SECOND ANNUAL REPORT

HCIA Disease-Specific Evaluation

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PRESENTED TO:
Erin Murphy Colligan &
Caitlin Cross-Barnet
Center for Medicare & Medicaid Innovation
7500 Security Blvd Mail Stop: WB-06-05
Baltimore, MD 21244
(410) 786-0263

PRESENTED BY:
NORC at the University of Chicago
Adil Moiduddin
Vice President, Health Care Research
4350 East-West Hwy, Suite 800
Bethesda, MD 20814
(301) 634-9419

NORC
at the UNIVERSITY of CHICAGO

Contributors

Rina Dhopeshwarkar

Sarah Downie

Maysoun Freij

Alison Laffan

Nina Litton

Sai Loganathan

Shriram Parashuram

Misti Paudel

Sarah Ruiz

Rachel Singer

Michelle Spafford

Megan Skillman

Tianne Wu

Disease-Specific Awardees

Awardee Name	Abbreviation
Duke University's South Eastern Diabetes Initiative	SEDI
FirstVitals Health and Wellness, Inc.	FirstVitals
The George Washington University	GWU
Joslin Diabetes Center, Inc.	Joslin
Health Resources in Action, Inc.	HRiA
Nemours Children's Health System of the Nemours Foundation	Nemours
Le Bonheur Community Health and Well-Being	Le Bonheur
Mountain Area Health Education Center, Inc.	MAHEC
Innovative Oncology Business Solutions, Inc.	IOBS
University of Alabama at Birmingham	UAB
The Trustees of the University of Pennsylvania	UPENN
The Rector and Visitors of the University of Virginia	UVA
Trustees of Indiana University	Indiana
Regents of the University of California, Los Angeles	UCLA
Ochsner Clinic Foundation	Ochsner
Christiana Care Health Services, Inc.	Christiana
Upper San Juan Health Service District	USJHSD
Vanderbilt University Medical Center	Vanderbilt

Table of Contents

List of Exhibits

Executive Summary

In July 2012, the Center for Medicare & Medicaid Innovation ("CMMI" or "Innovation Center") announced the first round of 108 Health Care Innovation Awards ("HCIA Round 1" or "HCIA"). Each award tests a health-care-delivery innovation focused on specific populations and settings. These innovations include integration and coordination of services, use of software applications, workforce training, and continuous quality improvement informed by rapid-cycle feedback. This report focuses on the subset of 18 HCIA projects targeting patient populations with specific diseases or diagnostic profiles. The HCIA disease-specific awards focus on seven conditions considered "priority" because of their cost, prevalence, and seriousness. They are Alzheimer's disease and dementia; cancer; cardiovascular disease (CVD) and stroke; chronic pain; diabetes; end stage renal disease (ESRD); and pediatric asthma.

Evaluation Goals and Methods

This report contains findings from the first two years of a four-year evaluation. In it, we address research questions on program implementation and examine overall program effectiveness—focusing on CMMI goals to achieve better care, smarter spending, and improved overall health.

Findings in this report reflect analysis of both qualitative and quantitative data. We use qualitative data gathered over two rounds of site visits conducted with all 18 awardees in the past 24 months. In year one, we conducted in-person site visits to all 18 awardees. In year two, we conducted a second round of in-person site visits to 12 awardees; and conducted phone interviews with the remaining six. For some awardees we visited multiple sites, and ultimately visited 44 locations across the 18 awardees over the course of two years. Site visits involved interviews with program leadership, staff, enrolled patients (participants), and caregivers, and also focus groups with participants and caregivers. We supplemented some in-person site visits with phone interviews with staff and patients that we could not interview during the site visit. For awardees for which we only conducted phone interviews in year two, we used the same interview protocols as those used in-person to discuss implementation experiences, challenges, successes, and outcomes with leadership and staff, as well as with patients. We also draw findings from information abstracted from awardee documents such as progress reports.

Data used to produce quantitative findings vary across the 18 awardees. We present results for the 11 awardees that had sufficient sample size to conduct analysis. Where the sample size of Medicare fee-for-service (FFS) participants exposed to an awardee intervention allowed (nine awardees), we use Chronic Conditions Warehouse (CCW) data from the CMS Virtual Research Data Center (VRDC) to capture information on health care cost and utilization for participants (treatment groups). In addition, where sample size allowed (six awardees), we identify "comparison group" cases using propensity scores calculated for the treatment group. For these awardees, we show how the awards impact CMMI priority measures: hospitalizations, hospital readmissions, emergency department (ED) visits, and total cost of care for Medicare FFS patients. This analysis uses "difference-in-differences" (DID) methods in order to take into account the specific characteristics of providers and patients as well as secular trends.

We employ similar analyses using Medicaid cost and utilization data for two awardees. In these cases, we use Alpha-MAX data from the VRDC or data obtained directly from Medicaid payers. For one of the two awardees, we also identify a suitable comparison group and conduct DID analyses. Finally, for six awardees, we present quantitative analysis of change in measures of health outcomes and health-related behaviors using participant data collected by the awardees.

Implementation Experience

We report on the overall reach of the interventions relative to targets and the mechanisms used by awardees to "dose" or disburse their interventions. We also describe barriers and facilitators to implementation as well as specific lessons learned regarding workforce development and use of technology.

Most awardees met or exceeded initial expectations for total participants and their reach into priority populations. Most awardees target participants considered high-risk for developing a more serious or worsened health condition. As a whole, the awardees reach a racially and ethnically diverse population by targeting conditions disproportionately affecting minorities (e.g., diabetes and CVD) and by operating in regions of high population density for minority groups.

Among recruitment strategies, awardees report greatest success from face-to-face interactions. Even as many awardees use clinical or administrative records to screen for eligible participants automatically, they note successful recruitment hinges on building trust through personal interaction. They also report that potential participants are often more receptive to care coordination or navigation interventions when in the hospital immediately following an acute event.

A participant's willingness and ability to articulate his or her needs drives the intensity of interaction with the intervention (the dosage). Awardees use different triggers to initiate a participant's exposure to specific program elements. Awardees may base these triggers on clinical and non-clinical assessments and passive or active monitoring of data transmitted through telemedicine. More than these structural triggers, however, participants generally receive an intensity of service proportional to the extent they reach out and articulate their own needs to intervention staff.

Provider discretion and protocols can mediate how much dosage is received from front-line intervention staff, such as care coordinators or lay health workers. For example, HRiA staff may provide more than the three or four home visits specified in the protocol if a child's asthma flares up due to seasonal changes.

Some awardees determine optimal dosages based on what is effective and feasible for their participant populations. For example, Nemours did not place a cap on the number of home visits but found that after five or six home visits, participants tend to have reached "maximum independence." Furthermore, Christiana determined that 60 to 90 days of case management is sufficient to stabilize and educate patients.

Workforce Experience

Most awardee interventions include prominent roles for lay health workers (LHWs). LHWs were primarily involved in coordinating communication and service activities, addressing participants' social or non-clinical needs, and offering education for program participants. This includes patient education to support self-management of the targeted disease conditions as well as training or coaching participants or their caregivers on self-care.

Awardees that employ LHWs for a wide range of activities report more successful workforce models. Many awardees used LHWs to enhance care coordination and encourage disease management. Where nurse practitioners (NPs) were filling similar functions, they struggled to address non-clinical needs on top of their demanding clinical caseloads.

Physicians play limited roles in most awardee programs. Physicians actively involved in the intervention usually play a supervisory role or offer specialized expertise. For example, at UCLA and Christiana, a physician acts as the medical director of the care coordination program. Programs used relevant specialists as well, such as a palliative care physician at UVA, and an endocrinologist at SEDI's Durham site. Le Bonheur represents an exception. For this awardee, the pulmonologist and allergy/immunologist initiates the intervention and subsequently determines the extent to which patients receive intervention services.

Some awardees had trouble recruiting and retaining staff due to local workforce shortages. Awardees located in rural areas, in particular, face challenges recruiting and retaining skilled staff such as NPs and behavioral health specialists. This leads to delays in implementation and forces the expansion of existing staff roles.

Training represents an important program component for LHWs; however, trainings vary significantly across awardees within the disease-specific cohort. Training varies in length of time, format (didactic versus experiential), location (on-site versus off-site), and instructor (e.g., program staff, subject matter experts, county health departments). LHWs and program staff at all sites report providing training on disease-specific care (e.g., Asthma 101 training) and organizational and administrative tasks (e.g., IRB training and EHR training). Program staff and LHWs at six awardee sites describe patient engagement training, and LHWs from four awardees mentioned training for motivational interviewing.

Flexibility and adaptability of staff facilitated effective implementation. Across awardees, leadership and staff noted that flexibility of individual team members was critical to implementing care coordination interventions. This includes willingness to adapt to evolving roles and the ability to manage unpredictable and dynamic situations independently. This was particularly critical for those awardees in which the program was new, and program leadership was developing and refining positions and protocols after the start of the program.

Program Effectiveness

We draw findings on program effectiveness from qualitative and quantitative sources:

Focus groups and telephone discussions with over 400 patients and caregivers revealed important quality of life improvements. The improvement in pediatric asthma and dementia patient caregivers' quality of life was particularly notable; many programs not only helped them better understand and manage the illness of the person they care for but also offered them direct counseling, education, and tips on self-care. Patent and caregiver discussions also reveal strong behavior change and improvements in disease management and communication with physicians.

Two awardees, UAB and Nemours, demonstrated program effectiveness across both claims and qualitative data:

- Quantitatively, UAB participants experienced fewer hospitalizations and ED visits after enrollment in the program relative to a comparison group. Among participants in our sample (n=46), several experienced changes in care utilization by way of reduction in ED visits. Patients and caregivers described past situations where having a navigator could have prevented them from unnecessarily going to the ED. Additionally, participants gave specific examples of where the navigator helped them avoid an unnecessary ED trip;
- For Nemours, we find statistically fewer ED visits and hospitalizations after enrollment. There is also significant evidence of a reduction in cost among participants enrolled in the program relative to a comparison group. Qualitative findings from caregivers (n=45) show they value LHWs for following up on physicians' asthma education. They report that LHWs educate them on asthma medications, triggers, and asthma action plans, enabling them to better manage the condition and provide effective care.

We observe a statistically significant decrease in at least one claims-based utilization measure (hospitalizations, readmissions, or ED visits) among six awardees—IOBS, UAB, UCLA, Indiana, Nemours, and Ochsner. We observe no significant reductions in cost or utilization measures for participants at the other five awardee programs—Christiana, Vanderbilt (Ambulatory and PAC), MAHEC, GWU, and FirstVitals.

Our analysis of data collected and shared by the awardee shows significant improvements among key indicators targeted by the interventions of five awardees—SEDI, Joslin, UVA, UPenn, and HRiA. These findings were highly congruent with qualitative data on participant experiences:

- **UVA:** The CARE Track program significantly reduced end-of-life hospitalizations and ED visits for participants with advanced cancer, relative to similar UVA patients who preceded them. Qualitative findings from patients and caregivers (n=4) show they believe the program helped them communicate with their doctors better about pain management;
- **UPenn:** We find evidence suggesting the program has performed significantly higher than its target goal for managing pain for participants with advanced cancers. Qualitatively, patients and caregivers

(n=10) report that the support from the program's home health staff improved their health and confidence in self-care;

- **HRiA:** We observe that asthma education and environmental assessments help caregivers manage children's asthma. We also find evidence of substantial improvements from visit one to visit three for the HRiA program participants. We see the greatest improvements in measures of caregiver quality of life, asthma control, and removal of environmental factors. Qualitative findings from focus groups with caregivers (n=39) confirm this. Caregivers indicate that home environmental assessments significantly increased their awareness of asthma triggers and how to mediate them;
- **SEDI:** Analysis of data from SEDI shows improvements in hemoglobin A1C. During telephone interviews, 16 of 20 participants indicated they had more control over their blood glucose levels, noting changes in health habits (e.g., exercise and diet) and weight loss helping them to better control their glucose levels;
- **Joslin:** The On the Road (OTR) program improved healthy behaviors, confidence in managing diabetes, and hemoglobin A1C levels. In focus groups and telephone interviews participants (n=49) consistently reported OTR had positive impacts on their health behaviors; at two sites participants were prompted to start a walking group after attending the classes. Across sites, participants found education about hemoglobin A1C beneficial. Many note that the class prompted them to ask their doctors for more information about this test.

Sustainability

Current payment models do not cover many of the services that awardees offer; a shift to value-based payment could help support their programs. Many awardees could not find viable codes to compensate for specific elements of the education, care coordination, or navigation they provide. Furthermore, awardees often cannot bill for services provided by uncredentialed staff (e.g., LHWs)—workers who may be critical to the intervention.

Awardees use long- and short-term approaches to addressing sustainability. Some awardees experiment with using existing FFS codes to obtain reimbursement. Others work on streamlining costs by integrating tasks into an existing work stream. On a longer-term basis, some awardees are working with payer organizations to evaluate the potential return on investment (ROI) from further investment or even looking to license the intellectual property associated with their model to generate revenue. ***While awardees actively pursue sustainability, we find that only five of the 18 awardees—FirstVitals, Indiana, MAHEC, UAB, Christiana, and Vanderbilt—have a high likelihood of sustaining their program by using one or more of these approaches to sustainability.***

Conclusion

Almost all awardees met their enrollment targets and established effective mechanisms for identifying and recruiting participants. All awardees implemented their program in a flexible manner relying on protocols as a starting point, but modifying key elements of the intervention such as dosing and risk-stratification as they went along.

Most interventions involve a high-level of personal engagement geared to helping participants manage their health, coordinate their care and improve health-related outcomes. Interventions added the most value through time spent with participants—coordinating services, facilitating communication with and between providers, providing tailored education, and serving as a primary contact for participant questions and concerns.

The most effective and efficient workforce models relied on a combination of lay health workers and licensed clinical staff (e.g., RNs). Individuals with a high-level of clinical training (e.g., NPs and PAs) may not be best suited to address non-clinical needs. In addition to the inefficiency of having clinical staff engage well below the top of their license, these staff were often not used to taking the time to help address personal needs that surface when engaging on a personal level with participants. Recruitment of behavioral health providers was also a challenge, particularly in rural areas.

Six of the 18 awardees—UAB, Nemours, UCLA, Indiana, IOBS, and Ochsner—demonstrate significant improvements in core measures associated with utilization or cost of care. In the case of UAB and Nemours, these results directly correspond with specific qualitative findings. UVA, UPenn, Joslin, SEDI and HRiA demonstrate quantitative improvement in non-core measures associated with quality of care.

As most awards are coming to an end, we see extensive activity to sustain innovations. In many cases, awardees hope to maintain some, but not all, intervention components. Strategies for sustainability range from licensing and marketing original material developed for the intervention to finding opportunities for third-party payment in a value-based framework. Many awardees using lay health workers contend with the lack of third party reimbursement for these staff. In the case of Nemours, this contributed to their decision to discontinue their seemingly effective lay health worker intervention. Most awardees would benefit from a shift away from a fee-for-service model to a value-based payment models but require greater support at the institutional and governmental levels.

Introduction

In July 2012, the Center for Medicare & Medicaid Innovation ("CMMI" or "Innovation Center") announced the first round of 108 Health Care Innovation Awards ("HCIA Round 1" or "HCIA"). Each award tests health care-delivery innovation focused on specific populations and settings. Under the three-year cooperative agreement (which ran until June 30, 2015), the HCIA Round 1 supported the testing of new care-delivery approaches, including those that leverage technology, workforce training, rapid deployment of new models, and ongoing improvement informed by rapid-cycle feedback.[1] Funded interventions intend to lower expenditures and improve health and quality of care for those with special health care needs. The Innovation Center organized the 108 first-round awardees into several portfolios, including the "disease-specific" portfolio described below.

Disease-Specific Innovation Awards

This report focuses on the subset of 18 HCIA projects targeting patient populations with specific diseases or diagnostic profiles. Target populations have specific chronic conditions, are medically fragile, and live in the awardee's community. These participants' treatment may involve multidisciplinary care teams across various care settings for long durations. Because of their disease profiles, the complexity of their care needs, and their social situations, these participants face the particular risk of receiving fragmented, inadequate, and inconsistent care. Therefore, care coordination, disease management, and continuity of care play an important role for them.

The HCIA disease-specific awards focus on seven conditions considered "priority" because of their cost, prevalence, and seriousness—Alzheimer's disease and dementia, cancer, cardiovascular disease (CVD) and stroke, chronic pain, diabetes, end stage renal disease (ESRD), and pediatric asthma. Each awardee project aims to improve clinical processes, intermediate clinical outcomes, and quality of life while reducing use of acute health care as well as costs for the target condition. Exhibit 1.1 provides an overview of the 18 disease-specific awardees, including each awardee's project focus and primary payer for program participants.

[1] Six awardees, Christiana, Nemours, Ochsner, UAB, HRiA, and UCLA, continued through no cost extensions (NCE); the length of each NCE varies by awardee.

Exhibit 1.1: HCIA Disease-Specific Awardees

Disease	Awardee	Project Focus	Primary Payer
Diabetes	Duke University's South Eastern Diabetes Initiative (SEDI)	Diabetes disease management, self-management support, and community-wide patient education and health resources	Medicare/Medicaid
	FirstVitals Health and Wellness, Inc. (FirstVitals)	Diabetes management and telehealth	Medicaid
	Joslin Diabetes Center, Inc. (Joslin)	Community-based diabetes education and screening workshops that aim to improve key diabetes-related biomarkers and re-engage participants with the health care system	Medicare/Medicaid
ESRD	The George Washington University (GWU)	Telemonitoring and monthly educational videos	Medicare
Pediatric Asthma	Health Resources in Action, Inc. (HRiA)	Asthma care management for children ages 2 to 17	Medicaid/CHIP
	Nemours Children's Health System of the Nemours Foundation (Nemours)	Family-centered medical home model complemented by community outreach and education	Medicaid/CHIP
	Le Bonheur Community Health and Well-Being (Le Bonheur)	Asthma care management for children ages 2 to 18	Medicaid/CHIP
Chronic Pain	Mountain Area Health Education Center, Inc. (MAHEC)	Chronic pain care management program, community collaborative-based prevention intervention, and provider education	Medicaid
Cancer	Innovative Oncology Business Solutions, Inc. (IOBS)	Patient-centered medical home model for comprehensive outpatient oncology care	Medicare
	University of Alabama at Birmingham (UAB)	Technology- and navigator-enabled care coordination and management	Medicare
	The Trustees of the University of Pennsylvania (UPenn)	Home-based comprehensive palliative oncology services integrated with home-care services	Medicaid/Medicare
	The Rector and Visitors of the University of Virginia (UVA)	Proactive symptom monitoring, team-based coordination and palliative care support, and adverse symptom reduction through advances in radiation therapy	Medicare
Dementia & Depression	Trustees of Indiana University (Indiana)	Care management through home visits	Medicare
	Regents of the University of California, Los Angeles (UCLA)	Care coordination and management and caregiver education and support	Medicare
CVD and Stroke	Ochsner Clinic Foundation (Ochsner)	Telemedicine-enabled inpatient care coordination and monitoring; one-year post-discharge post-stroke monitoring and education through home visits	Medicare
	Christiana Care Health Services, Inc. (Christiana)	Coordination of care transitions and longitudinal care management	Medicare
	Upper San Juan Health Service District (USJHSD)	Cardiovascular early-detection screenings, wellness programs, telemedicine, critical care and outreach paramedicine, care coordination, and patient navigation	Medicaid/Medicare
	Vanderbilt University Medical Center (Vanderbilt)	Inpatient transition care coordination (TCC) and outpatient care coordination (OCC)	Medicare

Evaluation Goals

Evaluation goals align with CMMI's overall objective to support implementation of payment and delivery system models that achieve better care, lead to smarter spending, and improve overall health. We group evaluation questions covered in this report in three domains: implementation experience, program effectiveness, and sustainability.

Implementation experience. We assess awardees' success with implementing their interventions. In our first Annual Report, we described this process broadly and presented initial findings on successes and challenges.[2] We update these findings in this report with a more detailed assessment of the contextual (endogenous and exogenous) factors influencing implementation.

We also present findings on the overall reach of these interventions relative to their targets, and on issues related to staffing and workforce. Using qualitative data, we report on the use of staff with different backgrounds and the perceived adequacy of workforce training and preparation.

Program effectiveness. We present qualitative and quantitative findings related to program effectiveness. This includes analysis of health outcomes, cost, utilization, and quality of care using health care administrative data and data from patient surveys. We also report on findings of perceived program impact from semi-structured interviews and focus groups with all program stakeholders, including enrolled participants (i.e., patients) and their caregivers.

Sustainability. We report qualitative findings on the sustainability of awardee interventions. We report on awardee plans as well as our assessment of their desire to sustain interventions and the feasibility of continuing the intervention after HCIA funding ends.

Data Sources and Methods

Findings in this report reflect both qualitative and quantitative analysis. We draw our methods from the evaluation design report developed during the base year of the evaluation and updates to that design as reported in each subsequent quarterly report. While we start with a common set of evaluation questions and framework, application varies by awardee. The variation is driven by both substantive motivations (i.e., the nature of the intervention or populations involved) and pragmatic factors (i.e., data availability, program enrollment, and site-level institutional review requirements).

Qualitative Data and Methods

We gathered qualitative data over two rounds of site visits conducted with all 18 awardees in the past 24 months. Site visits involved a combination of in-person and telephone interviews and focus groups with program stakeholders: leadership, staff, and enrolled patients (participants) and their caregivers. We visited all 18 awardees and almost all of their sites in person at least one time. We also conducted a review of awardee documents, such as progress reports (See Exhibit 1.2). The awardee-level analyses in this report build on qualitative data collected as outlined below.

[2] See First Annual Report: http://innovation.cms.gov/Files/reports/HCIA-DS-FirstEvalRpt.pdf

Exhibit 1.2: Overview of Qualitative Data Sources and Timeline

Data Source		Description	Timeline
Document Review		Review of awardee documents, including HCIA quarterly performance reports, HCIA narrative progress reports, and project officer reports	Ongoing
Baseline Interviews		Three rounds of semi-structured baseline telephone discussions with key informants—primarily core program staff—per awardee, on topics such as program overview and progress, data sharing and availability, and site visit planning	December 2013–February 2014
Site Visits (two rounds)	Leadership and staff interviews	Eight to ten interviews conducted during an annual visit to at least one of the awardee's geographic sites per year. Interviewees include members of key stakeholder groups involved in the intervention, including—but not limited to—lead awardee staff, providers/practitioners, newly trained staff, informatics team, evaluation/monitoring team, workforce training team, and partner organizations	Round 1: April–October 2014 Round 2: February–June 2015
	Direct observation	Observation of program implementation in cases where appropriate and feasible—for example, clinic or office practices, education programs, or IT systems—We also sometimes sat in on regularly scheduled meetings related to the intervention (e.g., a readmissions adjudication meeting) as observers.	Round 1: April–October 2014 Round 2: February–June 2015
	Patient/caregiver focus groups or interviews	One to three patient/caregiver focus groups were conducted during each site visit. If focus groups were not feasible, patients/caregivers were individually interviewed on site or by telephone.	Round 1: April–October 2014 Round 2: February–June 2015

Document Review

We review documents available from each of the 18 awardees on an ongoing basis. These documents include:

- quarterly performance reports
- quarterly report dashboards
- operational plan milestone trackers
- self-monitoring plans
- narrative progress reports
- project officer reports

In the initial phase of the evaluation, we abstracted data from these sources to produce a profile of each awardee. On an ongoing basis, we use data from awardee quarterly report to inform awardee-specific qualitative and quantitative analyses. For example, this data informed the protocols developed for each site visit and the awardee summaries produced in our quarterly reports.

Site Visits

We conducted two rounds of data collection per awardee (Exhibit 1.2). In the first round (April–October 2014), we visited all 18 awardees in person. In this initial round, we focused on validating and extending

our understanding of the awardees' interventions, assessing their progress, and identifying barriers and enablers to successful implementation.[3]

In the second round of site visits (February–June 2015), we visited at least one site in person for 11 out of the 18 awardees. In some cases, we visited specific sites that we did not visit in 2014, and in other cases, we conducted both a site visit and phone interviews to reach all team members. We decided to conduct only telephone interviews with the remaining seven awardees in round two after making a determination that the potential information gained would not justify the expense and time required for traveling onsite and the awardee burden for hosting an additional visit. Our second-round site visits (both in person and via phone) focused on multiple topics:

- changes in awardee's approach to the intervention and other program factors since the 2014 visits
- contextual factors influencing implementation progress and program effectiveness
- spillover of the impact of the intervention on non-participants
- innovation in staff management, planning, and workforce training—including perceived effectiveness and adequacy of planning and training activities
- program effectiveness as understood by staff and program leadership
- prospects and plans for sustainability including financial and organizational facilitators and barriers
- participant satisfaction with the intervention and perceived improvements to activation, health outcomes, access to care, and quality of life

The second-round site visits also gave us an opportunity to discuss any questions raised by the review of awardees' CMMI reports.[4]

It's important to note that we engaged with patients and caregivers for all awardees either in person or by telephone during both rounds of site visits. These discussions covered a wide range of topics—from the processes that awardees used to recruit and engage participants and their caregivers, to the participants' overall experience being part of the intervention, and, finally, to the perceived impact of the program on participant and caregiver knowledge, behaviors, health care utilization, and health-related outcomes. Depending on patient population and site-specific restrictions, discussions with patients took place in focus groups or one-on-one telephone interviews. We conducted 40 participant focus groups and 110 participant phone interviews. Overall, we spoke with over 400 participants and caregivers.

Semi-structured interviews. During each site visit, we conducted approximately 10 individual and small-group semi-structured key informant interviews, each lasting between 30 and 90 minutes. We

[3] For detail on the first round of site visits, please see the First Annual Report available at http://innovation.cms.gov/Files/reports/HCIA-DS-FirstEvalRpt.pdf/.

[4] As a number of awardees have multiple intervention sites that may be geographically dispersed, we may also have used this second round to visit additional sites than was feasible during the first round of site visits. For example, Innovation Oncology Business Solutions (IOBS) works with seven cancer centers throughout the United States. During the first round of site visits, our visit was limited to the New Mexico Cancer Center, where IOBS is based. The University of Alabama at Birmingham works with 10 sites throughout the southeastern United States; during our initial site visit, we only visited Birmingham, Alabama.

derived topics from the evaluation domains identified in our evaluation design report as well as from document reviews and baseline interviews. We also focused on topics relating to the quantitative outcomes including emergency department (ED) use, hospitalization, and overall health care utilization. Using a structured protocol allowed us to ask parallel questions across sites. However, within this overall structure, each protocol reflects the specific intervention characteristics, population, and awardee context which allows us to report on hypotheses and findings specific to individual awardees and sites. Our interview protocols and further description of our methods can be found in Technical Appendix B.

Direct observation. During site visits, we looked for opportunities to observe intervention-related meetings, care delivery, care coordination and management activities, education sessions, home visits, and other intervention components. In total, we conducted observations at 11 site visits. During observations, we recorded the physical setting, the roles of those present, the content of the intervention or activity, interactions between participants, tools used, and any additional descriptions and reflections related to evaluation research questions.

Participant and caregiver focus groups and interviews. When possible, site visits included focus groups with participants or with caregivers for innovations addressing dementia, cancer, and childhood asthma. Telephone interviews were conducted with caregivers of cancer and stroke recovery patients. Discussion topics can be found in Technical Appendix B. In some cases, focus groups were not feasible because of the timing of the site visit or the health status of the innovation participants (e.g., individuals homebound with ESRD). In such cases, we conducted individual interviews with program participants where they received care or by telephone.

Qualitative data analyses. For the first round of site visits, verbatim transcripts were coded using NVivo (QSR International Pty Ltd. Version 10, 2012) using conventional approaches for coding themes. For the second round of site visits, transcripts of each conversation were used to develop site visit summaries to hone in on the most important findings by awardee for each evaluation domain. We also created focus group or telephone interview summaries that identify participant and/or caregivers' understanding of the program as well as improvements in health, utilization, and quality of life. We provide the basic instrument for all site visit interviews and focus groups, as well as details on our coding approach, in Technical Appendix B.

To answer research questions in each domain—implementation effectiveness, workforce context and development, endogenous and exogenous factors, and program effectiveness (or participant experience)—summaries and notes were used to assess the relative frequency of themes or findings and develop cross-cutting analyses across practices in place of coding. This approach is well suited for a rapid cycle evaluation.[5] In the third year of the evaluation, we will code second round interview transcripts and all focus group and patient interviews.

[5] Hamilton, Alison B. Qualitative Methods in Rapid Turn-Around Health Services Research. Presented at the U.S. Department of Veterans Affairs Health Services Research and Development Cyberseminar Spotlight on Women's Health; December 11, 2013. http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/780-notes.pdf. Accessed July 13, 2015.

Quantitative Data and Methods

Our quantitative evaluation assesses the relationship between awardee programs and measures of health, quality of care, and health care costs and utilization using two sources of quantitative data:

- claims data for Medicare or Medicaid beneficiaries, depending on the primary population the awardee serves
- awardee-collected data, which includes administrative program data, electronic health record data, clinical measures, surveys, and other participant-reported outcomes

The data source used for assessing program effectiveness depends on the evaluability of the awardee's program, summarized in Exhibit 1.3. For the six awardees that do not have currently usable claims data (termed as low evaluability), we assess program effectiveness using awardee-collected data. For the remaining 12 awardees, we use Medicare claims for the nine awardees serving primarily Medicare beneficiaries and Medicaid encounter/claims data for the three awardees serving primarily Medicaid beneficiaries.

Exhibit 1.3: Evaluation Design for Awardees

Awardee	Primary Payer(s)	Evaluability	Intervention Type	Data Source
Christiana	Medicare	High	PAC	Medicare
SEDI	All payers	Low	Ambulatory care	Awardee data
FirstVitals	Medicaid	Medium	Ambulatory care	Medicaid
GWU	Medicare	Low	Ambulatory care	Medicare
HRiA	Medicaid	Low	Ambulatory care	Awardee data
Indiana	Medicare	High	Ambulatory care	Medicare
IOBS	Medicare	High	Ambulatory care	Medicare
Joslin	All payers	Low	Ambulatory care	Awardee data
Le Bonheur	Medicaid	Medium	Ambulatory care	Medicaid
MAHEC	Medicare & Medicaid	Low	Ambulatory care	Medicare
Nemours	Medicaid	High	Ambulatory care	Medicaid
Ochsner	Medicare	Low	PAC	Medicare
UAB	Medicare	High	Ambulatory care	Medicare
UPenn	All payers	Low	Ambulatory care	Awardee data
UCLA	Medicare	High	Ambulatory care	Medicare
USJHSD	All payers	Low	Ambulatory care	Awardee data
UVA	All payers	Low	Ambulatory care	Awardee data
Vanderbilt TCC	Medicare	Low	PAC	Medicare
Vanderbilt OCC	Medicare	Medium	Ambulatory care	Medicare

*****Awardee specific means that because of the variability in data between awardees, the analytic methods used for analysis of awardee-provided data are specific to the awardee and can be found in the awardee chapters.

Intervention type. We identify two broad groups of interventions among the disease-specific awardees based on the setting and goals of the intervention: post-acute interventions (three awardees) and ambulatory care programs (15 awardees). Post-acute care (PAC) interventions focus on improving patient

outcomes during or immediately after a discrete event, such as hospitalization. In general, participants in PAC interventions are enrolled at admission or discharge from an inpatient hospitalization and receive the intervention for a defined period of time after hospital discharge. Ambulatory care interventions identify and engage participants in outpatient settings and generally focus on improving health, increasing quality, and reducing spending for patients with chronic conditions living in the community. To analyze data for these two types of interventions, we use slightly different methods (see Exhibit 1.4).[6]

Exhibit 1.4: Methodological Overview by Awardee Intervention Type

	Post-Acute Interventions	Ambulatory Care Interventions
Awardees	Christiana, Ochsner, Vanderbilt in-patient care coordination intervention	FirstVitals, GWU, Joslin, HRiA, Nemours, Le Bonheur, MAHEC, IOBS, SEDI, UAB, UPENN, UVA, Indiana, UCLA, USJHSD, Vanderbilt outpatient care coordination intervention.
Intervention Overview	Participant selection event based, focused on transition from inpatient to post-acute settings for patients with the targeted conditions	Participant selection from the community, often a convenience sample of patients with the targeted condition seen in an outpatient clinic
Design	Serial cross-section—comparing treatment provider to other providers pre- and post-intervention period	Longitudinal cohort—comparing treatment cohort and comparison group at two (or more) points in time
Analytic Method	Difference-in-differences or time-series analysis	Difference-in-differences or time series analysis
Unit of Analysis	Patient-episode	Patient
Internal Comparison (pre-period)	Patient-episodes at awardee facilities before start of intervention	Patients before enrollment in the intervention
External Comparison, where possible[7] (pre and post- periods)	Patient-episodes from similar facilities from time period before and after intervention was implemented by the awardee	Patients selected from a comparable geographic region or provider organization followed for 2 – 4 years to mirror time period of awardee intervention

Measures of program effectiveness. Our summative analysis of program effectiveness, as noted above, studies the impact of the interventions on measures of health, quality of care, utilization, and cost.

For awardees with Medicare/Medicaid claims data, we assess impact on five core measures. [8] These core measures are used by CMMI as part of their broad assessment of health care innovations:

- all-cause hospitalizations per 1,000 patients
- 30-day readmissions per 1,000 patients
- Ambulatory care sensitive (ACS) hospitalizations per 1,000 patients

[6] Additional details about design considerations for each intervention type are provided in the Technical Appendix.
[7] External comparison groups are constructed for a sub-set of high evaluability awardees. Evaluability is determined based on a number of factors including available sample size and hypothesized impact on CMMI core measures. For this report high evaluability awardees are: Christiana, Indiana, IOBS, Nemours, UAB, and UCLA.
[8] For details on the specifications for the core measures please refer to the Technical Appendix.

- ED visits per 1,000 patients
- total cost of care per patient

For the seven awardees for which we assess program effectiveness using awardee data, we were not always able to duplicate the CMMI core measures. Instead we used measures of health, quality of care, utilization and cost available in the awardee dataset that were most likely to be affected by the awardee intervention. Exhibit 1.5 summarizes the measures used to evaluate each of the awardee programs.

Exhibit 1.5: Measures of Program Effectiveness for Awardees Included in Annual Report

	CMMI Core Measures					Other Measures	
Awardee[8]	Hospitalizations[9]	30-day Readmissions	Avoidable Hospitalizations	ED Visits	Total Cost of Care	Health	Quality
Christiana		•		•	•		
SEDI						PROMIS Mental/Physical Health; PHQ2 Depressed Mood; Patient Activation Measure	Glycemic control; diabetes care profile; Morisky Medication Adherence
FirstVitals	•	•		•	•		
GWU	•			•	•		
HRiA						Juniper Pediatric Asthma Caregivers Quality of Life Questionnaire	Asthma action plan; asthma control; environmental composite score
Indiana	•	•	•	•	•		
IOBS	•	•	•	•	•		
Joslin						Self-reported exercise, healthy diet, and sleep	Glycemic control; blood pressure control
Le Bonheur							Asthma action plan; asthma control
MAHEC	•			•	•		
Nemours	•			•	•		
Ochsner		•		•	•		
UAB	•	•	•	•	•		
UPenn							Pain management
UCLA	•	•	•	•	•		
USJHSD						VR-12 physical health measure; fiber intake	Blood pressure control; cholesterol control; weight management; smoking cessation
UVA							End-of-life hospitalizations and ED visits
Vanderbilt TCC		•		•	•		
Vanderbilt OCC	•		•	•	•		

[9] For awardees where admission to an in-patient facility is a requirement for participation in the innovation (Christiana, Ochsner, and Vanderbilt in-patient care coordination intervention) we report hospitalizations as readmissions.

Analytic methods. We use a difference-in-differences (DID) analysis where possible. This design allows us to estimate the average treatment effect for the program while limiting the influence of selection bias[10] and secular trends (analyzing the comparison and treatment groups during the same calendar time period). This analysis requires a comparison group, which we do not have for all awardees at this time (see Exhibit 1.6). When comparison groups are unavailable, we use time-series analysis.

Exhibit 1.6: Analysis by Awardees

Awardee	Comparison Group	Analysis*
Christiana	•	DID
Indiana	•	DID
IOBS	•	DID
Nemours	•	DID
UAB	•	DID
UCLA	•	DID
UVA	•	Awardee specific
Le Bonheur		Usability
Joslin		Awardee specific
HRiA		Awardee specific
UPenn		Awardee specific
USJHSD		Awardee specific
SEDI		Awardee specific
FirstVitals		Time series
GWU		Time series
MAHEC		Time series
Ochsner		Time series
Vanderbilt OCC		Time series
Vanderbilt TCC		Time series

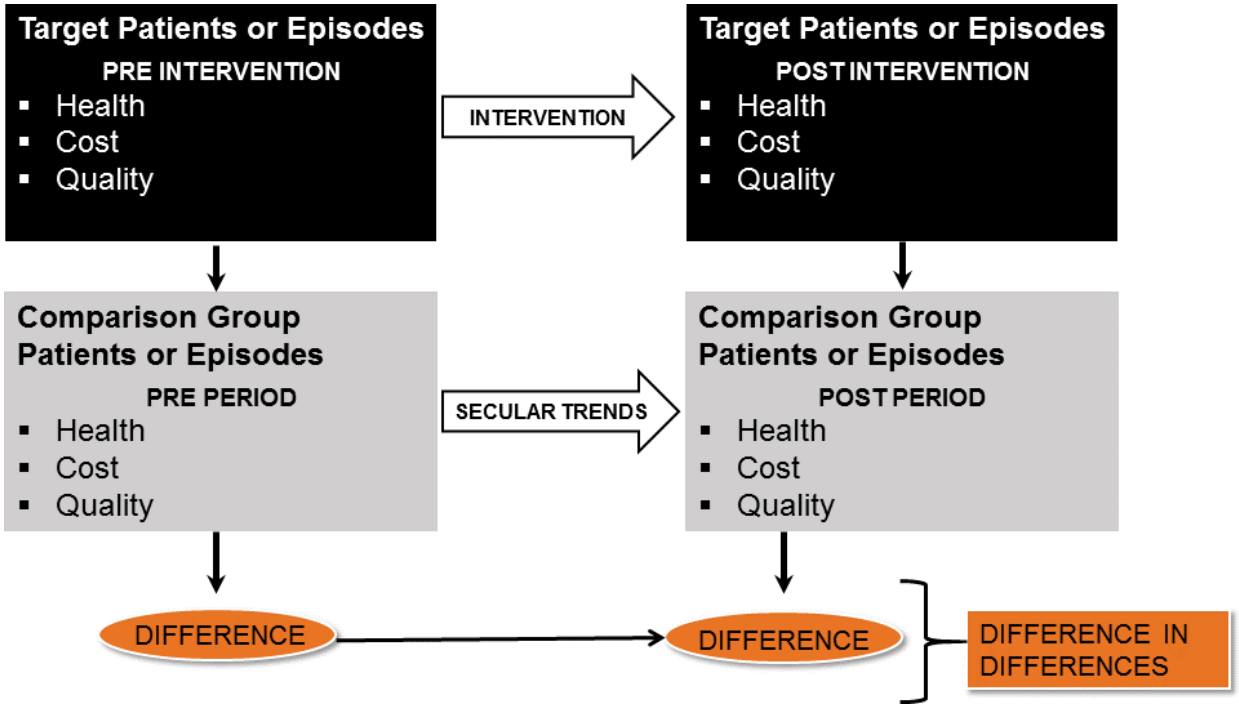
For the six awardees with comparison groups, we use DID methods to analyze program effectiveness. The DID estimator is the difference in an average outcome between the intervention and a comparison group *after* implementation of intervention minus the difference in an average outcome between the intervention and a comparison group *before* implementation of the intervention. This specification allows us to study the impact of the awardees' programs compared to either similar provider organizations (for post-acute interventions), or similar patients receiving usual source of care (for ambulatory interventions). The DID method for both post-acute and ambulatory awardees is visually represented in Exhibit 1.7.

The method assumes parallel trends between the intervention and comparison group, with the difference in trends between the two groups attributable to the intervention. To support such an assumption, we suitably incorporate propensity score methods within the DID framework that control for observable differences between the intervention and the comparison groups. For both the post-acute and ambulatory

[10] In the DID design, unobserved variables that correlate with selection into the intervention and outcomes do not bias the estimated effect, provided these variables are constant over time.

interventions, we assess program effectiveness over the entire post-intervention period using summative DID models, which provide a single effectiveness estimate for each outcome. In the accompanying quarterly report, we present analyses with quarter fixed effects DID models, which allow the effectiveness of the intervention to vary across each quarter of the post-intervention period. The specifications of our DID models are detailed in the Technical Appendix.

Exhibit 1.7: Difference-in-Differences Design for Post-Acute and Ambulatory Interventions



For five awardees without comparison groups we use time-series analyses to assess program effectiveness. This analysis measures the intervention's impact as the average difference in the outcome of interest in the period *after* and *before* the intervention. If a significant change is seen in outcomes, the intervention is assumed to cause the change, but, in the absence of a comparison group, we cannot be certain that changes in outcomes were actually caused by the intervention and not by other non-intervention factors coinciding with the intervention period. We acknowledge this limitation of time-series analyses in assessing program effectiveness, and caveat our findings for awardees without comparison groups. The specifications of our time-series models are detailed in the Technical Appendix.

Cross-Awardee Findings

In this section, we describe findings regarding HCIA disease-specific interventions as implemented by awardees. Information is organized into three evaluation domains—implementation experience, program effectiveness, and sustainability.[11]

Implementation Experience

We focus on six components of implementation experience—program reach and populations served, targeting and recruitment of participants, program dosage, workforce roles, technological challenges, and facilitators and barriers to implementation. Our findings and analyses describe how awardees have gone about implementing their programs and lessons learned related to implementation.

Program Reach and Populations Served

Awardees set goals around enrollment in interventions and the extent to which they would target specific populations, but, they define participants in different ways. Some only include those who are enrolled in the intervention from particular clinics or communities. Others include all members of a disease registry or community being targeted by the intervention activities. Finally, two consider all patients within its primary health care system to be participants regardless of the proportion that actively and knowingly engages with intervention components. Therefore, we report on *reach* in a relative fashion, defining it as the number of participants either directly served by the intervention or within the pool of patients who could be directly served, depending upon the awardees' approach.

The majority of awardees report to have reached their target in terms of cumulative number of participants. Exhibit 2.1 presents the total number of participants reached and cumulative dollars spent by awardees through 21 months, as reported to CMS.

The number of participants reached varies substantially across awardees, even among those targeting the same disease or condition. This variation may relate to intervention setting(s) (e.g., home, clinic, or community-based), the target population, and/or the type and intensity of interventions (e.g., direct care coordination or panel management). We see lower participant numbers among awardees offering home-based support for individuals who are self-monitoring or practicing self-management, such as FirstVitals, GWU, or Le Bonheur. Some awardees define participants based on their inclusion in a broader panel or registry. This approach to defining participations leads to higher numbers.

[11] For an analysis of awardee program components, please see the first annual report at http://innovation.cms.gov/Files/reports/HCIA-DS-FirstEvalRpt.pdf

Exhibit 2.1: Program Reach across Awardees

Disease	Awardee	Cumulative Reach as of March 2015*	Cumulative Spent as of March 2015*
Diabetes	SEDI	17,866[ii]	$6,713,226
	FirstVitals	398	$3,103,070
	Joslin	5,100	$3,713,086
ESRD	GWU	300	$697,358
Cancer	IOBS[i]	2,189	$14,837,607
	Penn	1,226	$2,296,935
	UAB	7,030	$7,778,778
	UVA[i]	347	$1,672,275
Asthma	HRiA	1,145	$3,430,622
	Bonheur	483	$2,250,075
	Nemours	10,091[ii]	$2,041,696
Chronic Pain	MAHEC[i]	376	$893,865
Dementia	UCLA	1,178	$2,334,421
	Indiana	2,898	$5,690,319
CVD / Stroke	Ochsner	2,616	$2,046,418
	Christiana	3,061	$7,305,104
	USJHSD	1,548	$1,254,379
	Vanderbilt	107,241[ii]	$10,256,478

*Source: Quarterly report to CMMI on performance through March 2015

[i] The exhibit shows the reported number of indirect participants for IOBS, UVA, and MAHEC instead of direct participants because the direct participants are either not reported, or because the reported indirect participants are comparable to other awardees direct participants. IOBS "indirect" participants are the target group in terms of having one of seven incident or recurrent cancers, receiving treatment based on clinical pathways, and accessing after-hours care. UVA and MAHEC only report "indirect participants," for which a specific numeric target is not set. Please note that definitions of direct and indirect participants are inconsistent.

[ii] Awardee counts "direct participants" broadly. SEDI includes an estimate of people reached through community outreach and education. Nemours includes patients who are in a registry, and Vanderbilt includes all primary care patients under surveillance through an EHR system as "direct participants" even though most will not interact with the staff implementing the intervention.

Targeting and Recruiting Participants

Variation in awardee experiences offers many lessons for targeting and recruiting participants. Most awardees target their intervention to participants considered high-risk for developing a more serious or worsened health condition and incurring costly complications. Some awardees target a mix of high-risk and low-risk individuals. Awardees use different mechanisms to identify participants and then often use multiple strategies to recruit the target populations to participate (see Exhibit 2.2).

Exhibit 2.2: Strategies for Identifying and Recruiting Program Participants

Care management staff receive referrals from physicians and other providers	11 awardees: SEDI, GWU, UPenn, UAB, HRiA, Le Bonheur, MAHEC, UCLA, Indiana, Vanderbilt, USJHSD
Use electronic health system data—such as disease registries, ICD-9 codes and risk algorithms built into EHRs, and case management software	10 awardees: SEDI, UAB, HRiA, Le Bonheur, Nemours, MAHEC, UCLA, Indiana, Christiana, Vanderbilt
Approach patients upon hospitalization for target condition	7 awardees: IOBS, UVA, HRiA, Le Bonheur, Ochsner, UCLA, Indiana
Use community outreach and media to attract residents with the target condition	3 awardees: Joslin, SEDI, USJHSD
Analyze insurance data (such as Medicaid claims data) sent by a partnering insurer or a state agency to review for patients with target health conditions	2 awardees: FirstVitals, HRiA

Awardees report using in-person conversations, mailings to potential participants' homes, and strategic messaging to emphasize program benefits and drive enrollment. Awardees found several approaches that avoid using "cold-calls" to introduce potential participants to the program. For example:

- HRiA community health workers (LHWs) explained that the program offers free vacuums in addition to asthma education to pique possible participants' interest;
- One Nemours site began hanging pictures of their LHWs in pediatricians' offices to make their faces familiar to participants; physicians would also try to introduce caregivers to LHWs at the practice site;
- Indiana sent a letter explaining the program prior to calling to schedule the first home visit with a care coordinator assistant;
- Indiana also helped the local newspaper cover the program, which helped to increase both patient and physician awareness of the program and its value.

Physician referrals served as a valuable recruitment strategy for many awardees, often used in combination with other strategies. This strategy was most successful in cases where awardees first worked to cultivate physician buy-in. For example:

- UCLA reaches out to physician-partners to educate them about how the program aims to supplement—not replace—the clinical role. They explain how care managers would work closely with clinicians to manage patient care. Physician referrals have been the program's main source of new patients, but they also look at inpatient and outpatient lists to identify eligible participants;
- MAHEC's physicians either refer eligible patients to a mid-level provider implementing the intervention, or they themselves implement protocols developed by the intervention. MAHEC developed standardized provider protocols that promote improved self-efficacy and harm reduction among chronic pain patients.

Programs relying on physicians to recruit fell short when physicians did not have sufficient understanding or awareness to "buy-in" to the program. At UAB, physicians did not understand the lay navigator program enough initially and were not actively referring patients. UAB now relies heavily on mining hospital and ED census reports to recruit patients. Two HRiA sites invested in recruitment through physician referrals but experienced disappointing results. Program staff reports that the physicians felt concerned that HRiA would "steal" patients.

Awardees report that potential participants more readily engage after an acute event or worsening of their condition. One HRiA site heavily recruits pediatric asthma patients in the hospital (inpatient and ED). Other HRiA sites also report greater success with recruitment within two days of an acute event. Staff observe that families contacted later may think the child's asthma was controlled, whether or not that was actually the case. Indiana program staff found that some individuals initially refusing the intervention were more likely to join when their condition worsened. Program staff receives alerts upon the hospitalization of an eligible individual so that a worker can go to the hospital and try to recruit them to the program in person.

Program Dosage

We define "program dosage" as the extent of engagement participants have with the intervention. Depending on the nature of the innovation, this may vary based on a combination of the frequency, length, and mode of engagement between awardee staff and participants. Most awardees developed and use protocols that specify the frequency of engagement (e.g., one contact every three months) and the mode of interaction (e.g., clinic visits, home visits, or phone contact). However, the ultimate dosage may deviate from the protocols at a provider or care coordinator's discretion, depending on patients' needs.

Given the variations in dosage, we have categorized the awardee's typical dosage level based on the frequency of interaction participants have with the intervention components. Dosage levels are defined as:

- **high:** daily or weekly interaction, generally with no established maximum for amount of contact or interaction with the intervention
- **medium:** monthly or quarterly interactions
- **low:** less than quarterly basis (e.g., annual contact or no regularly scheduled interaction or communication); including community interventions and interventions focused on participant self-reporting with remote monitoring

For awardees' inventions that intend to engage with patients for a limited duration (i.e., post-acute care awardees, or community based workshops), we characterize the frequency only during that time frame. For others that intend to engage patients over a longer period of time (i.e., care management), we characterize the typical frequency over the course of a year. Exhibit 2.3 presents descriptions and categorizations of typical dosage for awardees' participants.

Exhibit 2.3: Dosage Levels and Examples by Awardee

Disease	Awardee	Dosage*			Description of Typical "Dose"
		Low	Med	High	
Diabetes	Joslin			●†	Two to six diabetes education classes, depending on site
	SEDI			●†	Four to six diabetes education classes (low- to medium-risk participants)
			●		Telephone calls once per month (medium-risk participants)
			●		Clinic and home visits—range from once a week to once a month (varies by site and patient need)
	FirstVitals		●		Daily transmission of telemonitoring data (blood pressure, glucose). Telephone follow-up with out-of-range readings
ESRD	GWU	●			Daily transmission of telemonitoring data (blood pressure and weight). Selective monitoring of readings and follow up on out-of-range readings
Cancer	IOBS		●		Contact during clinic visits. 24/7 triage line available
	UPenn			●	Home visits ranging from daily to three times a week
	UAB			●	Minimum of quarterly contact in clinic or hospital or by phone; daily or weekly contact during treatment times
	UVA		●		Clinic visits based on need
Asthma	HRiA		●		Four home visits
	Le Bonheur		●		Home visits once per month
	Nemours		●		Five or six home visits
Chronic Pain	MAHEC		●		Minimum of quarterly in-clinic contact; optional group visits in between
Dementia	UCLA		●		Initial home visits and follow-up clinic or telephone visit based on need
	Indiana		●		Home visits every one to three months
CVD + Stroke	Christiana			●†	Transitions: phone call within 72 hours of discharge to check health status and schedule follow up appointment with cardiologist
			●		Outpatient: phone calls based on risk, follow-up for a year post transition as needed
	Ochsner			●†	Stroke Central: contact each day during rounds while hospitalized
			●		Stroke Mobile: monthly home visits for one year
	USJHSD			●†	12-week community wellness education program
		●			Telemedicine for acute events and follow-up care as needed
		●			Critical care paramedicine for acute events
			●†		Outreach paramedicine as needed
	Vanderbilt		●†		Inpatient (TCC): one-month ongoing follow up post discharge
		●			Outpatient (OCC): telephone calls and in-person counseling-based protocols, frequency depending on diagnostics/readings

*Definitions of low, medium and high dosage can be found in the preceding text.

† These interventions last for a short period of time.

Need as articulated by the participant drives dosage for most awardees. Across most interventions, care coordinators note that participant needs can increase dosage considerably:

- UAB establishes minimum contact of once per month for participants, with more contact as needed. Participants can reach out to their assigned navigators whenever they choose. The interactions can be daily;
- Indiana calibrates the level of "touch" to participants' needs. Program staff conducts home visits, administers structured assessments, and engages informally with participants. The staff uses the structured assessments to determine the need for additional home visits or referrals;
- Neither UAB nor UCLA established maximum levels of intervention interaction with participants. Both allow participants to contact intervention staff directly by phone as needed.

Over the course of the intervention, some awardees determined an "optimal" program dosage level based on what was feasible and effective for their participant population.

- One HRiA site doubled the number of home visits to six from three. However, they had difficulty keeping participants committed to all six visits and switched back to the three-visit standard;
- Nemours did not place a cap on the number of home visits but found that after five or six home visits, participants tend to have reached "maximum independence;"
- Christiana determined that 60 to 90 days of case management is sufficient to stabilize and educate patients.

Most awardees, however, have not set an "ideal" or "minimally effective" dosage. For many awardees, the ideal program dose always varies for each participant based on need. Several awardees note that they do not believe there is a minimally effective dose. Others attempt to establish ideal dosage through their internal monitoring data. UAB and UVA, for example, use care management software to understand variation in touches and treatment or end-of-life experience for cancer patients. While diabetes awardees build on an existing dosage of four educational classes to be effective, most awardee programs were new and spent much of the three year award period working through challenges. Finally, some awardees commented on the hardest to reach populations. Ochsner's home visit staff remarked that even the most hard to reach participants showed evidence of behavior change by the second to last visit over their year long period.

Workforce Roles

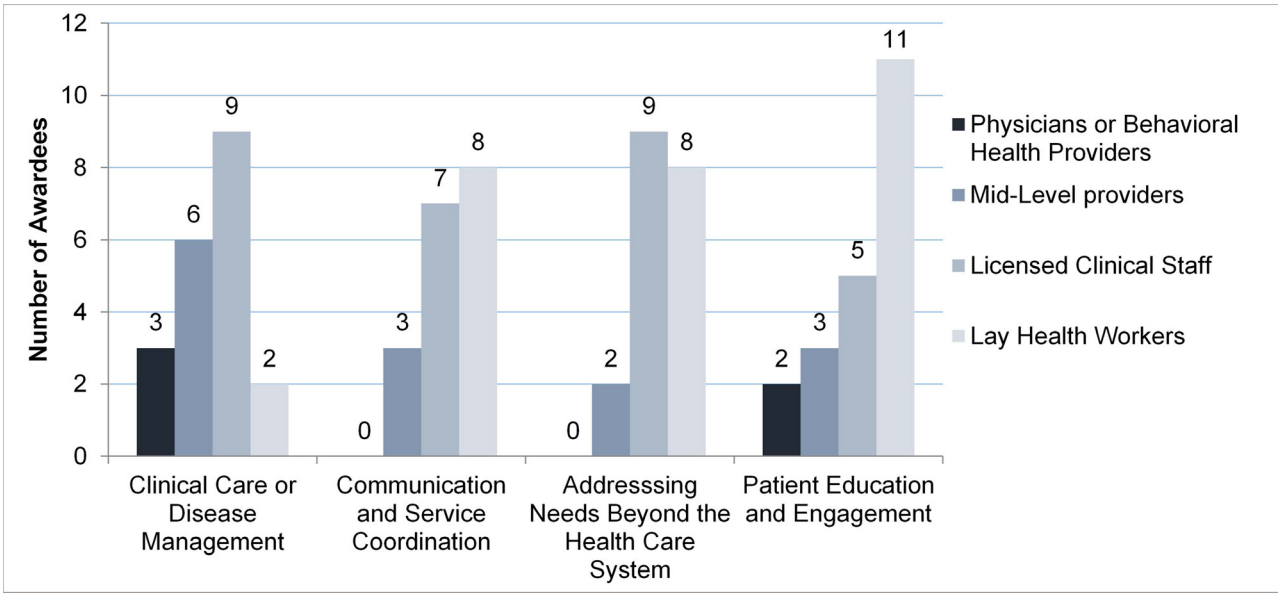
Most awardees use a multidisciplinary team to carry out intervention activities. They developed roles and responsibilities over time in response to both participant needs and the characteristics of staff available. In order to analyze the types of staff used in different intervention activities, we first identified staff integral to each intervention's workforce team, and then grouped them by their credentials. We consider those who are responsible for delivering the intervention and/or directly interacting with program participants to be integral, regardless of how their position was funded. We exclude non-clinical staff such as senior leadership and other management staff who were solely involved in oversight and management of the program.

We chose to group the staff somewhat differently than the way suggested by the HCIA meta-evaluator in order to emphasize the prominent roles of mid-level providers and lay health workers among the awardees. We use the term "lay health worker," defined by the World Health Organization as "any health worker carrying out functions related to health care delivery; trained in some way in the context of the intervention; and having no formal professional or paraprofessional certificated or degreed tertiary education."[12]

The meta-evaluator groups workforce members into four categories: 1) licensed independent clinical practitioners, including physicians, physician assistants, nurse practitioners, and clinical psychologists; 2) licensed clinical staff, including RNs, LPNs, and pharmacists; 3) non-licensed clinical support staff, including LHWs, aids/assistants/direct care workers, and health coaches; and 4) non-clinical staff.[13] Instead, we grouped staff into four different categories that more clearly demonstrate the distribution of staff responsibilities by their credentials among awardees: 1) physicians and psychologists; 2) mid-level providers which include nurse practitioners and physician assistants; 3) licensed clinical staff including registered nurses, licensed practical nurses, respiratory therapists, registered dieticians and social workers; 4) LHWs which include community health workers (CHWs), lay navigators, and others.

Across the board, awardees use LHWs and licensed clinical staff, primarily nurses, to carry out intervention activities, while physicians are rarely part of the team. Exhibit 2.4 illustrates the primary type of staff that awardees use to address four common functions: 1) clinical care or disease management; 2) communication and service coordination; 3) non-health care system needs; and 4) patient education and engagement.

Exhibit 2.4: Staff Performing Common Intervention Activities



[12] See Lewin S, Dick J, Pond P, Zwarenstein M, Aja GN, van Wyk BE, Bosch-Capblanch X, Patrick M. Lay health workers in primary and community health care. Cochrane Database of Systematic Reviews 2005, Issue 1.
[13] As reported in Appendix E of the HCIA Meta-Analysis and Evaluator's Collaborative Quarter 1.

Most awardees use mid-level providers or registered nurses (licensed clinical staff) to address clinical and disease management needs of program participants. Staff involved in clinical care or disease management might continuously monitor participants, develop and monitor medical care plans, assess patient needs, and/or facilitate care transitions. This role is critical for awardees serving medically frail patients or patients with complex conditions (e.g., cardiovascular disease, stroke).[14] Mid-level providers tend to develop care plans and manage symptoms, whereas RNs more commonly conduct assessments and monitor participants' health status over time. Most care coordinators have prior experience with the targeted disease condition. Therefore, their training focuses on specific program protocols or tools rather than on clinical knowledge. Exhibit 2.5 shows some examples of mid-level providers in these roles.

Exhibit 2.5: Examples of Mid-Level providers in Clinical Care and Disease Management

Examples of Mid-Level Providers in Clinical Care and Disease Management	
MAHEC	The prescribing ability of the mid-level provider (an NP at MAHEC's headquarters) has proven to be useful in symptom management of program participants. The NP is also able to consult with a pharmacist about drug interactions, which is a particular concern among patients on chronic pain medications.
UPenn	An NP engages with patients to understand their care goals, has discussions about advanced directives, and prescribes medications as needed in order to support symptom management. The NP actually meets with participants in their homes, which likely would have been difficult for a physician to do.
UCLA	The NP dementia care manager develops and implements care plans that include both clinical recommendations and referrals to social services as needed. In addition, the NP coordinates the needs of a program population that has medical, social, and mental health requirements, thereby addressing needs beyond the health care system.

Licensed clinical staff and mid-level providers engaged in communication and service coordination activities requiring clinical knowledge (e.g., triaging services) and interaction with other clinicians.

- Ochsner's RN facilitates daily rounds with clinicians and triages phone calls to the intervention phone line;
- The dementia care manager (an NP) at UCLA communicates directly with primary care providers about their medical recommendations for patients;
- If a LHW from HRiA encounters an issue to share with the pediatrician, the certified asthma educator (an RN or a respiratory therapist) calls the pediatrician to discuss the issue;
- In the case of UPenn, MAHEC, and UCLA, mid-level providers coordinate services with the assistance of less-credentialed staff (RNs, medical assistants, or LHWs) who would follow up with participants to see if they had questions, or needed to schedule time to speak with the mid-level provider again.

[14] Craig C, Eby D, Whittington J. *Care Coordination Model: Better Care at Lower Cost for People with Multiple Health and Social Needs.* IHI Innovation Series white paper. Cambridge, Massachusetts: Institute for Healthcare Improvement; 2011. (Available at http://www.ihi.org/resources/Pages/IHIWhitePapers/IHICareCoordinationModelWhitePaper.aspx)

While LHWs do not generally engage in clinical care or disease management, a few awardees did successfully use LHWs in that capacity.

- LHWs in Indiana's program conduct assessments and monitor participants' progress during home visits. These staff can address both clinical and mental health needs of the program population. The awardee invested resources in training to ensure LHWs were prepared to serve as the "first line of defense" in tackling issues, including depression;
- Trained LHWs in the SEDI program engage in some disease management activities during home visits, including medication reconciliation and monitoring of blood glucose logs.

LHWs tended to engage in activities that required frequent and often time-intensive contact with participants. LHWs provided a cost efficient work force option compared to clinical staff and allowed programs to offer comprehensive services to participants.

- At Indiana, Nemours, HRiA, and Le Bonheur, LHWs serve as the primary point of contact for participants. They often share information gathered from participants directly with treating providers to assist in service coordination;
- UAB and USJHSD LHWs work primarily in the clinical setting and help address barriers to care by connecting patients to resources inside and outside of the health care setting;
- Many awardees deliberately recruited LHWs exhibiting the capacity for empathy, understanding, and the ability to connect or relate with the program participants in a way that clinicians may not.

Many of the awardees use LHWs to address social needs of program participants, and some also engage social workers to handle referrals from health care teams. Staff use formal and informal assessments to identify non-health care needs and coordinate access to financial support, social services, and transportation.

- Five awardees—Indiana, SEDI, Le Bonheur, HRiA, and Nemours—have LHWs who conduct social assessments in a participant's home. Being in the home can help LHWs identify non-clinical needs;
- The Christiana, UPenn, SEDI, UVA, Vanderbilt, and Indiana care teams include social workers available to serve participants with more complex social needs.

Because of overlapping roles and workforce recruitment challenges, staff sometimes practices below their license.

- At SEDI, most team members perform disease management education. In a SEDI site that lacked a social worker, the NP sometimes addressed non-clinical social needs. Another SEDI site took a more streamlined approach and used LPNs and CNAs as gatekeepers to determine patients' needs. The LPNs and CNAs then assigned staff with the necessary training for home visits as appropriate;
- UCLA originally tasked NP-level care managers with connecting patients and caregivers with resources in the community. Some NPs indicated lack of familiarity with appropriate resources and felt overwhelmed by the multitude of tasks expected of them. In the final year of the award, UCLA hired a care assistant to support NPs in this role.

More than half of awardees used LHWs to provide education for participants or reinforce education provided by other clinical team members. LHWs helped educate patients on self-management of targeted conditions. They also helped coach participants and caregivers on navigating care transitions, self-care activities, and behavior change. According to staff, LHWs' lower costs allow them to spend more time with participants than clinicians can, which results in more effective education. Participants favorably recognize that LHWs can spend more time with them than their providers.

- Two asthma awardees—HRiA and Le Bonheur—used certified asthma educators (typically respiratory therapists or RNs) to provide direct asthma education to program participants. LHWs reinforced this education during subsequent home visits;
- In contrast, Nemours had a certified asthma educator train all the LHWs so that they could provide asthma education during home visits;
- LHWs from Ochsner and USJHSD focus on educating and empowering patients to manage their own condition. Staff from all of these sites received training on motivational interviewing or patient engagement.

Our findings suggest that clear definition of roles predicts effective use of LHWs. Clear guidance provided through trainings and job descriptions helps increase LHWs' confidence in understanding their role as it relates to other staff. For example, UAB strongly emphasizes the non-clinical nature of the navigator role and trains these staff in their role as non-clinical liaisons serving patients. Navigators understand this distinction and communicate it clearly to their patients.

Finally, awardee organizations that employed LHWs prior to the Innovation Awards were more likely to have LHWs who clearly understood their role. Prior experience was key to establishing protocols. For example, HRiA's partner organizations used previous experience to refine protocols for LHWs. They specify exactly which activities LHWs must complete during each home visit. These staff worked smoothly with pediatric nurse certified asthma educators despite some possible overlap in responsibilities. Similarly, Nemours' community liaisons worked in similar roles prior to the innovation award and were therefore clear on their responsibilities.

Technological Challenges

Challenges in the external technology environment hindered implementation effectiveness for over half of the disease-specific awardees.

Awardees often could not integrate software used in their interventions with the core electronic health records (EHR) systems used to document medical care. As part of standard care, physicians rely on the information within the EHR system and may not always review data in separate software used in the intervention (e.g., care management software). In many cases, clinicians faced challenges seeing important data entered into care management systems by frontline staff.

Awardees could not always access data across facilities or providers. Interventions aiming to reduce unnecessary hospitalizations or improve chronic care self-management, such as those at Vanderbilt and Christiana, did not have access to data from ED visits in other facilities. Christiana found that even if they

could access data streams from other providers, these data were not useful unless additional compatibility challenges were addressed.

Several awardees did not find appropriate software to support their work. In some cases awardees worked with internal staff or small vendors to take on unanticipated software development projects.

- Christiana partnered with a smaller vendor that worked very closely with Christiana's own senior IT development team to meet their needs;
- UCLA created its own care management software for the purposes of the intervention but will abandon this system moving forward. Instead, the intervention will switch to a different care management tool newly available from UCLA's EHR vendor.

Facilitators and Barriers to Implementation

We end our discussion of implementation experiences with some broader findings associated with facilitators and barriers to implementation.

Flexibility and adaptability of staff facilitated effective implementation. Across awardees, leadership and staff noted teamwork and flexibility as critical to implementing care coordination interventions. This includes willingness to adapt to evolving roles and manage unpredictable situations independently, particularly in newer programs.

- For example, Indiana's LHWs temporarily fill in for each other as needed. Likewise, Indiana nurses will take time to teach assistants about the EHR system and help with data entry;
- At multiple HRiA sites, asthma educators perform LHW duties as needed. Conversely, one LHW who is fluent in Spanish fills the asthma educator role (supervised by the educator) for Spanish-speaking families.

A clear alignment between the intervention and the organization's broader goals and mission facilitated implementation. Several awardees pursued HCIA as part of addressing broader priorities:

- Most IOBS COME HOME practices are concurrently working toward certification as an oncology medical home. The COME HOME program aligns with those efforts;
- Ochsner was concurrently working toward certification as a Joint Commission Certified Comprehensive Stroke Center. The changes necessary for this certification fed directly into their HCIA project.

Poor internal communication about new intervention staff and their roles led to challenges implementing programs. In some cases, awardees did not invest time upfront in achieving provider and staff buy-in. This slowed down implementation and led to confusion. For example:

- CHW managers at Nemours report that they did not engage physicians early enough in the program, and that at least one remained resistant to integrating CHWs in their practice throughout;

- Despite efforts to educate USJHSD providers on the patient navigator's role, providers refer cases to the navigator that fall outside of her expertise, such as patients who need substance abuse counseling or pain management;
- At UAB, patients were confused about the role of existing nurse navigators versus the new lay navigators.

Some awardees had trouble recruiting and retaining staff due to local workforce shortages. Awardees located in rural areas faced challenges recruiting and retaining skilled staff and mid-level providers, in particular.

- One MAHEC site suggested that the practice's rural location acts as a disincentive for the health care providers it tries to hire;
- UVA identified a shortage of palliative care doctors in rural areas;
- Ochsner had difficulties finding and retaining qualified advance practice clinicians due to regional shortages and the specific demands of the position (e.g., night and weekend hours).

Awardees needed to adapt interventions based on local geographic and environmental factors. For awardees with multiple sites, local adaptation was essential to effective implementation.

- Rural or geographically dispersed areas require extra time for travel among awardees offering home visits (i.e., Indiana, UCLA). Awardees tried to adapt by assigning staff participants within similar geographic locations;
- Gang violence in inner-city communities affected when and how Nemours offered home visits; the awardee discontinued nighttime and summer visits to ensure staff safety;
- Faced with a lack of affordable and healthy food options in local communities, SEDI offers vouchers to farmers' markets, sets up healthy food pantries, and offers cooking classes at different sites.

Discussants report that participants' socioeconomic and mental health needs affect program effectiveness, yet as few as five awardees had limited access to resources to address these needs.

- Le Bonheur reports that participants' mental health needs can interfere with asthma care management, yet its Memphis site lacks sufficient mental health resources and has had difficulty retaining a program psychologist;
- Poor housing conditions among low-income communities exacerbates childhood asthma, leading awardees to take an education and advocacy approach to improve these conditions. Le Bonheur is working with the University of Memphis law school through a grant to educate the local community on healthy housing conditions;
- MAHEC had difficultly treating addiction in patients on opioid treatment for chronic pain given the shortage of addiction treatment centers or methadone clinics in and around the Asheville area;

- HRiA encourages staff to make referrals to housing inspection services in order to encourage landlords to keep housing up to code; in addition, the awardee refers patients to a lawyer, who advocates for families with housing issues;
  - Participants' lack of reliable transportation affect their ability to make clinic appointments and pick up medications. Many awardees try to address this challenge but are unable to do so completely.
  - Nemours practices accommodate untimely or unreliable transportation by waiving the penalty for showing up late and by extending hours into the evening;
  - At Le Bonheur, LHWs collaborate with a delivery service, which is available to patients who cannot pick up their medications or have difficulty with medication adherence.

Program Effectiveness

As noted previously, HCIA programs identify promising new care-delivery approaches. Our analyses of program effectiveness in the first two years of the evaluation encompass multiple data sources:

- focus groups and interviews, including discussions with over 400 patients and caregivers
- over 200 semi-structured interviews with program staff
- Medicare FFS claims for nine awardees
- Medicaid data for two awardees
- awardee-provided data from seven awardees.

Focus groups and interviews with patients and caregivers provide firsthand accounts of program outcomes. However, we measure aggregated improvements in health, quality of care, utilization, and costs for programs using claims and awardee-collected data.

Exhibit 2.6 presents an overview of evidence of positive program effectiveness from quantitative data for the portfolio to date. We also note in the Exhibit where qualitative data supports our quantitative findings.

- Eleven awardees show statistically significant improvement in at least one measure. We see improvements for awardees focusing on asthma, cancer, diabetes, dementia, and stroke;
- Five of the 11 awardees showing improvement have statistically significant decreases in hospitalizations or ED visits. For two of these awardees, qualitative data provides evidence to support their lower utilization;
- Only one awardee, focusing on asthma, shows statistically significant improvement in cost of care, with qualitative data supporting the finding;
- Improvements in health or quality of care were seen for seven awardees and qualitative data support these findings.

Exhibit 2.6: Quantitative Evidence of Program Effectiveness

Disease	Awardee	Reduced Utilization		Improved Health
		Utilization	Total Cost of Care	
CVD	Christiana	○	○	--
	USJHSD	--	--	○
	Vanderbilt	○	○	--
Stroke	Ochsner	●	○	--
Diabetes	SEDI	--	--	○
	FirstVitals	○	○	--
	Joslin	--	--	◙
ESRD	GWU	○	○	--
Asthma	HRiA	--	--	○
	Le Bonheur	--	--	--
	Nemours	◙	◙	--
Dementia & Depression	Indiana	●	○	--
	UCLA	●	○	--
Chronic Pain	MAHEC	○	○	--
Cancer	IOBS	○	○	--
	UAB	◙	○	--
	UPenn	--	--	--
	UVA	--	--	--

Key:	
●	Quantitative analysis shows positive findings.
◙	Quantitative analysis shows positive findings supported with qualitative data.
○	Quantitative analysis shows null findings.
--	Insufficient data

In the following two sections, we present our quantitative and qualitative findings on program effectiveness in greater detail. First, we present findings from the quantitative analysis of claims and awardee-provided data, offering supporting qualitative findings when available. Second, we examine qualitative findings on health and quality of care improvements and discuss potential drivers of positive participant experiences.

Quantitative Findings

Our aim is to test whether awardees reduce utilization and total cost of care, and demonstrate this reduction relative to a comparison group. To test this hypothesis, we examine ED visits, hospitalizations, readmissions, and total cost of care for the 11 awardees that had sufficient quantitative data available. Exhibit 2.7 summarizes utilization and total-cost-of-care findings presented in awardee chapters.

Reduced utilization and total cost of care from claims. We show the difference in average utilization rates and Medicare cost pre- and post-intervention. Lower readmissions for awardees reflect better quality of acute and post-acute care, while lower ACS hospitalization for awardees reflect better quality of ambulatory care. Values in **bold font** suggest decreased cost or utilization following implementation. For each awardee and outcome, we indicate whether the difference between the pre- and post-intervention average is statistically significant.

In some cases, low enrollment precluded use of a comparison group. In these cases, we do not account for secular trends in care independent of the program. In other cases, trends in the comparison groups may drive our DID results. We encourage reference to the awardee chapters and technical appendix for further details.

Overall, we see some encouraging trends:

- **Hospitalization:** The Nemours and UAB programs significantly reduce hospitalizations for their participants relative to a comparison group. Smaller decreases in point estimates for ACS hospitalizations are observed for IOBS and UCLA.
- **Readmissions:** IOBS' and Ochsner's programs significantly reduce readmissions for participants relative to a comparison group**.** We observe decreases in point estimates for readmissions for UAB and Christiana relative to a comparison group, though not significant.
- **ED visits:** UAB, UCLA, and Indiana's programs significantly reduce the ED visits for participants relative to a comparison group; and much smaller decreases in point estimates for ED visits are observed for IOBS.
- **Costs:** Nemours' program significantly reduce total cost of care for its participants relative to a comparison group. Decreases in point estimates for cost of care are observed for UCLA, IOBS, Indiana, and Ochsner. For all awardees showing decreases in cost of care, we see evidence of significant decreases in utilization

Limitations. Early intervention findings should be viewed with caution, as positive effects of interventions in the first year tend to diminish over time. This particularly applies to analyses of awardees using Medicaid claims, which are only available for four quarters of the post-intervention period, compared to those relying on Medicare claims, which are available up to eight quarters post-intervention.[15]

[15] Analysis of program outcomes for FirstVitals, HRiA, Nemours, and MAHEC rely on Medicaid claims. For a complete summary of data sources, see Exhibit 3.

Exhibit 2.7: Difference in Utilization and Cost Measures Between Pre- and Post-HCIA Periods

Awardee	Comparison Group^	Difference^ in Average for Core Measures across Pre- and Post-Quarters§				
		Participants with Hospitalizations per 1,000	Participants with ACS Hospitalizations per 1,000	Participants with Readmissions per 1,000	Participants with ED Visits per 1,000	Total Cost of Care per Participant
Christiana	Yes	-	-	-6	4	$888
IOBS	Yes	-6	0.1	**-35****	**-9***	$-306
UAB	Yes	**-22*****	-3	-13	**-27*****	$375
UCLA	Yes	-5	-3	77**	**-37*****	$-388
Indiana	Yes	6	0	4	**-32*****	$-205
Nemours	Yes	**-25*****	**-13*****	-	-2	**$-533****
Ochsner	No	-	-	**-57***	20	$-3,226
Vanderbilt-Ambulatory	No	5***	2***	-	13***	$1,446***
Vanderbilt-PAC	No	-	-	-2	27	$1,323
MAHEC	No	3	-	-	0	$692
GWU	No	2	-	-	23	$3,037***
FirstVitals	No	2.6	-	195	3.5	$377

For awardees with a comparison group, the results represent the difference in core measures between pre- and post-HCIA quarters for awardee relative to the comparison group (difference-in-differences). For awardees without the comparison, the results represent difference in core measures between pre- and post-HCIA quarters for the awardee.

*p<0.1; ** p<0.05; ***p<0.01; p values for differences in average unadjusted outcomes pre versus post for time series models and differences in differences in DID models

§Quarters for PAC awardees are defined as calendar quarters before and after implementation of the HCIA program at the awardee site. Core outcomes are measured for patient-episodes in each quarter for PAC awardees. Quarters for ambulatory awardees are defined as quarters prior to and subsequent to enrollment of participants in the HCIA program. Core outcomes are measured for program participants in each quarter prior to and subsequent to program enrollment for ambulatory awardees. We report differences in average unadjusted outcomes across pre- and post-quarters for each awardee using t-tests.

[i] The main reason for Christiana's costs to be relatively higher than the comparison group's cost is that the comparison group's cost reduced between pre- and post-intervention quarters whereas Christiana's costs remained the same.

[ii] ACS hospitalizations for Nemours are limited to hospitalizations for asthma.

Among those with statistically significant reductions in utilization, there are comparable qualitative findings for two awardees: UAB and Nemours. At UAB, five participants attributed reduced ED visits to the efforts of their navigators, and several said they would call their navigator first during a medical emergency. At Nemours, most caregivers interviewed report that their child's asthma has stabilized. As a result, caregivers feel they visit the ED less frequently. Many attributed the stabilization to a better understanding of how to control and prevent asthma symptoms at home.

Improvements in health outcomes and behavior changes from awardee-provided data. We study program effectiveness for awardees on measures of health and quality of care available in awardee-provided data. Exhibit 2.8 summarizes the salient program effectiveness findings for five awardees from awardee-provided data.[16] Qualitative findings complement the quantitative trends:

- **The SEDI program showed significant improvements in hemoglobin A1C**. During telephone interviews 16 of 20 participants indicated they had more control over their blood glucose levels, noting changes in health habits (e.g., exercise and diet) and weight loss helping them to better control their glucose levels;
- **HRiA significantly improved the environment composite score for its participants.** Children in HRiA's program were exposed to significantly fewer environmental triggers of asthma. Qualitative findings from focus groups with caregivers (n=39) indicate that home environmental assessments substantially increased their awareness of asthma triggers and how to mediate them;
- **Joslin's On The Road (OTR) program improved healthy behaviors, confidence in managing diabetes, and hemoglobin A1C levels.** In focus groups and telephone interviews (n=49), participants consistently reported OTR had positive impacts on their health behaviors, at two sites participants were prompted to start a walking group after attending the classes. Across sites, participants found education about hemoglobin A1C beneficial, many noting they did not know about A1C measurements before the course and taking the class prompted them to ask their doctors for more information about this test;
- UPenn's CLAIM program performed significantly higher than its targeted benchmark in managing reported pain for its participants with advanced cancer. Qualitative findings from interviews with 10 participants or caregivers support this. Participants report that the support from the program's home health staff significantly improved their health and that they had more confidence to take care of themselves;
- UVA's CARE Track program significantly reduced end-of-life hospitalizations and ED visits for its participants with advanced cancer relative to a historical comparison group at UVA. Qualitative findings from interviews with a very small group of patients and caregivers (n=4) complement this result. Interviewees took comfort in the quality of care they or their loved one received at UVA and believe it helped them communicate with their doctors better about pain management.

[16] The table excludes awardees where we observed null results from analysis of patient reported data.

Exhibit 2.8: Program Effectiveness Findings from Awardee-Provided Data

Awardee	Health/Quality
SEDI	Hemoglobin A1C** Measured hemoglobin A1C decreased for 66% of participants in the SEDI high-risk intervention. The mean hemoglobin A1C declined from 9.7 A1C units to 8.5 units, an average decline of 1.2 units.
HRiA	Environmental Composite Score** Significant improvement observed across several environmental factors, with the greatest gains in the reductions of mold, smoke, and chemical exposures (20.7–26.9% of participants improved).
Joslin	Healthy behaviors** Confidence managing disease** Hemoglobin A1C control** Participants report engaging in more healthy behaviors (exercising, eating fruits and vegetables, and sleeping) and increased confidence managing their diabetes after attending the On The Road (OTR) program classes (3 – 14% increase). There is also a 5% reduction in number of participants with high hemoglobin A1C measurements.
UPenn	Pain management** Across the entire post-intervention period, 78% (95% CI 74%–82%) of patients with pain had it brought to a comfortable level by the CLAIM program within 48 hours of program enrollment, significantly higher than the benchmark goal of 65%.
UVA	End-of-life Hospitalizations** End-of-life ED Visits** Patients in CARE Track Program are significantly less likely to experience hospitalizations and ED visits in the 30 days and last seven days of their life relative to a historical comparison group at UVA

**Indicates statistically significant findings at p<0.05

Qualitative Findings

Awardee interventions intend to make important quality of care and health improvements for patients. We present data from qualitative interviews and claims-based measures to test the hypothesis that awardee programs improve quality of care, quality of life, behavior change, and health outcomes.

Qualitatively, we identified improvements in the following:

- **quality of life,** including greater comfort, empowerment, mobility, ability to meet nonclinical goals, and stress reduction
- **clinical outcomes,** including reduced health care system utilization as well as improvements in measures such as weight, A1C levels, fewer asthma attacks, etc.
- **self-monitoring,** including participants' and caregivers' efforts to monitor conditions, engage in prevention activities, appropriately address acute events, and/or their sense of confidence in these areas[17]

[17] For cancer awardees, this also includes managing pain and side effects of chemotherapy.

- **behavior change,** typically related to changes in diet, exercise, and cleaning habits but we include other nonclinical behavior changes related to programs
- **quality of care,** covering a range of positive changes from greater comfort approaching physicians with questions and improved access to care to delivery of medical equipment and greater communication between providers

At the awardee level, participants and caregivers most frequently report improvements in quality of life (see Exhibit 2.9). Staff generally provided participants and caregivers with a sense of emotional comfort and support while health education enhanced feelings of empowerment.

Exhibit 2.9: Qualitative Evidence on Improvements in Health, Quality of Life, and Quality of Care from Focus Groups and Patient Interviews (N=419)

Disease Group	Awardee (N)	Quality of Life and/or Stress Reduction	Clinical Outcomes	Self-monitoring	Behavioral Changes	Quality of Care
CVD	**Christiana** (n=18)	●	◙	●	◙	--
	USJHSD (n=17)	●	--	●	◙	--
	Vanderbilt (n=29)	◙	●	●	●	◙
Diabetes	**SEDI** (n=21)	●	●	●	●	●
	FirstVitals (n=16)	●	O	●	●	O
	Joslin (n=45)	--	O	●	●	O
ESRD	**GWU** (n=15)	--	--	●	--	◙
Asthma	**HRiA** (n=39)	●	●	●	●	O
	Le Bonheur (n=12)	●	●	●	◙	◙
	Nemours (n=17)	◙	●	●	●	●
Dementia & Depression	**Indiana** (n=43)	●	--	●	--	●
	UCLA (n=15)	●	O	●	--	O
Chronic Pain	**MAHEC** (n=20)*	●	O	◙	O	●
Stroke	**Ochsner** (n=28)	●	O	◙[18]	●	O
Cancer	**IOBS** (n=18)	●	--	--	--	◙
	UAB (n=52)	●	--	--	--	◙
	UPenn (n=10)	●	--	●	--	◙
	UVA (n=4)	●	●	--	--	O

Key:	
●	All or most respondents report positive effects
◙	About half respondents report positive effects
O	Few respondents report positive effects
--	No findings or not reported

[18] Ochsner participants do not directly manage symptoms or effects of strokes but monitor weight and blood pressure, which help prevent strokes and/or aid recovery.

Caregivers report that the program provided a source of support, increased confidence in caregiving abilities, offered encouragement to care for themselves, and subsequently relieved stress.

- One caregiver who participated in Ochsner's Stroke Mobile program noted: "It just made me feel good that I knew they were going to come back. I don't know why. Maybe it was just that little boost that I needed to keep me going on the right track with him. I felt like it was almost like a support group;"
- Similarly, a caregiver who participated in UCLA's Alzheimer's and Dementia Care program said: "The program has turned my life around. I now have a grip on things. I don't feel totally overwhelmed. I've been given some counseling and some adult daycare. It's turned my life around. … I can honestly say that [my dementia care manager] has sort of saved me;"
- Caregivers from the three programs addressing pediatric asthma frequently discussed stress relief in terms of managing acute episodes. One caregiver explained: *"It definitely made me feel more comfortable.… When he had an asthma attack, I don't feel like 'oh my God, what do I do?' There's no more sleepless nights."*

Participants perceive improved interactions with providers across multiple levels.

- SEDI participants found they could make appointments more easily and receive return calls faster, that they noted better information available during PCP visits, and that they knew that SEDI staff shared progress with their PCP. One participant compared the care team to *"a well-oiled machine."*

Participants also described how the intervention led to active and effective communication among the care delivery team:

- One Nemours caregiver noted: "[My] CHW helps keep that gap between the treatments that Nemours is giving [my son], and the treatment that [the PCP] is giving him, and if they conflict, I'll get a call;"
- A participant in Vanderbilt's outpatient program remarked: "My care coordinator, if I go to a doctor… she knows it and knows my history and knows that medicine has been changed. I don't have to worry about talking to my PCP because it is already handled. It really helps."

Across eight awardees, participants report that the intervention increased their motivation to self-monitor their disease and symptoms.[19] Relationships with care team staff foster accountability among participants. Participants discussed managing blood sugar, blood pressure, medication, and weight, which they report to program staff.

- For Christiana, the reliability and consistency of communication with staff fostered positive connections over the phone. Participants reported improvements in self-monitoring behaviors despite a lack of in-person interactions. One participant noted: *"I'll give [my nurse care manager] a call then and then she's just asking what did [my PCP] have to say, what are his recommendations, how are your numbers, and I actually have to know blood numbers and all of that for her;"*

[19] This applies to Christiana, SEDI, FirstVitals, GWU, HRiA, Le Bonheur, Ochsner, UPenn.

- The FirstVitals experience suggests diabetes self-management is effective when there is a balance between technology and relationship-building between staff and participants. FirstVitals staff cites the tablet is an incentive to join the program, but the interpersonal connections between care coordinators, providers, and participants truly drive behavior change. As one participant noted: *"Every morning when you get up, you take your blood sugar—you know there is somebody on the other end who's going to see this. So if you screw up the night before and your blood sugar is high, someone is going to call like you have bad grades or something;"*
- Le Bonheur's emphasis on appropriate medication adherence was appreciated by caregivers; one caregiver said: "I love [my physician], and she is going to check when [my son's] medication is being refilled and how often you are administering it.... She is going to make sure you fill it every 30 days;"
- Ochsner's monthly Stroke Mobile program encouraged participants and their caregivers to address risk factors for stroke, such as diet, exercise, and weight. Participants found this guidance helpful and motivational. One participant explained: *"What I like most of all is now I am monitoring my weight. Even if it's just once a month with [the program];"*

Qualitative findings suggest participants are willing to adapt behaviors when programs educate them on the small changes they can make and tie the changes to clear clinical goals.

- SEDI participants report knowledge gains and speak confidently about how behaviors link to their health: "I have learned that exercising after my meal helps me to distribute my carbs more properly. I did not know any of this stuff [before];"
- Joslin focus group participants across all sites could name the "five key diabetes tests" and cited the importance of "knowing [their] numbers." Among asthma awardees, participants changed their cleaning behaviors and most now follow asthma action plans.

Sustainability

Our discussions with awardees explored how they grapple with sustainability. Awardees express a recurrent theme that current payment models do not cover many services they offer. Innovation in workforce often adds another challenge as awardees generally cannot bill for services provided by LHWs—a role critical to some interventions. Value-based payment through different mechanisms holds promise for awardees.

Many awardees in this portfolio use intensive care-coordination services in their interventions; current reimbursement structures do not support this. Some awardees anticipated that a combination of value-based care, LHW reimbursement, and comprehensive chronic care management reimbursement would be fully in place at the end of the award period. For example, Nemours designed and pursued their intervention while under the impression that Delaware would pursue a Medicaid state plan amendment allowing for a reimbursement of preventive services by non-licensed providers. However, the state decided not to pursue this opportunity over concerns about the infrastructure required to develop standardized credentials and monitor LHW performance. Program leaders are optimistic that the state will ultimately develop a reimbursement mechanism for LHWs, but that they cannot sustain the program's LHW positions in the interim.

Overall, we group long and short-term awardee strategies for sustainability into five groups:

Utilization of new payment models under Medicare. Multiple awardees see specific value-based purchasing models as important mechanisms to sustain their program:

- Christiana is participating in the CMS Bundled Payment for Care Improvement Initiative (BCPI). They will expand their care management program to include valve replacement, joint replacement, and cervical spine surgery patients;
- HRiA will be participating in a bundled payment pilot in the Massachusetts site;[20]
- As a Medicare Shared Savings Program Accountable Care Organization (ACO), MAHEC uses lump-sum payments as compensation for any non-billable services offered in the course of providing behavioral health coverage for chronic pain participants;
- FirstVitals, Vanderbilt, and others may use new Medicare Chronic Care Management (CCM) or existing Care Coordination (CC) fees as part of their sustainability plan. As of 2015, providers can bill for non-face-to-face chronic care management services (i.e., development and revisions of a care plan, communication among treating physicians, and medication management) offered to Medicare beneficiaries with two or more significant chronic conditions using the monthly fixed rate CCM fee.[21] Other than the new CCM approach, reimbursement for care coordination can be received through capitated payments from Medicare or Medicaid managed care, with the provider receiving a small monthly care coordination fee for coordinating various needs of the beneficiaries' care.[22] Awardees recognize that billing for these fees should be part of a diversified sustainability strategy since the CC fees alone do not cover the amount of time on average that interventions offer each participant. Additionally, the eligibility criteria for these fees may not align with the intervention's eligibility criteria.

Billing for services. Some awardees find they can already bill for new services provided through their HCIA intervention using a traditional fee-for-service payment model. For example, SEDI sites have reported they are likely to sustain only elements of the high-risk intervention, such as nutrition counseling, which would be reimbursable through third parties. Nemours is sustaining the psychologists embedded in primary care practices in large part because their time is billable. MAHEC's chronic pain mid-level providers bill for their services and see sufficient numbers of patients to cover their salaries. FirstVitals bills for retinal screenings, charges for medical equipment and its maintenance as a Durable Medical Equipment provider.

Integrating intervention into the clinical work stream or business model. In some cases, awardees work to streamline and amortize intervention costs across a health care organization that is willing to

[20] Boston Children's Hospital

[21] CY 2015 Revisions to Payment Policies under the Physician Fee Schedule and Other Revisions to Medicare Part B. Accessed September 8, 2015 at http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Federal-Regulation-Notices-Items/CMS-1612-FC.html

[22] Medicare Payment Advisory Committee (MedPac). "Report to the Congress: Medicare and the Health Care Delivery System." June 2011. Accessed September 8 2015 at http://www.medpac.gov/documents/reports/Jun11_EntireReport.pdf?sfvrsn=0

absorb this expense. In many cases, providers see strategic value in continuing this work as a way to attract patients or follow-through on organizational priorities.

- Christiana's leadership plans to incorporate care management as part of the system's model of care. By leverage the existing IT investments, they will expand care management beyond cardiology with need for limited additional resources. Program leaders are also working with hospital administrators to plan resource allocation, shift workforce deployments, and align the intervention with other hospital initiatives.
- MAHEC incorporated their chronic pain clinic into their family health program and will also use the intervention's model for working with mid-level and behavioral health providers in their OB-GYN program.
- UAB's partner hospitals buy into the value of the LHW patient navigator as a member of the cancer care team, and some sites plan to add lay navigation to hospital budgets.

Engaging private payers. Working with payers, some awardees are looking for new opportunities to bill for services currently not commonly covered by private insurance.

- Vanderbilt plans to sustain, in part, by collaborating with a private partner, Aetna. This collaboration is attractive for the ability to use pay for performance "bundles" and shared-savings contracts.[23]
- HRiA and FirstVitals share data with private payers that can help these payers assess the benefit of covering specific services. Ochsner hopes to develop a new bundled payment mechanism with private payers to cover Stroke Central and Stroke Mobile services.

Engaging other stakeholders: Many awardees focus on fostering buy-in and financial support from partners, new funders, and other outside stakeholders.

- UCLA is planning to engage philanthropy and institutional leaders for funding.
- UVA has applied for competitive instructional grants to sustain patient-reported outcomes assessment.
- Le Bonheur recently received a planning grant from the Green and Healthy Homes Initiative, allowing them to fully explore the feasibility of a "pay for success" or social impact bond model. The program receives payment from a funder based upon the degree to which they meet agreed-upon performance measures.[24]
- Indiana is working with a third-party to generate revenue by licensing and distributing their dementia care coordination model to providers and payers.

[23] http://vhan.com/providers/faq/

[24] Green & Healthy Homes Initiative Selects Five Healthcare Organizations for Pay for Success Projects. http://www.greenandhealthyhomes.org/media/press-releases/green-healthy-homes-initiative-selects-five-healthcare-organizations-pay. Published March 11. 2015. Accessed March 19, 2015.

Conclusion

We find that almost all awardees met their enrollment targets and established effective mechanisms for identifying and recruiting participants. We also found that all awardees implemented their program in a flexible manner relying on protocols as a starting point, but modifying key elements of the intervention such as dosing and risk-stratification as they went along.

Most interventions involve a high-level of personal engagement geared to helping participants manage their health, coordinate their care and improve health-related outcomes. Our findings suggest that HCIA interventions added the most value through time spent with participants—coordinating services, facilitating communication with and between providers, providing tailored education, and serving as a primary contact for participant questions and concerns.

Population health or care management software was a critical component of many interventions. A majority of the awardees spent extensive time and resources working with vendors and internal information technology teams to develop solutions. Yet, most still encountered challenges integrating these systems with their EHRs and accessing data across facilities.

Relatedly, many innovations relied on the use of algorithms driven by clinical and non-clinical assessments to group participants by risk and target services. Awardees have mixed experiences using these tools and, in most cases, they still allowed human judgment to supplement or supersede automated processes for targeting services.

Our findings suggest that the most effective and efficient new workforce models relied on a combination of lay health workers and licensed clinical staff (e.g., RNs). Mid-level providers (NPs and PAs) may not be best suited to manage non-clinical needs that surface when engaging on a close, personal-level with participants in home visits or during care coordination due to both the financial inefficiency and inexperience of using providers with advanced clinical training in such roles. Recruitment of behavioral health providers was also a challenge in some cases.

We evaluated program effectiveness qualitatively and quantitatively. Qualitative findings indicate participants have largely positive experiences with the awardees' interventions. For six of the 18 awardees: UAB, Nemours, UCLA, Indiana, IOBS and Ochsner, we see significant improvements (reductions) in core measures associated with utilization or cost of care. In the case of UAB and Nemours, these results directly correspond with specific qualitative findings. For five other awardees—UVA, UPenn, Joslin, SEDI and HRiA—we see significant quantitative improvement in non-core measures associated with quality of care, also supported by qualitative findings.

As most awards are coming to an end, we see extensive activity to sustain innovations. In many cases, awardees hope to sustain some, but not all, intervention components. Strategies for sustainability range from licensing and marketing original material developed for the intervention to finding opportunities for third-party payment in a value-based framework. However, many awardees using lay health workers face the challenge that their services are not covered under current payment models. In at least the case of Nemours, this contributed to their decision to discontinue their seemingly effective lay health worker intervention. Most awardees would benefit from a shift away from a fee-for-service model to a value-based payment models but require greater support at the institutional and governmental levels.

Awardee-Specific Findings

In this section, we present an overview of each awardee—synthesizing qualitative data collected to date and incorporating quantitative results where possible.

Christiana Care Health System

Christiana Care Health System is a network of nonprofit, private hospitals based in Delaware with campuses in Newark and Wilmington. There are a combined 1,100 beds and more than 1,400 staff physicians. Christiana's Bridging the Divide (Bridges) program enhances care for patients following coronary revascularization or hospitalization for acute myocardial infarction through enhanced care at transition and care management following discharge. We present findings based on a review of the awardee's quarterly reports to CMMI, telephone interviews with the awardee, two rounds of site visits, focus groups with program participants, and analysis of Medicare claims data.

Program Title	**Bridges**		
Intervention Summary	The intervention consists of two pathways to care management: 1. *Transitional care coordination* that begins at inpatient admission through transition into post-acute care, and 2. *Longitudinal care management* in the outpatient setting that provides proactive monitoring and notification of health events and IT-enabled patient self-monitoring and management.		
Targeted Disease/Condition	Cardiovascular disease		
Total Amount Awarded*	$9,999,999	**Award Amount Spent***	$7,305,104
Number of Sites	1	**Locations by State**	DE
Cumulative Reach*	3,061		
Intervention Workforce	Approximately 1 lay health worker, 1 pharmacist, 4 registered nurses, and 2 social workers		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Christiana's intervention, like others targeting populations with cardiovascular problems, faces significant challenges reducing ED visits and readmissions. This is in part because of difficulty distinguishing between different causes of chest discomfort outside of a health care setting.
- We found no improvement in utilization for Medicare fee-for-service (FFS) patient-episodes at Christiana after implementation of the Bridges program.
- Christiana plans to continue the program and is in the process of expanding the care management pathway to include other patients.

Implementation Experience

Over the last year of the award, Christiana has solidified their operating procedures, honed their approach to risk stratification, and made progress with data integration. While they have encountered challenges along the way, they have also learned lessons, which will inform their ongoing care management initiatives.

Bridges uses automated assessment tools, supplemented by care manager judgement, to stratify eligible participants by risk-level. Initially, Christiana based risk stratification on an algorithm developed by the program team and implemented manually by care managers. Recently, Bridges automated this process using software[25] (Neuron™) that feeds data from multiple streams into risk stratification tools. During the transition, the Bridges team validated the system, and care managers continue to supplement the automated process with their own clinical knowledge and judgement.

To achieve efficiencies, Christiana shifted resources to focus on high-risk patients. As the project evolved, Christiana discontinued enrollment for percutaneous coronary intervention (PCI) patients. They shifted resources to provide more intensive care management for high-risk participants, including increasing touches and frequency of medication reconciliation. Care managers support this adjustment as it allows greater focus on patients with the most acute needs.

Christiana now receives data from the Delaware Health Information Network (DHIN), but using these data to support care management requires significant additional work. Christiana began receiving data on readmissions and laboratory test results through DHIN in April 2015. DHIN's data arrives to the Christiana's case management system (Aerial™) as task notifications. Staff then review these notifications and re-enter them, as appropriate, in individual patient records—a time-consuming process. Re-entry is required in part because DHIN sends all historical lab data to Christiana, rather than only those labs (e.g., cholesterol) central to the intervention. In the future, the team will work with DHIN to edit notifications and establish greater interoperability with their case management system.

Developing relationships with outpatient cardiology practices' staff facilitated care management; however, Bridges staff faced challenges when Bridges protocols were not in line with private practice norms. Having a point of contact at cardiology practices affiliated with Christiana facilitates care management. The Bridges care managers began identifying a single point of contact at each practice to communicate with the practices' clinicians on participant needs identified through Bridges. Building a relationship with this point of contact gives care coordinators an important inside perspective on the culture of a practice and allows them to advocate for a participant while respecting practice norms. Bridges' visit scheduling protocols did not align with norms in some private practices. Bridges staff report challenges using the intervention's protocols to manage care for patients from cardiology practices not affiliated with Christiana. Each cardiac practice uses different approaches for establishing the timing of post-discharge visits. Care managers felt it was unrealistic to expect external practices to comply with follow-up protocols that were more stringent than local care standards.

Longitudinal care managers express overwhelming job satisfaction. They appreciate the flexibility to developing effective relationships with participants by working around participants' schedules and listening to problems that go beyond the target condition. Even over the phone, care managers established close relationships, helping them influence participants' health-related behaviors. Almost all staff report they would take the same job again if given the opportunity.

[25] Neuron™ (ColdLight Solutions, LLC) is a software capable of processing large amounts of data and learning to identify patterns. It scans Christiana hospital system records for defined events and then generates a daily list of patients. It is integrated into Aerial™ (Medecision)—a commercial care management software—that assigns participants to care plans, provides scripts for transition calls, and generates prompts for other specific tasks.

A single inpatient care manager was not sufficient to meet the demands of transitional care coordination. As of the second site visit in May 2015, a single inpatient care manager was responsible for meeting with patients in the hospital prior to discharge. Given the short length of stay for most of the target population, the work required to introduce and educate patients proved too burdensome for a single resource. Bridges management plans to increase staffing for this function in the future.

Recognizing important limits on care coordination following cardiac episodes, Christiana de-emphasized the intervention's capacity to reduce readmissions and ED visits. For patients with cardiac problems, reducing ED use is difficult since many symptoms of cardiac distress may mimic common ailments (e.g., indigestion). Symptoms such as chest pain are difficult to assess remotely. Care managers suggested that the protocol for assessing patients complaining of chest pain over the phone was inappropriate. Furthermore, although Bridges leadership initially expected a decrease in readmissions, they found that Christiana maintained very sound pre-existing process around discharge and readmission prevention. Therefore, they now think it is unlikely that the program will reduce readmissions.

Participant Experience

In the focus groups held at both site visits, participants spoke very positively about their experiences with the Bridges program and staff (n=17).

Improvements in Quality of Life

Participants appreciate that Bridges helped them address concerns unrelated to their heart health including fear, uncertainty, and depressive feelings that can follow a cardiac event.

> *"Sometimes you're scared. You go through all this stuff here. And you used to be this athlete or this here. All of a sudden, you feel like this puny kind of a person. This person gives you incentives to get up and do things; they give you confidence that you'll be able to get back, but you got to work on it."*

> *"And then sometimes, like, I started feeling depressed. I am a person that is usually constantly going. ... I have this energy. Now I don't have this energy, and that was really hard.… And like she told me, 'It's going to take a while.' And so, that was helpful."*

> *"Well, you know, it was, like, going back to work: I was tired a lot. And she explained to me, 'You know, you're just getting over this. It will take time. Go at a slow pace.… If you need to talk to somebody, you know we're here."*

Focus group findings suggest participants have well-developed relationships with their care managers even though interactions are limited to the phone. The care managers ensure that the patients are clear on the care management role, frequency, and schedules for contact.

Improvements in Self-Monitoring
During the first focus group, five participants shared that they now measure their blood pressure regularly because staff would call and ask for their readings. Moreover, four participants felt the Bridges program helped increase awareness and determination to manage their own health. Two participants were specifically thankful for the free blood pressure cuffs because they could not afford to buy their own. One participant emphasized that Bridges *"gives you the desire to advocate for yourself."*
Behavior Changes
Participants note that care managers meet them "where they are" in their recovery journey and provide encouragement and clear guidance to help them meet personal goals. Participants also suggested that care managers encouraged them by holding them accountable. One participant explained: *"I coach basketball, and I wanted to get back on the court with my team. They said, 'Don't worry, you'll be able to do this, but you have to make sure you do A, B, and C first. You do those things, and you'll be back."*

Quantitative Analysis of Program Effectiveness

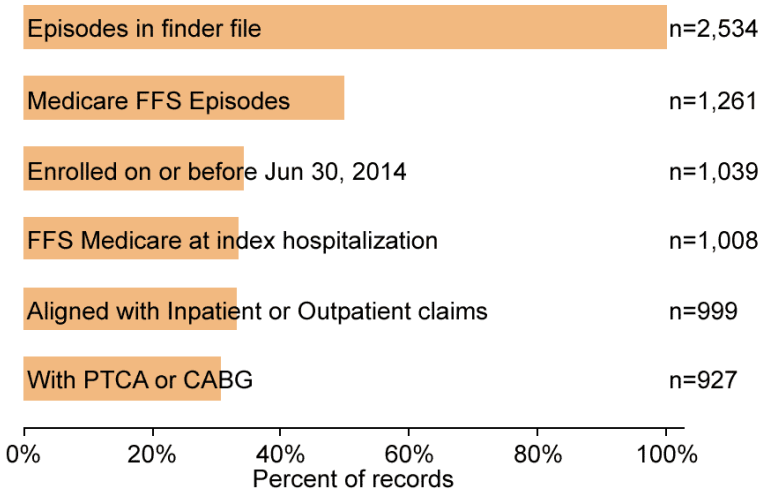
Our analysis of program effectiveness focuses on core measures of readmissions, ED visits, and total cost of care. We limit our analysis to patient-episodes from Medicare FFS claims and those including cardiac re-vascularization through percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG). Since Christiana uses clinical criteria unavailable in Medicare claims to enroll patient-episodes with AMI, we exclude these patient-episodes from our analysis.[26, 27] Furthermore we:

- use difference-in-differences (DID) analyses to compare core measures for patient-episodes at Christiana to patient-episodes at comparison hospitals pre- and post-intervention. To account for differences in the mix of target conditions and settings, we stratify the analysis by target condition (PCI inpatient; PCI outpatient; and CABG). We calculate a pooled DID estimate for Christiana as the weighted average of the DID estimate for the three target conditions. Using this approach, we account for secular trends and for systematic differences between Christiana and other hospitals unrelated to Bridges;
- start by using Christiana's finder file of Bridges participants to identify their Medicare FFS patients with coronary revascularization episodes in each post-intervention quarter from April 1, 2013, through September 30, 2014 (see Exhibit 3.1);
- add a group of baseline Medicare FFS coronary revascularization patient-episodes at Christiana in the pre-HCIA period, from April 1, 2011, through March 31, 2013; and

[26] Myocardial infarction patient-episodes with elevated troponin and catheterization defined by at least a 50 percent stenosis of one lesion.
[27] We exclude approximately seven percent of patient-episodes present in the finder file.

- include Medicare FFS coronary revascularization patient-episodes (pre- and post-intervention) at four comparison hospitals selected for their similarity to Christiana.[28, 29] For more details on our approach to selecting comparison hospitals for Christiana, please see Technical Appendix A.1

Exhibit 3.1: Christiana Patient-Episodes Identified through Finder File



Comparison group selection. For each target condition, we run separate propensity score models to produce Standardized Mortality Ratio (SMR) weights.[30] We then incorporate SMR weights into our analysis to minimize observed differences in covariates across Christiana and comparison group patient-episodes included in our propensity score models (see Exhibit 3.2). For more details on selection of comparison and SMR weighting, see Technical Appendix A.

In Exhibit 3.2, we show common support and balance in covariates across Christiana and comparison group patient-episodes for each target condition.[31]

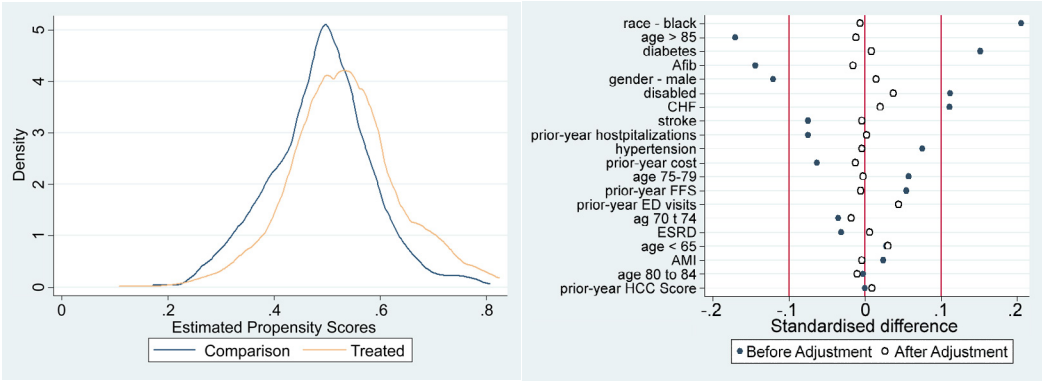
- We observe a high level of overlap in distribution of estimated propensity scores across Christiana and comparison group patient-episodes.
- The standardized difference between Christiana and comparison patient-episodes across all covariates is negligible after incorporating SMR weights.
- We use the following variables to adjust for differences in severity of patient-episodes between the treatment and the comparison group: severity of hospitalization for inpatient CABG & PTCA (Major

[28] University of Pittsburgh Medical Center Presbyterian Shadyside, PA; Abington Memorial Hospital, PA; Main Line Hospital Bryn Mawr Campus, PA; and Thomas Jefferson University Hospital, PA.
[29] We considered the following characteristics: geographic region, population density, teaching status, ownership type, bed size, target diagnosis/procedure volume, demographics of hospital population, and availability of cardiac-thoracic surgery and cardiac-catheterization.
[30] We include the following covariates in the propensity score model: age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year ED visits, prior-year cost, extent of FFS coverage in prior year, prior-year HCC score, severity of hospitalization, (CC or MCC DRG), and relevant chronic conditions (CHF, stroke, diabetes, atrial fibrillation, ESRD, and AMI).
[31] Overlap in distribution of estimated propensity scores across Christiana and comparison group patient-episodes

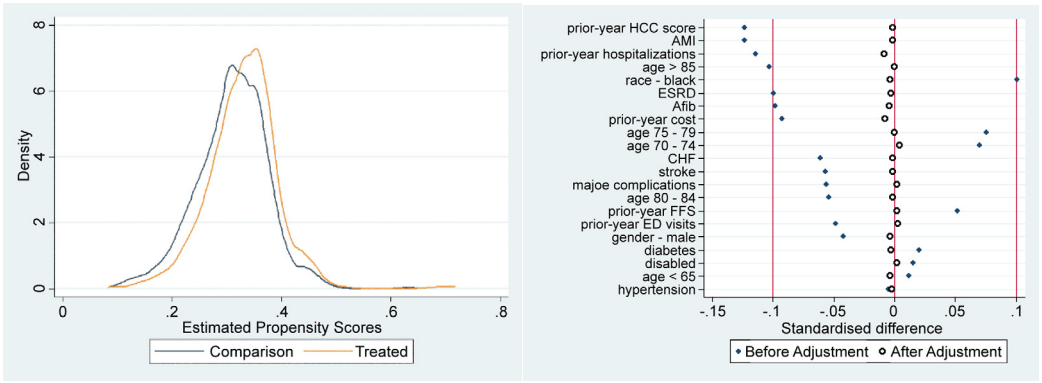
Complications or Comorbidities (MCC), or Complications or Comorbidities (CC), or no MCC/CC), relevant chronic conditions (CHF, stroke, diabetes, atrial fibrillation, ESRD, history of MI), as well as HCC score in the year prior to hospitalization.

Exhibit 3.2: Christiana Common Support and Covariate Balance for Christiana and Comparison Patient-Episodes

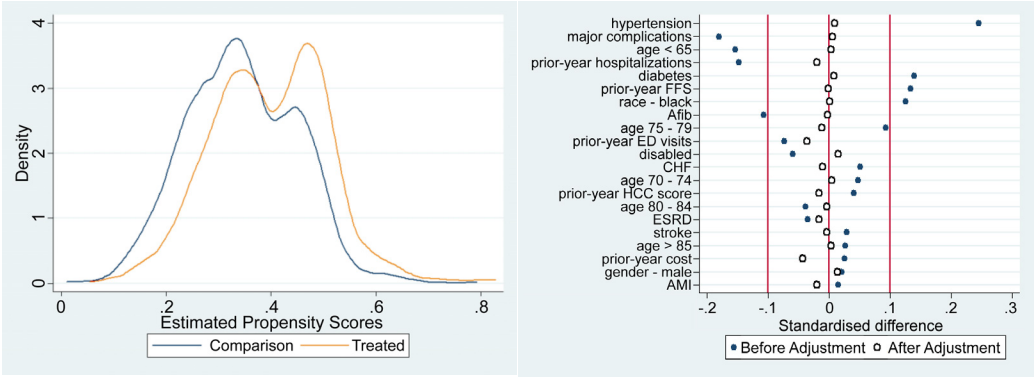
Percutaneous Transluminal Coronary Angioplasty (Outpatient) Subgroup



Percutaneous Transluminal Coronary Angioplasty (Inpatient) Subgroup



Coronary Artery Bypass Grafting (CABG) Subgroup



In Exhibit 3.3, we present demographic, clinical, and baseline utilization information for patient-episodes included in our analysis. We specifically focus on comparing the post-intervention patient-episodes at

Christiana and comparison hospitals. Relative to patient-episodes at Christiana, post-intervention episodes in the comparison group are more likely to be older (>80 years); have higher morbidity, ED, hospital utilization, and cost of care at baseline; be less likely to have percutaneous transluminal coronary angioplasty (PTCA) in an outpatient setting; and be more likely to be discharged to a skilled nursing facility after hospitalization. We use propensity score SMR weighting, described earlier, in our analytic models to adjust for these observable differences between Christiana and the comparison group's patient-episodes.

Exhibit 3.3: Christiana Descriptive Characteristics of Participants and Comparison Patient-Episodes

Variable	Pre-intervention Christiana	Pre-intervention Comparison	Post-intervention Christiana	Post-intervention Comparison
Number of Patient-Episodes	1,923	3,015	927	1,960
Age* **				
<65 years old	12.8% (246)	14.9% (449)	11.7% (108)	11.8% (231)
65–69 years old	23.3% (448)	23.4% (706)	26.9% (249)	24.5% (481)
70–74 years old	21.3% (410)	18.7% (564)	23.6% (219)	21.9% (429)
75–79 years old	20.0% (385)	16.4% (495)	17.5% (162)	15.8% (309)
80–84 years old	13.9% (268)	15.8% (475)	13.5% (125)	14.3% (281)
≥ 85 years old	8.6% (166)	10.8% (326)	6.9% (64)	11.7% (229)
Race/Ethnicity* **				
White	85.2% (1,639)	89.3% (2,691)	84.4% (782)	88.6% (1,736)
Black	11.5% (221)	8.2% (247)	12.0% (111)	8.2% (161)
Hispanic	0.5% (10)	0.2% (5)	0.3% (3)	0.0% (0)
Other	2.8% (53)	2.4% (72)	3.3% (31)	3.2% (63)
Gender				
Female	35.4% (680)	33.4% (1,008)	35.4% (328)	35.1% (687)
Comorbidities/Utilization Year Prior to Index Hospitalizations				
Number of HCCs***	2.7 (2.6)	2.9 (2.7)	2.5 (2.5)	2.8 (2.8)
HCC Score***	1.4 (1.3)	1.5 (1.3)	1.4 (1.2)	1.5 (1.3)
No. Hospitalizations per year***	0.7 (1.5)	0.9 (1.5)	0.5 (1.1)	0.7 (1.3)
No. ED Visits per year*	0.6 (1.6)	0.7 (1.7)	0.6 (1.6)	0.7 (1.6)
Prior 1-year cost***	$16,782 ($30,681)	$19,116 ($31,730)	$14,727 ($25,233)	$17,915 ($30,336)
Coverage Reason				
Old Age	77.3% (1,487)	75.0% (2,262)	77.5% (718)	77.9% (1,527)
Disability	21.1% (405)	21.9% (660)	21.1% (196)	19.8% (389)
ESRD	0.6% (11)	1.2% (37)	0.4% (4)	0.9% (17)
Disability and ESRD	1.0% (20)	1.9% (56)	1.0% (9)	1.4% (27)

Variable	Pre-intervention Christiana	Pre-intervention Comparison	Post-intervention Christiana	Post-intervention Comparison
Discharges* **				
Home	64.8% (1,247)	61.5% (1,854)	60.8% (564)	60.1% (1,178)
SNF	9.4% (181)	14.1% (424)	10.2% (95)	13.9% (273)
HHA	23.1% (444)	19.6% (591)	26.4% (245)	21.3% (418)
Hospice	0.4% (8)	0.3% (8)	0.4% (4)	0.3% (6)
Other	2.2% (43)	4.6% (138)	2.0% (19)	4.3% (85)
Disease Composition				
Inpatient PTCA***	50.0% (961)	61.6% (1,856)	47.4% (439)	59.9% (1,174)
Outpatient PTCA***	25.9% (498)	13.3% (401)	26.6% (247)	15.8% (310)
Inpatient CABG	24.1% (464)	25.1% (758)	26.0% (241)	24.3% (476)

*** p<0.01, ** p<0.05, *p<.1

Statistical significance assessed using chi-squared tests for proportions & t-tests for continuous variables, comparing characteristics of patient-episodes at Christiana and the comparison group during the post-intervention period.

For each core measure, we pose the following research question:

- Are there differences in core measures after implementation of the Bridges intervention between patient-episodes at Christiana and the comparison group, after adjusting for differences in secular trends and risk factors across both groups?

To answer this question we use a summative DID model that assesses the impact of the Bridges intervention over the entire post-intervention period. For details on specifications of this model, refer to Technical Appendix A.

Summative DID results. In Exhibit 3.4 we present results from our summative DID models assessing the impact of the Bridges intervention. The DID estimate (in the final column) shows how the difference in average outcome between patient-episodes at Christiana and those in the comparison group changed after Bridges implementation. In the summative DID model we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.[32]

- Implementation of the Bridges program at Christiana is associated with non-significant decreases in the point estimates for 30-day and 90-day readmissions for patient-episodes, relative to the comparison group.
- The Bridges program is not associated with decreases in ED visits or cost of care for patient-episodes at Christiana, relative to the comparison group.
- Relative to the comparison group, the Bridges program is associated with a significantly better physician follow-up after hospital discharge, for Christiana's patient-episodes.

[32] In the accompanying quarterly report, we present quarterly fixed effects (QFE) DID models where we estimate effects for each quarter of the program, assuming that program effects vary in each program quarter.

Exhibit 3.4: Christiana Difference-in-Differences Estimates for Core Measures, per 1,000

Pre-Intervention			Post-Intervention			DIFFERENCE IN DIFFERENCES [95% CI]
Comparison (N=3,015)	Christiana (N=1,923)	DIFFERENCE [95% CI]	Comparison (N=1,960)	Christiana (N=927)	DIFFERENCE [95% CI]	
Patient-Episodes with 30-Day Readmission (per 1,000)						
144	148	3 [-31, 38]	134	132	-2 [-46, 41]	-6 [-61, 49]
Patient-Episodes with 90-Day Readmission (per 1,000)						
258	253	-5 [-47, 37]	240	220	-20 [-73, 33]	-15 [-82, 52]
Patient-Episodes with 180-Day Readmission (per 1,000)						
350	345	-4 [-49. 41]	326	321	-5 [-67, 57]	0 [-77, 76]
Patient-Episodes with 90-Day ED Visit (per 1,000)						
175	177	1 [-37, 40]	189	195	5 [-47, 58]	4 [-61, 69]
Patient-Episodes with 180-Day ED Visit (per 1,000)						
262	271	9 [-35, 52]	281	290	10 [-55, 74]	1 [-77, 78]
90-Day Total Cost of Care per Patient-Episode ($)						
$11,918	$12,348	$430 [-$1,510, $2,370]	$10,669	$11,987	$1,318 [-$771, $3,407]	$888 [-$1,989, $3,765]
180-Day Total Cost of Care per Patient-Episode ($)						
$19,020	$19,385	$365 [-$2401, $3,131]	$16,415	$19,274	$2,858 [-$475, $6,192]	$2,494 [-$1,850, 6837]
Patient-Episodes with practitioner visit within 7 days of hospital discharge (per 1,000)						
335	343	8 [-37, 53]	355	440	85 [22, 147]	76 [0, 153]*

Inference: *** p<0.01; ** p<0.05; * p<0.1

ǂ Model-based estimates for cost measure deduced from Generalized Linear Model with Log Link and Gamma Distribution. Estimates for utilization measures deduced from Generalized Linear Models with Logit Link and Binomial Distribution.

Sustainability

Christiana is in the process of expanding the care management program to include other patients as part of the Bundled Payment for Care Improvement (BPCI) initiative. Under BPCI, Christiana plans to expand their focus to include valve, joint replacement, and cervical spine surgery patients. In the future, they will expand further to the acute myocardial infarction, coronary surgery, and chronic heart failure patients.

The bundled-care-focused care management will take place over 60 or 90 days, based on the bundle, instead of one year as piloted under the Bridges program. Care managers reported that the new time period would be sufficient to stabilize and educate patients and put them on a path toward behavior change and self-management. In 2016, Christiana plans to enter a risk-sharing agreement with a Medicare managed care plan and expand their care management approach to primary care patients.

Conclusion

Christiana's Bridges program uses care management during transition and following discharge to improve care for patients following coronary revascularization or hospitalization for acute myocardial infarction. Through site visit discussions, we found that, in the short term, there are limitations to reducing ED visits for patients with history of cardiac arrest or heart health concerns. Both program leadership and focus group participants believed in the longer-term impact of the program, especially in preventing future cardiac events. Quantitatively, we find that Bridges has significantly improved post-discharge practitioner follow-up for Medicare FFS patient-episodes at Christiana, relative to the comparison group. We do not observe decreases in cost of care or other measures of utilization for patient-episodes at Christiana after implementation of the Bridges program. Christiana leadership is committed to continue the program and is in the process of expanding the care management pathway to include other conditions.

Duke University/Southeastern Diabetes Initiative

Duke University and its partners manage the Southeastern Diabetes Initiative (SEDI) program. As implemented in HCIA, the SEDI intervention uses a risk algorithm to identify individuals at high, medium, or low-risk for diabetes-related complications and offers care management and education calibrated to these three risk levels. We present findings based on a review of the awardee's quarterly reports as well as telephone interviews with the participants, two rounds of site visits, and analysis of participant data collected by SEDI. Between both rounds of site visits, we visited all four intervention sites.

Program Title	**Southeastern Diabetes Initiative (SEDI)**		
Intervention Summary	SEDI offers three main interventions: ■ *High-risk*: diabetes management for patients with diabetes at high risk for hospitalization or death; ■ *Moderate-risk*: diabetes self-management telephone program, community-based diabetes education, and other health resources for patients at moderate risk for hospitalization or death; ■ *Low-risk*: targeted neighborhood diabetes education and health resources available to all county residents.		
Targeted Disease/Condition	Diabetes		
Total Amount Awarded*	$9,773,499	**Award Amount Spent***	$6,713,226
Number of Sites	4	**Locations by State**	Durham County, NC Cabarrus County, NC Mingo County, WV Quitman County, MS
Cumulative Reach*	17,866[l] including 536 high-risk intervention participants enrolled by SEDI		
Intervention Workforce	Approximately 2 certified nursing assistants, 1 counselor,[33] 2 dieticians, 1 endocrinologist, 14 lay health workers, 3 licensed practical nurses, 3 nurse practitioners, 1 pharmacist, 1 physician assistant, 1 registered nurse, and 1 social worker (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015 and SEDI survey data on high-risk participants.

[l] Awardee counts "direct participants" broadly. SEDI includes an estimate of people reached through community outreach and education.

Overview of Key Findings

- Qualitative findings suggest the program improves patient knowledge, engagement, and self-management.
- Quantitative analysis of awardee-collected program data from "high-risk" participants shows important improvements in hemoglobin A1C (A1C) and in some survey-based health outcomes, including readiness to manage one's health generally and diabetes specifically and medication adherence.

[33] This staff member holds a Master of Science in counseling and health administration.

  - However, participants aged 65 years or older are less likely to see improvements in overall physical health, medication adherence, or attitudes toward diabetes self-care compared to younger participants, and Medicare participants are less likely to show improvements in depressed mood compared to those insured through other means.
- Some SEDI sites are making efforts to sustain elements of the high-risk program.
- Community organizations and health departments plan to incorporate SEDI's low-risk intervention as part of their regular programming because it is low-cost and the staff have developed the capacity for ongoing implementation of the program.

Implementation Experience

SEDI's implementation experience varies across the program's four sites. SEDI leadership gave each site significant leeway in their approach to training, role definition, and recruiting and hiring staff. While this approach allows sites to accommodate local needs and circumstances, the lack of some standardized elements (e.g., training protocols) also delayed training.

Sites rely on prior experience to tailor general elements of the SEDI model to their local area. Overall, each site's experience with similar programs, including existing partnerships (e.g., partnerships with local health care providers and community-based organizations), informs effective implementation.

Staff members express the need for more centralized direction and frequent cross-site communication on implementation. According to implementation leads, the program does not include enough centrally led discussion of experiences at different sites to identify lessons and solve problems. It appears that Duke's coordinating center's weekly office hours and site-specific calls were insufficient. Some stakeholders thought more cross-site discussion might have mitigated challenges associated with the lack of a standardized implementation approach by helping sites identify effective practices, particularly among sites with less experience.

Our findings suggest benefits of using a combination of home and clinic-based settings. Home visits represent an important element of the program across all SEDI sites, yet the qualifications of staff managing home visits varies by site. Sites using clinicians (e.g., nurse practitioner or higher) on home visits felt that this did not always represent efficient use of time. However, sites note that more frequent home visits conducted by staff with different (or no) clinical credentials can help build a relationship and assess a patient's environment. As one site manager commented

> *"We've learned tremendously about the home visits, but I think […] a great model would be to have, get the medical part back into the clinic most of the time but then have some resources like the social worker, the community health worker, the dietician that could do a home visit. I think some of the SEDI sites have that particular model, but our original model was to have the whole team doing home visits so we've been following that and learning lessons from it." – Site Manager*

Sites rely heavily on patient navigators and community health workers (CHWs) to implement the high-risk intervention. Managers refer to CHWs as the "glue" of the program. CHWs and patient navigators were crucial to establishing trust with participants receiving home visits. Sites found that hiring CHWs and patient navigators directly from the community they serve facilitates relationship

building. At one site, the CHWs helped coordinate the high-risk intervention after turnover among the clinical staff.

However, one site effectively employs licensed practical nurses (LPNs) and certified nursing assistants (CNAs) rather than CHWs to educate patients, taking advantage of their clinical training. In this case, the LPNs and CNAs understand their primary role is to listen, motivate, and assist with patient navigation, but find their training and experience in health care useful. For example, in one case, an LPN helped a participant realize that she was not taking the cap off her insulin needle. Even limited clinical credentials helps staff assess and reinforce proper use of medications. Sites using CHWs noted challenges when home visiting staff could not help participants understand how to use their medications.

Multi-disciplinary teams may have to contend with differing professional standards around patient privacy when working together. For example, one licensed clinical social worker (LCSW) felt conflicted about sharing sensitive patient information with other care team members. This is problematic for a program that depends on actively sharing information on behavioral and social barriers across a multi-disciplinary team.

High and medium risk intervention participants can benefit from referrals to some community (low-risk) interventions. One high-risk intervention staff member said,

> *"[The low-risk intervention] gives us more things to offer the patient that they consider tangible. So if we say it's important to exercise, and we have part of our team that does free classes for exercise in the churches. They can see that as a benefit so it works together that way. It just gives you more goodies to give the patient." — Nurse Practitioner*

Intervention-Specific Findings

High-Risk Intervention:

Some clinicians feel the risk algorithm relies too heavily on prior hospitalization and should incorporate A1C and socioeconomic factors. Clinicians engaged in SEDI suggest the risk algorithm should include specific clinical indicators of diabetes control including A1C as well as socioeconomic factors. SEDI did not add clinical indicators, but did incorporate some socioeconomic variables into the algorithm.

Federally qualified health centers (FQHCs) make good partners for the high-risk program, according to site leadership. SEDI reports having an easier experience collaborating with FQHCs relative to private providers. They observe that FQHCs bring deeper experience with community and public health initiatives than other providers. FQHC clinicians interact regularly with the program team and came to appreciate the additional care and follow-up. In contrast, SEDI had difficulty building trust and gaining participation from private practices and thus has had very little contact with private practice clinicians.

Medium-Risk Intervention:

Staff report that the medium-risk telephone intervention is too scripted and affords no flexibility to "meet patients where they are." Also according to staff, the scripted approach does not help address socioeconomic barriers some participants face. Finally, staff note practical barriers to the phone intervention for individuals whose phone plans give them limited minutes. One site manager feels the phone intervention may be useful only for populations that do not face many socioeconomic barriers.

Low-Risk Intervention:

The community intervention relies heavily on local, community-based partnerships to market their programs and facilitate recruitment and enrollment. For example, at one site, the Community Advisory Board (CAB) helps find venues for community programming and helps with advertising.[34] At another, the CAB helps avoid service duplication and identifies gaps in resources available to community residents with diabetes. At a third site, the CAB focuses on bringing health providers together.

- Mapping, meant to support the planning and implementation of the low-risk intervention, plays a very limited role at all sites except one. SEDI's geospatial mapping team works effectively with community stakeholders to target the low-risk community outreach intervention at only one site. That site had an existing relationship with the mapping team, and is located in the same county. Other sites received some maps early in the intervention, but their engagement with the mapping team was too limited to have the planned impact on resource allocation. In these cases, the mapping team's work merely confirmed what the stakeholders already knew rather than adding more insight. The mapping team acknowledged that it could have done more to build relationships with the other sites to ensure those sites took advantage of what the mapping team could offer them.

Participant Experience

Based on telephone interviews with 20 participants, we assessed participants' experiences with the high-risk intervention of the SEDI program.

[34] Group of county stakeholders that meets to develop strategies for addressing county-specific goals in diabetes prevention and management.

Improvements in Quality of Care

Seventeen of 20 participants talked about improvements that include one or more of the following:

- greater ease in making doctor's appointments
- increased responsiveness from primary care physicians (PCPs) (e.g., calls returned quickly)
- better information available during PCP visits
- connection to new resources
- knowledge that SEDI staff shares the participant's progress with other staff and their PCP

One participant compared the care team to *"a well-oiled machine."* When a participant could not read her glucometer, her home visiting staff successfully advocated through the program to get her a device that generates audio readouts. Another high-risk participant explained that before participating in the program, her doctor had never told her about medical assistance and she did not know to ask:

> *"I'd been going to my doctor, and she knew I didn't have the money to pay for it, but she never mentioned a program being at my doctor's office, but [the Diabetes Coalition] did. And when I asked my doctor about it of course I was able to get my [insulin] and get my medicine and everything. Now I don't have to pay for it. If they hadn't told me about it, I wouldn't have ever known. … And because of that, I am able to take my medicine every single day. I wasn't taking it every day because I didn't have it to take. I couldn't afford it*."

Improvements in Chronic Disease Self-Monitoring

Fifteen of the 20 interviewees said they felt better because of the changes to their health or felt their overall quality of life had improved. Participants reported that learning to make small changes to their diet, such as adding greens to their meals or forgoing sweet iced tea when possible, made a big impact on their health. The education and resources they received—such as disease management tools, nutrition counseling, and educational reading material—allowed them to feel more confident in their ability to care for themselves and to manage their condition. One high-risk patient said,

> *"It changed my confidence a lot because it helped me to be able to help myself when nobody's here or around me …, so it gave me good feedback on what to do."*

At one site, participants who did not have access to healthy food received diabetes-friendly food from a SEDI-initiated food pantry. One high-risk participant explained the difference this can make:

> *"They go over and beyond, and then after we have group meetings, they provide bags of food for us and that helps out for a lot of us because a lot of us are not as fortunate to sit down and eat what we're supposed to eat. You have to sit down and eat what your family eats, and it might not be the right thing, but that's the only meal that you get for that particular time."*

Improvements in Clinical Outcomes
Sixteen of the 20 participants said they have more control over their blood pressure and/or blood glucose levels. Participants also mentioned increased mobility or improved exercise habits, weight loss, and changes to eating habits. A high-risk participant who lowered her A1C after joining the program explained how the program helped to improve her mobility and diabetes control: *"I got to a point where my mobility was affected because of my weight. I wasn't able to bend down and pick something off the floor. I knew that I needed to do something, and that program has definitely helped me get to where I am right now because I'm losing weight, I'm exercising, my mobility's better, my diabetes is under control. It was everything I needed to reach my goals."*
Enhanced Access
Three-fifths of participants reported receiving home visits. Some participants reported that if it were not for the home visits, they would otherwise be unable to receive the same services: *"I don't have transportation … so them coming out to me has been very helpful and very successful in helping me to lower my A1C and keep my sugars pretty much under control."* Some participants at one site in particular viewed the program favorably. One said her home visiting staff *"discusses what I've been doing and how I'm feeling and … to think that she cares enough to come out and sit down and talk to me."* Another felt that her home visitor *"treats me as though I'm the only patient that she has."* These participants felt they also had good access via telephone: *"She tells me if you have a problem at night or the weekend, she'll say call me at home. And I have to say I have done that."*

Quantitative Analysis of Program Effectiveness

We use questionnaire data and clinical measures collected by the SEDI team to evaluate the high-risk intervention. Participants complete each questionnaire at intake and at four follow-up time points (6, 12, 18, and 24 months). Clinical measures are abstracted from laboratory records and linked to the closest program visit (intake, 6-, 12-, 18-, or 24-month follow-up). In this report, we examine changes in outcome variables from the awardee data (see Exhibit 4.1).[35]

[35] In instances where there were more than two completed surveys, we calculated change between the first and last only.

Exhibit 4.1: SEDI Overview of Data and Measures

Outcome Measures	Description of Scale	Link to CMMI Core Measures
Patient-Reported Outcomes Measurement Information System (PROMIS) [36] Global Mental Health (GMH)	Global health rating scale that produces summary scores for mental and physical health (higher scores indicate higher self-rated health)	Hospital admission, hospital readmission, ED use, and total cost of care
PROMIS Global Physical Health (GPH)		
Patient Activation Measure (PAM)[37]	Evaluates the knowledge, skills, and confidence essential to managing one's own health and health care (higher scores indicate higher activation)	ED use; hospital readmission
Patient Health Questionnaire (PHQ-2)[38]	Screening for clinical depression (higher scores indicate worse depressive mood)	Total cost of care
Morisky Medication Adherence Scale[39]	Addresses barriers to medication-taking and permits health care providers to reinforce positive adherence behaviors (higher scores indicate worse adherence)	ED use
Diabetes Care Profile (DCP); Self-care ability subscale[40]	Patient ratings of their ability to successfully manage their diabetes (higher scores indicate higher-rated diabetes self-care ability)	ED visits
Improvement in Hemoglobin A1C	Defined as >1% decrease in hemoglobin A1C among those with hemoglobin A1C of 8% or greater at intake visit	Hospital admission, hospital readmission, ED use, and total cost of care

The SEDI team provided data files for each questionnaire and the clinical data; once combined, the datasets contained data for 536 unique individuals.41 Exhibit 4.2 presents demographic and other characteristics of the program participants.

- Overall, high-intensity intervention participants split fairly evenly between males and females and white and black patients. Thirty percent of patients were over 65, but though just over half of patients had Medicare insurance (either alone or with Medicaid), suggesting the likelihood of high rates of disability among participants.
- Enrollment at the Quitman County site is lower than at the other three sites, which each represent about 30 percent of the program. Because of low enrollment at Quitman, we may not be able to include Quitman in comparisons between the three large sites.

[36] For details on PROMIS, see http://www.nihpromis.org/default.
[37] For details on PAM, see http://www.insigniahealth.com/products/pam-survey.
[38] For details on PHQ-2, see http://www.commonwealthfund.org/usr_doc/PHQ2.pdf.
[39] For details on MORISKY, see http://c.ymcdn.com/sites/www.aparx.org/resource/resmgr/Handouts/Morisky_Medication_Adherence.pdf.
[40] For details on DCP, see http://www.med.umich.edu/borc/profs/documents/svi/dcp.pdf.
[41] The final participant count for our analysis is smaller than this number because we excluded patients who withdrew from the intervention (n=44) and one patient with no reported demographic information. Not all participants completed all questionnaires, thus the sample size for analysis of each measure is slightly different.

Exhibit 4.2: SEDI Descriptive Characteristics of High-Risk Intervention Participants

	Number of Participants	% in Category
Total Participants	491	100%
Sex		
Female	265	53.9%
Male	226	46.0%
Age		
Under 65 years old	343	69.9%
Over 65 years old	148	30.1%
Race/Ethnicity		
White	232	47.3%
Black or African American	229	46.6%
Hispanic or Latino	21	4.3%
Other/Unknown	9	1.8%
Insurance Status		
Medicare Only	155	31.6%
Medicaid Only	96	19.6%
Dual Medicare/Medicaid	95	19.4%
Neither Medicare/Medicaid	41	8.4%
Unknown	104	21.2%
Site		
Cabarrus	136	27.7%
Durham	181	36.9%
Mingo	143	29.1%
Quitman	31	6.3%

In Exhibit 4.3 we show the percentage of program participants that showed improvement in key outcomes between baseline and follow-up measurement as well as the average (mean) improvement across all patients with intake and follow-up data for each measure.

- For each of the self-reported questionnaire outcomes, 30 to 40 percent of participants report improvements when comparing intake and follow-up measurements.
- For the PAM and Morisky scale, improvements in the SEDI program are more modest than those reported in published data. Despite starting with similar PAM scores (SEDI: 57.3 vs. comparison: 56.2), SEDI participants only improved 1.56 points while another diabetes self-management program reported 8-point improvement over a one-year period. 42 For comparison on the Morisky scale, patients enrolled in a text messaging-based diabetes self-management intervention improved 0.9 points while the SEDI participants improved 0.44 points. The higher baseline score of SEDI participants in comparison to published literature (6.1 vs. 4.5 points) may explain some of the difference in Morisky improvement.[43]

[42] Otero-Sabogal R, Arretz D, Siebold S, et al. Physician-community health worker partnering to support diabetes self-management in primary care. *Quality in Primary Care.* 2010; 18:363-72.
[43] Arora S, Peters AL, Burner E, et al. Trial to examine text message-based mHealth in emergency department patients with diabetes (Text-MED): a randomized controlled trial. *Ann Emerg Med.* 2014; 63(6):745-54

- On A1C measures, nearly two-thirds of SEDI participants with high intake levels (> 8%) showed improvement, and average improvement was 1.2%, much greater than observed in another intervention study. [44]

Exhibit 4.3: SEDI Improvement in Program Outcomes for Participants

Program Outcome	Sample Size	% of Participants Reporting Any Improvement	Average Improvement	Scale of Measure
PROMIS Mental Health	404	32.9%	0.50	4–20
PROMIS Physical Health	404	38.9%	0.39	4–20
PHQ2	399	41.1%	-0.41	0–6
PAM (Patient Activation Measure)	405	32.7%	1.56	0–100
Morisky Medication Adherence	399	38.8%	0.44	0–8
DCP (Diabetes Care Profile)	399	43.9%	0.30	1–5
Hemoglobin A1C (negative value represents improvement)	228	—	-1.2	—
% with improvement in Hemoglobin A1C	228	65.8%	—	—

To understand what subgroups of participants are more or less likely to benefit from participation, we built multivariate regression models. We model the odds of improvement from baseline to follow-up for each outcome using multivariate logistic regression.[45] In Exhibit 4.4 we show factors associated with improvements in program outcomes.

The table displays odds ratios for the listed group relative to the reference group, controlling for all other covariates listed. Odds ratios greater than 1 are **bolded** and reflect higher likelihood of improvement relative to the reference group. Odds ratios less than 1 indicate lower likelihood of improvements compared to the reference group. From these analyses (Exhibit 4.4), we observe:

- Outcomes for the Quitman site were less likely to improve (six of seven outcomes) and participants at the Mingo site were more likely to improve (four of seven outcomes) than Durham participants (the largest site).[46] Qualitative interviews suggested that patients at the Quitman site might have had fewer community and social support resources available to them than in other sites.
- Participants over 65 were less likely to see improvements in overall physical health, medication adherence, or attitudes toward diabetes self-care. Participants with Medicare (the reference group) appeared to be less likely to show improvements in depressed mood than those not enrolled in Medicare (e.g., other types of insurance, uninsured).

[44] Otero-Sabogal R, Arretz D, Siebold S, et al. Physician-community health worker partnering to support diabetes self-management in primary care. *Quality in Primary Care.* 2010; 18:363-72.
[45] Each outcome was modeled as a function of all of the independent variables shown in table rows and standard errors adjusted for the clustering of patients by state.
[46] Estimates for the Quitman site should be interpreted with caution due to the small number of patients included (n=31; 6.3% of participants) in analysis.

Exhibit 4.4: SEDI Factors Associated with Improved Outcomes for the High-Risk Intervention

Program Outcomes	PROMIS MH Overall Mental Health	PROMIS PH Overall Physical Health	PHQ2 Depressed Mood	PAM Patient Activation	Morisky Medication Adherence	DCP Attitudes Toward Diab Self-Care	HbA1C[47] >1%pt decrease in pts starting>8.0%
Sex (ref=female)							
Male	1.31 (1.08, 1.60)	1.22 (0.84, 1.77)	0.70 (0.47, 1.04)	1.00 (0.60, 1.69)	0.62 (0.39, 0.99)	0.67 (0.50, 0.90)	0.97 (0.76, 1.23)
Age (ref=adult 26-64)							
Over 65	1.24 (0.73, 2.10)	0.58 (0.43, 0.77)	0.82 (0.40, 1.68)	1.03 (0.88, 1.20)	0.53 (0.32, 0.89)	0.60 (0.41, 0.87)	1.18 (0.31, 4.48)
Race (ref=White)							
Black	0.88 (0.68, 1.15)	1.16 (0.68, 2.00)	1.07 (0.35, 3.35)	1.08 (0.97, 1.21)	0.79 (0.49, 1.25)	0.86 (0.47, 1.58)	0.99 (0.67, 1.46)
Hispanic/Latino	0.55 (0.24, 1.27)	1.32 (0.96, 1.82)	1.90 (0.65, 5.61)	0.87 (0.27, 2.78)	0.77 (0.64, 0.92)	0.82 (0.31, 2.19)	(Excluded)
Other/Unknown	0.81 (0.43, 1.54)	**3.89 (1.71, 8.84)**	1.35 (0.44, 4.16)	0.86 (0.36, 2.06)	0.95 (0.34, 2.71)	0.47 (0.09, 2.45)	(Excluded)
Payer (ref=Medicare)							
Dual Medicare/Medicaid	0.88 (0.69, 1.12)	1.09 (0.78, 1.52)	**2.64 (1.10, 6.36)**	1.22 (0.89, 1.69)	0.96 (0.36, 2.56)	1.07 (0.60, 1.90)	0.78 (0.49, 1.26)
Medicaid Only	**1.09 (1.02, 1.18)**	0.62 (0.39, 1.01)	**3.36 (1.29, 8.75)**	1.08 (0.66, 1.77)	1.09 (0.30, 3.95)	0.72 (0.29, 1.76)	0.72 (0.22, 2.29)
Neither Medicare/Medicaid	0.65 (0.34, 1.23)	0.42 (0.22, 0.79)	**4.34 (1.46, 12.97)**	0.81 (0.52, 1.24)	1.33 (0.41, 4.31)	1.05 (0.90, 1.22)	0.91 (0.27, 3.00)
Unknown	0.70 (0.33, 1.49)	0.66 (0.59, 0.74)	1.72 (0.56, 5.23)	1.25 (0.73, 2.14)	1.28 (0.49, 3.31)	0.65 (0.30, 1.42)	1.12 (0.37, 3.36)
Site (ref=Durham)							
Cabarrus	1.59 (1.43, 1.78)	2.02 (1.54, 2.66)	0.61 (0.41, 0.90)	1.15 (1.06, 1.25)	0.66 (0.54, 0.80)	0.46 (0.40, 0.52)	0.77 (0.55, 1.06)
Mingo	1.08 (0.79, 1.46)	**2.23 (1.38, 3.58)**	1.85 (0.79, 4.36)	**2.04 (1.46, 2.84)**	0.87 (0.60, 1.27)	**1.88 (1.40, 2.52)**	**1.65 (1.12, 2.43)**
Quitman	0.52 (0.41, 0.66)	0.49 (0.41, 0.59)	0.42 (0.30, 0.58)	0.42 (0.26, 0.66)	1.08 (0.75, 1.56)	0.63 (0.50, 0.78)	0.09 (0.07, 0.11)
Number of Visits (ref=2)							
3	0.87 (0.74, 1.02)	0.81 (0.62, 1.04)	0.82 (0.79, 0.85)	0.80 (0.55, 1.15)	1.60 (0.60, 4.27)	**1.55 (1.21, 1.98)**	0.66 (0.44, 0.98)
4	0.79 (0.53, 1.18)	**1.58 (1.43, 1.75)**	**2.28 (1.32, 3.92)**	1.15 (0.80, 1.65)	2.06 (0.77, 5.54)	1.81 (0.75, 4.41)	0.72 (0.17, 3.10)
5	0.89 (0.70, 1.12)	**4.08 (2.42, 6.90)**	0.98 (0.89, 1.09)	1.29 (0.60, 2.77)	1.38 (0.51, 3.72)	1.59 (0.82, 3.07)	(grouped w/4)

[47] We exclude Hispanic/Latino and Other/Unknown race and ethnicity patients because of the smaller sample size of these groups. For the same reason, patients with five follow-up visits were grouped with patients with four follow-up visits.

Sustainability

We found substantial interest across sites in sustaining many elements of the program, but not the medium-risk (telephone) intervention.

The ability to sustain the high-risk intervention varies by site, though leaders value its benefits relative to the other two interventions. Home visits can help reach participants with limited mobility and access to transportation, and can address contextual barriers to diabetes self-management. The two largest sites report they can continue elements of the high-risk intervention reimbursable through third parties, including nutrition counseling. Further, opportunities to sustain home visits depend upon broader changes in payment models whereby CHWs can offer reimbursable services. One site will seek additional grants and hopes to extend the high-risk intervention to other conditions (e.g., COPD, heart disease).

Despite having limited information on their effectiveness, health departments and local organizations will likely continue some components of the low-risk intervention. These interventions are relatively easy to implement and low-cost, and sites have found willing partners in the community. Some participating health departments and community organizations plan to offer programs (e.g., fitness and diabetes self-management programs) as part of their regular programming.

Conclusion

Among participants in the high-intensity intervention, we find large improvements in A1C using the data provided by the awardee. Qualitative analysis found examples suggesting that SEDI improves patient knowledge, engagement, and self-management. We also find evidence of some improvement in a range of survey-based health outcomes for high-intensity intervention participants.

However, participants aged 65 years or older are less likely to see improvements in overall physical health, medication adherence, or attitudes toward diabetes self-care compared to younger participants, and Medicare participants are less likely to show improvements in depressed mood than those with other types of insurance or no insurance. As the Innovation Awards end, some SEDI sites are making efforts to sustain some elements of the high-risk program. Community organizations and health departments plan to incorporate SEDI's low-risk intervention as part of their regular programming.

FirstVitals Health and Wellness, Inc.

FirstVitals Health and Wellness, Inc. (FirstVitals) is a for-profit health and wellness company that provides clients (employers or individuals) with Web-based tools for health management. FirstVitals partners with two Medicaid managed care insurers, AlohaCare and Ohana Health Plan, to offer their beneficiaries at 19 participating health centers a technologically enhanced diabetes management program.

We present findings based on a review of the awardee's quarterly reports, interviews with program staff and patients, and analysis of AlohaCare Medicaid claims data. We conducted an in-person site visit in June 2014, during which we visited three health centers, spoke with FirstVitals and AlohaCare staff, conducted telephone discussions with staff at four other health centers, and conducted a focus group with program participants. During the second round of data collection, we conducted telephone interviews with FirstVitals staff (in HI and CA) and AlohaCare staff (in HI) and program participants.

Program Title	**FirstVitals**		
Intervention Summary	Using diabetic peripheral neuropathy (DPN) and retinopathy screening and blood glucose telemonitoring, care coordinators provide diabetes management for participants with diabetic peripheral neuropathy and patients with diabetes who show signs of other microvascular disease. FirstVitals recruits through health centers and provides participants electronic tablets that help them track health indicators and transmit data to care coordinators. The tablets also allow for videoconferencing and messaging with program staff.		
Targeted Disease/Condition	Type 2 diabetes		
Total Amount Awarded*	$3,999,713	**Award Amount Spent***	$3,103,070
Number of Sites	19	**Locations by State**	HI
Cumulative Reach*	398		
Intervention Workforce	Approximately 20 lay health workers, 1 social worker, and 16 registered nurses (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings suggest the intervention improves participants' engagement in routine diabetes screenings and health maintenance, and may lead to improvements in hemoglobin A1C (A1C) and weight loss.
- Quantitative analyses show non-significant, modest increases in health care utilization and costs after program enrollment, and a statistically significant increase in 30-day readmissions; however, the readmissions result is based on a small subset of program participants who were hospitalized (an average of 8.7 participants per quarter).

Implementation Experience

Throughout implementation, FirstVitals adapted the program in response to participant needs, health center resources, and staff and external changes.

FirstVitals' role as a third-party convener was both a challenge and a facilitator to program implementation. FirstVitals worked closely with FQHCs and other providers across Hawaii to implement the diabetes management program they developed. Although aided by the support of key payers, building relationships with each health center took time and effort. However, as a third party, FirstVitals leadership could readily distill lessons learned across settings and identify opportunities for program-wide improvement.

Health centers varied in their capacity to support care management. The level of involvement of FirstVitals staff varied depending on the availability of care coordination resources among participating health centers. FirstVitals provides integrated care coordinators (ICCs) that support use of the technology and establish automated reminders for health center-based care coordinators. At sites with in-house care coordinators, ICCs played a supportive role, visiting and contacting patients as needed. Where there was no in-house care coordinator, a FirstVitals ICC was stationed at the site at set days/times and directly implemented the program on their own.

Encouraging participant engagement in diabetes self-management requires balancing technology with relationship building. Both FirstVitals' care coordinators and those employed by health centers required training in how to engage with participants. FirstVitals found that the level of trust and quality of interaction between participants and coordinators drove effective use of the technology to transmit and track health indicators. Although they stress the high-tech nature of their program, FirstVitals learned that participants' relationships with care coordinators ultimately led to behavior change.

Disparities in technological literacy created communication challenges. Care coordinators found it important to "meet participants where they are" in terms of their use of the technology. Many older participants were wary of new technology and initially showed reluctance to using the Bluetooth-enabled glucometers and tablets.

Participants' use of tablets had benefits beyond those FirstVitals anticipated at the outset of the program. As planned, participants use their tablets to transmit their blood glucose and blood pressure readings. Participants also use tablets for other purposes related to diabetes (e.g., finding educational materials). In addition, many participants used their tablets for basic Internet access, facilitating job searches or other activities. While not an anticipated goal of providing the tablets, FirstVitals found this to be an important benefit for participants who otherwise may not have Internet access.

Participants used video conferencing function less than expected. FirstVitals expected that interactions between care coordinators and participants would benefit from the tablets' video capabilities. While care coordinators did connect with patients over the phone or in person as needed, they often were unable to find private spaces to be able to use the video conference functions with the patients. This highlights the importance of considering practical issues associated with workflow, physical setting and ergonomics into projects using video-conferencing or similar technologies.

Participant Experience

We offer the following findings based on focus groups and telephone conversations with 16 participants.

Improved Clinical Outcomes
Four participants report weight loss and lowering their A1Cs since joining the program. Many hope to manage their diabetes through lifestyle choices without the use of insulin.
Improvements in Disease Self-Monitoring
Many of the participants interviewed expressed that the program has helped their self efficacy: *"[I have] more confidence in knowing I can take control and have a little knowledge … as opposed to just going by anything someone tells me. It gives me a sense of empowerment, like, I know what I'm doing. I know where I want to go with this thing."* Participants also appreciate the remote monitoring of their diabetes and feel that the monitoring enhances their sense of accountability: *"The big thing is it gave me that sense of responsibility.… I think with the tablet, it's more like if I don't do this, they'll call me and ask if everything is okay. I hate getting the calls, you know? I feel like even if I don't want to, I do it before they call me. That's why I said it gives me a sense of responsibility. They gave me this machine."* Many participants have changed their behaviors related to their diabetes management because of their participation in the program. Over half of the participants interviewed discussed changing their diet throughout their participation, and six participants reported increasing their amount of exercise. FirstVitals' analysis of claims data indicates that participants are more likely to fill prescriptions, get test strips, and visit primary care doctors regularly than unenrolled patients with the same insurance.
Improvements in Quality of Care
FirstVitals works to improve quality of care by helping providers interpret trends in participants' daily glucose readings properly and by identifying problem cases. FirstVitals staff take time to look at participant self-monitoring data to reveal important information about successes or challenges in participant self-management; this is an important role for FirstVitals staff that helps to improve quality of care since staff within health centers and private practices may not have the time or resources to closely monitor data that could reveal potentially troubling information about participants' health status and disease management.

Quantitative Analysis of Program Effectiveness

To evaluate the impact of the FirstVitals program we use AlohaCare claims provided by the awardee.[48] From these data, we identify FirstVitals program participants and potential comparison patients to construct CMMI priority utilization (all-cause hospitalization, 30-day readmission, and ED visit rate) and cost (total cost of care) measures.[49]

A total of 392 patients enrolled in the FirstVitals intervention; however, we found no claims for 42 percent of these patients.[50] The majority of patients without claims in the AlohaCare file were also disenrolled from the intervention (81%, 132 of 162). From our qualitative findings, we know a large number of patients were disenrolled from the intervention after an unexpected change in AlohaCare's eligibility rules made them no longer eligible for coverage. After removing these participants from our sample, we have 229 program participants for analysis.

For identifying a comparison pool, we use the same claims file that includes all persons with diabetes enrolled in AlohaCare. There were 4,115 potential comparison patients, 46 percent of which did not have any claims[51] —leaving 2,213 patients in the comparison pool. In Exhibit 5.1, we present descriptive characteristics for FirstVitals participants and the comparison pool.

- While there were no differences in gender distribution between the two groups, FirstVital's program participants were more likely to be aged 35–65 years old than the comparison pool, where younger and older patients were more common. The claims dataset used for this analysis did not include any other sociodemographic factors.
- Participants in the FirstVitals program had higher risk scores (as measured by CDPS scores) at baseline and were more likely to be hospitalized, suggesting these patients may have been "sicker" than the comparison pool or in more need of support to manage their diabetes.[52]

[48] Enrollment in AlohaCare, a local health plan in Hawaii, is a requirement to participate in the FirstVitals program.
[49] Because reason for hospitalization information was incomplete in the claims records, ambulatory care sensitive (ACS) hospitalizations are not included.
[50] Because there were no claims for these patients, we assumed they had no health care encounters that were billed to AlohaCare. This could be because patients did not see a health care provider, had another source of health insurance, or were not enrolled in AlohaCare.
[51] Because there were no claims for these patients, we assumed they had no health care encounters that were billed to AlohaCare. This could be because patients did not see a health care provider, had another source of health insurance, or were not enrolled in AlohaCare.
[52] Chronic Illness and Disability Payment System (CDPS) scores use diagnosis information to assess risk for Medicaid patients. This risk algorithm is commonly used by Medicaid programs to set capitated payment amounts for beneficiaries. More information about CDPS can be found at: http://cdps.ucsd.edu/

Exhibit 5.1: FirstVitals Descriptive Characteristics for Participants and Comparison Pool

Variable	Treatment N=229	Comparison N=2,213
Female	55.5% (127)	51.7% (1,145)
Age**		
<35 years old	10.9% (25)	17.9% (396)
35–44 years old	23.1% (53)	20.2% (448)
45–54 years old	34.9% (80)	31.1% (688)
55–64 years old	27.5% (63)	24.1% (534)
65 years and older	3.5% (8)	6.6% (147)
CDPS Score***		
Mean CDPS Score (SD)	3.2 (1.8)	2.3 (1.5)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Hospitalizations per 1,000 (SD)**	283.8 (683.6)	183.4 (563.2)
ED Visits per 1,000 (SD)	943.2 (1,823.7)	752.8 (1,879.4)

Exhibit 5.2 compares cost and utilization patterns for FirstVitals participants pre- and post-enrollment in the program. We average across all pre-intervention and post-intervention quarters and use a Student's t-test to determine if differences are statistically significant.[53]

- Average cost, hospitalizations, and ED visits per quarter are all higher after enrollment; however, the difference is only statistically significant for readmissions within 30 days of a hospitalization. We encourage using caution when interpreting the readmission data because results are based on the very few participants who experience an index-hospitalization (average of 8.7 participants per quarter).
- For all measures, the standard deviation is much higher than the mean, suggesting that there is a lot of variability in the data. As an example, the standard deviation for ED visits is ten times the mean. This may be driven by the very low number of participants who experience events in any given quarter. On average, across all measures, less than four percent (9 people) of participants are hospitalized or visit an ED.

[53] We do not use regression models because of the small numbers of participants experiencing each of the outcomes. On average, less than four percent of participants experienced the utilization outcomes in any quarter.

Exhibit 5.2: FirstVitals Pre/Post Differences in Utilization and Costs for Participants

Outcome Measure	Pre-Period Mean (SD)	Post-Period Mean (SD)	t statistic	p-value
Hospitalizations (per 1,000 patients)	59.0 (255.6)	61.6 (315.7)	-0.245	0.806
Ed Visits (per 1,000 patients)	10.4 (106.6)	13.9 (117.2)	-0.8179	0.414
Readmission (per 1,000 patients)	70.7 (294.6)	265.3 (784.6)	-2.182	0.031
Cost (per patient)	$1,943 ($8,273)	$2,320 ($7,061)	-1.201	0.230

Statistical significance was assessed using Pearson's Chi-square for categorical variables, t-test for continuous variables

*** p<0.01, ** p<0.05, * p<0.1

The low rates of utilization among program participants and high rates of missing claims data overall limit our ability to quantitatively evaluate the FirstVitals program. This preliminary analysis of FirstVitals participants pre- and post-enrollment suggests modest, non-significant increases in health care utilization and costs after program enrollment. The exception being 30-day readmission, where we observe a statistically significant increase; however, this result is based on a small subset of program participants who were hospitalized.

We continue to evaluate the data-quality issues reported here (missing claims and demographics). As these issues are resolved, we plan to add a comparison group to our analysis as well as additional measures that may better reflect the utilization patterns of FirstVitals participants.

Sustainability

Because of interest from third parties, FirstVitals plans to continue some elements of the program.

AlohaCare and Ohana Health Plan are committed to continuing the program beyond the funding period. FirstVitals intends for the current participants to keep their equipment, including the tablets, but without a dedicated data plan. To allow participants to continue to transmit data using tablets, the program has been educating participants about the capabilities of Wi-Fi and how to use hotspots to continue to upload data into the FirstVitals system.

FirstVitals is also exploring other mechanisms for achieving sustainability:

- **Expanding retinal screenings and quality improvement for partner organizations.** AlohaCare plans to use the retinal screening data to show quality improvements among providers when reporting Healthcare Effectiveness Data and Information Set (HEDIS) measures. This may help AlohaCare to improve its scores and receive greater reimbursement.
- **Becoming a designated durable medical equipment (DME) supplier.** HCIA allowed FirstVitals to institutionalize their relationship with AlohaCare, becoming one of the DME suppliers. AlohaCare will pay FirstVitals to offer glucometers and test strips to all members beyond the award period.
- **Using new Medicare funding for non-face-to-face chronic care management.** FirstVitals is promoting a business plan for the expansion of the program without HCIA funding that will rely on a

new CPT code for non-face-to-face chronic care management services (CPT: 99490). Beginning January 1, 2015, this code allows providers of this service to bill for 20 minutes of non-face-to-face chronic care management per patient per month.

Conclusion

The FirstVitals intervention, in partnership with AlohaCare and Ohana Health Plan, uses telemonitoring to help individuals with diabetes who display signs and/or risks of peripheral neuropathy by providing them with a wireless glucometer and training them to take their blood sugar levels as prescribed by their physician. Through site visit discussions, we find evidence suggesting that the program is improving screenings, health maintenance, and outcomes among those enrolled. In our preliminary analysis, we also find evidence suggesting modest, non-significant increases in health care utilization and costs after program enrollment. The exception being 30-day readmission where we observe a statistically significant increase; however, this result is based on a small subset of program participants who were hospitalized. As the Innovation Awards end, FirstVitals and their partners are committed to continue the program.

The George Washington University

The George Washington University (GWU) peritoneal dialysis (PD) telemonitoring program incorporates remote transmission of data into the self-monitoring regimen of end-stage renal disease (ESRD) patients required to take daily blood pressure and weight readings. We present findings based on a review of the awardee's quarterly reports to CMMI as well as telephone interviews with the awardee, two rounds of site visits, and analysis of Medicare claims data. Over two rounds of data collection, we visited three sites in the Baltimore and Washington, DC area. We conducted telephone interviews with staff in three other locations in the Maryland, Virginia, and Washington, DC area.

Program Title	**Telemedicine Study**		
Intervention Summary	GWU's telemedicine study provides remote telemonitoring for patients on peritoneal dialysis. The intervention trains nurses working for DaVita clinics across Washington DC, Maryland, and Virginia to use telemedicine to offer continuous health monitoring.		
Targeted Disease/Condition	Peritoneal dialysis		
Total Amount Awarded*	$1,938,945	**Award Amount Spent***	$697,358
Number of Sites	10	**Locations by State**	DC, MD, VA
Cumulative Reach*	300		
Intervention Workforce	Approximately 2 study administrators and 19 DaVita nurses (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings do not suggest that the GWU intervention has altered the approach to care for PD patients at the DaVita clinics as anticipated.
- Quantitative results show that the total cost of care after enrollment in the GWU program increased for program participants compared to cost prior to enrollment. However, for patients with long-term chronic conditions requiring regular monitoring, it may not be reasonable to expect costs to decline or even remain flat over time.

Implementation Experience

We identified a number of important lessons from GWU's work.

GWU staff and DaVita nurses both play a crucial role in the program. GWU staff enroll eligible DaVita patients into the program, train nurses to use the remote monitoring database, assist participants with downloading the video conferencing software onto their personal devices, and address any technological issues that arise with the telemedicine equipment. Though offering their services in-kind, DaVita nurses are expected to monitor participants' vital signs in the remote monitoring database and reach out to participants to discuss abnormal readings.

Some participants use equipment provided by GWU inconsistently. GWU successfully equipped participants with a scale, a blood pressure cuff, and a small Bluetooth-enabled portable device called a HealthPAL. The HealthPAL transmits information from the scale and the blood pressure cuff to a

database in real-time, allowing DaVita nurses to see daily readings. We find that participants sometimes use their own personal equipment to measure weight and blood pressure instead of the study technology. The database displays missed readings when participants use their own equipment.

Although nurses appreciated and understood the value of the study, they did not monitor participants' readings on a daily or weekly basis. Instead of reviewing remote monitoring data for all participants regularly, at least two nurses chose to track data for specific priority participants (e.g., a participant who started a new blood pressure medication). One nurse explained:

> *"I had on my schedule for every Friday at a certain time to go on and review my GW patients' information. And I probably did it for maybe two months.… I removed it last month because I never got a chance. The only patients that I monitor are the ones … where the doctor's making changes, or there's been issues with the [patients'] fluid [retention or loss]. I do the patients that are still on the study. But when I do use [the database], it's pretty slow. It's a challenge for us to get it in our schedule."*

Nurses also report it is challenging and time-consuming to log into the remote monitoring database, separate from their own EHR system, to review telemonitoring results. These issues increased when a new company took over the database software and implemented changes to the interface. Nurses at one site said they would prefer a system that incorporates data into the EHR. Following the change in interface, one nurse noted:

> *"I don't look at it as much as I used to.… The first one was just, one, easier to log into it. And then once you opened it up, you could see a trend with your patients much quicker. With the new one, the more current one, it only shows the last recorded [reading]. So if they did their weight first, then their blood pressure, it only shows the blood pressure. You have to click on the patient; it has to open up then you have to wait for it to digest. I mean, it just takes so long to find the information that you need. Like I said, it was way too laborious."*

Nurses did not use the secure video chat consultations. GWU provided nurses with a secure video chat software to enable teleconsultation. However, the nurses interviewed note that participants prefer calling or dropping into the clinic with immediate concerns. Two nurses report that privacy concerns may drive some participants' discomfort with video chats. One nurse stated:

> *"I know they have the video; we never took part in that. We had one computer that had the camera on it. And we're supposed to use that as we need. It was available, but it was never implemented. I don't know if that would have benefitted us in any way. It would have probably benefitted the patient if they didn't have to come to the clinic, and we could actually do a video and monitor and not for them to have to drive here, that would have helped, but we never used that option." – DaVita Dialysis Nurse*

Interviews with participants (n=15) show they appreciate GWU's video educational modules. Participants receive a link to an educational video each month via email. The series of 12 educational modules covered topics important to PD patients such as blood pressure, exercise, exit site care, and peritonitis, among others. Participants stated that the videos served to reinforce prior knowledge. One participant said, *"Well, I somewhat knew them, but it's good to be reminded again."*

While their partnership with DaVita provides GWU access to essential workforce (dialysis nurses), GWU does not have the authority to actively manage this staff. GWU expected DaVita nurses to incorporate a daily or weekly review of the remote monitoring database into their workflow. However, they could not enforce this expectation or motivate nurses to participate, particularly since their time on the study was not paid for by the grant. While GWU leadership secured buy-in from DaVita practice directors, they could not force nurses to incorporate program tasks into their workflows.

Participant Experience

Through telephone interviews with 15 patients, we offer the following findings.

Improvements in Quality of Life
The telemedicine intervention facilitates communication between patients and health care professionals. However, participants did not report significant changes in quality of life. In general, participants felt their health had not changed throughout the study and could not link any improvements to the telemonitoring intervention.
Improvements in Disease Management
All 15 patients reported using their blood pressure cuff and scale regularly. At least ten patients, however, regularly monitored their blood pressure and weight before enrolling in the telemedicine study. Five participants noted that they checked their blood pressure and weight more regularly since joining the telemonitoring program. One participant said, *"I think it's an encouraging tool. It keeps you focused on what you're supposed to be doing."* Other participants did not find the telemedicine intervention helpful. One interviewee stated, *"Well, it doesn't make any difference because I had a machine before also."*
Improvements in Clinical Outcomes/Changes in Health Care Utilization
Participants did not generally report significant changes in their "numbers." Two participants stated that they had had fewer hospitalizations since joining the program; one clearly attributed the effect to the program—the other did not. Two participants said the program enabled them to correct their blood pressure or lower their weight.
Enhanced Access
Most participants did not feel the intervention had changed their interactions with DaVita clinical staff.[54] While discussions with nurses reveal they faced challenges monitoring the readings, some focus group participants suggest that they received calls from nurses responding to unusual blood pressure or weight readings. One participant felt their care had *"improved a bit because they've actually called me when they've observed my blood pressure reaching high levels."* Conversely, one participant explicitly stated she had not received phone calls about her weight. Four participants indicated that the intervention helped them check in with their doctors.

[54] Several participants did report receiving calls from staff but it was unclear whether those participants were representative and the nature of the call (e.g., appointment reminders, program enrollment, or monitoring).

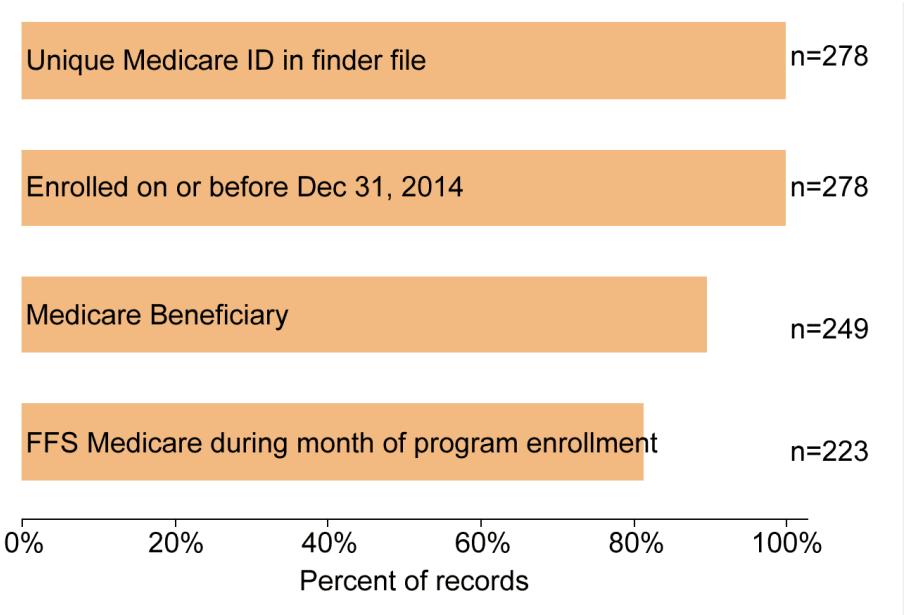
Quantitative Analysis of Program Effectiveness

Our analysis of program effectiveness for GWU compares changes in utilization and cost for Medicare fee-for-service (FFS) participants in the periods pre- and post-enrollment in the intervention.

- We present findings for three CMMI core measures: all-cause hospitalizations, emergency department (ED) visits, and total cost of care.[55]
- We include claims for FFS beneficiaries enrolled in GWU's program for one or more quarters, from January 1, 2013 through December 31, 2014. GWU provided a finder file that lists their program participants and enrollment dates; we used the finder file to identify claims for these beneficiaries (see Exhibit 6.1).

Limitations. The lack of a comparison group for GWU limits our analysis to a pre/post comparison. In this design, we are unable to separate secular trends from impact of the GWU program. Further, the small number of patients served by the program limits our power to detect changes in utilization and cost associated with participation in the GWU program. Finally, from our qualitative research, we know adherence to remote monitoring and thus dosage of the intervention varies; however, without access to GWU's research database we are unable to quantify these differences. Therefore, the reader should interpret these results with caution.

Exhibit 6.1: GWU Patients Identified through Finder File



[55] We intended to conduct a time-series regression on the 30-day readmissions measure and hospitalizations for ambulatory care sensitive conditions (ACS) measure, as we did for the other outcome measures. However, we observed too few "events" to conduct a regression analysis. In the case of readmissions, participants without an index admission in the quarter are by definition unable to have a readmission; our sample size for this regression was 403 patient quarters for an average of 25 patients in each quarter. For ACS hospitalization, the overall number of events observed was low, no more than eight in any quarter and an average of 2.9 per quarter.

For each of the three CMMI core measures, we pose the following research questions:

- What is the average experience for GWU's patients in each quarter prior to and after their enrollment in the program?
- Did core measures improve after patients enrolled in the GWU intervention?

Exhibit 6.2 presents demographic and other basic information about patients included in our analysis of core outcome measures.

Exhibit 6.2: GWU Descriptive Characteristics of Population

Variable	% (N)
Number of Persons	226
Mean Number of Quarters of Enrollment [Range]	4.5 [1–8]
Age Group	
<65 years old	74.8% (169)
65-69 years old	6.6% (15)
70-74 years old	9.3% (21)
≥75 years old	9.2% (21)
Gender	
Female	42.0% (95)
Race/Ethnicity	
Black	61.9% (140)
Dual Eligibility	
Dual Enrolled	24.8% (56)
Coverage Reason	
Old Age	20.8% (47)
Disability	10.6% (24)
ESRD	42.5% (96)
Hierarchical Condition Category (HCC)	
Mean HCC Score (SD)	1.9 (1.4)
Mean Count of HCCs (SD)	3.9 (2.8)
Mean Utilization and Cost in Year Prior to Program Enrollment	
Total Medicare Cost (SD)	$43,940 ($61,571)
Hospitalizations per 1,000 (SD)	746 (1,276)
ED Visits per 1,000 (SD)	714 (1,742)

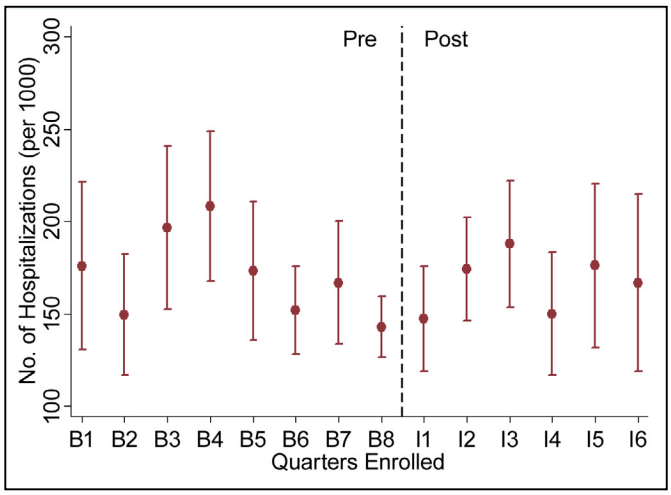
Time-series results. We present the results of our interrupted time-series models as the adjusted marginal effect of the GWU intervention on hospitalizations, ED visits, and total cost of care (Exhibit 6.3).[56] The effect is displayed as the average number of patient hospitalizations per 1,000 patients (and 95% confidence interval) for each quarter during patients' pre-intervention (B1–B8) and post-intervention (I1–I6) periods. Due to small numbers, we are unable to model readmissions.[57]

- Total cost of care increases for GWU's patients from the pre-intervention quarter through the post-intervention period. When costs are averaged across each period, the total cost of care is significantly higher in the post-intervention quarters compared to the pre-intervention quarters ($15,120 vs. $12,083, $p<0.01$)—indicating that the intervention is not reducing cost;
- No clear trends are discernable in hospitalizations or ED visits when looking at the averages for each quarter; for both measures, the rates fluctuate from quarter to quarter but do not consistently increase or decrease over time. For ED visits, the average for the entire post-intervention enrollment period is slightly higher than the pre-intervention period (150 vs. 127 patients with ED visits per 1,000, $p=0.01$).

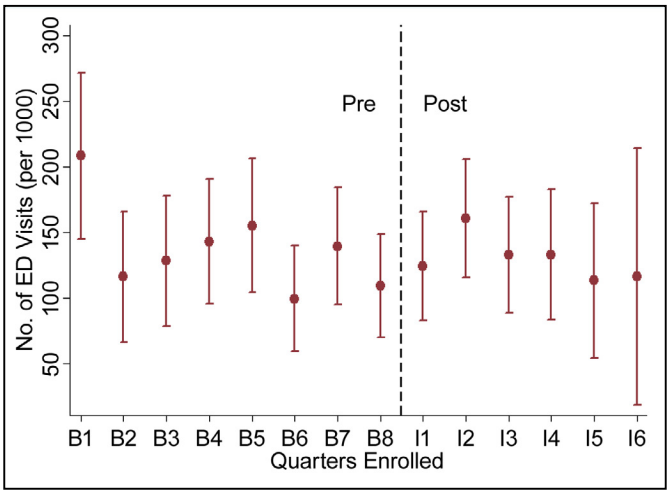
[56] We control for age, gender, race/ethnicity, comorbidity (using HCC score), diabetes, ESRD status, and type of dialysis (peritoneal or hemodialysis).
[57] Due to the small number of individuals enrolled for seven (n = 25) or eight (n = 1) quarters, we have restricted our analyses to the post-intervention (I1-I6) periods. As claims continue to accrue for patients enrolled in the intervention, we expect to be able to add more quarters of follow-up time in subsequent reports.

Exhibit 6.3: GWU Adjusted Rates for Core Measures by Quarter

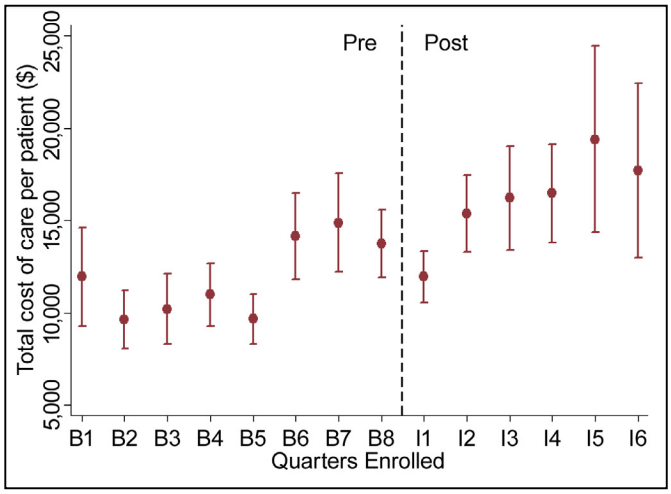
Hospitalizations



ED Visits*



Total Cost of Care (per patient)***



*** p<0.001, ** p<0.05, *p<.0.1

Statistical significance assessed using chi-squared tests for proportions & t-tests for continuous variables comparing OCC patients during the pre- and post-intervention period.

Sustainability

GWU is working with DaVita and other interested groups to secure funding for the continued collection of remote self-monitoring data from participants. As participants already have the telemonitoring equipment, GWU only needs external funding to pay for vendor fees for managing the self-monitoring data. GWU believes that DaVita may take over the program and pay this service fee themselves.

Conclusion

GWU's program focuses on real-time, continuous remote monitoring of adult patients with ESRD who are on peritoneal dialysis (PD), a home-based dialysis treatment. Through site visit discussions and observations, we find no evidence that the GWU intervention has altered the standard of care for PD patients at the DaVita clinics. We find evidence that the total cost of care increased for program participants when comparing cost prior to and after enrollment in the GWU program. However, for patients with long-term chronic conditions requiring regular monitoring—like the ESRD patients targeted by GWU—it may not be reasonable to expect costs to decline or even remain flat over time. Although not statistically significant, we also did observe an average increase of 23 ED visits per 1,000 patients each quarter, which may account for some of the increase in costs seen after program enrollment. As the Innovation Awards end, GWU is working to secure funding in an effort to sustain the program.

Health Resources in Action

Health Resources in Action's (HRiA) intervention targets asthma patients between two and 17 years of age who are Medicaid or CHIP beneficiaries served by one of nine provider partners in Massachusetts, Connecticut, Rhode Island, and Vermont. The program seeks to reduce preventable pediatric asthma-related utilization and cost by educating families, providing self-management support, and addressing environmental triggers.

We present findings based on a review of the awardee's quarterly reports, two rounds of site visits, telephone interviews with the awardee, and analysis of awardee-collected data. Over two rounds of data collection, we visited HRiA headquarters in Boston and six provider partners and conducted four focus groups. We held telephone interviews with one additional provider partner site.

Program Title	**New England Asthma Innovation Collaborative (NEAIC)**		
Intervention Summary	HRiA's asthma home-visiting program offers asthma mitigation materials (e.g., mattress covers, vacuums, natural cleaning agents) and core services over three to four home visits: ■ *Environmental assessments* identify asthma triggers in the home ■ *Education and reinforcement* about asthma management and trigger mitigation to promote behavioral changes		
Targeted Disease/Condition	Pediatric asthma		
Total Amount Awarded*	$4,247,747	**Award Amount Spent***	$3,430,622
Number of Sites	9	**Locations by State**	CT, MA, RI, VT
Cumulative Reach*	1,145		
Intervention Workforce	Approximately 14 lay health workers, 7 registered nurses, 1 nurse practitioner, 5 physicians/specialists, and 1 registered respiratory therapist (across all sites)[58]		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings indicate that asthma education and environmental assessments delivered over the course of three or four home visits help caregivers manage the child's asthma and reduce ED visits;
- Quantitative evidence demonstrates substantial improvements from visit one to the last available follow-up visit (visit 3 or 4, depending on the site) for the HRiA program participants, with the greatest improvements observed in measures of caregiver quality of life, asthma control, and removal of environmental factors;
  - However, as of December 31, 2014, 39 percent of participants did not receive the final visit (visit 3 or 4 depending on the site), and among those who completed a final visit survey, we observe substantial missing data across measures, which limits our ability to make solid inferences about the success of the program.

[58] The five physicians/specialists serve as site directors and are not frontline staff interacting with participants.

Implementation Experience

Important implementation takeaways relate to program's motivation, structure, operations, and workforce. Intervention staff include community health workers (CHWs) and certified asthma educators (AE-Cs). Most AE-Cs have prior clinical credentials as a respiratory therapist (RT), a nurse practitioner (NP), an advanced practice registered nurse (APRN), or a registered nurse (RN).

HRiA administers the award and convenes provider partners but does not directly implement the program. The awardee primarily selected provider sites with prior asthma home-visiting programs. Under the auspices of the Asthma Regional Council (ARC) of New England, HRiA collaborated with providers and payers throughout New England to form the New England Asthma Innovation Collaborative (NEAIC).[59] NEAIC's goal "is to promote sustainable financing and infrastructure for the delivery of cost-effective home-based care and education to children with poorly controlled asthma by CHWs."[60]

HRiA implements a modified version of a model implemented by the Seattle-King County Healthy Homes Project, which entails up to seven home visits.[61] HRiA allowed sites involved in previous asthma home-visiting programs to adopt a core three-visit model based on prior experience. This resulted in variation across sites, although all sites provided either three or four visits as a standard.[62]

The NEAIC program fostered a learning collaborative where sites and staff could share best practices, materials, and lessons learned. During early implementation, the learning collaborative focused on supporting sites in their efforts to recruit participants and launch their home-visiting programs. For instance, RI staff trained newer partners who were implementing the RI program model. More recently, the learning collaborative has focused on sharing efforts and ideas on how to expand and sustain programs.

Emergency departments (ED) served as the best referral source. Sites that attempted to engage local primary care providers to recruit participants struggled, in part because some providers worried about losing patients from their existing practice. Instead, sites predominantly used ED lists. Most hospital-based HRiA programs received automated referrals from their affiliated ED. Multiple sites reported recruiting participants shortly after an acute event, sometimes before families left the hospital.

Sites have developed useful strategies to provide education, assessment, and mitigation materials in participant homes. The program provides home environmental assessments as well as supplies to reduce

[59] ARC was launched in 2000 at an Asthma Summit sponsored by Region One of the Department of Health and Human Services and Environmental Protection Agency and the U.S. Department of Housing and Urban Development. ARC is a HRiA program that brings together a collation of public agencies, private organizations, and researchers to tackle environmental and clinical aspects of asthma for children and adults. About ARC. Asthma Regional Council Web site. http://asthmaregionalcouncil.org/about-arc/ Updated 2015. Accessed July 9, 2015.
[60] Case Study: New England Asthma Innovation Collaborative (NEAIC). Health Resources in Action Web site. http://hria.org/services/policy-practice/cs-neaic.html Updated 2015. Accessed July 9, 2015.
[61] Krieger JW, Takaro TK, Song L, Weaver M. The Seattle-King County Healthy Homes Project: A Randomized, Controlled Trial of a Community Health Worker Intervention to Decrease Exposure to Indoor Asthma Triggers. *American Journal of Public Health*. 2005; 95(4):652-659. doi:10.2105/AJPH.2004.042994.
[62] Please see our first annual report, page 88, for a summary of the different models.

or eliminate asthma triggers.[63] An AE-C or CHW walks through the home and provides education on environmental asthma triggers.[64] They deliver mitigation materials to families based on their assessments. Materials may include

- HEPA vacuums (several provide bagless models to avoid the cost of bag re-fills);
- Swiffers™ instead of a vacuum to families in non-carpeted units;
- bedding encasements for the patient;
- extra supplies to families if children split their time between homes.[65]

Additionally, CHWs may install supplies like mattress covers and put vacuums together during a home visit. Other mitigation supplies include plastic storage containers, covered trashcans, supplies to promote medication adherence,[66] and safe cleaning supplies (e.g., baking soda and vinegar).

Families prefer home visits to initial clinics visits offered by two sites. HRiA gave CT sites flexibility to provide education and orientation to the program during an initial clinic visit, which staff encouraged all participants to attend. Some families dropped out at this stage, prompting the sites to include a home visit option for the initial session. Many participants choose to have all visits in their home, sometimes because of transportation issues. Staff estimate that roughly 80 percent of families prefer home visits.

Both experienced and new CHWs found required trainings helpful. CHWs typically come from diverse and non-clinical backgrounds; thus, all CHWs receive significant formal training that covered asthma symptoms, asthma action plans, medications, environmental triggers, home-visiting best practices, and motivational interviewing. All CHWs are required to attend:

- a 48-hour core competency training with the Center for Health Impact;
- a four-day required training covering asthma and home visiting provided by the Boston Public Health Commission (BPHC); and
- quarterly continuing education facilitated by the BPHC and Massachusetts Association for CHWs (on topics such as mental health or smoking cessation).

While CHWs are an essential part of the intervention, a nurse AE-C supervisor serves as a hub for communication and guidance. The primary responsibility of AE-Cs in this program is to oversee and guide CHWs in their home visiting activities. Across all sites visited, AE-Cs and CHWs collaborated closely and expressed satisfaction with their supervisor/supervisee relationships. In the VT, CT, and RI sites, AE-Cs also accompany CHWs on the first home visit to provide asthma education and assess patients' clinical needs.

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[63] NEAIC employs the Environmental Protection Agency's Healthy Homes guidelines during environmental assessment.
[64] Staff discloses to participants which rooms they will review in advance of the visit. This increases families' comfort.
[65] Only limited supplies (e.g., mattress covers) were delivered to a second home and not a full duplication of cleaning and asthma mitigation supplies. HRiA did not conduct home visits to the second home.
[66] The program distributed spacers, which are tubes that hold inhaler medicine until the patient can breathe it in. These tubes are helpful for young children.

The presence of community teams or coexisting asthma programs within the hospital formed a network of support, resources, and expertise for partner providers. For example, one asthma home-visiting program was embedded into a hospital's Community Health Team (CHT). This connection allowed the CHW and AE-C to refer participants to the CHT's pediatric clinical social worker, registered dietician, and tobacco cessation counselors, allowing the program to address needs beyond asthma care management.

CHWs and AE-Cs interact with participants' primary care providers formally or informally but cannot ensure that recommendations filter into regular care. AE-Cs may call participants' physicians to raise a concern or recommend medication changes. At one site, an AE-C also accompanies some families on primary care visits to explain symptoms or fax reports and asthma action plans to treating pediatricians. This communication can give clinicians useful information on environmental triggers or social issues affecting families. However, while AE-Cs can recommend changes to care plans or medication regimens, only participants' physicians actually address these issues.

Program leadership considered national and local efforts to credential CHWs when they designed the program and provided implementation guidance. Across the country, policymakers and advocates are working towards certifying CHWs and exploring reimbursement options. In Massachusetts, HRiA's base, the movement is particularly strong. HRiA considered this context when selecting workforce models and training curricula. Ultimately, HRiA partnered with Massachusetts-based entities to train CHWs. At the site level, we infer that Massachusetts sites largely recruited from an existing pool of CHWs compared to sites located in states without formal CHW training and certification processes.[67]

Participant and Caregiver Experiences

We offer the following findings based on four focus groups with a total of 39 caregivers.

Improvements in Quality of Life
All caregivers feel more empowered to manage their child's asthma and agree that the program reduced their stress. All have asthma action plans, and most indicated that following the plans increased confidence in handling their child's asthma exacerbations. Caregivers can identify symptoms sooner and feel more comfortable managing asthma at home, which may be a driver of lower health care utilization. Staff described quality of life improvements throughout whole families. In one example, asthma management improved a child's educational performance through fewer missed school days; in the same family, better management enabled the caregiver to get adequate sleep since she was not up late tending to the child.

[67] For information on training and certification of CHWs in Massachusetts, please see http://www.machw.org/.

Behavior Changes
Caregivers confirmed that home environmental assessments significantly increased their awareness of asthma triggers. Most focus group participants found the program's materials useful, especially the vacuum. If caregivers did not switch to natural cleaning products, CHWs suggested smaller changes, such as cleaning while the child is outside the home. Caregivers reported large gains in knowledge about asthma triggers and medications: *"[My husband and I] didn't have asthma so it's new to us and we didn't know exactly what he had and what causes him to just have asthma attacks, … but we have realized that [it was] like she said, the cleaning products and, like, sprays and stuff in the house...."*
Improvements in Quality of Care
Staff help families connect with physicians to change medications, locate specialists, and switch providers. *"[The program] has helped me a lot because his primary care that he was seeing refused to let him see a specialist because she said he didn't have asthma … and [the program] pushed me to get him to a different primary care doctor because she was awful."* Some caregivers contrasted the program with their usual care, where providers typically lack the time to answer questions or walk through treatment recommendations.
Changes in Health Care Utilization
Caregivers attributed a reduction in ED visits to asthma education and better knowledge of medications. One caregiver joked that the ED used to be her son's "second home." Several mentioned that prior to the program they would visit the ED often, and some noted they have not been back since using the program.

Quantitative Analysis of Program Effectiveness

HRiA provided NORC with data from a caregiver survey, environmental assessment, and measures of asthma action plans and asthma control. These assessments were taken at the first home visit conducted between May 1, 2012 to December 31, 2014, and the third/fourth home visit conducted between February 19, 2013 and December 31, 2014. In this report, we provide an analysis of the performance of the program on four measures of intervention metrics, health outcomes, and quality of life:

- asthma action plans, receipt, and utilization (intervention metric)
- environmental composite score (intervention metric)
- asthma control (health outcome)
- Juniper Pediatric Asthma Caregiver's Quality of Life Questionnaire (quality of life)

As of December 31, 2014, the data provided indicate that of the 1,060 participants enrolled in the HRiA program, 650 had completed all home visits, and 410 had not yet completed them. Exhibit 7.1 compares characteristics of participants who completed them with those who did not. Those who had not had their final visit tended to be from Boston Medical Center or Children's Hospital and on average were older, female, African American, and reported having had an asthma action plan. There also was some indication that participants who had yet to complete the final visit had higher Juniper Pediatric Asthma Caregiver's Quality of Life scores and lower environmental composite scores, which suggests fewer environmental factors.

Limitations. There are several limitations of this data set worth noting. First, data is limited to those who completed the final visit survey by December 31, 2014, and includes missing observations on some measures. As more participants complete the intervention, we will continue to examine the effect of the intervention on survey outcomes. Therefore, we have limited analyses presented in this report to participants with first and final visit measures. Second, we do not have comparable populations with benchmark data to aid in the interpretation of most measures. For the Juniper Pediatric Caregiver's Quality of Life we were able to identify a published study with benchmark data (see Juniper Reference on next page), but on average, the children in this benchmark study were older and more likely to be Caucasian than HRiA participants. The benchmark data did suggest, however, that quality of life in caregivers was higher in HRiA than in benchmark populations. Finally, we have not yet been able to procure claims data for the HRiA population. HRiA is in ongoing conversations with MassHealth that suggest we may be able to access MassHealth Medicaid claims for the Massachusetts sites.

Exhibit 7.1: HRiA Baseline Characteristics of Participants Overall and According to Follow-Up Status

Variable	Overall	Completed All Home Visits	Had Yet to Complete Home Visits
Number of Persons	1,060	650	410
Site			
Baystate Medical Center (MA)	7.6% (80)	8.6% (56)	5.9% (24)
Boston Medical Center (MA)	13.8% (146)	8.9% (58)	21.5% (88)
Children's Hospital (MA)	32.6% (345)	23.4% (152)	47.1% (193)
Children's Medical Group (CT)	10.6% (112)	15.1% (98)	3.4% (14)
Middlesex Hospital (CT)	3.9% (41)	4.8% (31)	2.4% (10)
RI Hasbro & St. Joseph's (RI)	20.6% (218)	26.3% (171)	11.5% (47)
Rutland (VT)	6.2% (66)	7.2% (47)	4.6% (19)
Thundermist Health Center (MA)	4.9% (52)	5.7% (37)	3.7% (15)
Age (Range 1-19)			
Mean age in years (SD)	6.3 (3.5)	6.2 (3.5)	6.6 (3.6)
Gender			
Female	41.8% (439)	39.0% (253)	46.2% (186)

Variable	Overall	Completed All Home Visits	Had Yet to Complete Home Visits
Race/Ethnicity			
White, Non-Hispanic	9.9% (105)	11.7% (76)	7.1% (29)
Black or African American, Non-Hispanic	25.5% (270)	24.0% (156)	27.8% 114
White, Hispanic	12.7% (135)	14.9% (97)	9.3% (38)
Black or African American, Hispanic	6.3% (67)	5.5% (36)	7.6% (31)
Other, Hispanic	39.8% (422)	38.6% (251)	41.7% (171)
Other, Non-Hispanic	3.2% (34)	3.2% (21)	3.2% (13)
Caregiver Education Level			
8th grade or less	10.9% (112)	9.4% (60)	13.3% (52)
Some high school but did not graduate	18.2% (188)	18.6% (119)	17.7% (69)
High school graduate or GED	29.5% (304)	32.3% (207)	24.9% (97)
Some college/vocational or technical school	27.4% (282)	26.2% (168)	29.2% (114)
Graduated from college/graduate school	13.6% (140)	13.3% (85)	14.1% (55)
Other	0.5% (5)	0.3% (2)	0.8% (0.8)
Language Spoken Most at Home			
English	67.5% (709)	64.8% (420)	71.7% (289)
Spanish	37.2% (391)	39.7% (257)	33.3% (134)
Juniper Pediatric Asthma Caregivers QOL at Visit 1			
Mean (SD) at Visit 1	5.16 (1.31)	5.13 (1.36)	5.21 (1.21)
Asthma Action Plan at Visit 1			
Participants who have received an asthma action plan (reported at Visit 1)	58.5% (614)	56.7% (367)	61.4% (247)
Participants who used the asthma action plan the last time the child's asthma got worse	43.1% (457)	43.2% (281)	42.9% (176)
Asthma Control, at Visit 1			
Well controlled	17.5% (185)	17.4% (113)	17.6% (72)
Not well controlled	45.4% (481)	45.7% (297)	44.9% (184)
Poorly controlled	37.2% (394)	36.9% (240)	37.6% (154)
Environmental Factors, at Visit 1			
Composite score, mean (SD)	2.5 (1.3)	2.5 (1.3)	2.4 (1.3)

Exhibit 7.2 below provides an overview of the awardee-obtained outcomes, including a description of each scale and the potential impact of these measures on health care utilization.

Exhibit 7.2: HRiA Overview of Specific Measures

Measures	Description of Scale	Associated Measures of Health Care Utilization
Juniper Pediatric Asthma Caregivers Quality of Life Questionnaire[68] **Subscale 1:** Activity Limitation Domain **Subscale 2:** Total Score	Evaluates the limitations in normal daily activities in children with asthma as well as anxieties and fears due to having asthma **Subscale 1:** Measures physical problems in children with asthma **Subscale 2:** Measures functional problems (physical, emotional, and social) in children with asthma	ED use; asthma-related hospitalizations
Asthma Action Plan	Self-reported questions about whether the caregiver had received an asthma plan and whether they used it when the child's asthma got worse	ED use; asthma-related hospitalizations
Asthma Control	Uses information from five asthma control questions to assess whether asthma is well controlled, not well controlled, or poorly controlled	ED use; asthma-related hospitalizations
Environmental Composite Score	Evaluates number of asthma triggers (dust, chemical, pets, pests, mold, and smoke) using range of 0–6	ED use; asthma-related hospitalizations

We provide an assessment of the performance of each of the measures at the first and third/fourth home visit below. All analyses are limited to the subset of 650 participants who attended a final visit. Because many measures from the final visit survey had missing observations, an additional column showing the number of participants with complete observations is included in the table. The greatest amount of missing data occurred with the environmental measures. Furthermore, a great deal of missing data was observed with "parent report of using an asthma action plan during the last exacerbation of asthma," which is likely because many participants did not have an exacerbation within the specified time frame. Percent improved was computed as the number of participants who experienced an improvement in the measure between the first and the follow-up visit. In general, results of these analyses show that:

- Improvement in all measures was observed between visit one and visit three/four, with the largest improvements in measures of Juniper Pediatric Caregivers Quality of Life (62.5% of participants improved), asthma control (52.6% of participants improved), and receipt of an asthma action plan (30.5% of participants improved).
- Significant improvement occurred across several environmental factors, with the greatest gains in the reductions of mold, smoke, and chemical exposures (20.7-26.9% of participants improved).
- Almost two-thirds—62.5 percent (406)—of participants had improved Juniper Pediatric Caregiver Quality of Life Questionnaire scores from visit one to visit three, with an average increase of 1.2 points.

[68] Juniper, E. F., Guyat, G. H., Feeny, D. H., Ferrie, P. J., Griffith, L. E., & Townsend, M. (1996). Measuring quality of life in the parents of children with asthma. *Quality of Life Research, 5*, 27-34.

Exhibit 7.3: HRiA Outcomes in Provided Data

Variable	First Visit % (N)	Final Visit % (N)	N	Improved %
Juniper Pediatric Asthma Caregiver Quality of Life Questionnaire				
Median (IQR) score on 13 items	5.3 (4.2–6.2)	6.5 (5.7–7.0)	549	62.5%
Self-Monitoring Measures				
Participants who have received an asthma action plan	48.4% (300)	78.9% (489)	620	30.5%
Participants who used the asthma action plan the last time their child's asthma got worse	51.9% (232)	70.9% (317)	447	28.9%
Asthma Control				
Well controlled	17.4% (113)	48.3% (314)	650	52.6%
Not well controlled	45.7% (297)	38.8% (252)		
Poorly controlled	36.9% (240)	12.9% (84)		
Number of Environmental Factors (0-6)				
Mean (SD) Environmental Score	2.5 (1.3)	1.8 (1.3)	650	55.7%
Presence of Mold	51.2% (294)	40.6% (233)	574	20.7%
Presence of Pests	43.5% (248)	29.8% (170)	570	19.3%
Presence of Smoke	45.9% (209)	29.7% (135)	455	20.2%
Presence of Pets	32.2% (205)	28.6% (182)	637	8.2%
Presence of Chemicals	87.1% (529)	65.9% (400)	607	26.9%
Presence of Dust	7.8% (50)	5.0% (32)	645	5.0%

Sustainability

All sites are exploring ways to continue sustaining portions of the asthma home-visiting programs. Delays in receiving Medicaid data from states have affected sites' abilities to demonstrate a return on investment to payers. Despite this challenge, a few sites have made progress in developing sustainability plans. Employing CHWs part-time may be an avenue towards sustaining program components. CT and VT CHWs did not articulate any major challenges meeting patient needs when carrying out the program on a part-time schedule. Exhibit 7.4 summarizes the range in degree of and approach to sustainability across HRiA sites.

Exhibit 7.4: HRiA Sustainability Plans by Site*

Site	Sustainability Plans and Activities
Boston Children's Hospital (BCH)	▪ Site will continue program by participating in a bundled payment pilot program through MassHealth, which will provide fixed reimbursements for services.[69] ▪ Hospital is considering funding the program through its Community Benefits Office.
Hasbro Hospital/ St. Joseph's Hospital	▪ Hospital is in discussions with Neighborhood Health Plan about receiving reimbursement services for 60 participants. ▪ Both sites continuing work to use claims data to demonstrate ROI.
Boston Medical Center (BMC)	▪ Hospital leadership is exploring whether hospital resources can continue the program. ▪ Site is in discussion with a private payer to fund a pilot asthma program. ▪ Site plans to lay off one CHW and keep one CHW part time.
Baystate Medical Center	▪ Center won a planning grant through the Green & Healthy Homes Initiative that will allow the site to explore a pay-for-success model for the asthma program.
Middlesex Hospital**	▪ The hospital will return to its usual care management system, which provides limited asthma home visiting. Program will not continue in its current form.
Children's Medical Group*	▪ Site plans to continue the program, but a funding source is unclear. ▪ Leadership envisions that its program, CAiR, will support a patient-centered medical home (PCMH) model but did not report any plans to work with PCMHs.
Rutland Regional Medical Center	▪ Site will continue the program through its CHT. ▪ The site will provide services to referred participants but will not actively recruit. ▪ Staff is unsure whether the program can continue to fund asthma mitigation supplies.

* The information presented reflects findings through our last site visit in April 2015.

**Both Connecticut sites indicate that they continue to advocate with state officials and insurance companies to provide for this or a similar program.

Conclusion

HRiA's program focuses on asthma care management and aims to lower costs of asthma care by delivering prevention-oriented care using a workforce of CHWs and AE-Cs. Through site visit discussions and observations, we find evidence suggesting that asthma education and environmental assessments delivered over the course of three or four home visits help caregivers manage the child's asthma and reduce ED visits. We also find evidence of substantial improvements from visit one to visit three for the HRiA program participants, with the greatest improvements observed in measures of caregiver quality of life, asthma control, and removal of environmental factors. However, to date, 39 percent of participants are lacking a final visit, and among those who completed a final visit survey, we see substantial missing data across measures, which limits our ability to make solid inferences about the success of the program. As the Innovation Awards end, most HRiA sites are making efforts to sustain the program, albeit with reduced services.

[69] Bartlett J. Boston Children's Hospital asthma initiative receives Medicaid endorsement. *Boston Business Journal*. September 25, 2014. http://www.bizjournals.com/boston/blog/health-care/2014/09/boston-childrens-hospital-asthma-initiative.html?s=print. Accessed May 14, 2015.

Trustees of Indiana University

Indiana University's Aging Brain Care (ABC) Program provides care management for elderly dementia and depression patients at Eskenazi Health in Indianapolis and at Indiana University Health - Arnett in Lafayette, Indiana. ABC provides individualized and integrated care management through a care team composed of nurses, social workers, and lay health workers (LHWs). The care teams assess and monitor patients' needs and deliver education on self-management through home visits and telephone calls. We present findings based on a review of the awardee's quarterly reports to CMMI as well as telephone interviews with the awardee, analysis of Medicare claims data, and site visits to Indianapolis and Lafayette, IN.

Program Title	**Aging Brain Care Program (ABC)**		
Intervention Summary	Home visits by lay health workers, titled Care Coordinator Assistants (CCAs) who conduct patient assessments and teach coping mechanisms for patients and caregivers, as well as introduce advance care planning and follow bereavement protocols as necessary. RN care coordinators and social workers also visit patients with more complex medical or social needs, referring them to medical or social services as appropriate.		
Targeted Disease/Condition	Dementia and depression		
Total Amount Awarded*	$7,836,084	**Award Amount Spent***	$5,690,319
Number of Sites	2	**Locations by State**	IN
Cumulative Reach*	2,898		
Intervention Workforce	Approximately 21 lay health workers, 2 social workers, and 3 registered nurses (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Our qualitative findings suggest that Indiana's program achieves effective disease management for patients with dementia and depression using a workforce consisting primarily of LHWs.
- Our quantitative findings show a small but significant decrease in ED visits for program participants relative to matched comparison patients.
- As the HCIA project ends, leadership is working towards licensure and broader distribution of program materials.

Implementation Experience

The Aging Brain Care program includes a workforce overseen by a medical director, program manager, and principal investigator:

- **Care Coordinator Assistants (CCAs):** LHWs who primarily conduct home visits;
- **Care Coordinator RN (CCs):** RNs supervise the CCAs, conduct a portion of home visits that require RN skills, and coordinate with other providers in patients' care teams;

- **Care Coordinator Social Worker (SW):** Social workers supervise CCAs and address patients' social needs.

The program's division of labor allows RNs and social workers to serve as team leaders and specialized providers. By training CCAs to handle referrals, introduce advance directives, and offer supportive services to patients, RNs and social workers can concentrate on serious health or social problems. RN care coordinators focus on medical issues. Social workers focus on patients facing emotional or non-clinical crises.

Home visits allow program staff to develop a relationship with patients and learn more about their health issues than they could in an office setting. Home visits remove transportation barriers for patients and decrease caregiver stress. CCAs find the home to be a comfortable environment to conduct patient education, administer monitoring tools, and bond with the patient. Through this interaction, CCAs identify medication adherence issues, activity limitations, and other issues.

CCAs successfully hold advance care planning discussions during home visits. CCAs were initially reluctant to add advance care planning to their home visits. Over time, they became comfortable initiating conversations about end-of-life decisions. CCAs report that program participants want to talk about end-of-life issues and not wait until a moment of crisis.

Staff attribute the effectiveness of and positive feedback about CCAs to the program's rigorous approach to vetting and training these staff. Many of the CCAs cited a desire to work with elderly patients as a reason for pursuing the position. Management looked for this attribute during the candidate selection process. Some CCAs have had trouble separating personal time from work time in an effort to meet participant needs. Program leadership advised CCAs to maintain boundaries and not overextend themselves.

The social services and supports available in Indianapolis are not easily found in the rural site, Arnett. Service providers in Arnett maintain long waiting lists and transportation challenges impede access to these services for elderly patients. While the Arnett workforce has readily adapted to this challenge, it is one of the major differences between the two sites. Since social services and supports are a helpful complement to the medical care components of the intervention, a lack of resources could pose a challenge to replicability.

Leadership does not have extensive experience working with LHWs and said it was challenging at times to work with staff with this level of training. They feel the CCAs need greater clarity and certainty on their roles and protocols than the adaptable pilot study design could offer. They work regularly to communicate guidelines, process changes, and expectations. The program has a monthly meeting for CCAs to discuss challenges with a dementia care expert from Indiana's faculty.

A custom care tracking system facilitates the intervention but requires workarounds at some sites. Indiana adapted their system (called eMR-ABC) to centralize patient monitoring, facilitate provider communication, and aid data collection. The eMR-ABC is integrated into the larger Eskenazi system. The eMR-ABC did not integrate with the Arnett system. Therefore, Arnett CCAs had to document patient interactions through duplicate data entry.

Participant and Caregiver Experiences

Based on focus groups and telephone interviews with 46 participants and caregivers from both sites, we assess their experiences with the awardee's intervention and offer the following findings.

Improvements in Quality of Life
Participants described the CCAs as knowledgeable, patient, and compassionate—these qualities helped CCAs forge personal connections with program participants**.** Patients with both dementia and depression and caregivers greatly appreciated the opportunity to discuss their frustrations and problems with the CCAs. Even when CCAs were not able to achieve a concrete solution, participants still found these conversations helpful in alleviating stress related to living with or caring for someone with dementia and/or depression.
Improvements in Disease Management
Leadership and staff report that, thanks to the intervention, patients are better able to manage cyclical depression. CCAs teach and use behavioral activation and engage in relapse prevention during home visits. Leadership report that they are able to teach patients and caregivers to manage dementia and depression as they would any other chronic condition. CCAs are trained to teach a variety of coping mechanisms so that patients and caregivers are more willing and able to adapt to their condition and be less distressed about it.
Enhanced Access to Healthcare and Social Services
The close relationships with the CCAs afford patients a direct line of communication to their health care team. CCAs are able to share information and connect patients to the program's care coordinator or social worker, or the patient's primary care provider. Some participants reported that they were more comfortable sharing information about their health with the CCAs than with their physicians. CCAs also connected participants with community resources. One dementia patient reported that a CCA helped her transfer to a nursing home specializing in dementia. Another CCA connected a dementia patient to a physical therapist. Working with the physical therapist enabled the patient to do more work around the house. Still other participants were connected with adult daycare services, dentures, or cheaper medications.

Quantitative Analysis of Program Effectiveness

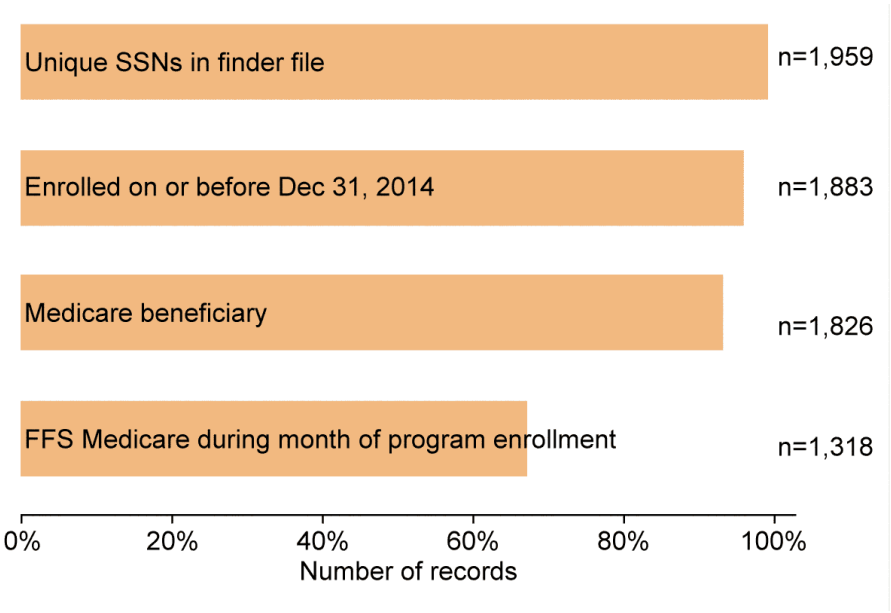
We use difference-in-differences (DID) analyses to evaluate the ABC program's impact on core measures: all-cause hospitalizations, hospitalizations for ambulatory care sensitive conditions (ACS), 30-day readmissions, emergency department (ED) visits, and total cost of care.

- We restrict our treatment group to Medicare fee-for-service (FFS) participants enrolled in Indiana's program for one or more quarters from October 1, 2012 through December 31, 2014.
- We worked with Indiana's finder file listing participants and their enrollment dates to identify FFS Medicare claims for individuals in our treatment group (see Exhibit 8.1).

- To identify a pool of comparison patients, we select FFS beneficiaries with a history of dementia or depression residing in selected comparison counties. For each Indiana implementation site, we selected five comparison counties using propensity score matching.[70]

Limitations. Although we include a matched comparison group in our analysis, results should be interpreted with some caution in all post-intervention quarters, as there were fewer than fifty participants with a 30-day readmission; further, analysis of 30-day readmissions is limited to patients with an index-hospitalization, reducing the sample size in these models.

Exhibit 8.1: Indiana Patients Identified through Finder File [71]



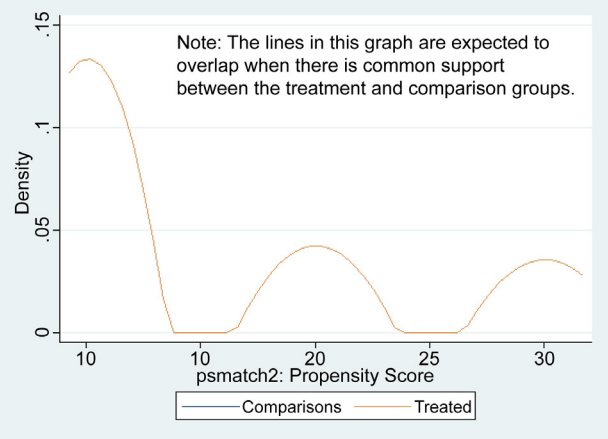
Comparison group selection. We use propensity score models to match intervention to comparison patients on demographics, comorbidities, and prior utilization. For more details on comparison selection and matching, see Technical Appendix A. Exhibit 8.2 summarizes the results from our propensity score matching. The left panel shows the common support after propensity score matching, and the right panel displays the covariate balance before and after matching.

[70] Comparison counties for the Eskenazi site are: Sangamon County, IL; Lucas County, OH; St. Louis County, MO; Wayne County, MI; and Dakota County, MN. For the Arnett Site, we selected Vigo County, IN; Summit County OH; Franklin County, MO; Jefferson County, MO; and Green County MO. For more details on the criteria used to select comparison counties, including diagnosis codes used to define dementia and depression and variables included in the propensity model, please see Technical Appendix A.

[71] The finder file Indiana shared with our team included both patients enrolled in their program and those eligible for the program (a total of 3,066 records). For this chart, we have limited to only those patients who were enrolled in the program.

- After matching, we observe the two groups have nearly identical distributions of propensity scores[72], suggesting that—at least on the factors included in the propensity model—these groups are well matched.
- On the balance chart, we show matching has achieved balance (reduced the difference between Indiana participants and comparison group to less than 10% standardized bias) on demographic, comorbidity, and prior-year utilization covariates.

Exhibit 8.2: Indiana Common Support and Covariate Balance for Indiana and Comparison Patients



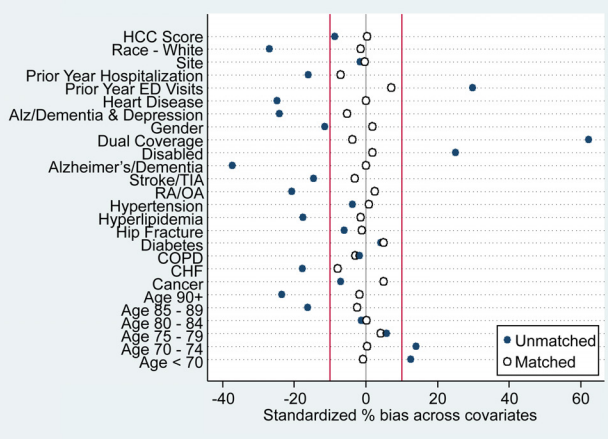


Exhibit 8.3 presents demographic and other basic information about treatment and matched comparison patients included in our analysis of core outcome measures. Because the comparison group is matched to the Indiana intervention group, we observe few differences on demographics, comorbidity, and prior health care utilization. We observe significantly higher rates of ED use prior to enrollment for matched comparison participants ($p < 0.05$), and Indiana participants are less likely than comparison participants to be Black ($p < 0.01$). Both of these factors are included in models to control for any remaining confounding after matching.

[72] After matching the density functions for the treatment and comparison group overlap and are nearly identical. In the figure the two lines are on top of each other giving the appearance of a single line.

Exhibit 8.3: Indiana Descriptive Characteristics of Indiana and Matched Comparison Patients

Variable	Matched Comparison	Indiana
	% (N)	
Number of Persons	1,318	1,318
Mean Enrollment Quarters	5.5 [1-9]	5.2 [1-9]
Conditions		
Alzheimer's/Dementia	20.0% (263)	20.0% (263)
Alzheimer's/Dementia & Depression	16.9% (223)	16.9% (223)
Depression	63.1% (832)	63.1% (832)
Gender		
Female	74.4% (981)	75.3% (992)
Age		
<65 years old	25.8% (340)	26.2% (345)
65–69 years old	22.5% (296)	22.3% (294)
70–74 years old	17.9% (236)	16.4% (216)
75–79 years old	16.6% (219)	16.5% (218)
80–84 years old	11.2% (147)	12.0% (158)
≥85 years old	6.1% (80)	6.6% (87)
Race/Ethnicity* **		
White	65.9% (869)	66.6% (878)
Black	33.1% (436)	29.7% (392)
Other	1.0% (13)	3.6% (48)
Provider Site		
Eskenazi Health	69.5% (916)	69.3% (914)
IU Health Arnett	30.5% (402)	30.7% (404)
Eligibility		
Full	49.6% (654)	51.4% (677)
Partial	50.4% (664)	48.6% (641)
Coverage Reason		
Old Age	72.3% (953)	73.0% (962)
Disability	27.5% (362)	26.8% (353)
ESRD	0.0% (0)	0.1% (1)
Hierarchical Condition Category (HCC)		
Mean HCC Score (SD)	1.7 (1.3)	1.7 (1.3)
Mean Count of HCCs (SD)	2.8 (2.5)	2.8 (2.5)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Hospitalizations per 1,000 (SD)	521 (1,056)	573 (1,116)
ED Visits per 1,000 (SD)**	1492 (229)	1316 (277)
Total Medicare Cost (SD)	$13,965 ($25,887)	$15,465 ($25,150)

Statistical significance was assessed using Chi-square for categorical variables and t-tests for continuous variables.
*** p<0.01, ** p<0.05, * p<0.1

For each core measure, we pose the following research question:

- Are there differences in core measures between Indiana's patients after enrollment in ABC and comparison patients, after adjusting for differences in secular trends and risk factors across both groups?

To answer this question we use a summative DID model that assesses the impact of Indiana's ABC intervention over the entire post-intervention period. For details on specifications of this model, refer to Technical Appendix A.[73]

Summative DID results. Exhibit 8.4 presents the results of our DID models assessing the impact of Indiana's program across the entire post-intervention period. The primary parameter of interest is the DID estimator (the final column) showing the difference in average outcomes between Indiana and the comparison group *after* intervention enrollment minus the difference in average outcomes between the two groups *before* intervention enrollment. In the summative DID model we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.

- We observe significant reduction in the DID estimator for ED visits. While ED visit rates for participants in Indiana's program remained higher than matched comparisons, during the intervention period the gap between the two groups narrowed significantly (32 ED visits per 1,000 patients).
- For total hospitalizations, 30-day readmissions, and ACS hospitalizations, we estimated an increase in Indiana patients' utilization and cost relative to a comparison and Indiana participant outcomes prior to enrollment. However, these increases were very small and not significant.
- Total cost of care for Indiana participants was lower than matched comparisons prior to enrollment. Although cost increased in both groups, the rate of increase was lower for Indiana, leading to a non-significant $206 lower average cost for Indiana participants versus comparison patients.

[73] All models are adjusted for: age, race, ethnicity, gender, HCC score, dual-eligibility, months of FFS coverage in the year prior to enrollment, dementia, and depression diagnosis.

Exhibit 8.4: Indiana Difference-in-Differences Estimates for Core Measures‡

Pre-Intervention Period			Post-Intervention Period			DIFFERENCE IN DIFFERENCES [95% CI]
Comparison (N=1,318)	Intervention (N=1,318)	DIFFERENCE [95% CI]	Comparison (N=1,318)	Intervention (N=1,318)	DIFFERENCE [95% CI]	
Patients with Hospitalizations (per 1,000)						
106	101	-6 [-16, 4]	122	122	0 [-12, 12]	6 [-7, 19]
Patients with 30-Day Readmissions (per 1,000)						
19	15	-4 [-8, 0]	22	22	0 [-5, 5]	4 [-2, 10]
Patients with ACS Admissions (per 1,000)						
23	26	3 [-2, 8]	27	30	3 [-3, 9]	0 [-7, 7]
Patients with ED Visits (per 1,000)						
172	243	71 [55, 87]***	192	231	39 [21, 57]***	-32 [-48, -16]***
Total Cost of Care Per Patient ($)						
$3,782.00	$3,412.00	-$370 [-$711, -$29]	$6,209.00	$5,634.00	-$575 [-$1,388, $238]	-$205 [-$1,016, $606]

Inference: *** p<0.01; ** p<0.05; * p<0.1

‡Model-based estimates for cost measure using generalized estimating equation model with log link and gamma distribution. Count measures estimated using population-averaged logit models.

Sustainability

Eskenazi Health and IU Health Arnett, plan to continue the intervention beyond the initial Innovation Award.

- Arnett has publicly committed to continuing the program through December 2015.
- Eskenazi is founding a new Center for Brain Care Innovation and the ABC medical home will be the flagship program of the new center.

The program is also being licensed through **an agent that will aim to disseminate the model to other health systems.** The intellectual package includes:

- Software: eMR-ABC and the healthy aging brain center application and simulation.
- Paper materials: protocols, handouts for participants, assessments, and training curriculum.
- Standard operating procedures: recommended workforce, implementation process, interview and hiring process, and a simulation-forecasting model for payers.

Conclusion

Findings from site visits suggest that Indiana's program achieves effective disease management for patients with dementia and depression using a workforce consisting primarily of LHWs. We see a small but significant decrease in ED visits for program participants relative to matched comparison patients. However, much of the data available at this time is from the first year of enrollment for program participants, and qualitative findings suggest program impact on utilization may not be realized until the second year of program participation.[74] Program leads are working towards licensing the model for broader dissemination.

[74] The number of participants included in analysis drops off each quarter and represents less than half of the program enrollment by the start of the seventh quarter of enrollment.

Innovative Oncology Business Solutions, Inc.

Innovative Oncology Business Solutions, Inc. (IOBS) is a New Mexico-based for-profit corporation created for the purpose of administering this CMMI award. The awardee represents seven community oncology practices across the United States implementing and testing the Community Oncology Medical Home (COME HOME) model, which strives to provide comprehensive outpatient oncology care.

We present findings based upon a review of the awardee's quarterly reports to CMMI as well as telephone interviews with the awardee's staff, two rounds of site visits, and analysis of Medicare claims data. In our first round of site visits, we visited New Mexico Cancer Center (NMCC) in Albuquerque, New Mexico. For our second round of site visits, we visited three out of the six other IOBS sites in Fort Worth, TX; Marietta, GA; and Portland, ME.

Program Title	**COME HOME Program**		
Intervention Summary	The COME HOME model has three main components: (1) *Triage pathways* that help first responders and triage nurses to identify and manage patient symptoms in real time as they call or come into the practice; (2) *Enhanced access* to COME HOME providers through a triage phone line, availability of same-day appointments, extended night and weekend office hours, and on-call providers; and (3) *Treatment pathways* that provide disease management guidance for providers to improve treatment decision-making; symptom recognition; and assistance with patients' self-care, pain management, and caregiver support		
Targeted Disease/ Condition	Breast, colon, lung, thyroid, pancreas, lymphoma, and melanoma cancer		
Total Amount Awarded*	$19,757,338	**Award Amount Spent***	$14,837,607
Number of Sites	7	**Locations by State**	NM, TX, GA, OH, FL, ME
Cumulative Reach*	2,189		
Intervention Workforce	Approximately 16 licensed practical nurses and 60 registered nurses (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings suggest that staff highly value the triage pathways for making their workflow more efficient, and patients greatly appreciate weekend hours and increased capacity for urgent care visits during the day.
- Quantitative analyses show a statistically significant reduction in ED visits and 30-day readmissions for participants across the entire post-intervention period relative to a matched comparison group.
  - We also observe the program significantly reducing total cost of care and hospitalization for its participants in multiple post-intervention quarters relative to the comparison group.

Implementation Experience

Implementation of the COME HOME intervention model varies across the seven sites in order to facilitate implementation and allow for innovation and ownership among strong physician leaders. Each oncology practice has unique experiences adapting the model to their own contexts and populations.

- Multiple leaders and staff members from the COME HOME practices that we visited described their practices as having innovative cultures. They try new things in order to provide the best care for their patients; IOBS honors this drive to innovate by allowing variations across sites, and also allowing sites to make changes to improve treatment pathways over time.
- Practices learned that it is important to consider existing staff capacity and perspectives when integrating the COME HOME model into their workflow and culture, thus fidelity to a particular workforce model is low.
  - The adaptability of the program to existing staffing structures may encourage replicability of the program's main components in new settings.
- Practices that allow not only Medicare patients but all patients in their practice to have access to the intervention find that the model can be effective and beneficial for multiple types of payer groups and cancer patients beyond the seven types specifically being tracked for this evaluation.

To facilitate timely implementation of the COME HOME model, IOBS leadership specifically recruited practices with existing EHRs and a drive toward accreditation. All seven COME HOME practices are up and running and none reported significant delays in implementation.

- **Practices have generally incorporated the COME HOME treatment pathways into their workflows by re-labeling existing evidence-based pathways in their EHRs as a COME HOME pathway for a COME HOME patient.** Differences between the existing treatment pathways and the COME HOME treatment pathways are minimal since they are all evidence-based pathways built based on current research and National Comprehensive Cancer Network (NCCN) guidelines.
- **Practices also report that being accredited or working toward accreditation facilitates implementation.** The COME HOME program has also helped sites receive accreditation as some of the components align with medical home accreditation standards. Implementing the COME HOME model has also helped some practices work toward additional certifications. For example, one practice said having the COME HOME model in place facilitated their experience in renewing their Quality Oncology Practice Initiative (QOPI) certification.

Overall, providers at the sites have had largely positive feedback regarding the COME HOME triage pathways. Though some of them may have been tentative about the utility of the pathways at the beginning, they now feel that they make their workflows more efficient and save a great deal of time for providers and other nurses. One clinic director explained:

> *"The triage system—I don't know why we didn't implement this 20 years ago. It has been great; they triage for all of our offices. And they have made life so much easier, for the nurses especially, since they're not getting all those calls, and they've made it easier on the docs as well."*

- Each site we visited uses different staffing models for triage. A practice's existing staffing model and organizational culture played a role in the design for who carries out the triage pathways. For example, one site used experienced oncology nurses who handled triage full-time; another used oncology nurses, who handled triage while also seeing patients in the clinic; and a third used medical assistants who covered the triage line in addition to other duties.
- Given varying staffing models, the sites vary in the extent to which the triage staff independently implement treatment pathways. The more experienced nurses work most independently, and the triage pathways allow them to work to the top of their licenses. The pathways allow them to make decisions for their patients, such as to have them come into the clinic, without having to ask for permission from a physician first. In contrast, at the site where medical assistants (MAs) fill the triage role, the triage staff are less autonomous when implementing the pathways because they rely on the physician to make decisions, and the physicians do not necessarily follow the suggested pathway.
- While the triage pathways are considered valuable, the proprietary COME HOME triage pathways software used when performing triage does not interact with practices' EHRs. This leads to the time-consuming task of double documenting information from the software into the EHRs at some sites.

There is no set dosage or specific number of contacts associated with program staff; however, dedicated case management staff contact their patients more often and for a longer duration than triage staff and first responders do. IOBS initially proposed to have a nurse educator position as part of the HCIA-funded workforce for the COME HOME model; practices have thus adopted this position of the model to their specific settings.[75]

- One site has patient navigators (with clinical credentials such as LPN), who work with all patients and help to educate them about the COME HOME model.
- Another site hired a case manager to provide more intensive care coordination and management for the practice's Medicare patients.
- Similarly, one site's primary nursing model means that primary nurses fill a case management role by working closely with and managing the care for their particular groups of patients and serve as their de facto case managers, despite the site not having a dedicated case manager position.
- For sites without case management, interactions with patients depend upon their needs and the treatment suggested by the triage pathways.

The regional health care market in some IOBS practices is an important external factor influencing implementation. Two of the practices we visited reported no particular challenges with regard to their local markets and have cooperative relationships with surrounding hospitals and other health care providers. This is not the case for other practices, though—indicating that the local health care market may impact COME HOME practices in some regions more than others. For instance, two practices faced competition and somewhat adversarial relationships with the local hospital systems. One large hospital system in the Northeast favors hospital-owned practices over provider-owned ones; however, leadership

[75] Some of these positions are HCIA-funded and some are not.

for the IOBS program in that region feel that being hospital-owned would not allow them to provide quality care at a reduced price.

Participant Experience

We offer the following findings based on in-person and telephone discussions with 12 participants.

Enhanced Access

The increased focus on triage provides patients with more timely access to the clinic and providers. Before implementation of the triage line, participants often had to leave messages before getting in direct contact with a nurse or provider at their practice. Triage staff now directly address calls in a timely fashion, typically within the same day.

Participants expressed being highly appreciative of enhanced access to care, whether through evening or weekend hours or same day appointments. Rather than waiting until the next day or until Monday morning, patients used this access for both critical and urgent needs as well as for more routine issues such as having consecutive days of medication injections and comforting IV hydrations while in treatment.

> *"I went at least 103 times to oncology: I know that I had 103 appointments from my income taxes, so that gives you a feel for how much I had to go there. … I don't know what I would've done if I hadn't been able to come in for that after care and on the weekends."*

Patients also reported that the triage line helped them feel more confident and secure knowing that their cancer care team would directly address issues in a timely fashion.

> *"I think every time we call [the IOBS practice], I had no sooner put the phone down when I was getting a call back. You get assistance right away. With other doctors, it was always not until after 3:00. And with the home health people, no one knew what your problems were so you had to go through everything. But here it's like everyone knows."*

Improvements in Health Care Utilization

Participants reported positive changes in their health care utilization. One of the goals of the COME HOME model is to reduce unnecessary ED visits. COME HOME practices educate their patients on the program and regularly encourage them to call the practice early so that they can address issues in the clinic as soon as possible rather than waiting for the issue to escalate to an ED visit.

Multiple participants reported situations in which having enhanced access helped them avoid going to the ED. For example, one participant described experiencing issues after a colostomy surgery that he thought would have otherwise driven him to go to the ED, but being able to call and get assistance through clinic staff prevented him from having to do so.

Quantitative Analysis of Program Effectiveness

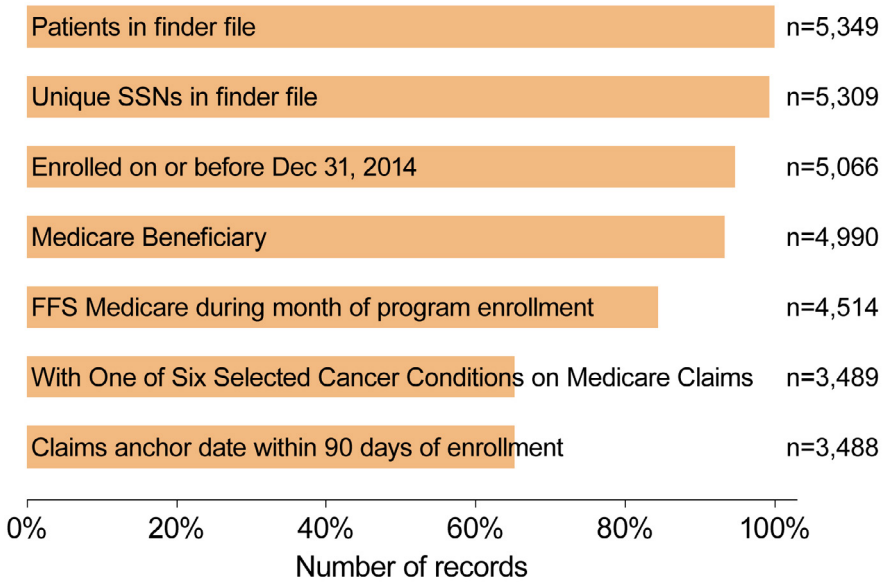
We use difference-in-differences (DID) analyses to evaluate the COME HOME program's impact on core measures: all-cause hospitalizations, hospitalizations for ambulatory care sensitive conditions (ACS), 30-day readmissions, emergency department (ED) visits, and total cost of care.

- We restrict our treatment group to Medicare fee-for-service (FFS) participants enrolled in IOBS' COME HOME program for one or more quarters from October 1, 2012 through December 31, 2014.
- We worked with IOBS' finder file listing participants and enrollment dates to identify FFS Medicare claims for individuals in our treatment group (see Exhibit 9.1). We redefine the "enrollment date" for the treatment group based on a claims anchor date.[76] The anchor date on claims corresponds to utilization of services for cancer treatment. We use anchor dates to ensure that the treatment and comparison groups experience a similar spike in utilization of services for treatment of their cancer at "enrollment" time. Individuals in the treatment group were limited to those with a claims anchor date within 90 days of the program enrollment date listed on the finder file.
- IOBS' program targets adult patients with incident or recurrent cancers of one of the following seven types: breast, colon, lung, thyroid, pancreas, lymphoma, and melanoma. We limited our evaluation of the treatment group to the following six cancer conditions: breast, colon, lung, lymphoma, melanoma, and pancreas. We deemed these six cancer groups to be evaluable since they had more than 100 patients in each group.
- To identify a pool of comparison patients, we select FFS beneficiaries with incident or recurrent cancers in 2013, limited to the six selected cancer conditions, treated at comparison oncology practices in the same Medicare region as one of the seven IOBS sites.[77] As with the treatment group, we define "enrollment date" for the comparison pool patients based on the claims anchor date. Comparison oncology practices are selected using propensity score matching after employing a propensity score model that includes both oncology practice-level characteristics and characteristics of the counties where the practices are located. For more details on our approach to selecting comparison practices for IOBS, please see Technical Appendix A.
- In the evaluation of IOBS' program in this report, we do not examine the variation in the program's treatment effects across the seven program sites, which show variation in program implementation. In future reports, we propose to conduct sensitivity analyses comparing changes in outcomes for IOBS' patients and their matched comparators across the seven program sites.

Limitations. Although we include a matched comparison group in our analysis, results should be interpreted with some caution. The number of patients experiencing an ACS hospitalization is small, limiting our power to detect differences.[78] Similarly, analysis of readmission is limited to patients with an index-hospitalization, reducing the sample size in these models.[79]

[76] We defined claims anchor date as the date when we observe a diagnoses code for one of the selected cancers on inpatient, outpatient, or physician visit claims.
[77] Comparison practices matched to IOBS' seven practice sites include the following: ACC, TX: Central Texas Medical Specialists, TX; Oncopath Laboratory, TX; Northshore Oncology Associate, LA; CCBD, TX: Cancer Care Network of South Texas, TX; Oncology Pharmacy Services, TX; DPHY, OH: IHA Health Services Corporation, MI; Cancer Care Associates PC, MI; MMCM, ME: Oncology Associates, P.C., CT; Berkshire Hematology Oncology, MA; Commonwealth Hematology-Oncology, P.C., MA; NGOC, GA: Integrated Community Oncology Network, FL; Greater Florida Emergency Group, FL; Peachtree Hematology Oncology Consultants, GA; NMOC, NM; Cancer Centers of Southwest Oklahoma, OK; Texas Oncology PA, TX; SCCC, FL: Watson Clinic, FL; Mayo Clinic Florida, FL; Cancer Centers of North Carolina, NC
[78] An average of 15 patients are hospitalized for an ambulatory care sensitive condition each quarter.
[79] In each quarter, 263 IOBS patients, on average, are admitted to a hospital and of those 48 experience a readmission.

Exhibit 9.1: IOBS Patients Identified through Finder File



Comparison group selection. We use propensity score models to match intervention to comparison patients on demographics, comorbidities, and prior utilization. For more details on comparison selection and matching, see Technical Appendix A. Exhibit 9.2 summarizes the results from our propensity score matching. The left panel shows the common support after propensity score matching, and the right panel displays the covariate balance before and after matching.

- After matching, we observe the two groups have nearly identical distributions of propensity scores, suggesting that—at least on the factors included in the propensity model—these groups are well matched.
- On the balance chart, we show matching has achieved balance (reduced the difference between IOBS participants and comparison group) on demographic, comorbidity, and prior-year costs.
- Given the paucity of information on severity of cancer in claims, we use four variables as proxies for cancer severity in our propensity score model: metastatic cancer, surgery for cancer, chemotherapy for cancer, and radiation therapy for cancer. It is important to include these treatment modality variables (surgery, chemotherapy and radiation therapy for cancer) in the propensity score models to adjust for observable differences in cancer severity between the treatment and comparison groups. We test the sensitivity of our propensity score matching results for IOBS—after excluding the variables for cancer surgery, chemotherapy, and radiation therapy—to assess whether the impact of IOBS's program is mediated through these modes of cancer treatment.

Exhibit 9.2: IOBS Common Support and Covariate Balance for IOBS and Comparison Patients

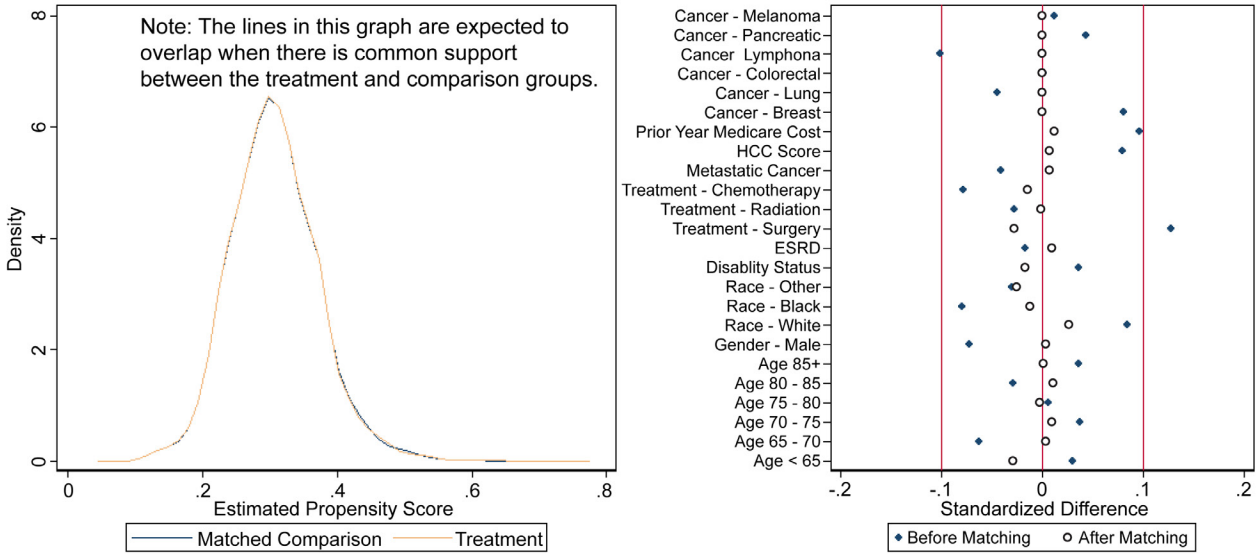


Exhibit 9.3 presents demographic and other basic information about treatment and matched comparison patients included in our analysis of core outcome measures. Because the comparison group is matched to the IOBS intervention group, we observe few differences on demographics, comorbidity, and prior health care utilization. We observe significantly higher rates of ED use prior to enrollment for IOBS participants and significantly higher rate of hospitalization prior to enrollment for the comparison group. We include these two variables in our outcome models to control for any remaining confounding after matching.

Exhibit 9.3: IOBS Descriptive Characteristics of IOBS and Matched Comparison Patients

Variable	IOBS Treatment Group	Matched Comparison Group
Number of Beneficiaries	3,488	3,488
Mean No. of Quarters Enrolled	3.97 [1–7]	4.00 [1–7]
Cancer Type		
Breast	42.3% (1,476)	42.3% (1,476)
Colorectal	13.2% (461)	13.2% (461)
Lung	25.6% (894)	25.6% (894)
Lymphoma	9.5% (331)	9.5% (331)
Melanoma	3.9% (136)	3.9% (136)
Pancreatic	5.5% (190)	5.5% (190)
Cancer Treatment		
Cancer surgery	48.4% (1,688)	49.8% (1,737)
Cancer radiation	31.9% (1,112)	32.0% (1,115)
Cancer chemotherapy	58.1% (2,026)	58.8% (2,051)

Variable	IOBS Treatment Group	Matched Comparison Group
Cancer Severity		
Metastatic Cancer	33.4% (1,166)	33.1% (1,154)
Age Group		
<65 years old	9.3% (324)	10.1% (353)
65–69 years old	25.4% (887)	25.2% (881)
70–74 years old	24.2% (843)	23.8% (829)
75–79 years old	18.8% (655)	18.9% (659)
80–84 years old	12.3% (429)	12.0% (417)
≥85 years old	10.0% (350)	10.0% (349)
Race/Ethnicity		
White	90.0% (3,138)	89.1% (3,109)
Black	5.9% (207)	6.2% (218)
Hispanic ***	1.1% (38)	2.2% (75)
Other	3.0% (105)	2.5% (86)
Gender		
Female	69.1% (2,410)	69.2% (2,415)
Comorbidity: Hierarchical Condition Categories (HCCs)		
Mean Count of HCCs (SD)	2.61 (2.29)	2.62 (2.39)
Mean HCC Score (SD)	1.69 (1.43)	1.68 (1.45)
Disability and ESRD		
Disability	16.5% (577)	17.1% (598)
ESRD	0.3% (10)	0.2% (8)
Dual Status		
Dually eligible	15.7% (547)	14.1% (491)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	17,101 (22,216)	16,844 (21,548)
Hospitalizations per 1,000 (SD)**	509 (900)	559 (914)
ED Visits per 1,000 (SD) **	836 (1,876)	687 (1,486)

Statistical significance was assessed using Chi-square for categorical variables and t-tests for continuous variables.
*** p<0.01, ** p<0.05, * p<0.1

For each core measure, we pose the following research question:

- Are there differences in core measures between IOBS patients after enrollment in the COME HOME program and comparison patients, after adjusting for differences in secular trends and risk factors across both groups?

To answer this question we use a summative DID model that assesses the impact of the IOBS COME HOME intervention over the entire post-intervention period. For details on specifications of this model, refer to Technical Appendix A.[80]

Summative DID results. Exhibit 9.4 presents the results of the summative DID models assessing the impact of IOBS' program across the entire post-intervention period. The primary parameter of interest is the DID estimator (the final column) showing the difference in average outcome between IOBS and the comparison group after intervention enrollment minus the difference in average outcomes between the two groups before intervention enrollment. In the summative DID model we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.

- We observe significant reduction in ED visits of 9 patients per 1,000 for the COME HOME Program relative to the comparison group.
- We observe significant reduction in 30-day readmissions of 35 patients per 1,000 for the COME HOME program relative to the comparison group.[81]
- For all hospitalization and total cost of care, we observe reductions that are smaller and non-significant for the COME HOME program relative to the comparison group.

Exhibit 9.4: IOBS Difference-in-Differences Estimates for Core Measures‡

Pre-Intervention Period			Post-Intervention Period			DIFFERENCE IN DIFFERENCES [95% CI]
Comparison (N=3,488)	Intervention (N=3,488)	DIFFERENCE [95% CI]	Comparison (N=3,488)	Intervention (N=3,488)	DIFFERENCE [95% CI]	
Hospitalizations per 1,000 Patients						
88	82	-6 [-11, -0.4] **	150	138	-12 [-20, -4] ***	-6 [-16, 3]
ED Visit per 1,000 Patients						
106	123	17 [10, 24] ***	153	161	8 [-2, 17]	-9 [-19, 0.3]*
30-day Readmissions per 1,000 Patients Hospitalized						
180	184	4 [-20, 27]	203	172	-31 [-55, -6] **	-35 [-67, -2] **
ACS Hospitalization per 1,000 Patients						
13	12	-1 [-3, 1]	21	20	-1 [-4, 3]	0.1 [-4, 4]
Total Cost of Care per Patient ($)						
$3,268	$3,407	$139 [-$22, $299]	$9,399	$9,366	-$33 [-$520, $454]	-$172 [-$681, $338]

Inference: *** p<0.01; ** p<0.05; * p<0.1 ‡Model-based estimates for cost estimated using population-averaged longitudinal models with log link and gamma distribution. Binary measures estimated using population-averaged longitudinal logit models.

[80] All models are adjusted for: age, race, ethnicity, gender, HCC score, presence of targeted cancer conditions, mode of cancer treatment (surgery, chemotherapy, and radiation therapy), metastatic cancer, and year of enrollment.
[81] Sample size in models for readmissions is smaller than other outcomes because readmissions models are limited to patients who had at least one index-hospitalization.

- In Technical Appendix C, we compare the results presented below with results from our sensitivity analyses for IOBS where we (1) do not match or adjust for mode of cancer treatment, and (2) use the enrollment date on the finder file for the treatment group instead of the enrollment date defined by claims. Our results for program effectiveness shift in favor of IOBS for hospitalizations, ED visits, ACS hospitalizations, and total cost of care when we do not match or adjust for differences in severity of cancer between the treatment and comparison group, using mode of cancer treatment as proxy.
- Our results for program effectiveness shift against IOBS for hospitalizations, ED visits, and total cost of care when we use the finder file based enrollment date instead of a claims-based enrollment date.

Sustainability

The ultimate vision for IOBS and the COME HOME model is to have a value-based payment system that provides bundled payments for the oncology medical home model that the COME HOME practices have established and refined through this program. This is a longer-term goal that is dependent upon health care policy reform and payer engagement. In the short term, the COME HOME practices intend to continue as oncology medical homes, though how much they will be continuing the specific components of the COME HOME program will vary.

The degree to which COME HOME practices will sustain enhanced access to care through extended evening and weekend hours is largely dependent on financial capabilities. Even at one site committed to keeping weekend hours, there a concern about financing staff beyond those needed for supportive care, such as more nursing staff, and potentially pharmacy and lab staff as well.

Practices may vary in their continued use of the COME HOME triage pathways after the award period ends. Based on our Round 2 site visits, COME HOME practices will continue to focus on triage, though they have not yet determined whether they will continue to use the COME HOME triage pathways or its proprietary software. IOBS hopes to continue providing the COME HOME triage pathways software system to these practices at a reasonable cost, and potentially to other practices in the future, too, but has not yet finalized details about doing so.

Private payers may provide a path for sustainability moving forward. A few of the COME HOME practices have begun participating in bundled payment pilots with private payers. For example, two sites are participating in a pilot project with UnitedHealthcare in which the practices received a capitated payment and created pathways to help reduce costs related to prescription drugs. These sites are also participating in a pilot shared savings program with Aetna to incentivize the practices to reduce costs and increase population management. IOBS is seeking to get involved in additional pilot programs. Its plan is to meet with top payers and with top self-insured employers in multiple markets to discuss the COME HOME model and outcomes data and to create bundled payment contracts that include data sharing from the payer claims database.

Policy reform and the CMS Oncology Care Model (OCM) may prove to be another approach for sustainability. CMS has initiated OCM as a new payment model for physician practices administering chemotherapy. Practices will enter into payment arrangements with Medicare, Medicaid, and other payers that include financial and performance accountability for episodes of care in order to provide higher-quality, more coordinated, and lower-cost oncology care. Multiple practices expressed that they are

applying and intending to participate in this model as a way to sustain their programs. However, leadership at these practices feel that they will not perform well in OCM, as benchmarks are being set specific to the practice rather than to the local market, and the COME HOME practices are already efficiently providing quality care relative to the broader market.

Conclusion

IOBS's COME HOME model was developed to provide comprehensive outpatient oncology care through three mechanisms: (1) triage pathways, (2) enhanced access, and (3) treatment pathways. Through site visit discussions and observations, we find evidence suggesting the triage function to be extremely valuable and patients greatly appreciate weekend hours and increased capacity for urgent care visits during the day. We also find evidence of statistically significant reduction in 30-day readmissions for participants across the entire post-intervention period relative to a matched comparison group. We also observe the program reducing total cost of care and utilization for its participants in multiple post-intervention quarters relative to the comparison group, though these reductions are small and non-significant. As the Innovation Award ends, most IOBS sites intend to continue as oncology medical homes but will not sustain all elements of the program.

Joslin Diabetes Center, Inc.

Joslin Diabetes Center, Inc. is a diabetes research and clinical care organization affiliated with the Harvard Medical School in Boston, Massachusetts. The center focuses on diabetes research, clinical care, education, and awareness. With HCIA funding, Joslin is implementing its community-based health education program, On the Road (OTR), in partnership with three sites: New Mexico State University (NM), Pennsylvania State University's Cooperative Extension Offices (PA), and Providence Hospital in Washington, DC (DC).

This chapter presents evaluation findings based upon a review of the awardee's quarterly reports as well as telephone interviews with OTR leadership, two rounds of site visits, and analysis of awardee-provided data.[82] Over two rounds of data collection, we visited all three partnering sites.

Program Title	**On the Road (OTR)**		
Intervention Summary	The OTR program uses trained community health advocates (CHAs) to deliver Joslin's established, community-based series of screening and health information classes to improve key biomarkers and engage participants with the health care system.[83] The focus of the classes is on key diabetes information and tests, nutrition, and exercise.		
Targeted Disease/Condition	Diabetes, pre-diabetes		
Total Amount Awarded*	$4,967,276	**Award Amount Spent***	$3,713,086
Number of Sites	3	**Locations by State**	DC, PA, NM
Cumulative Reach*	5,100		
Intervention Workforce	Approximately 20 lay health workers and 12 staff with clinical training (nurses or registered dieticians)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings suggest that program participants show more engagement with the health care system and improved health habits upon completion of the program. Participants with diabetes also show improvements in understanding the disease and important measures of diabetes control.
- Quantitative analyses show improvements in measures of health habits, engagement, and diabetes management on par with similar diabetes interventions.

Implementation Experience

Joslin used the Innovation Award to continue its OTR program (established in 2000) in partnership with New Mexico State University and Pennsylvania State University cooperative extension offices and to

[82] In our first round of site visits, we visited all three awardee sites (Providence Hospital, Pennsylvania State University, and New Mexico State University) and interviewed OTR program leadership over the phone. For our second round of site visits, we visited one out of the three OTR sites (Providence Hospital) and interviewed OTR leadership over the phone.

[83] "Community health advocates" is the workforce title used by the Joslin Diabetes Center since its instructors are not required to obtain a third-party certification. However, each site has a different title for its instructors. In Pennsylvania, they are called "Extension Educators;" in New Mexico, they are called "*Promotoras*" or "Ben Archer Educators;" and in DC, they are called "Community Health Workers (CHWs)."

implement the program in partnership with Providence Hospital in Washington, DC. Because Joslin provides sites with implementation discretion and sites have varying resources and target populations, each site has unique staffing models and approaches to the OTR curriculum. Joslin leadership attributes implementation success to this model. The site-specific implementation approaches and their effectiveness are detailed in the paragraphs below.

Recruitment incentive payments for instructors, targeted marketing, and instructors who have strong relationships with the target population help recruitment success. Each site developed a recruitment approach that works best for its staffing model and/or target population. The NM site incentivizes *promotoras* to recruit participants through payment; the PA site submits advertisements to local newspapers that the target population reads; and the DC site's recruitment efforts improved after the **community health workers** strengthened their relationships with communities.

- **Instructors across all three sites reported significant burden recruiting participants and finding reliable sites to conduct classes.** Meeting participants "close to home" often means working with sites that have limited space or resources, and sometimes the convenience of the location draws participants who are not committed to remaining with the program beyond the first session.
- The site that has staff with the strongest ties to the target population also has the highest retention rate. The NM site's *promotoras* have strong and ongoing relationships with the participants and the communities they serve, which may drive higher attendance.

The simplicity of the curriculum facilitates replicability, but some participants request more complex information or more sessions. Staff report that some participants feel the curriculum is too basic given their existing self-management activities. As the program manager said:

> *"[When] you get to these classes if you're the only person there helping these people, they will ask you anything and everything. So we try to just stay abreast on, like, a lot of issues or just healthy things that we can at least answer because if you go there and say 'I don't know—ask your doctor, don't ask me' you kind of turn them off because they're going to be like, 'well why am I here if you can't answer my questions?' So [CHAs] having a health background is very, very important to me."*

The PA site's clinically-licensed staff (i.e., nutritionists and dieticians) provide more detailed nutrition information to participants than the non-clinical staff at other sites. PA site participants were receptive to supplemental nutrition information and cooking demonstrations these staff were qualified to provide. Some participants at the DC site would like clinical staff to be available during OTR sessions to answer questions instead of having to wait for follow up with their doctors.

The NM and PA sites' organizational resources and prior experience implementing OTR facilitated program implementation. Both sites had been implementing previous iterations of OTR for over ten years before the Innovation Award. Pennsylvania State University's Extension Office mobilized its existing resources, partnerships, and internal expertise to expand the curriculum of OTR. NM's relationship with Ben Archer Health Centers allows them to implement OTR in health centers in and around Las Cruces without additional instructor staffing costs.

OTR did not bring many new patients to the new hospital-based Joslin diabetes outpatient clinic (as had been anticipated) at the DC site. While the site reached their target population of individuals at risk for diabetes or with diabetes, they found that most DC OTR participants already had a primary care provider and were uninterested in changing to a new provider at Providence Hospital. The hospital continues to support the program because it increases access to diabetes education and increases general visibility of the hospital. The program manager said:

> *"I think Providence benefits from [OTR] because we don't have too many of those programs. Like we have a wellness institute, but they don't go out into these places like we do, and you see it all the time: we go to these places, and people are so very grateful that we come to them to do this type of class."*

Although instructors provide resource guides to participants, instructors do not have the capacity to support all of their participants' social needs. For example, instructors reported they are unable to address participants' lack of access to or inability to afford healthy food. The contextual factors that affect their participants' health lead some staff to question whether the program had the capacity for long-term impact on participants.

Participant Experience

We offer the following based on focus groups and telephone interviews with 49 participants

Improvements in Quality of Life
Participants in all focus groups shared that OTR helped improve their quality of life and overall health. Participants found the focus of the program—the five key diabetes tests and "knowing your numbers"—to be very beneficial. Some participants did not know about the hemoglobin A1C (A1C) test until they enrolled in OTR. Additionally, participants across sites shared ways that their involvement in the classes helped people in their family or community.
Behavioral Changes
After the program's two scheduled classes, nine out of ten participants interviewed from one NM site reported thinking more actively about their choices regarding nutrition and exercise and trying to keep the lessons in mind when shopping and cooking. These participants also mentioned that they use the diabetes cookbooks to make healthier meals for their families. PA site participants reported similar improvements: they think more actively about nutrition and use the OTR incentives (e.g., cookbooks) to make healthy choices. Participants also reported that as a result of the program, they started exercising. One participant explained that she was often told to exercise but did not get active because she did not know specific exercises. She said, *"This class took the guesswork out of getting active."* One participant in PA lost 100 pounds, and she believes her weight loss would not have been possible without the exercise DVD and literature she received from OTR. Participants living in the same complex in DC reported that they started a walking group. While participants generally liked the intervention and believed they received beneficial educational information, many also noted the challenges associated with initiating and sustaining changes to diet and lifestyle. While providing support beyond the OTR sessions was not a formal part of the program, OTR instructors at the DC site developed a manual for participants with information about resources in the community (e.g., support groups) and in some cases followed up with participants by phone if their A1C was higher than 7.
Improvements in Quality of Care
Participants from all three sites report they are able to take a more active role in conversations with their doctors since taking OTR classes. Many participants who had never heard of A1C asked their primary care physician about it or intended to ask about it at their next visit since joining the program. A NM participant said that she understands her physician better after completing the program. Additionally, one participant from the DC site did not know that diabetes can cause kidney problems and said that she intends to ask her primary care physician about those complications.

Quantitative Analysis of Program Effectiveness

To evaluate the Joslin program we use data collected by the Joslin team. Participants complete a survey and program staff measure their blood pressure and A1C at the first session and three to six months later at the final session or a follow-up session. In this report, we examine change in outcome variables from the awardee data (see Exhibit 10.1).

Limitations. The results below may not be representative of the entire population that Joslin served, as we found significant differences between individuals who attend follow up appointments and those who do not. There may be self-reporting bias in the questionnaire data; we are unable to verify food consumption, amount of exercise and length of sleep. A further limitation to the evaluation of this awardee is lack of claims data, which would increase the robustness of this evaluation.

Exhibit 10.1: Joslin Overview of Data and Measures

Outcome Measures	Description of Scale	Link to CMMI Core Measures
Population Measures	Exercising 20 minutes or more	Engagement with the health care system and improved health habits may have some downstream preventive impact on hospitalizations and emergency department visits and lower health care costs.
	Eating a variety of fruits and vegetables	
	Sleeping between 6.5 and 8.5 hours at night	
	Making an appointment to see a provider	
Diabetes Measures	I'm confident that I can keep my diabetes under control.	Confidence and understanding in managing one's diabetes may reduce the likelihood of hospitalization, rehospitalization, or ED visits from acute complications such as hypoglycemia.
	How well do you think you could explain your A1C result to someone else?	
	Was A1C less than 7.5%?	Control of A1C and blood pressure may slow or prevent the progression of diabetes complications that are associated with increased health care utilization and cost.
	Was blood pressure systolic less than 140 AND diastolic less than 90?	

Joslin provided a dataset containing 4,599 participants enrolled in their OTR program and, of these, 2,827 (61%) completed follow-up surveys.[84] Exhibit 10.2 presents demographic and other characteristics of Joslin program participants.

- Overall, participants were predominantly female. Roughly, half of participants were elderly, reported non-white race/ethnicity, and had fair or poor self-rated health. Participants were of lower socioeconomic status and with a majority having incomes below $25,000 per year; one in five participants did not complete a high school degree or equivalent.

[84] Joslin enrolled 5,100 participants. At the time of this analysis, we did not have the final dataset with all participants thus our sample size is smaller.

- Despite targeting persons with diabetes for their intervention, approximately 40 percent of participants do not have diabetes—with half of these being persons classified as having "pre-diabetes." [85]
- Participants who complete a follow-up visit are significantly different from the overall population. They are more likely to be over 65, white, have Medicare insurance, and have diabetes.

Exhibit 10.2: Joslin Descriptive Characteristics of Participants

	All Participants (n=4,599 enrolled) % (n)	Participants with Follow-up (n=2,827 enrolled and completed follow-up session) % (n)	p-value for Difference Between Follow-up and Non-follow-up
Gender			
Female	73.4% (3374)	73.8% (2087)	0.0018
Age			
12-18 years	0.3% (12)	0.2% (6)	<0.0001
19-25 years	2.6% (120)	2.6% (68)	
26-64 years	40.8% (1875)	37.4% (1057)	
65-74 years	31.3% (1440)	35.5% (1003)	
>75 years	21.4% (982)	22.3% (629)	
Unknown	3.7% (170)	2.3% (64)	
Race/Ethnicity			
White	46.3% (2127)	53.4% (1509)	<0.0001
Black	25.4% (1167)	20.6% (581)	
Native American/Alaska Native	0.8% (38)	0.8% (22)	
Asian	0.4% (18)	0.3% (8)	
Hispanic	21.8% (999)	21.2% (598)	
Other	1.1% (50)	0.9% (24)	
Multi	1.7% (79)	1.2% (34)	
Unknown	2.5% (113)	1.8% (51)	
Insurance Status			
Medicare (Fee for Service)	26.5% (1216)	30.2% (855)	<0.0001
Medicare (Advantage)	13.5% (618)	14.6% (413)	
Medicaid	13.3% (612)	12.6% (356)	
Private	16.6% (760)	15.7% (443)	
None	13.5% (620)	12.2% (345)	
Health Status			
Fair or poor self-rated health	44.6% (2050)	43.1% (1218)	0.0006
Diabetes Status			
Diabetes	55.9% (2570)	58.3% (1648)	0.0002
Pre-Diabetes	20.3% (932)	19.2% (544)	
Socioeconomic			
Income less than $25,000	52.1% (2394)	52.1% (1474)	0.8837
Less than high school grad/ GED	18.9% (869)	19.0% (536)	0.8876

[85] Diabetes defined as responding *yes* to the question "Do you have diabetes" or reporting using diabetes medications. Participants classified as pre-diabetes did not meet the criteria for diabetes but did have a measured A1C between 5.7 and 6.4.

Exhibit 10.3 presents the percentage of participants with improvement in key outcomes between baseline and follow-up measurement.

- One of the OTR's stated goals is to re-engage participants in the health care system by encouraging them to make an appointment with a health care provider. In the full population, just over two-thirds of participants completing follow-up made an appointment with a health care provider.
- On measures of health habits (e.g., exercising, sleeping, and eating) 30 to 40 percent of Joslin participants reported improvements after attending the diabetes education classes. Another patient education intervention showed a similar increase in the average number of days participants report engaging in these health habits.[86]
- Fourteen percent of participants with diabetes note improvement in understanding A1C and about 23 percent noted improved confidence in managing their diabetes.
- For participants with diabetes with baseline clinical lab values for A1C and blood pressure outside the recommended range, 35 percent were able reduce their A1C and 41 percent were able to reduce their blood pressure to recommended values.[87] The absolute reduction in A1C and blood pressure for Joslin participants is similar to reductions observed in other diabetes education interventions.[88]

Exhibit 10.3: Joslin Improvement in Program Outcomes for Participants

Program Outcomes	% Participants Improvement at Follow-up
All Participants with Follow-up (n=2,827)	
% with improvement in number of days…	
… exercising 20 minutes or more	41.9%
… eating variety of fruits and vegetables	37.1%
… sleeping between 6.5 and 8.5 hours at night	29.6%
% made an appointment to see a healthcare provider since start of program	67.7%
Participants with Diabetes with Follow-up (n=1,741)	
% with improvement in confidence managing diabetes	22.8%
% with improvement in understanding Hemoglobin A1C	14.3%
Participants with Diabetes with Lab Values Not Under Control at Baseline	
% of participants with diabetes with baseline Hemoglobin A1C >8.0% (n=301) who finished the program with A1C<8.0%	34.9%
% of participants with diabetes with baseline systolic blood pressure >140 and diastolic >90 (n=137) who finished the program with blood pressure <140 and diastolic <90	40.9%

[86] Peek ME, Harmon SA, Scott SJ, et al. Culturally tailoring patient education and communication skills training to empower African Americans with diabetes. TBM. 2012; 2:296-308
[87] Minnesota Community Measurement. The D5 for Diabetes. http://mncm.org/reports-and-websites/the-d5/
[88] Peek, Monica E., Abigail E. Wilkes, Tonya S. Roberson, Anna P. Goddu, Robert S. Nocon, Hui Tang, Michael T. Quinn, Kristine K. Bordenave, Elbert S. Huang, and Marshall H. Chin. "Early lessons from an initiative on Chicago's South Side to reduce disparities in diabetes care and outcomes." *Health Affairs*, 31, no. 1 (2012): 177-186.

To understand what subgroups of participants are more or less likely to benefit from participation in the Joslin program, we model the odds of improvement from baseline to follow-up for each outcome using multivariate logistic regression.[89] In Exhibit 10.4 we show factors associated with improved healthy habits for the whole participant population. Improvements in diabetes control among participants with diabetes are shown in Exhibit 10.5.

The tables display odds ratios for the listed group relative to the reference group, controlling for all other covariates listed. Odds ratios greater than one are **bolded** and reflect higher likelihood of improvement relative to the reference group. We observe a number of trends from these analyses for the entire population (see Exhibit 10.4):

- For the overall population, the program seemed to be less effective (i.e., lower odds of improvement) for improving the health habits of elderly participants and those with Medicare. The program appeared to be more effective for participants in fair or poor (as opposed to good) self-rated health as well as those with incomes less than $50,000.
- We did not consistently find that lower program exposure (attending one or two sessions as opposed to three) was associated with worse program outcomes, which may indicate a shorter program can be sufficient for changing behavior for some participants.
- For most healthy habits, participants from the New Mexico site were more likely to report improvements compared to the PA and DC sites.
- We observed that males were less likely than females to have made an appointment with a health care provider, and those with more education were more likely than participants with less than a high school degree to have made an appointment.

[89] Each outcome was modeled as a function of all of the independent variables shown in table rows and standard errors for adjusted for the clustering of participants by state

Exhibit 10.4: Joslin Factors Associated with Improved Outcomes – Measures of Health Habits in the Overall Population

Program Outcomes	Exercise 20 Minutes or More	Eat Fruits and Vegetables	Sleeping 6.5 to 8.5 Hours	Made Healthcare Appointment
Gender (ref=female)				
Male	0.72 (0.61, 0.85)	1.09 (0.95, 1.26)	0.99 (0.80, 1.23)	0.70 (0.56, 0.87)
Age (ref=adult 26–64)				
12–25 years	0.66 (0.52, 0.84)	0.80 (0.54, 1.20)	1.18 (1.00, 1.39)	1.03 (0.94, 1.13)
65–74 years	0.97 (0.72, 1.30)	0.70 (0.62, 0.78)	0.97 (0.83, 1.14)	1.17 (0.90, 1.51)
75+ years	0.90 (0.84, 0.96)	0.66 (0.60, 0.72)	0.84 (0.74, 0.96)	1.00 (0.91, 1.11)
Race/Ethnicity (ref=White/Caucasian)				
Hispanic	1.08 (0.88, 1.33)	0.85 (0.57, 1.26)	0.75 (0.62, 0.92)	1.02 (0.82, 1.27)
Black	0.95 (0.89, 1.02)	0.90 (0.62, 1.31)	0.86 (0.47, 1.58)	1.00 (0.84, 1.19)
Other/unknown	0.82 (0.61, 1.10)	0.85 (0.80, 0.91)	1.17 (0.95, 1.46)	0.59 (0.47, 0.76)
Insurance Type (ref=private)				
Medicare FFS	0.84 (0.73, 0.97)	0.88 (0.74, 1.04)	0.78 (0.77, 0.80)	1.20 (0.98, 1.47)
Medicare Advantage	0.83 (0.72, 0.96)	0.90 (0.80, 1.02)	0.78 (0.70, 0.86)	1.41 (0.99, 2.00)
Medicaid	1.03 (0.78, 1.37)	0.93 (0.73, 1.19)	1.07 (0.79, 1.45)	1.34 (0.94, 1.90)
Dual Eligible	0.74 (0.61, 0.91)	1.01 (0.58, 1.76)	0.96 (0.74, 1.24)	**1.29 (1.15, 1.44)**
No Insurance	0.95 (0.77, 1.17)	**1.24 (1.02, 1.51)**	**1.31 (1.07, 1.60)**	0.41 (0.31, 0.55)
Diabetes (ref=no indication of diabetes)				
Diabetes	0.96 (0.93, 1.00)	1.05 (0.88, 1.24)	0.86 (0.77, 0.97)	**3.44 (2.68, 4.42)**
Pre-Diabetes	0.94 (0.91, 0.98)	1.07 (0.86, 1.35)	1.02 (0.77, 1.35)	**1.51 (1.30, 1.76)**
Health Status (ref=Good)				
Fair or poor	**1.33 (1.13, 1.57)**	1.03 (0.87, 1.23)	**1.40 (1.24, 1.58)**	1.39 (1.29, 1.50)
Income (ref=Greater than $50,000)				
less than 15k	1.18 (0.96, 1.45)	**1.50 (1.27, 1.78)**	**1.28 (1.20, 1.36)**	1.15 (0.93, 1.41)
$15–$24.9k	1.21 (0.86, 1.69)	**1.29 (1.23, 1.35)**	0.98 (0.79, 1.21)	1.12 (0.97, 1.29)
$25–$49.9k	**1.34 (1.18, 1.52)**	**1.27 (1.20, 1.34)**	1.12 (1.00, 1.25)	**1.31 (1.12, 1.54)**
Education (ref = < HS Graduate)				
HS grad or GED	**1.34 (1.21, 1.49)**	1.06 (0.87, 1.30)	1.12 (0.88, 1.43)	**1.10 (1.03, 1.18)**
Some college or trade	1.09 (0.95, 1.24)	0.79 (0.73, 0.85)	1.11 (0.93, 1.32)	**1.35 (1.15, 1.58)**
College grad or higher	**1.34 (1.20, 1.50)**	0.77 (0.70, 0.85)	1.04 (0.88, 1.22)	**1.37 (1.24, 1.51)**
Program Exposure (ref=3 or more sessions attended)				
One session	**1.39 (1.31, 1.47)**	1.21 (0.94, 1.56)	**1.53 (1.16, 2.01)**	0.77 (0.74, 0.80)
Two sessions	0.80 (0.74, 0.87)	0.94 (0.80, 1.12)	1.11 (0.86, 1.43)	0.89 (0.75, 1.05)
State (ref=Pennsylvania)				
New Mexico	**1.74 (1.44, 2.09)**	1.58 (0.90, 2.77)	**1.34 (1.17, 1.52)**	1.14 (0.67, 1.94)
Washington DC	0.86 (0.82, 0.91)	1.01 (0.84, 1.21)	1.29 (0.81, 2.05)	0.92 (0.78, 1.10)

Exhibit 10.5 is limited to participants with diabetes for two measures: confidence controlling diabetes and understanding A1C. On measures assessing clinical lab values, we limit analyses to those participants whose lab values were outside of the recommended range for those tests at baseline. Trends include:

- Participants who are black, have Medicaid, or incomes less than $50,000 are more likely to see improvement over the course of the program;
- In terms of program site variation, even after controlling for demographics and program exposure, the NM and DC participants are far less likely to see improvement in diabetes outcomes compared to PA participants;
- Participants whose highest level of education is a high school diploma or GED were more likely to get their blood pressure under control compared to those with greater educational attainment.

Exhibit 10.5: Joslin Factors Associated with Improved Outcomes – Diabetes-Specific Measures

Program Outcomes	Confident Controlling Diabetes (n=1,741)	Understand A1C (n=1,741)	From BP over Target to under Target (n=151)	From A1C over Target to under Target (n=335)
Gender (ref=female)				
Male	**1.37 (1.11, 1.68)**	0.99 (0.89, 1.10)	1.24 (0.44, 3.52)	0.64 (0.45, 0.90)
Age (ref=adult 26-64)				
12–25 years	1.16 (0.39, 3.49)	2.27 (0.81, 6.38)	No Est	No Est
65–74 years	1.27 (0.87, 1.86)	**1.32 (1.20, 1.45)**	0.50 (0.32, 0.78)	No Est
75+ years	**1.44 (1.08, 1.92)**	**1.15 (1.07, 1.24)**	0.37 (0.30, 0.45)	No Est
Race/Ethnicity (ref=White/Caucasian)				
Hispanic	1.09 (0.73, 1.64)	0.29 (0.27, 0.31)	1.01 (0.39, 2.64)	2.27 (0.94, 5.45)
Black	1.07 (0.59, 1.92)	1.72 (1.31, 2.26)	**1.10 (1.03, 1.18)**	**2.66 (1.74, 4.07)**
Other/unknown	0.81 (0.32, 2.09)	2.26 (1.70, 3.00)	0.34 (0.17, 0.69)	1.32 (0.11, 15.44)
Insurance Type (ref=private)				
Medicare FFS	0.92 (0.55, 1.53)	0.98 (0.73, 1.32)	2.68 (0.83, 8.58)	0.59 (0.38, 0.93)
Medicare Advantage	0.80 (0.54, 1.18)	1.11 (0.88, 1.40)	1.79 (0.70, 4.56)	0.49 (0.18, 1.35)
Medicaid	1.02 (0.74, 1.41)	**1.37 (1.08, 1.73)**	**2.80 (1.90, 4.13)**	0.66 (0.19, 2.31)
Dual Eligible	0.69 (0.26, 1.81)	1.18 (0.99, 1.41)	**6.07 (3.71, 9.94)**	1.15 (0.35, 3.84)
No Insurance	0.76 (0.28, 2.05)	0.45 (0.05, 3.86)	3.52 (0.47, 26.18)	0.46 (0.28, 0.74)
Health Status (ref=Good)				
Fair or poor	1.01 (0.83, 1.22)	0.97 (0.91, 1.02)	No Est	1.70 (0.99, 2.94)
Income (ref=Greater than $50,000)				
less than 15k	1.04 (0.63, 1.73)	**2.22 (1.55, 3.17)**	1.76 (0.83, 3.72)	0.96 (0.47, 1.97)
$15–$24.9k	0.96 (0.74, 1.24)	**2.20 (2.13, 2.28)**	1.30 (0.91, 1.86)	1.11 (0.90, 1.36)
$25–$49.9k	0.80 (0.62, 1.03)	**1.63 (1.43, 1.86)**	**1.25 (1.03, 1.52)**	**1.16 (1.07, 1.25)**
Education (ref = < HS Graduate)				
HS grad or GED	1.02 (0.74, 1.40)	0.97 (0.85, 1.12)	0.70 (0.21, 2.32)	**1.73 (1.04, 2.90)**
Some college or trade	0.84 (0.61, 1.16)	0.83 (0.69, 1.00)	0.38 (0.25, 0.58)	1.35 (0.64, 2.87)
College grad or higher	0.66 (0.43, 1.01)	0.79 (0.52, 1.21)	0.33 (0.24, 0.46)	**1.46 (1.03, 2.07)**
Program Exposure (ref=3 or more sessions attended)				
One session	**1.45 (1.03, 2.04)**	**1.59 (1.10, 2.30)**	No Est	2.53 (0.67, 9.54)
Two sessions	1.37 (0.92, 2.05)	1.16 (0.81, 1.67)	No Est	2.01 (0.61, 6.59)
State (ref=Pennsylvania)				
New Mexico	**1.18 (1.02, 1.37)**	0.56 (0.47, 0.67)	0.19 (0.07, 0.51)	0.30 (0.12, 0.77)
Washington DC	1.19 (0.64, 2.20)	0.54 (0.38, 0.78)	0.58 (0.41, 0.81)	0.56 (0.50, 0.62)

Sustainability

Joslin leadership is working to establish partnerships and earn accreditations that will support sustainability and spread. Joslin leadership is in the process of partnering with additional organizations that either (1) employ staff (e.g., community health workers) who have the capacity to implement the program as a curriculum or (2) write grants for programs that could include OTR. Providence Hospital is in the process of developing a plan to keep its CHAs for OTR and/or other outreach and education initiatives. The NM site will likely sustain the program through United States Department of Agriculture grant funding.

Joslin intends to seek accreditation for OTR from the American Diabetes Association (ADA) and the American Association of Diabetes Educators (AADE) in order to qualify for Medicaid and Medicare reimbursement as a disease self-management or training program. Leadership suggests that reimbursement of CHWs to utilize the accredited OTR program would be the ideal mechanism for sustainability.

Conclusion

Joslin's On the Road program is a community-based group for diabetes education and testing intervention that targets adults with diabetes and their interested friends and family. Through site visit discussions and observations, we find evidence suggesting that Joslin participants show more engagement with the health care system and improved health habits upon completion of the program. The program results are on par with similar diabetes interventions where participants with diabetes show improvements in understanding the disease and important measures of diabetes control. We also find evidence of improvements in measures of health habits, engagement, and diabetes management. As the Innovation Awards end, Joslin leadership is making efforts to establish partnerships and gain accreditations to increase opportunities for spread.

Le Bonheur Community Health and Well-Being

Le Bonheur Community Health and Well-Being (Le Bonheur) Changing High-Risk Asthma in Memphis through Partnership (CHAMP) program seeks to improve continuity of care for high-risk pediatric asthma patients in Shelby County, Tennessee.

This chapter presents evaluation findings to date. Our findings about the CHAMP program are based upon a review of the awardee's quarterly reports as well as telephone interviews with the awardee, two rounds of site visits at the Le Bonheur Children's Hospital in Memphis, Tennessee, and analysis of TennCare data.

Program Title	**Changing High-Risk Asthma in Memphis through Partnership (CHAMP)**		
Intervention Summary	CHAMP has four components: (1) *An initial clinic visit with an asthma physician specialist* during which participants receive an asthma action plan, asthma education, allergy testing, and access to a 24/7 CHAMP telephone line; (2) *Home visits* delivered by community health workers (CHWs) who connect CHAMP families to social support services, monitor medication adherence, reinforce asthma education, and conduct environmental assessments; (3) *Care coordination* provided by the 24/7 CHAMP telephone line and the Asthma Care Coordinators (ACCs) who liaise with school staff, connect participants to providers, call in medications, and arrange appointments; and (4) *The CHAMP pediatric asthma registry,* which includes program metrics and TennCare claims data, including prescription-fill data.		
Targeted Disease/Condition	Pediatric asthma		
Total Amount Awarded*	$2,896,415	**Award Amount Spent***	$2,250,075
Number of Sites	1	**Locations by State**	TN
Cumulative Reach*	483		
Intervention Workforce	Approximately 5 lay health workers, 1 nurse practitioner, 1 physician, 1 registered nurse, 2 respiratory therapists, and 2 social workers		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings suggest that caregivers who received CHAMP's services credit the program for helping stabilize their child's asthma and reducing the number of ED visits.
  - However, the program has a significant backlog of patients who have not had an initial CHAMP clinic visit—the visit where participants receive several key intervention components, including an asthma action plan. As of the latest data provided by the awardee, 334 of the 483 participants had received an initial visit.
- Our usability analysis of the TennCare claims indicates that we can report on CMMI core measures.

Implementation Experience

As the multi-component CHAMP intervention seeks to combine highly specialized medical care with community-based social support, the key issue affecting the implementation is the significant backlog of participants awaiting their first clinic visits. Though community health workers (CHWs) can provide home-based social support before this visit, they cannot offer support for medication adherence or asthma education until the specialists and asthma educators provide education and develop an asthma action plan in the clinic during the initial medical visit. Though enrollment has ended, approximately 21 percent (n=103) of the 483 participants had not completed an initial clinic visit as of April 2015.[90] Below, we describe contributing factors to the backlog and other findings about the implementation of the CHAMP program.

There are three interrelated factors that contribute to the backlog for the initial visit: physical space limitations, limited appointment slots, and high no-show rates. Program staff report that lack of physical space for the CHAMP clinic limits the clinical time slots to two half-days per week, and the limited hours may be inconvenient for patients, resulting in high no-show rates. The backlog itself may even contribute to the no-show problem, because participants are less likely to receive an appointment soon after an acute episode or emergency department (ED) visit, when they are perceived to be the most "teachable" or prepared to engage with the intervention. To further complicate matters, specialists use limited clinical hours for follow up appointments instead of the initial appointment because they have not established relationships with primary care providers who they believe can follow up on their treatment regimes. The CHAMP team adopted approaches to address challenges:

- **Space.** The CHAMP clinical team now uses a mobile van to conduct additional clinic visits in the community. The team has conducted six mobile clinic sessions since December 2014 and is still assessing the effectiveness of this model;
- **Follow-up**. The team is currently reaching out to Le Bonheur-owned pediatric practices to begin connecting with primary care physicians (PCPs) and raising awareness of the CHAMP program so that the primary care providers can provide the appropriate follow-up;
- **No shows.** To address this issue, the team provides reminder phone calls and arranges transportation to and from Le Bonheur. The team recently began offering (with limited effect) $30 incentive gift cards to a local grocery store upon completion of the first clinic visit;
- Additional staff. **A registered nurse and a respiratory therapist have shifted their focus from the community to the clinic in order to ensure that as many participants as possible can be seen.** They support the clinic by performing spirometry services, providing asthma health education to CHAMP families, and coordinating follow-up asthma care for program participants. **In addition,** a **nurse practitioner (NP) assists the asthma specialists and streamlines intake and testing procedures during the CHAMP clinic, and could further improve patient turnaround time if allowed to see patients independently. Although the NP feels prepared to work independently,**

[90] Le Bonheur had initially aimed to reach 600 participants in the three-year grant period. Approximately 20% of the 483 participants served did not receive their initial clinic visit.

the CHAMP medical director does not allow her to practice independently due to a perceived lack of asthma experience.

- **Asthma specialists feel that their expertise in managing complex asthma cases is necessary for the high-risk CHAMP participants**. The asthma specialists—a pediatric pulmonologist and pediatric allergy/immunologist—serve as the first clinical point of contact for CHAMP participants and continue to see participants for follow-up appointments. The specialists note that the population served by the program is high-risk not only due to their socioeconomic circumstances but also because of the severity of their disease. They feel that the medication regimens typically prescribed by a general pediatrician may not suffice and that they are able to prescribe combinations of medications that are more effective.

CHWs carry out the nonclinical activities of engaging families, reinforcing asthma education, helping participants to overcome barriers to self-management, and addressing environmental and social needs of program participants and their families. CHWs have built relationships with social support services in their communities in order to serve participants better. Although CHAMP would like to address environmental triggers of asthma, staff report that authorities rarely enforce local housing codes supporting healthy living conditions. CHAMP program staffers work with enforcement officials via a Healthy Homes Partnership to address this issue. CHWs now offer asthma-friendly cleaning supplies to CHAMP families to provide short-term relief from environmental triggers.

The CHAMP team developed a CHAMP 24/7 telephone assistance line, which is intended to reduce ED visits, hospital admissions, and lengths of stay. At the initial clinic visit, the clinical team informs participants about the 24/7 line and provides a loading dose of Prednisone to caregivers. When caregivers call the line, staff walks the caller through a protocol and counsels participants to take the initial dose of prednisone if necessary. The project team initially reported that the protocol for the 24/7 line was too complex and created confusion for the caregivers and project staff who answered the line; however, they were able to identify the issues and refine the protocol. The project team noted that the simplified protocol helped make the 24/7 line a valuable resource for program participants. During focus group discussions, caregivers confirmed that the 24/7 line helped them prevent trips to the ED. In future reports we will be able to evaluate the effectiveness of the program on measures of ED utilizations by linking participants to TennCare Medicaid claims.

The Asthma Care Coordinators (ACCs) also play a critical role in care coordination by ensuring that CHAMP participants receive appropriate care at school. Before receiving training from ACCs, school staff often sent CHAMP participants directly to the ED in the event of an asthma exacerbation (rather than administering rescue medication at school). However, as the team has focused on completing initial clinic visits, the ACCs have limited time to engage with and educate school staff. The ACCs' shift from community-based to clinical-based activities could challenge the ability of school staff to provide appropriate care to participants. One program team member explained:

> *"[The families] want help negotiating, educating the staff.… The child is wheezing and the school nurse may not feel be comfortable dealing with asthma, so she calls the parents to come get them. Well, they have to take off work, and it's unpaid. If you can manage them and make sure they take their medicine instead of default and call the parent to pick them up.…"*

The CHAMP pediatric asthma registry is a useful tool for coordinating care and sharing information among the CHAMP team members, but it is not used to coordinate care with participants' PCPs. The project team is planning to provide PCPs with access to the registry to allow them to see their patients' most recent encounters and medication refills. However, the team does not have a plan in place to ensure that providers will log into the registry, pull this information, and respond accordingly.

Le Bonheur engaged a clinical social worker to help provide case management services to participants. TennCare claims data show that many CHAMP participants do not refill their asthma medications. The CHAMP social worker now follows up with participants who do not refill a prescription in more than 90 days to connect them to an ACC and offer medication delivery services. She is also available during clinic sessions to assist the CHAMP clinical team by taking medical histories and addressing any social needs that arise.

Program leadership recognized gaps in services or a shortage of staff performing certain roles, and hired additional staff to cover them. Examples are:

- **An experienced certified asthma educator (AE-C) provided additional in-home asthma education to non-adherent participants.** This newly contracted AE-C is able to conduct home visits on a more flexible schedule than CHWs and will often meet with families during evenings and weekends. She spends extra time with families, ensuring they understand the causes of asthma and the appropriate use of medications.
- A new registered nurse who answers sick calls during business hours because patients often sought medical advice from CHWs, who were unprepared to answer such questions.
- An additional CHW and a new CHW supervisor who instructed CHWs to contact participants based on the level of their social needs in order to help alleviate CHWs workload and prioritize their assistance to participants. CHWs now report that they connect with average participants every month and high-need participants every one to two weeks.

Participant and Caregiver Experiences

We offer the following based on focus groups with 15 participants.

Improvements in Quality of Life

Caregivers of CHAMP participants reported that the program greatly improved their quality of life and ability to manage the asthma of the participants in their care. They credit the program with improving their understanding of asthma including symptom recognition, asthma trigger mitigation, and appropriate use of medications. The subsequent improved confidence reduces overall stress and has allowed them to focus on other aspects of their life or their child's care. One caregiver explained:

> *"I would say they have done absolutely what they set out to do because they have changed it with me and my son. We haven't had any emergency room outbreaks. He hasn't had an asthma attack since we've been on the program because I've been using my preventative meds because y'all know how it is when they can't breathe. We're frantic; they're frantic. We've got to take off work. They can't go to school. We're missing money; we still got bills coming in. So I would say I haven't had to have a day off work in a year because it has managed his asthma."*

Caregivers from the focus groups also mentioned that their children also felt less stressed and more in control over their own health. One parent noted that her child actually taught her teacher the proper administration of her inhaler.

Improvements in Disease Self-Monitoring

Many caregivers report that the CHAMP program greatly increased their knowledge of asthma and improved their ability to respond to their children's needs. Caregivers in the focus group report that CHAMP asthma education encouraged them to appropriately administer and refill their children's asthma medications. Some caregivers described important information they learned about asthma triggers. Several caregivers explained the benefits of using preventive medications to control asthma, rather than simply relying on medications to treat an acute attack. One caregiver reported:

> *"I enjoy the program because I gained a lot of knowledge that I didn't know about asthma; I didn't understand, and I felt like my son was the only one going through it. But since we've been in the CHAMP program and then with [asthma specialist], she's explained to me how important it is to use preventative medicines and stay on schedule, and it has helped. We haven't had an asthma attack—Easter made it a year since we've been to the E.R. for asthma."*

Asthma action plans helped caregivers and participants understand what to do at each step of an asthma attack and why and when to take medications to prevent an attack. Some caregivers also delivered asthma action plans to schools, daycares, and other caregivers.

Improvements in Quality of Care

Several caregivers reported their children had experienced difficulties in receiving asthma care at school before joining the CHAMP program, but the program advocated with schools on behalf of the CHAMP children. One caregiver stated:

> *"My biggest thing too was the school did not know how to handle it and did not want to handle it. Like they were suggesting, like, I should just send him home, and they called me every day to send him home."*

A few caregivers noted that CHAMP helped them interact with their schools to improve their children's care. For example, one caregiver stated: *"I went over there with my advocate (the CHW). We talked to the nurse; we talked to the principal. I let them know I'm a phone call away, and his school really went above and beyond to help him."*

Caregivers had conflicting opinions about the intent of the CHAMP program and how it relates to the care provided by pediatric primary care providers. Some caregivers maintained a strong relationship with their primary care provider and scheduled follow-up appointments after their child had an ED visit or hospitalization. Other caregivers contact the CHAMP program for any issues related to allergies or asthma after given instruction by the CHW and CHAMP specialists to do so. They have noted that their child's asthma care is exclusively managed by the CHAMP asthma specialists.

Enhanced Access

Caregivers report that CHWs provided consistent support and were easily accessible—helping the caregivers to stay engaged with the program. In discussing their interactions with CHAMP staff members, caregivers primarily spoke of their relationships with their CHWs. In particular, they praised the responsiveness of the CHWs in responding to their requests for help. One caregiver noted that her CHW helped her to address personal issues outside of her child's asthma. Many CHWs would follow-up with participants after learning that their child was brought to the ED or hospitalized.

Changes in Health Care Utilization

Overall, the caregivers reported that their children's health significantly improved since joining the program and, as a result, health care utilization decreased. Several caregivers noted that their CHAMP participants had experienced fewer or no asthma exacerbations since joining the program. Caregivers noted that the 24/7 CHAMP line, as well as the overall support of the clinical team (ACCs, CHAMP specialist), have helped to manage their children's asthma, reducing asthma exacerbations and the need for urgent and emergency care. Hospital admissions data analyzed by CHAMP staff support these findings.

Many also asserted that because of the program they had fewer visits to the ED. One mother explained:

> *"My daughter qualified for the CHAMP program after multiple ER visits. I was skeptical of the program at first, but I got sick of coming to the ER…. CHAMP gave us a 24/7 line to call in case of emergency. [We have not had any] ER visits since joining."*

Another caregiver emphasized this point as a way to encourage other parents to join the CHAMP program. When asked what she would tell other parents with asthmatic children, she said:

> *"We let people know in Memphis that CHAMP teaches you how to administer your child's medicine every day and ways to prevent triggers of asthma and going to ED. Tell parents that CHAMP helped teach us methods and then pass on the knowledge to our child. Also, telling parents that we haven't been back to the ED for years."*

Quantitative Analysis of Program Effectiveness

We received TennCare claims files on June 3, 2015. We present usability analysis for TennCare claims files that were provided to us for Le Bonheur participants and a comparison pool of children residing in Tennessee who have asthma. For details on usability analysis for Medicaid data, please see the Technical Appendix. In this report, we provide an overview of the data we have obtained thus far from TennCare, our ability to construct the CMMI priority measures and a comparison group (see Exhibit 11.1).

Exhibit 11.1: Le Bonheur Feasibility of Creating CMMI Priority Measures

Dimension	Feasibility[91]	Caveats/Considerations
Identification of Program Participants	Good	Using finder files from Le Bonheur, we have information on enrollment date, TennCare ID number, and demographics for 486 children enrolled in the CHAMP program.
Calculate CMMI Priority Measures	Good	Core measures of admissions, ED use, and total cost of care are readily calculable from TennCare files. Sufficient information to compute ACS hospitalizations is lacking in TennCare files. Additional details for each measure are provided in Exhibit 11.2
Construct Comparison Group	Good	TennCare claims identify a pool of approximately 100,000 potential comparisons who have been diagnosed with asthma and prescribed a bronchodilator. We are confident that this large pool will be sufficient to construct a comparison group.

In Exhibit 11.2, we examine the feasibility of constructing CMMI priority outcomes from TennCare claims files in greater detail.

Exhibit 11.2: Le Bonheur Feasibility of Creating CMMI Priority Measures (Detailed)

CMMI Core Measures	Validity[92]	Factors limiting validity of measure
Hospitalizations	Good	None expected
ED Visit Rates	Good	None expected
ACS Hospitalizations	Poor	Discharge destination not available in TennCare data, which hinders function of the ACS algorithm
Total Cost of Care	Good	None expected

Usability analysis indicates missing or incomplete data for medication adherence and the Patient Health Questionnaire-2.

Le Bonheur also provided information on the services provided to participants enrolled in the program. A breakdown of these services are detailed in Exhibit 11.3. A substantial number of children in the program received services. Of 467 patients enrolled in the program, 45.9 percent received all available services and 92.9 percent received all or partial services. The most prominent services rendered included an asthma medication review, a home visit, an asthma action plan, and an environmental assessment.

[91] Qualitative assessment of feasibility of using Medicaid claims and/or awardee-provided information for each of the dimensions listed. "Good" indicates we do not expect any problems; "fair" indicates that issues remain to be resolved; and "poor" indicates we believe creating this dimension is not possible from this data source.
[92] Qualitative assessment of validity of using Medicaid claims and/or awardee-provided information for each of the dimensions listed. "Good" indicates we do not expect any problems; "fair" indicates that issues remain to be resolved; and "poor" indicates we believe creating this dimension is not possible from this data source.

Exhibit 11.3: Le Bonheur Services Provided to Participants

Variable	% (N)
Number of Persons	467
Received all services	45.9% (253)
Received no services	7.1% (33)
Dropped out of study	2.6% (12)
First clinic visit	71.4% (334)
Asthma Education by Asthma Care Coordinator	
Within 30 days, % (N)	22.0% (103)
Within 60 days, % (N)	21.2% (99)
# Asthma Education Encounters by an Asthma Care Coordinator in 12 months	
None	34.2% (160)
1	30.1% (141)
2–4	31.6% (148)
5 or more	4.1% (19)
Asthma Education by Other Staff	
Within 30 days	58.5% (274)
Within 60 days	9.2% (43)
# Asthma Education Encounters by Other Staff in 12 months	
None	33.8% (158)
1	44.9% (210)
2 or more	21.4% (100)
Medication Review with Patient/Family	
Within 30 days	49.6% (232)
Within 60 days	28.4% (133)
Within 12 months	77.1% (361)
Asthma Education with the School	5.8% (27)
Medication Review for School Personnel	7.1% (33)
Home Visit	
Within 30 days	23.5% (110)
Within 60 days	9.2% (43)
# Home Visits within 12 Months	
None	30.6% (143)
1	45.1% (211)
2 or more	19.4% (91)
Missing	4.9% (23)
Asthma Action Plan Shared with:	
Primary Care Physician	62.8% (294)
School	59.4% (167)*
Family	62.8% (294)
Environmental Assessment	83.6% (391)
Environmental Modifications Made	17.5% (82)
School Absences Reported	<2.4% (<11)

*171 kids were not old enough to attend school, and 16 were recorded as missing an Asthma Action Plan (AAP) communication to school.

Sustainability

Hospital leadership pledged support for continuing the CHAMP program. The organization received a Plough Foundation grant to develop a Center for Excellence in Asthma, and CHAMP is a cornerstone of that effort. CHAMP will receive $500,000 of grant funds over five years.

The project team is exploring the feasibility of a Pay for Success model. The CHAMP team received a one-year planning grant from the Green and Healthy Homes Initiative to explore the feasibility of a Pay for Success model. The funding from this grant will provide capacity-building assistance for Le Bonheur to assess the feasibility of alternative payment strategies.[93]

CHAMP leadership is holding discussions with TennCare to discuss funding options. CHAMP leadership met with TennCare administrators in April 2015 to share preliminary data on cost-savings and discuss funding options for the CHAMP program. Funding strategies could include return on investment with shared cost savings or a value-based care package.

The CHAMP team is considering expanding the target population of the program. Leadership met with a local commercial payer, to discuss implementing CHAMP for its privately insured high-risk asthma clients in the Memphis area.

Conclusion

Le Bonheur Community Health and Well-Being's Changing High-Risk Asthma in Memphis through Partnership (CHAMP) program focuses on providing care management, self-management support, and asthma education for children with high-risk asthma and their families. Through site visit discussions and observations, we find evidence suggesting that caregivers who received CHAMP's services credit the program for helping stabilize their child's asthma and reducing the number of emergency department visits. However, the program has a significant backlog of patients who have not had an initial CHAMP clinic visit—the visit where participants receive several key intervention components, including an asthma action plan. Our usability analysis of the Le Bonheur program data indicates that a substantial number of participants have still been able to receive all or partial services. In a future report, we will present data on the effects of the Le Bonheur intervention on core CMMI measures using TennCare Medicaid claims. As the Innovation Awards end, Le Bonheur CHAMP program leadership is pursuing various avenues to support sustainability, including a planning grant to explore alternative payment models, a verbal commitment to continue the program from hospital leadership, and conversations with private payers.

[93] Green & Healthy Homes Initiative Selects Five Healthcare Organizations for Pay for Success Projects." March 11, 2015. Available at: http://www.greenandhealthyhomes.org/media/press-releases/green-healthy-homes-initiative-selects-five-healthcare-organizations-pay. Accessed August 7, 2015.

Mountain Area Health Education Center, Inc.

Mountain Area Health Education Center, Inc. (MAHEC) includes a family health center and medical education center. MAHEC's Integrated Chronic Pain Treatment and Training Project (ICPTTP) is focused on standardizing and streamlining chronic pain care. The program targets patients who have a diagnosis of chronic pain (ICD-9 diagnosis code 338.4/on opiods for over 90 days) entered into the practice's electronic health record system and a prescription for an opioid medication. The program then uses multidisciplinary teams to offer enhanced chronic pain management. MAHEC is also partnering with a community-based initiative, Project Lazarus, to conduct community outreach and education around prevention of opioid misuse and overdose deaths, which is being evaluated separately by the North Carolina State Center for Health Statistics.

This chapter presents evaluation findings to date. Our findings about the MAHEC program are based upon a review of the awardee's quarterly reports as well as telephone interviews with the awardee, two rounds of site visits, and analysis of Medicare claims data. Over two rounds of site visits, we collected data from four practices: MAHEC's Family Health Center (FHC) and Ob/Gyn in Asheville, NC, Andrews Internal Medicine (Andrews) in Andrews, NC, and Blue Ridge Community Health Services (Blue Ridge) in Hendersonville, NC (via video conference).

Program Title	**Integrated Chronic Pain Treatment and Training Project (ICPTTP)**		
Intervention Summary	MAHEC's intervention model calls for: (1) *Mid-level and behavioral health providers* to co-manage care and provide counseling and medication management services to patients with chronic pain (2) *Training primary care providers* to create protocols for chronic pain treatment and management		
Targeted Disease/Condition	Chronic pain		
Total Amount Awarded*	$1,186,045	**Award Amount Spent***	$893,865
Number of Sites	4	**Locations by State**	NC
Cumulative Reach*	376		
Intervention Workforce	Approximately 3 behavioral health providers, 16 lay health workers (Project Lazarus staff), 2 nurse practitioners, 2 pharmacists, and at least 4 physicians (across all sites)[94]		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings suggest improvements to participant quality of life and disease management attributable to the program.

[94] Two fully staffed sites (FHC and OBGYN) have at least one nurse practitioner (NP), one behavioral health provider, and one pharmacist. One site (Blue Ridge) has primary care providers (PCPs) and behavioral health providers. One site (Andrews) is solely staffed by one PCP.

  - We also find that having the ability to medically treat addiction and prevent overdose allows for more effective implementation of the chronic pain treatment program.
- We did find not any discerning trends in the utilization measures or the total cost of care measure that we examined for the MAHEC program.
- As the Innovation Awards end, all sites will continue operations using their current workforce models. Two MAHEC sites will continue the full program with both mid-level and behavioral health providers, and the other two sites will continue to rely on physicians to implement its protocols.

Implementation Experience

MAHEC's intervention model includes a mid-level provider, who is meant to serve as the main point of contact for all chronic pain issues for both patients and providers, and a behavioral health provider, who is embedded in participating practices. Together, they are meant to provide holistic, team-based chronic pain treatment as seamlessly as possible. Across the four participating practices in western North Carolina, each has had unique experiences adapting the model to their own contexts and populations; as such, implementation experiences vary. Practices learned that it is important to consider practice culture and workflow, existing staff capacity, and perspectives regarding chronic pain treatment as well as addiction treatment.[95] Exhibit 12.1 illustrates the presence of workforce types by site.

Exhibit 12.1: MAHEC Workforce Variation across Sites

Staff Type	MAHEC FHC	MAHEC Ob/Gyn	Blue Ridge	Andrews
Physician	✓	✓	✓	✓
Mid-level Provider	✓	✓		
Behavioral Health Provider	✓	✓	✓	

While the intervention was designed to have all three types of staff collaborating on patient care, we found the implementation of the key protocols and approaches to pain management enhanced the management of chronic pain patients regardless of staff structure. The following descriptions of the intervention components and lessons learned explain how this is achieved.

In order to enhance consistency of chronic pain treatment across providers, MAHEC developed standard protocols for managing chronic pain patients. They are meant to enable the safe and effective use of opioid therapies without enabling addiction or diversion of medications for sale or use by someone else. These protocols include guidelines on how to conduct screenings and assessments of chronic pain patients, how and when to prescribe and at what dosages, and more. Providers are advised that they should:

[95] MAHEC FHC had fully implemented all aspects of the chronic pain program and recruited and retained staff for the intervention; it serves as the sort of "gold standard" of the model for the chronic pain program. This is the only site to hold medical group visits as of the second round of site visits. MAHEC Ob/Gyn planned to begin holding group visits in June 2015. In contrast, Andrews and Blue Ridge have not held any medical group visits, and to our knowledge, do not have any plans to do so in the near future.

- conduct a urine drug screen (UDS) before prescribing, then repeat UDS at least once a year, if not more often;
- check patient medical records for other medications and check the North Carolina Controlled Substance Reporting System for existing prescriptions before prescribing an opioid;
- not prescribe opioids on first visits or over the phone;
- not continue opioids just because another provider had prescribed them before;
- not prescribe benzodiazepines (for anxiety) with opioids;
- not prescribe more than 120mg equivalents of opioids;
- not prescribe more than 10mg per pill of oxycodone and no more than four times per day.[96]

Hands-on experience in the pain clinic has proven vital to the providers' confidence in treating chronic pain and determination in reducing their patients' dependence on opioids. Having been in the role since the beginning, the mid-level provider at MAHEC FHC feels confident in her ability to work with the chronic pain patients and the primary care providers (PCPs) in the practice.

> *"I trust my judgment more. I feel more comfortable saying no [to patients and providers]. I've also done a lot of weaning—and I've done that a lot with patients. We're trying to bring our max dosage to under 120mg since that's generally thought to have less risk for accidental overdose. And I feel pretty good about doing that."*

- Program dosage is driven by chronic pain patient visits to the mid-level provider or primary care physician every three months to refill opioid prescriptions**.** Further interaction and dosage of the intervention varies by patient beyond this semi-standard schedule. Since the program is happening in a primary care setting, patients are exposed to the program essentially any time they come in for a visit, which contributes to the varying dosage that each patient receives.

PCPs and residents appreciate that the standardized protocols give them the confidence to prescribe medications more appropriately for chronic pain. Having the standardized protocols in place enables physicians and residents to point to a specific rationale for their decisions regarding chronic pain patients; they are therefore not beholden to writing a certain prescription just because another provider has written it in the past. One provider said:

> *"I have taken patients on chronic pain medicines that I was treating for pain, and finally I said, 'Look, you're just a drug addict.' And I've gotten that strength to do that through [MAHEC's Chronic Pain Treatment and Training Project]. I said, 'I can help you; I can help you feel better without the opiate, but with this other medicine. And would you give me that opportunity, and then let*

[96] The higher the dosage per pill, the higher the street value of the pills. By prescribing low dosage pills, providers are trying to discourage diversion of patients' medications to the community.

me know how you feel? And we'll work with you on this.' That might've been a patient in the past that I would've discharged."[97]

- Program leadership have found that training the residents in chronic pain management early on in their medical education means that they will likely carry that training into their own practice going forward; however it also creates the challenge of frequent staff turnover. Given this challenge, MAHEC stressed the value of standardized protocols in order to prevent inconsistency of chronic pain care with multiple providers treating the same patient over time.

Though physicians can implement the protocols directly, those doing so would appreciate having mid-level providers and behavioral health care providers integrated into their practice if they were available. Recruitment and retention of such staff in rural areas was particularly difficult. As such, two sites operate the programs through a chronic-pain-trained primary care physician.[98] These sites started implementation by training an existing mid-level provider for the chronic pain clinic role, then hiring from outside of the practice. However, those mid-level providers have subsequently left their positions. One physician noted that these additional responsibilities reduce his time with other patients:

"The one thing I will say is that it has affected my care of my other patients … Because the time involved in this is so much that I've had to be more brief with other people. So if you're not a chronic pain management patient, you may not get as much time now, which is sad, and that bothers me a little bit."

To prevent burnout from serving complex and demanding patients, the program utilizes a team-based approach and divides mid-level providers' time between chronic pain and general patients. Mid-level providers explained that serving general patients who are easier to treat keeps their morale and confidence up when trying to treat chronic pain patients who are more difficult. They divide their time in half between the two patient populations.

Behavioral health providers play an important role in the chronic pain program by supporting providers in their interactions with chronic pain patients through informal "curbside" consultations as well as by providing behavioral health services to chronic pain patients. In accordance with the integrated model at two sites, a behavioral health provider consults in the clinic on an ongoing basis. Behavioral health providers, physicians, residents, and mid-level providers have all expressed the importance of including behavioral health in the chronic pain program. One explained:

"I think if patients haven't had a mental health diagnosis and don't know, the behavioral health can bring that to light. And often what we find is that if there's a comorbid mental health issue, and it's not being treated and then they find out that it can be treated, then I think that makes the pain go down. … I think it's more critical than people realize. Like you could refer every chronic pain patient

[97] Prior to learning how to better manage chronic pain patients through MAHEC's program, the provider explained that he would have discharged, or not served, patients on opioid treatment out of concerns over liability for abuse of their medication, whether by addiction or diversion (i.e., selling prescription medications or having them stolen).
[98] One of the two sites discussed in this finding has a behavioral health provider in addition to the chronic pain physician. Please see Exhibit 12.1. Workforce Variation across MAHEC Sites.

to behavioral health. So even if there isn't a diagnostic or a sub-clinical mental health thing, we can still have an effect on those patients."

Clinical pharmacists also support the program by doing curbside consultations with physicians, the mid-level provider, and residents. MAHEC FHC and MAHEC Ob/Gyn sites have pharmacists who play an active role in their integrated care model; Andrews does not have any pharmacists on site and is seeking to collaborate with a local retail pharmacist to do medication reconciliation. One pharmacist explained:

"It goes back to supporting the provider because they can say, 'I'm sorry; I can't do this; this is against clinic protocols.' You can give the patient our policy, so it gives the physicians some backup. And we all reinforce this. So just having things standardized has been incredibly helpful."

In addition to the support from the intervention team members, the intervention tries to encourage chronic pain patients to learn from and support one another through medical group visits. Each group visit entails a guided discussion and individualized consultation with staff. During these group visits, the mid-level provider checks in with each patient, writes prescriptions, and provides brief private consultations to those who need them. The medical group visits are typically co-led by the clinical pharmacist or behavioral health services staff. The medical group visits also serve as an educational venue on topics such as potential dangers of medications, how to properly and safely store medications, alternative treatments (e.g., yoga and acupuncture), and the social aspects of chronic pain. The medical group visits further serve as a venue for peer-to-peer support and sharing of resources among patients.

There are limited addiction treatment resources and services throughout the region MAHEC serves, and most primary care providers in the region tend to refuse to treat patients for chronic pain because it is associated with addiction. Both create an extra burden on the participating practices to care for a large and underserved population. Through implementation of this program, MAHEC leadership and staff have seen that there is a need for more replacement therapy and more attention put on addiction treatment in conjunction with chronic pain treatment. Specifically, providers expressed that co-located addiction treatment would be a valuable resource for better chronic pain management.

- To address the issue of addiction, the community component of MAHEC's intervention—Project Lazarus—focuses on harm reduction and building community awareness around substance abuse throughout MAHEC's 16-county region. Project Lazarus leadership operates by seeking out community leaders, helping them establish county coalitions to suit the needs and culture of their specific communities, then allowing the coalition to continue to function and thrive independently. Along with this range of advocacy approaches, Project Lazarus offers MAHEC providers naloxone (Narcan) anti-overdose kits to give to patients at high risk for overdose. The organization is also critical in engaging providers in better chronic pain management practices. For example, Project Lazarus leadership helped recruit the physician champion at Andrews to join the program.

Participant Experience

We offer the following findings, based on three focus groups with 22 participants.

Improvements in Quality of Life
Participants expressed that the group medical visits can create a supportive environment that helps improve self-efficacy.[99] These participants feel the group helps to improve their pain self-management and overall well-being. Participants view the medical group visits as a setting to discuss common experiences and share resources and solutions. *"When I come to group … it's like I'm here with all my sisters or a brother, and it's like one big happy family, so it has boosted my self-esteem. … When I go to group, mainly we all listen to each other and can learn something from each other. So we relate to each other about what's going on."*
Behavior Changes
As a result of participating in the chronic pain program and attending the medical group visits, many patients have changed their behavior to better cope with and manage their chronic pain. MAHEC often refers patients to alternative forms of pain management—such as acupuncture, exercise, and yoga—and many patients have come to embrace their options and change their behavior accordingly. One participant explained: *"I've learned to try different things. Since I started the group, I've been using a treadmill as well as a stationary bike. I've tried all kinds of different approaches and walking. And I learn from other people what's working for them and try different things, and if it don't work, then I quit, but at least I've been trying things I hadn't done before."*

Quantitative Analysis of Program Effectiveness

Our analysis of program effectiveness for MAHEC compares changes in utilization and cost for Medicare fee-for-service (FFS) participants, in the periods pre- and post-enrollment in MAHEC's program.

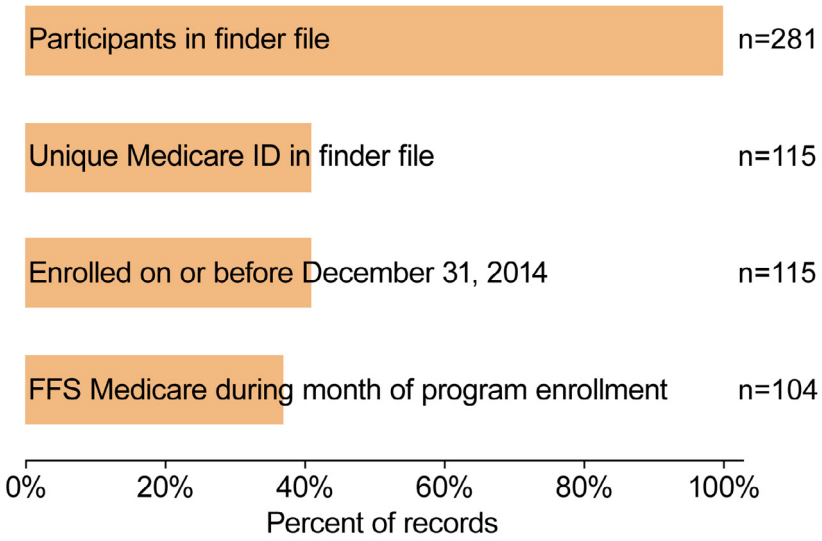
- We present findings for three CMMI core measures: all-cause hospitalizations, emergency department (ED) visits, and total cost of care.[100]
- We include claims for FFS beneficiaries enrolled in MAHEC's program for one or more quarters, from January 1, 2013 through December 31, 2014. MAHEC provided a finder file that lists their

[99] Program staff and leadership also expressed that although pain scores may not go down, participants' self-efficacy scores have increased. Program leaders report that group medical visits in the FHC practice attract a stable group of about five or six patients.
[100] We intended to conduct a time-series regression on the 30-day readmissions measure and hospitalizations for ambulatory care sensitive conditions (ACS) measure, as we did for the other outcome measures. However, we observed too few "events" to conduct a regression analysis. In the case of readmissions, participants without an index admission in the quarter are by definition unable to have a readmission; our sample size for this regression was 168 patient quarter for an average of 10.5 patients in each quarter. For ACS hospitalization, the overall number of events observed was low—no more than six in any quarter and an average of 2.4 per quarter.

program participants and enrollment dates; we used the finder file to identify claims for these beneficiaries (see Exhibit 12.2).

- **Limitations.** Lack of an external comparison group limits our analysis—in particular, any trends observed may reflect secular trends unrelated to the MAHEC program. Additionally, the small number of individuals served limits our power to detect differences that may exist; the large confidence intervals on estimates reflect this limitation. Therefore, readers should interpret these results with caution.

Exhibit 12.2: MAHEC Patients Identified through Finder File



For each of the measures, we pose the following research questions:

- What is the average experience for MAHEC's patients in each quarter prior to and after their enrollment in the MAHEC program?
- Did core measures improve after patients enrolled in the MAHEC intervention?

Exhibit 12.3 presents demographic and other basic information about patients included in our analysis of core outcome measures.

Exhibit 12.3: MAHEC Descriptive Characteristics of Population

Variable	% (N)
Number of Persons	104
Mean Number of Quarters of Enrollment [Range]	6.0 [1–8]
Conditions	
Arthritis	36.5% (38)
Gender	
Female	72.1% (75)
Age	
<65 years old	56.7% (59)
65–75 years old	26.0% (27)
>75 years old	17.3% (18)
Race/Ethnicity	
Black	7.7% (8)
Eligibility	
Full	59.6% (62)
Partial	40.4% (42)
Coverage Reason	
Old Age	26.0% (27)
Disability	74.0% (77)
Dual Eligibility	
Dual Enrolled	59.6% (62)
Hierarchical Condition Category (HCC)	
Mean HCC Score (SD)	1.6 (1.3)
Mean Count of HCCs (SD)	2.8 (2.7)
Mean Utilization and Cost in Year Prior to Program Enrollment	
Hospitalizations per 1,000 (SD)	592 (1105)
ED Visits per 1,000 (SD)	1669 (364)
Total Medicare Cost (SD)	$16,454 ($23,655)

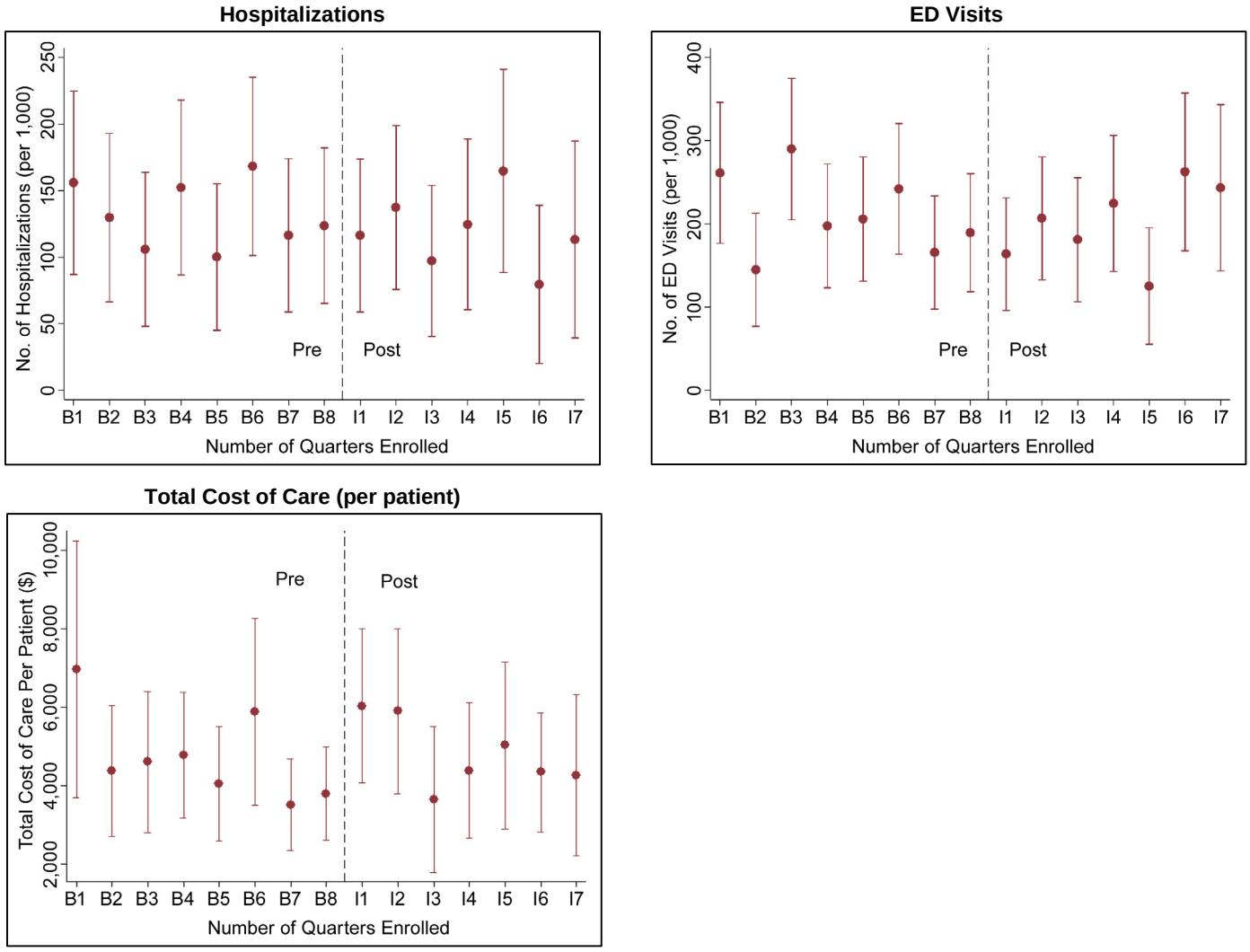
Time-series results. We present the results of our time-series models as the adjusted marginal effect of the MAHEC chronic pain program on hospitalizations, ED visits, and total cost of care (Exhibit 12.4).[101] The effect is displayed as the average number of patient hospitalizations per 1,000 patients (and 95% confidence interval) for each quarter during patients' pre-intervention (B1–B8) and post-intervention (I1–I7) periods.[102]

[101] We control for arthritis, age, race/ethnicity, gender, reason for Medicare eligibility, and comorbidity in the year prior to enrollment in the time-series models.

[102] Due to the small number of patients enrolled for eight quarters (n = 34), we dropped this quarter from analysis. As claims continue to accrue for patients enrolled in the intervention, we expect to be able to add more quarters of follow-up time in subsequent reports.

- Although the quarter-specific average utilization and cost vary, we do not observe consistent increases or decreases in these measures. Overall, there are no clear trends in the rates of hospitalizations and ED visits or total cost of care when comparing rates from one quarter to the next quarter.
- When we take the average for the entire pre-period and compare it to the average for the entire post-period, we observe no significant difference. The average utilization and costs are similar for patients prior to and after joining the intervention.

Exhibit 12.4: MAHEC Adjusted Rates for Core Measures by Quarter



Sustainability

MAHEC program leadership plans to continue the chronic pain program as the fully implemented model at both MAHEC FHC and MAHEC Ob/Gyn. The MAHEC chronic pain program is self-sustaining through provider billing. Mid-level providers, PCPs, and behavioral health providers are able to cover their salaries through billing visits. Program leadership noted that the "curbside" consultations that the mid-level provider, behavioral health providers, and pharmacists provide are not technically billable; however, if the provider goes in and talks to a patient and does any sort of screening or assessment or does a brief intervention to try to problem-solve or provide medication, those are billable services in North Carolina. As such, most of their providers' time is billable.

- The two rural sites currently operating without a mid-level provider plan to continue their programs as well. One site is open to having a mid-level provider if one could be recruited to the rural area. This site would also add a behavioral health component, particularly if further grant funding were available to better integrate behavioral health within their clinic system. The other rural site does not feel such mid-level provider fits in with their organizational culture, and feel they can implement the program better without one. This site has an integrated behavioral health provider.

MAHEC's ACO participation may provide a path towards long-term program sustainment. Through MAHEC's status as an ACO with Mission Health (a local hospital system) and Community Care of North Carolina (CCNC, a Medicaid quality care program), it is developing a chronic pain care process model for its own sites. Program leadership explained that although chronic pain is not a priority to insurers, MAHEC has determined that this is a priority for its communities and will continue to support development of the program.

Consultations with practices in the region may serve as a potential avenue for program replication and sustainability. Through its relationship with Mission Health, MAHEC has begun to educate other practices and providers on their chronic pain model through consultations and training. For example, Mission Health acquired a practice and found that there were patients on extremely high dosages of opioids. MAHEC staff—including the mid-level provider, a behavioral health provider, and a pharmacist—served as consultants for that practice to help them bring down those dosages and establish standardized chronic pain protocols. Leadership and staff feel that MAHEC has become a leader in chronic pain management, so they plan to both sustain and spread their program through consultations such as these as well as through broader provider education and training in the region.

Conclusion

MAHEC's program uses multidisciplinary teams to offer enhanced primary care using mid-level providers who co-manage care, provide counseling, and medication-management services. Through site visit discussions and observation, we find evidence suggesting improvements to participant quality of life and disease management attributable to the program. We also find that having the ability to medically treat addiction and prevent overdose, along with the consistent protocols of this program, allows for more effective implementation of the chronic pain treatment program. We did find not any discerning trends in the utilization measures or the total cost of care measure that we examined for the MAHEC program. Because of the design of MAHEC's intervention, these utilization measures may not identify changes that the MAHEC chronic pain program may be causing. As the Innovation Awards end, two MAHEC sites will continue the full program and the other two sites will continue some components of the program.

Nemours Children's Health System of the Nemours Foundation

The Nemours Children's Health System of the Nemours Foundation (Nemours) implemented the Optimizing Health Outcomes for Children with Asthma in Delaware initiative to improve asthma care and reduce asthma triggers in three communities. The Nemours intervention integrates services for children with asthma in three pediatric practice sites using an enhanced medical home model. It also includes community-wide education on asthma triggers in neighborhoods surrounding these practices.

We present findings based on a review of quarterly reports, two rounds of site visits, focus groups with caregivers, and analysis of Medicaid claims data. In our first round of site visits, we visited the Nemours Division of Health and Prevention Services and all three program sites.

Program Title	**Optimizing Health Outcomes for Children with Asthma in Delaware**		
Intervention Summary	■ Nemours' intervention involves three components: ■ *Home visits:* Community health workers (CHWs) conduct environmental assessments, provide asthma education, and address participants' non-clinical needs in participants' homes; ■ *Care management:* Integrated clinical care teams, which include CHWs, physicians, nurses, a care coordinator, and a behavioral health provider based in the participating patient-centered medical home (PCMH) pediatric sites, provide comprehensive asthma care management to participants, including an asthma action plan and asthma education; ■ *Community engagement:* Community liaisons lead community partnership teams comprised of local organizations in an effort to create widespread policy change to address pediatric asthma.		
Targeted Disease/Condition	Asthma		
Total Amount Awarded*	$3,697,300	**Award Amount Spent***	$2,041,696
Number of Sites	3	**Locations by State**	DE
Cumulative Reach*	10,091 direct and indirect participants[i], including 855 registry participants		
Intervention Workforce	3 behavioral health providers, 10 lay health workers, 1 certified asthma nurse educator, and 3 community liaisons (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015 and Medicaid claims data on participants.

[i] Awardee counts "direct participants" broadly. Nemours includes patients who are in a registry.

Overview of Key Findings

- Qualitative findings suggest that the Nemours' asthma program— community health worker (CHW) home visiting in particular—gives caregivers tools to help control children's asthma and reduce ED visits.
- Quantitative analysis shows statistically significant reductions in hospitalizations and cost of care relative to a matched comparison group.
- Despite the potential positive impact from the CHWs, Nemours will not continue the CHW role for several reasons, including the lack of a payment model to cover CHW services and an organizational

infrastructure to support home visits. In some cases, practice-level clinicians did not buy-in to the value these staff bring relative to their cost to the practice.

- Nemours is planning to continue and expand the psychologist and community liaison positions, both of which existed prior to the Innovation Award and whose services are currently billable.

Implementation Experience

For their HCIA intervention, Nemours purposefully selected three clinical practices (Jessup Street, Dover, and Seaford) that reflected distinct communities – urban, suburban/rural, and rural – within the state of Delaware. These three practices were also identified as suitable locations to pilot the process of applying for National Committee for Quality Assurance (NCQA) patient-centered medical home (PCMH) accreditation.

Nemours leadership, program, and clinical staff asserted that CHW home visiting was effective in helping to better control children's asthma. Program leadership, clinical providers, and staff report that social support, education, coordination with schools, connections to resources, and supplies CHWs provided were critical to reducing ED visits. For example, some CHWs communicated with school nurses to help them better manage children's asthma. When they identified environmental hazards in the home, they facilitated home assessments through the Department of Public Health. Physicians and nurses also noticed that when families worked with CHWs they better understood their asthma action plan, how and when to use medications, how to maintain nebulizers, and how to reduce triggers.

Physicians found CHWs provided insight into clinically relevant psychosocial barriers which helped them understand why caregivers were not giving children the right drugs at the right times. One physician explained:

"We really do not have that time to sit down with the family and let them know about other factors contributing to their asthma care. So that's where the help of the community health workers comes in because we talked to them about this patient and yet they're the ones who visit the house and environments, and they give us the feedback and then they're also the ones who tap community resources…"

At one site, CHWs conducted pre-physicals for children on the asthma registry where they identified issues that families may not have shared with the physician in advance, increasing both efficiency and productivity of the physician visits. One physician called the CHWs his "*eyes and ears in the house of my patients*" which allowed him to better understand the barriers families faced.

After reviewing program data, Nemours program staff found that after five visits most participants reached a point of being able to better manage their children's asthma. During the intervention, there was no protocol dictating the number of home visits, and participants could and did contact CHWs as needed, in some cases on a daily basis. Based on learnings from the outpatient CHW program, Nemours began pilot testing an inpatient-based CHW program to reduce 30-day asthma-related readmission rates in early 2015. Nemours developed a protocol that tiers patients based on risk level. Each tier receives varying levels of interaction with the CHW over a 30-day period:

- Tier 1, low-risk patients: receive one phone call from the CHW during which she reviews the participant's asthma action plan and answers questions.
- Tier 2, medium-risk patients: receive four phone calls from the CHW (one per week). CHW reviews the asthma action plan, addresses social needs, and reinforces asthma education.
- Tier 3, high-risk patients: receive a modified version of the outpatient intervention, with no more than five visits spaced out over a month. CHW addresses social needs, reinforces asthma education, and delivers asthma mitigation supplies as needed.

Nemours will continue this pilot program through June 2016.

Pursuing NCQA PCMH certification and implementing the asthma program at the same time presented opportunities and challenges for Nemours. The PCMH emphasis on population management and care coordination directly supports Nemours' efforts to address the non-clinical needs and coordinate care. In addition, care coordinators hired to support PCMH certification requirements served as a resource to CHWs and supported program goals. However, practice managers were stretched thin by having to complete PCMH applications while implementing the HCIA program.

Nemours leadership speculated that working with physician leaders earlier in the program design and implementation phases might have increased physician buy-in and eased CHW integration. Leadership described difficulties integrating CHWs into the practices due to some initial confusion about the CHW role. For example, staff at one practice expressed concerns that CHWs spent more time outside of the practice conducting home visits than in the practice when, in fact, that was their job. Nemours leadership subsequently spent great effort educating practices about the CHW roles and responsibilities and how the role could support care management goals.

While staff noted that "matrix management" created inefficiencies and decreased CHW job satisfaction, they were not able to identify a viable alternative to managing CHWs. CHWs said they received conflicting guidance from different managers (one at the clinic and one on Nemours' HCIA team) and were left to resolve these discrepancies themselves. The CHWs found this situation and lack of clarity surrounding their role stressful. Some of Nemours' HCIA leadership team acknowledged these problems and felt that the clinic-based manager is in a better position to guide CHW activities. However, due to competing demands, and a lack of clear direction and consistent support for the CHW role, clinic staff were not prepared to independently manage CHWs.

Psychologists' impact on patients with asthma was limited because of the complexity of patients' and families' psychosocial issues and their lack of ongoing engagement with counseling. While the Innovation Awards only allowed psychologists to work with patients and families on the Nemours asthma registry, their work went beyond asthma care management (e.g., treatment adherence) and largely focused on parental confidence, ADHD, and other underlying psychosocial issues that could affect disease management. Yet in part, stigma associated with behavioral health care prevented patients and families from engaging in ongoing counseling to adequately address these issues. Ultimately, p**ractice sites saw value in having a psychologist embedded in the practice, but did not see the value in their focusing specifically on asthma**.

Through the HCIA intervention, Nemours re-shaped the preexisting community liaison role to involve greater collaboration with practices and community stakeholders on asthma. Before the HCIA program, community liaisons operated independently from Nemours' practices. Nemours restructured this role to produce greater engagement between clinical practices and community liaisons supporting joint population health objectives. A supervisor notes that the program has enhanced partnerships between liaisons and community stakeholders related to asthma. In addition to their focus on the needs of their specific communities, the community liaisons and community partnership teams also **engage in community-based activities that have broader reach and potential to spread across the state.** For example, one community liaison developed a train-the-trainer approach to enable community stakeholders across the state to promote safe homes. Another community liaison piloted an online training module on asthma-friendly childcare center environments with a child care center, which plans to train all their centers across Delaware.

Patient and Caregiver Experiences

The following findings are based on focus groups and telephone interviews with 45 caregivers.

Improvements in Quality of Life
Caregivers appreciated CHWs' commitment and support in caring for their children. CHWs' persistence and compassion enable them to develop genuine bonds with program participants and caregivers. One mother described the extraordinary effort one CHW exerted just to get in touch with her. Several caregivers noted that CHWs never talked down and always treated them with dignity and respect. Another caregiver remarked that she appreciated her CHW's relationship with her child. The caregivers touted the benefits of having *"somebody that you see genuinely cares."* These findings corroborate the CHWs' own descriptions, which show strong bonds. Several CHWs expressed genuine sadness when describing the program's end and transitioning their patients. Many chose to write the transition letters by hand, and some even delivered these letters in person.
Improvements in Disease Management
Caregivers said the program educated them about asthma triggers and prevention. Caregivers from focus groups at both of our site visits explained that CHWs follow-up on physicians' asthma education. They reported that CHWs increased their understanding of asthma medications, triggers, and asthma action plans, which enabled them to better manage their children's condition.
Improvements in Quality of Care
Caregivers appreciated the CHWs' role in facilitating communication with health care providers. Caregivers explained CHWs updated specialists and primary care providers on their children's asthma and facilitated communication with and between providers. Caregivers found that the information CHWs provided gave doctors a more complete understanding of their children's health.

Enhanced Access
CHWs were able to meet participants' wide-ranging needs. One caregiver explained that her CHW worked with an insurance company and pharmacy to help her child gain access to an asthma medication that she was told was not covered. Other caregivers explained that their CHW helped them access medical equipment such as spacers and nebulizers. Caregivers also described CHWs connecting them to nonclinical resources such as furniture and food as well as helping them overcome challenges with obtaining transportation to and from medical appointments.
Changes in Health Care Utilization
Some caregivers noted that by reducing exposure to asthma triggers and better managing symptoms, they were able to reduce the number of times they took their child to the ED. Nearly all of the caregivers felt their child's asthma had stabilized over the course of the intervention. They attributed this to fewer exacerbations caused by triggers in the home and to better understanding of how to control symptoms through appropriate medication use. One caregiver stated that her child visited the ED twice a month before enrolling in the program. She and her child have not been back since enrolling in the Nemours asthma program. This finding is consistent with the CHWs' descriptions of "breaking through" to caregivers and creating real behavior change.

Quantitative Analysis of Program Effectiveness

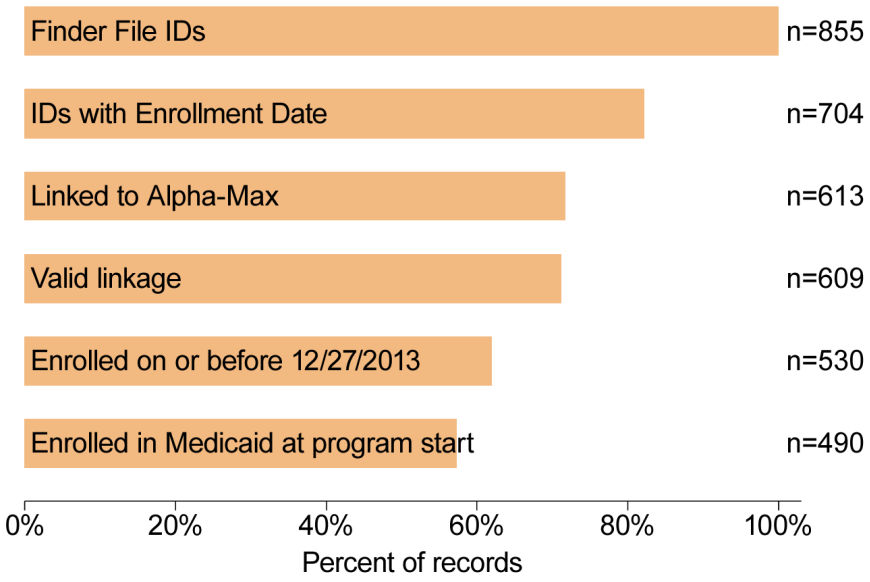
We use difference-in-differences (DID) analyses to compare change in utilization and cost for Medicaid participants in Nemours' intervention and those in a comparison group, looking at the period pre- and post-enrollment. We present findings for four core measures: all-cause hospitalizations, hospitalizations for asthma, ED visits, and total cost of care:

- We include claims for Medicaid children enrolled in Nemours' program for one or more quarters from December 20, 2012 through December 31, 2013.[103] Nemours provided a finder file that listed their program participants and enrollment dates; we used the finder file to identify Medicaid claims for these participants using Alpha-MAX for Delaware (see Exhibit 13.1).
- To identify a pool of comparison children with asthma, we use Delaware's Alpha-MAX data.[104] We limit our comparison group to children not enrolled in Nemours's program, who reside in similar zip codes, diagnosed with asthma in an office visit, and who are prescribed a bronchodilator.
- **Limitations.** A short follow-up period, limited to four post-intervention quarters, is a limitation of our analysis. Furthermore, while we were able to get good balance on several characteristics in the intervention and matched control samples, we were unable to achieve balance on all pre-intervention health care utilization measures such as hospitalizations.

[103] Delaware Alpha-MAX data was only available through December 31, 2013.

[104] Residence in same zip codes as treatment population, aged 2–17, enrolled in Medicaid, an office visit for asthma in the past year, and a prescription for a bronchodilator in the past year

Exhibit 13.1: Nemours Patients Identified through Finder File



We use propensity score models to match intervention to comparison patients on demographics, comorbidities, and prior utilization. For more details on comparison group selection and propensity score matching, please see Technical Appendix A. Exhibit 13.2 summarizes the results from our propensity score matching. The left panel shows the common support after propensity score matching, and the right panel displays the covariate balance before and after matching.

- Prior to matching, we observe substantial common support in Nemours patients and the comparison pool. After matching, we observe nearly identical common support in the two populations.
- We were able to achieve balance for the majority of covariates, with the exception of gender, number of ED visits in the prior year and number of hospitalizations in the prior year.

Exhibit 13.2: Nemours Common Support and Covariate Balance for Nemours and Comparison Patients

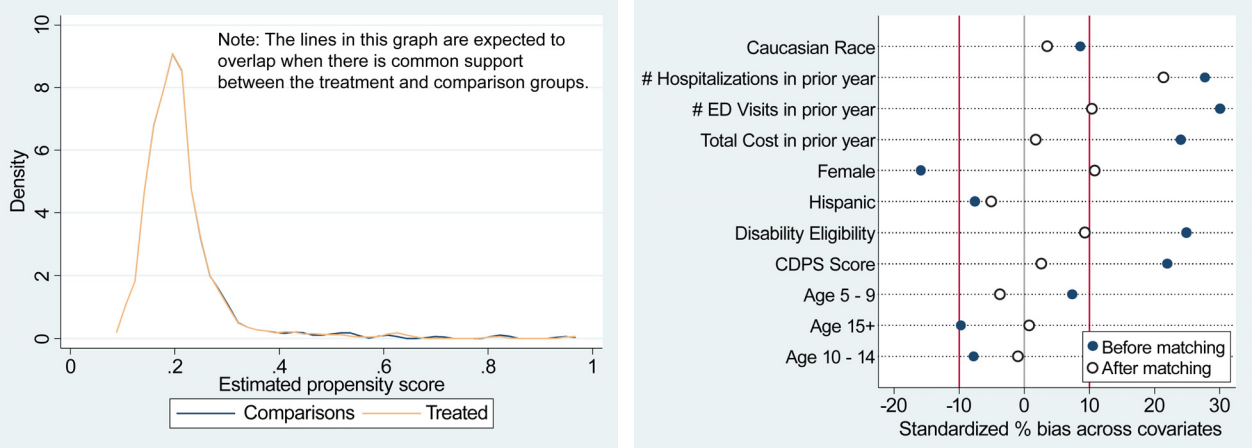


Exhibit 13.3 presents demographic and other basic information about treatment and comparison patients included in our analysis of core outcome measures. Because the comparison group is matched to the Nemours group, we observe few differences on demographics, comorbidity, and prior health care utilization. We observe significantly higher rates of hospitalizations prior to enrollment for Nemours participants, who are also significantly more likely to be female.[105]

[105] When building regression models, we limited the data to quarters where both the treatment and comparison patient from the matched pair had data, so in the final models, the number of quarters enrolled is balanced between the two groups.

Exhibit 13.3: Nemours Descriptive Characteristics of Nemours and Matched Comparison Patients

Variable	Nemours Participants	Matched Comparisons
Number of Persons	490	490
Quarters of Post-Intervention Enrollment		
One	490	490
Two	442	442
Three	376	376
Four	328	328
Gender		
Female**	36.5% (179)	31.2% (153)
Age		
<5	31.8% (156)	29.8% (146)
5–9 year old	41.4% (203)	43.3% (212)
10–14 years old	20.0% (98)	20.4% (100)
15+ years old	6.7% (33)	6.5% (32)
Race/Ethnicity		
White	23.1% (113)	21.6% (106)
Black	69.0% (338)	68.4% (335)
Hispanic	7.6% (37)	9.0% (44)
Basis of Eligibility (BOE)		
Blind/Disabled Individual	16.7% (82)	13.7% (67)
Comorbidity: Chronic Illness and Disability Payment System (CDPS)		
Weighted CDPS (SD)	2.09 (3.48)	2.01 (2.76)
Utilization/Cost of Care in Year Prior to Enrollment		
Total Medicare Cost (SD)	$5,712 ($9,772)	$5,565 ($10,946)
Hospitalizations per 1,000** (SD)	149 (480)	63 (33)
ED Visits per 1,000 (SD)	1,298 (1,793)	1,129 (1,898)
Asthma-related Hospitalizations per 1,000	82 (335)	10 (101)
30-day Readmissions per 1,000	10 (135)	6 (78)

Statistical significance was assessed using Chi-square for categorical variables and t-tests for continuous variables.
*** p<0.01, ** p<0.05, * p<0.1

For each core measure, we pose the following research question:

- Are there differences in core measures between Nemours children after program enrollment and the comparison group, after adjusting for differences in secular trends and risk factors across both groups?

To answer this question we use a summative DID model that assesses the impact of Nemours intervention over the entire post-intervention period. For details on specifications of this model, refer to Technical Appendix A.[106]

Summative DID results. Exhibit 13.4 presents the results of our summative DID models assessing the impact of Nemours program across the entire post-intervention period.[107] The primary parameter of interest is the DID estimator (the final column), which shows the difference in average outcome between Nemours children and the comparison group *after* intervention enrollment minus the difference in average outcomes between the two groups *before* intervention enrollment. In the summative DID model, we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.

- We observe significant reduction in hospitalizations (25 fewer children with hospitalizations per 1,000) and asthma related hospitalizations (13 fewer children with asthma related hospitalizations per 1,000) for children in Nemours' program relative to the comparison group.
- We also observe significant reduction in total cost of care (-$533 per child per quarter) for children in Nemours' program relative to the comparison group.
- We observe significant reduction in ED visits (60 fewer children with an ED visit per 1,000) for children in Nemours' program relative to the comparison group.

Exhibit 13.4: Nemours Difference-in-Differences Estimates for Core Measures, per 1,000‡

Pre-Intervention			Post-Intervention			DIFFERENCE IN DIFFERENCES [95% CI]
Comparison (N=490)	Intervention (N=490)	DIFFERENCE [95% CI]	Comparison (N=490)	Intervention (N=490)	DIFFERENCE [95% CI]	
Hospitalizations per 1,000 Patients						
11	28	17 [10, 25]***	17	9	-8 [-16, 0]*	-25 [-35, -15]***
Asthma-Related Hospitalization per 1,000 Patients						
3	13	10 [6, 15]***	6	4	-2 [-7, 2]	-13 [-19, -7]***
ED Visit per 1,000 Patients						
196	237	41 [15, 66]***	164	145	-19 [-48, 9]	-60 [-90, -30]***
Total Cost of Care per Patient ($)						
1,391	1,443	52 [-340, 444]	1,602	1,121	-481 [-963, 1,525]	-533 [-993, -72]**

Inference: *** p<0.01; ** p<0.05; * p<0.1

‡Model-based estimates for cost measure using generalized estimating equation model with log link and gamma distribution. Count measures estimated using population-averaged logit models. Adjusted models adjust for age groups, gender, race, disability eligibility, and CDPS risk score.

[106] All models are adjusted for age groups, gender, race, basis of eligibility (disability), and CDPS risk score.
[107] We are unable to show difference-in-difference results for the outcome of 30-day readmissions because we do not have sufficient events in the treatment population.

Sustainability

Nemours faces challenges sustaining some elements of their intervention.

Nemours will integrate behavioral health providers and care coordinators in all of their outpatient practices. Nemours will also expand these roles to other outpatient sites across the state and will continue to support behavioral health providers through its existing behavioral health department. This is part of Nemours' work to pursue NCQA PCMH Level 3 certification in all of its outpatient sites. Care coordinators are a critical component of PCMH certification, and behavioral health integration supports the PCMH multidisciplinary approach. Nemours leadership noted that practices were inclined to incorporate the behavioral health provider role into their practices because behavioral health providers can bill for services.

Nemours will continue to support the salaries of the three community liaisons provided "in kind" by Nemours for the HCIA program. The community liaison role existed at Nemours prior to the Innovation Award funding, but the incorporation of community liaisons into practices was new. Through the award, their role was transformed to create better communication with providers about community issues. The initiative intended to pair a community liaison with all Nemours practices across Delaware in order to raise awareness of and better address patients' non-clinical needs. In addition to their work with practices, the community liaisons will continue to work with their respective community coalitions to promote education and awareness around asthma and environmental triggers.

Despite consensus among program staff that the CHW component was critical to the intervention's success, Nemours will not continue the CHW home visiting role in any of its outpatient practices. CHWs have been notifying participants that they will no longer be assigned to a CHW nor will they receive home visits. Program leaders noted that practices would continue to provide some of the services—including connection to social services—using their existing clinical staff. A number of factors contributed to the decision not to continue the CHW role, as designed during the Innovation Award:

- Delaware is not currently pursuing a state plan amendment to adopt a recent CMS rule allowing states to reimburse for preventive services conducted by non-licensed providers under Medicaid. Nemours feels it will be difficult to sustain the CHW role without reimbursement.
- Through its State Innovation Model Initiative (SIM) Model Test Award, Delaware is testing approaches to using CHWs through a community model; Nemours leadership are engaged in this effort.[108]
- Nemours does not have an existing infrastructure (e.g., supervisors, training, and other resources) to sustain and expand the CHW role, particularly the home visiting function.
- Finally, practices had the option to sustain the CHW role by absorbing them into their practices' budgets, but did not choose to do so for various reasons, including not wanting to be ahead of changes at the state level regarding reimbursement of CHWs.

[108] http://innovation.cms.gov/initiatives/State-Innovations-Model-Testing-Round-Two/index.html

- Because they were unable to receive Medicaid claims data on program participants until late in the award period, Nemours was not able to demonstrate a return on investment based on data-driven findings during the award period. Ultimately, Nemours was able to obtain Medicaid data through a contract with the University of Delaware to support future analyses.

Conclusion

The Nemours program focuses on improving care management and providing self-management support for children with high-risk pediatric asthma and their families. Qualitative findings suggest that the Nemours asthma program—the CHW component in particular—gives caregivers tools to help control children's asthma and reduce ED visits. We also see statistically significant reductions in hospitalizations and cost of care relative to a matched comparison group.

As the Innovation Awards end, Nemours will integrate behavioral health providers and care coordinators in their outpatient practices but will no longer use outpatient CHWs for home visiting. State policy decisions, reimbursement, and organizational priorities contributed to this decision. Nemours will continue to advance the role of the CHW through participation in the Delaware SIM process.

Ochsner Clinic Foundation

Ochsner Clinic Foundation developed its Stroke Central and Stroke Mobile programs to coordinate stroke care from the time a patient is admitted to the emergency department (ED) through outpatient rehabilitation. Stroke Central serves patients presenting at and admitted to Ochsner Medical Center with suspected stroke symptoms. Stroke Mobile serves a subset of these patients who had a final discharge diagnosis of stroke and who live in Jefferson and St. Tammany Parishes, Louisiana. We base our findings on a review of quarterly reports, two rounds of telephone interviews with the awardee, an in-person site visit in August 2014, focus groups and telephone interviews with patients and caregivers, and analysis of Medicare claims data.

Program Title	**Stroke Central/Stroke Mobile**		
Intervention Summary	Ochsner's two interventions provide a continuum of care from the time a patient is admitted to the ED for a stroke to one year post-discharge. **Stroke Central** is a care coordination system that manages patients across all "nodes" of stroke care, including communication with multidisciplinary teams in the hospital and with the Stroke Mobile team following discharge **Stroke Mobile**'s registered nurse (RN) and lay health educator (LHE) teams conduct monthly, home-based follow-up care for one year post-discharge and provide targeted stroke education for participants, caregivers, and their families.		
Targeted Disease/Condition	Stroke		
Total Amount Awarded*	$3,864,744	**Award Amount Spent***	$2,046,418
Number of Sites	1	**Locations by State**	LA
Cumulative Reach*	2,616: Stroke Central 2,452; Stroke Mobile 421		
Intervention Workforce	Approximately 3 advanced practice clinicians, 3 lay health workers, and 4 registered nurses		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative results suggest that the program improves patient and caregiver quality of life and has led to important behavior changes for patients.
- Quantitative results show a significant reduction in 90-day and 180-day readmissions when comparing to readmissions prior to and after enrollment in Stroke Central. Without a comparison group, we cannot attribute decreases in readmissions to the Stroke Central program alone.
- Ochsner leadership is seeking partnerships with private payers to conduct trials and sustain the program.

Implementation Experience

Stroke Central

Ochsner concurrently instituted several changes to secure the Joint Commission's Comprehensive Stroke Center Certification, which supported the Stroke Central model. These changes involved collaboration between departments and stakeholders at Ochsner to 1) provide basic stroke education and training to all nurses who interact with stroke patients; 2) reorganize admitting protocols to create a stroke unit on one floor of the hospital; 3) conduct daily multidisciplinary rounds; and 4) educate personnel about the Stroke Central telephone line.

Stroke Central advance practice clinicians (APCs) follow participants from admission to discharge. The three APCs help to diagnose participants in the ED, develop care plans with the broader care team during daily rounds, check in with their patients four to five times a day, and order necessary tests for their patients.

Daily multidisciplinary rounds and care plans encourage a team approach to stroke care. The project staff collaborated with several departments within Ochsner to establish daily multidisciplinary rounds. During these meetings, Stroke Central staff develop care plans for new participants in collaboration with a social worker; physical, speech, and occupational therapists; and—on a weekly basis—the Stroke Mobile team.

Stroke Central staff emphasize patient education and engagement throughout participants' hospital stays. The floor nurses, the Stroke Central RN, the APCs, and the vascular neurologists all play a role in ensuring that patients understand their condition and the importance of adhering to post-discharge instructions. The Stroke Central RN, in particular, provides education at multiple points during the inpatient stay to ensure participants and caregivers comprehend this information despite a chaotic hospital environment.

Stroke Mobile

Stroke Mobile required a flexible design to allow staff members to meet the needs of the post-acute stroke patients through home visits. Stroke Mobile includes a protocol for each of 12 post-discharge visits. However, the team had the latitude to deviate from the protocol:

- Lay health educators (LHEs) often tailor their education curriculum to reinforce information on risk factors for specific participants, such as hypertension.
- While the Stroke Mobile calls for home-based services. However, some participants with milder strokes asked the team to meet them at their workplaces, while others with more severe strokes could request visits in rehabilitation facilities.
- The Stroke Mobile team aimed to visit each patient once a month over the course of a year, but the team could delay visits to accommodate participants' schedules.
- Stroke Mobile RNs provided families contact information to reach them directly and regularly communicated with some participants over the phone between visits.

The Stroke Mobile team infrequently used telemedicine in the field. Ochsner provided the Stroke Mobile teams with Jabber-enabled laptops to allow them to initiate secure video consultations with Stroke Central staff during home visits. While this technology allowed an Ochsner vascular neurologist to conduct an important exam in one emergency, the Stroke Mobile team rarely needed to use telemedicine in the field. Instead, the Stroke Mobile team called Stroke Central to discuss any medical issues that arose during visits, indicating that telemedicine was unnecessary.

The Stroke Mobile team was not prepared to address the social needs of participants. Some participants do not have the resources to follow staff recommendations. One staff member noted,

"How can we expect them to eat when they can't afford to buy food, or they don't have a car? So we're scrounging, and I'm looking for resources for some seniors. There is only Meals on Wheels, but they still have to pay."

These challenges prevent patients from accessing care and obtaining prescriptions. The Stroke Mobile team does not have the background or training to identify and connect participants to resources to address social needs. While the Stroke Mobile nurses can request a social work consult through Ochsner, the team does not have a dedicated social worker or team member to work with Stroke Mobile participants on a regular basis. The Ochsner team has not yet implemented a solution to this issue.

Participant and Caregiver Experiences

We present the following findings based on focus group and telephone interviews with 26 participants and caregivers.

Enhanced Access
Both caregivers and participants report that the Stroke Mobile team was accessible and responsive. The participants emphasized that Stroke Mobile RNs are always willing to take the time to discuss concerning symptoms, even when the participants reach out on a weekend. One participant reported that he and his caregiver now call their Stroke Mobile RN to discuss health concerns instead of immediately going to the ED. Some participants reported that the Stroke Mobile team also helped facilitate communication with other medical providers. One participant explained: *"One time we wanted to get something done, I could never get it done. [Stroke Mobile RN] got on the phone and took care of it. She got straight through to the doctor and got it taken care of."*

Improvements in Quality of Life
Many participants praised Stroke Mobile for the support and reassurance that the program provides to their family members and caregivers. For example, one participant stated, *"I loved the fact not so much what it does for me, but what it does for my wife."* He elaborated that watching his recovery can be difficult for his family but that they are reassured by the presence of the Stroke Mobile team and the knowledge that the team is involved in his care. **Several caregivers reported that the Stroke Mobile team helped reduce their stress and increase their confidence to provide care.** One caregiver said: *"It has reduced my stress. The team were very helpful—especially in the beginning. It was so much easier as time went on. They were wonderful. I didn't know much about strokes. I was new to this. The basic part of the program was to avoid this from happening again. They made suggestions on how to lose weight, but the whole purpose was to avoid reoccurrence. We tried to listen to them as much as possible. They made good suggestions."*
Behavior Changes
Most participants and caregivers reported learning about stroke risk factors and the importance of diet and exercise in preventing recurring strokes. Participants often described positive lifestyle modifications that they adopted on the recommendation of the Stroke Mobile team, including reducing sodium in their diets and increasing physical activity and fruit and vegetable consumption.

Quantitative Analysis of Program Effectiveness

We use a time-series model to examine changes in readmissions, ED visits, and total cost of care following implementation of the Stroke Central intervention at the Ochsner Medical Center. Specifically, we address the following research questions:

- What is the average experience of Stroke Central patient-episodes when compared to patient-episodes for stroke at Ochsner prior to the intervention?
- Did CMMI core measures improve for patient-episodes occurring after implementation of the Stroke Central program?
- We present findings for three CMMI core measures: readmissions, ED visits, and total cost of care.[109]
- We include claims for FFS patient-episodes for stroke enrolled in Ochsner's Stroke Central in each post-intervention quarter from January 1, 2013 through September 30, 2014. Ochsner provided a finder file that lists program participants and enrollment dates; we used the finder file to identify claims for these patient-episodes (see Exhibit 14.1).
- We include a comparison group of Medicare FFS patient-episodes admitted for stroke at Ochsner in each pre-intervention quarter from January 1, 2011, through December 31, 2014.

[109] Since enrollment into the Ochsner's Stroke Central program is based on hospitalization for stroke, we present measures of readmissions instead of hospitalizations. The 90-day readmission measure is equivalent to the measure of hospitalizations in the quarter after program enrollment.

Limitation. The lack of an external comparison group and ability to do an analysis on all but a small subgroup of the population served limit our analysis. Our findings may reflect secular trends in stroke treatment unrelated to the intervention; therefore, readers should interpret these results with caution.

Exhibit 14.1: Ochsner Stroke Central Patient-Episodes Identified through the Finder File

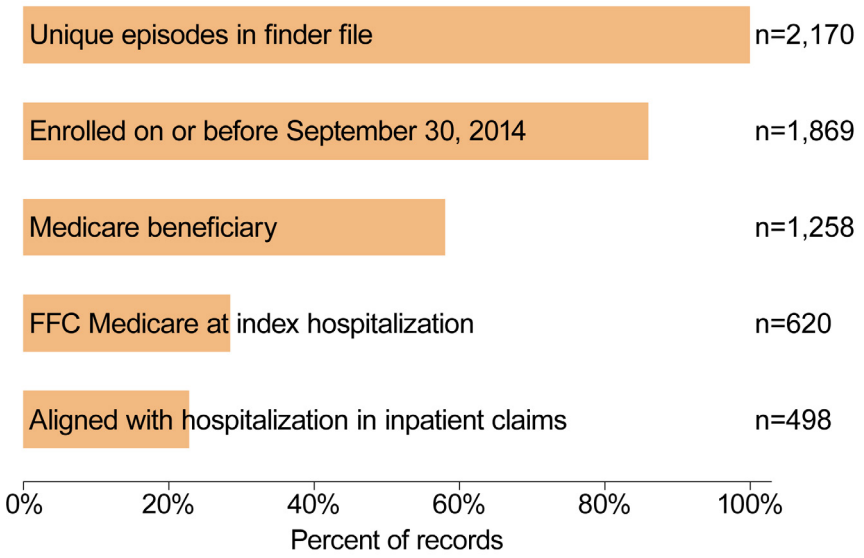


Exhibit 14.2 presents demographic, clinical, and baseline utilization information about the stroke patient-episodes at Ochsner included in our analysis. There are significant differences in disease composition and prior-year costs of care between pre- and post-intervention patient-episodes.[110]

[110] The pre-intervention group is comprised of episodes for target stroke conditions identified in inpatient claims data for Medicare FFS beneficiaries at Ochsner. Ochsner's finder file, which serves as the source for the post-intervention group, includes patient episodes unrelated to the target stroke conditions, such as septicemia. We believe this is the source of the difference between the pre- and post- intervention groups.

Exhibit 14.2: Ochsner Descriptive Characteristics of Patient-Episodes for Stroke

Variable	Pre-Intervention	Post-Intervention
	% (N)	
Number of Patient-Episodes	660	498
Age		
<65 years old	19.7% (130)	23.1% (115)
65–69 years old	17.7% (117)	18.1% (90)
70–74 years old	17.4% (115)	14.9% (74)
75–79 years old	15.2% (100)	16.3% (81)
80–84 years old	14.7% (97)	11.8% (59)
≥85 years old	15.3% (101)	15.9% (79)
Race/Ethnicity		
White	58.0% (383)	56.8% (283)
Black	38.8% (256)	39.6% (197)
Hispanic	0.5% (3)	1.0% (5)
Other	2.7% (18)	2.6% (13)
Gender		
Female	55.5% (366)	57.0% (284)
Comorbidities/Utilization Year Prior to Index Hospitalizations		
Number of HCCs	3.0 (2.9)	2.9 (3.1)
HCC Score	1.7 (1.4)	1.7 (1.5)
No. Hospitalizations per Year*	0.8 (1.4)	0.7 (1.2)
No. ED Visits per Year	1.4 (3.2)	1.3 (2.2)
Prior 1-Year Cost**	$22,194 ($39,879)	$17,830 ($27,710)
Coverage Reason		
Old Age	70.2% (463)	65.1% (324)
Disability	27.3% (180)	31.7% (158)
ESRD	1.2% (8)	1.0% (5)
Disability and ESRD	1.4% (9)	2.2% (11)
Discharges		
Home	40.0% (264)	33.3% (166)
SNF	10.0% (66)	10.6% (53)
HHA	22.3% (147)	24.3% (121)
Hospice	3.9% (26)	4.0% (20)
Other	23.8% (157)	27.7% (138)
Disease Composition* **		
Ischemic Stroke	67.0% (442)	61.8% (308)
Hemorrhagic Stroke	13.0% (86)	11.6% (58)
TIA	20.0% (132)	9.2% (46)
Other/Not specified	0.0% (0)	17.3% (86)

Statistical significance was assessed using chi-squared tests for proportions and t-tests for continuous variables.

*** p<0.01, ** p<0.05, *p<.1

The categorical variables are listed as % (n), and the count and continuous variables are listed as mean (std).

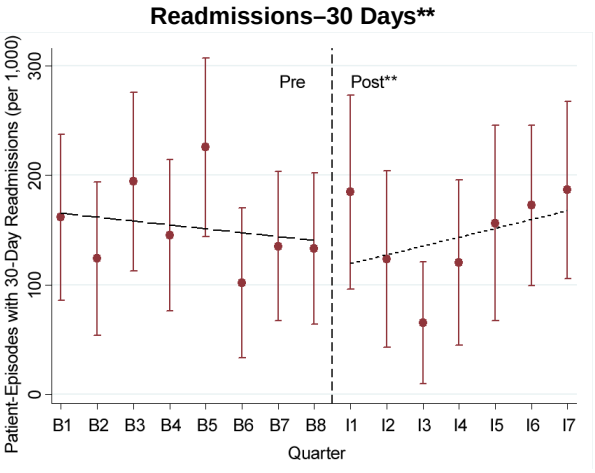
Time-series results. Exhibit 14.3 presents the results of our time-series models as the adjusted marginal effect of Ochsner's intervention on readmissions, ED visits, and total cost of care.[111, 112] We summarize the details of the time-series models and specification of our measures in the technical appendix. We present readmissions at 30, 90, 180, and 365 days post-discharge and ED visits and total cost of care at 90 and 180 days post-discharge. Since 180-day and 365-day outcomes require a longer post-acute follow up period for which claims are mostly incomplete, we present results for a limited set of post-intervention quarters for these two variables.[113]

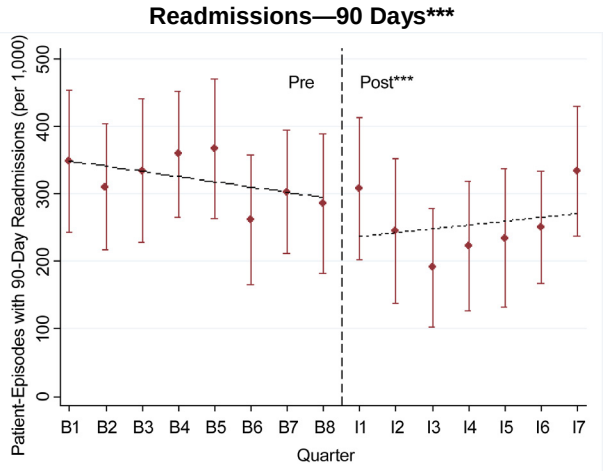
The adjusted marginal effect is displayed graphically as the average outcome (and 95% confidence interval) for stroke patient-episodes at Ochsner, during each pre-intervention (B1–B8) and post-intervention (I1–I7) calendar quarter. We include dashed and dotted lines that represent the trend for outcomes in the pre- and post-intervention periods. We also assess difference in average outcomes for stroke patient-episodes at Ochsner between the entire pre- and post-intervention periods using a z-test for statistical significance.

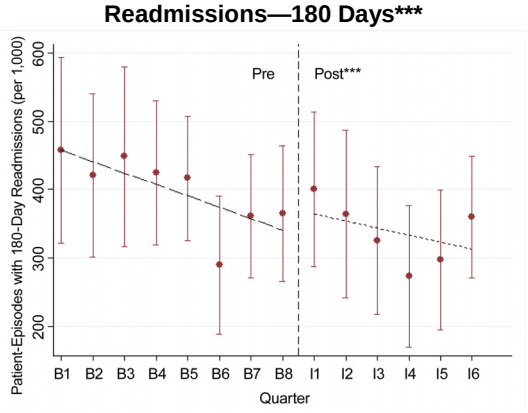
- We observe decreases in 30-, 90-, and 180-day readmissions for Stroke Central patient-episodes in the baseline and initial intervention quarters. We observe trend reversals in 30-day, 90-day, and 180-day readmissions in the latter intervention quarters. We observe a statistically significant decrease in 30-day ($p<.05$), 90-day ($p<.01$) and 180-day ($p<.01$) readmissions in the intervention period compared to the baseline period.[114] We observe an increase in 365-day readmissions prior to intervention implementation.
  - Trends in ED visits remain stable across both baseline and intervention period. We observe increasing trends in both baseline and intervention period.
- We observe an increase in total cost of care in the baseline period. In the intervention period, 90-day total cost of care remains stable and 180-day total cost of care decreases.

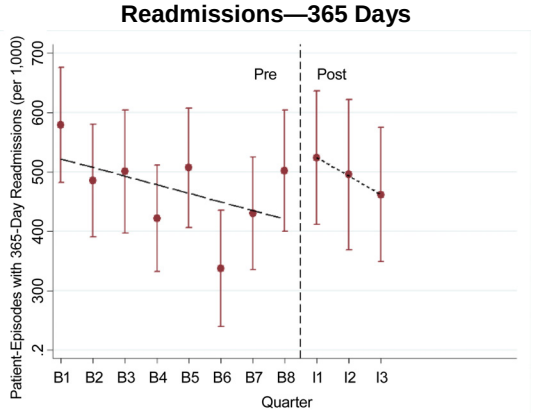
[111] We control for type and severity of stroke condition, age, race/ethnicity, gender, reason for Medicare eligibility, discharge disposition, comorbidity, cost, and utilization in year prior to index-hospitalization in the time-series models to estimate adjusted outcomes.
[112] ED visits include ED visits as well as observation stays not resulting in a short-term inpatient hospitalizations.
[113] Medicare claims data at the time of claims extraction were incomplete for periods beyond CY2014. To ensure incomplete claims do not bias results, we only present intervention periods with runoffs that end prior to CY2014.
[114] While we observe an overall decrease in readmission rates in the intervention period, this results from a continuation of decreasing trends in the baseline period and may not be a result of improvement attributable to Ochsner's interventions.

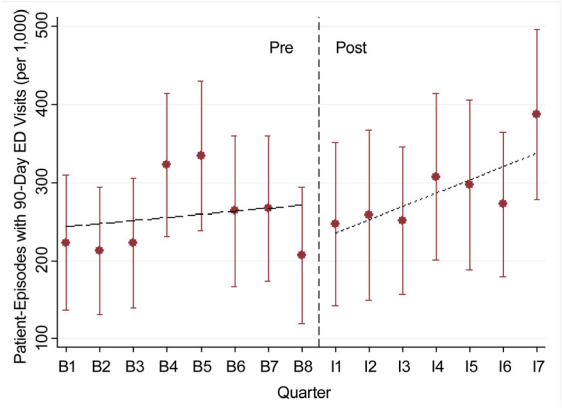
Exhibit 14.3: Ochsner Adjusted[115] Rates for Outcome Measures by Quarter - Stroke Central

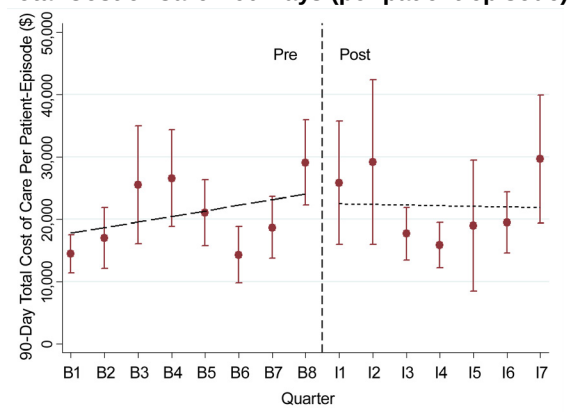






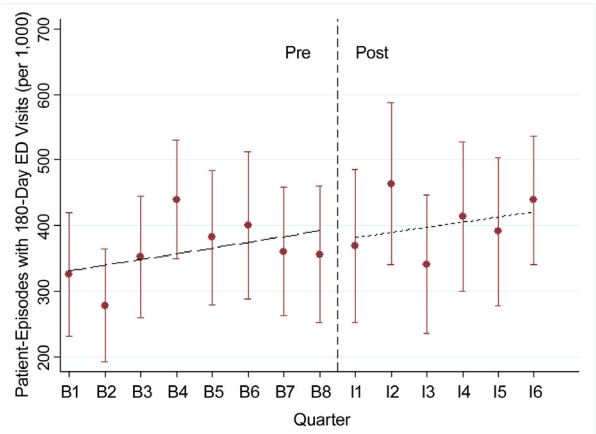




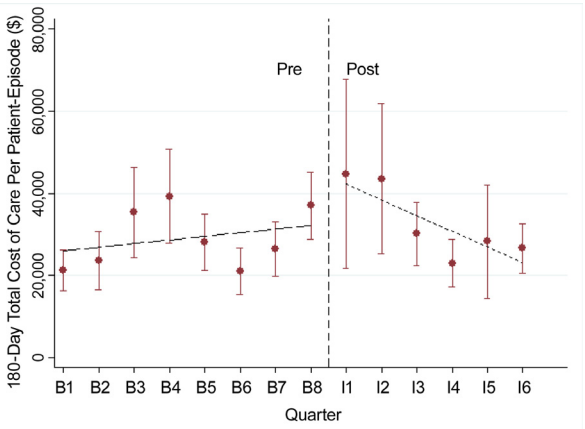


[115] We estimate adjusted rates from the time-series models by controlling for type of stroke condition, age, race/ethnicity, gender, reason for Medicare eligibility, comorbidity, and utilization in year prior to index hospitalization.

ED Visits—180 days



Total Cost of Care—180 days (per patient-episode)



*** p<0.01, ** p<0.05, *p<.1

Statistical significance tests assess difference in average outcomes for stroke patient-episodes at Ochsner across the entire pre- and post-intervention period.

The linear trend lines in the pre- and post-intervention periods represent the line of best fit for quarterly average adjusted outcomes.

Sustainability

As of May 2015, program leadership was pursuing several concurrent plans to promote sustainability of Stroke Mobile beyond the Innovation Award. Ochsner has been collaborating with Blue Cross Blue Shield of Louisiana and Humana to develop a bundled payment scheme that provides stroke care, including Stroke Mobile services, for one year. Both payers plan to provide one-year cost data to Ochsner for Stroke Central/Stroke Mobile patients.

Program leadership is exploring opportunities to develop a comparative effectiveness trial randomized by hospital. Such a trial could help the program team demonstrate effectiveness of the program and provide stronger support for intervention activities.

Conclusion

Ochsner's HCIA program seeks to enhance care coordination and improve care quality across the nodes of stroke care, from admission to the emergency room to one-year post-discharge from the hospital. Our site visit discussions suggest evidence that the program has improved patient and caregiver quality of life and has led to important behavior changes for patients. We also see a statistically significant reduction in 90-day and 180-day readmissions when comparing to 90-day and 180-day readmissions prior to and after enrollment in Stroke Central. However, without a comparison group, we cannot attribute decrease in readmissions to the Stroke Central program alone. As the Innovation Awards end, Ochsner leadership is making efforts to establish partnerships with private payers and develop a comparative effectiveness trial to sustain the program.

University of Alabama at Birmingham

University of Alabama at Birmingham (UAB) is implementing a lay navigator program called the Deep South Cancer Navigation Network (DSCNN), also known as Patient Care Connect (PCC) at the UAB Comprehensive Cancer Center and its 11 partner sites. UAB's program provides coordinated oncology care using lay navigators to Medicare patients 65 and older with cancer.

This chapter presents evaluation findings based on a review of the awardee's quarterly reports to CMMI as well as a baseline telephone interviews with awardee leadership, two rounds of site visits, and analysis of Medicare claims data.[116]

Program Title	Patient Care Connect (PCC) Program		
Intervention Summary	PCC uses lay navigators help to improve adherence to care plans and educate cancer patients and survivors on how to find and use the resources they need, with the goal of empowering patients, caregivers, and families to better advocate for themselves in their care.		
Targeted Disease/Condition	All cancers		
Total Amount Awarded*	$15,007,262	Award Amount Spent*	$7,778,778
Number of Sites	12	Locations by State	AL, FL, GA, MS, TN
Cumulative Reach*	7,030		
Intervention Workforce	Approximately 34 lay navigators, 10 physicians, 7 registered nurses, and 14 management/administrators (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Evidence suggests important improvements to patient quality of life and empowerment attributable to the program.
- We find evidence of statistically significant reductions in hospitalizations and ED visits for UAB PCC patients relative to a matched comparison group.[117]
- While some sites have had challenges with physician buy-in, overall sites have found that lay navigators fill in gaps and complement the role of the physician.
- As the Innovation Awards end, UAB and its sites are pursuing bridge funding from their hospitals to support the program until the next source of funding.

[116] During the first round of site visits, we visited the UAB Comprehensive Cancer Center. During the second round, we visited UAB, as well as three of the 13 partner sites—Northside Hospital in Atlanta, Georgia; Navicent Health (formerly known as Medical Center of Central Georgia) in Macon, Georgia; and Northeast Alabama Regional Medical Center in Anniston, Alabama.
[117] In our analysis of UAB's program in this annual report, we exclude patients with cancers other than the six selected cancers and patients with multiple cancers. Our analyses, therefore, may not capture the overall impact of UAB's program.

Implementation Experience

Throughout the implementation process, UAB and its affiliated sites have been continuing along a steady path of program development and operation. UAB is implementing the lay navigator program at 13 different hospitals throughout the Deep South; each hospital has unique experiences adapting the program to their own contexts and populations. Sites learned that it is important to consider existing programs and perspectives among providers and other staff when integrating the lay navigator program into their workflow and culture. All sites generally adhere closely to the core concepts of the program—specifically, having non-clinical navigators focus on patient empowerment and identify resources—and vary in their specific approaches and adaptations to carrying out the program in their particular contexts.

Lay navigators encourage patient empowerment. As part of their care coordination efforts, lay navigators may contact participants' providers or nurses to request clarification on treatment or information on upcoming appointments or find resources to address a barrier. The navigator essentially serves as the conduit between the provider and the participant or caregiver as well as a liaison with other potentially helpful community resources. These practices help empower patients and caregivers by improving communication and information exchange between patients and providers.

Lay navigators engage with participants both face to face and over the phone; the amount and type of interaction varies across sites, mostly based on workload size and the nature of the setting. For instance, the navigators at one large hospital in an urban setting have very large patient loads and do not have time to see each patient in person. Therefore, most of the interaction occurs over the phone. In contrast, navigators at one of the smaller rural hospitals have somewhat smaller patient loads. Their cancer services, such as the infusion center, are also located onsite such that navigators have more opportunities to interact in person with their patients.

The dosage of the UAB intervention varies across sites and individual patients due to mode of interaction and availability of the lay navigators. Participants may contact their lay navigators as often as they want, such that interaction could be daily, and the program essentially has no maximum amount of contact (no maximum dosage). The program specifies that lay navigators should contact participants at least once per month if the patient has expressed a need for regular contact. It also specifies that lay navigators contact participants who have not expressed a need for regular contact approximately every three months. Some lay navigators offer 24/7 access to participants while others limit their access to business hours.

Program staff and providers at the sites have expressed that the lay navigators play a supportive role for providers and nurses by way of allowing the providers and nurses to focus on clinical issues while the lay navigator helps to address participants' psychosocial barriers to care. For example, if a patient has challenges with transportation, it makes it difficult for nurses and providers to see him or her since the patient may have difficulty getting to appointments. Knowing that the lay navigator is there to help patients with those issues therefore helps providers maintain their workflow and focus on clinical issues.

UAB initially faced some pushback from providers as well as lay navigators themselves about whether lay navigators were the appropriate people to be having end-of-life conversations with patients. At all of their sites, UAB rolled out a module called Respecting Choices, which focuses on lay people having goals of care and end-of-life discussions with participants. Program leadership feels that advance care planning is an important program component and that lay navigators are often in a unique position to bring up this conversation and explain the importance of having those discussions with family members and providers. Navigators reported difficulty in finding appropriate time and space for these conversations. UAB program leadership reports that they have allayed most of the concern on the part of providers by communicating and educating them about the role of the navigator; however, some navigators still experience some discomfort with carrying out this component. That said, many navigators have also had positive experiences with these conversations. Many feel that by having a close, non-clinical relationship with patients, they are able to present the issues more effectively than busy clinicians.

Physician engagement with the lay navigator program has been both a challenge and a facilitator of the program. Some providers initially expressed hesitation due to concerns about how the lay navigators would fit into the practice and the ability of non-clinical people to work with participants and convey clinical information. UAB program leadership helped ease these concerns through communication and education of providers and nurses and saw increased understanding and acceptance of the program as a result. At sites with strong provider buy-in, navigators sometimes go beyond their duties in order to help providers, such as assisting oncologists in getting a patient's scans from a different hospital. Enhanced provider engagement also facilitates program enrollment through provider referrals.

Site managers hired internally have an advantage in terms of garnering physician engagement and buy-in for the program. Site managers vary in terms of how UAB hired them into the role. UAB added some site managers specifically for this position. Others came from other positions within the hospital; for example, one site manager had served as a breast cancer nurse navigator, and another had been an oncology nurse in their respective hospitals prior to the implementation of this program. Since those hired from within the hospital were already familiar, providers were more likely to understand and accept the lay navigator program and thus trust and accept the lay navigators as they began working with their patients.

Participant and Caregiver Experiences

We offer the following findings based on focus groups and telephone discussions with 46 participants and caregivers.

Improved Quality of Life
Staff most frequently mentioned improved quality of life as a change attributed to the program. Medical directors, nurses, and navigators observe reduced stress for patients, caregivers, and their families. Patients report strong relationships with navigators and describe the navigators using words such as "angels" or "godsends." They note navigators help alleviate their stress and support their well-being prior to, during, and after their cancer treatment. Six participants had previously experienced cancer treatment (their own or that of a family member) and found the experience drastically different and better with the support of a navigator.
Reduced Utilization
Several participants experienced changes in care utilization by way of reduction in emergency department (ED) visits. Patients and caregivers described situations in the past in which having a navigator would have prevented them from unnecessarily going to the ED, and additional participants gave specific examples of where the navigator helped them to avoid an unnecessary ED trip. One caregiver said, *"[Our navigator] would've been there to tell us that we didn't need to make that decision to go to the ER because that was an unnecessary visit. If we had had someone with the calmness to explain things to us, we wouldn't have done that."*

Quantitative Analysis of Program Effectiveness

We use difference-in-differences (DID) analyses to evaluate the program's impact on core measures: all-cause hospitalizations, hospitalizations for ambulatory care sensitive conditions (ACS), 30-day readmissions, ED visits, and total cost of care.

- We restrict our treatment group to Medicare fee-for-service (FFS) participants enrolled in UAB's program for one or more quarters from January 1, 2013 through December 31, 2014;
- We worked with UAB's finder file listing participants and their enrollment dates to identify FFS Medicare claims for individuals in our treatment group (see Exhibit 15.1). We redefine the "enrollment date" for the treatment group based on a claims anchor date.[118] The anchor date on claims corresponds to utilization of services for cancer treatment. We use anchor dates to ensure that the treatment and comparison group experience a similar spike in utilization of services for treatment of their cancer at "enrollment time." Individuals in the treatment group were limited to those with claims anchor date within 90 days of the program enrollment date listed on the finder file;

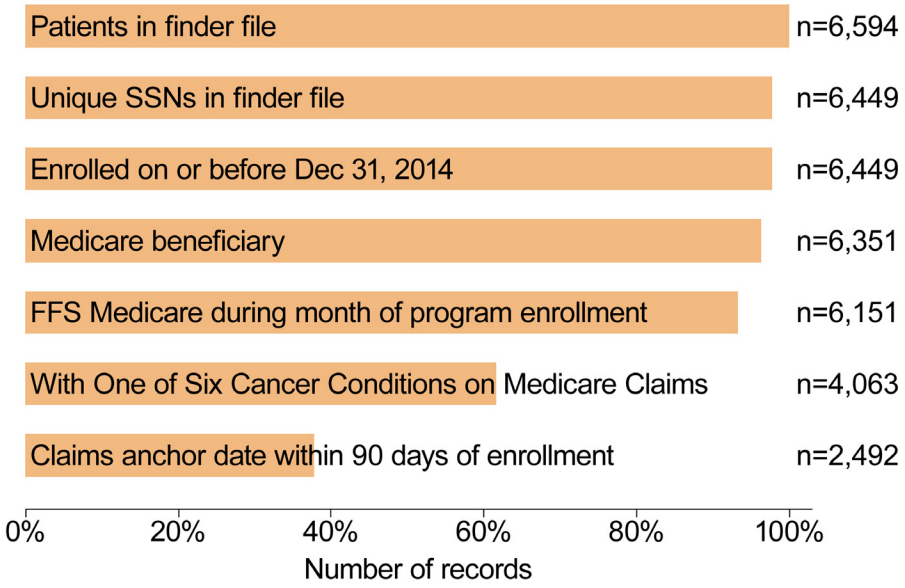
[118] We defined claims anchor date as the date when we observe a diagnosis code for one of the selected cancers on inpatient, outpatient, or physician visit claims.

- UAB's program targets Medicare patients with all types of cancers. Though UAB treats all cancers, we limited our evaluation of treatment group to the following six cancer conditions—breast, lung, colorectal, lymphoma, and male and female genitourinary cancers. We deemed these six cancer groups to be evaluable since they had more than 70 patients in each group.
- To identify a pool of comparison patients, we select FFS beneficiaries treated for one of the six selected cancer conditions at one of two National Cancer Institute Comprehensive Cancer Centers (NCI CCCs) and their affiliated facilities.[119] We choose these two NCI CCCs and their affiliated facilities because they were closest in geographic distance to the awardee and mirrored the arrangement between UAB's CCC and its affiliated hospital sites. For more details on comparison group selection, please see Technical Appendix A. As with the treatment group, we define "enrollment date" for the comparison pool patients based on the claims anchor date.
- In this evaluation of UAB's program against a comparison group, we exclude patients with cancers other than the six selected cancers and patients with multiple cancers. Our analyses, therefore, may not capture the overall impact of UAB's program. In future reports, we propose to conduct sensitivity analyses comparing changes in outcomes for UAB's patients included and excluded in these analyses.

Limitations. Although we include a matched comparison group in our analysis, results presented here should be interpreted with some caution. The number of participants enrolled in the intervention for five or more quarters and the number of patients experiencing an ACS hospitalization are small, limiting our power to detect differences. Similarly, analysis of readmission is limited to patients with an index-hospitalization, reducing the sample size in these models.[120, 121, 122]

[119] Models adjusted for provider, county, demographics, and prior utilization.
[120] Approximately 23 percent of our sample (555 out of 2,492 patients) are enrolled for more than five quarters; there are 146 patients in the sixth intervention quarter and 38 in the seventh quarter. Each quarter after this, the number of enrolled patients diminishes further, and results for these quarters are not included in charts here.
[121] An average of 30 patients are hospitalized for an ambulatory care sensitive condition each quarter.
[122] In each quarter, 198 UAB patients, on average, are admitted to a hospital; of those, 34 experience a readmission.

Exhibit 15.1: UAB Patients Identified through Finder File



Comparison group selection. We use propensity score models to match intervention to comparison patients on demographics, comorbidities, and prior utilization. For more details on comparison selection and matching, see Technical Appendix A. Exhibit 15.2 summarizes the results from our propensity score matching. The left panel shows the common support after propensity score matching, and the right panel displays the covariate balance before and after matching.

- After matching, we observe the two groups have nearly identical distributions of propensity scores, suggesting that—at least on the factors included—these groups are well matched.
- On the balance chart, we show matching has achieved balance (reduced the difference between UAB participants and comparison group) on demographic characteristics, comorbidity, and prior-year costs.
- Given the paucity of information on severity of cancer such as stage of disease on claims, we use four variables as proxies for cancer severity in our propensity score model—metastatic cancer, surgery for cancer, chemotherapy for cancer, and radiation therapy for cancer. It is important to include these treatment modality variables (chemotherapy for cancer and radiation therapy for cancer) in the propensity score models to adjust for observable differences in cancer severity between the treatment and comparison groups. We test the sensitivity of our propensity score matching results for UAB after excluding the variables for cancer surgery, chemotherapy, and radiation therapy to assess whether the impact of UAB's program is mediated through these modes of cancer treatment.

Exhibit 15.2: UAB Common Support and Covariate Balance for UAB and Comparison Patients

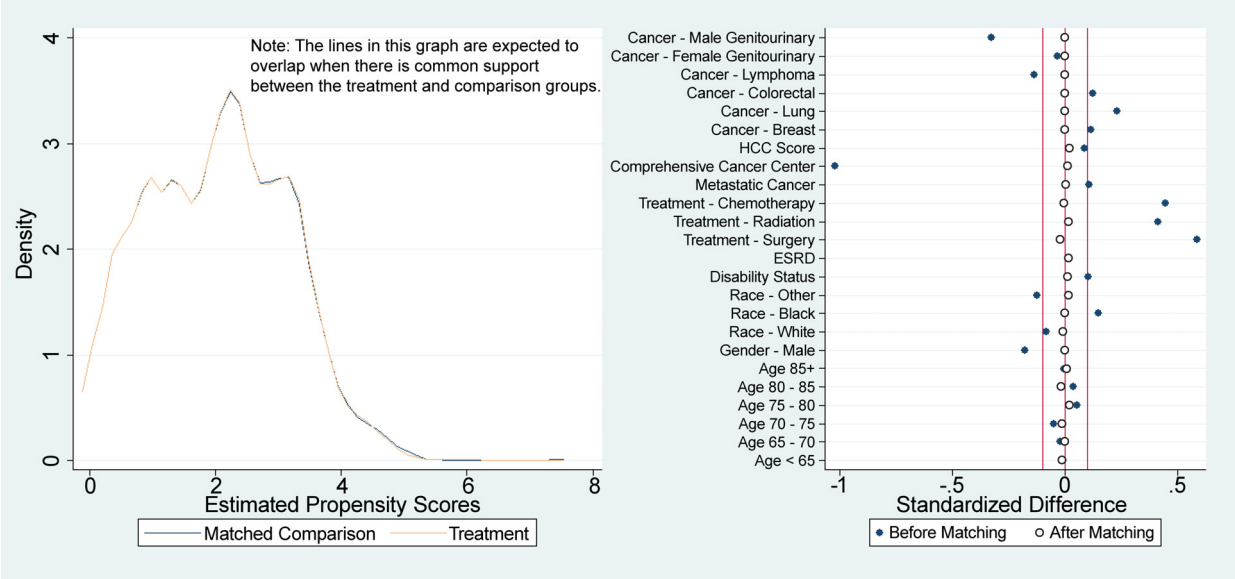


Exhibit 15.3 presents demographic and other basic information about treatment and matched comparison patients included in our analysis of core outcome measures. Because the comparison group is matched to the UAB intervention group, we observe few differences on demographics, comorbidity, and prior health care utilization. We observe significantly lower rates of ED use prior to enrollment for UAB participants ($p < 0.01$). In addition, the UAB patients are more likely to be dually eligible ($p < 0.05$) and Hispanic participants ($p < 0.05$). We include these variables in our outcome models to control for any remaining confounding factors after matching.

Exhibit 15.3: UAB Descriptive Characteristics of UAB and Matched Comparison Patients

Variable	UAB Treatment Patients	Matched Comparison Patients
Number of Beneficiaries	2,492	2,492
Mean No. Quarters Enrolled	3.12 [1–7]	3.13 [1–7]
Cancer Type		
Breast	33.3% (829)	33.3% (829)
Colorectal	13.7% (341)	13.7% (341)
Lung	24.7% (615)	24.7% (615)
Lymphoma	7.5% (188)	7.5% (188)
Female genitourinary	3.1% (77)	3.1% (77)
Male genitourinary	17.7% (442)	17.7% (442)
Cancer Treatment		
Cancer surgery	45.5% (1,134)	46.3% (1,155)
Cancer radiation	33.6% (837)	32.9% (820)
Cancer chemotherapy	62.9% (1,567)	63.0% (1,570)
Cancer Severity		
Metastatic cancer	34.4% (858)	34.2% (852)

Variable	UAB Treatment Patients	Matched Comparison Patients
Cancer Hospital		
Comprehensive Cancer Center	11.1% (277)	12.4% (310)
Affiliate Hospital	88.9% (2,215)	87.6% (2,182)
Age Group		
<65 years old	0.4% (10)	0.5% (12)
65–69 years old	31.0% (773)	30.9% (771)
70–74 years old	26.6% (664)	27.2% (677)
75–79 years old	22.4% (559)	21.5% (537)
80–84 years old	13.1% (326)	13.6% (339)
≥85 years old	6.4% (160)	6.3% (156)
Race/Ethnicity		
White	84.9% (2,116)	85.1% (2,122)
Black	13.7% (341)	13.7% (341)
Hispanic **	0.2% (4)	0.0% (0)
Other	1.2% (31)	1.2% (29)
Gender		
Female	57.5% (1,434)	57.6% (1,435)
Comorbidity: Hierarchical Condition Categories (HCCs)		
Mean count of HCCs (SD)	2.85 (2.22)	2.82 (2.36)
Mean HCC score (SD)	1.97 (1.56)	1.94 (1.58)
Disability and ESRD		
Disability	12.8% (318)	12.3% (307)
ESRD	0.2% (6)	0.2% (4)
Dual Status		
Dually eligible **	12.8% (320)	10.6% (265)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare cost (SD)	19,320 (25,031)	19,245 (26,082)
Hospitalizations per 1,000 (SD)	522 (917)	538 (988)
ED visits per 1,000 (SD) ***	775 (1,571)	951 (2,642)

Statistical significance was assessed using Chi-square for categorical variables and t-tests for continuous variables.
*** p<0.01, ** p<0.05, * p<0.1

For each core measure, we pose the following research question:

- Are there differences in core measures between UAB's patients after enrollment in the program and comparison patients, after adjusting for differences in secular trends and risk factors across both groups?

To answer this question we use a summative DID model that assesses the impact of UAB's intervention over the entire post-intervention period. For details on specifications of this model, refer to Technical Appendix A.[123]

Summative DID results. Exhibit 15.4 presents the results of our summative DID models assessing the impact of UAB's program across the entire post-intervention period. The primary parameter of interest is

[123] All models are adjusted for: age, race, ethnicity, gender, HCC score, presence of targeted cancer conditions, and year of enrollment.

the DID estimator (the final column) showing the difference in average outcome between UAB and the comparison group *after* intervention enrollment minus the difference in average outcomes between the two groups *before* intervention enrollment. In the summative DID model we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.

- We observe a significant reduction in hospitalizations of 22 patients per 1,000 in UAB's program relative to the comparison group.
- We also observe significant reduction in ED visits of 27 patients per 1,000 for participants in UAB's program relative to the comparison group.
- Readmissions and ACS hospitalizations show a small, non-significant decrease for UAB's program relative to matched comparisons.[124]
- UAB's program shows a non-significant increase in the point estimate for cost of care of $375 per patient per quarter relative to the comparison group.

Exhibit 15.4: UAB Difference-in-Differences Estimates for Core Measures‡

Pre-Intervention Period			Post-Intervention Period			DIFFERENCE IN DIFFERENCES [95% CI]
Comparison (N=2,492)	Intervention (N=2,492)	DIFFERENCE [95% CI]	Comparison (N=2,492)	Intervention (N=2,492)	DIFFERENCE [95% CI]	
Hospitalizations per 1,000 Patients						
92	87	-5 [-11, 1]	204	177	-27 [-41, -13] ***	-22 [-37, -7] ***
ED Visits per 1,000 Patients						
125	116	-9 [-17, 1]	216	180	-36 [-51, -20] ***	-27 [-43, -11] ***
30-Day Readmissions per 1,000 Patients						
175	168	-7 [-32, 19]	197	177	-20 [-48, 8]	-13 [-50, 24]
ACS Hospitalizations per 1,000 Patients						
16	14	-2 [-5, 1]	30	25	-5 [-10, 1]	-3 [-9, 3]
Total Cost of Care per Patient						
$3,941	$3,852	-$89 [-$312, $133]	$11,175	$11,461	$286 [-$420, $992]	$375 [-$356, $1,106]

Inference: *** p<0.01; ** p<0.05; * p<0.1

‡Model-based estimates for cost estimated using population-averaged longitudinal models with log link and gamma distribution. Binary measures estimated using population-averaged longitudinal logit models.

- In Technical Appendix C we compare the results presented above with results from our sensitivity analyses for UAB where we (1) do not match or adjust for mode of cancer treatment, and (2) use the enrollment date on the finder file for the treatment group instead of the enrollment date defined by claims.

[124] Sample size in models for readmissions is smaller than other outcomes because readmissions models are limited to patients who had at least one index-hospitalization.

- Our results for program effectiveness shift against UAB for hospitalizations, ED visits, and total cost of care, when we do not match or adjust for differences in severity of cancer between the treatment and comparison group, using mode of cancer treatment as proxy.
- Our results for program effectiveness are robust to using the finder file based enrollment date instead of a claims-based enrollment date, even though using the former results in loss of 40 percent of our study sample.

Sustainability

UAB leadership's vision for their program and for cancer care more generally, is to move toward a value-based payment system in which navigation services are included. This is a longer-term goal that is dependent upon health care policy reform and payer engagement. In order to work toward this goal and to promote shorter-term sustainability, UAB and its affiliated sites are pursuing bridge funding from their hospitals for continuing the program.

Program leaders and hospital administrators from multiple sites expressed strong support for the program and intended to fill any gap between HCIA funding and the next source of funding. Some sites also intend to include lay navigation services as a regular line item in their budgets. UAB program leadership also reported that two sites have developed plans to expand navigation services to other cancer patient groups, beginning with the Medicaid and indigent population. Two additional sites have committed to continue and expand navigation services to multiple service lines, integrating nurse navigators and the non-clinical navigators as working teams.

UAB program leadership reported that multiple payers have expressed interest in oncology care modeling to include navigator services. The American Society of Clinical Oncology (ASCO) will assist with analysis of claims and clinical data to create a model for oncology care including navigation that is acceptable to hospital and physician leaders.

Conclusion

UAB developed the Patient Care Connect (PCC) program to provide coordinated oncology care by employing a workforce of lay navigators to expand cancer support in five Southern states. Through site visit discussions and observations, we find evidence suggesting important improvements to patient quality of life attributable to the program. Lay navigators encourage patient empowerment and help improve clinical workflow. We also find evidence of statistically significant reductions in hospitalizations and ED visits, supported by qualitative data, for UAB PCC patients relative to a matched comparison group.[125] As the Innovation Awards end, UAB and its sites are pursuing bridge funding from their hospitals to support the program until the next source of funding.

[125] In our analysis of UAB's program in this annual report, we exclude patients with cancers other than the six selected cancers and patients with multiple cancers. Our analyses, therefore, may not capture the overall impact of UAB's program.

Regents of the University of California, Los Angeles

The Regents of the University of California, Los Angeles Alzheimer's and Dementia Care (ADC) Program—which launched in 2012—coordinates and manages care for Medicare and Medicaid beneficiaries with Alzheimer's disease or other forms of dementia and supports their caregivers.

This chapter presents findings based on a review of the awardee's quarterly reports to CMMI, a baseline telephone interview with program leadership; two rounds of site visits, including focus groups with caregivers and patients; and analysis of Medicare claims data.

Program Title	**UCLA Alzheimer's and Dementia Care (ADC) Program**		
Intervention Summary	Nurse practitioners serve as dementia care managers (DCMs) who coordinate and manage patient care and conduct home visits to assess patient needs, create individualized dementia care plans, and provide caregiver support and education.		
Targeted Disease/Condition	Dementia		
Total Amount Awarded*	$3,208,541	**Award Amount Spent***	$2,334,421
Number of Sites	1 primary site with 3 satellite sites	**Locations by State**	CA
Cumulative Reach*	1,178		
Intervention Workforce	Approximately 2 lay health workers and 5 nurse practitioners (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- The program has improved caregiver quality of life according to qualitative data.
- ED visits appear to significantly decline for program participants; however, this trend begins well before program enrollment, suggesting the intervention does not drive this decline.
- Nurse practitioners find their caseloads to be overwhelming, and addressing their participants' social needs to be challenging.

Implementation Experience

The core program components—an intake visit, annual follow-up visits, ongoing monitoring, and 24/7 access—remained consistent throughout the three-year implementation period. When participants enroll, dementia care managers (DCMs) first conduct a 90-minute intake evaluation where the patient and caregiver receive a structured needs assessment that DCMs use to develop an individualized dementia care plan, in collaboration with the patient's primary care physician. The individualized dementia care plan contains recommendations for addressing both clinical and social needs. At annual in-person follow-up visits, a DCM administers the same structured needs assessment, ensures that the care plan is up to date, and addresses any medical or social issues identified during the visit or the previous year. While the visits are typically annual, there may be additional in-person visits if needed; there is also ongoing communication by phone or email. The DCM also visits participants who are hospitalized. DCMs serve as points of contact for patients and caregivers, answering medical

questions, updating medical plans, communicating with physicians, and connecting patients and caregivers to social services, such as counseling, education, or adult daycare. Patients are stratified into red, yellow, and green, with the red patients requiring greater interaction and the green patients being more stable and requiring less interaction. Patients may move to different groups depending on their current situation.

Physicians view co-management of care with DCMs favorably. Under the ADC program, primary care physicians (PCPs) manage overall patient care while DCMs provide care directly related to dementia. When asked, one physician reported that the program respects her sense of ownership of her patients. ADC program staff members reported that physician referrals are their most successful method of recruiting program participants.

- **The eight physicians interviewed believe the program adds value and benefits for their patients.** The physicians interviewed think all dementia patients and their caregivers could benefit from the program, particularly the education component. Physicians reported that DCMs add value by providing additional services, addressing caregiver stress, and providing medical recommendations specific to dementia. One physician stated that she could not imagine her practice without the DCMs;
- **Collaborating with DCMs has changed how some primary care providers (PCPs) care for their patients.** PCPs report that they have learned a lot about challenges associated with dementia care, and have improved their approach to prescription medications for this population from their interactions with DCMs. They report spillover by using this new information to inform their interactions with other patients. For example, one physician set up phone calls with some patients who cannot come in because she saw how well this model worked for ADC participants.

Over the course of the program, DCMs began conducting more initial and annual visits in patients' homes and find them to be effective but costly in terms of staff time. DCMs want to provide access to care for patients whose mobility challenges make it difficult to travel. DCMs perceived home visits to be more effective than an office visit in assessing some patient needs; for example, they are able to conduct home safety evaluations and assess the patient's fall risk. They also may learn more about family dynamics and the impact of paid caregivers and friends and neighbors on families. However, while there are benefits to home visits, there is also an opportunity cost, as DCMs spend more time in transit and less time interacting with patients or coordinating care. DCMs note that travel time makes it difficult for them to keep up with their caseloads. DCMs have learned to target specific areas and days to conduct home visits as efficiently as possible. The ADC program now assigns DCMs to specific locations for different days of the week, limiting travel during the day. Expanding the program to UCLA health clinics in Thousand Oaks and Porter Ranch increased access for participants who live northwest of Los Angeles, and the DCM who works out of those offices can visit participants in that region.

UCLA hired two DCM assistants to ease the burden on the DCMs. The program hired one DCM assistant in June of 2014 and added a second in spring 2015. The DCM assistants are not licensed clinicians. They manage routine contacts with the more stable patients and make follow-up phone calls, mostly following a script. The DCM assistants also provide information about community resources that the DCM has recommended for the participant. At times, assistants use their judgement to suggest that the

DCM follow-up with a participant even if not explicitly requested, based on what they heard on the call. The DCM assistants also help the DCMs prep for appointments and phone calls.

Having scheduled phone calls between the DCMs and participants—a process facilitated by the DCM assistant—has allowed DCMs to use their time efficiently. Before the addition of the DCM assistant, DCMs did not consistently schedule phone calls and would instead try to call in a less organized fashion. DCMs said they were often playing phone tag with participants, which was frustrating for both parties and wasted a lot of time. They now have a DCM assistant who makes calls to check in on more stable participants and schedules a time for them to talk with the DCM if they have questions—noting what participants want to talk about so DCMs can be prepared. DCMs have found that most of the time participants answer the phone at the appointed time and this process has been more efficient overall.

Despite staffing model changes and new technology solutions, DCMs felt overwhelmed by their caseloads and reported that a 250-patient panel is unmanageable. DCMs reported high levels of work stress, difficulty separating work and personal time, and feeling guilty about not being able to do more or follow up more frequently. All DCMs reported regularly working early mornings, nights, and weekends to complete work—especially completing visit notes and writing care plans. UCLA reports that beyond the funding period, they plan to reduce the caseload, probably to 200 patients per DCM.[126] Adding a DCM assistant and some attrition due to death and relocation also eased workload.

DCMs cite connecting program participants to social resources as challenging. An important goal of the program is to ensure that participants have access to outside social resources, such as counseling, adult daycare, or assistance with financial planning. Most DCMs did not have prior experience in this area and said that learning about social resources was a challenging part of their initial training. One DCM described the referral process:

> *"So it is just getting us to get a feel for when we need to refer out. And who do we refer to. We're not helpful if we just say go see a financial planner. These people can't even go in the car to the grocery store anymore. So, you know, we need to be able to say, here is who you can call. We are constantly developing lists of resources. So we'll say, we offer this snapshot list of the financial planners we've worked with in the past that we have gotten good feedback from the families for."*

The UCLA ADC program is dependent on community-based organizations (CBOs) to provide social services for patients and caregivers in the program. As in other metropolitan areas, the region has a number of dementia-related CBOs, which may not be as prevalent in other areas of the country. However, there are fewer adult day care centers since California's Medicaid program reduced funding in 2011.[127] With many adult day care centers closing, the remaining are eager to participate and receive funding from programs like ADC. When the program expanded to Thousand Oaks and Porter Ranch, staff had to establish relationships with new CBOs in those areas. The staff was able to build relationships with

[126] Q11 HCIA Narrative Progress Report, April 30, 2015, p. 6.
[127] California bill would restore funding for adult day care centers, Reuters, June 18, 2014: http://www.reuters.com/article/2014/06/19/us-usa-california-disabilities-idUSKBN0EU04Z20140619.

three new organizations located at a farther distance from ADC participants than CBOs in Los Angeles proper.

UCLA changed the payment method for community-based organization partners (CBOs) to allow more flexibility based on patient needs and to enhance accountability. They moved away **from providing upfront block grants to CBOs to a model where they pay for services provided.** Because the five participating CBOs provide a range of different services, from adult daycare and counseling to education and support group services, budgets for each CBO evolved to reflect greater need for certain services over others. UCLA is able to reallocate CBO budgets should those needs change.

DCMs are responsible for determining patient needs, and offering patients vouchers to CBO's for services that could meet those needs. By its second year, UCLA offered CBOs a retainer fee and a preliminary award budget based on their past performance and the need-based projection of the services it would offer program participants. CBOs could only receive the balance of the award if they actually perform the projected number of services, as demonstrated through redeemed vouchers. Three-quarters of the way through the year, if agencies are below their projected amount, UCLA may re-allocate funding depending on current needs.

The UCLA ADC program developed its own case management software, which took more time and money than originally planned. In October 2014, program staff began using case management software to more efficiently assign, delegate, and track tasks among team members. The case management software has the following functionalities:

- Sends alerts for task assignments, including initial visits, care management plans, annual visits, and patient phone calls. Assignments may come attached with a protocol detailing required steps;
- Provides an abbreviated patient dashboard;
- Tracks referrals to CBOs—although this function has not fully materialized because the CBOs have experienced technical challenges using the software.

DCMs worked with external software developers to define the desired capabilities. Program leadership reported that in retrospect they should have been less ambitious when planning the software and limited the scope to day-to-day logistical functions. The hospital installed a new EHR after the ADC program started developing its software; had leadership known the capabilities of the hospital's new EHR, they would have shaped the design of the case management software differently.

Participant and Caregiver Experiences

We offer the following findings based on focus group discussions with 33 participants and caregivers.

Improvements in Quality of Life
Caregivers were satisfied with the care and services they received from their DCM and indicated that it reduced their stress as a caregiver. Caregivers see the DCM as someone who could guide them through their caregiving responsibilities, especially when they did not know what to do. Caregivers felt emotionally supported by the program's dementia care managers. One caregiver said, "*The program has turned my life around. I now have a grip on things. I don't feel totally overwhelmed. I've been given some counseling and adult daycare.… I can honestly say she has sort of saved me.*" Caregivers also give positive feedback about services provided through referrals to community-based organizations. In particular, participants highlight counseling and group educational sessions from OPICA Adult Day Program & Counseling Center, which helps them with caregiving responsibilities and reduces their stress. Caregivers noted it was helpful that counselors had knowledge of dementia, as they were able to provide both education and comfort during counseling. Caregivers also mention that OPICA's adult daycare service allows time away from direct caregiving, which further reduces their burden.
Enhanced Access
Caregivers report that DCMs are responsive to their calls, which has enhanced access to care. One participant reported that on more than one occasion she contacted the DCM rather than go to the emergency room. Though responsive to calls, some caregivers would appreciate if DCMs reached out to them more frequently and proactively.
Suggested Improvements
Caregivers express a desire for more services tailored to their current situation. In particular, caregivers recommended that the program identify specific resources that could help people with mild to moderate dementia. For example, one caregiver thought a support group for caregivers of more advanced dementia patients was overwhelming and upsetting. She explained, "*For me, to go to a caregiver class or anything like that, they don't separate the early Alzheimer's, with the moderate and advanced. So I really don't go. I wish I could, I want to go … but for the most part, I have to hear about the advanced stuff that I don't necessarily think I'm ready for.*"

Quantitative Analysis of Program Effectiveness

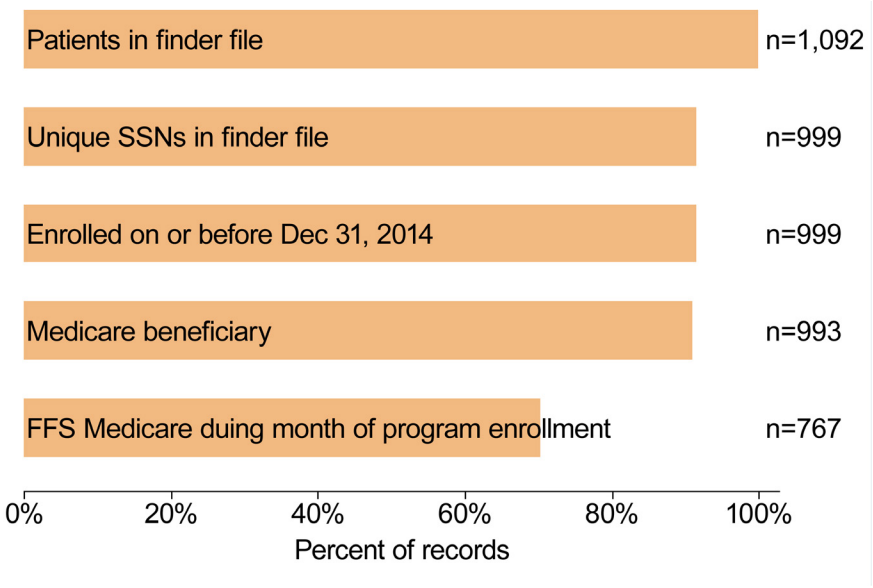
We use difference-in-differences (DID) analyses to evaluate the ADC program's impact on core measures—all-cause hospitalizations, hospitalizations for ambulatory care sensitive conditions (ACS), 30-day readmissions, emergency department (ED) visits, and total cost of care.

- We restrict our treatment group to Medicare fee-for-service (FFS) participants enrolled in UCLA's program for one or more quarters, from July 1, 2012 through December 31, 2014;

- We worked with UCLA's finder file listing participants and their enrollment dates to identify FFS Medicare claims for individuals in our treatment group (see Exhibit 16.1);
- To identify a pool of comparison patients, we select FFS beneficiaries with a history of Alzheimer's diseases or other forms of dementia residing in the same zip codes as participants.[128]

Limitations. Although we include a matched comparison group in our analysis, results should be interpreted with some caution. The number of participants enrolled in the intervention for five or more quarters and the number of patients experiencing an ACS hospitalization are small, limiting our power to detect differences. Similarly, analysis of readmission is limited to patients with an index-hospitalization, reducing the sample size in these models. [129, 130, 131]

Exhibit 16.1: UCLA Patients Identified through Finder File



Comparison group selection. We use propensity score models to match intervention to comparison patients on demographics, comorbidities, and prior utilization. For more details on comparison selection and matching, see Technical Appendix A. Exhibit 16.2 summarizes the results. The left panel shows the common support after propensity score matching, and the right panel displays the covariate balance before and after matching.

- After matching, we observe the two groups have nearly identical distributions of propensity scores, suggesting that—at least on the included factors—these groups are well matched.

[128] For more details on the criteria used to define the comparison group including diagnosis codes used to define dementia, please see Technical Appendix A.
[129] Less than half of our sample (309 out of 767 patients) are enrolled for more than five quarters; there are 309 patients in the sixth intervention quarter and 231 in the seventh quarter. Each quarter after this, the number of enrolled patients diminishes further and results for these quarters are not included in charts here.
[130] An average of 10.7 patients are hospitalized for an ambulatory care sensitive condition each quarter.
[131] In each quarter, 63 UCLA patients, on average, are admitted to a hospital and of those 10 experience a readmission.

- On the balance chart, we show matching has achieved balance (reduced the difference between UCLA participants and comparison group) on demographic characteristics, comorbidity, and prior-year costs.

Exhibit 16.2: UCLA Common Support and Covariate Balance for UCLA and Comparison Patients

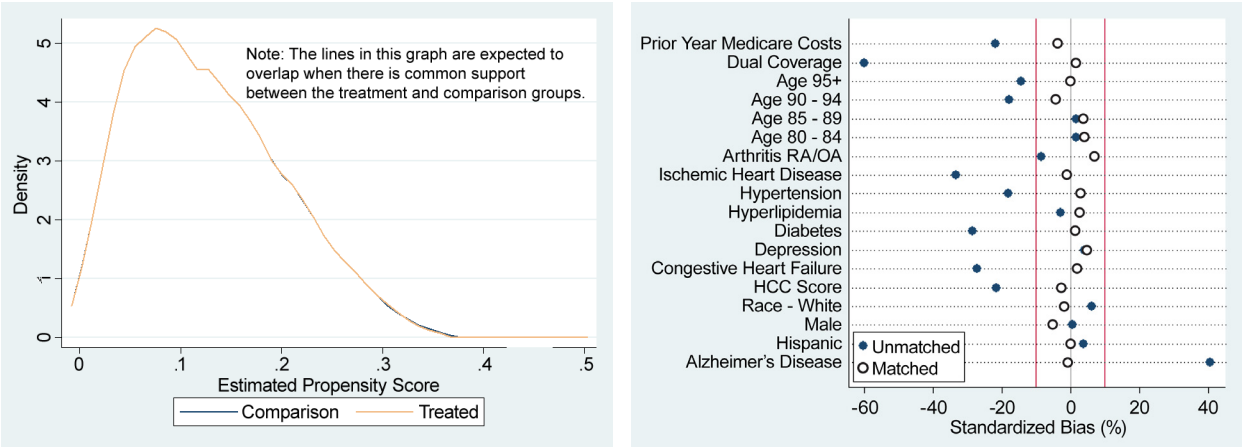


Exhibit16.3 presents demographic and other basic information about treatment and matched comparison patients included in our analysis of core outcome measures. Because the comparison group is matched to the UCLA group, we observe few differences on demographics, comorbidity, and prior health care utilization. We observe significantly higher rates of ED use prior to enrollment for ULCA participants ($p < 0.01$) and differences in the distribution of quarters of follow-up data available ($p < 0.01$).[132]

[132] When building regression models, we limited the data to quarters where both the treatment and comparison patient from the matched pair had data, so in the final models, the number of quarters enrolled is balanced between the two groups.

Exhibit 16.3: UCLA Descriptive Characteristics of UCLA and Matched Comparison Patients

Variable	Treatment	Matched Comparison
	% (N)	% (N)
Number of Persons	767	767
Mean No. of Quarters Enrolled***	4.8 [1–11]	7.3 [5–9]
Alzheimer's Diagnosis		
Diagnosis of Alzheimer's on Claims	72.6% (557)	72.8% (558)
Gender		
Female	65.3% (501)	62.8% (482)
Age Group		
54–64 years old	1.8% (14)	1.6% (12)
65–69 years old	5.2% (40)	4.8% (37)
70–74 years old	9.4% (72)	11.9% (91)
75–79 years old	18.8% (144)	18.8% (144)
80–84 years old	21.6% (166)	20.3% (156)
≥85 years old	43.2% (331)	42.6% (327)
Race/Ethnicity		
White	76.5% (587)	77.2% (592)
Black	10.4% (80)	10.3% (79)
Hispanic	3.9% (30)	4.0% (31)
Other	9.1% (70)	8.5% (65)
Dual Eligibility		
Dual enrolled	16.9% (130)	16.0% (123)
Hierarchical Condition Category (HCC)		
Mean HCC score (SD)	1.8 (1.2)	1.8 (1.4)
Mean count of HCCs (SD)	3.2 (2.5)	3.0 (2.8)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare cost (SD)	$19,031 ($34,598)	$19,717 ($31,297)
Hospitalizations per 1,000 (SD)	580 (1,177)	560 (1,079)
ED visits per 1,000 (SD)***	1179 (211)	548 (106)

Statistical significance was assessed using Chi-square for categorical variables and t-tests for continuous variables.
*** p<0.01, ** p<0.05, * p<0.1

For each of the measures, we pose the following research question:

- Are there differences in core measures between UCLA's patients after enrollment in the ADC program and comparison patients, after adjusting for differences in secular trends and risk factors across both groups?

To answer this question we use a summative DID model that assesses the impact of enrollment in UCLA's ADC intervention over the entire post-intervention period. For details on specifications of this model, refer to Technical Appendix A.[133]

Summative DID results. Exhibit 16.4 presents the results of our summative DID models assessing the impact of UCLA's program across the entire post-intervention period. The primary parameter of interest is the DID estimator (the final column) showing the difference in average outcome between UCLA and the comparison group *after* intervention enrollment minus the difference in average outcomes between the two groups *before* intervention enrollment. In the summative DID model we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.

- We observe significant reduction in the DID estimator for ED visits. Although ED visit rates for participants in UCLA's program began declining before the intervention and remained higher than matched comparisons throughout the observation period, during the intervention period, the gap between the two groups narrowed significantly by 37 ED visits per 1,000 patients.
- Readmissions show a statistically significant increase of 77 per 1,000 patients for UCLA's program relative to matched comparisons. The decline in readmissions for the comparison group of from 190 to 131 per 1,000 patients coupled with a smaller (non-statistically significant) increase in readmission for UCLA participants may be driving DID estimator results.
- The DID point estimates for hospitalizations, ACS hospitalizations, and total cost of care were in UCLA's favor but not statistically significant.

Exhibit 16.4: UCLA Difference-in-Differences Estimates for Core Measures‡

Pre-Intervention			Post-Intervention			DIFFERENCE IN DIFFERENCES [95% CI]
Comparison (N=767)	Intervention (N=767)	DIFFERENCE [95% CI]	Comparison (N=767)	Intervention (N=767)	DIFFERENCE [95% CI]	
Hospitalizations per 1,000 Patients						
97	100	4 [-10, 18]	115	114	1 [-19, 17]	-5 [-24, 14]
ED Visits per 1,000 Patients						
106	172	67 [48, 86] ***	128	158	30 [8, 52] ***	-37 [-58, -16] ***
30-day Readmissions per 1,000 Patients Hospitalized						
190	144	-46 [-99, 76] *	131	163	32 [-25, 88]	77 [9, 146]**
ACS Hospitalization per 1,000 Patients						
17	18	1 [-5, 7]	19	17	-2 [-9, 6]	-3 [-10, 5]
Total Cost of Care per Patient ($)						
4,719	4,108	-610 [-1230, 9] *	8,271	7,272	-999 [-2,413, 415]	-388 [-1,665, 889]

Inference: *** p<0.01; ** p<0.05; * p<0.1

‡Model-based estimates for cost measure using generalized estimating equation model with log link and gamma distribution. Count measures estimated using population-averaged logit models.

[133] All models are adjusted for age, race, ethnicity, gender, HCC score, presence of Alzheimer's type dementia, and year of enrollment.

Sustainability

Program leadership's primary strategy to sustain the program is to make the business case for the program to UCLA Health in the hopes that they absorb it into their operating budget it and clinical workflow. They estimate that only 25 percent of a DCM's time is currently billable; they may explore the new Medicare Chronic Care Management (CCM) fee as a way of boosting reimbursement for services.[134] However, UCLA physicians affiliated with the intervention that we interviewed showed great support for the program, commending the impact that it has on patients' lives and the care they receive. In addition, the program is seeking charitable donations, given that the ADC program is located in an affluent area.

Conclusion

UCLA's program works with community-based organizations and UCLA physicians to enhance care for UCLA patients with Alzheimer's or other forms of dementia by managing their care and supporting caregivers. Through site visit discussions and observations, we find evidence suggesting the program has improved caregiver quality of life, but that nurse practitioners find their caseloads to be overwhelming, and addressing their participants' social needs to be challenging. We also find that ED visits appeared to significantly decline for program participants. However, this trend begins well before program enrollment, suggesting the intervention does not drive this decline. As the Innovation Awards end, UCLA leadership hopes to sustain the program but funding mechanisms for long-term continuation of the program remain uncertain.

[134] CY 2015 Revisions to Payment Policies under the Physician Fee Schedule and Other Revisions to Medicare Part B. Accessed September 8, 2015 at http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Federal-Regulation-Notices-Items/CMS-1612-FC.html

Trustees of the University of Pennsylvania

The Trustees of the University of Pennsylvania (UPenn) Comprehensive Longitudinal Advanced Illness Management (CLAIM) program provides a comprehensive set of home care services for individuals with advanced cancer who do not yet qualify for hospice. UPenn's intervention is implemented through Penn Home Care & Hospice Services, part of the UPenn Health System. The CLAIM program delivers services in counties throughout the Philadelphia region.

This chapter presents findings based upon a review of the awardee's quarterly reports to CMMI as well as telephone interviews with the awardee leadership, staff, and patients; site visits, which included observations of home visits; and analysis of awardee-collected data.

Program Title	**CLAIM Program**		
Intervention Summary	Using care coordination and planning, the intervention team provides in-home support, symptom management, crisis management, and emotional and spiritual support for individuals with advanced cancers.		
Targeted Disease/Condition	Cancer		
Total Amount Awarded*	$4,352,754	**Award Amount Spent***	$2,296,935
Number of Sites	1	**Locations by State**	PA
Cumulative Reach*	1,226		
Intervention Workforce	Approximately 1 chaplain, 4 lay health workers, 6 nurses, 1 nurse practitioner, and 2 social workers		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- The program has improved quality of life for cancer patients and their caregivers, relieving them of much anxiety surrounding their illness and treatments.
- While **we are currently unable to assess the performance of CLAIM program on hospitalizations, readmissions, ED visits and total cost of care, t**he program performed significantly higher than its target goal for managing pain for its participants with advanced cancers in most of the post-intervention quarters and over the entire post-intervention period.
- As the Innovation Awards end, UPenn is unlikely to sustain most program components.

Implementation Experience

Using a mid-level provider trained in oncology is a critical component of the intervention. The NP frontloads her visits, targeting patients that require more symptom management and discussions of care goals. The NP also writes short-term medical prescriptions for patients in crisis if their doctor is not readily available, instead of sending the patient to the hospital. The NP has established herself as a leader of the intervention, serving as an educator and general resource for the nursing staff. To replicate the program, any future NPs should also be able to take a leadership role, act as an educator, and be an expert in symptom management and oncology care. Furthermore, it is crucial that the NP develop relationships

and work with oncology providers to actively acquire patients early in the end-of-life trajectory. This is so they can start an effective and patient-centered transition to hospice. The NP also must be proficient in discussing goals of care, guiding the patient through the end-of-life decision process.

A background in oncology is also important for CLAIM nurses conducting home visits. The nurse practitioner noted that oncology patients have medical needs compounding their cancer, such as pain management or nausea and other symptoms related to chemotherapy, making cancer care unique from other medical issues. She noted that cancer care is often about meeting the participant "where they are" and noted that caring for stage 4 cancer patients required understanding not only the disease trajectory but also the psychological endeavor that patients face throughout their illness. Because many of the home visit nurses lacked an oncology background, they relied more on the NP and had to learn on the job.

CLAIM staff received on-going on-the-job training; future programs should consider formal preparatory training programs for staff lacking extensive oncology experience. Rather than hold a consolidated training period at the beginning of the program, the NP led informal weekly meetings to confer and provide basic guidance on topics such as how to facilitate discussion of end-of-life issues and goals of care. The NP also led individual case studies, examining challenging experiences faced by case managers, such as managing both the needs of the patient and the input of the family. Nurses also received some training on end-of-life care in a home-based setting, particularly with pain and symptom management. Leadership found this approach to training to be inadequate for nurses without oncology experience.

The CLAIM program places significant emphasis on advance directives to ensure that participants have a plan in place to better manage their end-of-life care trajectory. The CLAIM program guides advance directive conversations by tracking a "Comfortable Dying" measure to gauge a participant's anxiety level about their end-of-life care. Conversations with patients also address goals of care and strategies for symptom management. To ensure advance directives are easily accessible to all providers involved in care, UPenn used funds from the award to purchase a number of scanners that allow nurses to scan a patient's advance care directive straight into the program's EHR while at a home visit.

The CLAIM program places significant emphasis on advance directives to ensure that participants have a plan in place to manage their end-of-life care trajectory better. The CLAIM program guides advance directive conversations by tracking a "Comfortable Dying" measure to gauge a participant's anxiety level about their end-of-life outlook. Conversations with patients also address goals of care and strategies for symptom management. To ensure advance directives are easily accessible to all providers involved in care, UPenn used funds from the award to purchase a number of scanners that allow nurses to scan a patient's advance care directive straight into the program's EHR while at a home visit.

Interoperability of electronic home care systems and the hospital's EHR is key to continuity in end-of-life care. The CLAIM program functions within UPenn Home Care & Hospice Services, a separate entity from the UPenn Hospital System. The program coordinators of CLAIM identified that if someone in CLAIM has a conversation about end-of-life care, it is important for the hospital to have this information readily available. Advance directives are scanned into the CLAIM EHR, leaving them unavailable to the hospital staff. The email systems are jointly secure, but the communication would be more efficient if the hospital and home care program shared the same medical record. The Principal

Investigator identified the need for seamless communication and recognized the benefit and opportunity for aligning electronic systems. He stated that UPenn recently purchased a license for Epic, which will align the systems in late 2016. Until then, the CLAIM staff does receive a daily summary from the hospital concerning all CLAIM patients.

Participant and Caregiver Experiences

We offer the following findings based on in-person and telephone discussions with 11 participants and caregivers.

Improvements in Quality of Life
Patients report that the program has significantly improved their health and that they had more confidence to take care of themselves because of the support from the home health staff. Nurses taught patients important information about their symptoms and illness. These patients feel taken care of, more comfortable, and reassured about their condition and quality of life. One CLAIM caregiver even stated *"[the patient] wouldn't be with us if it weren't for this program. It's been a lifesaver."*
The CLAIM program allows patients to receive holistic care remotely from their homes. Patients noted that, through the program, they are able to regularly communicate any problems or concerns with their home nursing staff and that their concerns are then relayed on to their doctors for further medical instructions if needed. Caregivers also noted that the regular monitoring of the patient's symptoms made them feel less stress: "*I appreciate that the nurse can tell [my husband] when his symptoms are serious enough to see a doctor because it relieves a lot of anxiety."*

Quantitative Analysis of Program Effectiveness

Due to the low evaluability of UPenn's CLAIM program with respect to Medicare/Medicaid populations, we use data obtained from the awardee through March 2015 for our analysis of program effectiveness.

The UPenn team provided data files for CLAIM participants' demographic characteristics, self-reported pain, and services provided by the program. Exhibit 17.1 summarizes these characteristics for the program participants enrolled over the seven post-intervention quarters in our analysis:

- A quarter of the CLAIM participants reported pain at an uncomfortable level at the time of enrollment.
- Commercial enrollees account for 65 percent of the CLAIM participants; Medicare beneficiaries, including Medicare Advantage, account for less than a third.
- In-person and skilled nursing visits were the most common form of service provided by the CLAIM program, with all participants receiving such services; followed by social support (92%), phone support (85%), and spiritual support (44%).

Exhibit 17.1: UPenn Descriptive Characteristics of Participants

Variable	N (%)
Total Participants	918
Participants with Self-Reported Pain during Admission to CLAIM	
Pain at uncomfortable level	228 (25%)
Gender	
Female	514 (56%)
Age	
<40 years	48 (5%)
40–49 years	78 (9%)
50–59 years	198 (22%)
60–69 years	274 (30%)
70–79 years	185 (20%)
80+ years	135 (15%)
Payer	
Medicaid	34 (4%)
Medicare (including Medicare Advantage)	289 (31%)
Private	594 (65%)
Number of CLAIM Contacts	
Average number of CLAIM contacts (SD)	18.3 (20.4)
Type of CLAIM Contact	
Skilled nursing	918 (100%)
LPN	39 (4%)
Home health aide	220 (24%)
Occupational/physical therapy	247 (27%)
Spiritual support	408 (44%)
Social support	842 (92%)
Phone support	782 (85%)
Other in-person visits	918 (100%)

We use a dataset provided by UPenn on patient-reported outcomes for pain to assess how the CLAIM program achieves its goal of better pain management. The CLAIM program administers questions on self-reported pain to participants during program enrollment and sets a benchmark target of having pain under control for over 66 percent of participants who reported pain. This measure benchmark was 10 percent greater than the pain management performance of 55.5 percent observed for a historical UPenn comparison group. We report the CLAIM program's performance on pain management against the target benchmark across the entire post-intervention period and in seven post-intervention quarters (I3–I9 in Exhibit 16.3).

Limitations. Our analysis of program effectiveness for the CLAIM program is limited to the awardee's self-reported performance on pain management for its patients, with reference to a historical comparison group benchmark. We are currently unable to assess the performance of CLAIM program on hospitalizations, readmissions, ED visits, and total cost of care. We are also unable to compare CLAIM

patients to a comparison group to determine if the program differentially affects pain outcomes. Exhibit 17.2 summarizes the pain management measure used by the program.

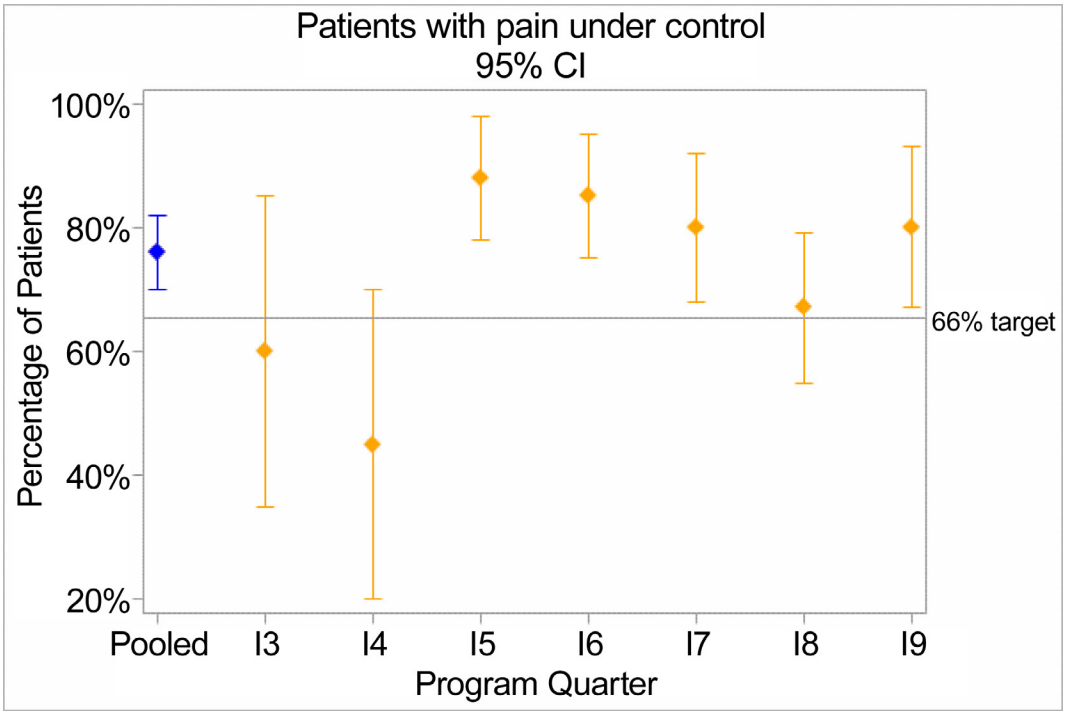
Exhibit 17.2: UPenn Overview of CLAIM Program's Pain Management Measure

Outcome Measure	Description of Measure	Comparison Group/ Benchmark	Link to CMMI Core Measures
Pain Management for CLAIM Participants	Percentage of CLAIM participants with self-reported pain brought to a comfortable level. **Denominator** includes CLAIM participants who reported uncomfortable pain during initial assessment at the time of admission to CLAIM. **Numerator** includes CLAIM participants who reported pain at a comfortable level within 48 hours of initial assessment upon admission to CLAIM.	UPenn provided benchmark for historical comparison group of patients with advanced cancer not enrolled in CLAIM	Hospitalization and ED Use

Exhibit 17.3 shows the performance of the CLAIM program on pain management relative to their target goal of bringing pain to a comfortable level for over 66 percent of their patients with self-reported pain within 48 hours of program enrollment. We present the program's performance for each of the seven post-intervention quarters and show a pooled performance measure for the entire post-intervention period.

- Across the entire post-intervention period, 78 percent (95% CI 74%–82%) of patients with pain had their pain brought to a comfortable by the CLAIM program within 48 hours of program enrollment.
- The program's performance on pain management was significantly higher than the target of 66 percent in four of the seven post-intervention quarters.

Exhibit 17.3: UPenn Performance of CLAIM Program on Pain Management



To understand what subgroups of participants were more or less likely to have better pain management, we ran multivariate logistic regression model that studied the association between the pain management measure and participant characteristics summarized in Exhibit 15.2. We did not find any significant differences by subcategory.

Sustainability

UPenn is unlikely to sustain most program components. However, program leaders note that the program will continue in some capacity (e.g., the NP role may continue) and are exploring two potential avenues to support sustainability:

- **Discussions with private payers:** CLAIM leadership is exploring the possibility of partnering with private payers. CLAIM leadership is currently engaging potential payers who would be interested in supporting the program. Program leadership has shared data on cost of care and ED admissions for CLAIM participants and a historical comparison group with a large private payer in the state. CLAIM leadership suspects that the number of patients at UPenn may simply be too small to pique the company's interest.
- **Serving Medicaid population in Penn's Health System:** Hospital losses for the Medicaid population are substantial in the University of Pennsylvania Health system. Based on self-monitoring data, CLAIM reduced hospitalizations by over 40 percent for the Medicaid enrollees they served. The CLAIM program is sharing this pre-post data with the UPenn Health System to explore the potential value of the CLAIM program for the health system's Medicaid population. CLAIM leadership is uncertain that the numbers will be large enough to draw interest given the low number of Medicaid enrollees in CLAIM and at the UPenn Health System as a whole.

Conclusion

UPenn's CLAIM program offers comprehensive home care services to advanced cancer patients who have significant palliative care needs but are not yet ready for hospice care. Through site visit discussions and telephone discussions with patients, we find evidence suggesting the program has improved quality of life for cancer patients. Quantitative data to evaluate the CLAIM program is limited. We are currently unable to assess the performance of CLAIM program on hospitalizations, readmissions, ED visits and total cost of care. However, we find evidence that the program performed significantly higher than its target goal for managing pain for its participants with advanced cancers in most of the post-intervention quarters and over the entire post-intervention period. As the Innovation Awards end, UPenn is unlikely to sustain most program components.

Upper San Juan Health Service District

The Upper San Juan Health Service District (USJHSD) innovation award focuses on reducing cardiovascular risk for its population and improving care for cardiovascular disease patients in a medically-underserved area of southwestern Colorado. USJHSD includes Pagosa Spring Emergency Medical Services (EMS) and the Pagosa Springs Medical Center (Medical Center). We present findings from a review of the awardee's quarterly reports to CMMI, one in-person site visit, another site visit conducted by telephone, and analysis of data collected by USJHSD. We also report on findings from telephone interviews with patients who participated in navigation and outreach paramedicine programs.

Program Title	Upper San Juan Health Service District (USJHSD) Program		
Intervention Summary	USJHSD Program contains three primary initiatives: (1) *Wellness programs:* cardiovascular early-detection screening, wellness education programs, and patient navigation for participants at risk in the community; (2) *Telemedicine initiative:* teleconsultations with neurologists for patients at risk for stroke and remote diagnostics and treatment for patients who display signs of stroke. Cardiology telemedicine is available to patients in the Medical Center primary care clinic as well; (3) *Paramedicine initiative:* education, equipment, and upgrades to scope of service for the community Emergency Medical Services (EMS); expanding paramedics' role to include specialized critical care during urgent care transport and in-home, follow-up services for the most vulnerable patients.		
Targeted Disease/Condition	Cardiovascular Disease		
Total Amount Awarded*	$1,724,540	**Award Amount Spent***	$1,254,379
Number of Sites	1	**Locations by State**	CO
Cumulative Reach*	1,548		
Intervention Workforce	Approximately 8 ER doctors, 3 lay health workers, 8 neurologists, and 9 paramedics		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Qualitative findings suggest that the telemedicine and critical care paramedicine programs may reduce utilization of costly health care services (e.g., air ambulances) and improve patient outcomes and patient and family satisfaction with care.
- Perhaps because the program serves high-need patients, we find no quantitative evidence of a decrease in any of stroke risk factors for participants in the wellness program.
- Medical center leadership will continue the paramedicine and telemedicine programs, but may modify or discontinue the wellness and patient navigation programs.

Implementation Experience

The Innovation Award allowed USJHSD to expand its offerings for patients across the Medical Center. Through the program, USJHSD established partners for teleconsultation, engaged community stakeholders for outreach and education, recruited new staff, and trained existing staff. USJHSD experienced a number of implementation delays and challenges due to unanticipated contextual factors affecting implementation. We describe the overall implementation experience and specifics associated with patient navigation, wellness programs, telemedicine, and outreach paramedicine.

USJHSD leadership noted that it was overly ambitious to implement a three-year program with components that affected many different departments. The project manager described how she might do things differently if she had the opportunity to implement a similar program: *"If anyone were considering this project as a whole or something similar then I would definitely advise to spread out the timeline quite a bit more and give themselves more opportunity to let things simmer before offering new services."* She believed this strategy would lessen the overall burden on staff.

USJHSD's wellness programs educate the community, connect them to resources, and increase awareness of the wellness center programs. The early detection screening has built USJHSD's relationship with the community, raised awareness about the resources and education available at the wellness center, and reengaged participants with their primary care providers. Although program instructors for worksite wellness might encounter resistance from employees at first, they find that by the end participants are able to make changes or at least discuss issues they are having more openly.

Patient navigation received more patient referrals for patients with multiple diseases and social needs than expected. The patient navigation intervention enrolled patients with varying profiles and needs. Some participants had a one-time need for a referral. Others have complex, multilayered health, mental health and social service needs. The awardee did not expect navigators to be faced with the variety and intensity of needs encountered. Despite these challenges, the navigator program has successfully connected many patients to insurance and reduced the uncompensated care burden of the medical center.

USJHSD now uses a clear timeline for navigation and establishes a manageable caseload (20 patients per full-time navigator). USJHSD established these practices after the initial patient navigator struggled to manage her caseload and to establish clear start and endpoints with some participants. Still, as of the second round of site visits the patient navigator wonders:

> *"How can we make the start and finish really clear to the patient? And I'm wondering and taking a step back asking, is it myself? Am I not being clear? Is it the protocols that are in place—are they not clear? Where is the clarity of this program? Where does it need to be re-addressed? Or is it just the nature of patient navigation?"*

- For emergency telehealth, giving a neurologist the ability to rule out stroke via the camera has decreased the number of EMS flights. Patients are able to stay close to home, eliminating the cost of air transport. The system allows neurologists in Denver to speak directly with the families as well as patients to discuss treatment options and associated risks. As a USJHSD coordinator said, *"They do better when they're with their family. Once you load Grandma on the plane, you send someone*

there—you're not just sending them, you're sending their whole family […] it's quite cumbersome for them and traumatic for them when we do that."

Telehealth enables the effective administration of thrombolytic in cases where a stroke has not been ruled out. While most patients receiving thrombolytic treatment for stroke still need to be transferred to a tertiary care facility for specialized care, the telemedicine program allows treatment before transport, which is critically important for eligibility and effectiveness of treatment, and expected to result in large lifetime cost savings from improved outcomes in stroke patients. As of the March 2015 report, USJHSD reports that five patients diagnosed with stroke via telemedicine have received thrombolytic treatment.

Over time, the emergency department (ED) physicians developed stronger relationships with the consulting neurologists, leading to an increased number of camera activations. Initially, ED physicians were hesitant to receive direction from neurologists that could prompt administering thrombolytics because they felt it fell outside their expertise and were uncomfortable with the associated risks. As one neurologist described, *"I think that was the main challenge was just getting them comfortable that we were not going to do anything reckless, that we were going to help them, and once they started feeling comfortable with that then they started using the camera a lot more."*

Local provider availability, the type of technology used, and the relationship between receiving and consulting providers influenced success for USJHSD telemedicine initiatives in different areas.

- *Local provider availability.* The closest neurologists are more than six hours away, while cardiology services are available within an hour drive of USJHSD. Patients often opt to drive for cardiology services. Furthermore, cardiologists hold clinics in-person several times a month at the medical center itself;
- *Type of Technology used.* The neurology program uses an advanced system with camera movement that mimics human movement. This has helped to humanize the experience. In contrast, the cardiology program relied on a screen fixed to a wall;
- *The relationship between the receiving and consulting providers.* Trust between the medical center providers and neurology telemedicine doctors increased the use and effectiveness of the telemedicine service. To build this relationship, each month one of the neurologists travels to the medical center to deliver continuing medical education classes.

USJHSD does not currently bill for telemedicine services but is researching a new billing option passed by the state of Colorado. USJHD hopes it will soon be able to receive reimbursement. Currently, the limited reimbursement for telemedicine discourages billing for this service; the reimbursement amount is lower than the cost to collect the necessary information that needs to be submitted.

Under the critical care paramedicine program, paramedics make suggestions to doctors and work in tandem with them. This has fostered curiosity in paramedics and created an environment that supports learning. The critical care paramedicine role expands the responsibilities of the traditional paramedic through waivers approved by Colorado's Emergency Medical Practice and Advisory Council

that allow paramedics to "exceed the scope of practice of an EMS Provider as defined in the rules."[135] Their expanded scope allows them to improve critical care during transport and also be a resource to doctors in the ED. One ED doctor reported that he appreciates the opportunity to engage in educational e-mail discussions paramedics on relevant clinical topics.

- The outreach paramedicine program faced significant challenges from evolving state regulations, resistance from other service providers, and a shortage of trained staff.
- To comply with Colorado regulations, patients must call 911 to request services from paramedics. This model does not work for outreach paramedicine because it does not allow paramedics to schedule visits in advance of receiving a call. The intervention is meant to be a proactive (not responsive) approach to ongoing management of a patient's health care needs;
- USJHSD had to engage with home health agencies, nurses, and providers to allay their concerns that outreach paramedicine would replace their services. USJHSD sees outreach paramedicine as a temporary service post discharge that would fill a gap home health could not;
- Under Colorado government regulation, outreach and community paramedicine may need to apply for a home health waiver. If this is the case, leadership will have to consider discontinuing the program because of the high burden of the application process.

While they saw the value of their higher credentials, working paramedics found it difficult to complete extensive training requirements (i.e., classroom training and 196 hours of practical work). Trying to complete the training on top of working 48-hour shifts was exhausting. Furthermore, some of the practical work required that the paramedics to travel to Durango (over an hour-long drive away); and some of the training in certain specialty areas was not as relevant to the USJHSD patient population.

By implementing the HCIA program, USJHSD learned what a valuable service telemedicine was and is now expanding the teleconsultation portfolio to other specialty areas. Because the district has so few specialists and the neurology telemedicine has been a success, they are looking to further augment their care using the telemonitoring equipment. They have added psychological services and are looking at other types of specialists (e.g., pulmonology) as well.

The sparsely populated rural area makes recruitment of skilled staff and long-term retention difficult. Low patient volume at the Medical Center leads to limited staffing. Many staff members serve more than one function and experience competing pressures to fulfill their duties. Even if the medical center could hire additional staff, they have a very limited supply of highly skilled local candidates. This makes it challenging to staff positions for projects of limited duration such as HCIA. Additionally, it can be difficult to retain staff when they receive attention for their increased skill level. Critical care transport and outreach paramedic training made paramedics more marketable and at least one has left to accept a new position.

[135] Colorado Department of Public Health and Environment: Emergency Medical and Trauma Services. "Medical direction: waiver requests." 2014. http://www.colorado.gov/cs/Satellite/CDPHE-EM/CBON/1251589738546

Participant Experience

We offer the following findings based on a focus group with nine participants and one-on-one phone interviews with nine participants (n=18).

Improvements in Quality of Care

Six participants used patient navigation to get medications they otherwise could not afford. If needed, the patient navigator can also help them understand when and how to take medications. One participant said:

> *"[The patient navigator] helped me get all my meds that I needed, and there was a couple of meds that I needed through the manufacturer, and she was able to contact them … so I could get my meds for free.… I wasn't compliant with taking my meds and so she encouraged me to start trying a little harder to get on my meds and stay on them and take them when I was supposed to."*

The patient navigator helps to coordinate appointments for patients and supports them in navigating the health care system. Patients can feel overwhelmed, particularly if they have multiple conditions to manage, and they found it helpful to have a guide. One explained:

> *"Just having somebody there if I needed some assistance. I could pick up the phone and call her and either leave a message or, if she was there, I'd talk to her about it, and we worked together to try to come up with a solution and get me squared away with whatever I needed."*

The patient navigator was also able to connect people with a primary care provider, and she helped two patients interviewed get insurance and navigate the process of signing up for affordable insurance. One participant said:

> *"I had a stroke—it was a year ago last February, and I'm diabetic and she helped with all the insurance, getting on Medicare and Medicaid for me, and she is tenacious like a bull dog."*

Another participant was going to the emergency department (ED) every four to six weeks and was underweight until she connected with a patient navigator who connected her to a primary care provider and Medicaid to pay for her medication. Since then, the patient had visited the ED only once as of the time of our interview.

Enhanced Access

Through the wellness classes and screenings, patients were able to access services and education they otherwise could not afford. Many participants wanted to lose weight and learn how to eat more healthfully. The wellness program taught them how to think about the nutritional value of what they eat, cook healthier foods, and read food labels. One patient lost 50 pounds by attending the classes and applying what he learned. Another patient was concerned about her health after her brother was diagnosed with diabetes but couldn't afford the blood work. She explained how the early detection screenings and wellness classes helped her:

> *"So when I came [to the wellness center] I found, to me it ended up being a very cost-effective solution to one—get the blood work done that I wanted—but also get the nutritional, the class, the diet health, and have that sort of support structure was, has been, an amazing option for me. It's changed my life."*

Quantitative Analysis of Program Effectiveness

USJHSD's interventions serve different populations and require different evaluation approaches.

Wellness Program

The Wellness Program aims to reduce risk factors for cardiovascular disease, including stroke. We evaluate the wellness intervention using USJHSD's clinical and self-reported health status data. USJHSD provided the following wellness program data files:

- Clinical data file: Information on registered participants who complete a biomarker test and a short lifestyle counseling session. This file includes 2,166 records for 1,571 unique participants collected from July 2012 through May 2015. We exclude participants with only baseline data and no follow-up data. The resulting dataset includes 826 records and 413 unique participants.
- RAND 12-item health survey (VR-12): Self-reported physical and mental health status. This includes 1,858 records for 1,413 participants collected from July 2012 through May 2015. We exclude participants with only baseline data and no follow-up data. The resulting dataset includes 480 records and 240 unique participants.

Limitations. The small number of individuals served limits our power to detect differences that may exist. Furthermore, since the analysis is based on limited follow up (limited to one pre- and post-intervention data point) information, it may not capture any long-term improvements in health status. We are unable to account for demographic and disease-related information in our analysis since the awardee data files lack this information. Furthermore, we lack a comparison group and are unable to determine if USJHD differentially affects health status. Therefore, readers should interpret these results with caution.

Exhibit 18.1 presents outcome measures we use to evaluate reduction in health risk factors attributable to the wellness program. We define outcome measures as a proportion of participants who are at risk in the baseline and intervention period. We use USJHSD's guidelines to define at-risk criteria for blood pressure management, weight management, and fiber intake measures. We use Mayo Clinic guidelines to define at-risk criteria for cholesterol measures.[136] We use self-reported data to measure smoking cessation status.

[136] For details on Mayo Clinic guidelines, see http://www.mayoclinic.org/diseases-conditions/high-blood-cholesterol/basics/tests-diagnosis/con-20020865

Exhibit 18.1: USJHSD Overview of Wellness Program Outcome Measures

Outcome Measure	Description of Measure	Statistical Test
Blood pressure control	Percent of participants with blood pressure not within range (140/90 mmHg)	McNemar's test for binary matched-pairs
Cholesterol management	Percent of participants with LDL >130 mg/dL; HDL <50 mg/dL; and Triglycerides >200 mg/dL	
Smoking cessation	Percent of participants who smoke	
Fiber intake	Percent of participants eating fewer than 5 daily servings of fiber	
VR-12 physical health summary measure	Percent with self-reported excellent or very good health	
Weight management	Percent of participants with high-risk BMI levels	Paired t-test

We present results of the Wellness Program as the change in outcomes measures between the baseline and intervention period. Exhibit 18.2 presents paired McNemar's chi-squared and t-tests to assess if risk factors for participants decrease in the intervention period relative to the baseline period. We find no evidence of a decrease in any of the stroke risk factors for participants in the Wellness Program.

Exhibit 18.2: USJHSD Wellness Program Outcomes

Outcome Measure	Sample Size	Percent of Participants		p-Value for Difference Between Baseline and Intervention Period
		Baseline Period	Intervention Period	
Blood pressure management	413	11.6%	15%	.11
Cholesterol management (LDL)	413	30.5%	33.9%	.12
Cholesterol management (HDL)	413	1.7%	2.2%	.25
Cholesterol management (Triglycerides)	413	16.7%	17.4%	.71
Smoking cessation	413	9.4%	10.7%	.3
Weight management	413	27.5%	27.6%	.83
Fiber intake	413	83.1%	83.5%	.82
VR-12 physical health summary measure	240	50.4%	53.3%	.26

Statistical significance assessed using McNemar's chi-squared tests for proportions and paired t-tests.

Sustainability

The medical center will incorporate critical care paramedicine and telemedicine programs into its budget. Both of these areas include some billable components. For telemedicine, providers perceive the costs associated with billing insurers to be higher than the level of reimbursement. Colorado regulations for outreach paramedicine are still being developed. If final regulations require a home health waiver, the burden of applying for the waiver may affect USJHSD's decision to continue this program as well.

Telemedicine program may expand to additional specialties through the CO-DOC's teleconsultation network.[137] Collaboration with CO-DOC allows the medical center to give its patients access to specialists and technology that are part of the network. This partnership facilitates efficiency because leadership does not have to take the time to establish partnerships with consulting specialists. It has already added psychological services, and is considering pulmonology as well.

The medical center may or may not incorporate wellness programs and patient navigation into their budget. While patient navigators reduce uncompensated care by helping enroll patients in health insurance, and the wellness program helps draw in patients through community wide education about their services, neither service is billable and therefore they require upfront funding to operate.

> *"Both wellness and patient navigation are sort of in the same boat. I'm preparing a sustainability proposal for the district so that those can be adopted into the operational budget. It's been proven as a tremendous service to the patients, a tremendous benefit to the health care system. For the district, it's a little more difficult because of reimbursement issues or lack of reimbursement.… The health benefits are undeniable: it does what it set out to do, and it's a fairly low-cost service to offer. But with a district like ours where the belt is truly tight, we need to find ways to make the financial case and that's the most difficult part of it." – USJHSD Program Manager*

Conclusion

The Upper San Juan Health Service District (USJHSD) team has implemented a wide range of components—telemedicine, patient navigation, wellness programing, and outreach paramedicine—with the goal of creating a healthier community and lowering health care costs by reducing risk for cardiovascular disease and improving health outcomes for patients with cardiovascular disease. Site visit discussions suggest telemedicine and critical care paramedicine programs have reduced utilization of costly health care services (e.g., air ambulances) and improved patient outcomes and patient and family satisfaction with care.

Qualitative findings also indicate that the patient navigators in the wellness program served patients with higher medical and psychosocial needs than expected. Perhaps as a result, we find no quantitative evidence of a decrease in any of the stroke risk factors for participants in the wellness program. As the Innovation Awards end, the medical center leadership has decided to continue the paramedicine and telemedicine programs but may not continue wellness programming and patient navigation in their current state.

[137] CO-DOC, the Collaborative Digital Online Consultant, is a program that uses HIPAA-compliant telemedicine equipment to connect specialized physicians at large, certified facilities to rural, suburban, and urban hospitals that do not have local resources due to location and/or population factors. This allows real-time, fully interactive acute consultations.

The Rector and Visitors of the University of Virginia

The Rector and Visitors of the University of Virginia (UVA) Innovation Award implemented a program that uses palliative care to provide symptom management to stage 4 cancer patients at the Emily Couric Clinical Cancer Center within the UVA Medical Center in Charlottesville, Virginia. The UVA program is comprised of three components:

- **Comprehensive Assessment with Rapid Evaluation and Treatment (CARE Track),** a comprehensive and coordinated approach to palliative cancer care focused on helping participants better control their pain and other symptoms;
- **My Course**, a patient reported outcomes questionnaire that focuses on the psychosocial, functional, and clinical status of the patient used to support the CARE Track program; and
- **STAT RAD**, a condensed schedule of targeted radiation treatment for metastatic cancer patients, providing the opportunity for same-day treatment and streamlining the delivery of palliative radiation therapy.

This chapter presents findings based upon the awardee's quarterly reports to CMMI as well as one in-person site visit, follow-up telephone interviews with the awardee leadership, and staff and patients, and an analysis of awardee-collected data.

Program Title	**CARE Track, My Course Questionnaire, & STAT RAD**		
Intervention Summary	UVA's innovation award focuses on palliative care and reduced radiation treatment for stage 4 cancer patients.		
Targeted Disease/Condition	Stage 4 cancers		
Total Amount Awarded*	$2,571,322	**Award Amount Spent***	$1,672,275
Number of Sites	1	**Location by State**	VA
Cumulative Reach*	347		
Intervention Workforce	Approximately 1 medical assistant, 2 palliative care physicians, 1 radiation oncologist, 1 registered nurse, and 1 social worker		

*Source: Quarterly report CMMI on performance through March 2015

Overview of Key Findings

- Limited qualitative evidence suggests improvements to quality of care for cancer patients at end of life.
- Participants in the CARE Track program had significantly fewer hospitalizations and ED visits in the last 30 days and 7 days of life according to data provided by the awardee, relative to a historical comparison group of patients with advanced cancer at UVA.
- As the Innovation Awards end, UVA is likely to sustain the program through institutional support and new potential funding.

Implementation Experience

UVA's palliative care doctors use patient-reported outcomes to determine which patients need enhanced palliative care; this allows them to maximize limited palliative care resources. Having finalized implementation at all stages, UVA now uses the MyCourse questionnaire, which draws on the PROMIS survey, to identify patients with the greatest need for enhanced palliative care, particularly those with high levels of uncontrolled pain.[138] By having patients report levels of pain, anxiety, depression, constipation, and other psychosocial and physical conditions, the CARE Track team can identify patients that need additional care and greater symptom management, and tailor the level of care to their needs. Previously, they referred all terminal cancer patients to the same level of palliative care. The questionnaire's assessment triggers offer an automated approach to allocating resources, and improves scalability and sustainability given the ongoing national shortage of palliative care resources. Furthermore, through this study, UVA seeks to be able to identify the best time to refer patients for palliative care based on their self-reported symptoms, in order further maximize palliative care resources.

We found limited evidence that oncologists rely on patient-reported outcomes collected through MyCourse. The MyCourse assessment findings on a patient's physical and emotional condition while under cancer treatment trigger an alert notification to care teams when there is a need for a palliative care intervention, such as pain management. While the palliative care doctors rely heavily on these findings and alerts in conducting pain and symptom management, oncologists vary in the extent to which they incorporate the MyCourse findings into their patients' treatment plans, or coordinate with the palliative care doctors.

Integral to CARE Track's success is a nurse coordinator who serves as the main point of contact for participants. A registered nurse with previous palliative care experience follows the CARE Track participants and ensures they have what they need. She was hired specifically for the program and, as a result, often has more immediate availability for the CARE Track participants than a palliative or oncology nurse. The nurse coordinator schedules CARE Track visits, answers questions over the phone or in person, administers the MyCourse questionnaire, and helps patients through the system. She also connects them with social work or other supportive services as needed. An administrative specialist assists with recruiting, gathering statistics and data, and generally helps the nurse coordinator wherever possible to allow her more time with patients.

UVA has a Supportive Care Tumor Board (SCTB) that remains an effective tool to address complicated patient cases that require expertise and consultation of various disciplines. The board is comprised of palliative care doctors, oncologists, psychiatrists, anesthetists, social workers, palliative care pharmacists, nutritionists, and radiologists who meet weekly to discuss the most complex cases. **Upon its inception, the SCTB typically attracted seven hospital staff that reviewed three patients and now includes an average of roughly 15 people who weekly review a caseload of 10 to 12 patients.** Patients are typically brought to the SCTB by the treating physician, palliative team, or other supportive staff. What makes the SCTB so unique is its sole mission to improve pain and symptom management and

[138] MyCourse is an electronic version of the Patient Reported Outcomes Measurement Information System (PROMIS) survey, incorporating cancer specific questions, and embedded in Epic's MyChart personal health record system and the hospital's electronic health record (EHR).

quality of life. Since the board is comprised of a variety of disciplines, it is difficult to find a time that suits all members; therefore, the board can only meet once a week for a one-hour session. In order to expand the SCTB services, the board would have to find a way either to expand the number of participants they see or offer similar services outside the formal confines of the board. **Although all clinicians agree that the multidisciplinary SCTB is effective, scaling this format to meet the needs of a larger group of patients may prove challenging.**

Program leaders attribute success, in part, to UVA's long-running commitment to palliative care and trust between staff in radiation oncology and palliative care. The Emily Couric Clinical Cancer Center within the UVA Medical Center is dedicated to implementing palliative care early in treatment. This philosophy is facilitated by the strong leadership of the Principal Investigator and the Director of Palliative Care Research at UVA, who have developed a strong connection between radiation oncology and palliative care. The relationship is based on the sentiment that the palliative care program does not stop treatment methods such as chemotherapy but rather allows the oncology team to continue to treat the patient while the palliative care team focuses on symptom and pain management.

STAT RAD dramatically reduces the number of treatment days and trips to the hospital. However, the current radiation payment structures do not incent such interventions. The small STAT RAD program (n=112)—aimed at individuals with metastatic, non-spinal, bone cancers—offers an innovative workflow that achieves rapid pain relief and offers more efficient clinical care. STAT RAD compresses treatment into a one-day all-encompassing visit that includes consultation, CT scans, and a treatment plan. This condensed model of radiation is particularly conducive to the largely rural population that UVA serves, reducing the number of hospital trips. Although STAT RAD has clear benefits to patients, the current radiation payment scheme supports a more traditional 10-session treatment and will not support this new condensed model.

Participant Experience

We offer the following findings based on in-person and telephone interviews with five participants and conversations with program staff.

Improvements in Quality of Life
Patients report that the UVA program has provided them with the confidence to continue everyday activities despite being in treatment and ultimately improves their quality of life**.** The level of attentive care they receive from UVA staff has also put their mind at ease and provided comfort.
Improvements in Quality of Care
The program facilitated behavior changes regarding care management as well. One caregiver expressed that the MyCourse questionnaire helped them communicate with the doctors about the patient's pain. The questionnaire made the caregiver and patient more aware about pain and how to describe it beyond just providing a number on a 1–10 point scale.

Quantitative Analyses of Program Effectiveness

Due to the low evaluability of the UVA program with respect to Medicare/Medicaid populations, we use data obtained from the awardee for our analysis of program effectiveness.

We use data from CARE Tracker, a patient registry database used by UVA's CARE Track team. The dataset contains details on demographics, end-of-life hospitalizations, and ED visits for CARE Track program participants. The dataset also contains similar variables and outcome measures for a historical comparison group of deceased UVA patients with advanced cancer. Limiting the CARE Tracker dataset to deceased patients, we assess how the CARE Track program meets its goals of reducing end-of-life (EOL) hospitalizations and ED visits for patients with advanced cancers. We measure EOL hospitalizations and ED visits for patients in the last 30 days and 7 days of life. We compare EOL hospitalizations and ED visits for CARE Track participants against those observed in the historical comparison group, and present the results as relative differences (odds ratios) in hospitalizations/ ED visits between the two groups.

Limitations. In the data provided by UVA, hospitalizations and ED visits for both the treatment and the comparison group are limited to those occurring within the UVA Health System. While it's unlikely that the two groups systematically differ in their use of hospitalizations/ED outside the UVA system, results presented in this report should be interpreted with caution. Additionally, this data is self-reported by the awardee and we cannot independently verify it. Finally, we are unable to define a comparison group of patients outside the UVA system and thus cannot control for institutional characteristics at UVA outside the innovation award that may contribute to outcomes.

Exhibit 19.1 summarizes the descriptive characteristics for the deceased CARE Track program participants and the historical UVA comparison group:

- CARE Track participants are significantly more likely to be younger than 60 years and more likely to be female relative to the comparison group.
- While Medicare, Commercial, and Medicaid are the three most common payers for the two groups, CARE Track has a significantly higher proportion of Medicaid enrollees and lower proportion of Medicare enrollees relative to the comparison group.
- The two groups are similar in their racial distribution.

Exhibit 19.1: UVA Descriptive Characteristics for CARE Track Participants and Comparison Group

Variable	CARE Track	Comparison Group
	% (N)	% (N)
Number of Deceased Patients	338	199
Age**		
18–39 years	7% (22)	2% (4)
40–59 years	43% (144)	27% (54)
60–69 years	25% (85)	33% (66)
70–79 years	17% (57)	25% (50)
80 and over	9% (30)	13% (25)
Gender**		
Female	59% (201)	41% (82)
Race/Ethnicity		
White	80% (271)	81% (161)
Black	15% (89)	15% (30)
Other	5% (28)	4% (8)
Payer Categories**		
Medicare Including Medicare Advantage	42% (142)	58% (116)
Medicaid	18% (61)	7% (13)
Commercial	28% (96)	29% (57)
Other	10% (34)	3% (6)
None	1% (5)	4% (7)

Statistical significance was assessed using Chi-square for categorical variables and t-tests for continuous variables.
*** p<0.01, ** p<0.05, * p<0.1

Exhibit 19.2 compares EOL hospitalizations and ED visits for the two groups. We present unadjusted measures in the last 30 days and 7 days of life as well as odds ratios (OR) and 95% confidence intervals obtained from a multivariate logistic regression that adjusts for differences in age, gender, race, and payer types.

- Patients in the comparison group are significantly more likely to experience hospitalizations in the last 30 days (Adjusted OR: 2.88) and last 7 days (Adjusted OR: 1.95) of their life, compared to those in CARE Track program.
- Patients in the comparison group are also significantly more likely to have ED visits in the last 30-days (Adjusted OR: 2.38) and last 7-days (Adjusted OR: 3.88) of their life, compared to those in CARE Track program.

Exhibit 19.2: UVA End-of-life Outcomes for CARE Track Participants and Comparison Group

End-of-life Outcomes	CARE Track (N=338)	Comparison Group (N=199)	Odds Ratio (95% CI) Comparison vs. Care Track
End-of-life Hospitalizations			
Last 30 days of life**	**60% (204)**	**77% (153)**	**2.88** (1.82–4.54)**
Last 7 days of life**	**27% (91)**	**40% (79)**	**1.95** (1.31–2.91)**
End-of-life ED Visits			
Last 30 days of life**	**25% (85)**	**32% (64)**	**2.38** (1.47–3.87)**
Last 7 days of life**	**8% (26)**	**18% (35)**	**3.88** (2.09–7.19)**

Statistical significance *** p<0.01, ** p<0.05, * p<0.1; odds Ratios and their 95% confidence intervals obtained from multivariate logistic regression adjusting for differences in age, race, gender, and payer type.

To understand what subgroups of participants are more or less likely to have better EOL outcomes, we study the association between outcomes and participant characteristics. We did not find any statistically meaningful association between participant characteristics and EOL outcomes.

Sustainability

Our findings suggest that UVA will sustain some elements of its program beyond the funding period. The Cancer Center plans to continue the CARE Track and STAT RAD programs, and program leadership aims to institutionalize the CARE Track program in other areas of the hospital. The UVA program also serves as a national advocate for radiation oncology payment reform. The PI sits on a national payment reform committee that actively pursues a value-based payment scheme for palliative radiation.

Conclusion

UVA's program focuses on improving the quality of care for stage 4 cancer patients by integrating early palliative care. Through site visit discussions and telephone interviews with patients, we find preliminary evidence suggesting improvements to quality of care for cancer patients at the end of life. We also find evidence that participants in the CARE Track program had significantly fewer hospitalizations and ED visits in the last 30 days and 7 days of life, relative to a historical comparison group of patients with advanced cancer at UVA. As the Innovation Awards end, UVA is likely to sustain the program through institution support and new potential funding.

Vanderbilt University Medical Center

The Vanderbilt University Medical Center (Vanderbilt) MyHealth Team program uses an inter-professional team to improve chronic disease management, care coordination, and transition management for high-risk, high cost patients. We present findings based upon a review of the awardee's quarterly reports as well as telephone interviews with the awardee, two rounds of site visits to Vanderbilt and their two partner hospitals—Maury Regional Hospital (Maury) in Columbia, TN and Williamson Medical Center and clinic (Williamson) in Franklin, TN—and analysis of Medicare claims data.[139]

Program Title	**MyHealth Team**		
Intervention Summary	The MyHealth Team model includes two care coordinator-driven interventions: ■ Transition care coordination (TCC) for inpatients with target conditions; ■ Outpatient (OCC) for primary care patients with target conditions. Both use health IT-enabled monitoring, patient education, and a real-time informatics system.		
Targeted Disease/Condition	Congestive heart failure (CHF); chronic obstructive pulmonary disease (COPD); acute myocardial infarction (AMI); pneumonia; hypertension; diabetes mellitus; and chronic kidney disease (CKD)		
Total Amount Awarded*	$18,846,090	**Award Amount Spent***	$10,256,478
Number of Sites	3	**Locations by State**	TN
Cumulative Reach*	107,241[i], including 20,562 outpatient Medicare beneficiaries and 790 inpatient Medicare beneficiaries		
Intervention Workforce	Approximately 27 registered nurses, 1 social worker, and 8 medical assistants (across all sites)		

*Source: Quarterly report CMMI on performance through March 2015 and Medicare claims data.

[i] Awardee counts "direct participants" broadly. Vanderbilt includes all primary care patients under surveillance through an EMR system as "direct participants" even though most will not interact with the staff implementing the intervention.

- Primary care patients' interactions with Outpatient Care Coordinators (OCCs) led to improvements in their blood pressure, blood sugar, and hemoglobin A1C levels.
- We find evidence of increasing trends in hospitalizations, emergency department (ED) visits, and total cost of care in the intervention period for outpatient care coordination patients;
  - Because of small sample sizes in the early intervention quarters, we are currently unable to assess trends in CMMI core measures through claims to evaluate impact of the transition care coordinator (TCC) program. We also did not observe any change in 30-day and 90-day readmissions, ED visits, or cost of care in the intervention period for TCC patients.

[139] On our second round of data collection, we conducted calls with staff at Maury in place of an in-person visit.

- The TCC component of the intervention faced significant implementation challenges, particularly at Vanderbilt University Medical Center (VUMC), in large part because the transition care coordinator (TCCs) role was not well integrated into the existing case management structure. Only the Maury site will continue the TCC as designed under the Innovation Award after it ends.
- Vanderbilt is utilizing lessons learned from this intervention as they expand their institutional focus on population health management. They have begun testing other models of care coordination within VUMC and the Vanderbilt Health Affiliated Network.

Implementation Experience

Vanderbilt is implementing their model at three different hospitals and various affiliate practices throughout the region; each site has unique experiences with adapting the model to its own contexts and populations. Throughout the implementation process, Vanderbilt and its partner sites used program data and feedback from physicians, staff, and patients to develop the program on an iterative basis. Below we discuss the differences in care coordinator role definition, IT development, and risk stratification of patients. The program leadership explained that fidelity to the model was not a concern for this intervention because it operated as a rapid-cycle quality improvement project.

IT-enabled panel management facilitated a systematic approach to care coordination. Each OCC uses the care coordinator EHR module to manage a panel of 1,400 to 1,600 patients. Coordination of this large patient panel require that two-thirds of the panel are under surveillance, meaning that the participants are identified as low risk, and have little to no interaction with the OCC. The EHR module mines the patient data and flags patients who are above specified clinical thresholds (e.g., blood pressure over 140/90 or A1C level over 8.0). Vanderbilt OCCs review the shortlist of patients who need attention, confirm their needs, and reach out to them to provide necessary services. A care coordinator will only contact a patient under surveillance if his or her risk increases; these patients would otherwise not even be aware of the data monitoring in the EHR system.

Because they did not have access to the surveillance tool, Vanderbilt's partner sites took a different approach to care coordination, focusing on fewer patients more intensively. At these sites, OCCs identify patients manually, through physician referral or chart review. Participant interactions are more personal and time-intensive than at VMUC. In addition to reviewing patient data in the hospital's EHR, these OCCs spend more time with participants on the phone or in person to gather the most recent self-management data (e.g., blood pressure or A1C) from them to inform the care plan.

Clearly defined roles and responsibilities facilitated implementation of outpatient care coordination. The role of the OCC is new at all three sites. Each office adapted the role and responsibilities of the OCCs to fit their organizational culture and capacity. Where one site had a large technological infrastructure, another focused on developing relationships with participants. In both settings, the OCCs had firmly defined tasks within the office, including longitudinal care management and care coordination. OCCs worked cooperatively with office nurses and therefore were able to mitigate concerns of overlapping with office nurse responsibilities. The co-location of the OCC with their assigned physician provider facilitated strong communication and fostered physician champions for the intervention.

OCCs embedded into physician practices found that proximity to the primary care doctor allowed for a collaborative relationship with providers and opportunities for in-person patient education. OCCs were assigned to one to three providers, depending on the size of the practice, and were co-located with the providers. For OCCs who worked with multiple providers, they would float between offices throughout the week. In addition to speaking with participants on the phone, OCCs are able to meet with them in person. OCCs felt this facilitated participant engagement. Moreover, the proximity allowed primary care physicians to communicate easily and frequently about participant issues for OCCs to address and vice versa. Leadership confirmed this to be an effective model for care coordination but continue to evaluate the efficacy of purely telephonic care coordination for participants who live in remote areas.

Hospital staff were unclear on the TCC role, in part due to infrequent interactions with TCCs given the low volume of patients hospitalized for the diagnoses targeted by the intervention. One TCC reported that she took on more case management responsibilities (e.g., arranging home care, setting up bypass surgery) than she had originally anticipated and that case managers on the floor assumed this was her role. She reported that there were no written standard operating procedures to refer to or share with others to reinforce the responsibilities of her position during her tenure. The TCCs at Maury and Williamson did not face these same challenges; these sites designed the TCC role to complement the services of existing care managers, focusing heavily on patient education and discharge, and offering extra support for patients with more complex social needs.

The mix of professional roles on the care coordination team varied by site based on the implementation needs and size of each site's patient population. For example, at the most rural site, the patient population faced extensive social barriers (e.g., lack of transportation, difficulty accessing healthy foods). The care coordinators at this site worked closely with the on-site social worker to address these needs. At the main site, the large volume of patients led to the integration of medical assistants (MAs) into the team to alleviate care coordinators of administrative tasks. The MAs assist care coordinators in patient-facing tasks such as follow-up calls, entry of self-reported data entry for the patient portal, and serving as the operator to direct callers to their appropriate care coordinator.

Participant Experience

We present the following findings based on focus groups and telephone interviews with 26 participants.

Improvements in Self-Monitoring and Quality of Life

Participants noted that care coordinators enabled them to monitor their disease better. Of the eight participants who were able to discuss specific experiences with care coordinators, all reported interactions to be informative and helpful. They felt the care coordinators understood their needs and were persistent in getting them to monitor their blood pressure, blood sugar, and A1C without being overbearing.

Participants appreciated the consistent phone calls and care coordinators' persistence. One participant said he was not monitoring his blood pressure as he should have, and the care coordinator was persistent and kept calling and sending relevant materials. He finally started monitoring his blood pressure. Another participant described how her care coordinator helped her learn how to better self-monitor her blood pressure:

> *"She helped me with getting a blood pressure machine. And then she coordinated with me online … with taking records … like blood sugars and blood pressures. She educated me [and made me] record. And then calling and following up, like 'Hey, I see your numbers were [high gesture]. How is everything going? Did you do anything different?' … I have had a great experience with them."*

Participants also described how the care coordinator's calls provided them with peace of mind:

> *"I remember thinking when they called the first time, I was glad that someone was keeping up with what was going on. It wasn't just my doctor. It was someone saying they were on top of it, and it was very comforting. It's nice to have somebody track you like that."*

Improvements in Quality of Care

Less than one third of the focus group participants (n=8) knew the name of their care coordinator and communicated frequently with her over phone or email or within the Vanderbilt charting system. Most of these 8 had very positive things to say about how the coordinator helped them access resources, make appointments with specialists, communicate with doctors, and learn about their illness. The majority were not aware that they had been contacted by a care coordinator, and could not recall any direct benefits of the program.

Quantitative Analysis of Program Effectiveness

Vanderbilt's two interventions serve different populations and require different quantitative evaluation approaches:

- We evaluate the TCC program using an episode-level serial cross-section design (see Section 1 and Technical Appendix A.1 for post-acute care study design).
- We evaluate the OCC program using a patient-level longitudinal cohort design (see Section 2 and Technical Appendix A for ambulatory-care study design).

Inpatient Care Coordination Transitions Program

Our claims-based analysis calculates changes in Medicare utilization and cost for Medicare fee-for-service (FFS) patient-episodes involving hospitalizations at Vanderbilt and partner hospitals pre- and post-intervention.

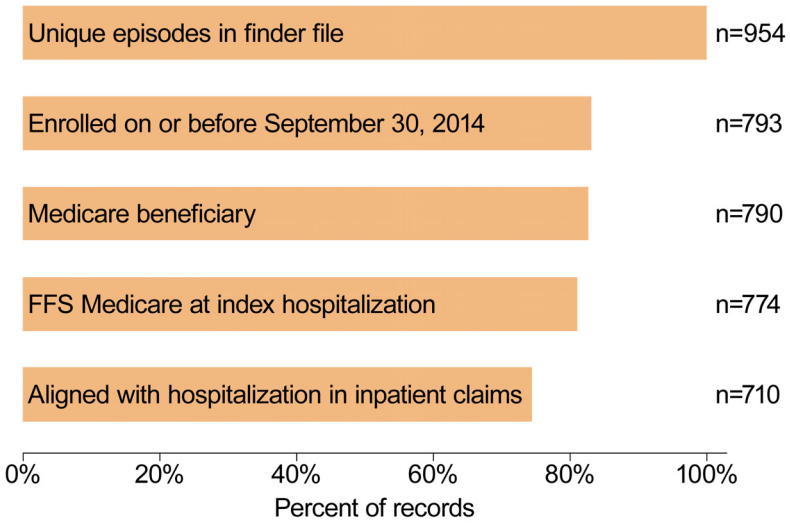
- We present findings for CMMI core measures: readmissions, emergency department (ED) visits, and total cost of care.
- We include claims for FFS patient-episodes enrolled in TCC in each post-intervention quarter, from April 1, 2013 through September 30, 2014. Vanderbilt provided a finder file that lists participants and enrollment dates; we used this to identify claims for these patient-episodes (see Exhibit 20.1).
- We include a comparison group of Medicare FFS patient-episodes admitted to Vanderbilt for congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), acute myocardial infarction (AMI), and pneumonia in each pre-intervention quarter, from April 1, 2011 through March 31, 2013.

Limitation. The lack of an external comparison group limits our analysis. Particularly, our findings may reflect secular trends for Medicare FFS patient-episodes unrelated to the intervention.

For each of the four measures, we pose the following research questions:

- What is the average experience of TCC patient-episodes when compared to similar patient-episodes occurring prior to the intervention?
- Did core measures improve for patient-episodes occurring after TCC implementation?

Exhibit 20.1: Vanderbilt Post-Acute Care Patient-Episodes Identified through Finder File



Intervention population. Exhibit 20.2 presents demographic and other basic information about the patient-episodes at Vanderbilt for the pre- and post-intervention periods.

Exhibit 20.2: Vanderbilt Descriptive Characteristics of Patient-Episodes Included in Analysis[140]

Variable	Pre-Intervention	Post-Intervention
	% (N)	
Number of Patient-Episodes	5,439	710
Age*		
<65 years old	24.1% (1,309)	19.6% (139)
65–69 years old	16.6% (902)	17.3% (123)
70–74 years old	15.2% (828)	18.7% (133)
75–79 years old	14.3% (777)	14.9% (106)
80–84 years old	13.4% (730)	13.7% (97)
≥85 years old	16.4% (893)	15.8% (112)
Race/Ethnicity***		
White	88.1% (4,791)	88.3% (627)
Black	10.5% (573)	9.7% (69)
Hispanic	0.1% (7)	0.3% (2)
Other	1.3% (68)	1.7% (12)
Gender		
Female	50.4% (2,742)	47.5% (337)
Comorbidities/Utilization Year Prior to Index Hospitalizations		
Number of HCCs	4.5 (3.2)	4.7 (3.2)
HCC score	2.5 (1.8)	2.6 (1.8)
No. hospitalizations per year**	1.6 (2.2)	1.5 (1.7)
No. ED visits per year	1.8 (3.7)	1.9 (3.2)
Prior year cost	$34,163 ($45,693)	$32,075 ($39,483)
Coverage Reason***		
Old Age	61.1% (3,321)	67.0% (476)
Disability	35.7% (1,944)	30.4% (216)
ESRD	0.7% (39)	1.1% (8)
Disability and ESRD	2.5% (135)	1.4% (10)
Discharges***		
Home	58.2% (3,168)	62.0% (440)
SNF	16.4% (893)	9.4% (67)
HHA	17.1% (929)	25.6% (182)
Hospice	3.0% (165)	1.3% (9)
Other	5.2% (284)	1.7% (12)
Disease Composition***		
CHF	32.6% (1,775)	38.9% (276)
COPD	22.7% (1,234)	10.4% (74)
AMI	17.2% (933)	12.7% (90)
Pneumonia	27.5% (1,497)	16.2% (115)
Other/Not specified[141]	0.0% (0)	21.8% (155)

Statistical significance was assessed using chi-squared tests for proportions and t-tests for continuous variables.
*** p<0.01, ** p<0.05, *p<0.1

[140] Vanderbilt's program does not serve Medicaid and Dual-eligible patients. The demographic characteristics pertain to the Medicare FFS patient-episodes at Vanderbilt for the pre- and post-intervention periods.
[141] A majority of these patient-episodes have a history of CHF, PN, COPD, or AMI. However, the index admission was for a condition not directly related to the target conditions.

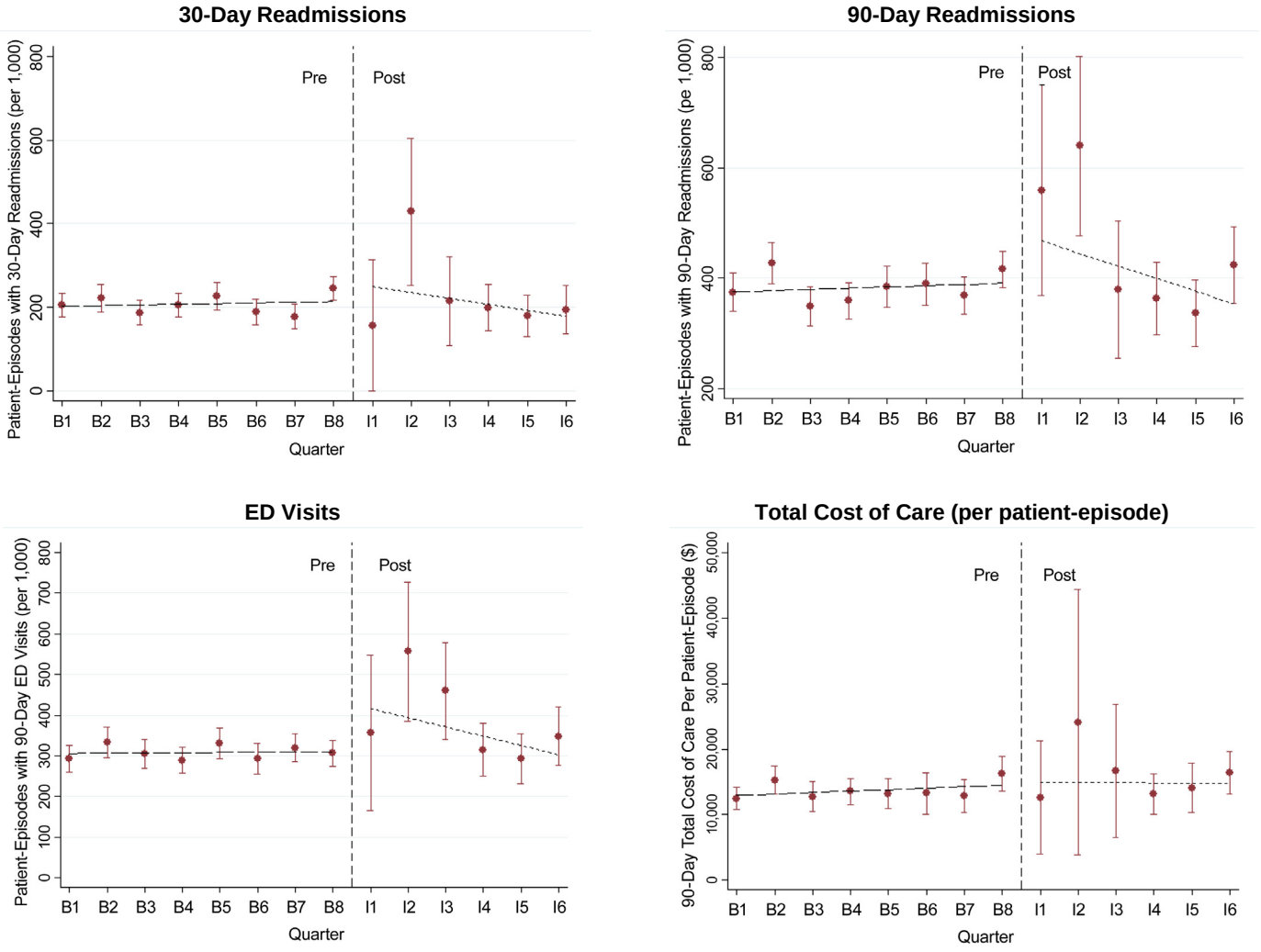
The categorical variables are listed as % (n) and the count and continuous variables are listed as mean (std).

Time-series results. We present the results of our time-series models as the adjusted marginal effect of TCC readmissions, ED visits, and total cost of care (Exhibit 20.3).[142,143] We summarize the details of the time-series models and specification of our measures in the technical appendix. We present readmissions at 30 and 90 days post-discharge and ED visits and total cost of care at 90 days post-discharge. The effect is displayed as the average cost of Medicare A and B services, proportion of hospitalizations, readmissions, and ED visits (and 95% confidence interval) for each quarter during the pre-intervention (B1–B8) and post-intervention (I1–I6) periods.

- Hospitalizations, 30-day and 90-day readmissions, ED visits, and total cost of care remain stable for TCC patients across baseline quarters.
  - We observe no statistically significant decreases ($p<.05$) in 30-day and 90-day readmissions, ED visits, and total cost of care for TCC patient-episodes in the intervention period compared to the baseline period. Readmissions and ED visits decrease in the later intervention quarters, but this may be a result of small sample sizes in the early intervention quarters.[144]

[142] We control for type and severity of target condition (CHF, COPD, AMI, and pneumonia), age, race/ethnicity, gender, reason for Medicare eligibility, comorbidity, cost, and utilization in year prior to index hospitalization, and discharge disposition in the time-series models to estimate adjusted outcomes.
[143] ED visits include ED visits as well as observation stays not resulting in short-term inpatient hospitalizations.
[144] We urge caution in interpreting findings in the early intervention quarters since enrollment in the TCC program for these quarters is low ($n<25$).

Exhibit 20.3: Vanderbilt Adjusted Rates for Outcome Measures for Vanderbilt TCC by Quarter[145,146]



*** p<0.01, ** p<0.05, *p<.0.1

Statistical significance tests assess difference in average outcomes for patient-episodes at Vanderbilt across the entire pre- and post-intervention period.

The linear trend lines in the pre- and post-intervention periods represent the line of best fit for quarterly average adjusted outcomes.

[145] We control for type and severity of target condition (CHF, COPD, AMI, and pneumonia), age, race/ethnicity, gender, reason for Medicare eligibility, comorbidity, cost, utilization in year prior to index hospitalization, and discharge disposition in the time-series models to estimate adjusted outcomes.

[146] Estimates related to the first two interventions quarters (11 and 12) have high uncertainty as a result of very low sample size (N < 30)

Outpatient Chronic Care Management Program

Our claims-based analysis calculates changes in utilization and cost for Medicare FFS participants, comparing the periods pre- and post-enrollment.

- We present findings for CMMI core measures: all-cause hospitalizations, hospitalizations for ambulatory care sensitive conditions (ACS), ED visits, and total cost of care[147].
- We include claims for FFS participants enrolled in the OCC for one or more quarters, from September 30, 2012 through September 30, 2014. Vanderbilt provided a finder file that lists its program participants and enrollment date; we used this to identify Medicare FFS claims for these FFS participants (see Exhibit 20.4).

Limitation. Lack of an external comparison group limits our analysis. Particularly, our findings may reflect secular trends unrelated to the OCC program. Therefore, readers should interpret these results with caution.

Exhibit 20.4: Vanderbilt's Finder File Vanderbilt Ambulatory Care Patients Identified through Finder File

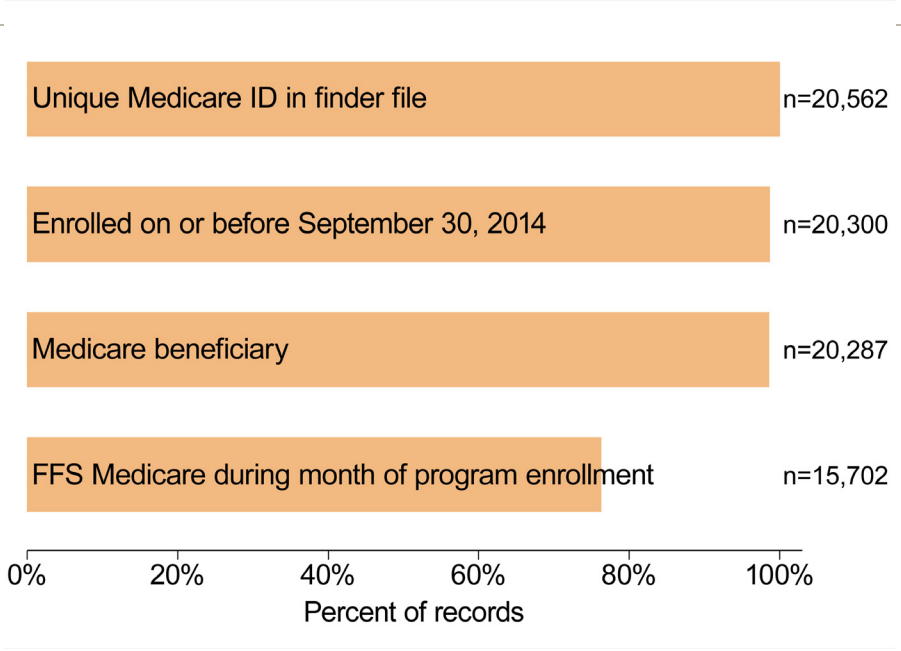


Exhibit 20.5 presents demographic, clinical, and baseline utilization information about OCC participants included in our analysis of core outcome measures.

[147] The 30-day readmissions core measure is not applicable to the OCC program since patients admitted to Vanderbilt are enrolled in the TCC program.

Exhibit 20.5: Vanderbilt Descriptive Characteristics of OCC Participants

Variable	% (N)
Number of Persons	15,702
Mean Quarters of Program Enrollment [Range]	3.0 [1–8]
Target Condition	
None	35.5% (5,580)
CHF	1.2% (187)
COPD	1.5% (234)
Hypertension	28.8% (4,526)
Diabetes	4.2% (652)
Multiple Conditions	28.8% (4,523)
Gender	
Female	57.9% (9,095)
Age Group	
<65 years old	14.4% (2,267)
65–69 years old	27.6% (4,337)
70–74 years old	22.1% (3,476)
75–80 years old	15.0% (2,359)
80–84 years old	10.7% (1,676)
≥85 years old	10.1% (1,587)
Race/Ethnicity	
White	88.6% (13,916)
Black	8.7% (1,372)
Hispanic	0.3% (41)
Other	2.4% (373)
Dual Eligibility	
Dual enrolled	% (1,463)
Coverage Reason	
Old Age	78.9% (12,393)
Disability	20.1% (3,153)
ESRD	0.3% (42)
ESRD and disability	0.7% (114)
Hierarchical Chronic Conditions (HCC)	
Mean HCC score (SD)	1.1 (1.1)
Mean count of HCCs (SD)	1.8 (2.2)
Mean Utilization and Cost in Year Prior to Program Enrollment	
Total Medicare cost	$10,545 ($23,627)
Hospitalizations per 1,000	328 (932)
ED visits per 1,000	810 (2,205)

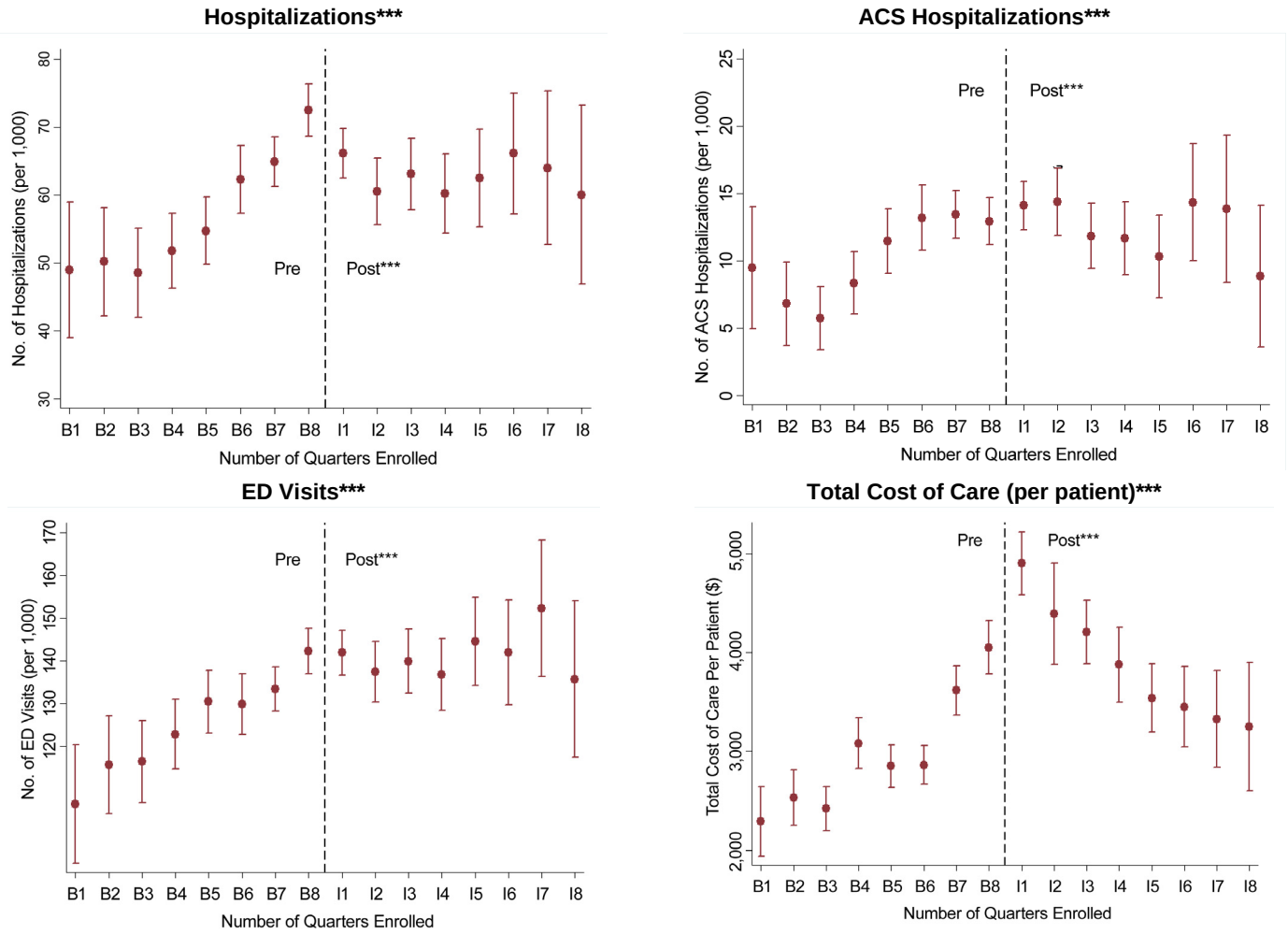
The categorical variables are listed as % (n) and the count and continuous variables are listed as mean (std).

Time-series results. We present the results of our time-series models as the adjusted marginal effect of OCC program on hospitalizations, ACS hospitalizations, ED visits, and total cost of care.[148, 149] We summarize the details of the time-series models and specification of our measures in the technical appendix. We present the results as average cost of Medicare A and B services, proportion of participants with all-cause hospitalizations in each quarter, proportion of participants with ACS hospitalizations in each quarter, and proportion of participants with ED visits in each quarter.

- We see increasing trends in hospitalizations, ACS hospitalizations, ED visits, and total cost of care increase for OCC patients. This increase is most pronounced in the quarters immediately prior to enrollment. This suggests that acute exacerbation of chronic conditions leads to higher utilization and to program enrollment.
- We observe statistically significant increases in hospitalizations, ED visits, and total cost of care in the intervention period relative to the baseline period.
- Engagement with the program is more likely after an acute exacerbation of a patient's condition. The change in trends in the intervention quarters may be a result of patients returning to a stable state after chronic exacerbation.

[148] We control for target conditions (CHF, COPD, AMI, Hypertension, and Diabetes), age, race/ethnicity, gender, reason for Medicare eligibility, comorbidity, cost, and utilization in year prior to index hospitalization in the time-series models to estimate adjusted outcomes.
[149] ED visits include ED visits as well as observation stays not resulting in a short-term inpatient hospitalizations

Exhibit 20.6: Vanderbilt Adjusted Rates for Core Measures OCC by Quarter



*** p<0.01, ** p<0.05, *p<.1

Statistical significance assessed using chi-squared tests for proportions & t-tests for continuous variables comparing OCC patients during the pre- and post-intervention period.

Sustainability

Vanderbilt is actively increasing its focus on population health management both within VMUC and as part of the Vanderbilt Health Affiliated Network (VHAN). VHAN is a provider-organized network of doctors, regional health systems, and other health care providers in Tennessee and surrounding areas who collaborate to provide high-quality, coordinated, and cost-effective health care services. VHAN has grown from three affiliate institutions to over 50 hospitals. VHAN providers who connect to the Vanderbilt EHR system have access to the risk stratification and surveillance capabilities used in MyHealth Team. Parts of the outpatient care coordination model, tested by MyHealth Team, will be sustained and scaled through VHAN, as discussed below.

Outside of HCIA, Vanderbilt is testing two additional models of care coordination in addition to the "embedded" model used by the secondary sites during the award period. The first is a "flex" model in which the care coordinators can meet the patient in person to enroll and then manage the rest from a distance. Under the second model, Vanderbilt recruits and coordinates care remotely, largely over the phone with follow-up mailings and emails. The "flex" approach is intended to accommodate the relationship building that care coordinators report is important to the success of their work. To start, the target population will include a subset of patients; a patient will be identified by reviewing claims data across multiple providers rather than assigning a care coordinator a panel from one or two specific providers as in the current model. The goal of the new model is to move away from provider-centric, disease-specific care coordination to being claims-based and focused on patients with multiple co-morbidities.

The TCC program is likely to be sustained at some sites but not others because of its overlap with existing, well-developed case management, discharge programs. Vanderbilt hired external consultants to review the TCC program and develop recommendations for incorporating the TCC functions into the case management department. Maury Regional presented hospital leadership with a business plan to expand on the TCC program. Williamson will discontinue its TCC program.

Conclusion

Vanderbilt's MyHealth Team intervention focuses on improving health through the reduction of major cardiovascular risk, hospital readmissions, and emergency department visits for patients with CHF, COPD, AMI, pneumonia, hypertension, and diabetes. Through site visit discussions, we find evidence suggesting improvements in patient blood pressure, blood sugar, and A1C levels through their outpatient interactions with care coordinators. We also found that there were difficulties integrating transition care coordinators in VUMC's main hospital with existing case managers performing discharge planning. We also find evidence of increasing trends in hospitalizations, ED visits, and total cost of care in the intervention period for OCC patients. Due to small sample sizes in the early intervention quarters, we are currently unable to assess trends in CMMI core measures through claims to evaluate impact of TCC program. We also did not observe any change in 30-day and 90-day readmissions, ED visits, or cost of care in the intervention period for TCC patients. As the Innovation Awards end, Vanderbilt leadership is committed to sustain the outpatient care coordination program.

TECHNICAL APPENDICES

Appendix A: Quantitative Methods

This report presents quantitative analysis on 18 disease-specific awardees. Decisions on the analytic approach for each awardee are based on intervention type, data source, and availability of a comparison group. Exhibit A.1 outlines the awardees and key considerations for selecting an analytic approach.

- Data Source: The primary payer group for participants enrolled and availability of health care claims for that group influences the data source selection;
- Intervention Type: Awardee interventions can be separated into two groups based on setting and goals of the intervention. (1) Post-acute care (PAC) interventions focus on improving patient outcomes during or immediately after an index hospitalization. (2) Ambulatory care interventions identify and engage participants with a chronic disease in the outpatient setting;
- Comparison Group: The feasibility of constructing a comparison group and likelihood of sufficient power to detect a statistically significant difference-in-differences (DID) estimate between participants and a comparison group affects the type of analysis conducted; [150]
- Analysis: Selection of statistical analysis methods takes into consideration the intervention type, data source, and availability of a comparison group.

In this section, we provide details on data set construction (data sources, population, and measure specification), comparison group selection, followed by analytic methods.

Exhibit A.1: Summary Quantitative Analysis Methods Population[151]

Awardee	Data Source	Intervention Type	Comparison Group	Analysis
Christiana	Medicare	PAC	Yes	DID
SEDI	Awardee data	Ambulatory care	No	Awardee specific[152]
FirstVitals	Medicaid	Ambulatory care	No	Time series
GWU	Medicare	Ambulatory care	No	Time series
HRiA	Awardee data	Ambulatory care	No	Awardee specific
Indiana	Medicare	Ambulatory care	Yes	DID
IOBS	Medicare	Ambulatory care	Yes	DID
Joslin	Awardee data	Ambulatory care	No	Awardee specific
Le Bonheur	Awardee data	Ambulatory care	No	Awardee specific

[150] Inclusion of a comparison group is not feasible for SEDI, HRiA, Joslin, Le Bonheur, UPenn, USJHSD, and UVA because the analysis is based on awardee data. Until recently, Ochsner and Vanderbilt lacked sufficient power to detect a statistically significant DID estimate. We plan to include comparison groups for these awardees in future reports. For MAHEC, Nemours, and FirstVitals, we continue to explore and refine methods to identify comparison groups using claims data.
[151] Vanderbilt's HCIA program includes two interventions serving different populations. The inpatient care coordination is for patients admitted with acute myocardial infarction, congestive heart failure, chronic obstructive pulmonary disease, and pneumonia. The other, outpatient chronic care management, is for patients living in the community with diabetes and hypertension. We treated these interventions separately for analysis.
[152] Because of the variability in data between awardees, the analytic methods used for analysis of awardee-provided data are specific to the awardee and can be found in the awardee-specific chapters.

Awardee	Data Source	Intervention Type	Comparison Group	Analysis
MAHEC	Medicare	Ambulatory care	No	Time series
Nemours	Medicaid	Ambulatory care	Yes	DID
Ochsner	Medicare	PAC	No	Time series
UAB	Medicare	Ambulatory care	Yes	DID
UPenn	Awardee data	Ambulatory care	No	Awardee specific
UCLA	Medicare	Ambulatory care	Yes	DID
USJHSD	Awardee data	Ambulatory care	No	Awardee specific
UVA	Awardee data	Ambulatory care	Yes	Awardee specific
Vanderbilt TCC	Medicare	PAC	No	Time series
Vanderbilt OCC		Ambulatory care	No	Time series

Data Set Construction

Construction of analytic files is similar for Medicare and Medicaid data. We begin with claims-level data and identify participants using unique patient identification numbers, selecting all claims for those patients during the relevant time period. We describe the methods used to build these data sets separately for the two intervention types—PAC and ambulatory care interventions.

In addition to core measures, each analytic file also includes:

- patient demographics: age, gender, race/ethnicity, dual eligibility, and reason for Medicare/Medicaid eligibility (e.g., age, disability, end stage renal disease);
- CMS region, state, county, and zip code of residence;
- Medicare or Medicaid FFS/managed care status in each quarter;
- chronic condition variables calculated from diagnoses codes on claims;
- risk score for the 12 months before enrollment in the program;[153] [154]
- specific type of chronic conditions targeted by the awardee (e.g., type of cancer), severity of condition (e.g., metastatic cancer), and type of treatment for the targeted condition (e.g., cancer surgery, chemotherapy, radiation therapy); and
- utilization of hospital and outpatient emergency department care for the 12 months before enrollment in the program.

[153] For Medicare, we use CMS's Hierarchical Condition Categories (HCC) risk score; for Medicaid, we use Chronic Illness and Disability Payment System (CDPS) risk score. CMS's HCC model, which is used to adjust payments for Medicaid Advantage plans, groups diagnoses codes for beneficiaries into 70 CMS HCCs. The model also includes demographic factors to estimate a patient risk score that predicts Medicare expenditures. The CDPS model, which is similarly used for Medicaid populations, assigns patient diagnoses codes to one or more of 67 possible medical condition categories and, in combination with demographic factors, estimates a patient risk score that predicts Medicaid expenditures.

[154] Pope, Gregory C., et al. Risk adjustment of Medicare capitation payments using the CMS-HCC model. (2004); Kronick, Richard, et al. "Improving health-based payment for Medicaid beneficiaries: CDPS." *Health care financing review* 21.3 (2000): 29-64.

Post-Acute Care Interventions

PAC interventions focus on improving patient outcomes during or immediately after an index hospitalization. Awardees implementing this type of intervention are Christiana, Ochsner, and Vanderbilt's transitions care coordination (TCC) program. Thus, enrollment into PAC interventions occurs during admission to or discharge from an inpatient hospital. Participants then receive the intervention for a defined period after hospital discharge. Salient features of data structure for these awardees are:

- A patient-episode is the unit of analysis because each episode of acute/post-acute care provides the awardee an opportunity to intervene to improve outcomes; [155]
- The analysis of time uses calendar quarters before and after implementation of the intervention.

Data source. We use the CMS Virtual Research Data Center (VRDC) and participant enrollment information from awardees as our primary data sources. We use information from the awardee on Medicare ID number, social security number, birth date, and sex to identify Medicare beneficiaries enrolled in PAC programs. We also identify a comparison group. (The methods for selecting comparison groups are discussed in the Comparison Group Selection section)

- We include participants enrolled before October 1, 2014. We then apply a claims run-off period of 90 days and construct measures from claims through December 31, 2014. All patient-episodes and associated measures are assigned to the calendar quarter during which hospital discharge occurs. Thus, the last quarter of data presented in this report is Q3 of 2014;
- The final data set includes four distinct groups, defined based on time and location (see Exhibit A.2). Only patient-episodes meeting the stated enrollment criteria for each intervention are included in the data set. For example, Christiana enrolls patients upon discharge following a revascularization procedure; therefore, all treatment and comparison episodes included in the data set have been discharged from a hospital after revascularization.[156]

[155] A person can have multiple patient-episodes within the treatment or comparison group. We exclude any patient-episodes associated with persons who are admitted to both treatment and comparison provider facilities. Fewer than 5% of people had multiple patient-episodes. In all models, we modify the covariance structure to account for the repeated measures over time for each patient and obtain clustered standard errors at the patient level.

[156] More details on awardee inclusion criteria and operational definitions for selecting comparisons are provided later in this appendix.

Exhibit A.2: Distinct Groups Included in PAC Analytic Files

Location	Time Period	Description
Awardee Intervention Site	Pre-intervention	Patient-episodes discharged from the awardee intervention site (e.g., Christiana hospital) during the eight quarters before implementation of the intervention
	Post-intervention	Patient-episodes discharged from the awardee intervention site after implementation of the intervention and included in the awardee enrollment file
Comparison Site	Pre-intervention	Patient-episodes discharged from a comparison site during the eight quarters before implementation of the intervention at the awardee site
	Post-intervention	Patient-episodes discharged from a comparison site after implementation of the intervention at the awardee site

Measure specification. In this report, we focus on three CMS-identified core measures for PAC awardees—emergency department (ED) visits, readmissions, and total cost of care (Exhibit A.3). These specifications deviate from those provided by the meta-evaluation in the following ways:

- Because a discrete event determines enrollment, we use a design with patient-episode as the unit of analysis rather than patients;
- We define quarters pre- and post-intervention as calendar quarters at the site before and after the start of HCIA programs to account for the awardee's pre-HCIA performance on core measures;
- We treat 90-day post-discharge readmissions as a proxy for all-cause hospitalizations in the quarter as all hospitalizations in the post-acute period can be deemed readmissions.

Exhibit A.3: Core Measures for PAC Interventions[157]

Measure	Definition
Post-discharge Emergency Department (ED) Visits	Proportion of patient-episodes with an emergency department visit within 90-, 180-, and 365-days of index hospital discharge
Post-discharge Readmissions	Proportion of patient-episodes readmitted to an acute care hospital within 30-, 90-, 180-, and 365-days of index hospital discharge
Post-discharge Total Cost of Care[158]	Total cost of Medicare Part A and B services per patient-episode provided within 90-, 180-, and 365-days of index hospital discharge

Ambulatory Care Interventions

Ambulatory care interventions identify and engage participants in the outpatient setting; these interventions include FirstVitals, GWU, Indiana, IOBS, MAHEC, Nemours, UAB, UCLA, and Vanderbilt's outpatient care coordination (OCC) program. Ambulatory care interventions focus on

[157] We use time frames greater than 90 days to assess whether the awardee's intervention reduces cost of care in the longer term—both six months and one year after discharge.
[158] Total cost of care is expressed in 2013 dollars after adjusting for medical care consumer price index. Cost of non-hospital services are suitably inflated to 90, 180, or 365 days for partial periods of patient enrollment.

improving health, increasing quality of care, and reducing spending for patients with chronic conditions living in the community. Salient features of data structure for these awardees are:

- Program participants are often a convenience sample of patients presenting to the awardee program site during the intervention period;
- The unit of analysis for these awardees is patient-quarters before or after enrollment in the intervention;
- Time is treated as enrollment time and measured as number of quarters before or after program enrollment for each individual.

Data source. Our data sources are CMS VRDC data enclave environment for Medicare claims and Alpha-MAX Medicaid claims, managed care claims obtained from the awardee, and program files obtained from the awardee identifying program participants and their enrollment dates.[159] We then link awardee program files to Medicare/Medicaid claims. Participants enrolled in the awardee's intervention program before January 1, 2015, and who have least one post-intervention quarter of enrollment are included.[160] We create a longitudinal analytic file for each awardee, with claims for each quarter after enrollment and eight quarters before enrollment. The unit of analysis of the resulting analytic dataset is a patient-quarter before or after enrollment in the intervention.

Measure specification. For each quarter, we calculate five core measures for ambulatory care interventions (see Exhibit A.4). Our specifications for these measures conform to the recommendations of the meta-evaluator.

Exhibit A.4: Core Measures for Ambulatory Care Interventions

Measure	Definition
All-cause Hospitalization Rate	Proportion of patients per 1,000 admitted to a short-term inpatient facility in a quarter
ED Visit Rate	Proportion of patients per 1,000 with an ED visit or a hospital observation stay (not resulting in hospitalization) in a quarter
30-day Readmission Rate	Proportion of patients per 1,000 readmitted to a short-term inpatient facility within 30 days of hospital discharge in a quarter
Ambulatory Care Sensitive (ACS) Hospitalization Rate[161]	Proportion of patients per 1,000 admitted to a short-term inpatient facility for ACS conditions in a quarter
Total Cost of Care[162]	Total cost of Medicare (Part A and B services) or Medicaid per patient in a quarter

[159] For awardees targeting Medicaid populations, we use Medicaid claims data through Alpha-Max (Nemours) or provided by the awardee (FirstVitals).

[160] Both awardees have a cut off of January 1, 2015, but PAC awardees participants need to be discharged/enrolled by October 1, 2014 in order to have a 90 day follow up of January 1, 2015. We have set a minimum of 90 days follow-up for PAC awardees to ensure we can capture entire post-acute period. For ambulatory care awardees, we do not apply the same criteria. Instead we adjust the models to account for the number of days of follow-up time.

[161] Prevention Quality Indicators #92 Technical Specifications, Prevention Quality Chronic Composite. Rockville, MD: Agency for Healthcare Research and Quality; May 2013. http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V45/TechSpecs/PQI%2092%20Prevention%20Quality%20Chronic%20Composite.pdf.

[162] Total cost of care is expressed in 2013 dollars after adjusting for medical care consumer price index. Cost of non-hospital services is suitably inflated to 90 days for partial periods of patient enrollment in the quarter.

Comparison Group Selection

We include a comparison group for six awardees: Christiana, Indiana, IOBS, Nemours, UAB, and UCLA. For each awardee, we use a three-stage process to define the comparison group:

- identify sampling frame: select area and/or facility comparable to program implementation site
- limit to qualified patients: apply awardee program enrollment criteria to restrict comparison pool to patients who would have been eligible to participate in the awardee program
- select similar patients: use propensity score methods to match or weight treatment and comparison groups on potential confounding factors[163]

Identify sampling frame. The first step to selecting a comparison group is to select the sampling frame. Variation in utilization and costs across geographic regions and providers is well documented.[164] This is a potential source of bias for our evaluation if not well controlled. Therefore, we explicitly consider geographic- and provider-level factors in selecting the sampling frame. Exhibit A.5 summarizes the sampling frame and the approach to identifying comparison providers/areas for the four awardees.

- Residence-based: For Indiana, Nemours, and UCLA, the participant place of residence was used to define the primary sampling frame. Propensity score models are used to identify comparison counties for Indiana based on sociodemographic factors, health care service availability and utilization, and disease burden in the county. In the case of Nemours, the entire state of Delaware was used as the comparison sampling frame because of the extensive reach of Nemours' clinics throughout the state. The comparison zip codes for UCLA are the same as the zip codes where the treatment population resided.[165]
- Practice-based: For IOBS and UAB, who implemented the intervention across multiple practices, similar practices serve as our sampling fame. We selected comparison oncology practices for IOBS by propensity score matching on practice characteristics. We selected two comprehensive cancer centers (and their affiliates) in the South for comparison hospitals for UAB.
- Hospital-based: To select a comparison sampling frame for post-acute care interventions, we developed a propensity score model for a national pool of hospitals paid by Medicare to identify comparison hospitals that are most similar to each awardee hospital on a set of selected hospital characteristics. We used this method for Christiana.

When we use propensity scores to identify comparison areas, practices, or hospitals, we employ logistic regression models that include geographic- and facility-level covariates, as appropriate. The propensity

[163] We use propensity score weighting for PAC awardees because we use a serial cross-section design where we compare outcomes across patient-episodes within each calendar quarter. We use propensity score matching for ambulatory awardees.
[164] Fisher, Elliott S., et al. "The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care." *Annals of internal medicine* 138.4 (2003): 273-287. (2) Fisher, Elliott S., et al. "The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care." *Annals of internal medicine* 138.4 (2003): 288-298. (3) Welch, H. Gilbert, et al. "Geographic variation in diagnosis frequency and risk of death among Medicare beneficiaries." *JAMA* 305.11 (2011): 1113-1118.
[165] Our expectations of resulting comparison group size prompted us to use different geographic sampling frame definitions for different awardees.

score is the probability of the county, practice, or hospital being a part of the awardee's program. **T_i** is the probability of being a treatment county, practice or hospital. **Geographic level$_i$** and, **Facility level$_i$** are vectors of county-level and practice/hospital-level characteristics respectively. The following specification is used for the propensity score models:

$$\text{Logit}[\Pr(T_i=1)] = \beta_0 + \beta_1 \text{Geographic Level}_i + \beta_2 \text{Facility Level}_i$$

Exhibit A.5: Sampling Frame for Comparison Groups

Awardee	Sampling Frame	Comparison Areas/Providers
Christiana	Propensity-score-matched hospitals in the same CMS region as Christiana	UPMC Presbyterian Shadyside, PA; Abington Memorial Hospital, PA; Main Line Hospital Bryn Mawr Campus, PA; Thomas Jefferson University Hospital, PA
Indiana	Propensity-score-matched counties in the Midwest	**Eskenazi Site:** Sangamon County, IL; Lucas County, OH; St. Louis County, MO; Wayne County, MI; and Dakota County, MN **Arnett Site:** Vigo County, IN; Summit County, OH; Franklin County, MO; Jefferson County, MO; and Green County, MO
IOBS	Propensity-score-matched comparison oncology practices	**ACC, TX:** Central Texas Medical Specialists, TX; Oncopath Laboratory, TX; Northshore Oncology Associate, LA **CCBD, TX:** Cancer Care Network of South Texas, TX; Oncology Pharmacy Services, TX **DPHY, OH:** IHA Health Services Corporation, MI; Cancer Care Associates PC, MI **MMCM, ME:** Oncology Associates, P.C., CT; Berkshire Hematology Oncology, MA; Commonwealth Hematology-Oncology, P.C., MA **NGOC, GA:** Integrated Community Oncology Network, FL; Greater Florida Emergency Group, FL; Peachtree Hematology Oncology Consultants, GA **NMCC, NM:** Cancer Centers of Southwest Oklahoma, OK; Texas Oncology PA, TX **SCCC, FL:** Watson Clinic, FL; Mayo Clinic Florida, FL; Cancer Centers of North Carolina, NC
Nemours	Zip codes in the state of Delaware	Zip codes where the treatment population resides
UAB	National Cancer Institute Comprehensive Cancer Centers in the South/Midwest and their affiliated hospitals	**NCI Comprehensive Cancer Centers:** MD Anderson, TX; Vanderbilt-Ingram, TN **MD Anderson Affiliates:** Providence Hospital, AL; DCH Regional Medical Center, AL; Sacred Heart Hospital, FL; Piedmont Hospital, GA; Piedmont Fayette Hospital, GA; East Jefferson General Hospital, LA; St. John Medical Center, OK; Spartanburg Regional Medical Center, SC **Vanderbilt-Ingram Affiliates in TN:** Baptist Memorial Hospital, Middle Tennessee Medical Center, St. Thomas Hospital, Baptist Memorial Hospital Union City, Baptist Hospital, Stones River Hospital and Dekalb Community Hospital, River Park Hospital, Highlands Medical Center, Hickman Community Health Services, Jackson-Madison County General Hospital
UCLA	Zip codes in the Los Angeles area	Zip codes where the treatment population resides

Limit to qualified patients. After identifying the sampling fame, we apply the same criteria the awardee used to enroll patients in their programs and limit the comparison pool to all Medicare FFS (or Medicaid) patients within the sampling frame during 2013 who would have been eligible for the program under

study.[166] Exhibit A.6 provides an overview of awardee enrollment criteria and claims-based rules used to operationalize these criteria.

We align the timeframe across treatment and comparison groups to ensure that we compare patients at similar calendar time to control for differences in treatment patterns or treatment availability. To accomplish this for the comparison cases, we identify the first instance of a hospitalization, hospital outpatient visit, or ambulatory provider visit for the target chronic condition during CY2013. We define this date as the "pseudo" enrollment date for the patients in the comparison group. Based on this pseudo enrollment date, we construct quarter-level patient covariates for eight pre-intervention patient quarters and all post-intervention patient quarters.

Pre- and post-intervention quarters for the treatment group patients for most awardees are based on the enrollment date defined as the date patients actually enrolled in the program. For awardees like IOBS and UAB, where the treatment group patients experience a spike in utilization and cost at the time of program enrollment, we define the enrollment date from claims as the first instance of a hospitalization, hospital outpatient visit, or ambulatory provider visit occurring within 90 days of the date that the patients actually enroll in the program.

Exhibit A.6: Claims Rules Used to Identify Comparison Patients

Awardee	Target Population	Diagnoses/Procedure Codes[167]
Christiana	Medicare FFS beneficiaries 18+ years undergoing percutaneous transluminal coronary angioplasty (PTCA) or coronary artery bypass graft (CABG) at Christiana	**PTCA:** (ICD9P 00.66, 36.XX; BETOS P2D; CPT 929XX, G029X; HCPCS C96XX) **CABG:** (IC9P 36.1X, 36.2, 36.3X; BETOS P2A; CPT 335XX)
Indiana	Medicare FFS beneficiaries 65+ years with a diagnosis of depression or dementia	Dementia: 331.0, 331.11, 331.19, 331.2, 331.7, 290.0, 294.0, 294.10, 294.11, 294.20, 294.21, 294.8, 797 **Depression:** 296.2X. 296.3X, 296.5X, 296.6X, 296.89, 298.0, 300.4, 309.1, 311
IOBS	Medicare FFS beneficiaries with one of seven specific types of incident or recurrent cancers (breast, lung, colorectal, pancreatic, thyroid, melanoma, or lymphoma)	**Breast cancer:** 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8, 174.9, 175.0, 175.9, 233.0, V10.3 **Lung cancer:** 162.2, 162.3, 162.4, 162.5, 162.8, 162.9, 231.2, V10.11 **Colorectal cancer:** 153.0–153.9, 154.0, 154.1, 230.3, 230.4, V10.05, V10.06 **Pancreatic cancer:** 157.0, 157.1–157.4, 157.8, 157.9 **Thyroid cancer:** 193, 258.02, 258.03, V108.7 **Melanoma:** 172.0–172.9, V108.2 **Lymphoma:** 200.00–200.88, 202.00–202.28, 202.70–202.98, V107.1, V107.9 And no diagnoses for similar cancers in 2012
Nemours	Medicaid children 2–17 years who had an outpatient office visit with a diagnosis of asthma and a prescription for a bronchodilator	**Asthma:** 493.00–493.02, 493.10–493.12, 493.20–493.22, 493.81–493.82, 493.90–493.92

[166] We attribute patients to areas based on their county or zip code of residence, as indicated in the Master Beneficiary Summary File (MBSF). For groups selected at the facility level, we attribute patients to facilities using either the NPI or Provider ID.
[167] All codes are ICD-9 codes unless otherwise specified.

Awardee	Target Population	Diagnoses/Procedure Codes[167]
UAB	Medicare FFS beneficiaries 65+ years with one of six specific types of cancers (breast, lung, colorectal, lymphoma, or male and female genitourinary)	**Breast cancer:** 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8, 174.9, 175.0, 175.9, 233.0, V10.3 **Lung cancer:** 162.2, 162.3, 162.4, 162.5, 162.8, 162.9, 231.2, V10.11 **Colorectal cancer:** 153.0–153.9, 154.0, 154.1, 230.3, 230.4, V10.05, V10.06 **Lymphoma:** 200.00–200.88, 202.00–202.28, 202.70–202.98, V107.1, V107.9 **Male genitourinary cancer:** 185, 186.0, 186.9, 187.1–189.9, 209.24, 233.4–233.7, 233.9, V10.45–V10.53, V10.59 **Female genitourinary cancer:** 179, 180.0, 180.1, 180.8, 180.9, 181, 182.0, 182.1, 182.8, 183.0, 183.2–183.5, 183.8, 183.9, 184.0–184.4, 184.8, 184.9, 188.0–188.9, 189.0–189.4, 189.8, 189.9, 209.24, 233.1, 233.2, 233.30–233.32, 233.7, 233.39, 233.9, 795.0, 795.01–795.03, 795.04, 795.06, 795.16, V10.40–V10.44, V10.50–V10.53, V10.59
UCLA	Medicare FFS beneficiaries 18+ years with Alzheimer's Disease or other forms of dementia	**Dementia:** 331.0, 331.11, 331.19, 331.2, 331.7, 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42, 290.43, 294.0, 294.10, 294.11, 294.20, 294.21, 294.8, 797

Select similar patients. Finally, for ambulatory care awardees we use propensity score models to select a sub-set of the comparison pool that most closely match the treatment group participants on observed covariates. Propensity score matching for serial cross-sectional design requires matching awardee patient-episodes to comparison patient-episodes in each quarter. Since such matching would result in loss of unmatched treatment patient-episodes and our goal is to maximize our power to detect differences, we use propensity score weighting rather than matching for PAC awardees.

We estimate the propensity score using logistic regression as the probability of a patient being enrolled in the awardee's program, conditional on the patient's covariates. Exhibit A.7 summarizes the approach to propensity score models and the variables used for each awardee. Variables in the propensity score model include, but are not limited to, patient demographics, clinical covariates, morbidity, prior utilization, and characteristics of provider/area. $\mathbf{T_i}$ is the probability of being a treatment group, $\mathbf{Patient_i}$ is a vector of patient characteristics, and $\mathbf{Practice/Area_i}$ is a vector of characteristics of the practice or the area for the participant. The following specification was used for the propensity score models:

$$\text{Logit}[\Pr(T_i=1)] = \beta_0 + \beta_1 \text{Patient}_i + \beta_2 \text{Practice/Area}_i$$

We assess and confirm both common support as well as covariate balance between the treatment and comparison group patients before and after applying propensity score.[168] The results of these model diagnostics are included in the awardee-specific chapters. We then compare the two groups—treated and comparison—to estimate the effects of the intervention.

[168] We assess common support by visually inspecting overlap in distribution of estimated propensity scores across treatment and comparison groups. We compute standardized differences in baseline covariates between treatment and comparison groups to assess balance.

Exhibit A.7: Approach and Variables Used in Propensity Score Models

Awardee	Propensity Score (PS) Approach	Variables Used for Propensity Score Model
Christiana	Standardized mortality ratio weighting where treatment patient-episodes are weighted as 1 and comparison patient-episodes are weighted as PS/(1- PS)	Age (in categories <65, 65–69, 70–74, 75–79, 80–84, >85), gender, race, ethnicity (Hispanic, non-Hispanic), disability status, prior-year hospitalizations, prior-year ED visits, prior-year cost, extent of prior-year FFS coverage, prior-year HCC score, target procedure (inpatient and outpatient PTCA or CABG), disease severity (CC or MCC DRG), and relevant clinical conditions (CHF, stroke, diabetes, atrial fibrillation, ESRD, and AMI)
Indiana	Exact match by diagnosis (dementia or depression) followed by nearest neighbor 1:1 matching based on PS—without replacement[169]	Condition (dementia, depression, or both dementia and depression), age (in categories <70, 70–75, 75–80, 80–85, 85–90, >90), gender, race (black, white), prior cancer diagnosis, heart diseases, arthritis (RA or OA), hyperlipidemia, ED visits in the prior year, and HCC score
IOBS	Exact match by cancer type followed by nearest neighbor 1:1 matching based on PS—without replacement	Cancer type (breast, colorectal, lung, lymphoma, melanoma, pancreatic), mode of cancer treatment in quarter before and after enrollment (surgery, chemotherapy, radiation therapy),[170] cancer severity (metastatic cancer), age (in categories <65, 65–70, 70–75, 75–80, 80–85, >85), race (white, other), disability, ESRD, and comorbidity (HCC score in year before enrollment in program)
Nemours	Nearest neighbor 1:1 matching based on PS—without replacement	Age (in categories <5, 5–9, 10–14, 15–17), gender, race (white, non-white), ethnicity (Hispanic, non-Hispanic), disability, CDPS score in year before enrollment, prior-year Medicaid costs, prior-year hospitalizations, and prior-year ED visits
UCLA	Nearest neighbor 1:1 matching based on PS—without replacement	Alzheimer's-type dementia, age (in categories <85, 85–89, 90–94, 95+), gender, race (white, non-white), ethnicity (Hispanic, non-Hispanic), congestive heart failure, depression, diabetes, hyperlipidemia, hypertension, ischemic heart disease, arthritis (RA or OA), HHC score, and prior-year Medicare costs
UAB	Exact match by cancer type followed by nearest neighbor 1:1 matching based on PS—without replacement	Cancer type (breast, colorectal, lung, lymphoma, male genitourinary, female genitourinary), mode of cancer treatment in quarter before and after enrollment (surgery, chemotherapy, radiation therapy),[171] cancer severity (metastatic cancer), type of cancer hospital (CCC or affiliated hospital), age (in categories <65, 65–70, 70–75, 75–80, 80–85, >85), race (white, other), disability, ESRD, and comorbidity (HCC score in year before enrollment in program)

Analytic Methods

Here we summarize our approach to estimating treatment effects for the 18 disease-specific awardees. The analytic method is chosen based on two factors: data source and availability of comparison group.

[169] We use propensity score matching without replacement to improve efficiency of the estimates. Large comparison groups with adequate common support enables us to match without replacement.

[170] For IOBS, we use mode of cancer treatment—cancer surgery, chemotherapy, and radiation therapy—to adjust for differences in severity of cancer because of limited information on cancer severity on claims. We test the sensitivity of our results after excluding cancer surgery, chemotherapy, and radiation therapy from our propensity score model. We do so because there is a possibility that the intervention may influence the mode of cancer treatment that their patients receive.

[171] For UAB, we use the mode of cancer treatment—cancer surgery, chemotherapy, and radiation therapy—to adjust for differences in severity of cancer, because of limited information on cancer severity on claims. We also test the sensitivity of our results after excluding cancer surgery, chemotherapy, and radiation therapy from our propensity score model.

We first discuss Medicare and Medicaid claims-based analysis where we use DID analyses for awardees with comparison groups and interrupted time-series analyses for awardees without comparison groups. We then summarize methods using awardee data to estimate changes from the baseline.

Difference-in-Differences

We use DID analyses for awardees with comparison groups to estimate the average treatment effect on the treated (ATT).[172] DID compares average outcomes between patients or patient-episodes in the awardee program and a comparison group across the entire pre- and post-intervention periods while limiting the influence of selection bias and secular trends.

The primary parameter of interest in the DID is the difference in average outcome between the treatment group and a comparison group *after* implementation or exposure to the intervention minus the difference in average outcome between the treatment group and a comparison group *before* implementation or exposure to the intervention. We call this the DID, or double difference, estimator. This construction allows us to study the impact of an awardees program on outcomes relative to a comparison group while also taking advantage of baseline (pre-intervention) data on both groups.[173]

For each outcome, we conduct DID analyses employing suitable serial cross-sectional models (PAC awardees) or longitudinal population average models (ambulatory awardees) with the appropriate functional form for the dependent variable (see Exhibit A.8). [174]

Exhibit A.8: Functional Form for Regression Models

Measure	Functional Form[175]
All-cause Hospitalization Rate	Binomial distribution with a log link, modeled using xtlogit command in Stata
ED Visit Rate	Binomial distribution with a log link, modeled using xtlogit command in Stata
30-day Readmission Rate	Binomial distribution with a log link, modeled using xtlogit command in Stata
Ambulatory Care Sensitive (ACS) Hospitalization Rate	Binomial distribution with a log link, modeled using xtlogit command in Stata
Total Cost of Care	Costs converted to 2013 dollars and modeled using a gamma distribution with a log link, modeled using xtgee command in Stata

[172] In estimating treatment effects for an awardee's program, our objective is to estimate the average treatment effect on the treated (ATT) rather than the average treatment effect (ATE). ATT is the average gain from treatment for those who were actually treated while ATE is the expected gain for treating a randomly selected unit from the population

[173] More details on the selection of comparison groups for each awardee can be found in the Comparison Group Selection section

[174] We use serial-cross-section models for PAC awardees since the goal is to compare outcomes for patient-episodes across pre- and post-intervention calendar quarters. In the case of ambulatory awardees, we use longitudinal population-average models to compare outcomes for the same set of enrolled patients before and after the intervention.

[175] We used modified Park test to identify the best link and variance function for each outcome.

We run two sets of DID models: summative pre/post model and quarterly fixed-effects model. Results from the summative DID models are presented in the annual report, while results from the quarterly fixed-effects models are presented in the accompanying quarterly report.[176] Because the quarterly fixed-effects results are intended to assess quarter to quarter program impact for awardees rather than summarize overall impact, we do not present these results in our main report. The specifications for these models are similar, differing only in how time is modeled. The general specification for these models is:

$$Y_i = \beta_0 + \beta_1 \text{ Treatment}_i + \beta_2 \text{Time}_i + \beta_3 \text{Treatment}_i * \text{Time}_i + \beta_4 \text{ Patient}_i + \varepsilon_i$$

In the summative pre/post model, **Time** is an indicator variable for implementation (or exposure) to the intervention. Thus the interaction term $\boldsymbol{\beta_3}$ allows for estimation of the double difference comparing outcomes between the treatment and comparison groups for the entire post-intervention period to the entire pre-intervention period. In the summative pre/post model we estimate a single program effect for the entire post-period, assuming that program effects in each post-quarter do not differ.

In the quarterly fixed effects model, **Time** is a vector of dummy variables for quarter, taking the value of quarters before and after the program. In this model, the $\boldsymbol{\beta_3}$ term is another vector showing the impact of the awardee's program in each quarter after program implementation.

Variables in the model are detailed in Exhibit A.9, showing differences in between PAC and ambulatory care awardee programs in how variables are specified.

[176] Unlike PAC awardees, for ambulatory awardees, quarter is defined as enrollment quarters (exposure time) and not the calendar quarter in which enrollment occurs. Enrollment quarters are successive 90-day time periods occurring before and after program enrollment.

Exhibit A.9: Variables in DID Models

Variable/Parameter	PAC Awardee	Ambulatory Awardee
Time Scale	Calendar time, separated into before and after program implementation	Exposure time, separated into before and after program enrollment
Y_i	Outcome variable for the i^{th} patient-episode	Outcome variable for the i^{th} patient
$Treatment_i$	Dummy variable indicating whether the patient-episode was seen at the awardee or a comparison provider site	Dummy variable indicating whether the patient was part of awardee's program or comparison group
Time Quarterly Fixed-Effects Model	Vector of dummy variables for calendar quarters before and after program implementation at the awardee site. The interaction term only includes dummy variables for calendar quarters after program implementation.	Vector of dummy variables for quarters before and after patient's enrollment in the program. The interaction term only includes dummy variables for quarters after program enrollment.
Time Summative Model	Dummy variable for time period before and after program implementation at the awardee site	Dummy variable for time period before and after patient's enrollment in the program
$Patient_i$	Vector of patient-episode demographic and clinical variables at the time of index hospitalization, which are imbalanced in the propensity score model or continued to remain significantly associated with outcomes in the DID model	Vector of patient demographic and clinical variables at the time of enrollment in program, which are imbalanced in the propensity score model or continued to remain significantly associated with outcomes in the DID model
ε_i	Error term	Error term

Patients or patient-episodes in the treatment and comparison group are matched or weighted on key participant covariates. For our DID models, we limit the participant covariates that continue to be associated with outcomes. This does result in some overlap between covariates used in matching or weighting and those included in our models for estimating treatment effects. We also test the sensitivity of our results by excluding these participant covariates in the treatment effects models. The details of the participant covariates included in the models for each awardee are summarized in the specific awardee chapters. In all models, we use an exchangeable covariance structure to account for the repeated measures over time for each patient and to obtain clustered standard errors at the patient level.

Time Series Analysis

For awardees without comparison groups, we use interrupted time-series models to estimate the impact of programs on measures of utilization and cost. Interrupted time-series methods compare average outcomes between pre- and post-periods for the awardee program. These models allows us to study the impact of an awardee's program compared to what would have been expected under usual care, which can be inferred by comparing to outcomes in the period before the intervention.[177] Since this design lacks a comparison group, we are unable to distinguish between secular trends and changes in trends resulting from the intervention. For each outcome, we estimate the treatment effect by employing suitable population

[177] We assume that secular trends remain consistent in the pre- and post-periods. Therefore, trends in outcomes that are a result of usual care in the post-period are assumed to be similar to those in the pre-period.

average models with the appropriate functional form for the dependent variable (see Exhibit A.8 for model details on each outcome).

We run two sets of interrupted time-series models for the PAC and ambulatory awardees (comparable to the two DID models described above). The first model uses quarterly fixed effects to assess the impact on outcomes of each quarter of the awardee's program. The second model estimates the impact of the program on outcomes over the entire implementation (or exposure) period. The specifications for these models are similar, differing only in how time is modeled. The general specification for these models is:

$$Y_i = \beta_0 + \beta_1 Time_i + \beta_2 Patient_i + \varepsilon_i$$

In the summative time-series model, **Time** is an indicator variable for implementation (or exposure) to the intervention. In this case the $\boldsymbol{\beta_1}$ term estimates the difference in average outcome, comparing the entire post-intervention period to the entire pre-intervention period.

In the quarterly fixed-effects time-series model, **Time** is a vector of dummy variables for quarter, including quarters before and after program implementation. In this model, the $\boldsymbol{\beta_1}$ term is another vector showing the average outcome in each quarter.

Variables in the model are detailed in Exhibit A.10—showing differences between PAC and ambulatory care awardee programs in how variables are specified.

Exhibit A.10: Variables in the Interrupted Time-Series Models

Variable/Parameter	PAC Awardee	Ambulatory Awardee
Time Scale	Calendar time, separated into before and after program implementation	Exposure time, separated into before and after program enrollment
Y_i	Outcome variable for the i^{th} patient-episode	Outcome variable for the i^{th} patient
Time Quarterly Fixed-effects Model	Vector of dummy variables for calendar quarters before and after program implementation at the awardee site	Vector of dummy variables for quarters before and after patient's enrollment in the program
Time Summative Model	Dummy variable for time period before and after program implementation at the awardee site	Dummy variable for time period before and after patient's enrollment in the program
$Patient_i$	Vector of patient-episode demographic and clinical variables at the time of index hospitalization	Vector of patient demographic and clinical variables at the time of enrollment in program
ε_i	Error term	Error term

The details of the patient or patient-episode covariates included in the interrupted time-series models for each awardee are summarized in the specific awardee chapters. In all models, we use an exchangeable covariance structure to account for the repeated measures over time for each patient and to obtain clustered standard errors at the patient level.

Awardee Data Analysis

For awardees without usable and timely claims data, we use awardee-collected data for evaluating the awardee's program. Awardee-collected data includes surveys, administrative program data, electronic health record data, clinical measures, and/or patient-reported outcomes. The awardee-collected data varies greatly by type, outcome, completion, validation, sample size, and quality. Thus, details on the analytic approach, measures, and statistical methods are provided in the awardee chapters.

Appendix B: Qualitative Methods

Data Collection

Our evaluation team conducted two rounds of qualitative data collection per awardee. The first round of site visits ran from April to September 2014, and the second took place from February to June 2015.[178] Exhibit B.1 provides an overview of the timeline for both rounds of site visits. During our first and second round of site visits, we interviewed staff and leadership in person at 44 of 84 sites covered by the 18 awardees included in this evaluation. We also interviewed 11 awardees' program staff by phone or videoconference to gather data from five sites that we did not visit during either round of in-person data collection.[179] Data collection also included 40 focus groups, 110 patient phone interviews, and over 300 structured interviews. Exhibit B.2 provide an overview of key themes covered in the interviews by type of key informant.

Exhibit B.1: Site Visit Schedule

Awardee	Date of First Site Visit(s)	Date of Second Site Visit(s)
IOBS**	4/9/14 (IOBS staff, New Mexico Cancer Center)	3/18–3/19/15 (Center for Cancer and Blood Disorders); 3/31–4/1/15 (Northwest Georgia Oncology Center); 4/9–4/10/15 (New England Cancer Specialists) 6/17/14 (IOBS leadership)*
Christiana	4/21–4/22/14; 9/11/14	5/5–5/7/15
UCLA	5/7–5/8/14 (UCLA Health, Santa Monica)	2/24–2/25/15 (UCLA Health, Santa Monica)
Joslin**	5/12/14 (Washington, DC); 5/27/14 (Pennsylvania); 6/19–6/20/14 (New Mexico); 9/24/14 (leadership)*	4/10/15 (Washington, DC); 4/7/15 (leadership)*
SEDI**	5/15/14 (Durham); 5/16/14 (Cabarrus); 5/29/14 (Quitman)	2/11/15 (Durham); 2/12/15 (Cabarrus); 2/19/15 (Mingo); 2/25/15 (leadership and data team)*
Le Bonheur	5/27–5/28/14	3/16–3/18/15
UVA**	5/29–5/30/14	3/26/15;* 3/31/15*
MAHEC	6/9/14 (MAHEC FHC); 6/10/14 (Blue Ridge Community Health Services)*	5/20/15 (Andrews Internal Medicine); 5/21/15 (MAHEC FHC; MAHEC Ob/Gyn)
USJHSD**	6/16–6/17/14 (USJHSD)	4/1/15;* 4/9–4/10/15**

[178] Some site visits included traveling to multiple awardee sites. As a number of awardees have multiple intervention sites that may be geographically dispersed, we used the second round to visit sites that we could not visit during the first round. For example, IOBS works with seven cancer centers throughout the United States. During the first round of site visits, our visit was limited to the New Mexico Cancer Center, where IOBS is based. UAB works with 10 sites throughout the southeastern United States; during our initial site visit, we only visited Birmingham, Alabama.

[179] Some interviews by phone occurred with sites we had previously visited in person. This conserved staff time and resources. These calls supplemented in person site visits or were a substitute for them; the latter typically occurred if we observed few intervention changes, had visited most or all awardee sites in round one, and/or anticipated fewer updates than other awardees.

Awardee	Date of First Site Visit(s)	Date of Second Site Visit(s)
FirstVitals**	6/24/14 (AlohaCare, Ko'olauloa Health Center, Waikiki Health Center); 6/25/14 (Kalihi-Palama Health Center)	4/2/15 (AlohaCare, FirstVitals in HI and CA)*
UAB	6/25–6/26/14 (UAB Comprehensive Cancer Center)	2/10/15 (Northside Hospital); 2/11/15 (Navicent Health); 2/12/15 (UAB Comprehensive Cancer Center); 2/13/15 (Northeast Alabama Regional Medical Center)
Nemours	6/26–6/27/14 (Wilmington); 8/27/14 (Seaford); 9/17–9/18/14 (Dover; Wilmington)	3/25–3/26/15
UPenn**	7/1–7/2/14	3/9/15*
Vanderbilt**	7/7, 7/9/14 (Vanderbilt University Medical Center); 7/8/14 (Maury Regional Hospital, Williamson Medical Center)	4/24/15 (Maury)* 4/27–4/29/15
GWU**	7/28 (GW Medical Faculty Associates Office); 7/29 (Washington D.C. site); 7/30 (Baltimore, MD site); 8/18 (Easton, MD)*	4/6 (GW Medical Faculty Associates Office); 4/14 (Richmond, VA);* 4/15 (Lanham, MD); 4/15 (Woodbridge, VA);*
Indiana**	7/23–7/24/14 (Ezkenazi); 7/25/14 (Arnett)	5/7–5/14/15 (Eskenazi and Arnett)*
Ochsner**	8/5–8/6/14	8/8, 8/9*
HRiA	10/6/14 (Boston Children's Hospital, Leadership); 10/7/14 (Boston Medical Center); 10/8–10/9/14 (Hasbro Children's Hospital and St. Joseph's Health Services)	4/27/15 (Middlesex Hospital); 4/28/15 (Children's Medical Group); 5/6/15 (Rutland Regional Medical Center);* 5/8/15 (leadership)*

*We conducted interviews via phone at these awardees.

**We conducted discussions with individual participants in person or by telephone at these sites in place of focus groups.

Exhibit B.2: Interview Themes

Stakeholder Group	Discussion Topics
Program Leadership	▪ Ways in which the care model builds on previous interventions ▪ Organizational characteristics or events that shaped and challenged implementation; how the intervention team adapts to challenges to foster success ▪ Perceived impact to date of the program on target population ▪ Lessons learned from the program's workforce model ▪ Lessons learned about coordinating with partners ▪ Adoption of systems to monitor and evaluate progress ▪ Changes to the intervention over time ▪ Insights or lessons learned about program replicability, scalability, and spread ▪ Sustainability plans
Frontline Staff	▪ Prior experience with similar programs ▪ Role within the intervention and changes to that role over time ▪ Experience with training ▪ Organizational support and teamwork ▪ Perceived impact on participants ▪ Job satisfaction ▪ Challenges ▪ Lessons learned
Care Team Supervisors and Training Staff	▪ Recruitment and hiring of staff ▪ Ideal qualifications, background, and characteristics of frontline staff ▪ Format and content of trainings provided ▪ Perceptions of and data on job satisfaction, turnover, and burnout among frontline staff ▪ Impact of intervention on program participants ▪ Key accomplishments, challenges, and lessons learned ▪ Changes to intervention over time ▪ Organizational support and teamwork ▪ Insights or lessons learned about program replicability, scalability, and spread ▪ Sustainability plans
Clinical Providers	▪ How the program has changed workflow ▪ Changes to organizational culture or how providers practice ▪ Spillover to non-participants (e.g., family or community) ▪ Experiences working with an interdisciplinary team, when relevant ▪ Perceptions of the program's impact on patient outcomes

Recruitment - Participant and Caregiver Focus Groups and Telephone Interviews

We used three approaches to recruit participants and caregivers for focus groups and on-site one-on-one interviews, which entailed a mix of active and passive recruitment efforts. In order to maximize response rates, we were flexible in approaches to recruitment. Since the purpose of the focus group was to understand participants experience with the intervention, we prioritized recruiting participants familiar with the intervention. While several awardee-led recruitment sites contacted specific individuals, several also called a random subset of enrolled participants or used passive recruitment strategies.

NORC-led (active recruitment). Active recruitment included the following:

- mailing advance letters and/or informational flyers to participants
- requesting participant lists and contact information from awardees, sometimes focused on a specific subsets of patients (e.g., participants who received a particular service, or services within the past year)
- calling participants to find focus group volunteers, employing screening questions in the creation of participant lists or screening calls (e.g., awareness of program or recent interactions)
- calling focus group volunteers a day or two before the focus group as a reminder
  - particularly effective when calls made by staff familiar with the awardee

NORC-Awardee collaboration (passive recruitment). Depending on the awardee's needs, NORC and awardees partnered to employ a combination of the efforts bulleted above. For example, we created focus group flyers and sent them to an awardee, who distributed the flyers to participants who then called NORC's phone line to confirm their attendance and ask questions.

Awardee-led recruitment. A few awardees chose to conduct all outreach and recruitment for focus groups. In some cases this was because of IRB concerns; in others, awardee staff suggested that participants would be more likely to respond if contacted by a familiar institution, or recommended conducting a focus group following a scheduled event where participants would already be gathered. NORC requested that awardees recruit a diverse set of participants who represent the participant populations (e.g., variation in race and ethnicity, gender, years of experience as a caregiver), and/or subpopulations of patients (e.g., participants who receive a particular service or services within the past year) and provided awardees with a flyer to use for recruitment.

Telephone interviews. We also recruited participants for phone interviews through active and passive recruitment strategies. Phone interviews occurred primarily in the second round of data collection when we did not visit all awardees in person. In two cases, awardees distributed NORC-created informational materials. Participants interested in an interview contacted NORC via phone or mailed a signed consent form to NORC. As participants volunteered, we called them for interviews on a rolling basis. More often, we requested patient lists from awardees and selected subsets of participants, and interview teams placed calls to conduct interviews on the spot.[180] At participants' request, interview teams could contact them at a specified date and time. When NORC and awardees deemed it an effective strategy, we created informational fliers and mailed them to participants.

Exhibit B.3 below indicates recruitment method by awardee.

[180] This strategy increased likelihood of gathering a range of responses. For example, participants who received services within a recent timeframe could better recall services, or we spoke to participants in different risk groups that received different services.

Exhibit B.3: Patient Focus Group and Interview Recruitment Methods

Awardee	Recruitment Type: Round 1	Recruitment Type: Round 2
Christiana	NORC-led	NORC-led
FirstVitals	NORC-Awardee Collaboration	NORC-led**
GWU	NORC-Awardee Collaboration**	NORC-Awardee Collaboration**
HRiA	NORC-Awardee Collaboration	NORC-Awardee Collaboration
Indiana	NORC-Awardee Collaboration	NORC-led**
IOBS	Awardee-led*	NORC-led* **
Joslin	NORC-Awardee Collaboration	Awardee-led*
Le Bonheur	Awardee-led	Awardee-led
MAHEC.	Awardee-led	Awardee-led
Nemours	NORC-led	NORC-led
Ochsner	NORC-Awardee Collaboration	NORC-led**
UAB	Awardee-led	Awardee-led
UCLA	Awardee-led	Awardee-led
SEDI	NORC-led**	NORC-led**
UPenn	N/A	NORC-led**
USJHSD	NORC-Awardee Collaboration	NORC-Awardee Collaboration**
UVA	Awardee-led*	NORC-led**
Vanderbilt	NORC-Awardee Collaboration	NORC-led

*Conducted one-on-one patient/caregiver interviews on site in place of focus groups

**Conducted telephone interviews

Sample Participant and Caregiver Focus Groups and Telephone Interview Protocol

All focus groups and phone interviews centered on three major questions:

- To what extent was the innovation understood by the patient?
- To what extent does the intervention improve health, quality of life, quality of health care, and utilization?
- What aspects of the innovation have the greatest impact on patient outcomes?

Key topics of discussion included satisfaction with care; knowledge of the disease; confidence and ability to manage their own health/that of their dependent (patient activation); sense of empowerment; burden on caregiver or family; relationship with provider(s); care coordination; access to care; and daily functioning and quality of life. Exhibit B.4 provides an example of a full protocol.

Exhibit B.4: Example of Interview Protocol

Domain	Questions
Participant Introductions	**[Optional] Please tell us something about yourself, such as how long you have been seeking care at [organization].**
Experience with Awardee and Intervention	■ **How did you get connected to/ first hear about the program?** ○ Did a primary care physician refer you? ○ Were you contacted directly by the program? ○ How long have you been participating in the program? ○ Why did you choose to participate? ■ **Have you worked with a community health worker/navigator/care coordinator other than through this program?** ○ How is this the same? ○ How is it different? ■ **In your own words, please describe what you know about the program. How is the program supposed to work?** ○ What are the main goals of the program? ○ When you first started participating in the program, do you feel that the program was explained well? ○ Have you received adequate information about the goals of the program and how it works? ○ Are program staff available to answer your questions about the program? ■ **What was your impression of your first visit with the CHW/navigator/care coordinator?** ○ Did you find the first visit useful? ○ Was it clear what was going to happen after the visit? What happened? ○ If you shared concerns during the first visit, was it clear how those concerns would be addressed? ■ **How would you describe your interactions with the navigators or other program staff?** ○ How often do you meet or speak? ○ Do they call you or can you call them? ○ How easy or difficult do you find it to talk to them about your health? ○ Have your communications with the program staff been positive or negative? ○ Have you been able to communicate with program staff as much as you needed? ○ Do you feel the staff are sensitive to your needs? ■ **Can you tell us about how, if at all, the CHW/navigator/care coordinator has helped you?** ○ How does the staff work with you to meet your needs and goals? ○ Do you have a good understanding of the things you are responsible in meeting these goals? ■ **Please use your props to indicate whether you agree or disagree with the following:** ○ My interactions with the navigator were helpful. ○ I was able to reach my navigator when I needed him/her. ○ My navigator listened to my concerns. ○ My navigator explained things in a way that I could understand.

Domain	Questions
	○ The resources my navigator connected me to meet my needs. ■ **Please use your props to indicate whether you agree or disagree with the following:** ○ Overall, I was satisfied with the care and services that I received through the program. ○ Participating in the program improved my daily functioning.
Care Coordination/ Caregiver/Patient Relationship with Provider(s)	■ **Since joining the program, have your experiences with your [primary care physician] been different?** ○ If yes, how so? ○ More or less helpful? ○ Frequency of visits? ○ Ease of communication with your primary care physician's office? ■ **Are far as you can tell, how well do your providers—primary care provider, navigator, other physicians and agencies that you work with—communicate effectively with each other?**
Impact of Intervention on the Participant	■ **How, if at all, has the [care coordinator/CHW/etc.] in this program helped you with your daily functioning or quality of life?** ○ What aspects of the program helped improve the daily functioning and quality of life the most? ○ What was most helpful? ■ **Has the program facilitated connections to community-based organizations that you did not know about before?** ■ **How, if at all, has participating in the program changed your confidence and ability to care for yourself?** ○ What are you more confident about? ○ What are you better able to do? ■ **What part of the program has helped you the most?** ■ **How do you think the program could be improved to better support you?**
Wrap Up (5 minutes)	■ **Are there any last thoughts you wish to share?**

Qualitative Coding

Our first round of data collection yielded more than 200 transcripts from interviews and focus groups. Between November 2014 and February 2015, we coded approximately 140 verbatim transcripts from our first round of data collection that consisted of interviews with program leadership, management, and staff using NVivo (QSR International Pty Ltd. Version 10, 2012).[181] We did not code the data team or evaluation team interviews, as the content tended to fall under a limited number of codes that could be easily gleaned from notes taken during the site visit. In place of coding, we developed summaries of patient and caregiver focus groups and interviews in place of coding. These summaries captured key findings in terms of:

[181] Since focus group discussions tended to feature little diversity in terms of coded themes, we developed summaries of all 25 focus group transcripts from our first round of data collection to enumerate and capture key patient responses in lieu of coding these transcripts during this initial round of coding. We will code data collected during the second round of site visits to inform future reports.

- patients' understanding of the program,
- quality of life, behavioral, self-monitoring, and clinical improvements,
- utilization changes, and
- participant recommendations.

In the third year of the evaluation, we will code these remaining focus group transcripts in addition to the transcripts of second round of interviews and focus group using a modified codebook that concentrates on patient perspectives, experiences, and outcomes.

We developed the codebook deductively based on a framework established by RAND and the meta-evaluation domains.[182, 183] The codebook underwent 13 iterations to modify or delete codes that were unclear to the coding team and to refine code definitions as well as inclusion and exclusion criteria (see Exhibit B.5 for a depiction of the final coding structure, which encompasses 32 codes). As interviewees frequently describe complex concepts, we permitted coders to apply multiple codes as necessary and advised coders to select enough text to expresses a standalone thought.

We trained a team of six coders over the course of a four-week period (see Exhibit B.6).[184] We calculated inter-rater reliability (IRR) each week of training. We set an IRR benchmark at 70% that falls in the middle of the range of Kappa scores considered "substantial agreement," 61-80%. IRR from 81-100 constitutes almost perfect agreement.[185, 186]

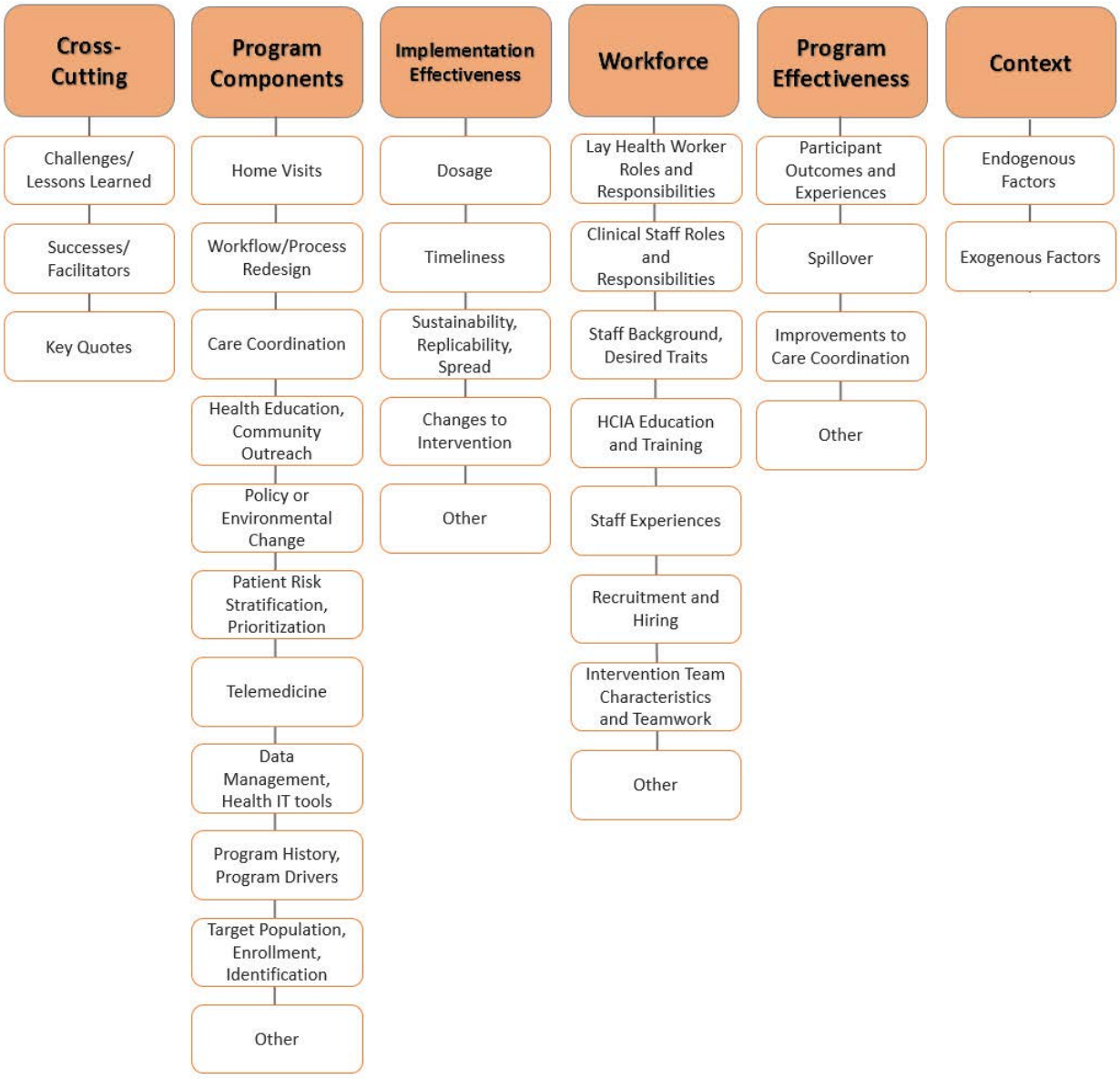
In NVivo, two coders can choose identical codes but have less than 100% IRR because they selected different lengths of transcript text. To overcome this misrepresentation, we overlaid transcripts that were independently coded in NVivo and located areas of identical coding. If coders captured the same codes but different lengths of text, we extended both coders' selections to the same length without shortening selections. If coding schemes did not match, we did not reconcile code selections.

Once IRR had reached >72% calculating via Cohen's Kappa, staff began independently coding transcripts for their assigned awardees. By the end of training, each team member coded at least seven half-transcripts and three full transcripts, over 100 pages total. Regular meetings and discussion between coders and senior staff continued throughout the process. We resolved questions that arose through consensus-gathering discussions between two or more coders or between a coder and senior members of

[182] Berry SH, Concannon TW, Gonzalez-Morganti K, et al. CMS Innovation Center Health Care Innovation Awards Evaluation Plan. *RAND*, 2013: 1-109.
[183] Cromwell J, Bir A, Smith K, Kahwati L, Kane H, Stockdale H. Health Care Innovation Awards (HCIA) Meta-Analysis and Evaluators Collaborative. *RTI International*. November 22, 2013.
[184] One or more members of each NORC site visit participated in transcript cleaning and coding. Tapping site visit or cohort team members for coding is a best practice that improves coding quality by maximizing the coder's background knowledge about the awardee. In addition, a coder's familiarity with multiple awardees improves their capacity to propose refinements to the codebook that capture meaningful developments while retaining a parsimonious approach to coding.
[185] Viera, A., Garret, J.M. Understanding Interobserver Agreement: The Kappa Statistic. *Family Medicine*, 35(5): 2005, 360-363.
[186] We calculated IRR using NVivo files that reflected independent coding before they were updated to reflect consensus decision, which would have positively skewed IRR.

the team. This constant communication ensured that coding styles remain consistent with training.[187] We also conducted an additional round of IRR calculations nine weeks into independent coding to ensure that coder agreement and reliability remained high.

Exhibit B.5: Code Families



[187] If a challenging transcript requires additional program expertise, untrained senior staff review the coder's work. If senior staff recognized consistent errors in coding, they conferred with the coder, who corrected their coding decisions. This process occurred in only a handful of instances.

Exhibit B.6: Coder Training Timeline and Activities

Week	Coder Activities[188]
One	■ Independently coded first eight pages of two transcripts in NVivo ■ Entire group met two times, once per transcript, to discuss coding decisions
Two	■ Independently coded the first 10 pages of three transcripts in NVivo[189] ■ Discussed coding each transcript in groups of three to four* ■ Meeting leader incorporated group decisions into his/her pre-coded transcripts ■ Calculated IRR among all groups
Three & Four	■ Independently coded three full transcripts in NVivo (week three); first 10 pages of three transcripts (week four) ■ Discussed coding each transcript in pairs* ■ Meeting leader incorporated group decisions into his/her pre-coded transcripts ■ Calculated IRR among pairs

*Members of small groups and pairs rotated so coders could interact with different codes as frequently as possible. This facilitated creating a unified coding style shared by all coders.

[188] There are two exceptions to this regimen. One coder could not participate in one half-transcript practice round. Another more experienced coder participated in fewer practice rounds in weeks 3 and 4. Both coders met satisfactory IRR of >72% before independently coding.

[189] Because of the length of transcripts, which typically run 20 to 30 pages, we determined that training would be more beneficial if coders were exposed to more types of interview conversations, thus coding less than complete transcripts, instead of coding fewer transcripts in their entirety. The range of interviewed staff and varying transcript content also informed this decision.

Appendix C: IOBS Sensitivity Analyses—Difference-in-Differences Estimates for Core Measures‡

Definition of Treatment Group Enrollment/ Matching & Adjusting for Mode of Cancer Treatment	Number of Patients in each group	Pre-Intervention Period			Post-Intervention Period			DIFFERENCE-IN-DIFFERENCES [95% CI]
		Comparison	Intervention	DIFFERENCE [95% CI]	Comparison	Intervention	DIFFERENCE [95% CI]	
Hospitalizations per 1,000 Patients								
Claims Anchor Date/ *Mode of Tx.*	3,488	88	82	-6 [-11, -0.4] **	150	138	-12 [-20, -4] ***	-6 [-16, 3]
Claims Anchor Date/ *No Mode of Tx*.	3,488	87	82	-5 [-10, 0.2] *	155	139	-16 [-24, -7] ***	-11 [-20, -2] **
Finder-file Enrollment Date/ *Mode of Tx.*	3,489	82	75	-7 [-12, -2] ***	149	150	1 [-7, 10]	8 [-1, 17] *
Finder-file Enrollment Date/ *No Mode of Tx*.	3,489	80	75	-5 [-10, -1] **	146	150	4 [-5, 12]	9 [0.1 18] **
ED Visit per 1,000 Patients								
Claims Anchor Date/ *Mode of Tx.*	3,488	106	123	17 [10, 24] ***	153	161	8 [-2, 17]	-9 [-19, 0.3] *
Claims Anchor Date/ *No Mode of Tx.*	3,488	103	123	20 [13, 27] ***	154	161	7 [-3, 16]	-13 [-23, -3] ***
Finder-file Enrollment Date/ *Mode of Tx.*	3,489	102	117	15 [9, 22] ***	148	167	19 [10, 29] ***	4 [-6, 13]
Finder-file Enrollment Date/ *No Mode of Tx*.	3,489	100	117	17 [11, 24] ***	151	167	16 [6, 26] ***	-1 [-11, 9]
30-day Readmissions per 1,000 Patients Hospitalized								
Claims Anchor Date/ *Mode of Tx.*	3,488	180	184	4 [-20, 27]	203	172	-31 [-55, -6] **	-35 [-67, -2] **
Claims Anchor Date/ *No Mode of Tx.*	3,488	178	184	6 [-17, 30]	195	172	-23 [-47, 2] *	-29 [-62, 3] *
Finder-file Enrollment Date/ *Mode of Tx.*	3,489	166	178	12 [-12, 36]	207	180	-27 [-52, -3] **	-39 [-72, -7] **
Finder-file Enrollment Date/ *No Mode of Tx*.	3,489	172	178	6 [-18, 30]	204	180	-24 [-48, 1] *	-30 [-63, 3] *
ACS Hospitalization per 1,000 Patients								
Claims Anchor Date/ *Mode of Tx.*	3,488	13	12	-1 [-3, 1]	21	20	-1 [-4, 3]	0.1 [-4, 4]
Claims Anchor Date/ *No Mode of Tx.*	3,488	12	12	0.1 [-2, 2]	26	20	-6 [-9, -2] ***	-6 [-10, -2] ***
Finder-file Enrollment Date/ *Mode of Tx.*	3,489	11	12	1 [-1, 3]	23	21	-2 [-6, 2]	-3 [-7, 0.4] *
Finder-file Enrollment Date/ *No Mode of Tx*.	3,489	12	13	1 [-1, 3]	23	21	-2 [-6, 1]	-3 [-7, 1]
Total Cost of Care per Patient ($)								
Claims Anchor Date/ *Mode of Tx.*	3,488	$3,268	$3,407	$139 [-$22, $299]	$9,399	$9,366	-$33 [-$520, $454]	-$172 [-$681, $338]
Claims Anchor Date/ *No Mode of Tx.*	3,488	$3,181	$3,338	$157 [$3, $312] **	$10,046	$9,701	-$345 [-$865, $174]	-$502 [-$1,042, $36] *
Finder-file Enrollment Date/ *Mode of Tx.*	3,489	$3,101	$3,082	-$19 [-$178, $139]	$9,447	$9,990	$543 [$43, $1,042]**	$562 [$35, $1,088] **
Finder-file Enrollment Date/ *No Mode of Tx*.	3,489	$3,089	$3,077	-$12 [-$162, $137]	$9,933	$10,382	$449 [-$82, $980] *	$461 [-$90, $1,013]

Inference: *** p<0.01; ** p<0.05; * p<0.1

‡Model-based estimates for cost estimated using population-averaged longitudinal models with log link and gamma distribution. Binary measures estimated using population-averaged longitudinal logit models.

Appendix D: UAB Sensitivity Analyses—Difference-in-Differences Estimates for Core Measures‡

Definition of Treatment Group Enrollment/ Matching & Adjusting for Mode of Cancer Treatment	Number of Patients Per Each Group	Pre-Intervention Period			Post-Intervention Period			DIFFERENCE-IN-DIFFERENCES [95% CI]
		Comparison	Intervention	DIFFERENCE [95% CI]	Comparison	Intervention	DIFFERENCE [95% CI]	
Hospitalizations per 1,000 Patients								
Claims Anchor Date/ *Mode of Tx.*	2,492	92	87	-5 [-11, 1]	204	177	-27 [-41, -13] ***	-22 [-37, -7] ***
Claims Anchor Date/ *No Mode of Tx.*	2,492	88	87	-1 [-7, 5]	178	176	-2 [-16, 11]	-1 [-15, 12]
Finder-file Enrollment Date/ *Mode of Tx.*	4,063	94	102	8 [3, 13] ***	190	176	-14 [-24, -3] **	-22 [-33, -11] ***
Finder-file Enrollment Date/ *No Mode of Tx.*	4,063	93	102	9 [4, 14]	178	176	-2 [-13, 8]	-11 [-22, -0.1] **
ED Visit per 1,000 Patients								
Claims Anchor Date/ *Mode of Tx.*	2,492	125	116	-9 [-17, 1]	216	180	-36 [-51, -20] ***	-27 [-43, -11] ***
Claims Anchor Date/ *No Mode of Tx.*	2,492	125	116	-9 [-18, -1] **	195	179	-16 [-31, -1] **	-7 [-22, 8]
Finder-file Enrollment Date/ *Mode of Tx.*	4,063	126	121	-5 [-12, 2]	211	169	-42 [-54, -29] ***	-37 [-49, -24] ***
Finder-file Enrollment Date/ *No Mode of Tx.*	4,063	131	121	-10 [-17, -3] ***	195	170	-25 [-38, -14] ***	-15 [-27, -3] **
30-day Readmissions per 1,000 Patients Hospitalized								
Claims Anchor Date/ *Mode of Tx.*	2,492	175	168	-7 [-32, 19]	197	177	-20 [-48, 8]	-13 [-50, 24]
Claims Anchor Date/ *No Mode of Tx.*	2,492	155	166	11 [-14, 37]	175	178	3 [-25, 32]	-8 [-45, 30]
Finder-file Enrollment Date/ *Mode of Tx.*	4,063	178	180	2 [-18, 22]	197	183	-14 [-38, 8]	-16 [-46, 13]
Finder-file Enrollment Date/ *No Mode of Tx.*	4,063	173	181	8 [-12, 27]	193	188	-5 [-28, 17]	-13 [-43, 17]
ACS Hospitalization per 1,000 Patients								
Claims Anchor Date/ *Mode of Tx.*	2,492	16	14	-2 [-5, 1]	30	25	-5 [-10, 1]	-3 [-9, 3]
Claims Anchor Date/ *No Mode of Tx.*	2,492	14	14	0 [-2, 3]	26	25	-1 [-7, 4]	-1 [-7, 4]
Finder-file Enrollment Date/ *Mode of Tx.*	4,063	17	16	-1 [-3, 1]	30	28	-2 [-7, 2]	-1 [-6, 3]
Finder-file Enrollment Date/ *No Mode of Tx.*	4,063	16	16	0 [-2, 2]	29	28	-1 [-6, 3]	-1 [-6, 3]
Total Cost of Care per Patient ($)								
Claims Anchor Date/ *Mode of Tx.*	2,492	$3,941	$3,852	-$89 [-$312, $133]	$11,175	$11,461	$286 [-$420, $992]	$375 [-$356, $1,106]
Claims Anchor Date/ *No Mode of Tx.*	2,492	$3,941	$3,843	-$98 [-$316, $120]	$9,064	$11,408	$2,343 [$1,668, $3,018] ***	$2,441 [$1,741, $3,141] ***
Finder-file Enrollment Date/ *Mode of Tx.*	4,063	$4,281	$4,565	$284 [$101, $466] ***	$10,300	$10,742	$442 [-$109, $993]	$158 [-$420, $737]
Finder-file Enrollment Date/ *No Mode of Tx.*	4,063	$4,290	$4,554	$264 [$77, $451] ***	$9,081	$10,903	$1,822 {$1,270, $2,375] ***	$1,558 [$294, $2,134] ***

Inference: *** p<0.01; ** p<0.05; * p<0.1

‡Model-based estimates for cost estimated using population-averaged longitudinal models with log link and gamma distribution. Binary measures estimated using population-averaged longitudinal logit models.