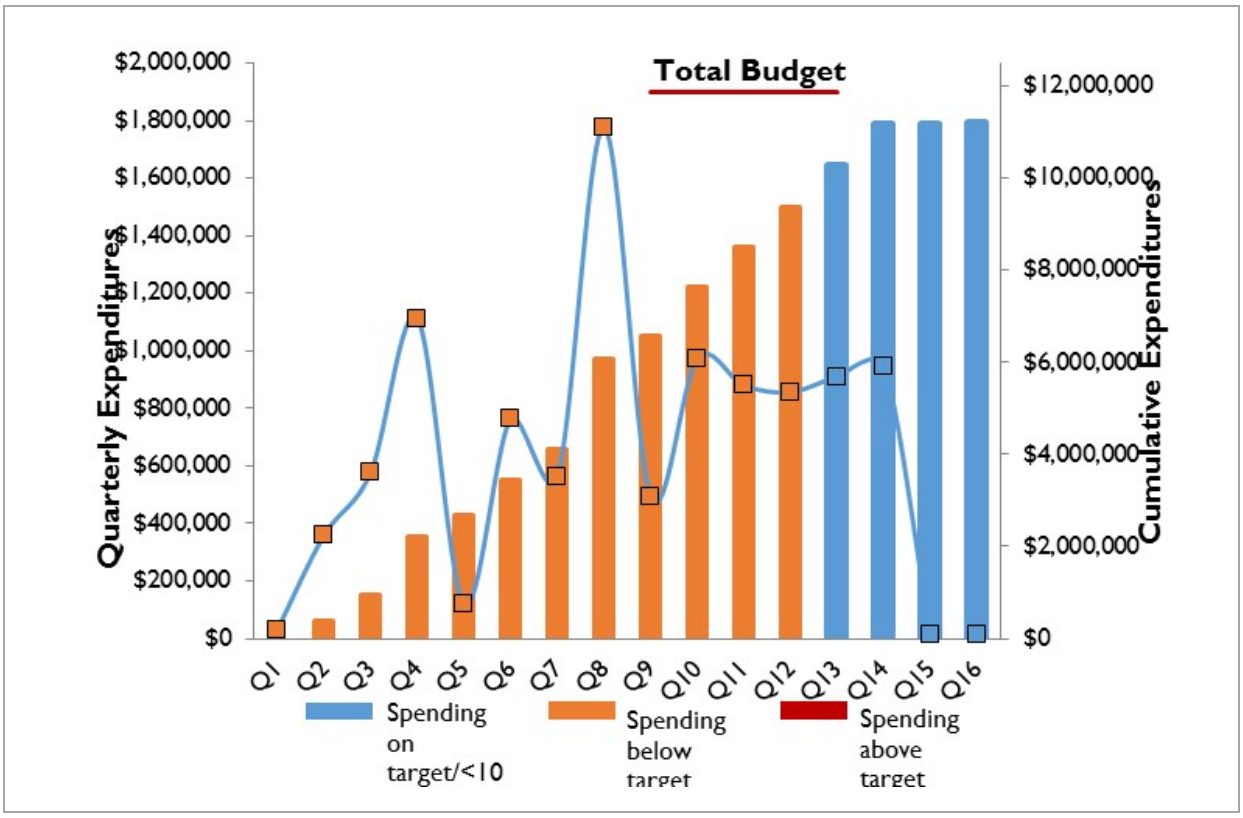
2.16 Qualitative Findings: Context

The context in which HCIA innovations operate weighs heavily in the success of implementation, sustainability, and the possibility of scaling and replication. This section provides updates to three contextual factors—award execution, leadership, and organizational capacity.

2.16.1 Award Execution

The annual report highlights the significance of Y-USA's expenditure rates on implementation. As of June 2016 (Q16), Y-USA spent 94.4 percent of its total budget, which is slightly below the projected target of 100% (see ***Figure 15***).

Figure 15. Cumulative Spend Rate from Q1 (June 1, 2012) to Q16 (June 30, 2016): Y-USA



Notes:

- **Source:** *Quarterly Awardee Performance Reports.*
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions

- Y-USA = YMCA of the USA.

2.16.2 Leadership

No changes have taken place in the Y-USA leadership since our third annual report. During end-of-year interviews, respondents reiterated that this project remained a high priority for Y-USA, and the accountability for its success is shared throughout all levels of leadership. The CEO at the time of the inception of the HCIA project was very engaged, and when a new CEO took over Y-USA operations (16 months before the interviews), he was also eager to understand the needs of the Medicare population and advance this program to reduce diabetes prevalence

At the local level, turnover among leadership of the local YMCAs was very low. One interviewee during the end-of-year interviews noted that only one of the local YMCAs lacked strong leadership. This YMCA was large and struggled due to limited innovation staffing and disengaged local leadership. One interviewee suggested that local leaders might be more effective in building partnerships when they work in small markets. In larger communities with a greater number of stakeholders, building connections can be more difficult.

2.16.3 Organizational Capacity

As reported in the third annual report, Y-USA continues to build organizational capacity to recruit and provide services to the Medicare population. To increase capacity of the local YMCAs, Y-USA set aside resources for each participating site to create recruitment innovation projects. The local YMCAs improved recruitment strategies and were reimbursed based on performance. One interviewee noted his local YMCA worked to recruit Medicare eligible YMCA members. They learned that sending US mail (physical letter) worked best with this age group and resulted in a large enrollment.

Local YMCAs also initiated their own efforts to increase organizational capacity. When demand for National DPP classes was greater than the number of lifestyle coaches available (to provide them) at one site, staff mobilized to meet annual training expectations to provide National DPP courses. Local leaders characterized capacity challenges as relatively minor.

> ***I think there was one additional training we had to organize to get a few of those people who hadn't delivered the class in the last year up and running because there are annual training expectations for coaches and we had to dig a little more deeply to find the lifestyle coaches than the Y had expected. But it was not a major groundbreaking innovation; we just had to respond rapidly.***

The organizational capacity of Y-USA depends largely on its partnerships and ability to leverage various resources. Previously, Y-USA had discussed both the need for additional resources and engaging health systems to increase capacity in serving their target population. During the end-of-year interviews in 2016, we learned that Y-USA used funding from the John A Hartford Foundation to scale learnings from the HCIA project to other local YMCA sites and found that more than half of the sites were serving older adults. With this funding, Y-USA was able to increase their capacity to target communities that have a higher penetration of older adults and focus their energies on engaging this target population nationally.

Engagement of health systems further increases the capacity of the local YMCAs to provide services and improve the overall health outcomes of the attendees. As one interviewee explained when asked why it's important to have the involvement of health systems,

> ***It is really important for a number of reasons. It does not show quite as much of a difference in enrollment as when we have a payer engaged. I look at these things as synergistic, you really want payers and providers engaged. It makes a big difference when payers are engaged. When a provider is referring to the Y when we have connected to a health care system, the bump in enrollment is on average 17 percent and as high as 45 percent. However, it is more important for outcomes. Especially when they consent to share the data back with their provider; they attend more sessions and they lose more weight. I expect their cost savings is also greater but I don't know if you would be able to tease that out.***

2.16.4 Innovation Adoption and Workflow Integration

Since the third annual report, no additional changes were made to Y-USA's innovation adoption and integration efforts as the program is now an established component of the Y-USA operations. At the national level, the innovation was adopted into the Y-USA strategic plan as a high priority in its Healthy Living initiative.

2.17 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). This section provides an update to the reach measures presented in the third annual report.

2.17.1 Innovation Reach

Y-USA stopped enrollment in July 2015. Therefore, reach has not changed since the 2016 annual report. The total number of recruited participants (attended at least one session) was 7,832; the total number enrolled was 6,947 (88.7% of total recruited). Reaching the target audience was an initial obstacle for this innovation; however, Y-USA has been able to successfully recruit and enroll older adults through various internal and external efforts including educating the program staff, marketing the program to existing YMCA members, a huge recruitment surge, and engagement of providers and health systems as described in the third annual report.

2.17.2 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 1-hour sessions (16 weekly sessions in the first 6 months plus 6 monthly maintenance sessions for months 7–12). We examined dose for this analysis among those 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).

As shown in ***Table 30***, as of June 2016, 42.8 percent of recruited participants attended 17 or more sessions, 36.4 percent of recruited participants attended 9 to 16 sessions, fewer than 15 percent (11.3%) attended 1 to 3 sessions, and almost 10 percent (9.6%) attended 4 to 8 sessions. Overall, 79.2 percent of participants attended 9 or more 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.

Table 30. Number of Sessions Completed by Participants through June 2016: Y-USA

Number of Sessions	Number of Participants	Percentage of Total Recruited Participants[1] (n=7,832)
1–3 sessions	885	11.3%
4–8 sessions	748	9.6%
9–16 sessions	2,850	36.4%
17+ sessions	3,349	42.8%
Total	7,832	100.0

[1] Recruited participants include those who have attended at least one session.

Notes:
- **Source:** Patient-level data provided to RTI by Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- Y-USA = YMCA of the USA.

Table 31 shows the number of participants within each group (e.g., recruited, enrolled, completed) as well as the average number of sessions per participant per group. As shown in the table, recruited participants attended, on average, 14.4 sessions, compared to those enrolled who attended on average, 16.1 sessions, and completers who attended on average 17.3 sessions.

Table 31. Average Number of Sessions Completed for Recruited, Enrolled, and Completer Participants through June 2016: Y-USA

Group	Number of Participants	Average Number of Sessions
Recruited (1+ sessions)	7,832	14.4
Enrolled (4+ sessions)	6,947	16.1
Completed (9+ sessions)	6,199	17.3

Notes:
- **Source:** Patient-level data provided to RTI by Y-USA.
- **Period of activity:** January 2011 to June 2016.

Terms and Definitions
- Y-USA = YMCA of the USA.

We also examined the average number of sessions attended by YMCA site. Overall, attendance across the 17 YMCA sites did not vary substantially. The range was 11 sessions on average to 18 sessions on average.

2.18 Qualitative Findings: Sustainability

Y-USA maintained a strong organizational commitment to the National DPP during the innovation period and developed a sustainability plan that will guide future scaling and dissemination activities through 2017. In the third annual report, we noted that Y-USA obtained funding from the John A. Hartford Foundation for sustaining and dispersing the innovation. Since then, Y-USA secured a 10-year

partnership with RWJF for initial 3-year, $15 million grant, focusing on community integrated health. Y-USA also established a contract with Aetna Health, so the results from National DPP program will also be a part of the clinical patient records and obtained a CPT code that allows providers to bill for reimbursement for participation in the National DPP innovation.

> ***All of our program data will be able to be part of the clinical record. It is a crucial concept for the Medicare population that is showing huge and generalizable findings to have cost savings and improve population health.***

Additionally, the Y-USA hosted former Health and Human Services Secretary Sylvia M. Burwell when she highlighted the YMCA National DPP program as a model for health care delivery reform. Her visit was also when it was announced that Medicare would cover the National DPP for beneficiaries. Coverage will begin January 2018. This is the first prevention/lifestyle intervention Medicare has covered.

> ***Medicare coverage of this intervention will be crucial to the long-term sustainability of the intervention. With the Secretary's announcement on March 23, 2016 of certified cost savings and improved quality, the intervention is now on the path to coverage. If payment becomes available to non-licensed providers of the intervention, it could be wholly sustained across the country and the learning achieved in this project would have invaluable impact on scaling of the intervention.***

Although Medicare is slated to begin covering the National DPP, Y-USA's progress reports stated that the ultimate success and enrollment in this program lies in both Medicare and Medicare Advantage covering the program:

> ***While we, and others, have shown that the commercial insurers (including Medicare Advantage insurers) are willing to contract for the provision of this intervention, this project has also shown that success in enrollment is likely dependent upon having an 'all-payor' environment. Significant enrollment and referral challenges were only overcome when both traditional Medicare and Medicare Advantage coverage was being modeled. This is possibly not going to be how the CMS rules are implemented, and would be a significant challenge to scale and sustainability.***

Y-USA reported in Q15 that it had completed the community profiles for the 17 markets it served as part of the HCIA innovation to document information on the key partners engaged (including health care partners) and recruitment and operational activities. Using this information and new streams of funding, Y-USA will facilitate the work of other YMCA affiliates that want to implement the National DPP in their community.

Y-USA is also applying learnings from the HCIA initiative to scale the program nationally and to expand program offerings based on a growing demand for these services. We learned during the end-of-year interviews that Y-USA expanded its activities in various ways such as further collaborations with health systems and sharing facilities with health clinics and providers.

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:	Recruited participants attended an average 14.4 sessions, compared to those enrolled who attended an average 16.1 sessions, and completers who attended an average 17.3 sessions.	***Innovation reach:***	Y-USA stopped enrolling in July 2015. Therefore, reach did not change. A total of 7,832 participants were recruited (attended at least 1 session). The total enrolled number was 6,947 (88.7% of total recruited).
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 percent were female and 100 percent were covered by either Medicare fee for service or Medicare Advantage.
Sustainability:	Focused on quality improvement by securing additional funding and engaging health care systems for reimbursement. Funding secured through the John A. Hartford Foundation to work on diabetes prevention and scaling through EMR integration, and the Robert Wood Johnson Foundation for a community health integration project. Successfully contracted with Aetna Health. In November 2016, HHS finalized the rule establishing the expansion of Medicare Diabetes Prevention Program (DPP). Beginning in January 2018, Medicare will provide reimbursement for eligible beneficiaries enrolling in the program. Continued work on the innovation based on completed sustainability plan that guides all activities. Completed community profiles for all 17 sites for scaling and replication.		
Innovation type:	 Coordination of care	 Health care workforce	

Key Findings

Smarter spending. The Y-USA diabetes prevention model resulted in significant reductions in Medicare spending ($246 per person per quarter across 3 years; 90% CI −$357, −$136) relative to the comparison group. On average, over 3 years the strength of evidence in favor of savings is 77.4 percent. Savings are greater among program completers than among noncompleters.

Better care. Total decreases in inpatient stays and ED visits were statistically significant over the entire innovation period and amounted to 8 (90% CI: −10, −5) fewer inpatient stays and 7 (90% CI: −11, −3) fewer ED visits per 1,000 participants per quarter. The impact on inpatient stays and ED visits was also highest in the first year (10 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 (−7; 90% CI: −30, 15) per 1,000 admissions per quarter.

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 (6.23%) than those who attended fewer than nine sessions.

Section 3
Cross-Awardee Findings

3.1 Introduction

This chapter summarizes 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 June 2016, awardee secondary data, and key informant data obtained through June 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*** explores the relationship among implementation effectiveness, spending and utilization outcomes. ***Section 3.4*** examines the context of implementation and more specifically the influence of external factors and factors that facilitated interoperability among innovations with health information exchanges (HIE). ***Section 3.5*** examines the progress achieved in workforce development and efforts to integrate navigators into health information technology (HIT)-enabled innovations and the staffing characteristics associated with implementation effectiveness. ***Section 3.6*** looks at the extent to which awardees reached their intended populations and the quality of the innovation dose provided to participants. ***Section 3.7*** assesses the prospects for sustaining the innovations. 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 June 30, 2016 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 (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 (21).

In this report, we analyze Medicare claims through June 30, 2016. In selecting this cutoff, we assume that nearly all claims were submitted and processed within 6 months after services were provided. We performed for this report descriptive Medicare analyses for the 17 eligible awardees: AACI, Altarum, BAHC, Bronx RHIO, Curators, ECCHC, IA, Intermountain, MPHI, Mineral Regional, Northeastern, 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 fourth quarter 2012 to second quarter 2016 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=23). 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 21 awardees: AACI, Altarum, BAHC, Bronx RHIO, Children's Hospital, Curators, Delta Dental, ECCHC, Finity, IA, Intermountain, Mary's Center, MPHI, Mineral Regional, NEU, Prosser, REMSA, South County, SEMHS, U-Chicago, and W&I.

For our claims analyses, we calculated four measures: spending per patient, inpatient admissions, unplanned readmissions, and ED visit rates. For some awardees we added an additional measure: primary care visit rates, which are shown in the individual awardee chapters.

Table 3-1. Payer Shares for HCIA Community Resource Program Participants through June 30, 2016

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 Third Annual Report Addendum	Number of Unique Patients in Medicaid Claims Analyses for Third Annual Report Addendum	Medicaid Data in Alpha-MAX
AACI	3,113	27.5	42.7	603	615	15Q3
Altarum	N/A/-NPIs	—	—	45,964 [2]	220	15Q3
BAHC	601	64.4	29.0	180	98	13Q4
Bronx RHIO	28,844	28.8	24.8	3,892	4,857	15Q2
Children's Hospital	1,722	0.0	100.0	N/A	513	15Q3
Curators	9,932	72.2	18.1	6,476	2,387	15Q3
Delta Dental	7,781	0.0	73.0	N/A	5,390	15Q3
ECCHC	1,653	1.8	19.1	76	274	14Q2
Finity	13,517	0.0	100.0	N/A	5,457	14Q4
IA	172,073	—	—	3,800 [2]	3,088 [2]	12Q4
Intermountain	42,018	99.4	0.06	29,409	299	15Q2
Mary's Center	2,963	3.0	78.6	N/A	2,507	N/A
MPHI	8,301	35.1	46.7	2,416	483	16Q2
Mineral Regional	N/A-NPIs	—	—	13,823 [2]	6,591 [2]	14Q1
NHCHC	N/A	—	—	N/A	N/A	N/A
NEU	14,153	7.4	58.0	1,127	1,463	13Q3
Prosser	1,016	31.3	30.1	275	130	14Q4
REMSA	20,593	9.7	24.6	2,139	27	13Q4
SEMHS	639	6.7	85.0	106	128	14Q4
South County	3,341	4.3	84.7	53	167	15Q3
U-Chicago	125,182	12.9	46.1	8,381	3,042	13Q4
U-Miami	11,281	3.0	46.8	N/A	—	N/A
W&I	1,391	0.0	53.5	N/A	321	14Q4
Y-USA	7,145	100.0	0.0	3,317	N/A	N/A
Total	477,259	N/A	N/A	124,912	37,365	N/A

[1] As reported in patient identifiers uploaded by the awardees.
[2] Number of patients is derived from provider identifiers.

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.

Terms and Definitions

- Third Annual Report Addendum includes data through June 2016; N/A = not applicable; NPI = National Provider Identifier; Q = quarter.
- — Data not available.

3.2.2 Strategy for Comparison Groups, Descriptive Analyses, and Regression Analyses

In the awardee sections, we present claims-based descriptive Medicare data for 17 awardees and claims-based descriptive Medicaid data for 21 awardees. In addition, we present multivariate regression analyses for 15 Medicare sites and 20 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 serving participants indirectly through providers, we identified similar providers who were not part of the innovation. The individual awardee sections and ***Appendix B.2*** present the details of the comparison group construction.

3.2.3 Medicare Claims Data Findings

This section summarizes Medicare spending and utilization for 15 Medicare awardees and 20 Medicaid awardees. The findings are presented as the weighted average treatment effect during the innovation period for beneficiaries enrolled in the awardee-specific innovation compared to their matched comparison group. All regressions took into account 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. Additional details on the regression specification and the full results, including quarterly estimates, are provided in the individual awardee sections and Appendix B.2.

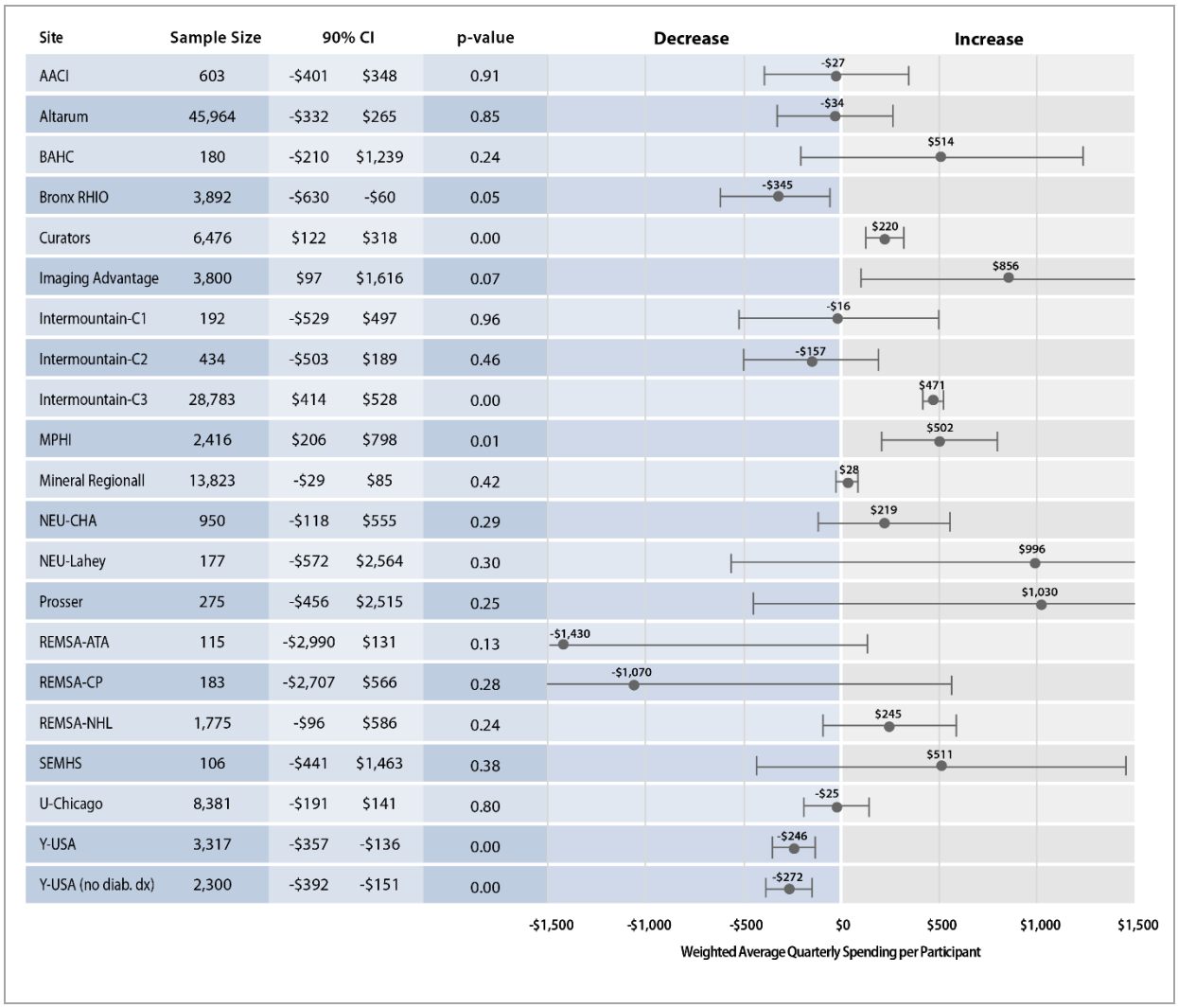
These findings span the full 3 years of the innovation and an additional year of data, which for some awardees includes an extension period after the innovation ended for others. Some awardees that received extensions continued to enroll new patients after the initial 3-year period, these results include data on these new enrollees.

Key Finding: Medicare Spending per Participant Decreased Notably for One Awardee

As shown in ***Figure 3-1***, only Y-USA (both with and without diabetes diagnoses) showed statistically significant savings in the innovation period that was also supported by the innovation's theory of action. The Bronx RHIO innovation also showed spending reductions and could theoretically indirectly impact Medicare spending, but we lacked sufficient information to evaluate how this could have occurred. The reduction in spending is consistent with the Y-USA's theory of action that diabetes prevention and weight loss can reduce health expenditures. Four awardees showed statistically significant losses during

the innovation period (IA, 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



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of June 2016.
- Figure 3-1 shows the point estimate and 90 percent confidence interval. 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 −$25, but the confidence interval falls on both the left and right sides of the zero cutoff, indicating that the finding is not significant.

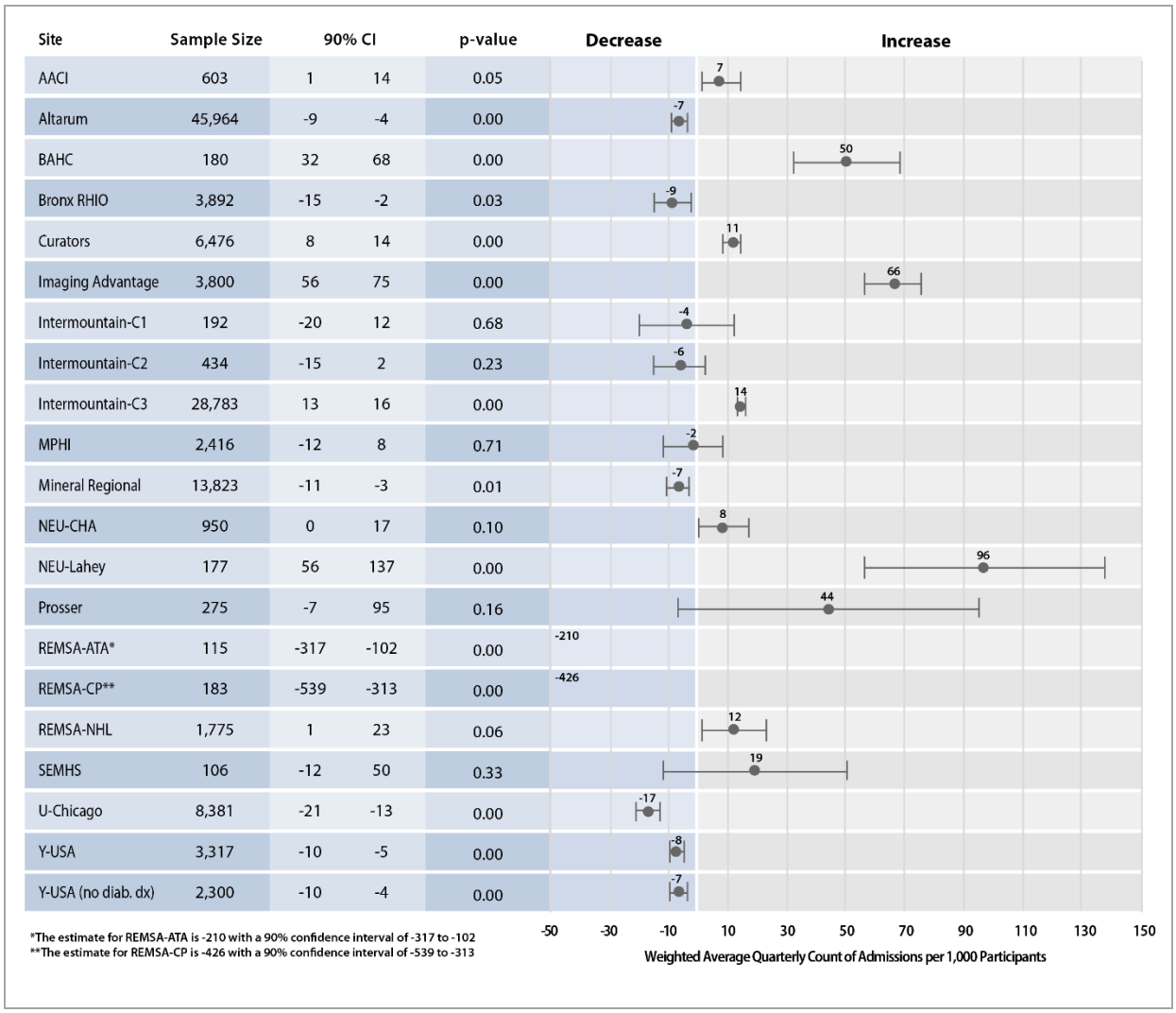
Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.
- OLS = ordinary least squares.

Key Finding: Medicare Inpatient Admissions Decreased Notably for Two Awardees

For inpatient admissions (***Figure 3-2***), the number of inpatient hospitalization in the innovation period significantly decreased for six awardees (Altarum, Bronx RHIO, REMSA-ATA, REMSA-CP, Mineral Regional, U-Chicago, and Y-USA—those without a diabetes diagnosis). The number of inpatient hospitalizations in the innovation period significantly increased for seven awardees (AACI, BAHC, Curators, IA, Intermountain-C3, NEU-CHA, NEU-Lahey, and REMSA-NHL). The others had no significant change. Reductions in inpatient hospitalizations for REMSA-ATA, REMSA-CP, Y-USA, and Y-USA (no diabetes subsample) are notable because they are consistent with the awardee's theory of action. Increases in inpatient hospitalizations are notable for BAHC and Curators because these awardees linked patients with care, potentially increasing inpatient utilization.

Figure 3-2. Difference-in-Differences Counts for Weighted Average Quarterly Inpatient Admissions per Medicare Participant, HCIA Community Resource



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of June 2016.
- Figure 3-2 presents regression coefficients and 90 percent confidence intervals. 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.

Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.

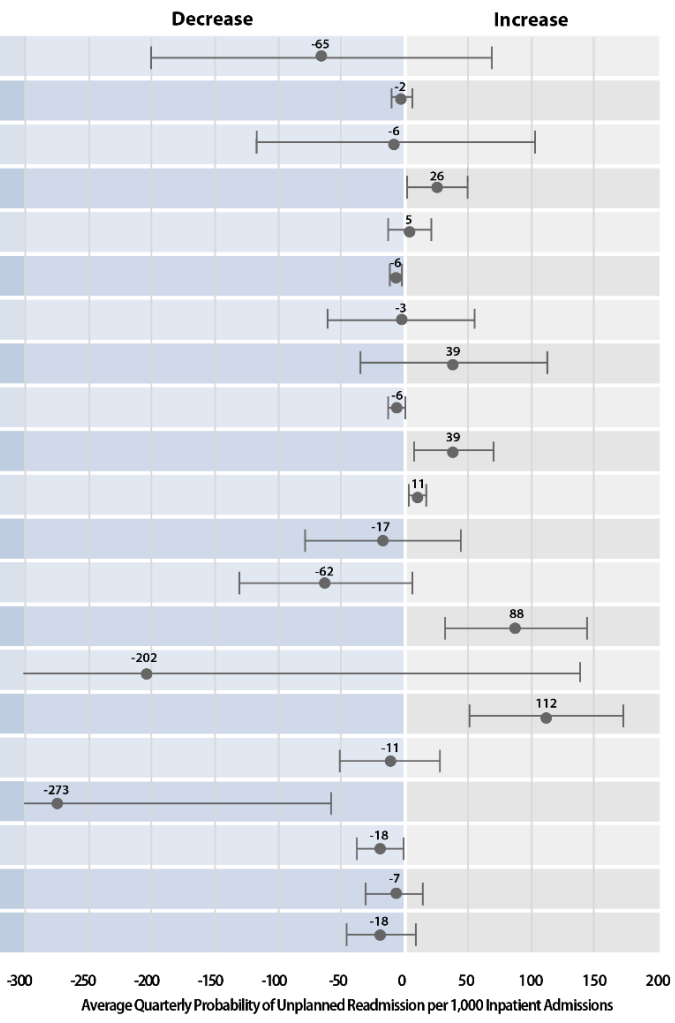
Key Finding: Medicare Unplanned Readmissions Decreased Notably for No Awardees

For unplanned readmissions (***Figure 3-3***), the rate of readmissions in the innovation period decreased significantly for three awardees (IA, SEMHS, and U-Chicago) and increased significantly for five awardees (Bronx RHIO, MPHI, Mineral Regional, Prosser, REMSA-CP). The others were not

statistically significant. Changes in readmissions are not likely to be caused by these innovations. MPHI, Prosser and REMSA-CP innovations targeted adults with a recent inpatient stay; so that this population would avoid a readmission.

Figure 3-3. Difference-in-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicare Inpatient Admissions, HCIA Community Resource

Site	Sample Size	90% CI		p-value
AACI	603	-199	69	0.43
Altarum	45,964	-10	6	0.73
BAHC	180	-116	103	0.92
Bronx RHIO	3,892	3	50	0.07
Curators	6,476	-12	22	0.62
Imaging Advantage	3,800	-11	-1	0.04
Intermountain-C1	192	-60	55	0.94
Intermountain-C2	434	-34	112	0.38
Intermountain-C3	28,783	-13	1	0.19
MPHI	2,416	8	70	0.04
Mineral Regional	13,823	4	18	0.01
NEU-CHA	950	-78	44	0.65
NEU-Lahey	177	-129	6	0.14
Prosser	275	32	144	0.01
REMSA-ATA	115	-542	138	0.33
REMSA-CP	183	51	172	0.00
REMSA-NHL	1,775	-50	28	0.65
SEMHS	106	-489	-57	0.04
U-Chicago	8,381	-37	0	0.10
Y-USA	3,317	-30	15	0.59
Y-USA (no diab. dx)	2,300	-45	9	0.27



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of June 2016.
- Figure 3-3 presents regression coefficients and 90 percent confidence intervals. 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 unplanned readmissions in the innovation period. A zero coefficient indicates the results are not significant at the 90 percent confidence level. For example, Intermountain-C1 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.

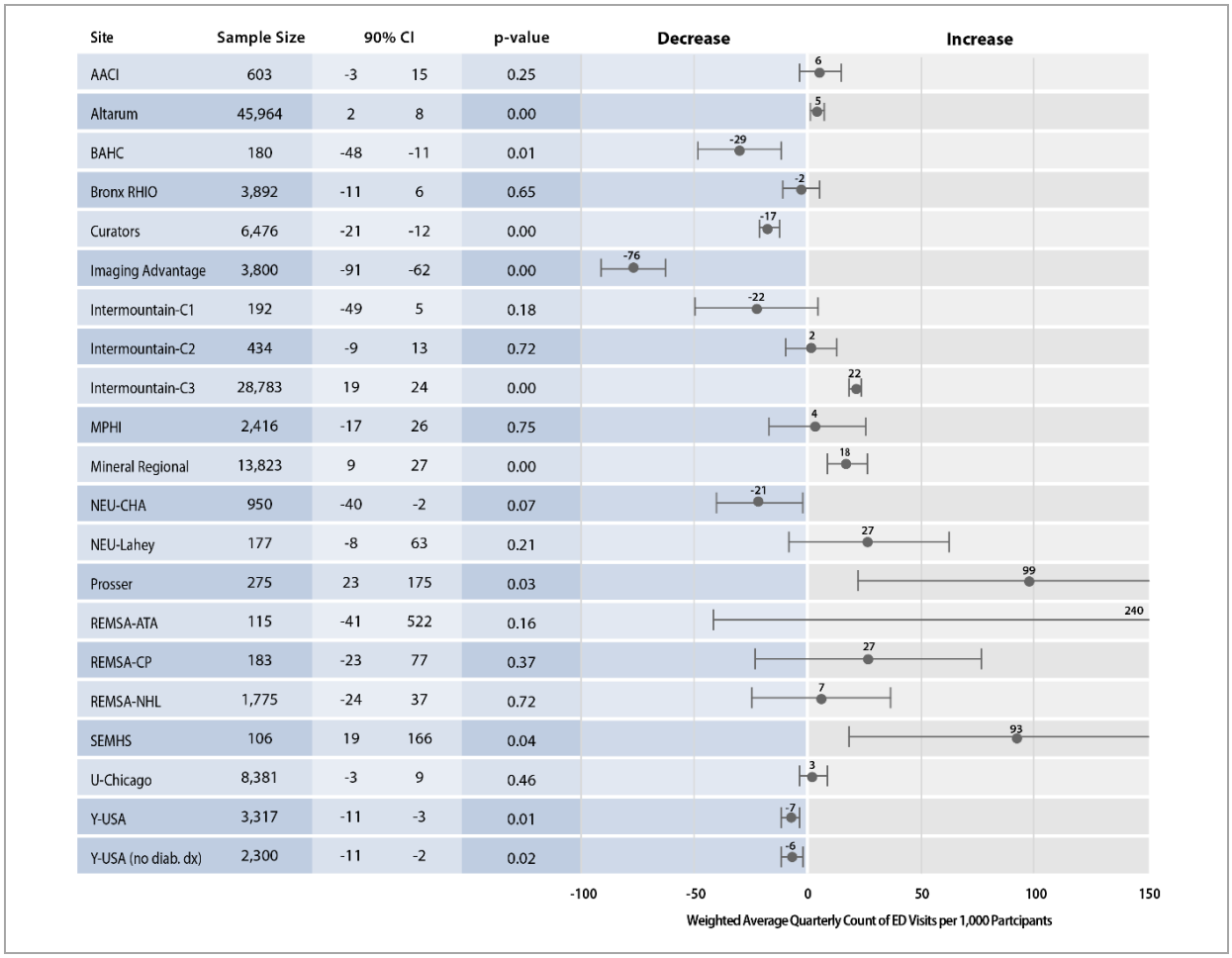
Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.

Key Finding: Medicare ED Visits Decreased Notably for Three Awardees

As shown in ***Figure 3-4***, the number of ED visits in the innovation period decreased significantly for five awardees (BAHC, Curators, IA, NEU-CHA, and Y-USA [those without a diabetes diagnosis]). For five awardees the number of ED visits in the innovation period increased significantly (Altarum, Intermountain-C3, Mineral Regional, Prosser, and SEMHS). The others had no significant change. Changes in ED visits were notable for BAHC, Curators, and Y-USA because they were consistent with the awardees' theory of action for reducing ED visits.

Figure 3-4. Difference-in-Differences Counts for Weighted Average Quarterly ED Visits per Medicare Participant, HCIA Community Resource



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicare fee-for-service claims as of June 2016.
- Figure 3-4 presents regression coefficients and 90 percent confidence intervals. 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 4, and the confidence interval falls on the left side of the zero cutoff, indicating that the finding is significant.

Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.
- ED = emergency department.

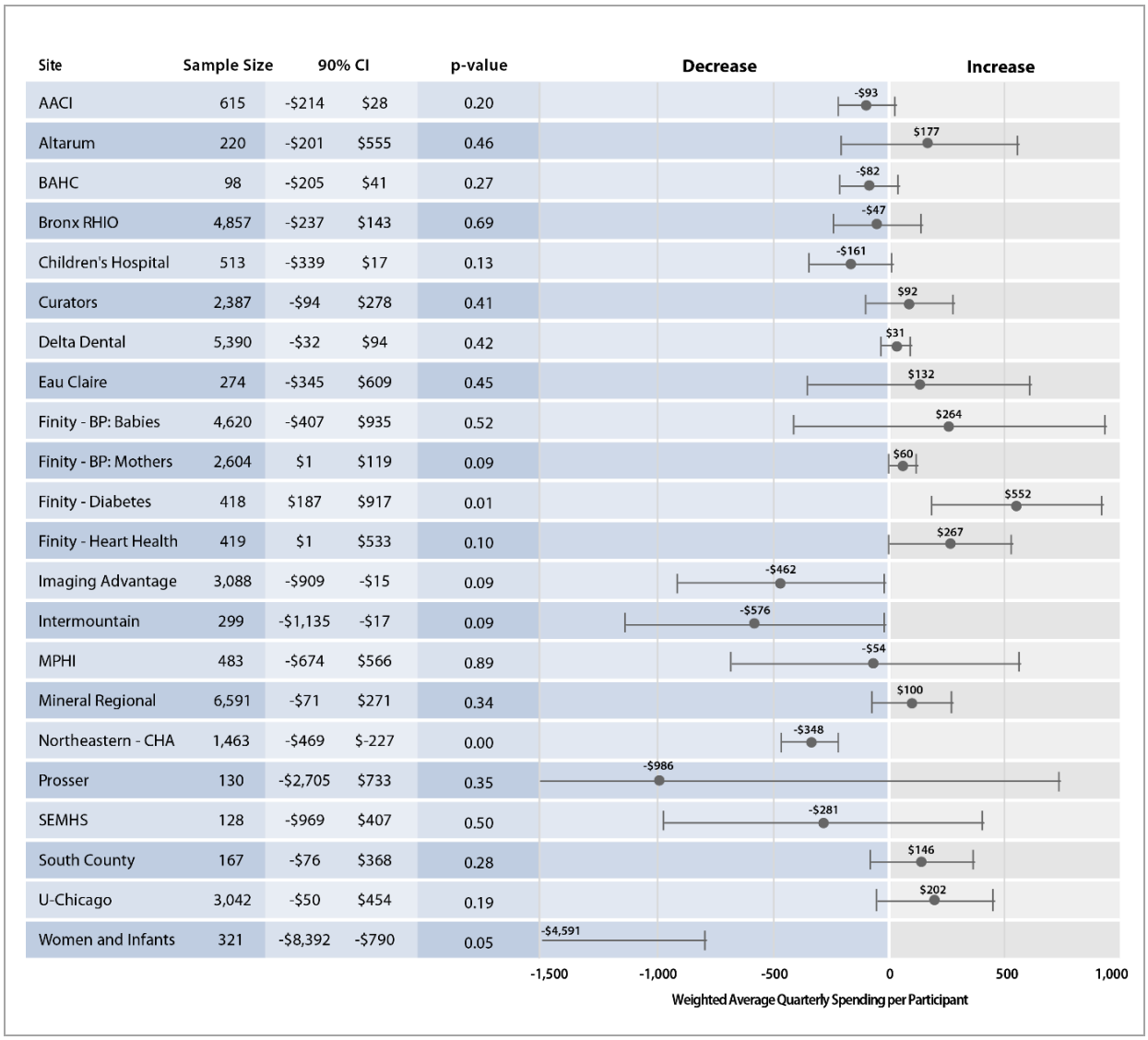
3.2.4 Medicaid Claims Data Findings

This section provides a high-level summary of Medicaid spending and utilization across 18 awardees with data available to conduct a regression analysis. The Medicaid results do not cover the entire innovation period; awardees often had regression analyses for less than 3 years 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. Some of these results include data on new enrollees, because some awardees that received no- cost extensions continued to enroll new patients after the initial 3-year period. Further details about the specific awardees that showed positive findings are presented in the individual awardee sections.

Key Finding: Medicaid Spending per Participant Decreased Notably for One Awardee

As shown in Figure 3-5, four awardees (W&I, Intermountain, NEU-CHA, 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/Finity-Heart Health). The remainder showed neither significant savings nor significant losses, likely due to small sample sizes and lack of claims data available through the entire innovation period. The savings for W&I are notable given the awardee's focus on improved transitions to home for high-risk infants.

Figure 3-5. Difference-in-Differences OLS Regression Estimates for Weighted Average Quarterly Medicaid Spending per Participant, HCIA Community Resource



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims available as of June 2016.
- Figure 3-5 shows regression coefficients and 90 percent confidence intervals. 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.
- Mary's Center is not pictured because they did not have an external comparison group.

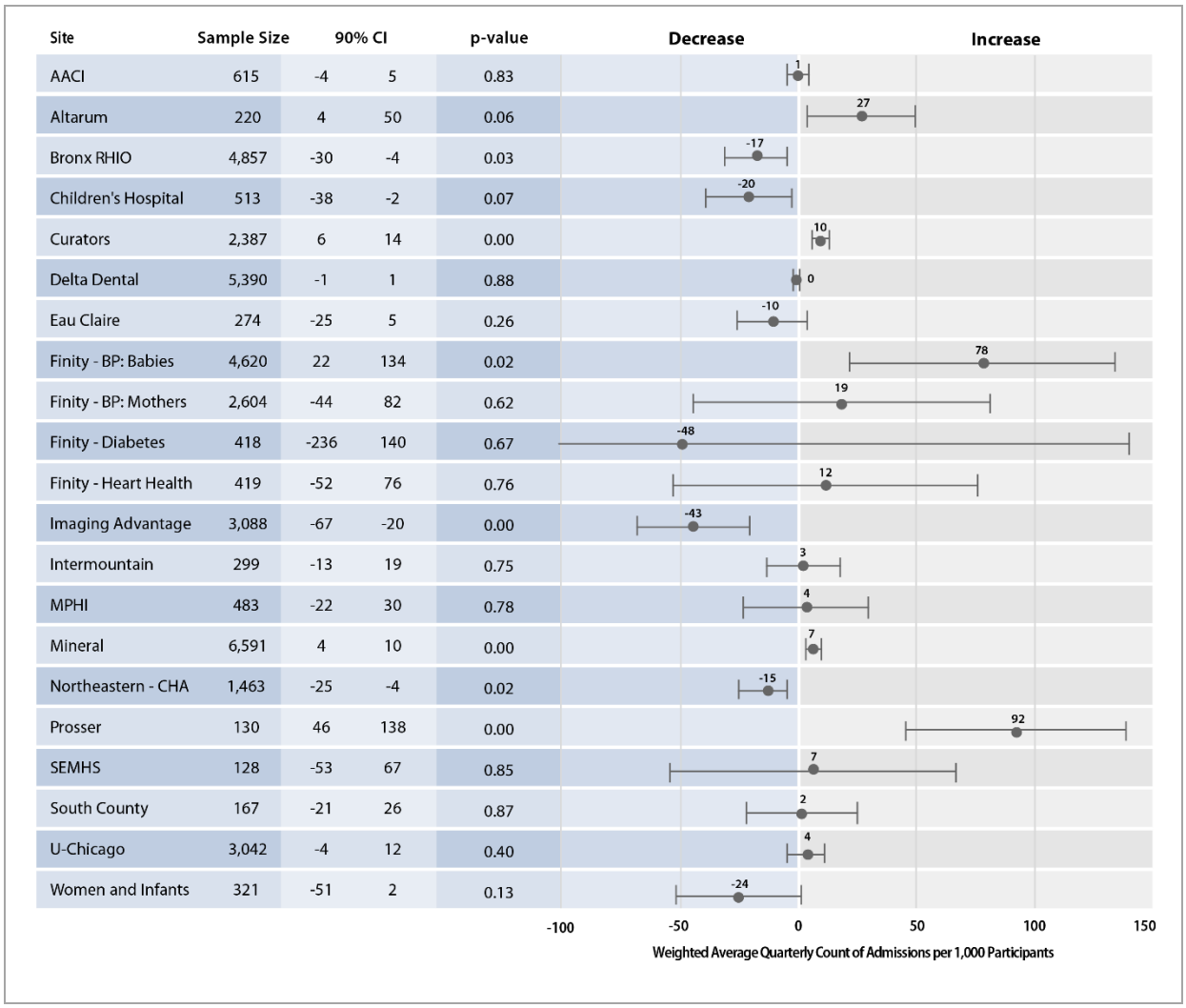
Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.
- OLS = ordinary least squares.

Key Finding: Medicaid Inpatient Admissions Decreased Notably for Two Awardees

Figure 3-6 shows the number of inpatient hospitalization significantly decreased for three awardees (Children's Hospital, IA, and NEU-CHA). The number of hospitalizations increased significantly during the innovation period for five awardees (Finity-BP: Babies, Prosser, Altarum, Curators, and Mineral Regional). For the remainder, we found no statistically significant change. The results for Children's Hospital, and Curators are consistent with the awardees' theory of action to improve access to primary care and reduce inappropriate high-cost care among high-risk patients.

Figure 3-6. Difference-in-Differences Counts for Weighted Average Quarterly Inpatient Admissions per Medicaid Participant, HCIA Community Resource



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims available Medicaid claims available through a range of dates from December 2012-June 2016.
- Figure 3-6 shows regression coefficients and 90 percent confidence intervals. 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, Intermountain has a point estimate of 3, and the confidence interval falls on the left side of the zero cutoff, indicating that the finding is significant.
- Mary's Center is not pictured because they did not have an external comparison group.

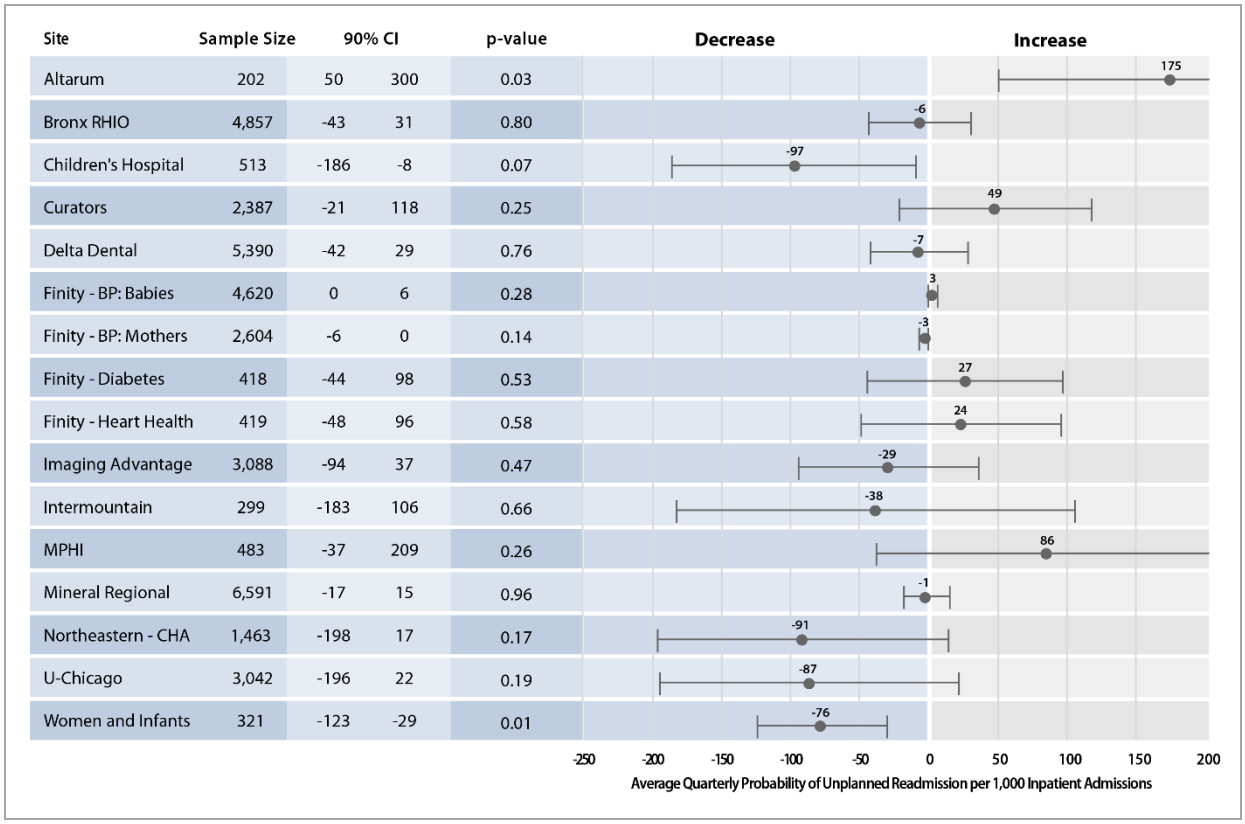
Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.

Key Finding: Medicaid Unplanned Readmissions Decreased for Two Awardees

Figure 3-7 shows the rate of readmissions during the innovation period decreased significantly for three awardees (Children's Hospital, Finity - BP: Mothers, W&I); the rate of readmissions during the innovation period increased significantly for two awardees (Altarum, Finity - BP: Babies) and was not significant for the rest. Sample size only allowed for readmission regressions for 13 awardees. These findings are notable for Children's Hospital and W&I because these awardees connected participants to care, potentially reducing the need for an avoidable readmission.

Figure 3-7. Difference-in-Differences Logistic Regression Estimates for Hospital Unplanned Readmissions per 1,000 Medicaid Inpatient Admissions, HCIA Community Resource



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims available Medicaid claims available through a range of dates from December 2012–June 2016.
- Figure 3-7 shows regression coefficients and 90 percent confidence intervals. 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 −90, and the confidence interval falls on the left side of the zero cutoff, indicating that the finding is significant.
- Mary's Center is not pictured because they did not have an external comparison group.

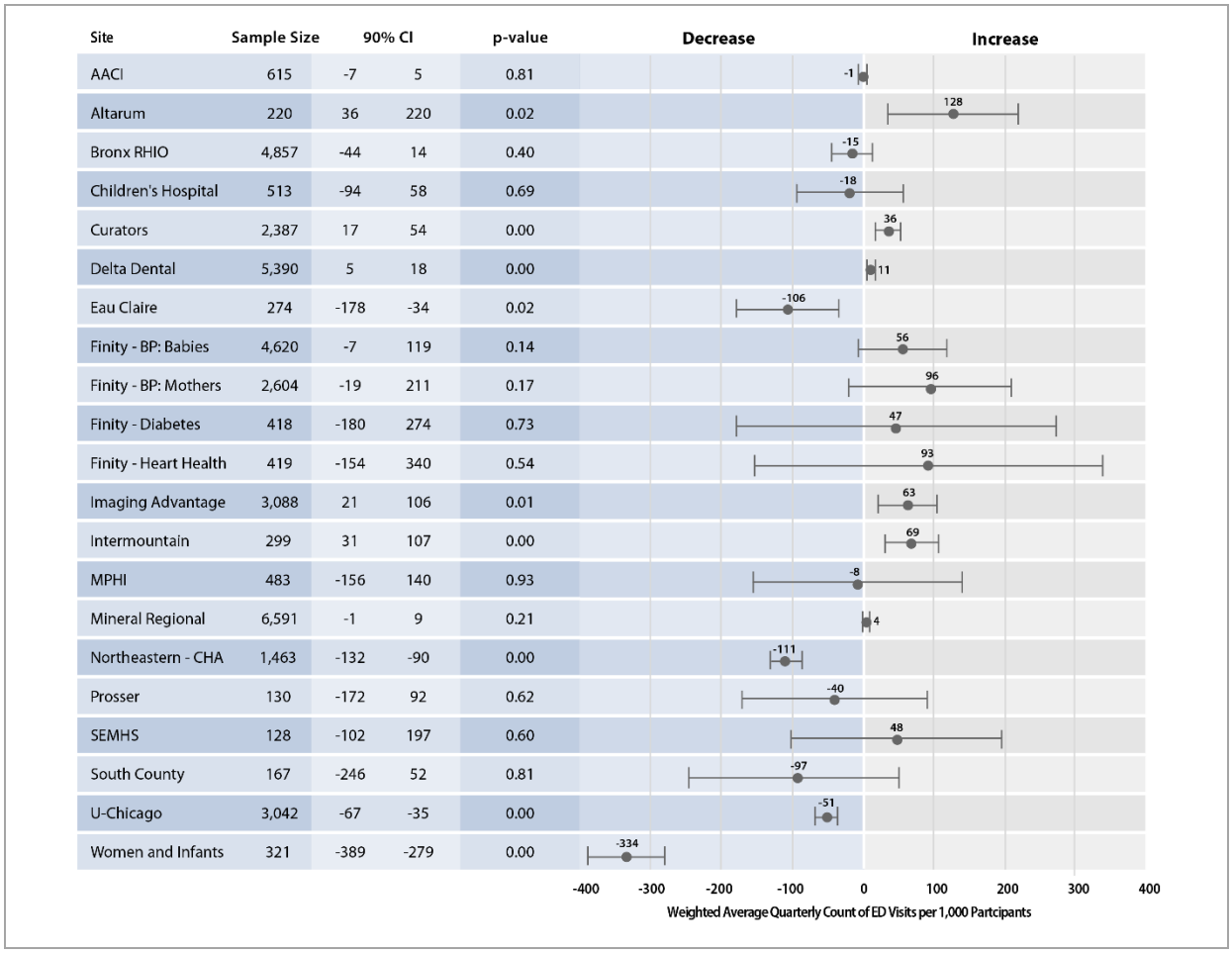
Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.

Key Finding: Medicaid ED Visits Decreased for Two Awardees

Figure 3-8 shows four awardees significantly decreased the number of ED visits in the innovation period (ECCHC, NEU-CHA, U-Chicago, and W&I). The number of visits increased significantly during the innovation period for five awardees (Altarum, Curators, Delta Dental, IA, and Intermountain). For the remainder, we found no significant change. Changes in ED visits were consistent with the theory of action for ECCHC and W&I to connect high-risk patients to appropriate care and reduce the need for ED visits.

Figure 3-8. Difference-in-Differences Counts for Weighted Average Quarterly ED Visits per Medicaid Participant, HCIA Community Resource



Notes:

- **Source:** RTI analysis of Chronic Conditions Data Warehouse Medicaid fee-for-service claims and awardee provided Medicaid claims available Medicaid claims available through a range of dates from December 2012-June 2016.
- Figure 3-8 shows regression coefficients and 90 percent confidence intervals. 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.
- Mary's Center is not pictured because they did not have an external comparison group.

Terms and Definitions

- **Sample size** is the unique number of treatment beneficiaries with matched claims data.

3.3 Implementation Factors Related to Spending and Utilization

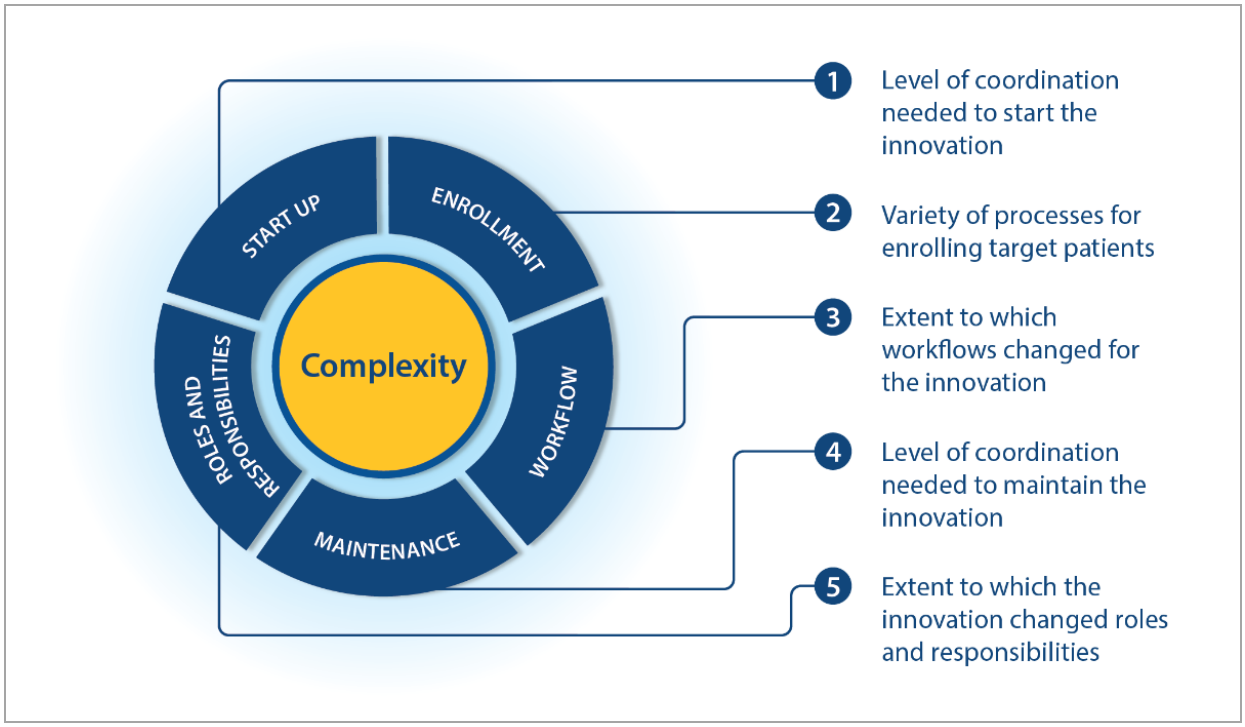
3.3.1 How is Innovation Complexity Related to Health Care Utilization?

This section explores the relationship between innovation complexity, or the difficulty of putting the innovation into place, and health care utilization. Innovation adoption frameworks generally suggest that simple, clear innovations that require only limited expertise to implement are more adoptable.[1] Alternatively, complex innovations may be necessary because of how complicated health care systems themselves have become. Multistep, nonlinear, and collaborative solutions to problems are required when settings are too unpredictable to rely on straightforward, simple interventions.[2]

Defining Complexity

The five attributes that define complexity for this analysis are shown in ***Figure 3-9*** and collectively they capture the difficulty of putting an innovation into place**.** We measured these attributes at the innovation component level rather than at the awardee level because awardees had multiple components designed to affect different outcomes (e.g., Intermountain developed the IndiGO tool for patients and a shared savings model for physicians). These five measures were combined to create a composite score of complexity ranging from 0 (not complex) to 1 (most complex). ***Appendix F*** provides additional information on our methods.

Figure 3-9. Measures of Complexity



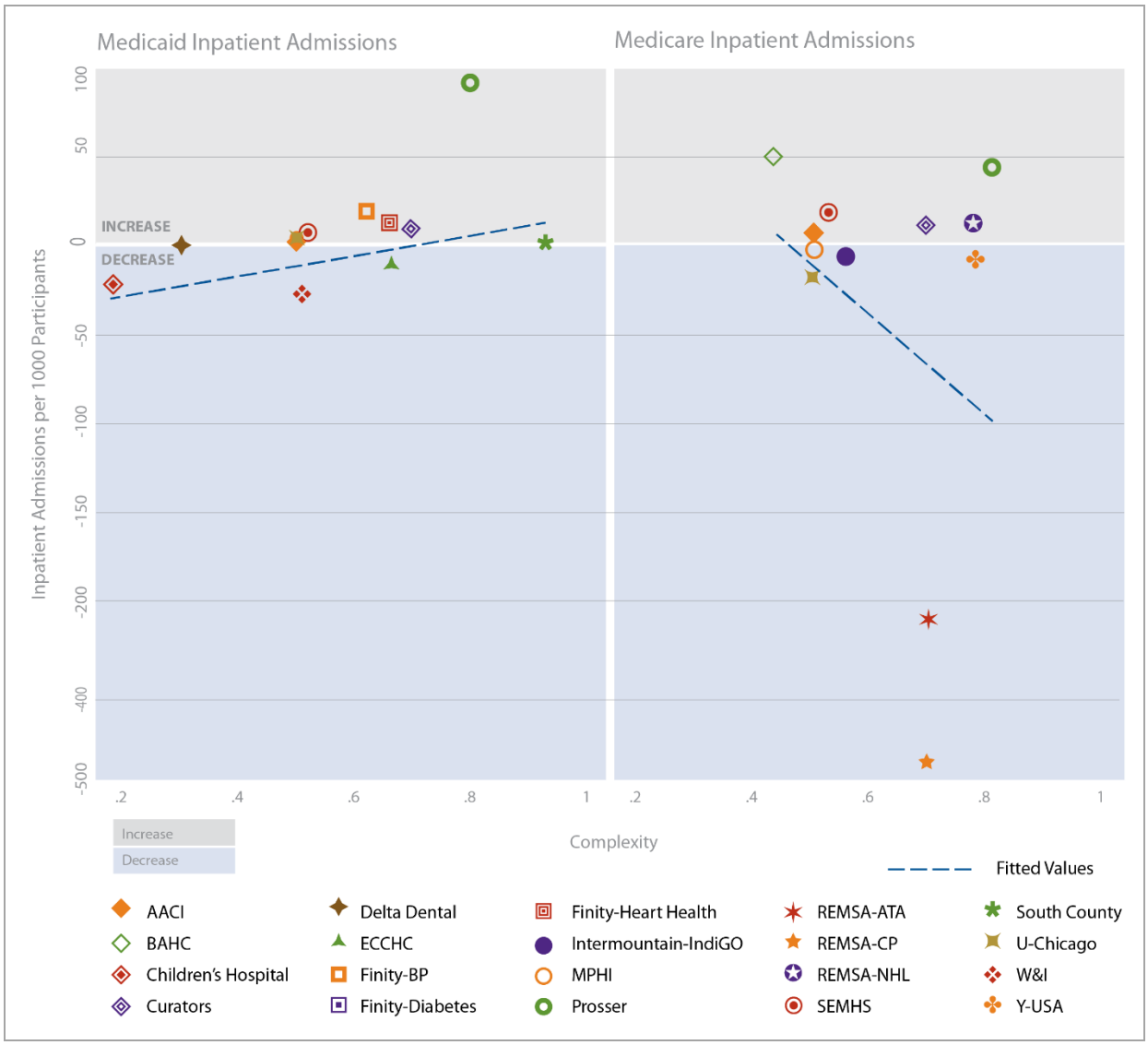
Key Finding: Associations Between Complexity and Utilization Differ Among Medicaid and Medicare Patients

The slopes of the lines on each graph of ***Figure 3-10*** show the relationship between complexity and inpatient admissions. The line sloping up suggests higher complexity scores are associated with increased inpatient admissions. The line sloping down indicates the opposite: greater complexity is associated with decreased inpatient admissions. As Figure 3-10 indicates, the relationship between complexity and inpatient admissions is different for Medicare and Medicaid samples.

The Community Paramedics 30-Days enrollment program in the REMSA innovation illustrates how higher complexity could lead to fewer inpatient visits in the Medicare sample. This program required significant changes to workflow and roles and responsibilities and, thus, was difficult to implement. However, Community Paramedics (CP) were able to execute this program as designed and offer an average of 4.5 home visits to review post-discharge instructions and identify needs or problems. Their services may have reduced the need for Medicare patients to revisit the hospital.

In contrast, Prosser's similarly complex CP innovation failed to reduce inpatient admissions among Medicaid patients. Prosser's innovation entailed a single CP visit to reduce inappropriate utilization among three high-risk populations: high utilizers, surgical patients, and patients referred by providers. Innovation staff characterized the target population, especially the first group, as reluctant to change their behavior, transient, nonresponsive, and distrustful of CPs. A more intensive level of service involving may have been required to address of the unique needs of this population of beneficiaries.

Figure 3-10. Complexity and Inpatient Admissions



Significance for Policy and Practice

KEY INSIGHTS	
	• Greater innovation complexity may have both positive and negative impacts on utilization and may affect payer groups differently depending on their needs. • Complex patients may require complex innovations, although they may be more difficult to implement.

3.3.2 Is Implementation Effectiveness Associated with Spending and Utilization?

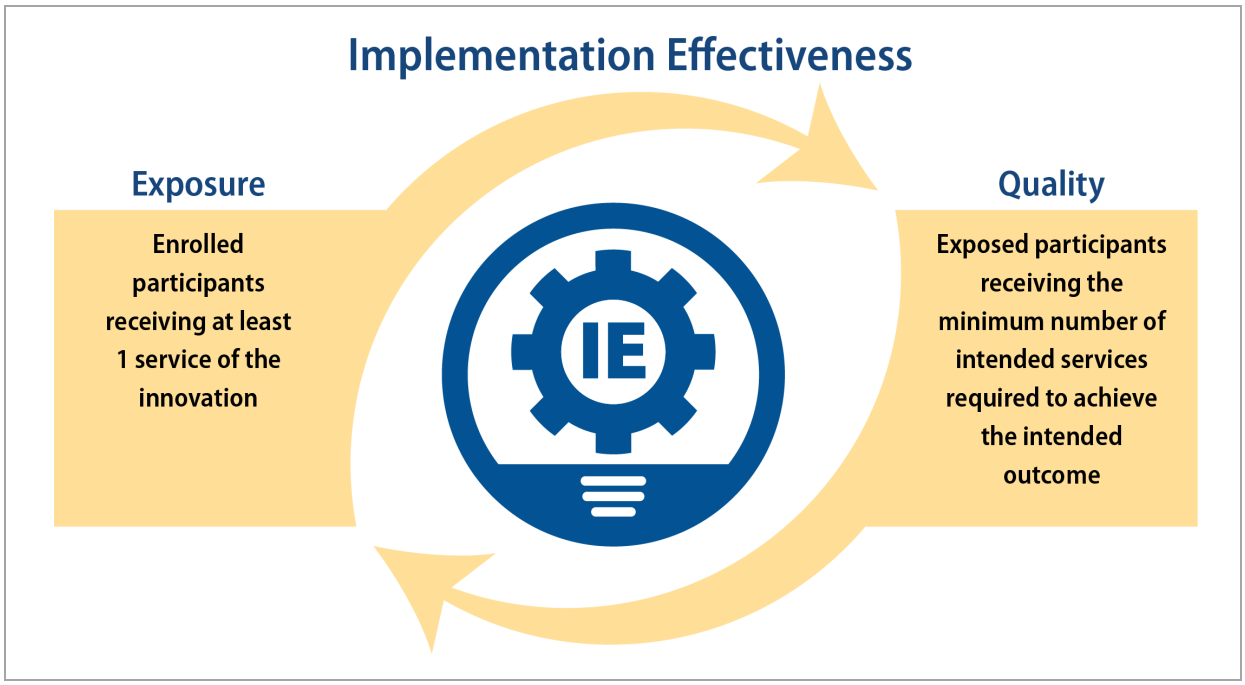
To attribute changes in health and/or health care utilization outcomes to the innovation, we must first ascertain if the innovation itself was implemented effectively. *Implementation* effectiveness is a key

predictor of *innovation* effectiveness. In other words, the success of the implementation influences how effective the innovation itself is in improving health outcomes and/or lowering health care utilization and costs.[3]

Defining Implementation Effectiveness

Two concepts define implementation effectiveness (see ***Figure 3-11***): (1) *exposure* to the innovation, and (2) the *quality* of organizational members' initial or early use of a new idea, program, process, practice, or technology.[4] We defined exposure as receiving at least one service of the innovation. We defined the quality of the innovation based on exposed participants receiving the minimum number of intended services to achieve the intended outcome. The goal of this analysis was to determine if implementation effectiveness was associated with Medicare and Medicaid health care utilization and costs.

Figure 3-11. Definition of Implementation Effectiveness



Although we presented several analyses in the third annual report based on implementation effectiveness,[5] we further refined the concept for use in this report. One significant change is that in the third annual report we defined implementation effectiveness at the awardee level, whereas for this analysis we calculated implementation effectiveness at the awardee innovation component level and by payer. For example, we determined three distinct implementation effectiveness scores for each of REMSA's innovation components (i.e., CP, ATA, and NHL). We examined implementation effectiveness at the innovation component level because distinct innovation components may have varying success with implementation. Additional details regarding how implementation effectiveness, exposure, and quality scores were calculated per awardee innovation component are provided in ***Appendix F***.

We examined implementation effectiveness scores relative to utilization and cost claims data. Our overall sample size was 12 innovation components for Medicare and 15 innovation components for Medicaid and we examined: Medicare spending, inpatient admissions, unplanned readmissions, and ED visits.

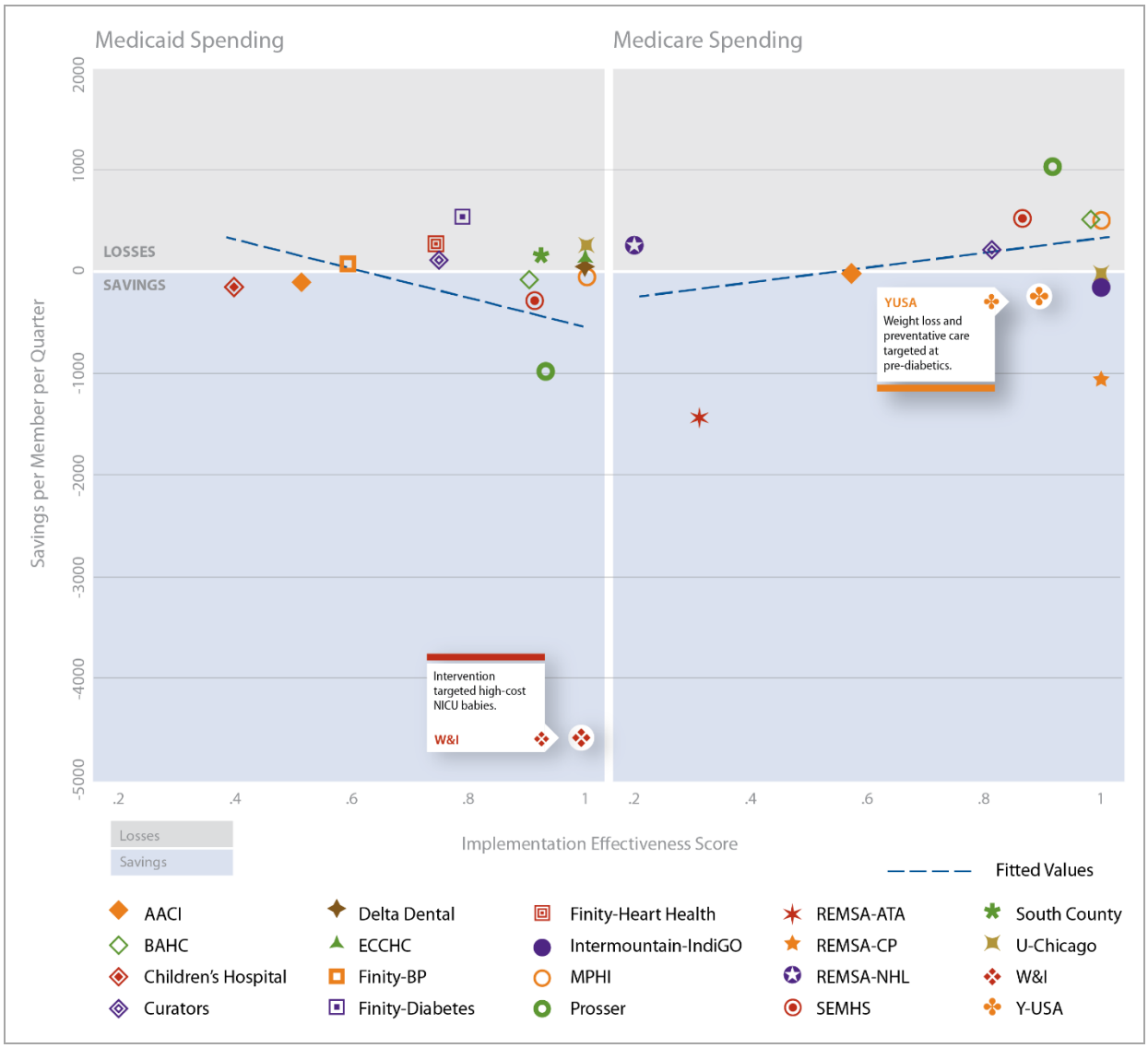
Key Finding: Implementation Effectiveness is Associated with Positive Outcomes for Medicaid Spending.

Overall, we found a positive correlation between implementation effectiveness and Medicaid savings, Medicaid ED visits, and Medicare ED visits. We did not find an association with the remaining utilization and cost measures.

The negative slope in ***Figure 3-12,*** for Medicaid indicates a potential positive relationship between cost savings and implementation effectiveness. For Medicare, however, the upward slope indicates an inverse, positive relationship. This relationship could indicate that a younger population was more easily influenced to change their health behavior or their overall health trajectory compared to older Medicare beneficiaries. For example, W&I's Partnering with Parents program aimed to improve transition to home services for high-risk infants with a NICU admission of 5 or more days. Family care teams offered education and support to parents during the transition from the NICU to home, and monitored infants' growth and development. The program also supported primary care providers who served this at-risk population, and partnered with home nursing agencies throughout Rhode Island to coordinate infants' care post-discharge. Therefore, based on how the innovation was designed and implemented, we theoretically expect the program to lead to fewer admissions, readmissions, and ED visits for participants, which in turn lead to overall Medicaid cost savings.

Although the overall trend did not indicate that Medicare cost savings were associated with implementation effectiveness, several awardees had high implementation effectiveness scores and had significant cost savings, including the Y-USA. The Y-USA's innovation sought to improve care by offering the National Diabetes Prevention Program (National DPP) in community or clinical settings to Medicare beneficiaries. The National DPP is a Centers for Disease Control and Prevention (CDC)-recognized lifestyle change program, which includes regular classes focused on improving health through diet and exercise, with the overall goal of preventing or delaying the onset of Type II diabetes. Based on the program's design and implementation effectiveness score, we expect the program to lead to lower utilization of the ED and, therefore, result in overall cost savings.

Figure 3-12. Overall Spending and Implementation Effectiveness



Key Finding: Implementation Effectiveness is Associated with Positive Outcomes for Medicaid and Medicare ED Visits.

As shown in ***Figure 3-13,*** for both Medicaid and Medicare a downward trend indicates a positive relationship between decreased ED visits and implementation effectiveness. Therefore, decreased ED utilization may be an outcome that is impacted by how effectively the innovation component was implemented. For example, ECCHC's Medicaid innovation provided comprehensive primary care in microclinics and integrated high-utilizing patients into traditional primary care homes. They had a specific goal of reducing inappropriate ED use by 20 percent over 3 years. Therefore, based on the innovation's design and its high implementation effectiveness score, we expect reductions in inappropriate ED visits.

For Medicare, Curators, an integrated health system, used nurse case managers (NCMs) and health information analysts (HIAs) to facilitate care coordination. NCMs arranged for preventive care

services among cohorts of relatively healthy patients and offered care coordination and oversight for more complex patients. NCMs were especially critical in the care of Medicare beneficiaries and likely played an impact in the significant decrease in ED visits.

Figure 3-13. ED Visits and Implementation Effectiveness

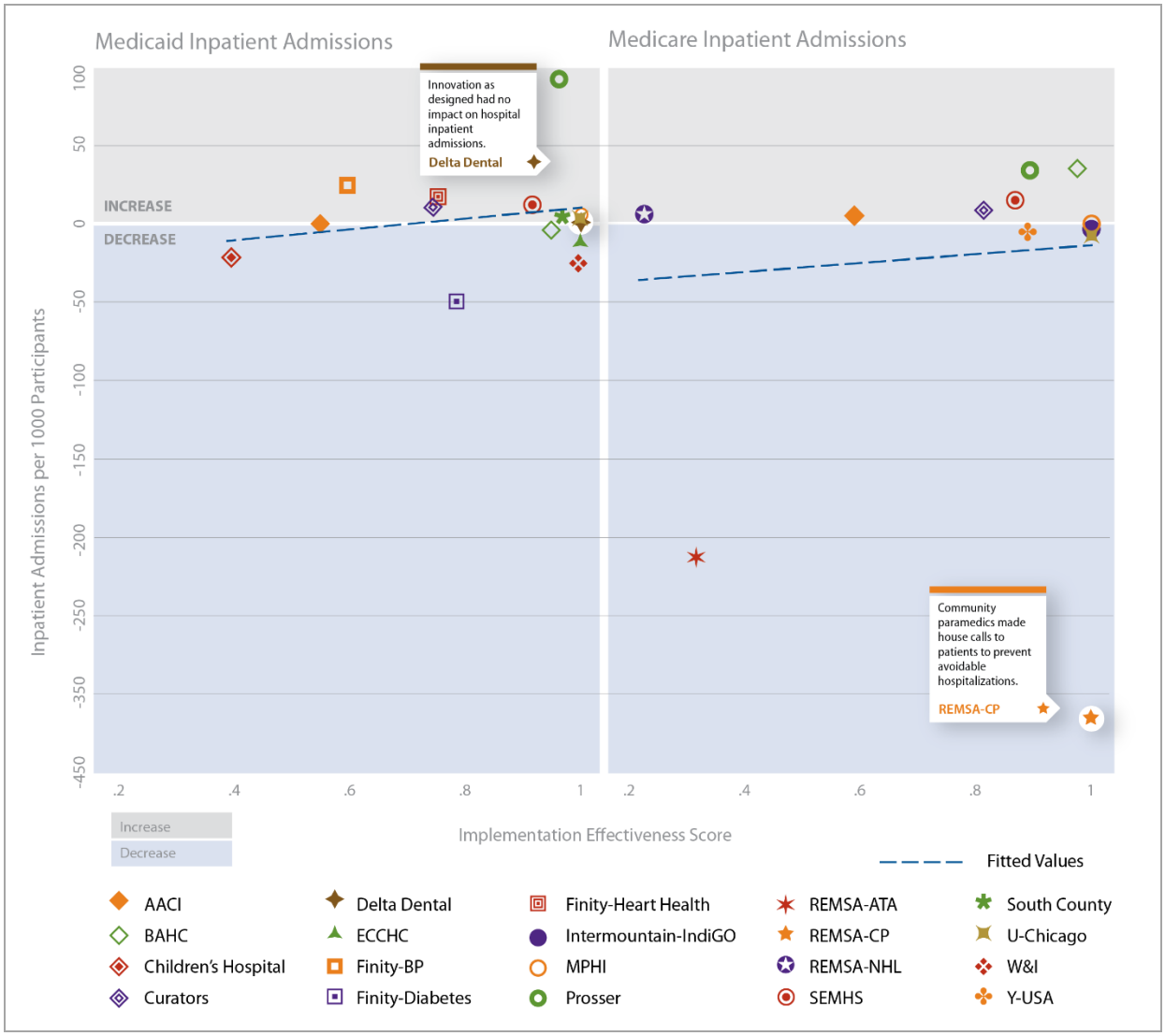
Key Finding: Implementation Effectiveness is Not Associated with Positive Outcomes for Hospital Inpatient Admissions.

As shown in ***Figure 3-14***, for Medicaid a slight upward trend occurs and for Medicare a slight downward trend occurs although hospital inpatient admissions are relatively stable regardless of implementation effectiveness score. For Medicaid, overall implementation effectiveness score does not appear to be correlated with a reduction in hospital inpatient admissions. Many innovation components were not intended to impact hospital inpatient admissions, so this outcome is likely longer-term and may take years to impact. For example, the goal of Delta Dental's innovation was to improve the oral/dental

health of American Indian children age 9 and younger living on South Dakota reservations by providing dental visits. Although preventive dental services may result in some positive health outcomes and potential long-term savings, one would not expect any change in inpatient admissions, regardless of how well the innovation was implemented.

Although Medicare overall hospital inpatient admissions are relatively stable regardless of the implementation effectiveness score, several awardees demonstrated a positive relationship. For example, in the REMSA-CP program, the CPs visited patients after they were released from an inpatient stay. During the visit, they reviewed post-discharge instructions and provided any necessary care. This visit was designed to reduce readmissions, but plausibly could have resulted in reduced inpatient hospital admissions for other conditions as well.

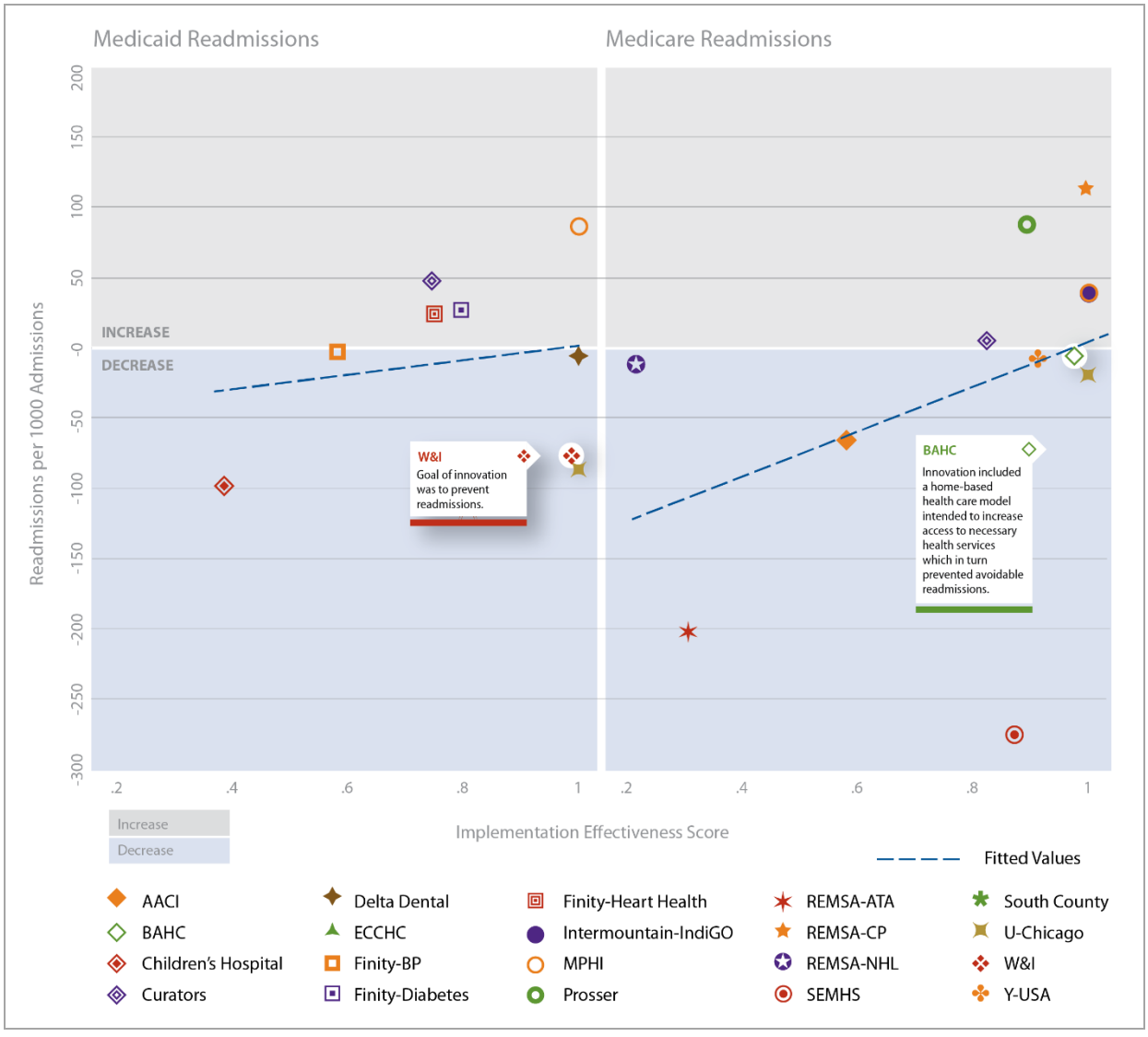
Figure 3-14. Hospital Inpatient Admissions and Implementation Effectiveness



Key Finding: Implementation Effectiveness Is Not Associated with Positive Outcomes for Hospital Readmissions.

As shown in ***Figure 3-15,*** for both Medicaid and Medicare an upward trend indicates a negative relationship between decreased hospital readmissions and implementation effectiveness. This measure has a much smaller sample size than the others, so these results should be interpreted with caution. As with hospital inpatient admissions, lack of positive relationship may also occur because many innovation components were not intended to reduce readmissions. There are some exceptions: Medicaid W&I, for example, provided home visits and services to high-risk infants to avoid readmissions. For Medicare, BAHC's innovation included a home-based health care model that enlisted community health workers (CHWs) and nurse health educators to promote healthy lifestyles, provide quality health care education, increase access to health services, and link participants to a primary medical care home. Given the focus on increasing access to care, a potential decrease in readmissions would be expected.

Figure 3-15. Hospital Readmissions and Implementation Effectiveness



Significance for Policy and Practice

The mixed results suggest implementation effectiveness is a necessary but not sufficient condition for innovation effectiveness (i.e., cost savings, decreased utilization). Although an innovation is extremely unlikely to yield significant benefits to an adopting organization unless the innovation is implemented appropriately, effective implementation does not guarantee that the innovation will prove beneficial for the organization in generating cost savings and decreased utilization.

KEY INSIGHTS

- Implementation effectiveness is a necessary but not sufficient condition to produce desired outcomes.
- Mixed results demonstrate that some innovation outcomes may be more sensitive to implementation effectiveness than others, for example, reduced ED visits but not hospital readmissions.
- Implementation effectiveness should be evaluated within the context of innovation design and theory of action. Successful implementation can lead to intended impacts only if the activities of the innovation are designed to affect outcomes.

3.4 Context of Implementation

3.4.1 Which External Factors Most Influence Implementation Effectiveness?

External factors, such as policy changes and access to HIT can influence the awardee's ability to effectively implement the innovation. Using qualitative data specific to 33 innovation components among the 24 HCIA awardees, we examined whether awardees reported the presence of external factors as a facilitators or barriers in implementing their innovations Additional details regarding the methods for this analysis can be found in Appendix F.

Key Finding: Four External Factors Influence Innovation Implementation

The conceptual framework for this evaluation[6] divides the outer setting of the awardee organization into four external factors, each noted in ***Figure 3-16***. These factors are often beyond the control of HCIA awardees but are influential in determining an innovation's success. The figure summarizes and defines these factors, highlighting the percentage of awardee component's that reported one or more conditions for each factor.

Most awardees (n=29) encountered some *policy or political*-related factor that affected the implementation of the innovation, such as Medicaid expansion or other policy changes. Nearly half (43%) of awardees (n=15) reported factors associated with *community resources and infrastructure*, including interagency cooperation, local geography, or support services. To a lesser extent, slightly more than one-third of awardees noted *technological* (37%, n=13) and/or *socioeconomic* (34%, n=12) factors.

Figure 3-16. Definition of External Factors and Percentage of Influenced Components (n=35)

External Factors		Definition	Percentage of Awardee Components (yellow) Reporting Factor Influence
Community Resources & Infrastructure		Extent to which the organization accurately knows and prioritizes patient needs outside the organization, as well as barriers and facilitators to meet those needs.[1]	
External Technological		Technological trends and movements and the availability of technology that may affect the innovation and its context.[2]	
Policy & Political		External policies or regulations (governmental or other central entity) that may impact HCIA implementation, including external policies, regulations, or mandates; clinical recommendations and guidelines; and public or benchmark reporting.[1,3]	
Socio-Economic		Social and economic conditions in which people live their daily lives, including social norms, social support and community connectedness; employment and working conditions; living conditions; and culture, religion, and ethnicity shape health.[4]	

[1] Damschroder, L.J., Aron, D.C., Keith, R.E., Kirsh, S.R., Alexander, J.A., Lowery, J.C. (2009). Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implementation Science 4:50 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.

[3] Berry, S.H., Concannon, T.W., Gonzalez Morganti, K., Auerbach, D.I., Beckett, M.K., Guey-Chi Chen, P., Farley, D.O., Han, B., Harris, K.M., Jones, S.S., Liu, H., Lovejoy, S.L., Marsh, T., Martsolf, G., Nelson, C., Okeke, E.N., Pearson, M.L., Pillemer, F., Sorbero, M.E., Towe, V.L., Weinick, R.M. CMS Innovation Center Health Care Innovation Awards RAND Project Report for CMS. 2013.

[4] Minnesota Department of Health, Strategies for Public Health: A compendium of ideas, experience and research from Minnesota's public health professionals, Volume 2; http://www.health.state.mn.us/strategies/social.pdf; accessed 3/6/17.

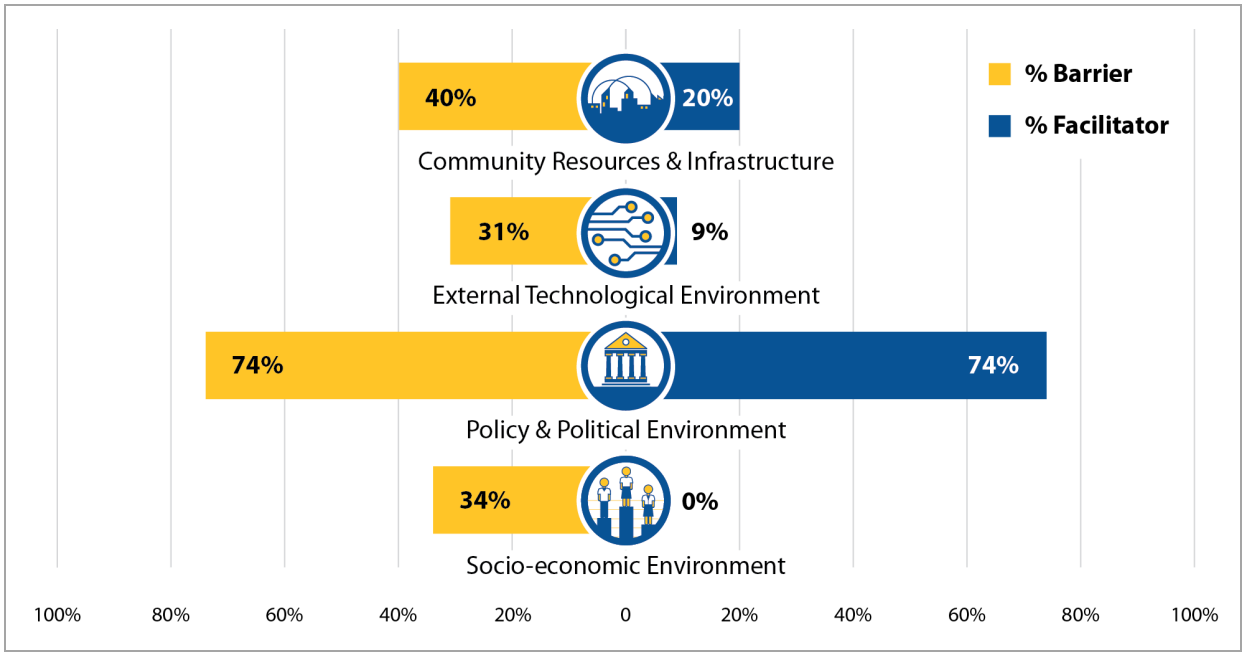
Notes:

- Out of possible 35 innovation components, implementation effectiveness measures were not available for IA, Altarum, and Mineral Regional due to nonresponse and/or innovation components that did not target patients.
- The yellow part of the circle indicates the percentage for the total N reporting the factor as influential.

Review of the qualitative interview and report data identified positive and negative conditions that awardees experienced during implementation, thereby, beginning to address the role of environmental factors in program implementation and overall "fit" of a program to its setting. External factors that served as facilitators or barriers to implementation were coded as positive or negative for community resources/infrastructure, socioeconomic participant factors, external technological factors, and general

policy/political environment. ***Figure 3-17*** summarizes the facilitators and barriers for each external factor, expressed as a percentage of the reporting innovation components.

Figure 3-17. Reported Facilitators and Barriers for Each External Factor



Key Finding: Policy and Political Environment is a Prime External Driver

Among all innovation components, 74 percent (n=26) reported that their innovation was hindered by factors related to their state or local ***policy and/or political*** environment. Delta Dental's innovation was influenced by policy changes to the Women, Infants, and Children (WIC) program, which eliminated the requirement that pregnant women and new mothers pick up benefit checks in person. Consequently, Delta Dental readjusted its recruitment strategy to reach pregnant women and new mothers.

Inversely, *policies and/or political* factors reported to affect the implementation of 74 percent of the innovation components (n=26) were positive and enabling. For example, the state of Michigan's support of "multi-purpose collaborative bodies" allowed MPHI to bring together business, labor, health care, and social service agencies and advocates. The collaborative approach allowed MPHI to move its innovation more quickly through state legislative and regulatory changes needed to develop a closed-loop system to serve all state Medicaid beneficiaries.

Key Finding: Technology Reported More Frequently as Barrier than Building Block

In contrast, only three awardees (Bronx RHIO, Children's Hospital, and Intermountain) noted positive impacts from ***external technological*** factors, such as using the Bronx Regional Analytic Database (BRAD) data to improve quality of care (Bronx RHIO) or receiving daily notifications of ED visits (Children's Hospital). For Intermountain, technological factors helped to expedite the implementation of the innovation's payment reform. One-third of innovation components (33%, n=11) encountered one or

more technological barriers that hindered implementation of their innovation. For example, U-Chicago experienced a delay in delivery of Medicaid data due to competing state-level priorities. U-Chicago also had technology challenges that affected beneficiaries, including the lack of reliable, monthly SMS texting services for innovation participants, especially those who pay for cell phone service on a monthly basis. Bronx RHIO faced a major technological impediment because it was unable to exchange data with other RHIOs; in response, the state has since mandated that RHIOs exchange data.

Key Finding: Collaboration and Competition Mediate the Influence of Community Resources and Infrastructure

A notable percentage (40%) of the innovation components encountered implementation barriers due to ***community resources and infrastructure***. Resources and opportunities for external collaborations varied considerably across the settings. In Washington, DC, Mary's Center partnered with the local medical care organization (MCO); however, the MCO's contract with Medicaid was not renewed. The newly funded MCO subsequently viewed the awardee's innovation as a competitive threat, creating a major barrier to achieving the goals.

Only 20 percent of innovation components benefitted from *community resources and infrastructure*. BAHC's rural New Mexico location was an obstacle to developing external partnerships, such as limiting fire departments' abilities to provide smoke detectors. However, BAHC's external relationships connected patients to many medical and social services, especially social services that BAHC was unable to support. In some cases, participating in BAHC's innovation allowed partners to learn about programs in other locations that could benefit their local communities. Housing programs were found to facilitate implementation, given the necessity of addressing patients' basic needs before attempting to improve care.

Key Finding: Socioeconomic Factors Continue to Present Hurdles to Implementation Effectiveness

Most environmental factors were not considered facilitators. Awardees were more likely to report that ***socioeconomic*** conditions served as barriers rather than facilitators: 12 (34%) awardees reported that ***socioeconomic*** environment of the innovation created barriers to implementation. For example, NHCHC served a transient population, which hindered its ability to find and retain patients for the innovation. Traditional barriers to implementation, such as language differences between providers and patients, were also factors for other awardees, such as BAHC.

Significance for Policy and Practice

KEY INSIGHTS

- Policy and political changes were the most significant external barriers to implementation. Addressing them offers an opportunity for collaboration and engagement among key stakeholders.
- Successful innovations showed resiliency despite a changing environment and dynamic conditions that affected awardees' implementation process and activities.
- Awardees' familiarity with patients' needs and local resources enhances ability to anticipate and deliver appropriate care.

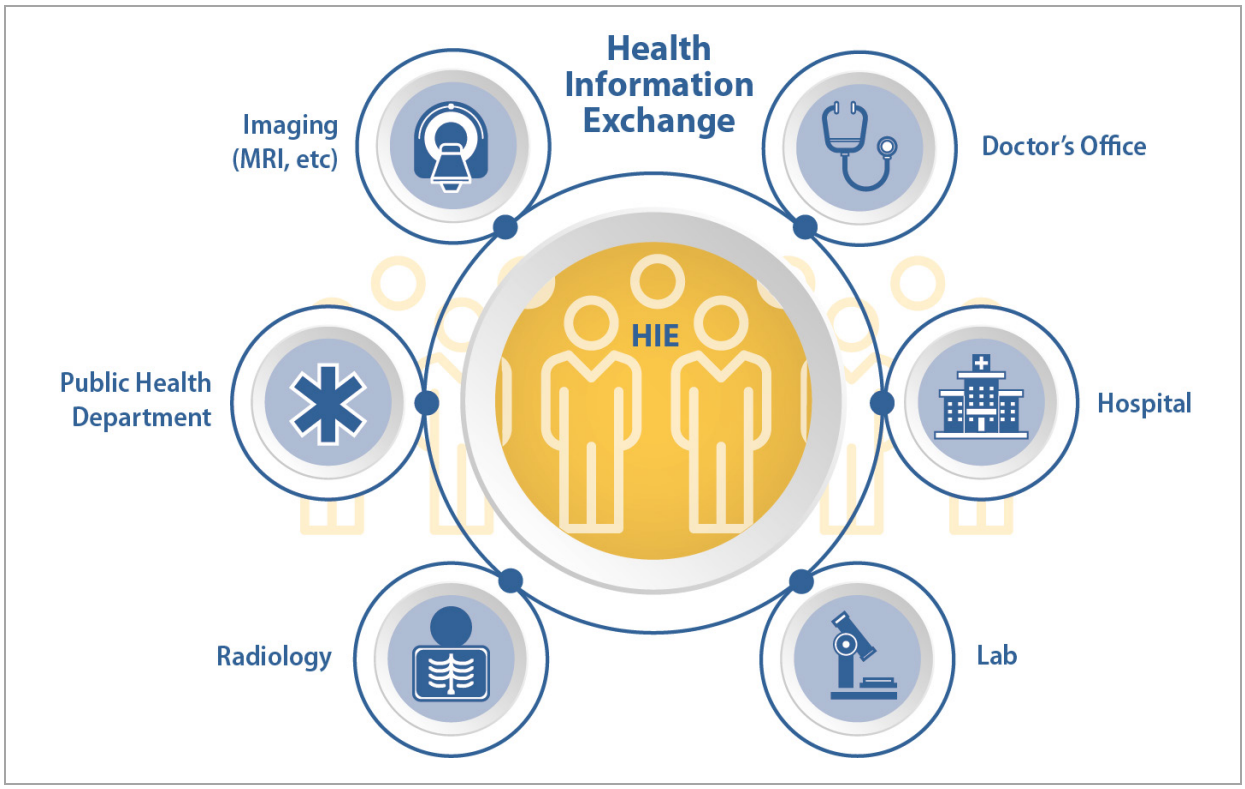
3.4.2 Overcoming Interoperability Challenges to Community-Based Health Information Exchange

Effective community-based innovations need reliable data that can be shared with many organizations. Hospitals, physician offices, laboratories, imaging services, public health organizations, and long-term and post-acute care units are just a few examples of organizations that generate, share, and use health information. As shown in ***Figure 3-18***, HIE can connect these organizations so health care workers can use that information across organizations to support care.

Innovations that leverage HIE to connect workers in new roles such as CHWs and patient navigators add another layer of complexity to the familiar challenges to HIE, which include inconsistent application of data standards, variation in privacy and security solutions across organizations, and the need to address impact on workflow. HIE can streamline communications and facilitate coordination of care. Future community-based health innovations need to understand how to overcome these challenges.

This analysis used 3 years of qualitative program evaluation data from progress reports, site visits, and telephone interviews. We analyzed qualitative evaluation data from Mary's Center, Bronx RHIO, and U-Chicago to identify the factors relevant to overcoming interoperability challenges. The results identified governance, technical and process factors as the most relevant and we discuss each in this section. See ***Appendix F*** for additional detail on methods.

Figure 3-18. Health Information Exchange



Key Finding: Successful Interoperability Requires Governance at Both HIE and Contributing Organizations.

In community-based health innovations, HIEs are shared resources for the community. Organizations that are part of the HIE are both contributors and end users of data. Developing, implementing, and using HIE to support community health means that both the HIE itself and contributing organizations play interrelated roles.

Governance at the HIE level involves community-based decisionmaking, and governance at the contributing organizations involves local decisionmaking. A shared governance structure allows organizations to maximize their use of the HIE and develop common strategies to overcome technical challenges such as the application of data standards, patient matching, and data aggregation. Organizations approached HIE-level governance differently. For example, in addition to monthly or quarterly governance meetings, Bronx RHIO engaged stakeholders at pilot sites to identify similar challenges and opportunities across sites and shared the findings across sites. U-Chicago created interdisciplinary working groups about specific topics, such as clinical partners, workforce development, and quality improvement. They then used feedback from these working groups to inform the design of their information exchange tool and prepare for pilot testing.

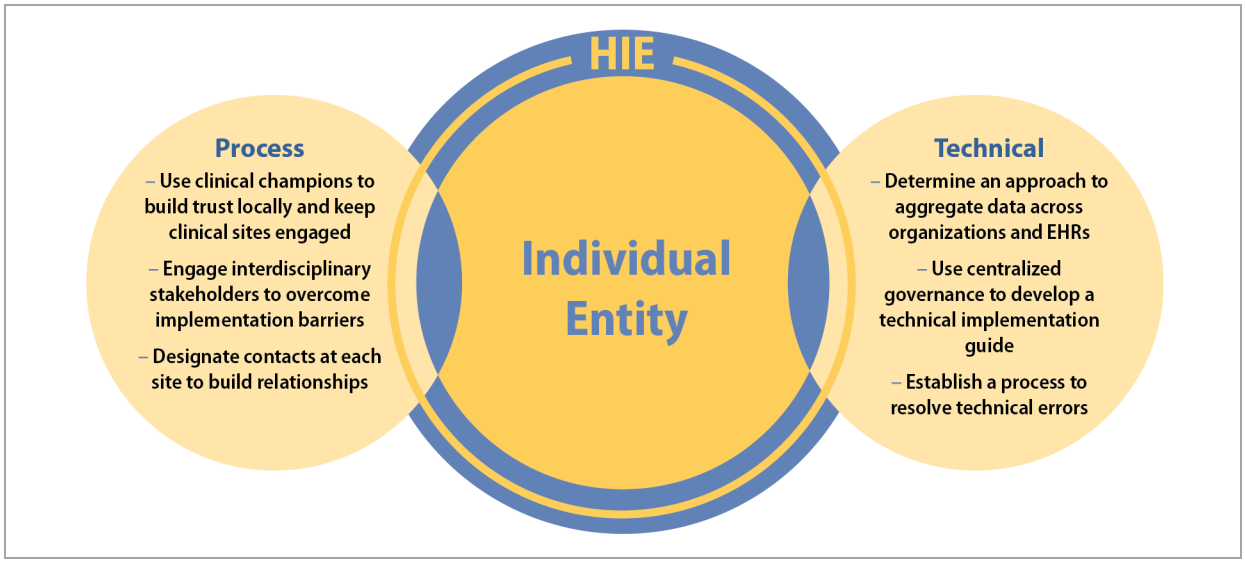
Governance also occurred at the contributing organization. Each awardee consisted of many sites, each of which had its own structures and processes. Organizations had to identify how HIE fit into these and make necessary changes. For example, at Bronx RHIO, sites addressed obtaining patient

consent differently. Other governance issues that contributing organizations had to address included identifying technical and clinical points of contact and identifying roles and responsibilities for data managers.

Key Finding: HIEs and Contributing Organizations Should Consider Both Process and Technical Factors.

HIEs and contributing organizations must consider how HIE data will be used; workflow and usability issues are particularly significant. ***Figure 3-19*** shows the kinds of process and technical factors awardees encountered in planning for the implementation of their HIEs. Awardees noted the importance of planning at both levels (HIE and within the contributing organization).

Figure 3-19. Consider Technical and Process Factors at HIE and Contributing Organizational Level



Process Factors

Stakeholder engagement and the characteristics of individuals and teams who participate are the most important process factors to consider. Awardees noted that physician and administrative champions were highly desired, if not essential, at each contributing organization. Designated contacts were also helpful for relationship building and resolving issues. Clinical champions build trust locally and keep clinical sites engaged. The Chicago Family Health Center identified a physician champion who understood the technology and the potential benefit; that person engaged other providers. As a staff member at that site explained, *"We always had an internal clinical champion to convince them along with us to help build local trust."* Another site emphasized the importance of having champions at each site. Bronx RHIO noted that having a designated contact at each site to attend regular meetings proved invaluable. Although the sites were diverse, they experienced similar issues, challenges, and opportunities that they could share with one another.

Equally as crucial are technical staff's involvement and contribution and interdisciplinary involvement in leadership and governance structure. Even with data standards, awardees noted issues with data interoperability and sharing information across organizations. Although physician champions at sites were helpful, other clinicians, administrators, IT staff, and others are (or should be) involved in using the HIE. Interdisciplinary involvement, awardees noted, helped overcome implementation barriers and garnered more diverse opinions and a more complete understanding of concerns across occupations.

Technical Factors

Because HIEs aggregate data across organizations, data issues with interoperability may occur. Decisionmakers at sites should understand that different EHRs have their own nuances that must be considered in building interfaces and algorithms. Sites also use different elements in their own way. At the HIE governance level, U-Chicago decided to prioritize commonly transmitted fields such as history and discharge versus the problem list. The reasoning was that those fields were consistently completed in the same way, captured current health issues, and captured diagnosed chronic conditions. This order enhanced interoperability.

Bronx RHIO and Mary's Center used central governance to overcome interoperability issues, for example, by developing a technical implementation guide. Items in the implementation guide included file formats, standards interpretation, management of incomplete or inaccurate data, and working error logs. Bronx RHIO mapped and standardized raw data across 12 different sources, and found the process challenging, time consuming, and prone to errors. They tested data files to identify and correct errors. In one case, a major error caused by data truncation required rebuilding the data feed into the analytic database. As a result, Bronx RHIO implemented additional routine testing as data sources changed or were added. The staff person indicated that,

> ***This plan includes review of all rules and transformations applied to raw data as it enters the RHIO's data feeds from all 12 data sources. This methodology will be applied in the future to plan for adding data from all new sources.***

U-Chicago found errors caused by address verification functionality that was inconsistently implemented across EHRs. This innovation involved identifying community-based resources that were convenient for patients, so the address functionality was critical. The HIE then adopted system-level functionality to check addresses.

Significance for Policy and Practice

KEY INSIGHTS

- Consider both technical and process factors.
- Cultivate clinical and administrative champions.
- Develop implementation guides that communities can use to support HIE implementation and ongoing use.
- Develop processes for error management.
- Think about workflow across organizations.

3.5 Workforce Development

3.5.1 How do Patient Navigators Enhance Care Coordination in HIT Innovations?

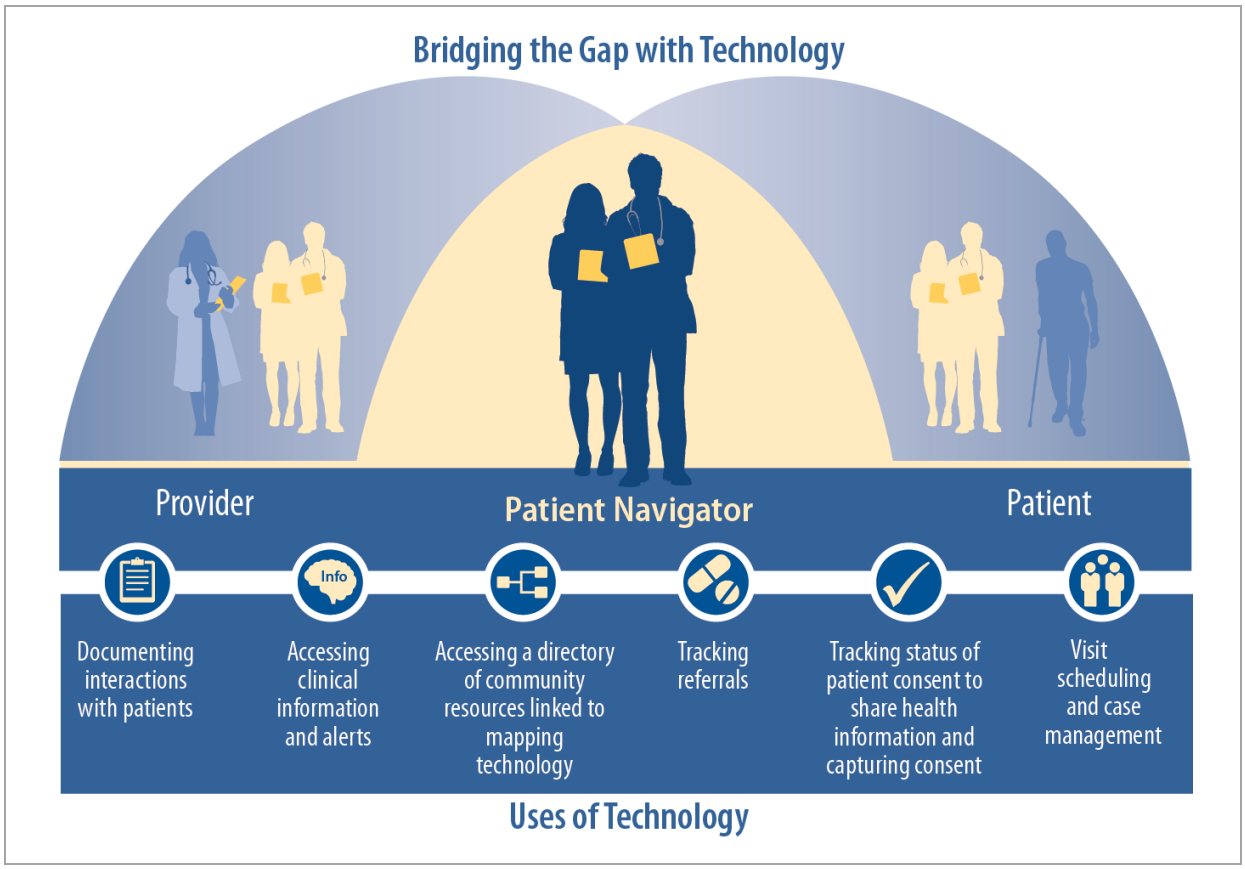
Patients with complex health care needs and vulnerable patients benefit from community health innovations that incorporate care coordination strategies across settings. Some care models use patient navigators to provide this assistance directly. Although the benefit of navigators on health outcomes is well documented, the benefit of using technology to support innovation and communication with the care team is less well documented. The increase in health IT adoption allows patient navigators to use these systems to support innovation and communication.

We analyzed 3 years of qualitative program evaluation data relevant to workflow to examine how eight awardees with HIT-enabled innovations integrated their patient navigators. We defined "workflow" as the tasks and activities necessary to implement the program, including interdependencies between staff and responsibilities. Additional details on our methods can be found in Appendix F.

Key Finding: Embedding Navigator Tools in EHRs and Other Health IT Systems Creates Efficient Workflow.

Most awardees noted that when patient navigators integrated their recordkeeping in the same electronics system other care team members used, efficiency and value resulted. ***Figure 3-20*** shows how patient navigators used technology to interface with providers and patients.

Figure 3-20. Bridging the Gap with a Variety of Technology Applications



Awardees used health IT, including HIEs and EHRs, to share information between navigators and the rest of the care team. For three awardees, HIE was a key component to the navigators' work. Providers could review data that navigators entered into health IT systems and receive updates on patient status even when outside of their care. One innovation leader stated, *"When clinics can share all the information with CHWs and see what CHWs have been doing, we can begin to look at population health."*

Navigators consistently used health IT to help patients get and use health care more effectively. One awardee leader said,

> ***…[navigator] are a new CHW with hyper-local, expert knowledge about places where individuals can get goods and services to manage their health and who uses information technology to collate, manage, and search this information.***

As shown in Figure 3-20, technology served various purposes for navigators, including tracking referrals and documenting communication with patients.

Embedding navigator tools in existing EHRs and health IT systems created integrated systems that connected navigators and the entire care team. These integrated systems allowed resource allocation issues to be managed and population health issues to be addressed directly. Data were used to identify those patients who most need navigator innovation: high-cost/high-utilization patients with

complex care requirements. Analysis can be based on clinical or geographical groupings. Efficient workflows enabled by integrated systems allow the care team to reach out to selected patients proactively rather than passively waiting for them to return to the clinical setting for additional care.

The most successful integrated systems were easy for navigators and the care team to access and use. A provider in the Mary's Center innovation noted that access to CHW reporting data was, *"…easy; just open another section of the EMR*." Another awardee wished for even more efficient information flow:

> ***CHWs should be able to press the right button in the EMR without writing anything. We should have data templates that flow from one check box to the next. I want the CHWs to check off what they did for the patient, whether it's education, or medication, which then flows into more specific information.***

Key Finding: Health IT Can Help Integrate Patient Navigators into the Care Team.

Managing the care of complex patients requires comprehensive care teams. Adding navigators to this mix increases the need for information to flow back to the rest of the care team. Primary care providers are protective of their patients and wary of increasing complexity. For instance, provider participants in the Mary's Center innovation initially expressed concern about time lags between the navigator assistance and providers receiving information about these events. These same providers later reported greater satisfaction when additional navigator training reduced this lag. Health IT can provide efficient ways to track and document navigator interactions with patients. Health IT solutions that are integrated, functional, and easy to use help integrate navigators into the care team.

In sum, those developing community health innovations for complex patients should consider providing navigators with secure, portable devices (e.g., tablets) to facilitate access to EHRs, manage and document interactions with patients, and communicate with the care team.

Key Finding: Segregated Systems and Lack of Access to Patient Records Impedes Navigator Integration.

For three awardees, data entry into multiple, segregated systems added time to navigator workflow unnecessarily. Navigators had to document the same information from their patient interactions in multiple places. For example, one provider stated:

> ***Now we have access to the information they gather in the homes. They gather information on paper and then they input it into the [reporting system] and the EHR. We only have [access to] information in the EHR, so the CHWs are doing double work. If they must do double work, they see fewer patients.***

Another awardee (U-Miami) reported that navigators had to first document information on paper and then enter the data into an electronic version of the paper form. Although the electronic system was reportedly easy to use, the system was not initially designed to accommodate navigators' needs.

Navigators appreciated having the paper forms available until the system was tailored to meet their needs, but documenting in multiple places created inconsistencies in the data, such as the number of home visits completed.

Two awardees reported issues with access to patient information. Navigators in these two innovations did not have access to data at home visits, and for one awardee, navigators did not have electronic access to patient information at provider sites. If they had an electronic tool, navigators reported, they could access key information, reduce time spent on data entry, and streamline documentation. To illustrate this point, one navigator stated:

> ***Having a tablet would be really useful. I need something I could take with me to the home, because sometimes I end up taking triple documentation. Documentation can take up your day. We have the paper documentation that we have to put in the registry and then EHR. I don't always remember everything. If I had the EHR and reporting system, we could at least do one, or download it and upload it when we get into the office. The data input becomes overkill and the patients have to see us with our bags with papers and papers.***

Key Finding: Patient Navigators Need to Learn Various Health IT Systems to be Effective.

Awardees reported that navigators had to learn to use health IT systems of varying complexity to perform their jobs. In one innovation, CHWs used a case management system integrated with local providers' EHRs via an HIE. The navigators needed training and support to ensure timely and accurate recordkeeping. Another awardee reported that navigators needed technical skills to use the clinic's EHR, while a third awardee trained navigators to use text messaging to complement their HIE for patient outreach. This awardee trained navigators to respond to messages and developed a workflow for documenting text message interactions.

The need for technical skills has implications for hiring and training. Awardees prioritized other skills above technology in navigator hiring, yet technology was an integral part of the job. Awardees often refined hiring processes after identifying the specific skill set and personality traits needed for productivity and efficiency. Awardees noted that navigators should be self-starting, gregarious, and outgoing in care settings. One awardee said:

> ***The CHWs need to know a lot to do their jobs, operating a computer, accessing EMR in the field; they carry electronic signature devices, editor load all demographic information into the patient record, perform intake interviews, schedule the initial clinical visit.***

Navigators need social skills to gain patient trust and technical skills to provide services.

Key Finding: Health IT Systems Design Should Account for Patient Navigators' Needs.

To prevent workarounds and improve documentation, health system leaders and innovation planners engaged the care team when designing their health IT implementations. Care teams worked with their technology vendors to create more structured documentation notes and templates for navigators to access. One awardee followed these best practices, stating:

> ***At the beginning, we had meetings as a group to talk about what should be in the [reports/viewpoint page]; [we] have a form to document our work; everything we do goes down on that form; initially, we had to develop a separate note to help the physician find our documentation.***

Navigators' needs varied across the different functions listed in Figure 3-22, but not all systems had the functionality necessary to support those functions. When the EHR did not accommodate the navigator role, navigators had to use separate systems. When the role was entirely new, developers initially had to guess at required functions. As the navigator role became more clearly defined over time, organizations did not prioritize updating systems requirements and functionality to match the role.

Significance for Policy and Practice

KEY INSIGHTS

- Embedding navigator tools in EHRs and other health IT systems creates efficient workflow.
- Integrating health IT can help integrate patient navigators into the care team.
- Lack of access to patient records and use of segregated systems impedes workflow.
- Patient navigators need to learn various health IT systems to be effective.
- Health IT systems design should account for patient navigators' needs.

3.6 Implementation Effectiveness

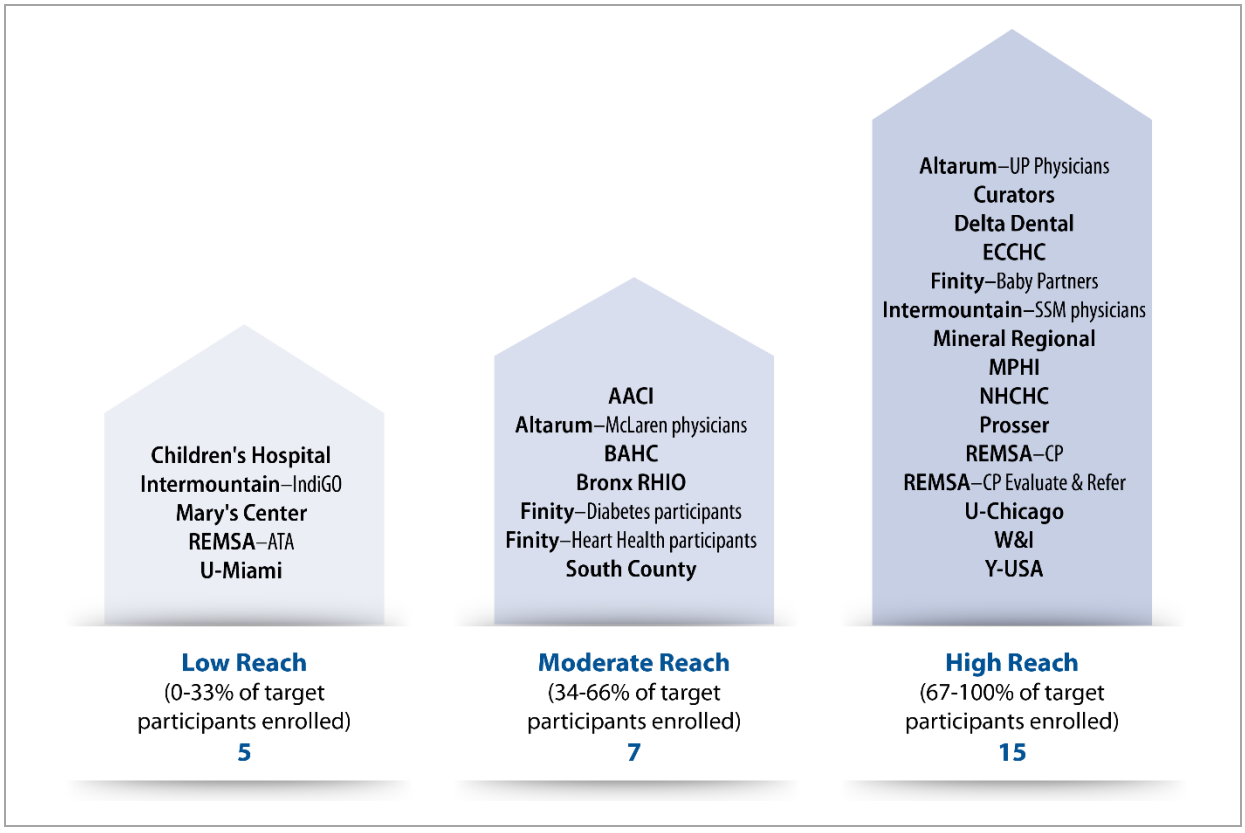
3.6.1 Innovation Reach

As noted in the third annual report, 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.

Key Finding: Over Two-Thirds of Awardees Achieved High Reach

Figure 3-21 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 participants were patients. Two awardees reach targets included physicians (IA and Altarum), and one includes 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). Additional information on successful achievement of reach, challenges with defining reach, suggestions for planning for capturing reach, as well as significance for policy and practice can be found in the third annual report.[8]

Figure 3-21. Cumulative Reach for All Awardees



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 their target population, not all those enrollees received innovation services. Participants must get a sufficient

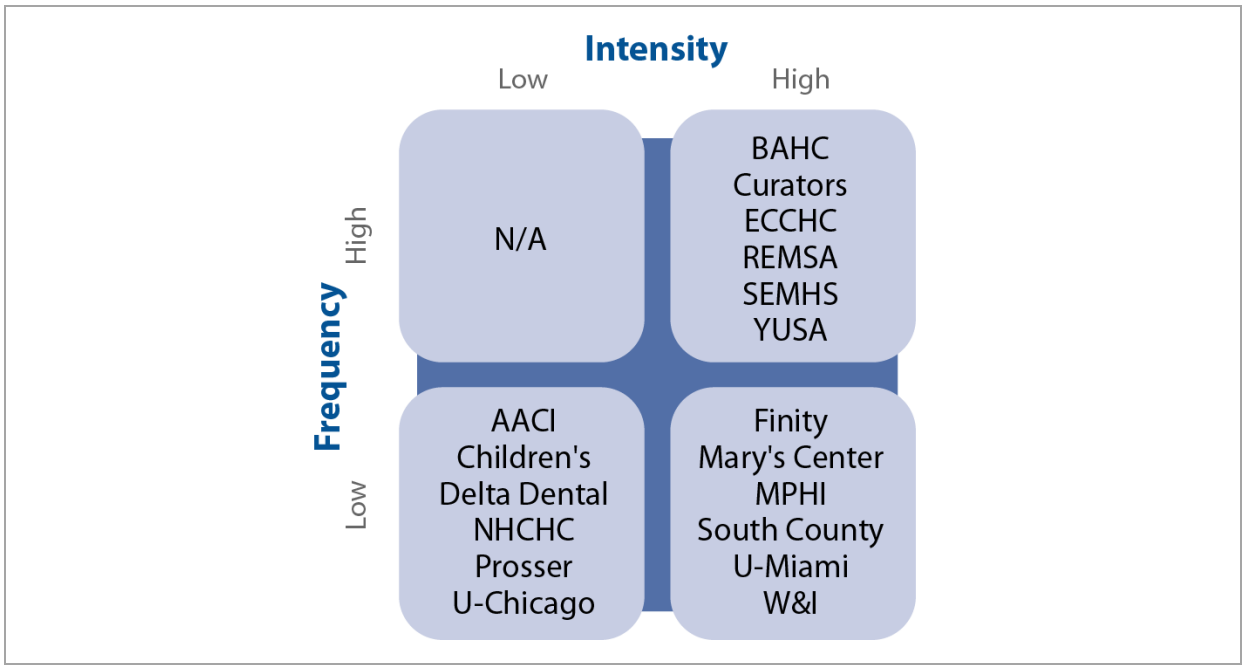
dose of the innovation (i.e., intensity and frequency of services)—and dose can range from low to high. Intensity captures the degree of contact or engagement with participants; we examine it relative to frequency to better understand the potential impact of dose on patient outcomes. High-intensity services (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 higher-intensity services.

Key Finding Half of Awardees Provided a High-Intensity Dose

The results presented in the third annual report remain the same except for REMSA, which was moved from low frequency, high intensity to high frequency, high intensity. The change is due to a correction in the calculation of REMSA's dose frequency.

The results in ***Figure 3-22*** show that 12 awardees provided high-intensity dose and these were split evenly between high and low frequency.

Figure 3-22. Dose Frequency by Intensity



Significance for Policy and Practice

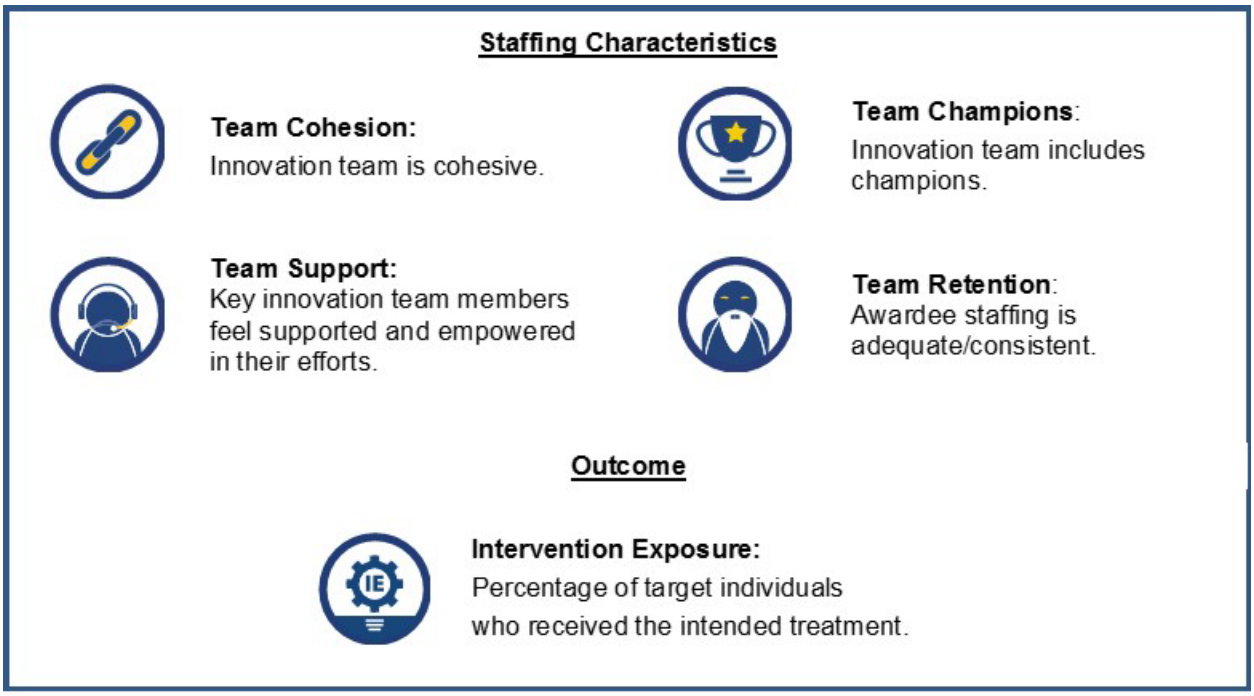
Our assessments regarding the implications of dose for policy and practice remain unchanged. More specifically, our findings suggest programs should systematically assess the intensity of services at the beginning of innovation and adjust the frequency as needed over time to increase the likelihood of affecting health outcomes.

3.6.3 *Which Characteristics of Innovation Teams Predict Intervention Exposure?*

Staff involvement is essential to the success of any workplace initiative. In this section, we consider the staffing characteristics, and associated program environments, that predicted success defined as program exposure (or the percentage of target individuals who received the intended treatment). Findings from this investigation may inform future innovations' strategy for staffing to help maximize innovation impact.

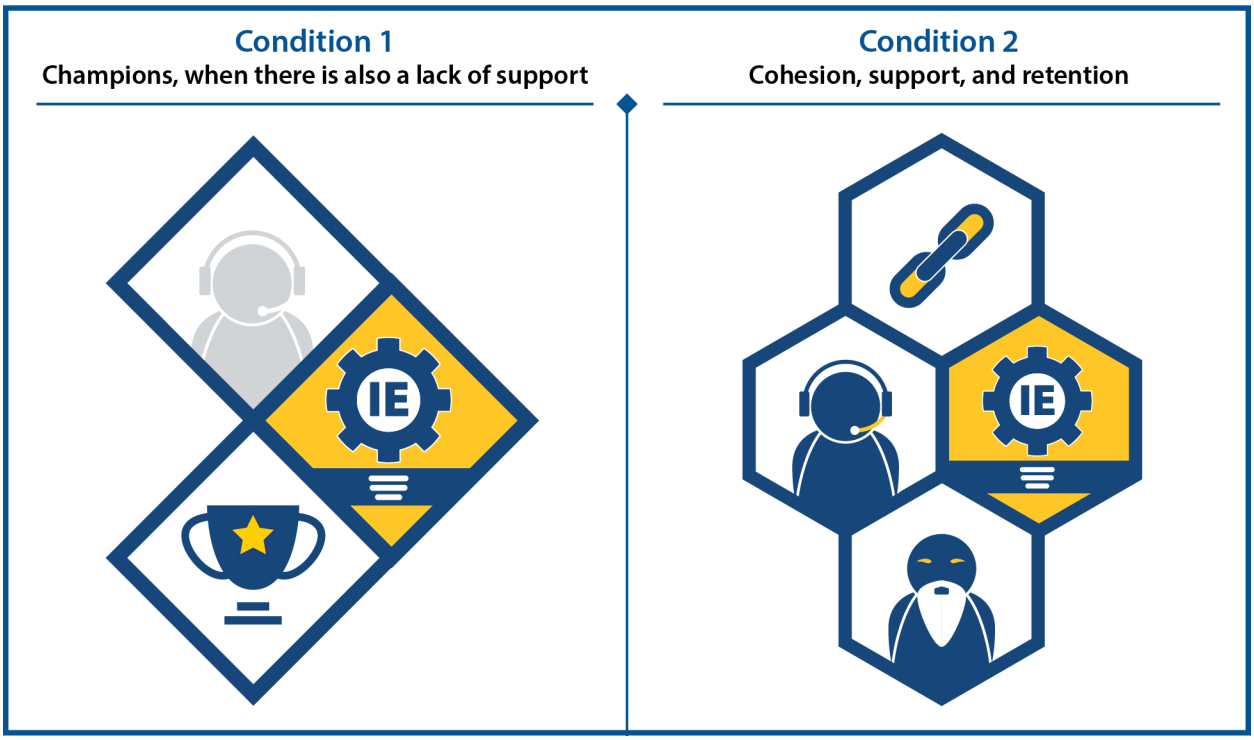
The analysis examined four staffing characteristics depicted in **Figure 3-23**: team cohesion, team champions, team support, and team retention. We selected these staffing characteristics based on their demonstrated relationship to performance outcomes in the organizational literature, and preliminary analyses of the associations between the staffing characteristics and innovation exposure (reach). Detailed analysis methods and statistical results from the analysis are presented in ***Appendix E and F***.

Figure 3-23. Associations Between Staffing Characteristics and Innovation Exposure



The QCA results in ***Figure 3-24*** demonstrate that two conditions, or combinations of staffing characteristics, are related to greater innovation exposure. Based on these results, the presence of champions is only critical to innovation exposure under conditions of low perceived support (Condition 1). However, when the team is cohesive, feels supported, and is adequately staffed, champions are no longer as critical to achieving greater innovation exposure.

Figure 3-24. Two Conditions for Innovation Exposure



To gain insight about how these staffing characteristics interact, including the impact of the innovation context, we analyzed interviews with awardees about their experiences implementing innovations. The next section provides those details.

Key Finding: Champions Are Critical to Innovation Exposure When Support is Lacking

Participants described champions as leaders—or as taking a leadership role in an innovation. Across innovations, these individuals were often physicians and supervisors for RNs, nurse care managers, and/or CHWs.

For ECCHC and Curators, we investigated the benefits of champions in environments where key innovation team members perceived little to no support in their efforts. Participants from these innovations described low support and related challenges, including teams that *"did not function well,"* and absent leadership: ("*I wonder who is in charge of the program now and where do we go from here as a community?").* There was also tension about the scope of CHWs and other new staff's responsibilities in relation to preexisting staff, and concern over whether hospitals would accept and finance new roles.

Innovation stakeholders described champions as potential buffers to these challenges. For example, physician champions were reported to help innovations gain entrée to an otherwise skeptical and/or reluctant hospital. One staff member said,

> ***NCMs had strong advocates in the physicians they worked with, which helped… [the physician advocates] went back to the other physicians and nurses to promote the project).***

Other participants described champions as supervisors, especially their role as a catalyst to unify staff, and reinstate a culture of support and empowerment:

> ***…you can go to [this type of supervisor] with anything. She will see what she can do and she'll talk to the team … you can call your team and let them know what is happening and help. It's like you have somebody.***

Where staff felt that support was lacking from their institution and/or colleagues, the presence of varied champions (e.g., physicians and nurses), may have helped to create inroads to program acceptance, staff empowerment, and increased patient exposure to program services.

Key Finding: Cohesion, Support, Retention May Facilitate Innovation Exposure Even Without a Champion

According to participants, these teams are familiar with one another's personalities and roles, communicate regularly about work challenges and experiences, and ask questions. Cohesive characteristics were often related to a staff culture of meetings where *"everyone is involved,"* and is encouraged to provide input and experiences toward patient care. According to participants, this meeting platform is *"full of recognition, morale, and improvement,"* and helps to promote trust among colleagues and a sense of support in work. Stakeholders argued that trust is critical to exposure given inevitable glitches (*"when technology is not working, everyone is pulling their hair out*); service constraints and demands (*we have big city problems with small town budget"*), and requirements that physicians relinquish the control of patient care to other staff. According to one participant, for this cultural shift in the responsibilities for patient care to take place, *"[physicians] having a leap of faith is critical"* and largely depends on the cultivation of trust.

Where teams were cohesive and supported, stakeholders identified improvements in workflow and efficiency. For example, teams talked about work as a revolving door, where "*each of [the staff] does [their] part in the process,"* and *"gains energy from [their] peers."* Another participant added that cohesion and support created *"warm hand-offs"* or a seamless and thoughtful relay of complex tasks. Innovations often had a large staff, dispersed across departments and buildings. Combined with characteristics of cohesion and support, sufficient staffing meant colleagues who were reliable and could share responsibilities, skills, and networks to meet patient needs.

Some staff explained the result of these conditions as greater continuity of care (across providers and services) and more comprehensive and effective treatment (e.g., catching and then communicating health problems and relate contexts otherwise missed in the doctor's office). Extending beyond staff services, one participant added that *"when patients see cohesion in the form of endorsement of one provider by another, their trust in the overall health service may increase."* For this innovation and others, a cohesive, adequate, and supported staff may also help to create more positive perceptions of care.

Significance for Policy and Practice

KEY INSIGHTS

- Consider the characteristics of the innovation workforce in efforts to increase program exposure.
- Cultivate champions across innovation staff (especially when the team has less support), including hospital leadership, physicians, and nurse supervisors.
- Foster cohesion and trust through inclusive meetings and by creating a shared understanding of roles, responsibilities, and goals.
- Maintain consistency in staffing when implementing new initiatives, and have a transition plan in place to minimize disruption when turnover occurs.

3.7 Innovation Sustainability

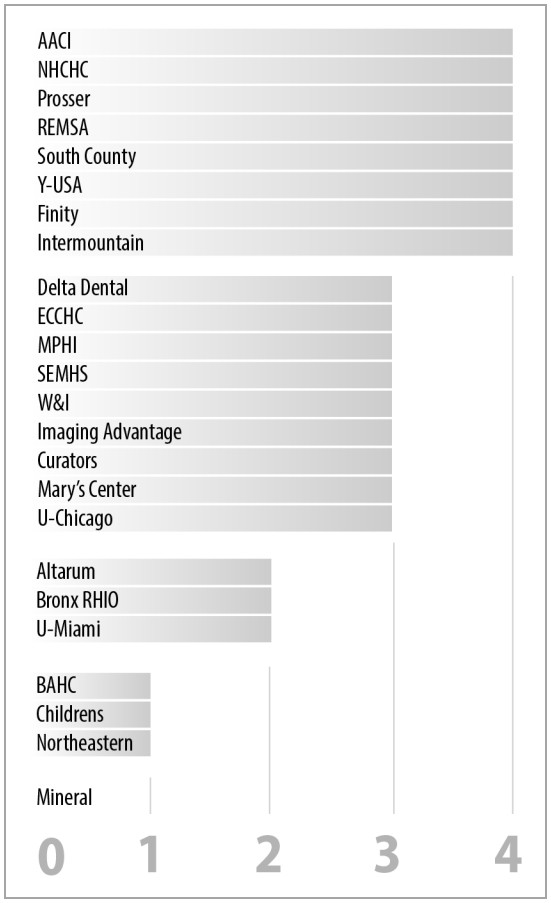
RTI assessed the likelihood of sustainability among awardees in the previous reporting period. This section provides a sustainability update for those awardees that received a no-cost extension (NCE). The NCE for Bronx RHIO, Y-USA, REMSA, MPHI, and Curators allowed the innovations to continue, thus increasing the likelihood of sustainability for awardees.

Using a checklist to capture the presence or absence of key sustainability factors—planning, funding, partnering, workforce development, and other system-level changes—awardees were scored on a 5-point scale where 0 indicated a low likelihood of sustainability and 4 a high likelihood. Additional details of the methods used to assess sustainability can be found in Appendix F.

Key Finding: The Majority of the Innovations Were Sustained

Figure 3-25 shows the sustainability scores for all awardees. The scores are the same as those presented in the third annual report with two exceptions. REMSA and MPHI improved the likelihood of sustaining their innovations through positive developments in funding and partnerships in the last quarter of operations.

Figure 3-25. Updated Sustainability Scores



3.8 Conclusions

Overall, 15 HCIA Community Resource awardees met one or more goals of smarter spending and better care (two more than reported in the third annual report). Seven of these awardees (BAHC, Children's Hospital, Curators, ECCHC, REMSA-CP 30, W&I, and Y-USA) achieved these goals consistent with a theory of action that would impact spending and utilization outcomes. Most awardees reached over two-thirds or more of their targeted participants, and half provided high-intensity services; these findings remain unchanged from the third annual report.

The awardees' workforce development and implementation experiences offer additional useful lessons and insights for future health care transformation initiatives. In examining the role of patient navigators in HIT-enabled innovations, we found that embedding the needs and tasks of navigators into the EHR created efficient workflows that enhanced communication and timely information exchange. Using data analytics to identify high-need patients also allowed navigators to prioritize their limited time to those at highest risk.

Our examination of staffing characteristics related to implementation effectiveness revealed two important conditions. In settings where staff do not feel supported, the champion's role can create a buffer and help staff overcome implementation challenges. Where staff cohesion and support are strong, the team is able to work together to meet challenges and, thus, the necessity of a program champion becomes less salient.

We examined two aspects of implementation context for this report: the role of external factors and the factors relevant to interoperability in HIE innovations. Among the four external factors we examined, the policy and political environment was either a barrier or a facilitator to implementation for two-thirds of the awardees. Notably, it was equally positive and negative in its influence. Awardees had

little direct control of this factor, but a few were able to work with stakeholders to shape policies conducive to implementation and sustainability.

Our evaluation of the three awardees with HIEs revealed several important factors that facilitated successful interoperability: (1) presence of strong governance structures both within the HIE and each of the contributing organizations; and (2) attention to processes and technical tools to support information exchange, quality, and timeliness.

Our findings about sustainability of the awardees remain largely the same as those reported in the third annual report. REMSA and MPHI secured additional funding for their innovations and, thus, we raised their sustainability scores from the prior report. 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.

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Appendix A

HCIA Community Resource Evaluation Framework

No updates to Appendix A were required for the third annual report addendum. For details about the HCIA Community Resource Evaluation framework, please refer to the third annual report (https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf).

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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 June 30, 2016, and we present Medicare claims data through June 30, 2016. We updated Medicaid analyses for awardees that had new data available in Alpha-MAX files or directly from awardees. Since the third annual report, we added Medicaid analyses for AACI, Intermountain, and W&I.[1] 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.

Core Measures

As part of a broad assessment of health care innovations, the Center for Medicare & Medicaid Innovation (CMMI) has been 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.

CMMI programs are designed to 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.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

- **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.

  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.

  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.

- **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 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-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. 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. For Medicare, 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. For Medicaid, we report all-cause ED visits including those that result in 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 June 2016. 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 refined CGs for the third annual report and this addendum. Previously, we applied the rolling entry matching (REM) approach to Medicare analyses. We expanded the REM methodology to Medicaid analyses in the third annual 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 incorporated new regression models in the third annual report and this addendum. 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.[2] PSM allowed us to estimate the average treatment effect on the treated (ATT), which was the impact of the innovation on those who participated.[3]

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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[2] Rosenbaum, P., and Rubin, D.B.: The central role of the propensity score in observational studies for causal effects. Biometrika. 70(1):4155, 1983

[3] 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.

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.[4]

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, 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.

[4] 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.

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.[5,6]

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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5 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.

6 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.

Medicaid

Potential CG members included Medicaid beneficiaries enrolled in FFS living near AACI. Patients who visited AACI since the innovation started enrolling patients in October 2013 were excluded from the CG. CG 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 Medicaid beneficiaries similar in observable characteristics to innovation Medicare beneficiaries. The PSM model adjusted for the following potentially confounding factors: age, gender, race, disability, dual Medicare-Medicaid status, 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.

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 CGs. 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.[7] 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.

[7] CG physicians did not receive ImageSmart training. Each comparison physician was assigned the same training date as the matched TG physician.

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.

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. Results have not changed since the third annual report because no new data are available; therefore, the Medicaid analysis for BAHC is not included in this report.

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 CG 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 CG 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 participants as those who received at least one home visit, and nonparticipants as those who declined services or, despite agreeing to participate in Care Links, did not receive any home visit. The CG included all nonparticipants, i.e., those who enrolled but did not receive any home visit and those who declined services. We used PSM to select CG beneficiaries with similar 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, race, number of ED visits, inpatient admissions, readmissions and primary care visits, and expenditures in the calendar quarter prior

to the innovation. We use one-to-variable matching with replacement, matching each innovation beneficiary with up to three CG beneficiaries with the closest propensity score.

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 CG 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 CG beneficiaries with the closest propensity score. Results have not changed since the third annual report because no new data are available; therefore, the Medicaid analysis for ECCHC is not included in this report.

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 CG 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 CG beneficiaries with the closest propensity score. Results have not changed since third annual report because no new data are available; therefore, the Medicaid analysis for Finity Baby Partners is not included in this report.

Diabetes

For each claims outcome measure, we compared eligible participants to eligible nonparticipants in the Diabetes Management program. We used PSM to select CG 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 CG beneficiaries with the closest propensity score. Results have not changed since third annual report because no new data are available; therefore, the Medicaid analysis for Finity Diabetes is not included in this report.

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 CG 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 CG beneficiaries with the closest propensity score. Results have not changed since third annual report because no new data are available; therefore, the Medicaid analysis for Finity Heart Health is not included in this report.

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.

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. Results have not changed since third annual report because no new data are available; therefore, the Medicaid analysis for IA is not included in this report.

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.

Medicaid

Potential CG members included Medicaid beneficiaries living in the state of Utah during the innovation launch who were not enrolled in the innovation. Medicaid claims analyses focused on patients participating in the SSM component of Intermountain's innovation. Enrollment by Medicaid beneficiaries in the IndiGO and population management (hot spotting) components of Intermountain's innovation was too small to perform descriptive and regression analysis; therefore, no CG was selected for IndiGO and population management.

We use PSM to select CG 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 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 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 CG beneficiaries with the closest propensity score.

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 so no PSM was performed. Results have not changed since third annual report because no new data are available; therefore, the Medicaid analysis for Mineral Regional is not included in this report.

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 CG 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. For beneficiaries enrolled in Medicaid prior to 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. Beneficiaries who were not enrolled in Medicaid prior to the innovation had no utilization or spending history and were matched based on the demographic and enrollment variables listed previously. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three CG 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 CG 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 CG 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 tradeoff of using PSM to further refine the CG. However, PSM did not appreciably improve the statistical balance of characteristics between the innovation and CGs, and would have excluded 72 participants in the innovation group who could not be closely matched to individuals in the CG. In addition, the potential CG 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 CGs. This report includes the same CG as used in the third annual report except for two individuals who had a change in their recorded FFS eligibility status and two additional beneficiaries enrolled.

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). Results have not changed since the third annual report because no new data are available; therefore, the Medicaid analysis for Prosser is not included in this report.

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) was revised in this report to contain beneficiaries with FFS Medicare living in the cities of Reno and Sparks and in Washoe County.

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 prior to the innovation. For REMSA ATA, the propensity score model also included years since Medicaid enrollment and 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. Results have not changed since the third annual report because no new data are available; therefore, the Medicaid analysis for REMSA is not included in this report

Southeast Mental Health Services

Medicare

The CG consists of F Medicare beneficiaries living in Prowers, Kiowa, Bent, or Baca Counties in southeastern Colorado. We use PSM to select CG 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 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 use one-to-variable matching with replacement, matching each innovation beneficiary with up to three CG beneficiaries with the closest propensity score.

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. Results have not changed since the third annual report because no new data are available; therefore, the Medicaid analysis for SEMHS is not included in this report.

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 December 31, 2015 and in San Mateo County for at least 1 month while the innovation enrolled 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 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 CG 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, race, disability, dual Medicare-Medicaid status, and total Medicaid payments in the calendar quarter and calendar year prior to the innovation. Ninety-two of the 169 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, race, disability and dual Medicare-Medicaid status. We used one-to-variable matching with replacement, matching each innovation beneficiary with up to three CG 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.

Women and Infants Hospital of Rhode Island

Medicaid

The CG for W&I is a set of high-risk infants born prior to the innovation's launch. 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 compare the innovation infants with a group of comparison infants born prior to the innovation start in Rhode Island. Before the innovation, W&I treated high-risk infants through a similar program, Transition Home Plus. 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.

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:

$$y_{i,t} = \alpha_0 + \mu I_i + \sum_t^T \beta_t Q_t + \sum_t^T \theta_t (Q_t \cdot I_{i,t} \cdot D_t) + \sum_k \lambda_k X_{i,t,k} + \varepsilon_{i,t} \quad \text{(B-1)}$$

$y_{i,t}$ = 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 t^{th} 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 $\mu = 0$. 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 t^{th} 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 several 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 many 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:

$$y_{i,t} = \alpha_0 + \mu I_i + \beta D_t + \theta I_i D_t + \sum_k \lambda_k X_{i,t,k} + \varepsilon_{i,t} \quad \text{(B-2)}$$

- $y_{i,t}$ = 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

No updates to Appendix C were required for the third annual report addendum. For details about awardee-specific data collection and analysis methods, please refer to the third annual report (https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf).

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Appendix D

Qualitative Data Collection and Analysis Methods

No updates to Appendix D were required for the third annual report addendum. For details about qualitative data collection and analysis methods, please refer to the third annual report (https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf).

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Appendix E

Qualitative Comparative Analysis Methods

No updates to Appendix E were required for the third annual report addendum. For details about qualitative comparative analysis methods, please refer to the third annual report (https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf).

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Appendix F

Detailed Methods for Cross-Awardee Analyses

Technical Appendix F.1: How is Innovation Complexity Related to Changes in Utilization and Spending?

Methods

Project staff adopted a mixed-methods approach to examine the relationship among innovation complexity and utilization and spending. The quantitative part of the analysis entailed creating scatterplots with innovation complexity plotted against the outcomes and fitting a trend line to best represent the association between the variables. The qualitative part of the analysis involved contextualizing the associations using insights from the awardee case studies, Narrative Progress Reports, and interview notes that had been coded as relevant to complexity. For the purposes of this evaluation, complexity is defined as *the difficulty of putting the innovation into place.*

Data and Sample

Project staff measured complexity using the items listed in ***Table F.1-1***. All complexity measures came from the qualitative comparative analysis (QCA) structured instrument, described in detail in our third annual report, ***Appendix E***.[1] A composite measure of complexity was calculated by averaging the values of each component. Overall regression coefficients from claims analyses, outlined in ***Appendix B,*** were used as indicators of utilization and spending.

[1] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., and Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table F.1-1. Complexity Measures from the QCA Structured Instrument

Measure	Response Options/ Range
Complexity of start-up: Level of coordination needed to start the innovation	0 = none, 0.33 = slight, 0.66 = considerable, 1 = great
Complexity of enrollment: Variety of processes for enrolling target patients	Count of approaches that the innovation team enroll patients into the innovation, standardized to a 0-1 scale • 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., ED 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., ED 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.
Complexity of workflow: Extent to which workflows changed for the innovation	0= none, 0.33= a slight extent, 0.66 = a considerable extent, 1 = a great extent
Complexity of maintenance: Level of coordination needed to maintain the innovation	0 = none, 0.33 = slight, 0.66 = considerable, 1 = great
Complexity of roles/ responsibilities: Extent to which the innovation changed roles and responsibilities	0= none, 0.33= a slight extent, 0.66 = a considerable extent, 1 = a great extent
Terms and Definitions • ED = emergency department.	

The complexity analysis sample was restricted to those innovation components that directly served patients. The availability of claims outcome data differed across the Medicare and Medicaid populations. We analyzed 12 innovation components in the Medicare sample and 14 innovation components in the Medicaid sample.

Technical Appendix F.2: Is Implementation Effectiveness Associated with Spending and Utilization?

Methods

Implementation effectiveness was calculated as an average (i.e., equal weight) of exposure to the innovation and quality of implementation of the innovation. Exposure to the innovation was defined for enrolled participants as receiving at least one service of the innovation and quality of innovation implementation was defined for exposed participants as receiving the minimum number of intended services required to achieve the intended effect or outcome. Given the definitions of exposure and quality, we limited our analyses to awardee innovation components in which the targeted user was a patient. Therefore, we excluded awardees and awardee components that targeted providers and/or organizations (i.e., Altarum, Bronx RHIO, Imaging Advantage, SSM components of Intermountain, Mineral, Northeastern). ***Table F.2-1*** provides details on how exposure and quality were calculated for each awardee innovation component. ***Table F.2-2*** provides the exposure, quality, and implementation effectiveness scores for each awardee innovation component by payer (i.e., Medicare and/or Medicaid).

Table F.2-1. Exposure and Quality Definitions by Awardee Innovation Component

Awardee Innovation Component	Exposure Definition	Quality Definition
AACI	% of those enrolled who received at least 1 service	% of those who received at least 1 service that had at least 1 in-person visit and/or received at least 1 health education service
BAHC	% of those enrolled who received at least 1 service	% of those who received at least 1 service that had at least 1 intensive care management home visit
Children's Hospital	% of those enrolled who received at least 1 visit	% of those who received at least 1 visit that had at least 2 visits
Curators	% of those enrolled who received at least 1 service	% of those who received at least 1 service that had at least 1 communication with NCMs and at least 1 of the following services: aligning resources and needs, assessing needs and goals, facilitating care transitions, developing a care plan, and/or receiving self-management support
Delta Dental	% of those enrolled who received at least 1 visit	By definition, participants only ever offered and received 1 visit; therefore, exposure and quality scores are equal
ECCHC	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 home and at least 1 micro-clinic visit
Finity: Babies	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 prenatal and at least 1 postnatal visit

(continued)

Table F.2-1. Exposure and Quality Definitions by Awardee Innovation Component (continued)

Awardee Innovation Component	Exposure Definition	Quality Definition
Finity: Diabetes	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 HbA1c assessment, at least 1 LDL-C test, and at least 1 provider visit
Finity: Heart Health	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 a LDL-C test and at least 1 provider visit
Intermountain-IndiGO only	% of those enrolled who received at least 1 view	No specific data on number of views received; therefore, exposure and quality scores are equal
Mary's Center	% of those enrolled who received at least 1 service	% of those who received at least 1 service that completed a care plan
MPHI	% of those enrolled who received at least 1 pathway	% of those who received at least 1 pathway that completed at least 1 medical referral and/or social service referral pathway
NHCHC	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 eligibility assistance/financial counselling and/or health education/supportive counselling service
Prosser	% of those enrolled who received at least 1 CP visit	% of those who received at least 1 CP visit that received at least 1 of the specific services offered by the CP: assisting with scheduling PCP appointment, filling prescription, and/or reviewing discharge instructions
REMSA-ATA	% of those enrolled who received at least 1 transport	Transports are considered separate incidents; therefore, exposure and quality scores are equal
REMSA-CP	% of those enrolled who received at least 1 CP visit	Visits are considered separate incidents; therefore, exposure and quality scores are equal
REMSA-NHL	% of those enrolled who completed at least 1 protocol	Calls are considered separate incidents; therefore, exposure and quality scores are equal
SEMHS	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 behavioral health and/or case management service
South County	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received at least 1 comprehensive assessment and had a care plan initiated
U-Chicago	% of those enrolled who received at least 1 report	Reports received considered separate incidents; therefore, exposure and quality scores are equal
U-Miami	% of those enrolled who received at least 1 service	% of those who received at least 1 service that had at least 1 of the following services: dental services, behavioral health/counselling, health education, dermatologic, and/or mental health services
W&I	% of those enrolled who received at least 1 service	% of those who received at least 1 service that received a 1-month assessment, post-discharge phone call and completed the Edinburgh Depression Scale
Y-USA	% of those enrolled who attended at least 1 session	% of those who attended at least 1 session that completed at least 9 sessions

Terms and Definitions

- TCP= community paramedic; NCM=nurse care managers; HbA1c=hemoglobin A1c; LDL-C=low density lipoprotein cholesterol.

Table F.2-2. Exposure, Quality, and Implementation Effectiveness Scores by Awardee Innovation Component and Payer

Awardee Innovation Component	Medicare Exposure Score	Medicare Quality Scores	Medicare IE Score	Medicaid Exposure Score	Medicaid Quality Score	Medicaid IE Score
AACI	0.872	0.291	0.581	0.826	0.286	0.556
BAHC	0.990	0.966	0.978	0.983	0.860	0.921
Children's Hospital	—	—	—	0.033	0.753	0.393
Curators	0.707	0.942	0.825	0.577	0.908	0.743
Delta Dental	—	—	—	1.000	1.000	1.000
ECCHC	1.000	1.000	1.000	1.000	1.000	1.000
Finity: Babies	—	—	—	0.855	0.314	0.584
Finity: Diabetes	—	—	—	1.000	0.585	0.793
Finity: Heart Health	—	—	—	0.999	0.497	0.748
Intermountain-IndiGO only	1.000	1.000	1.000	1.000	1.000	1.000
Mary's Center	1.000	1.000	1.000	0.964	0.917	0.940
MPHI	1.000	1.000	1.000	1.000	1.000	1.000
NHCHC[1]	—	—	—	—	—	—
Prosser	0.995	0.788	0.891	1.000	0.868	0.934
REMSA-ATA	0.313	0.313	0.313	0.201	0.201	0.201
REMSA-CP	0.994	0.994	0.994	1.000	1.000	1.000
REMSA-NHL	0.227	0.227	0.227	0.844	0.844	0.844
SEMHS	1.000	0.744	0.872	1.000	0.821	0.911
South County	0.971	0.948	0.960	0.990	0.899	0.944
U-Chicago	1.000	1.000	1.000	1.000	1.000	1.000
U-Miami	0.994	0.997	0.995	0.078	0.637	0.358
W&I	—	—	—	0.993	1.000	0.997
Y-USA	1.000	0.781	0.890	—	—	—

Terms and Definitions

- — Indicates no claims data.

Data Analysis

Once we computed the implementation effectiveness scores for each awardee innovation component and by Medicare and/or Medicaid we correlated the implementation effectiveness score with the utilization and cost claims data (i.e., overall cost savings, inpatient-admissions, readmissions, and ED visits). We generated scatterplots of the correlations and calculated a line of best fit through the data. We also examined the significance of the correlations at the 10% level. Data was presented in scatterplots by utilization or spending outcome and by either Medicare or Medicaid.

Technical Appendix F.3: Overcoming Interoperability Challenges to Community-Based Health Information Exchange

We collected and analyzed 3 years of qualitative program evaluation data including progress reports, site visits, and telephone interviews. Awardees prepared quarterly progress reports to provide updates on implementation activities and document results of self-monitoring analyses. Evaluators trained in qualitative methods conducted site visit and telephone interviews using standard study protocols. Protocol questions related to program design, implementation progress, partnerships, organizational resources and capacity, workforce development, and lessons learned.

We analyzed evaluation data for three awardees, U-Chicago, Bronx RHIO, and Mary's Center, because they implemented innovations that included a health information exchange component. We analyzed data relevant to governance, planning, and workflow, defined as the tasks and activities necessary to implement the program, including interdependencies between staff and responsibilities. Using an inductive analytic approach, all authors independently reviewed a sample of the data and identified preliminary themes for a working codebook. Using QSR International's NVivo qualitative analysis software (version 11.0), we then used the preliminary themes to inform a second round of independent coding. Ambiguous passages were flagged and discussed within the group or adjudicated by a third reader, informing codebook refinement. To ensure consistency in coding, approximately 40 percent of the qualitative text was double-coded, and then adjudicated by a third reader. Coders achieved a final kappa of 0.8, suggesting excellent interrater reliability.

A full description of the coding process and procedures for analyzing coded data are in the third annual report, ***Appendix D***.[2]

[2] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Technical Appendix F.4: How Do Patient Navigators Enhance Care Coordination in HIT Innovations?

We collected and analyzed 3 years of qualitative program evaluation data including progress reports, site visits, and telephone interviews. Awardees prepared quarterly progress reports to provide updates on implementation activities and document results of self-monitoring analyses. Evaluators trained in qualitative methods conducted site visit and telephone interviews using standard study protocols. Protocol questions related to program design, implementation progress, partnerships, organizational resources and capacity, workforce development, and lessons learned.

We analyzed evaluation data for eight awardees who utilized patient navigators: U-Miami, Curators, Bronx RHIO, BAHC, ECCHC, Finity, U-Chicago, and Mary's Center. We reviewed data relevant to workflow, defined as the tasks and activities necessary to implement the program, including interdependencies between staff and responsibilities. Using an inductive analytic approach, all authors independently reviewed a sample of the data and identified preliminary themes to develop the codebook. Using QSR International's NVivo qualitative analysis software (version 11.0), we then used the preliminary themes for a second round of independent coding. Ambiguous passages were flagged and discussed within the group or adjudicated by a third reader, informing codebook refinement. To ensure consistency in coding, approximately 40 percent of the qualitative text was double-coded, and then adjudicated by a third reader. Coders achieved a final kappa of 0.8, suggesting excellent interrater reliability.

A full description of the coding process and procedures for analyzing coded data are in the third annual report, ***Appendix D***.[3]

[3] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Technical Appendix F.5: Innovation Dose

Details on how we calculated frequency and assigned intensity scores to each service awardees provided to participants can be found in Appendix F of the third annual report.

The average awardee-level dose intensity score ranged from 1 to 3, with a mean of 1.7, and the average awardee-level dose frequency score ranged from 1 to 3, with a mean of 2.1 (***Table F.5-1***). For ease of interpretation, we categorized the awardee-level intensity and frequency scores into low (1–1.5) and high (1.6–3.0). The table below reflects the updated average dose frequency for REMSA, which changed from 1.0 to 2.0, moving them into the high frequency, high intensity category as noted in Section 3. The scores for all other awardees did not change from those reported in the third annual report.

Table F.5-1. Average Dose Frequency and Intensity 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	3.0
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	1.8
REMSA	2.0	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.6: Which Characteristics of Innovation Teams Predict Intended Intervention Exposure?

Methods

RTI adopted a mixed-methods approach to examine which characteristics of innovation teams are best associated with innovation exposure. First, we used qualitative comparative analysis (QCA) to determine which factors—alone or in combination—were necessary and/or sufficient to produce high participant exposure to the innovation. The staffing characteristics used in the QCA were chosen using the Job Demands-Resources model (JD-R) as a guiding framework.[4] According to the JD-R model, all work characteristics can be categorized as a demand or a resource. Demands are not inherently stressful, but require effort and deplete employees' resources. Employees' well-being and performance outcomes depend on the extent to which they have job resources needed to meet their job demands. In the context of this resource question, team cohesion, support, champions, and retention were selected as potential resources based on their demonstrated relationships with positive employee and organizational outcomes in the research literature.

Next, we examined coded qualitative data to identify themes to help explain the QCA results. We focused specifically on qualitative data coded as team dynamics, or *staff interactions with each other and those outside of the practice*. These data include positive and negative statements about a collective sense of team, a shared vision, communication networks, information sharing, and levels of mutual respect and trust among team members.

Data and Sample

Table F.6-1 shows all measures included in the QCA, and how they were scored for the analysis. We measured characteristics of innovation teams using the QCA structured instrument (see third annual report, ***Appendix E***).[5] Using the organizational performance literature and simple correlations, we identified four characteristics of innovation teams hypothesized to predict high participant exposure to the innovation: cohesion, support, champions, and retention. High participant exposure to the innovation was defined as exposure in excess of the average across innovation components (80 percent).

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[4] Bakker, A.B., Demerouti, E.: The Job Demands-Resources model: State of the art. *Journal of Managerial* Psych, 22, 309-328, 2007.

Demerouti, E., Bakker, A.B., Nachreiner, F., & Schaufeli, W.B.: The Job Demands - Resources model of burnout. J Appl Psych, 86, 499-512, 2001.

[5] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf

Table F.6-1. Constructs, Measures, and Calibration Decisions

Construct	Measure	Calibration Decision
Team Cohesion	Innovation team is cohesive.	• Score = 1 if checked. • Score = 0 if unchecked.
Team Support	Key innovation team members feel supported and empowered in their efforts.	• Score = 1 if checked. • Score = 0 if unchecked.
Team Champions	Innovation team includes champions.	• Score = 1 if checked. • Score = 0 if unchecked.
Team Retention	Awardee staffing is adequate/consistent.	• Score = 1 if staff adequacy was characterized as "great" or "considerable." • Score = 0 if staff adequacy was characterized as "minimal" or "poor."
Exposure	Proportion of enrolled participants receiving at least one innovation service	• Score = 1 if exposure exceeded the average exposure for all innovation components (0.80) • Score = 0 if exposure was less than or equal to the average exposure for all innovation components (0.80)

Table F.6-2 shows how all measures were scored on an awardee/innovation component basis.

Table F.6-2. Data Matrix with Awardees and Their Scores

Awardee / Innovation Component	Team Cohesion	Team Support	Team Champions	Team Retention	Exposure
AACI	1	1	1	1	1
BAHC	1	1	1	1	1
Children's Hospital	1	0	0	0	0
Curators	0	1	1	1	0
Delta Dental	1	1	1	1	1
ECCHC	0	0	1	0	1
Finity - Baby Partners	1	1	1	1	1
Finity - Diabetes Management	1	1	1	1	1
Finity - Heart Health	1	1	1	1	1
Intermountain	1	0	1	1	1
Mary's Center	1	1	1	1	0
MPHI	1	1	1	1	1
NHCHC	1	1	1	0	0
Prosser	1	1	1	1	1
REMSA – ATA	1	1	1	1	0
REMSA – CP	1	1	1	1	1
REMSA – NHL	1	1	1	1	0
South County	1	1	1	1	1
SEMHS	1	1	1	1	1
U-Chicago	1	1	1	1	1
U-Miami	0	0	0	0	0
W&I	1	1	1	1	1
Y-USA	1	1	1	1	1

Analysis

We used R statistical analysis software to conduct a crisp set QCA, consistent with the general approach to QCA described in the third annual report, ***Appendix E***.[6] The partial truth table shown in ***Table F.6-3*** lists all combinations of the team characteristics that appeared in at least one case in our sample. The combinations in the top three rows achieved consistency above the 80 percent threshold suggested in the literature,[7] meaning that at least 80 percent of the cases represented by the combinations achieved the intended outcome of high exposure.

Table F.6-3. Original Partial Truth Table

Row #	Team Cohesion	Team Support	Team Champions	Team Retention	Number of Awardees in This Combination	Consistency
16	1	1	1	1	17	0.824*
5	0	1	0	0	1	1.000*
14	1	1	0	1	1	1.000*
1	0	0	0	0	1	0.000
8	0	1	1	1	1	0.000
9	1	0	0	0	1	0.000
15	1	1	1	0	1	0.000

* = 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.

Consistent with the approach described in the third annual report, ***Appendix E***, we adopted best practices for QCA. We first examined conservative, parsimonious, and intermediate solutions from the original analysis. We then repeated the original analysis for the non-occurrence of the outcome (i.e., NOT achieving high exposure) to evaluate whether logical contradictions appeared in the analysis solutions or assumptions used to simplify the combinations (e.g., the same combination predicted high exposure and also a failure to achieve high exposure). Through this process, we identified the four combinations listed in ***Table F.6-4*** that do not appear in our sample but were used by the software in contradictory ways to logically reduce the truth table combinations. To resolve the contradictions, we used theory to make assumptions about whether each combination would lead to high exposure or not, and then manually assigned the combinations to align with our predictions. ***Table F.6-4*** shows the manual assignments for rows 6, 12, and 13 that we used in the final model.

[6] Ibid.

[7] Ragin, C.C.: Fuzzy-Set Social Science. Chicago: University of Chicago Press, 2000.

Table F.6-4. Contradictory Rows and Manual Reassignment of the Outcome

Row #	Team Cohesion	Team Support	Team Champions	Team Retention	Outcome Manual Assignment
6	0	1	0	1	1
10	1	0	0	1	0
12	1	0	1	1	1
13	1	1	0	0	1

Our final solution appears in ***Table F.6-5***. The two combinations of team characteristics that produce high exposure are: (1) champions and a *lack of* support, and (2) cohesion, support, and retention. The two solutions have good consistency values, suggesting a strong relationship between the combinations and the outcome of high exposure.[8] The first solution has relatively low coverage (0.125), indicating that it is empirically uncommon. The second solution, however, has high coverage (0.875), suggesting that it is highly empirically relevant.

Table F.6-5. Final Coverage and Consistency Scores for Team Characteristics Solution

Reduced Solutions	Raw Coverage	Unique Coverage	Solution Consistency
Champions and *lack of* support	0.125	0.125	1.000
Cohesion and support and retention	0.875	0.875	0.824
Total consistency = 0.842 **Total coverage = 1.000**			

We examined qualitative data on the awardees/innovation components for each combination to better understand why and how the combination resulted in high participant exposure to the innovation. Two awardees in our sample exhibited the first pattern and achieved high exposure: Curators and ECCHC. Seventeen awardees/innovation components exhibited the second combination: ACCI; BAHC; Delta Dental; Finity – Baby Partners – Babies, Diabetes Management, and Heart Health; Mary's Center; MPHI; Prosser; REMSA – ATA, CP, and NHL; South County; SEMHS; U-Chicago; W&I; and Y-USA. All of these awardees except Mary's Center, REMSA – ATA, and REMSA – NHL also achieved high exposure.

[8] Ibid.

Technical Appendix F.7: Which External Factors Most Influence Implementation Effectiveness?

Section 3.6.4 analyzed qualitative data for 24 awardees, differentiating implementation effectiveness across the 33 innovation components that each experienced varying external influences. The analysis excluded IA, Altarum, and Mineral Regional because no measures resulted from either nonresponse and/or innovation components that did not target patients. We examined external factors that influenced implementation effectiveness using previously coded qualitative data on community resources and infrastructure, external technological environment, policy and political environment, and the socioeconomic environment. We described the coding process and procedures for analyzing qualitative coded data in the third annual report, Appendix D.[1] Using QSR International's NVivo qualitative analysis software (version 11.0), we then exported the coded data reports into Microsoft Excel to complete the second round of binary coding, identifying whether the qualitative excerpts reported the presence of external factors that served as potential facilitators (positive, 1) or barriers (negative, 0). To ensure consistency in coding, approximately 25 percent of the code reports were double-coded and ambiguous excerpts were flagged, then adjudicated by a third reader, and discussed within the group informing refinement.

Technical Appendix F.8: Innovation Sustainability

RTI assessed the sustainability of all innovations using a sustainability checklist, as described in the third annual report, ***Appendix D***.[9] RTI collected new data from the five awardees with 9- to 12-month NCEs for the Third Annual Addendum Report, and updated the sustainability scores for REMSA and MPHI on the basis of closeout interviews, Narrative Progress Reports, and Awardee Performance Reports.

[9] Rojas Smith. L., Amico, P., Hoerger, T. J., Jacobs, S., Payne. J., & Renaud, J.: Evaluation of the Health Care Innovation Awards: Community Resource Planning, Prevention, and Monitoring: Third Annual Report 2016. Centers for Medicare & Medicaid Services, 2017, March. https://downloads.cms.gov/files/cmmi/hcia-communityrppm-thirdannualrpt.pdf