THIRD ANNUAL REPORT

HCIA Disease-Specific Evaluation

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Disease-Specific Awardees

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

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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. This report discusses the subset of 18 HCIA projects targeting patient populations who have specific diseases or diagnostic profiles. The HCIA disease-specific awards focus on seven conditions considered priorities 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)
- pediatric asthma

Evaluation Goals and Methods

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

We present analysis of both qualitative and quantitative data. We also draw findings from information abstracted from awardee documents such as progress reports. We gathered qualitative data over two rounds of site visits conducted with all 18 awardees. Over the course of two years, we visited 44 locations across the 18 awardees, including multiple sites for some awardees. Six sites participated in virtual site visits by telephone in the second year. In-person and virtual site visits involved interviews with program leadership, staff, enrolled participants, and caregivers, as well as focus groups with participants and caregivers.

Data used to produce quantitative findings vary across the 18 awardees. For awardees serving Medicare fee-for-service (FFS) participants (10 awardees), we used claims data from the Centers for Medicare & Medicaid Services (CMS) Chronic Condition Data Warehouse (CCW) to capture information on health care costs and utilization for participants (treatment groups).

For nine of these awardees, we identified comparison group cases from the CCW, using propensity score matching or weighting. We then evaluated the awardees' impact on CMMI priority measures—hospitalizations, hospital readmissions, emergency department (ED) visits, and total cost of care—for their Medicare FFS patients relative to the comparison group. We used difference-in-differences (DID) methods to take into account the specific characteristics of providers and patients as well as secular trends. For one awardee without a comparison group, we analyzed the effects of the program on the

priority measures among their Medicare FFS patients before and after program implementation (time-series) and analyzed awardee-collected program data.

We performed similar analyses using Medicaid cost and utilization data for three awardees. In these cases, we used Alpha-MAX data from the CCW or data obtained directly from Medicaid payers, identified suitable comparison groups, and conducted DID analyses. Finally, using participant data collected by five awardees, we conducted pre-post quantitative analysis of changes in utilization, quality of care, or health-related behavior measures.

CMMI prioritized four core measures for analysis: total cost of care, ED visits, hospitalizations, and 30-day rehospitalizations. Altogether, we had sufficient access to Medicare or Medicaid claims data or awardee-reported utilization data to assess at least most of the core measures for 14 of the awardees. Of these, we identified comparison groups for 12; we did not use a comparison group for two awardees, one with an insufficient sample size and another with only self-reported data. No claims data were available for the remaining four awardees, and therefore we were unable to assess the priority measures.

Exhibit 1.1 provides a brief summary of the 14 programs for which we analyzed CMMI's priority measures, as well as an overview of their impact on these measures. Measures for awardees with favorable findings (i.e., significant reductions in utilization or cost measures) are marked with a **down arrow**; similarly, those with unfavorable findings (i.e., significant increase in utilization or cost measures) are marked with an **up arrow**. Measures that were non-significant are marked NS, and those lacking sufficient data appear shaded. We also note awardees that have qualitative data that suggest evidence of improved quality of care or quality of life. Awardees are arranged in order by the quality of the evidence, with the best at the top. Unless otherwise specified, analyses involved the use of comparison groups.

Exhibit 1.1: HCIA Disease-Specific Awardees: Findings among CMS Core Measures±

Awardee	Project Focus	Program Effectiveness				Qualitative Evidence	
		ED	Hosp.	Readm.	Cost	QoL	QoC
Innovative Oncology Business Solutions, Inc. (IOBS)	Patient-centered medical home model for comprehensive outpatient oncology care	↓	↓	NS	↓	✓	
Regents of the University of California, Los Angeles (UCLA)	Care coordination and management for patients with dementia, and caregiver education and support	NS	↓	↓	↓	✓	
Le Bonheur Community Health and Well-Being (Le Bonheur)	Asthma care management for children ages two to 18 years	↓	NS	NS	↓	✓	
Nemours Children's Health System of the Nemours Foundation (Nemours)	Family-centered medical home model complemented by community outreach and education to address pediatric asthma	↓	↓		NS		✓
University of Alabama at Birmingham (UAB)	Technology- and navigator-enabled care coordination and management for cancer patients	↓	↓	NS	NS	✓	

Awardee	Project Focus	Program Effectiveness				Qualitative Evidence	
		ED	Hosp.	Readm.	Cost	QoL	QoC
The George Washington University (GWU)	Telemonitoring and monthly educational videos on end-stage renal disease (ESRD)	NS	↓	↑	NS		
Health Resources in Action, Inc. (HRiA)*	Asthma care management for children ages two to 17 years	↓	↓			✓	
Christiana Care Health Services, Inc. (Christiana)	Coordination of care transitions and longitudinal care management following acute CVD-related episodes	NS	NS	NS	NS	✓	✓
FirstVitals Health and Wellness, Inc. (FirstVitals)	Diabetes management and telehealth	NS	NS		NS	✓	
Mountain Area Health Education Center, Inc. (MAHEC)*	Chronic pain care management program, provider training and education	NS	NS	NS	NS	✓	✓
Ochsner Clinic Foundation (Ochsner)	Telemedicine-enabled inpatient care coordination and monitoring; post-stroke monitoring and education through home visits up to one year post-discharge	NS	NS	NS	NS	✓	✓
Trustees of Indiana University (Indiana)	Care management of depression and dementia through home visits	NS	NS	NS	NS	✓	
The Rector and Visitors of the University of Virginia (UVA)	Proactive palliative care support for advanced cancer patients and advances in radiation therapy				NS	✓	
Vanderbilt University Medical Center (Vanderbilt)	Inpatient transition care coordination (TCC) and outpatient care coordination (OCC) for patients with varying target conditions, including hypertension, congestive heart failure, and diabetes	NS	NS	NS	NS		

Key: ↓ significant reduction in core measures; NS, non-significant finding; ↑ significant increase in core measures; blank grey cell, insufficient data; ✓ indicates evidence of improved quality of care or quality of life.

±Significance assessed at p>0.10 level.

ED, emergency department visits; hosp, hospitalization; readm, readmission after index hospitalization; cost, total cost of care; QoL, quality of life; QoC, quality of care. All awardees except MAHEC and HRiA have comparison groups.

*Bolded text = no comparison group

Exhibit 1.2 summarizes results from awardee-collected data for the four programs without claims data. We highlight key findings from each analysis. Further details can be found in awardee chapters.

Exhibit 1.2: HCIA Disease-Specific Awardees: Findings among Programs without Claims Data

Awardee	Project Focus	Findings from Awardee-Collected Data
Duke University's Southeastern Diabetes Initiative*	Diabetes disease management, self-management support, and community-wide patient education and health resources	Improved understanding of diabetes management Improvements in HbA1C levels
Joslin Diabetes Center*	Community-based diabetes education and screening workshops	Improvement in HbA1C levels, exercise, diet, sleep patterns, and blood pressure among participants with diabetes
The Trustees of the University of Pennsylvania*	Home-based comprehensive palliative oncology services integrated with home health care services	Improved quality of life and greater sense of confidence for cancer patients and caregivers
Upper San Juan Health Service District*	Early-detection screenings for cardiovascular disease, wellness programs, telemedicine, critical care and outreach paramedicine, and patient navigation	Substantial decrease in specialty care transports via air ambulance
		Wellness center screened more than 1,600 patients, promoting engagement with primary care providers.

NOTE: *No comparison group available

Conclusion

Six of the 18 awardees—IOBS, UCLA, Le Bonheur, Nemours, UAB, and GWU—demonstrated significant improvements in cost of care or core utilization measures among their participants relative to comparison groups. FirstVitals, Indiana, Ochsner's Stroke Central, and UVA had non-significant but promising trends in one or more core measures relative to comparison groups. HRiA, Joslin, MAHEC, SEDI's high-risk program, and UPenn all showed improvements in either a core utilization measure or program-specific measures related to quality of care or health maintenance behaviors, as evidenced by changes in program data before and after enrollment.

Finally, three awardees—Christiana, Vanderbilt, and USJHSD—did not demonstrate aggregated improvement among program participants with either claims or program data. However, when we analyzed the Vanderbilt sites separately, one TCC site had a significantly improved core utilization measure relative to a comparison group.

Qualitative findings often suggest improvements in patients' access to care and services not necessarily reflected in the aggregated quantitative measures. The majority of programs focused on enhancing the coordination of care through direct patient engagement and indirect systems interventions to improve access to timely and appropriate care. This included hiring care coordinators and developing health information technology that improved communication among providers and between providers and their patients. Most awardees used multidisciplinary teams with identifiable care coordinators to offer more patient-centered care. Many awardees offered care coordinators or patient navigators specifically to help patients manage their primary and specialty care. Awardees showing positive program outcomes commonly used community health workers and home visits to deliver their interventions. Awardees invested in offering participants a high level of personal engagement in order to encourage and support patients to manage and maintain their own health.

Most awardees sustained some, if not most, of their intervention components after conclusion of their award period. Most benefited from internal institutional support for continuation, particularly those with positive findings. Other strategies for sustainability ranged from licensing and marketing original materials to identifying opportunities for third-party payment in value-based models. Given the relatively short project time frame, awardees sometimes made decisions to continue the intervention based on a qualitative sense of program success, with the expectation of demonstrating quantitative impacts in the longer term.

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 a health care–delivery innovation focused on specific populations and settings. Under the three-year cooperative agreement (which ran until June 30, 2015), HCIA Round 1 supported the testing of new approaches to delivering care, including approaches that leverage technology, workforce training, and ongoing improvements informed by rapid-cycle feedback.[1] The funded interventions sought optimal use of resources to improve health and quality of care for individuals 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 who have specific diseases or diagnostic profiles. The populations targeted have specific chronic conditions, are medically fragile, and live in the awardee's community. Because of their disease profiles, the complexity of their care needs, and their social situations, targeted patients face the particular risk of receiving fragmented, inadequate, or inconsistent care. Therefore, care coordination, disease management, and continuity of care played an important role across these interventions.

The HCIA disease-specific awards focused 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 aimed to improve clinical processes, intermediate clinical outcomes, and quality of life, while reducing use of acute health care and costs for the target condition. Exhibit 1.3 provides an overview of the 18 disease-specific awardees, including each project's focus and the 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 1.3: HCIA Disease-Specific Awardees

Disease	Awardee	Project Focus	Primary Payer
Diabetes	SEDI	Diabetes disease management, self-management support, and community-wide patient education and health resources	Medicare/Medicaid
	FirstVitals	Diabetes management and telehealth	Medicaid
	Joslin	Community-based diabetes education and screening workshops that aim to improve key diabetes-related biomarkers and to reengage participants with the health care system	Medicare/Medicaid
ESRD	GWU	Telemonitoring and monthly educational videos	Medicare
Pediatric Asthma	HRiA	Asthma care management for children ages two to 17 years	Medicaid/CHIP
	Nemours	Family-centered medical home model complemented by community outreach and education	Medicaid/CHIP
	Le Bonheur	Asthma care management for children ages two to 18 years	Medicaid/CHIP
Chronic Pain	MAHEC	Chronic pain care management program, community collaborative-based prevention intervention, and provider education	Medicaid
Cancer	IOBS	Patient-centered medical home model for comprehensive outpatient oncology care	Medicare
	UAB	Technology- and navigator-enabled care coordination and management	Medicare
	UPenn	Home-based comprehensive palliative oncology services integrated with home health services	Medicaid/Medicare
	UVA	Proactive symptom monitoring and reduction, team-based coordination and palliative care support, and advances in radiation therapy	Medicare
Dementia & Depression	Indiana	Care management through home visits	Medicare
	UCLA	Care coordination and caregiver education and support	Medicare
CVD and Stroke	Ochsner	Telemedicine-enabled inpatient care coordination and monitoring; post-stroke monitoring and education through home visits up to one year post-discharge	Medicare
	Christiana	Coordination of care transitions and longitudinal care management	Medicare
	USJHSD	Cardiovascular early-detection screenings, wellness programs, telemedicine, critical care and outreach paramedicine, care coordination, and patient navigation	Medicaid/Medicare
	Vanderbilt	Inpatient transition care coordination (TCC) and outpatient care coordination (OCC)	Medicare

CHIP, Children's Health Insurance Program; CVD, cardiovascular disease; ESRD, end-stage renal disease

Data Sources and Methods

Findings in this report reflect both qualitative and quantitative analyses. We drew 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. Although we started with a common framework and set of evaluation questions, our application of them varied by awardee. The variation was driven by both substantive motivations (e.g., the nature of the intervention or populations involved) and pragmatic factors (e.g., data availability, program enrollment, and site-level institutional review requirements).

Qualitative Data and Methods

We gathered qualitative data during two rounds of site visits conducted with all 18 awardees in the first two years of the evaluation. Site visits involved a combination of in-person and telephone interviews, observations of the programs, and focus groups with program stakeholders, including leadership, staff, enrolled patients (participants), and their caregivers. We visited all 18 awardees and almost all of their sites in person at least once. We also conducted a review of awardee documents, such as progress reports. A summary of the qualitative approach and timeline can be found in Technical Appendix B.

Quantitative Data and Methods

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

- Claims data for Medicare or Medicaid beneficiaries, depending on the primary population that the awardee serves
- Awardee-collected data, which includes administrative program data, electronic health record (EHR) data, clinical measures, surveys, and participant-reported outcomes

The data source used for assessing program effectiveness depended in part on the evaluability of the awardee's program, summarized in Exhibit 1.4. We considered the awardee to have low evaluability if they had a small sample size (<300 participants) and/or considerable challenges with data access; medium evaluability if there were minor challenges to data access, challenges in creating comparison groups, or sample size limitations (300 to 1,000 participants); and high evaluability if there were no apparent challenges in accessing data or creating comparison groups, and sample size exceeded 1,000 participants.

Ultimately, we used Medicare claims data for 10 awardees serving primarily Medicare beneficiaries and Medicaid encounter/claims data for the three awardees serving primarily Medicaid beneficiaries. Analysis for five awardees relied exclusively on awardee data, including awardee staff and program participant accounts of utilization, quality of care, quality of life, and health behaviors. We included analysis of awardee data in addition to the claims-based analysis for one awardee because the awardee data on quality of care measure were more representative of the intended impact of the program than the CMMI core measures.

Exhibit 1.4: Evaluation Design for Awardees

Awardee	Data Source	Small Sample Size	Data Access Challenges	Evaluability
Ambulatory Awardees				
SEDI	Awardee data		Y	Low
FirstVitals	Medicaid	Y		Medium
GWU	Medicare	Y		Low
HRiA	Awardee data	Y	Y	Low
Indiana	Medicare			High
IOBS	Medicare			High
Joslin	Awardee data		Y	Low
Le Bonheur	Medicaid	Y		Medium
MAHEC	Medicare Awardee data	Y	Y	Low
Nemours	Medicaid	Y	Y	Medium
UAB	Medicare			High
UPenn	Awardee data	Y	Y	Low
UCLA	Medicare			High
USJHSD	Awardee data	Y	Y	Low
UVA	Medicare	Y	Y	Low
Vanderbilt OCC	Medicare			Medium
Post-acute Care Awardees				
Christiana	Medicare			High
Ochsner	Medicare		Y	Medium
Vanderbilt TCC	Medicare		Y	Low

Intervention type. We identified two broad groups of interventions among the disease-specific awardees based on the setting and goals of the intervention: post-acute care (PAC) interventions (three awardees) and ambulatory care programs (15 awardees). PAC interventions focused on improving patient outcomes during or immediately after a discrete event, such as a hospitalization. In general, participants in PAC interventions were enrolled at admission or discharge from an inpatient hospitalization and received the intervention for a defined period of time after hospital discharge. Ambulatory care interventions identified and engaged participants in outpatient settings and generally focused on improving health, increasing quality of care, and optimizing spending for patients with chronic conditions living in the community. To analyze data for these two types of interventions, we used slightly different methods (see Exhibit 1.5).[2]

[2]Additional details about design considerations for each intervention type are provided in Technical Appendix A.

Exhibit 1.5: 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 the treatment provider to other providers pre- and post-intervention periods	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)	Awardee facilities before start of intervention	Patients before enrollment in the intervention
External Comparison, Where Possible[3] **(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 two to four years to mirror time period of awardee intervention

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

For awardees with Medicare/Medicaid claims data, we assessed impacts on four core measures.[4] For four awardees, we also assessed ambulatory care–sensitive hospitalizations. 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
- ED visits per 1,000 patients
- total cost of care per patient

For the seven awardees for which we assessed 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's data set that were most likely to be affected by the

[3]External comparison groups are constructed for a subset 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.

[4]For details on the specifications for the core measures, please refer to the Technical Appendix.

awardee's intervention. Exhibit 1.6 summarizes the measures used to evaluate each of the awardee programs.

Exhibit 1.6: Measures of Program Effectiveness for Awardees Included in Annual Report

Awardee	CMMI Core Measures					Other Measures	
	Hosp.	30-day Readmissions	Ambulatory Care-Sensitive Hosp.	ED Visits	Total Cost of Care	Self-reported Health Outcomes	Clinical Quality Outcomes
Christiana	●	●		●	●		
FirstVitals	●	●		●	●		
GWU	●	●		●	●		
HRiA	●			●		●	●
Indiana	●	●	●	●	●		
IOBS	●	●	●	●	●		
Joslin						●	●
Le Bonheur	●	●		●	●		●
MAHEC	●	●		●	●		●
Nemours	●			●	●		
Ochsner	●	●		●	●		
SEDI						●	●
UAB	●	●	●	●	●		
UCLA	●	●	●	●	●		
UPenn							●
USJHSD						●	●
UVA					●		●
Vanderbilt OCC	●		●	●	●		
Vanderbilt TCC		●		●	●		

Exhibit 1.7: Health and Clinical Quality Outcome Measures of Program Effectiveness

Awardee	Self-Reported Health Outcomes	Clinical Quality Outcomes
HRiA	Juniper Pediatric Asthma Caregivers Quality of Life Questionnaire	Asthma action plan; asthma control; environmental composite score
Joslin	Self-reported exercise, healthy diet, and sleep	Glycemic control; blood pressure control
Le Bonheur	Not available	Asthma action plan; asthma control
MAHEC	Pain management	Morphine equivalent dose
SEDI	PROMIS Mental/Physical Health; PHQ2 Depressed Mood; Patient Activation Measure	Glycemic control; diabetes care profile; Morisky Medication Adherence score
UPenn	Pain management	Not available
USJHSD	VR-12 physical health measure; fiber intake	Blood pressure control; cholesterol control; weight management; smoking cessation
UVA	Not available	End-of-life analysis only

Analytic methods. We used a difference-in-differences (DID) analysis where possible. This design allowed us to estimate the treatment effect for the program while limiting the influence of selection bias and secular trends (analyzing the comparison and treatment groups during the same calendar period). This analysis required a comparison group, which we did not have for all awardees (see Exhibit 1.8). When comparison groups were not available, we used time-series analysis. Further details on our analytic methods can be found in Technical Appendix A.

Exhibit 1.8: Quantitative Evaluation Design

Awardee	Comparison Group	Analysis
Christiana	●	DID
FirstVitals	●	DID
GWU	●	DID
Indiana	●	DID
IOBS	●	DID
Le Bonheur	●	DID
Nemours	●	DID
Ochsner	●	DID
UAB	●	DID
UCLA	●	DID
UVA	●	DID
Vanderbilt	●	DID
HRiA		Time-series and awardee-specific
Joslin		Awardee-specific
MAHEC		Time-series and awardee-specific
SEDI/ Duke		Awardee-specific
UPenn		Awardee-specific
USJHSD		Awardee-specific

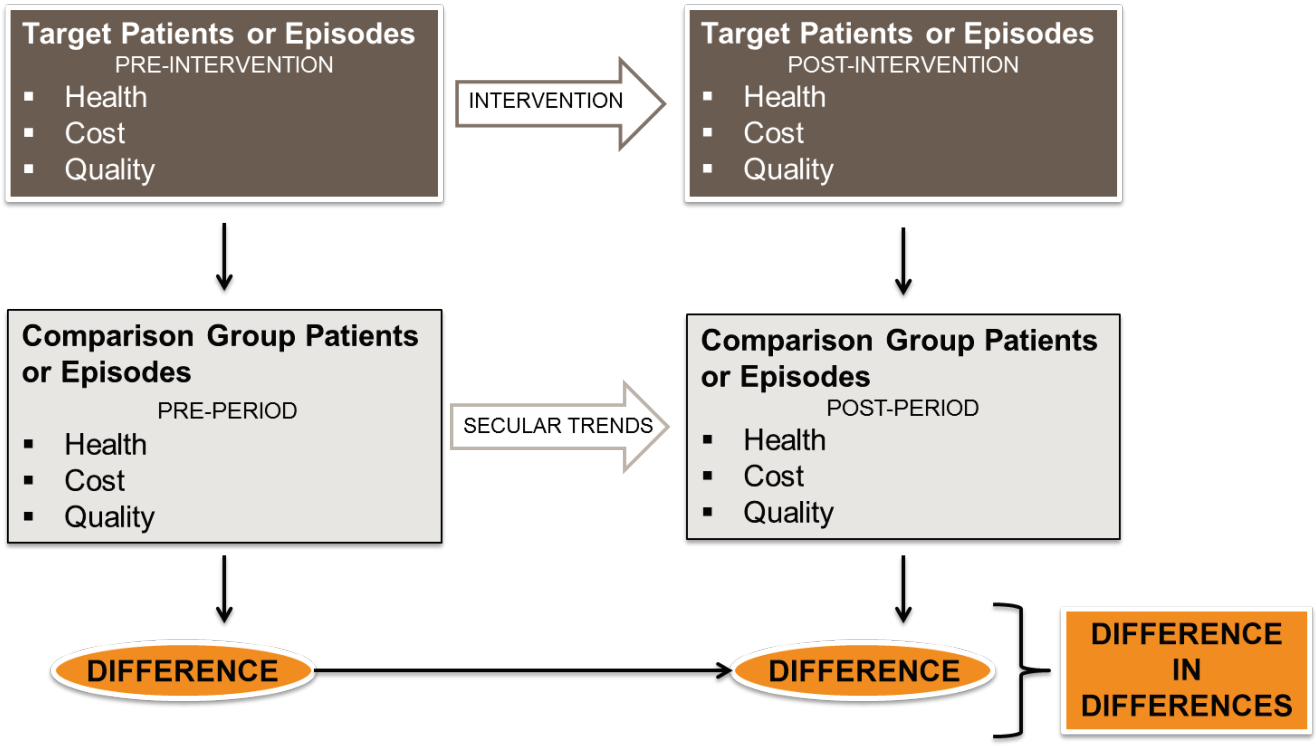
NOTE: Awardee-specific means that because of the variability in data among awardees, the analytic methods used for analysis of awardee-provided data are specific to the awardee and can be found in the awardee chapters.

For the 12 awardees with comparison groups, we used DID methods to analyze program effectiveness. The DID method for both post-acute and ambulatory awardees is presented visually in Exhibit 1.9.The DID estimator is the difference in an average outcome between the intervention and a comparison group *after* implementation of the intervention minus the difference in an average outcome between the intervention and a comparison group *before* implementation of the intervention. This specification allowed us to study the impact of the awardees' programs compared with either similar provider organizations (for post-acute interventions) or similar patients receiving usual standard of care (for ambulatory interventions).

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

interventions, we assessed program effectiveness over the entire post-intervention period, using summative DID models, which provided a single effectiveness estimate for each outcome. The specifications of our DID models are detailed in the Technical Appendix.

Exhibit 1.9: Difference-in-Differences Design for Post-Acute and Ambulatory Interventions



For two awardees, HRiA and MAHEC, which had no comparison groups, we used time-series analyses of claims data 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 the period *before* the intervention. If a significant change in outcomes is seen, it is possible that the intervention caused the change. However, in the absence of a comparison group, we cannot assume that changes in outcomes were caused by the intervention and not by other non-intervention factors coinciding with the intervention period. This is a general limitation of time-series analyses in assessing program effectiveness. The specifications of our time-series model are detailed in the Technical Appendix A.

Implementation Effectiveness

Throughout our evaluation, we focused on the awardees' implementation experience. In our first annual report, we offered detailed descriptions of the intentions and designs of awardee programs.[5] In the second annual report, we focused on assessing program reach relative to awardees' targets and the strengths and weakness of the various workforce models employed.[6] We found that almost all awardees ultimately met their enrollment targets and established effective mechanisms for recruiting and identifying participants.

[5]Available at: https://innovation.cms.gov/files/reports/hcia-ds-firstevalrpt.pdf.
[6]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

Awardees developed flexible protocols that involved a high level of personal engagement and adapted their protocols based on patients' needs.

In this third annual report, we consider aspects of implementation that served as facilitators or barriers to positive program outcomes. We also consider how workforce models and cross-site variation affected overall sustainability and spread of awardee programs. In general, we found that by the third year, implementation challenges had either been resolved or programs were working in a more limited capacity than the awardees had planned. For example, some awardees that had challenges in recruiting sites or retaining staff implemented their programs without them.

Awardees that successfully implemented care coordination teams involving multiple disciplines or a combination of lay and clinical staff were eager to sustain their programs and build on their early successes, even if effects were not quantitatively demonstrable. Several programs did not expect to see returns on their investments in terms of improvements in patients' health for many years, particularly those targeting patients with cardiovascular disease. Finally, we found that awardees with multiple sites allowed their sites to have autonomy in terms of program implementation styles and decisions, and we found few patterns in the variation in outcomes across sites.

Program Effectiveness

Our mixed-methods analysis of program effectiveness in the third year of the evaluation revealed findings of enhanced quality of care and health for patients and significant improvements in utilization and effective spending among awardees relative to comparison groups.

Overview of Qualitative Findings

Qualitatively, we identified improvements in the following:

- **quality of life,** including greater comfort, empowerment, mobility, ability to meet nonclinical goals, and stress reduction for patients and/or their caregivers
- **clinical outcomes,** including reduced health care system utilization, as well as improvements in measures such as weight, HbA1C levels, fewer asthma attacks, and others
- **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[7]
- **behavior change,** typically related to changes in diet and exercise among patients, and household cleaning habits among caregivers
- **quality of care,** covering a range of positive changes, from greater comfort in approaching physicians with questions and improved access to care to delivery of medical equipment and better communication between providers

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

At the awardee level, participants and caregivers most frequently reported improvements in quality of life (see Exhibit 1.10). Staff generally provided participants and caregivers a sense of emotional comfort and support, and health education enhanced feelings of empowerment.

Exhibit 1.10: Qualitative Evidence on Improvements in Health, Quality of Life, and Quality of Care from Focus Groups and Patient Interviews (N = 445)

Awardee (n)	Quality of Life and/or Stress Reduction	Clinical Outcomes	Self-monitoring	Behavioral Changes	Quality of Care
SEDI (n = 21)	●	●	●	●	●
Nemours (n = 20)	◑	●	●	●	●
HRiA (n = 39)	●	●	●	●	○
Christiana (n = 17)	●	◑	●	◑	●
Le Bonheur (n = 18)	●	●	●	◑	◑
Indiana (n = 43)	●	--	●	--	●
FirstVitals (n = 17)	●	○	●	●	○
USJHSD (n = 17)	●	--	●	◑	◑
MAHEC (n = 20)	●	○	◑	○	●
UPenn (n = 10)	●	--	●	--	◑
Ochsner (n = 28)	●	○	◑[8]	●	○
UCLA (n = 15)	●	○	●	--	○
Joslin (n = 54)	--	○	●	●	○
UVA (n = 6)	●	●	--	--	○
Vanderbilt (n = 29)	◑	○	◑	○	◑
IOBS (n = 17)	●	--	--	--	◑
UAB (n = 59)	●	--	--	--	◑
GWU (n = 15)	--	--	●	--	◑

Key:	
●	All or most respondents report positive effects
◑	Approximately half of respondents report positive effects
○	Few respondents report positive effects
--	No findings or not reported

In addition to these findings, our qualitative findings also support evidence of positive program effectiveness from quantitative data on utilization and cost. Exhibit 1.11 presents mixed-methods findings regarding program effectiveness and includes only qualitative evidence that supports the quantitative evidence. Programs are sorted by the strength of the evidence, with higher performing programs at the top. In some cases, there were positive qualitative findings regarding reduced utilization that were not found at the aggregated quantitative level.[9]

- Seven awardees showed statistically significant improvement in at least one core utilization measure based on claims or program data.

[8]Ochsner participants monitor weight and blood pressure, which helps prevent strokes and/or aid recovery.
[9]Further details on qualitative findings related to the CMMI priority measures can be found in the respective awardee chapters.

- Three awardees showed statistically significant improvements in cost of care, with qualitative data supporting these findings.
- Improvements in health or quality of care were seen for two awardees, and qualitative data supported these findings.

Exhibit 1.11: Quantitative and Qualitative Findings on Program Effectiveness

Awardee	Utilization		Improved Health/Quality of Care	
	Quantitative	Qualitative	Quantitative	Qualitative
HRiA	✓	✓	○	✓
Le Bonheur	✓	✓	--	✓
UCLA	✓	✓	--	✓
Nemours	✓	✓	--	✓
MAHEC	○	✓	✓	✓
SEDI	--	✓	✓	✓
IOBS	✓	✓	--	✓
UAB	✓	✓	--	✓
GWU	✓	✓	--	✓
Indiana	○	✓	--	✓
UVA	○	✓	--	✓
Ochsner	○	✓	--	✓
FirstVitals	○		--	✓
Joslin	--		○	✓
USJHSD	--		○	✓
UPenn	--	✓	--	✓
Christiana	○		--	
Vanderbilt	○		--	

Key:	
✓	Quantitative or qualitative analysis shows positive findings
○	Quantitative analysis shows null findings
--	Insufficient quantitative data

Overview of Quantitative Findings

Exhibit 1.12 provides an overview of the total Medicare and Medicaid spending as an estimate of the amount spent by participant per quarter and the total amount spent or saved by all program participants. Our analysis took into account the total number of participants and the average time (in quarters) that they were enrolled in the awardee's program.

Our analysis suggests that:

- Two awardees (IOBS and UCLA) significantly reduced total Medicare spending, and one awardee (Le Bonheur) significantly reduced Medicaid spending among program participants relative to their respective comparison groups. Three other awardees (GWU, UAB, and Vanderbilt's OCC and TCC programs) had non-significant trends toward spending reduction.
- One awardee (MAHEC) increased total estimated Medicare spending in a pre-post analysis. Given the nature of chronic pain management, this increase in spending is not unexpected and may indicate that participants are receiving the care they need. Four others (Indiana, Nemours, Christiana, and Ochsner) had non-significant trends toward spending increases.

Exhibit 1.12: Program Impact: Total Medicare and Medicaid Spending

Awardee	Medicare or Medicaid	No. of Program Participants	Mean Quarters of Enrollment[§]	Quarterly Estimate[§§§] per Participant [90% CI]	Total Estimate[§§§] for Program [90% CI]
Community Awardees[§]					
IOBS	Medicare	3,664	5.8	**-$612 [-$979, -$245]*** **	**-$13,005,734 [-$20,804,924, -$5,206,544]*** **
UCLA	Medicare	1,082	5.3	**-$605 [-$1,090, -$120]** **	**-$3,469,433 [-$6,259,685, -$688,221]** **
Le Bonheur	Medicaid	476	8.0	**-$536 [-$928, -$144]** **	**-$2,041,088 [-$3,533,824, -$548,352]** **
FirstVitals	Medicaid	229	4.4	-$979 [-$2,694, $736]	$-986,440 [-$2,714,474, $741,594]
UAB	Medicare	4,038	4.4	-$37 [-$418, $344]	-$657,386 [-$7,426,689, $6,111,917]
GWU	Medicare	229	6.5	-$411 [-$2,233, $1,411]	-$611,773 [-$3,323,820, $2,100,273]
Vanderbilt OCC	Medicare	3,057	7.5	-$10 [-$240, $220]	-$229,275 [-$5,502,600, $5,044,050]
Nemours	Medicaid	490	2.9	$16 [-$173, $205]	$22,736 [-$245,833, $291,305]
Indiana	Medicare	1,120	7.5	$60 [-$311, $431]	$504,000 [-$2,612,400, $3,5620,400]
MAHEC	Medicare	121	9.8	**$817 [$43, $1,591]***	**$968,798 [$50,989, $1,902,199]***
Post-Acute Care Awardees[§§]					
Vanderbilt TCC	Medicare	978	9	-$464 [-$2,301, $1,373]	-$4,084,128 [-$20,253,402, $12,085,146]
Ochsner Stroke Central	Medicare	631	10	$2,441 [-$1,409, $6,291]	$15,402,710 [-$8,890,790, $39,696,210]
Christiana	Medicare	1,525	9	$1,162 [-$340, $2,664]	$15,948,450 [-$4,666,500, $36,563,400]

NOTES: ***p<0.01, **p<0.05, *p<0.1

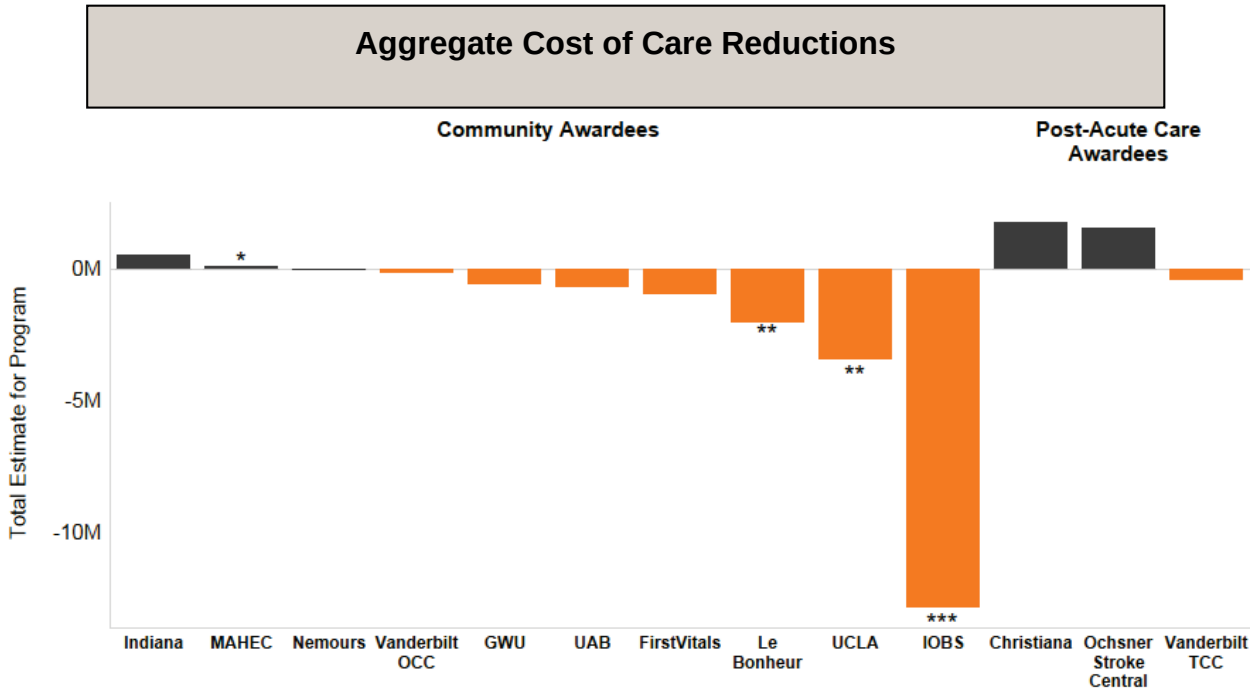
[§]Quarters for community awardees are defined as quarters of enrollment in program (i.e., exposure). MAHEC is a pre-post analysis and does not have a comparison group.

[§§]Quarters for post-acute awardees are defined as number of post-implementation quarters. No. of program participants is defined as no. of patient-episodes.

[§§§]Quarterly estimate is the *average* quarterly difference-in-differences (DID) estimate per program participant per quarter. Total estimate is the total DID estimate for all program participants across all program quarters.

Exhibit 1.13 summarizes aggregate cost reductions, which is the total estimate for the program in Exhibit 1.12. Orange bars represent favorable decreases and grey bars represent unfavorable increases. We organize Community and PAC programs in ascending order of their impact on reducing aggregate cost.

Exhibit 1.13: How Do Aggregate Cost Impacts Compare across Programs?



NOTE: ***p<0.01, **p<0.05, *p<0.1

In addition, we assessed awardee impacts on three utilization measures relative to comparison groups: hospitalizations, ED visits, and readmissions (Exhibit 1.14). To summarize:

- Three awardees (GWU, Nemours, and UAB) significantly reduced hospitalizations for their participants.
- Four awardees (IOBS, Le Bonheur, Nemours, and UAB) significantly reduced participants' ED visits. Participants in Vanderbilt's OCC had increased ED use relative to a comparison group. However, this result should be interpreted with caution as there is no evidence that increased ED use is attributable to the OCC program; the increase may be considered statistical noise.
- One awardee (UCLA) and one Vanderbilt TCC site significantly reduced participants' 30-day readmissions, and one awardee's program (GWU) was associated with significantly increased 30-day readmissions; for GWU, we believe that the program might have been more successful for the average patient and that high-risk beneficiaries who required hospitalization maintained high utilization.

Exhibit 1.14: Program Impact: Quarterly Estimates[§] for Core Measures of Utilization

Awardee	Hospitalizations per 1,000 Participants [90% CI]	ED Visits per 1,000 Participants [90% CI]	30-day Readmissions per 1,000 Participants [90% CI]
Christiana	Not applicable	-4 [-32, 24]	8 [-17, 33]
FirstVitals	2 [-26, 30]	10 [-25, 45]	6 [-2, 13]
GWU	**-23 [-44, -2]***	1 [-31, 33]	**106 [12, 200]***
Indiana	-4 [-14, 6]	2 [-12, 16]	-9 [-39, 21]
IOBS	2 [-5, 9]	**-13 [-21, -5]*****	-16 [-41, 9]
Le Bonheur	-8 [-19, 3]	**-39 [-67, -11]****	Not applicable
MAHEC	11 [-11, 32]	13 [-13, 40]	Not applicable
Nemours	**-10 [-19, -1]***	**-33 [-61, -5]****	Not applicable
Ochsner	Not applicable	28 [-24, 80]	13 [-28, 54]
UAB	**-11 [-18, -4]****	**-22 [-30, -14]*****	17 [-7, 41]
UCLA	-8 [-19, 3]	5 [-10, 20]	**-41 [-76, -6]****
Vanderbilt OCC	3 [-2, 8]	**15 [6, 24]*****	Not applicable
Vanderbilt TCC (1 of 3 sites)	Not applicable	-14 [-80, 52]	**-63 [-125, -1]***

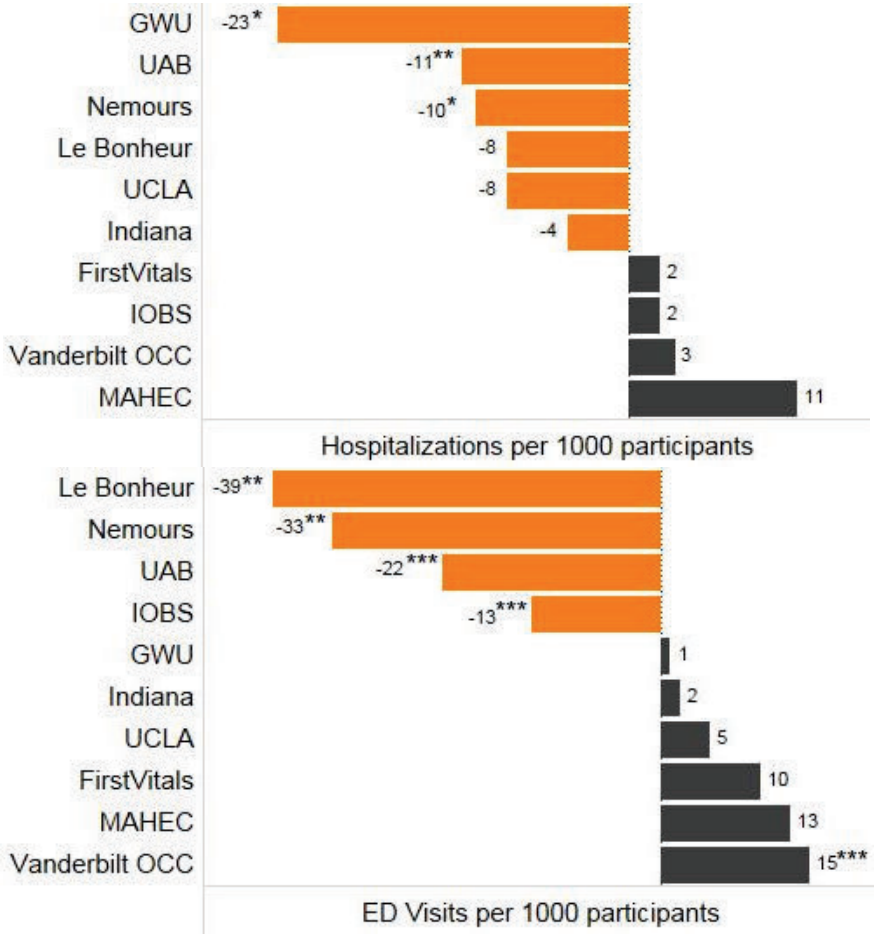
NOTES: ***p<0.01, **p<0.05, *p<0.1

[§]Quarterly estimate is the *average* quarterly difference-in-differences estimate per program quarter. Quarters for community awardees are defined as quarters of enrollment in program (i.e., exposure). Quarters for post-acute awardees are defined as number of post-implementation quarters.

Exhibit 1.15 summarizes utilization trends reported in Exhibit 1.14 for hospitalizations and ED visits. We rank awardees by the size of the impact, with orange bars representing favorable reductions and grey bars representing unfavorable increases.

Exhibit 1.15: Which Programs Decreased Participants' Hospitalizations or ED Visits?

Top Reductions in Utilization: We found statistically significant reductions in hospitalizations for GWU, UAB, and Nemours and statistically significant reductions in ED visits for Le Bonheur, Nemours, UAB, and IOBS.



NOTE: ***p<0.01, **p<0.05, *p<0.1

Finally, we extended our analysis of costs further by comparing savings to estimated program costs for awardees that have estimated cost savings (IOBS, Le Bonheur, and UCLA). We identified program costs by reviewing the awardee applications and reports to CMMI and by direct requests to the awardees. In estimating program costs, we included costs of front-line staff salaries, information technology maintenance, equipment (e.g., tablets, inhalers, mattress covers, and so forth), communication (telephone and Internet costs), travel, and patient incentives (i.e., stipends given to patients to attend workshops). For this analysis, we included only the population for which Medicare or Medicaid data were available; for IOBS and UCLA we did not include the Medicaid population and for Le Bonheur we did not include the uninsured population. Estimates are for the available insurance group only.

We did not include start-up costs or salaries of research staff involved in awardee programs, or portions of key staff salaries that were paid through billing Medicare or Medicaid. Annual program costs were then divided by the average number of participants served per year in order to estimate annual program costs per participant and quartered to obtain the program costs per participant per quarter. We obtained net program savings by subtracting program costs from estimated program savings. Exhibit 1.16 presents the results of this analysis. Overall, we found net savings among all three awardees that had reduced Medicare or Medicaid spending. Further details on our analysis of program costs for IOBS, Le Bonheur, and UCLA can be found in Technical Appendix A.

Exhibit 1.16: Program Impact: Difference in Program Savings and Program Costs

Awardee	Program Cost per Quarter per Participant[§]	Estimated Program Savings per Participant per Quarter[§§] [90% CI]	Net Program Savings per Participant per Quarter [90% CI]	N (Average Length of Enrollment)	Total Net Program Savings [90% CI]
IOBS	$324	**-$612 [-$979, -$245]*** **	-$288 [-$655, $79]	**3,664** (5.8 quarters)	**-$6,120,346** [-$13,919,536, $1,678,845]
Le Bonheur	$339	**-$536 [-$928, -$144]** **	-$197 [-$589, $195]	**476** (8.0 quarters)	**-$750,176** [-$2,242,912, $742,560]
UCLA	$514	**-$605 [-$1,090, -$120]** **	-$91 [-$576, $394]	**1,082** (5.3 quarters)	**-$556,256** [-$3,303,130, $2,259,432]

NOTES: ***p<0.01, **p<0.05, *p<0.1

[§]Program cost defined as operational costs of the key program components. Operational costs include annual personnel and non-personnel costs required to deliver program components. We excluded costs associated with start-up and reporting requirements. Details of the program cost calculation for awardees are provided in Appendix A.

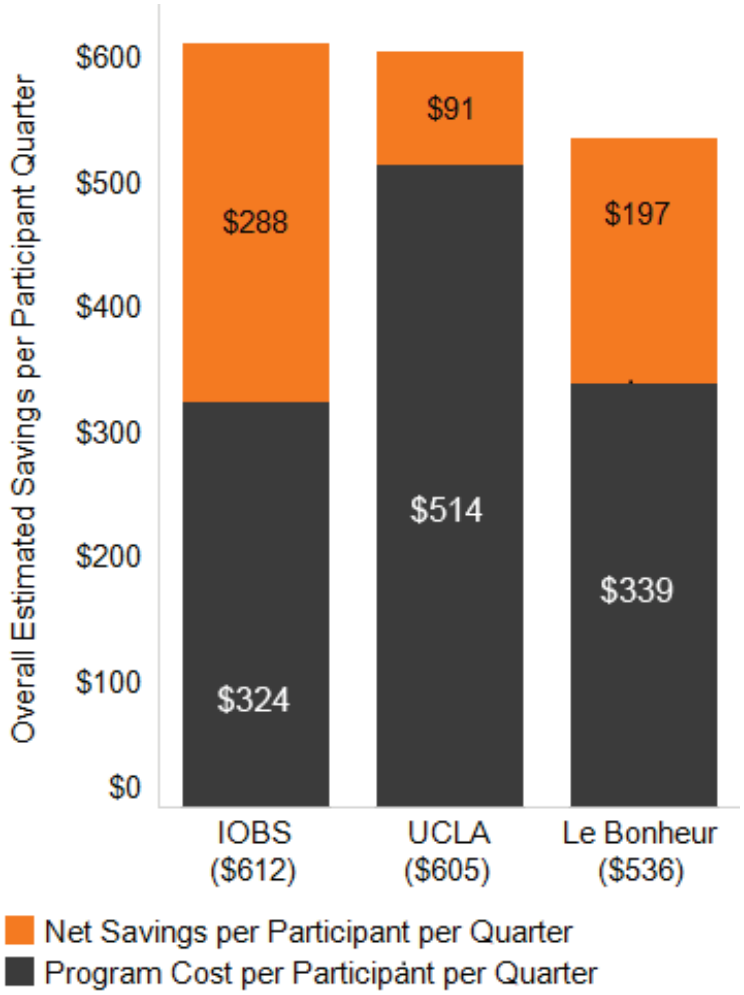
[§§]Estimate is the average annual difference-in-differences (DID) estimate per program participant per year. Total estimate is the total DID estimate for all program participants across all program quarters.

Exhibit 1.17 summarizes the relationship between programs savings and program costs for IOBS, Le Bonheur, and UCLA. The overall bar presents the total savings seen in claims. The grey bar shows the cost of the program, and the orange bar is the net savings after the program costs are taken into consideration. Since the program cost is the cost of serving the specific group of HCIA program participants, one can expect per participant program costs to decrease due to economies of scale as the program expands.

Exhibit 1.17: Which Programs Show Possible Return on Investment?

Return on Investment

The bar graph to the right summarizes overall savings for the program (full length of bar) related to quarter program cost per participant (grey) and the net savings realized per participant quarter (orange) after program costs are taken into consideration. For the disease-specific portfolio, three of the 18 programs demonstrated a possible return on investment.



Awardee Specific Chapters

In the 18 chapters that follow, we present mixed-methods case studies of each awardee program. Each chapter offers more in-depth information on program effectiveness from the quantitative and qualitative findings presented above, as well as key drivers of program effectiveness related to workforce; cross-site differences; and sustainability, replicability, and spread. We conclude each chapter with a discussion of the policy implications of each program based on its effectiveness and its implementation challenges and successes.

Awardee-Specific Findings

In this section, we present an overview of each awardee, synthesizing qualitative data from the evaluation and incorporating quantitative results where possible.

Christiana Care Health System

Summary. Christiana Care Health System's Bridging the Divide (Bridges) program provided enhanced care for patients following coronary revascularization or hospitalization for acute myocardial infarction (AMI) through health IT-enabled care management. The Bridges program consists of two intervention components—transitional care coordination and longitudinal care management—providing varying levels of support from admission to one year after admission.

Awardee Overview

SITE:	1 health system in Delaware	***REACH:***	3,061 patients
AWARD:	$9,999,999	***TARGETED CONDITION:***	Cardiovascular disease
AWARD DATES:	July 2012—June 2016	***PAYER(S):***	Medicare
NO-COST EXTENSION:	12 months		

Key Findings

These key findings are based on quantitative analysis of Medicare claims (July 2012—June 2015), qualitative interviews with staff, and focus groups with program participants.

Implementation

During the third year of the award period, Christiana implemented an improved approach to risk stratification, using predictive analytics informed by clinical knowledge and judgment.

With the ability to better stratify patients, Christiana adjusted care managers' workloads to increase the focus on the highest-risk patients.

Utilization and Cost

We observe no clear cost or utilization trends for the program.

Quality of Life and Care

We observe favorable improvements in 7- and 30-day follow up with a practitioner after hospitalization among treatment participants (Medicare FFS data).

From focus group data, patients and caregivers who participated in focus groups noted improvements in quality of life, as well as increased self-monitoring and changes in behavior.

Sustainability and Scaling

Christiana continues the program using funding from the Centers for Medicare & Medicaid Services' (CMS) Bundled Payment for Care Improvement (BPCI) initiative and by becoming a Medicare Shared Savings Program (MSSP) Accountable Care Organization (ACO).

Christiana expanded the program to serve a broader population of patients, including those who have undergone heart valve or joint replacement, cervical spine surgery, coronary surgery, and congestive heart failure.

Introduction

Christiana Care Health System's Bridging the Divide (Bridges) program provided enhanced care for participants following coronary revascularization or hospitalization for acute myocardial infarction (AMI) through health IT-enabled care management. The intervention consisted of two components: (1) transitional care coordination that begins at inpatient admission through transition into post-acute care, and (2) longitudinal care management in the outpatient setting providing proactive monitoring and notification of health events and IT-enabled participant self-monitoring and management. Over the course of the award, the program served approximately 3,000 patients. The program aimed to reduce 30-day readmissions, improve measurements of blood pressure and low-density lipoprotein (LDL) (bad) cholesterol control, and lower costs. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[10] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

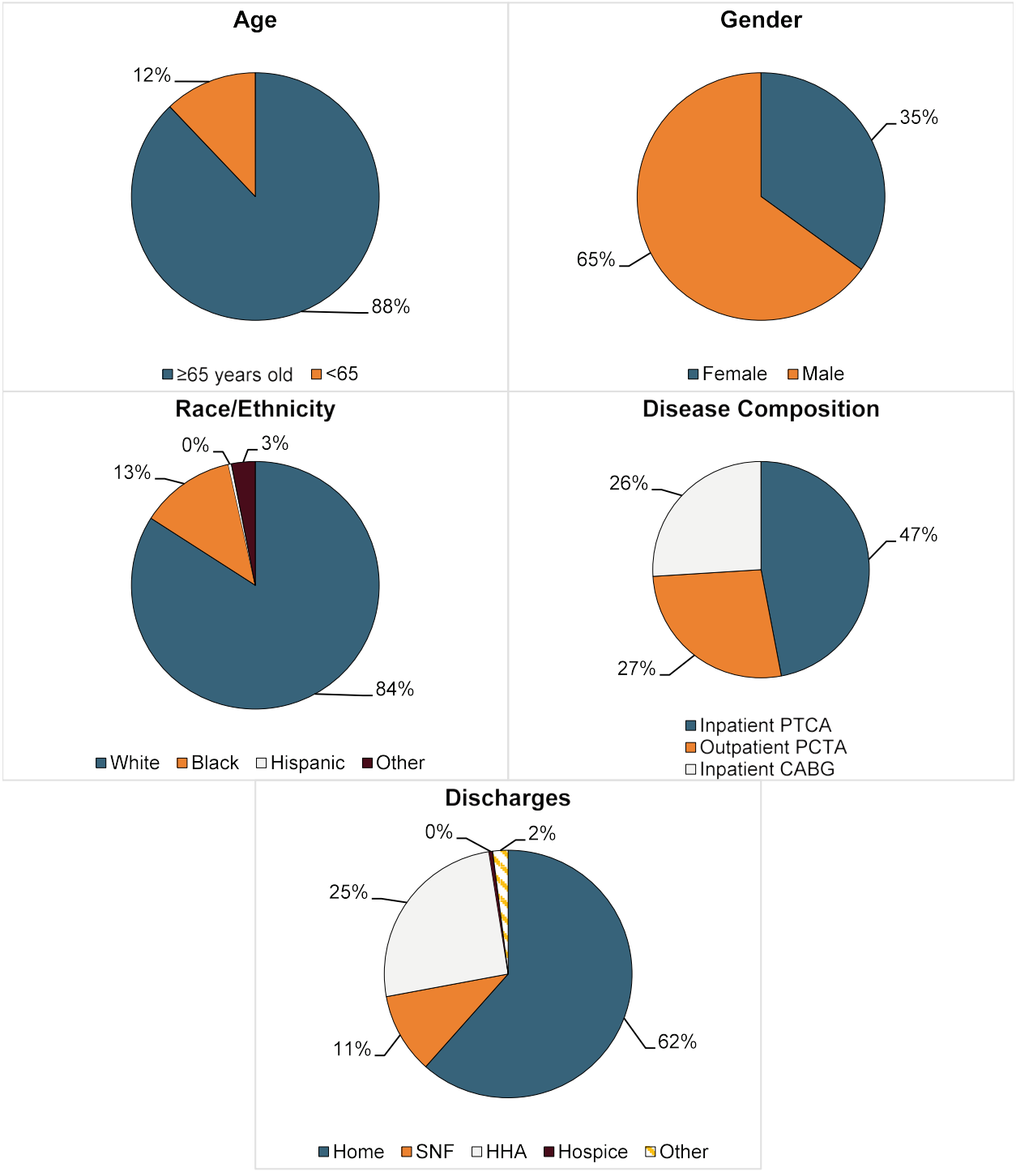
In this evaluation, we include patient-episodes with a coronary artery bypass graft (CABG)—i.e., open-heart surgery, or percutaneous transluminal coronary angioplasty (PTCA)—i.e., balloon angioplasty. We exclude patient-episodes with an AMI target condition due to the difficulty of accurately identifying comparisons with similar eligibility criteria in claims.[11] We analyzed claims data to assess the effectiveness of Bridges in reducing cost and utilization and in improving quality of care. We explored differences in outcomes before and after the intervention between Bridges patient-episodes and comparison patient-episodes, focusing on the following measures:

- 30-, 90-, and 180-day readmissions
- 90- and 180-day emergency department (ED) visits
- 90- and 180-day total cost of care
- 90- and 180-day repeat revascularizations or AMI
- 7- and 30-day follow up with a practitioner within 30 days of hospital discharge

Exhibit 2.1 summarizes demographic and other basic information about Christiana patients with episodes included in our analysis of core outcome measures.[12]

[10]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[11]We exclude approximately five percent of patient-episodes present in the finder file.
[12]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 2.1: Descriptive Characteristics of Patients with Episodes in Christiana Group[13]



Summative program impact. Exhibit 2.2 summarizes the results of our difference-in-differences (DID) model, which included adjustment for key demographic and other risk factors.[14]

[13]Descriptive statistics are based on findings prior to propensity score weighting.

- There were no significant decreases in readmissions, ED visits, total cost of care, repeat revascularizations, or AMI for patient-episodes at Christiana relative to the comparison group.
- Practitioner follow-up within seven and 30 days after hospital discharge increased for patient-episodes at Christiana relative to the comparison group.

Exhibit 2.2: Difference-in-Differences Estimates for Core Measures for Christiana

Average Quarterly Impact	
Outcome Measure (Patient-episodes per 1,000, unless noted)	**Adjusted Estimate [90% Confidence Interval]**
30-Day Readmission	8 [-17, 33]
90-Day Readmission	-8 [-37, 21]
180-Day Readmission	7 [-27, 41]
90-Day ED Visit	-4 [-32, 24]
180-Day ED Visit	7 [-27, 41]
90-Day Total Cost of Care per Patient-episode ($)	$1,162 [-$340, $2,664]
180-Day Total Cost of Care per Patient-episode ($)	$1,725 [-$473, $3,923]
90-Day Repeat Revascularizations/AMI	26 [-1, 53]
180-Day Repeat Revascularizations/AMI	18 [-11, 47]
7-Day Practitioner Follow-up	**133 [80, 186]*** **
30-Day Practitioner Follow-up	**50 [10, 90]***
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
90-Day Total Cost of Care ($)	$1,771,370 [-$519,825, $4,062,565]

NOTE: ***p<0.01, **p<0.05, *p<0.1

Quarter-specific program impact. Findings from a quarterly fixed effects (QFE) DID model of impact in each intervention implementation quarter were consistent with the average quarterly impact summarized in Exhibit 2.2; please see Appendix A for presentation of these results.

Subgroup Analysis: Ramp-up Period

Along with assessing the overall effectiveness of the Bridges program, we explored the program's impact after a year-long ramp-up period. Christiana took approximately one year to fully implement its program and to enroll participants. Enrollment during this ramp-up period was low, and few cases for comparison with other programs were secured. To examine the impact of Christiana's Bridges intervention after a year-long ramp-up period, we selected a subgroup of Christiana and comparison group patient-episodes starting in Year 2 of implementation (April 1, 2014). We examined average differences in outcomes

[14]We adjusted for age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year ED visits, prior-year cost, extent of fee-for-service (FFS) coverage in prior year, prior-year hierarchical condition categories (HCC) score, severity of hospitalization (chronic condition [CC] or multiple chronic conditions [MCC] diagnostic-related group [DRG]), severity of inpatient procedure (CABG: one artery, two arteries, three arteries, four or more arteries, or other; PTCA: drug-eluting stent, non-drug-eluting stent, or other), and relevant chronic conditions (congestive heart failure [CHF], stroke, diabetes, atrial fibrillation, ESRD, and AMI).

between the fully implemented Bridges program and comparison patient-episodes starting in the second year of the post-intervention period for each core measure.

Exhibit 2.3 summarizes the impact of Christiana's Bridges program starting in the second year of the intervention. We included adjustment for key demographic and other risk factors.[15]

- There were no significant decreases in readmissions, total cost of care, repeat revascularizations, or AMI for patient-episodes at Christiana relative to the comparison group.

Exhibit 2.3: Differences in Core Measures between Patients with Episodes in Christiana's Fully Implemented Subgroup and Comparison Patients with Episodes

Outcome Measure (Patient-episodes per 1,000, unless noted)	**Adjusted Estimate [90% Confidence Interval]**
30-Day Readmission	5 [-25, 35]
90-Day Readmission	-15 [-50, 20]
180-Day Readmission	1 [-41, 43]
90-Day ED Visit	-10 [-42, 22]
180-Day ED Visit	8 [-33, 49]
90-Day Total Cost of Care per Patient-Episode ($)	-$55 [-$1,772, $1,662]
180-Day Total Cost of Care per Patient-Episode ($)	$941 [-$1,791, $3,673]
90-Day Repeat Revascularizations/AMI	13 [-19, 45]
180-Day Repeat Revascularizations/AMI	8 [-28, 44]

NOTE: *p<0.10, **p<0.05, ***p<0.01. AMI, acute myocardial infarction; ED, emergency department

Qualitative Findings

As discussed in our second annual report, patients and caregivers who participated in focus groups noted improvements in their quality of life and quality of care, as well as changes in behavior.[16] Below, we outline the major findings that support replicating and scaling up this program based on recent conversations with program leads.

Focus group participants reported varying levels of interaction with care managers. In conversations with one another, patients recognized that each had a unique set of protocols for frequency or type of interactions with their care manager, based on their goals and overall health. Patients felt adequately cared for by care managers at the level of care that they received.

Through reliable and consistent communication, participants built relationships with their care managers. Patients reported that care managers contacted them on a reliable and consistent schedule,

[15]We adjusted for age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year ED visits, prior-year cost, extent of fee-for-service (FFS) coverage in prior year, prior-year hierarchical condition categories (HCC) score, severity of hospitalization (chronic condition [CC] or multiple chronic conditions [MCC] diagnostic-related group [DRG]), severity of inpatient procedure (CABG: one artery, two arteries, three arteries, four or more arteries, or other; PTCA: drug-eluting stent, non-drug-eluting stent, or other), and relevant chronic conditions (congestive heart failure [CHF], stroke, diabetes, atrial fibrillation, ESRD, and AMI).

[16]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

which helped create trust and confidence in the care managers' recommendations. Patients felt that the advice was not only medically sound, but also appropriate for their goals and lifestyle.

Care managers supported participants' physical and psychological recovery following hospitalizations. Focus group participants reported feeling depressed, isolated, and fearful after the trauma of having one or more heart attacks. Care managers helped them to identify goals for their recovery and provided encouragement in taking the steps needed to reach them. Participants reported that the care managers' encouragement and support enabled them to regain the will to live at the same quality of life that they had prior to their hospitalization.

Having had a heart attack, patients appreciated the education and reinforcement from care managers to quit smoking. Several patients reported that they quit smoking after surviving a heart attack. The reminders and support from care coordinators helped them remain cigarette-free.

Care managers helped patients improve their self-monitoring behaviors. Care managers would ask about medication, diet, exercise, weight, and blood pressure measurements. Participants felt obliged to monitor and improve these measurements regularly. Patients reported that the compassion and education from their care coordinators kept them motivated to monitor their health.

> *"It is nice to know that there is someone out there that cares. They keep track of your progress and they may be there to nudge you along. They are there to help provide it for you and steer you in the right direction."*
>
> —Program Participant

Workforce

A co-location or hub infrastructure facilitated effective collaboration among the care management team members. The care management staff had offices in a building outfitted specifically as a central hub where registered nurse (RN) care managers, pharmacists, and social workers could conduct care coordination activities over the telephone. Care management staff stressed the importance of co-location, particularly while the program was under development. Staff members were able to discuss challenges for specific patients and brainstorm new solutions with other staff members who may not be in regular contact with a patient. Overall, staff collaborated effectively to meet the patients' physical and social needs in a timely manner.

Responsive management allowed care managers to maintain balanced workloads. The program found that care managers could handle caseloads of 250 to 300 patients. As the program grew, the care management hub experienced individual workload issues. Hub management addressed the caseload balance concerns not only by hiring additional care managers, but also by adding advanced tools to improve efficiency and time management, such as new protocols and modified interaction protocols with physicians.

Context

Integrating data from the Delaware Health Information Network (DHIN)[17] to support care management required significant additional work. Christiana began receiving data on readmissions and laboratory test results through DHIN in April 2015. DHIN's data arrived in Christiana's case management system (Aerial™) as task notifications. Staff members then reviewed these notifications and reentered them, as appropriate, in individual patient records—a time-consuming process. Reentry is required in part because DHIN sends Christiana all historical laboratory data rather than only the lab data that are central to the intervention. The team is working with DHIN to edit notifications and establish greater interoperability between their multiple case management systems.

Sustainability, Scalability, and Spread

Christiana expanded its care management program to include other patients as part of the CMS Bundled Payment for Care Improvement (BPCI) initiative. Under BPCI, Christiana includes patients with heart valve or joint replacement, cervical spine surgery, AMI, coronary surgery, and congestive heart failure. Christiana has hired more care coordination staff to accommodate this expansion.

Starting in January 2016, Christiana became a Medicare Shared Savings Program (MSSP) Accountable Care Organization (ACO).[18] This ACO includes approximately 200 primary care physicians across three health care systems in Delaware, as well as affiliated private practice doctors with at least 26,000 associated Medicare beneficiaries. Christiana applied its surveillance/risk-stratification platform developed during the award period to the entire ACO. Leadership believe that the HCIA program gave it a competitive edge.

> *"[The ACO] is an iterative process of learning and we have more to learn. But the brick and mortar is exactly through Bridges."*
>
> —Program Leader

Limitations

For our quantitative analysis, we exclude patient-episodes with an AMI target condition due to the difficulty of accurately identifying comparison patients with similar eligibility criteria in claims records. Due to data limitations, this analysis includes only Medicare FFS patient-episodes, which account for 57 percent of all patient-episodes in Christiana's finder file. Our analyses, therefore, might not have captured the overall impact of Christiana's Bridges program.

Conclusion and Policy Implications

Christiana developed the Bridges program to provide enhanced care transitions and care management for patients after coronary revascularization or hospitalization for AMI. Qualitatively, patients reported improvements in quality of life and changes in behavior and an increased focus on self-monitoring stemming from interactions with their care managers. In particular, participants noted that psychosocial

[17]From http://dhin.org/about/: DHIN creates efficiencies for doctors, patients, practices, and those who send them clinical information. In 2007, DHIN became the first operational statewide health information exchange in the nation.

[18]Please see: http://news.christianacare.org/2016/02/quality-partners-aco-to-participate-in-medicare-shared-savings-program/.

support they received during their recovery improved their quality of life following their hospitalizations. Christiana continues the program using CMS's BPCI initiative and by becoming a MSSP ACO.

Christiana spent much of the first year getting the Bridges program up and running, including developing a health IT system to support care management and creating care management processes and protocols. Over the entire award period, we observed no clear overall trends in quality of care, cost of care, or other measures of utilization for patient-episodes at Christiana relative to a comparison group. In an analysis limited to the period following the year-long ramp-up phase, we also observed null findings.

The null claims findings may be partially attributable to the high quality of care at Christiana prior to the award period. Christiana already had low readmission rates, allowing limited room for improvement. Over the course of the award period, Christiana continued to hone their approach to risk stratification and made progress with data integration. During the third year of the award period, Christiana shifted resources to provide more intensive care management for the highest-risk patients. Claims findings may not reflect this programmatic adjustment.

Our findings suggest that policymakers should take into account the delayed impacts of programs intended to reduce costs and improve the quality of care. Although we noted favorable trends and positive qualitative findings, our claims analysis did not show significant improvement over the three-year award period. In their internal evaluation, Christiana also observed the contrast between positive participant reports and null claims findings. Programs aimed at improving long-term outcomes among patients recovering from acute cardiovascular conditions may need a longer time to demonstrate impacts because of the lengthy recovery period and the substantial lifestyle changes needed to prevent a recurrence.

Duke University/Southeastern Diabetes Initiative

Summary. The Southeastern Diabetes Initiative (SEDI) at Duke University targeted patients based on their risk of adverse events from diabetes through three interventions: a care management program, including home visits for high-risk participants; a telephone support program for medium-risk participants; and an outreach and education program targeted to an entire community, including low-risk participants. One site used a geospatial mapping component, meant to target the community intervention.

Awardee Overview

SITES:	4 sites across North Carolina, Mississippi, West Virginia[19]	***REACH:***	537 patients[20]
AWARD:	$9,773,499	***TARGETED CONDITION:***	Diabetes
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare, Medicaid, commercial

Key Findings

Key findings are based on quantitative analysis of awardee-collected data (April 2013—February 2016) and qualitative interviews with staff and program participants.

Implementation

The ability to tailor all low- and high-risk interventions to their context benefited sites, but they reported the need for more detailed guidance on training and better cross-site communication.

Risk stratification using clinical data was used to target the intervention, with varying success across sites.

High-risk participants had behavioral health needs that were best screened for and addressed by social workers.

Cost

Data are not available to evaluate this measure.

Quality of Life and Care

Among high-risk participants:

Improved understanding of diabetes management and sense of connection between SEDI staff and providers

Improvements in confidence to manage diabetes and self-rated mental and physical health

Improvements in hemoglobin A1c (HbA1c) levels

Sustainability and Scaling

Two sites will sustain elements of the high-risk and low-risk programs through foundation and grant funding; no sites will continue the medium-risk intervention. SEDI's low-risk intervention will be incorporated into community organization and public health department programming because it is low-cost and the staff have developed the capacity for ongoing implementation of the program.

[19]Implementation partners included a Federally Qualified Health Center, hospital, clinic, medical center, and department of health. Please see our first annual report for a complete list of partners: https://innovation.cms.gov/Files/reports/HCIA-DS-FirstEvalRpt.pdf.

[20]SEDI estimates serving 27,165 patients. For the quantitative analysis, we include only high-risk intervention participants (N = 537).

Introduction

Duke University's Southeastern Diabetes Initiative (SEDI) used multidisciplinary teams to provide diabetes management and education interventions for people at low, moderate, and high risk for hospitalization or death associated with type 2 diabetes. Over the award period, the program estimated that it served more than 27,000 patients, including 537 high-risk intervention participants across four sites. The program aimed to reduce mortality for patients with diabetes and to identify high-risk communities by using aggregated electronic health record (EHR) data. However, no appropriate data sources were available for the present evaluation to assess whether these goals were met.[21] This chapter presents summative findings drawn from quantitative analysis of data from the awardee as well as qualitative research concerning program effectiveness, quality of care, workforce, context, and sustainability, all updated since NORC's second annual report (March 2016).[22] For technical details on the methodology and supplemental analysis to the findings reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

We analyzed survey data collected by the awardee from high-risk intervention participants to assess program impact on quality of life, self-management, and medication adherence.[23] For the SEDI high-risk program, we examined changes in outcomes, focusing on the following patient-reported measures:[24]

- global mental health (GMH)
- global physical health (GPH)
- patient activation measure (PAM)
- Morisky medication adherence scale (MMAS-8)
- screening for clinical depression (PHQ-2)
- diabetes self-care (DCP)
- Hemoglobin A1c (HbA1c)

Exhibit 3.1 summarizes health measures used to analyze the effectiveness of the SEDI program. Participants completed each questionnaire at baseline and at four follow-up time points (six, 12, 18, and 24 months). We also analyze clinical measures abstracted from laboratory records by awardee staff and

[21]NORC explored use of publically available data such as the behavioral risk factor surveillance system (BRFSS, http://www.cdc.gov/brfss/) and County Health Rankings (www.countyhealthrankings.org) to investigate whether SEDI's hypotheses about reducing mortality could be tested. Unfortunately, these systems do not report specific measures (e.g., diabetes-related mortality) in the right time frame, and we were not able to test whether SEDI's claims of population health impact occurred during their implementation period in the affected North Carolina counties.

[22]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

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

[24]For details on GPH/GMH, see http://www.ircimh.org/local/uploads/content/files/ALL%20COMPLETE%20PROMIS%2010%20PROMIS%2029%20Well-being%20measures%2020114_4_29kk(1).pdf.
For details on PAM, see http://www.insigniahealth.com/products/pam-survey.
For details on PHQ-2, see Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care*. 2003; 41(11):1284-1292.
For details on DCP, see http://www.med.umich.edu/borc/profs/documents/svi/dcp.pdf.

linked to the closest program visit (baseline, six, 12, 18, or 24 months). Follow-up refers to a new measurement point rather than to receiving additional program touches.

Exhibit 3.1: Overview of SEDI Outcome Measures

Outcome Measure[25]	Description of Scale	Range
GMH, GPH	Produces summary scores for mental and physical health (higher scores indicate higher self-rated health)	4-20
PAM	Evaluates the knowledge, skills, and confidence essential to managing one's own health and health care (higher scores indicate higher activation, or confidence in self-care skills)	0-100
MMAS-8	Addresses barriers to medication-taking and permits health care providers to reinforce positive adherence behaviors (higher scores indicate better adherence)	0-8
PHQ-2	Screens for clinical depression (higher scores indicate worse depressive mood)	0-6
DCP	Patients' ratings of their ability to successfully manage their diabetes (higher scores indicate higher-rated diabetes self-care ability)	1-5
HbA1c	Defined as >1% decrease in HbA1c among those with HbA1c of ≥8% at baseline visit	0-16

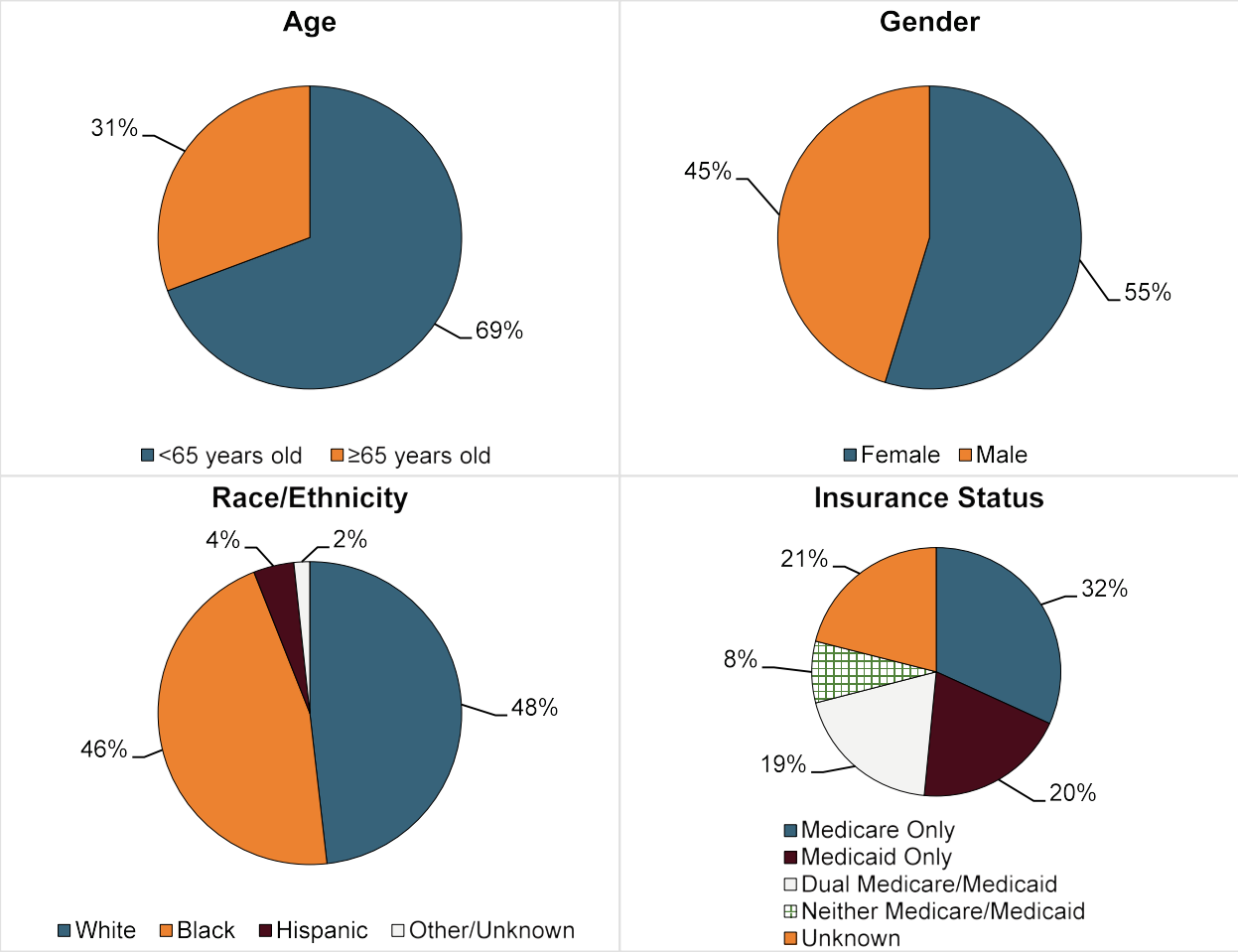
SEDI provided data files with clinical information for all 537 unique participants in their high-risk intervention.[26] Exhibit 3.2 summarizes demographic and other characteristics of this group.[27]

[25]For details on PROMIS, see http://www.nihpromis.org/default.
For details on PAM, see http://www.insigniahealth.com/products/pam-survey.
In the second Annual Report, we provided an incorrect citation for the MMAS-8; we provide the correct citation here:
For details on MMAS-8, see Morisky DE, Ang A, Krousel-Wood M, et al. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens (Greenwich)*. 2008; 10:348-354**.**
For details on PHQ-2, see Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care*. 2003; 41(11):1284-1292.
For details on DCP, see http://www.med.umich.edu/borc/profs/documents/svi/dcp.pdf.

[26]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; therefore the sample size for analysis of each measure is slightly different.

[27]For more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 3.2: Descriptive Characteristics of SEDI High-Risk Intervention Participants



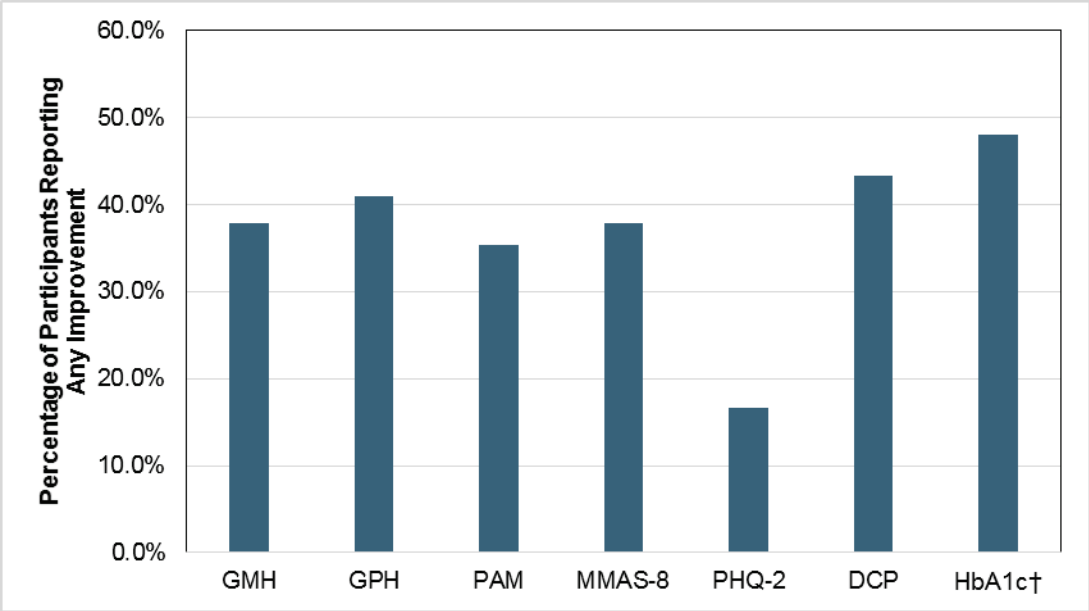
Summative program impact. Exhibit 3.3 summarizes improvements in key outcomes as well as the average (mean) change at baseline and follow-up.[28] Sample sizes vary across outcome measures as not all participants completed surveys. All findings relate to the SEDI high-risk population compared with benchmarks we found in the literature.

- Almost half of participants showed improvements of greater than 1 percentage point in the HbA1c measure, much greater than observed in a study of a similar intervention.[29]
- SEDI participants had similar PAM scores at baseline (57.5 for SEDI, 56.2 for a similar comparison diabetes self-management program drawn from the literature), but SEDI participants showed smaller improvements (1 point compared to an 8-point improvement in the comparison study).[30]

[28]One-way analysis of variance (ANOVA) with repeated measures was used to control for subject variability. Significance shown is based on the corresponding F-statistic.
[29]Otero-Sabogal R, Arretz D, Siebold S, et al. Physician-community health worker partnering to support diabetes self-management in primary care. *Qual Prim Care*. 2010;18:363-372.
[30]Ibid.

- Using findings of a study on participants enrolled in a text messaging–based diabetes self-management intervention as a benchmark, we found that the text-intervention participants improved 0.9 points on the MMAS-8 scale, whereas SEDI's participants improved by only 0.35 points.[31] Higher MMAS-8 baseline score for SEDI compared with published literature (6.1 and 4.5 points, respectively) suggests that SEDI's population might have faced underlying factors that complicated medication adherence. This may help to explain the limited MMAS-8 score improvement for SEDI high-risk participants.

Exhibit 3.3: Improvement in Program Outcomes for SEDI Participants



NOTES: GMH, global mental health; GPH, global physical health; PAM, patient activation measure; MMAS-8, Morisky medication adherence scale; PHQ-2, screening for clinical depression; DCP, diabetes self-care, HbA1c, Hemoglobin A1c.

†Population assessed for improvement in HbA1c had a measure of ≥8% at baseline. Reference levels are based on National Institutes of Health guidelines.

In addition to these result, we provide findings from multivariate linear regression models that examined the effects of demographics, time since baseline, insurance status, and site on outcomes. These results can be found in the awardee-specific supplement in Technical Appendix A.

Qualitative Findings

As discussed in our second annual report, patients who participated in phone interviews noted gains in quality of life, quality of care, diabetes self-monitoring, and improvements in clinical outcomes. [32,33] In this chapter we present the drivers behind behavioral changes and then outline the major findings that support scaling up the program and replicating it in other regions.

[31]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):745-754.
[32]High-risk participants were cold-called using contact lists provided by all four sites.
[33]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf

High-risk patients benefited not only from home visits but also from group activities in the community or clinic. Participants in the high-risk intervention who were able to attend community classes, from the low risk intervention, appreciated the nutrition education and tangible materials distributed through the low-risk intervention.[34] Younger patients were more likely to take advantage of these classes.

> *"I went to a diabetes class when I first started … they told us what kinds of food we could eat, what foods we don't need to be eating. See, I didn't know any of that; I really didn't."*
>
> — High-Risk Program Participant

Older participants were less likely to report confidence in managing their diabetes than younger participants. Older participants were more likely to have physical limitations, whereas high-risk participants overall might have had limitations related to severity of their diabetes (e.g., vision loss, mobility issues) that prevented them from participating. Older participants were also more likely to have advanced diabetes-related complications (e.g., lower extremity amputation).[35] Such limitations might have prevented participants from accessing the full range of SEDI services, such as community education classes.

We hypothesize that several factors help explain SEDI's modest quantitative impacts on patient activation measures (PAM) and medication adherence (MMAS-8) measures:

- Many patients could not access medications they needed for disease management either because they were unable to afford the medication, could not afford to pay for transportation to pick up medication, or could not take the medication during work hours. The physician at the Durham site emphasized that the program cannot work if patients cannot afford medications.
- Many participants did not have insurance coverage for key components of diabetes management: e.g., foot care, dental care, and eye care.
- Many participants could not easily access healthy food, and as a result would skip meals or eat in a way that made maintaining glycemic control challenging.
- SEDI sites' ability to address barriers to disease management varied. For example, the social worker at the Mingo site could only sometimes convince a drug company to provide free medication for patients whose insurance did not cover a medication. One staff member at the Durham site explained that because North Carolina does not have a lot of social supports, challenges such as poverty and food insecurity persisted, and she sometimes felt she could not adequately help her patients. Cultural beliefs of some patients (e.g., believing God, not medicine, would heal them) may have impeded patients' activation as well.

We describe SEDI's programmatic impact as modest relative to benchmarks established in the literature.

[34]Staff reported that few high-risk participants attended community or clinic classes, perhaps indicating that interview participants were more active in these activities than other high-risk program participants. Community class participation was not recorded in the participant data reported by the awardee.

[35]Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. *Diabetes Care*. 2012;35(12):2650-2664.

Cross-Site Variation

SEDI sites differed across multiple intervention components that were shaped by each site's context. Flexibility at the site level helped program leaders:

- hire staff who could meet the unique needs of target populations
- determine which credentials were necessary to serve the target population
- shape the low-risk intervention based on community preferences
- leverage community advisory board resources

At the same time, sites expressed:

- a desire for more central leadership
- consistency in staff training and cross-site communication.

Future programs would benefit from a system in which sites learn from each other and share ongoing lessons learned as they address challenges.

These findings specifically address SEDI's model, in which sites had a range of different workforce models, partners, and program components. Exhibit 3.4 shows site differences across all three levels of SEDI's intervention.

Exhibit 3.4: SEDI Differences across Sites

Program	Component	Durham (NC)	Cabarrus (NC)	Mingo (WV)	Quitman (MS)
High-Risk	Activities	Home visit	Clinic visit	Home visit	Home visit
	Staff	NP,* LHWs,* nutritionist, LCSW***	MSW,* NP, nurse, registered dietitian	LCSW,* CNAs or LPNs, nutritionist, nurse, midlevel providers	CNA,* LPN, CHW
Medium-Risk	Activities	Telephone calls	Telephone calls	Telephone calls	Telephone calls
	Staff	LHWs	LHWs	CNAs and LPN	LPN
Low-Risk**	Activities	■ Geospatial mapping ■ Support groups ■ Distributes food ■ Classes in self-management and specialized workshops	■ 5K running groups ■ Classes in self-management, cooking, exercise, and diabetes	■ 5K running groups ■ Community garden ■ Walking programs ■ Classes in self-management, agriculture, nutrition	■ Health fairs ■ Grocery store tours ■ Classes in self-management, conversation maps
	Staff	LHWs	LHWs	LHWs	Pharmacist
	Community Advisory Board	Identifies gaps in resources	■ Locates venue for community classes ■ Advertises program	Convenes health providers	Plans staff events
Context	Urbanicity	Urban	Suburban	Rural	Rural

Program	Component	Durham (NC)	Cabarrus (NC)	Mingo (WV)	Quitman (MS)
	Major Partner(s)	Department of public health, local clinics	Health alliance, health system, local FQHC	FQHC, diabetes education center	Nonprofit health promotion institute, hospital, local medical center

NOTES: *Primary case manager for high-risk intervention; these individuals were not necessarily central home-visiting staff.

**The low-risk intervention was available to participants in high- and medium-risk programs. CHW, community health worker; CNA, certified nursing assistant; FQHC, Federally Qualified Health Center; LCSW, licensed clinical social worker; LHW, lay health worker; LPN, licensed practical nurse; MSW, [staff with] Master of social work degree; NP, nurse practitioner.

***Durham tried to switch from a LCSW to a MSW, but as of our second site visit, an MSW had not been hired.

Geospatial mapping was generally underutilized across sites.[36] Although geospatial mapping was foundational to SEDI's innovation concept, the mapping program encountered major implementation challenges.

> *"In the beginning [geospatial mapping] helped staff target areas but beyond that not as much."*
>
> —Project Director
>
> *"We did have some issues trying to geomap neighborhoods [at two sites] because so many addresses are PO boxes or rural routes, so that kind of prevented us from being able to fully use the things*."
>
> —Project Leader

- **Lack of relationships.** The mapping team's work largely focused on their existing relationship with only one site located in the same county. The team did not make efforts to forge new relationships with the three other sites spread across the region and noted that from the beginning, these sites seemed less familiar with the concept of geospatial mapping and less likely to ask questions about its capabilities.
- **Lack of useful mapping information.** In most cases, mapping confirmed what community stakeholders already knew and did not add significant value. More outreach to different sites by the team might have led to development of maps that would have helped these sites target their low-risk intervention at certain communities.
- **Data access challenges.** SEDI had to establish data-use agreements with all nine partnering entities to gain access to EHRs that fed into the geospatial mapping system. Although they were able to establish agreements and share data, this was both more resource- and time-intensive than SEDI anticipated. A large health care system at one site required substantial effort and time from the SEDI staff to negotiate an agreement. Better coordination with sites and cooperation with providers on data issues might have led to more useful mapping activities.
- **Departure from awardee institution of the principal investigator (PI), who was leading geospatial mapping.** Due to the departure of one of the program's PIs, the program became less invested in obtaining community-level data to support effective mapping. Although this PI continued to support the project, the program's emphasis on the geospatial mapping component declined after this individual left.

SEDI's risk algorithm had mixed success in identifying appropriate patients for the high-risk intervention. The initial risk algorithm focused on patients' prior history of diabetes-related hospitalizations and risk of death to drive selection into the high-risk intervention. However, many physicians felt that patients who did not meet these criteria still faced significant risk of diabetes-related

[36]Please see more about SEDI's informatics system in relation to other noteworthy initiatives that leverage technology to promote diabetes self-care here: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4492450/pdf/nihms701782.pdf.

complications and "overrode" the algorithm to enroll non-selected participants into the intervention. In general, providers also felt that the algorithm focused too heavily on utilization and risk of death and neglected to identify patients who were on the cusp of experiencing high diabetes-related hospitalization rates and health risks. SEDI did refine the algorithm partway through the award period to incorporate a broader set of comorbidities, prior inpatient stays, diabetes complications, substance use habits, and diabetes medications into the risk score calculation.[37]

However, even the refined algorithm did not include factors that providers felt were important, such as HbA1c level. Including HbA1c criteria in the risk algorithm might have led to an influx of participants who had high HbA1c readings but were at low risk of hospitalization or death. However, some discussants suggested that HbA1c could be one of a number of criteria used in the risk algorithm, even if it is inappropriate to use as the primary criterion to designate risk. This is an important consideration for future efforts if programs want to replicate and improve SEDI's risk algorithm.

Finally, without access to historical electronic clinical records at most sites, providers entered by hand information to support the risk algorithm. Providers found this process too resource-intensive, especially when they felt that they already had a sense of which patients would benefit from the program.

Capacity for collecting program data varied across sites. In a few cases, site-level staff used the participant's clinic EHR to capture program-related data and took the appropriate steps to share these data within the SEDI team. More often, program staff used a separate database established by SEDI to record program information. Although this system facilitated communication across the SEDI high-risk team, it was not ideal for coordination with participants' providers, who did not regularly access the system.

Workforce

High-risk teams were composed of clinicians and lay health workers who, through collaboration, were comfortable in determining the frequency of home visits based on individual patients' needs. From its inception, the program designed home visits to be flexible and to vary with patient needs, which included hiring different types of staff as sites determined patient needs. Ultimately, high-risk teams and clinically credentialed home-visiting staff were well-equipped to make decisions about the optimal number of home visits by communicating often and viewing their work as team-based.[38] To facilitate implementation, staff actively pursued formal and informal channels to communicate with participants and care givers about social needs and barriers to home visits, such as patient transportation or housing instability.

Nurse practitioners (NPs) added the most value as team leaders rather than as home-visiting staff with logistical duties. Our findings suggest that participants benefited from home-visiting staff who had some medical training. However, when NPs could not delegate home visiting activities to LHWs because of LHWs' limited training and experience, NPs felt burdened by scheduling and travel demands. The

[37]A third risk algorithm was developed but was never implemented due to time and resource constraints. This algorithm incorporated social and economic variables operationalized at the neighborhood level. The model was constructed in a longitudinal framework, using a transition model in which the likelihood of experiencing a serious outcome in the current year is conditional on whether a patient had a serious outcome in the previous year.

[38]Frequency among interview participants typically ranged from once a week to once a month. Staff could also meet patients at alternate locations, depending on patients' preferences, which facilitated delivering proper dosage.

most effective model might have been one employed at a site where an NP managed and delegated duties to a home-visiting team of certified nursing assistants (CNAs) and licensed practical nurses (LPNs) who were capable of identifying medical issues or complications with medications. For example, an LPN brought up a patient's irregular heart rate to the SEDI team and a CNA noticed that a participant was not removing a cap from her insulin needle as she was administering injections, meaning she received no insulin.

LCSWs and MSWs typically assumed case-management roles identifying social needs and directing patients to resources rather than providing behavioral health counseling. Sites typically hired MSWs to assume roles on care teams; one site wanted to switch from staffing a licensed clinical social worker **(**LCSW) to hiring MSW, though at the time of our second site visit, the site had not yet recruited this person.

Two sites employed LCSWs with mixed results. One site found that using LHWs rather than a LCSW to perform home visits made for appropriate use of staff resources. LHWs at this site consulted with the LCSW on a case-by-case basis to determine if the LCSW should make a home visit and/or conduct depression screenings. At this site, the LCSW also sent assessments to physicians and described their role as being a case manager. However, an LCSW at a different site felt uncomfortable in sharing patient details with the care team due to therapist-client privilege. With limited information on social needs, the team could not anticipate and address as many challenges as if they had more complete knowledge of these needs. Establishing effective program flow could be aided by determining guidelines for information sharing between LCSWs and other staff members and implementing a process for informing participants about how staff will use personal information.

Context

Compared with private providers, Federally Qualified Health Center (FQHC) partners worked more effectively with the high-risk program. FQHC clinicians appreciated the additional care and follow-up that SEDI's program offered their patients. Furthermore, FQHCs have more experience in working with outside entities, such as health departments. Private providers from external organizations feared that SEDI would take away their patients. This was particularly true of a major regional health system at one site. Negotiations with these entities delayed implementation of the high-risk intervention. Staff recommended that future programs involve health care systems in early planning and demonstrate how these initiatives align with, rather than threaten, providers' business models.

Future program planners and leaders should consider how sharing staff with partners, particularly public health agencies, will affect implementation. Because of the jurisdictional variation in rules and norms, such as required credentials for LHWs employed in public health settings or limitations on their roles, interventions that rely on these staff should align with rules early. One SEDI site encountered challenges in working with LHWs employed by a local health department because LHWs did not have the training or experience to conduct home visits. An NP ultimately conducted home visits, which reduced program efficiency and effectiveness. In cases where LHWs lack sufficient home visiting experience, LHWs are better suited to focus on community outreach rather than direct care of participants.

Sustainability, Scalability, and Spread

Two of four sites will sustain different portions of the high- and low-risk interventions. None of the sites will continue the medium-risk intervention. Exhibit 3.5 summarizes sustainability across the sites.

Staff were generally skeptical of the effectiveness of the medium-risk telephone intervention among the target population, although some thought that it might be helpful to patients with few socioeconomic disadvantages. Staff reported that the telephone intervention was too scripted to "meet patients where they are" and did not allow flexibility to address socioeconomic barriers, such as limited minutes on prepaid phone plans or housing instability that makes contacting patients more difficult (see the second annual report[39]). Home visits in the high-risk intervention were a better indicator than phone calls of whether patients were changing behaviors and being truthful about their adherence to recommended diabetes management activities. Overall, staff noted the value of face-to-face relationships over phone interactions.

Exhibit 3.5: SEDI Sustainability across Sites

Site	High-Risk Components	Medium-Risk Components	Low-Risk Components
Cabarrus, NC	▪ Not sustained	▪ Not sustained	▪ Not sustained
Durham, NC	▪ Will continue until the end of 2016 under Bristol-Myers Squibb Foundation funding ▪ An NP will continue to monitor and manage currently enrolled patients ▪ Billable nutrition counseling will continue	▪ Not sustained	▪ Will continue until the end of 2016 under Bristol-Myers Squibb Foundation funding
Mingo, WV	▪ Grant funding will partially support clinical team services ▪ Billable nutrition counseling will continue	▪ Not sustained	▪ Will continue through partnerships with the community
Quitman, MS	▪ Not sustained	▪ Not sustained	▪ Sustainability pending. Site remains in talks with a department of health and local stakeholders

As noted in NORC's second annual report, the low-risk community intervention is low-cost and comparatively easy to implement. Sites typically partner with community organizations or public health departments on this work, which helps keep costs low. The Cabarrus and Quitman sites stopped delivering all SEDI services, and the medium-risk intervention will not continue at any sustained sites.

[39]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf

Limitations

Because few patients had identifiers for Medicare claims, we were not able to report on claims data for the SEDI program. Sites shared a subset of the program's patient lists for focus groups and participated in recruitment for phone interviews. Therefore, selection bias might have shaped the positive patient and caregiver outcomes reported in this report as well as in the second annual report.[40]

Conclusion and Policy Implications

SEDI developed its diabetes management program to provide coordinated care from multidisciplinary teams across high, medium, and low risk levels via home visits, telephone support, and community education classes, respectively. Our analyses of high-risk participants suggest that the SEDI program might have been effective in increasing patient activation and medication adherence. Nearly half of participants reduced their HbA1c levels by more than one percentage point. Two sites planned to continue implementing parts of the high-risk and low-risk programs after the end of the CMMI award period; no sites planned to continue the medium-risk telephone intervention.

To help address the prevalence, mortality, and economic burden associated with diabetes in the United States, SEDI concentrated its efforts in states in or adjacent to the "diabetes belt" of the Southeast (so named because of the high prevalence of diabetes diagnoses in that region).[41, 42, 43, 44] Future policy initiatives that focus on diabetes education and care coordination in rural areas, where community resources and access to healthy foods are usually limited, could help to alleviate some burdens of this disease on communities.

Although implemented with mixed success, SEDI's approach to managing population health via geospatial mapping and risk stratification holds potential promise that could be researched further. Whether as part of this or other programs, reimbursement for home-visiting services or multidisciplinary team care coordination could help to deliver care to individuals with advanced diabetes-related comorbidities or multiple chronic conditions. Such support would help chronically ill individuals who face conditions that prevent them from receiving needed services from health care providers and community resources in traditional settings.

[40]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf

[41]National Diabetes Statistics Report. Both 2014 and 2002 surveys estimate prevalence of diagnosed and undiagnosed diabetes. Available at: http://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf. Accessed May 26, 2016.

[42]Centers for Disease Control and Prevention. National diabetes fact sheet; United States 2003. Both 2014 and 2002 surveys estimate prevalence of diagnosed and undiagnosed diabetes. Available at: http://www.the-wow-collection.com/software/ndfs_2003.pdf. Accessed May 26, 2016.

[43]Centers for Disease Control and Prevention. CDC identifies diabetes belt. Available at: http://www.cdc.gov/diabetes/pdfs/data/diabetesbelt.pdf.

[44]Dall TM, Yang W, Halder P, et al. The economic burden of elevated blood glucose levels in 2012: diagnosed and undiagnosed diabetes, gestational diabetes mellitus, and prediabetes. *Diabetes Care*. 2014;37(12):3172-3179.

FirstVitals Health and Wellness, Inc.

Summary. FirstVitals Health and Wellness, Inc. (FirstVitals) implemented a diabetes management telemonitoring and screening program that incorporated remote transmission of data to care coordinators in real time through participants' use of electronic tablets, wireless glucometers, and blood pressure cuffs.

Awardee Overview

SITES:	19 community health centers across Hawaii	***REACH:***	398 patients
AWARD:	$3,999,713	***TARGETED CONDITION:***	Diabetes
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicaid Managed Care

Key Findings

These key findings are based on quantitative analysis of Medicaid claims (January 2013—June 2015), qualitative interviews with program staff, and focus groups with program participants.

Implementation
Tablets incentivize participation, but behavior change requires interpersonal connection with a care coordinator.

User-friendly data platforms allow patients, payers, and providers to track patient metrics in real time.

Utilization
No clear impact on hospitalization and ED visit outcomes

Cost
Non-significant decrease of $993 per patient per quarter in total cost of care

Self-Monitoring and Health Status
Improved diabetes self-monitoring

Four out of 16 participants interviewed reported improved HbA1c levels and weight loss

Sustainability and Scaling

FirstVitals continued to conduct billable screening activities (i.e., retinal screenings). It also continued its relationship with AlohaCare as a durable medical equipment (DME) provider. Enrolled participants were allowed to retain the tablets for the transmission of biometrics information with clinics and to receive ongoing support from integrated care coordinators.

FirstVitals has developed a data platform service that would allow providers to offer and bill for non-face-to-face chronic care management; it is currently marketing this service as Carepanion Mobile Application.[45]

[45]For a description of the platform, please see https://telehealth.firstvitals.com/healthcare_service/help/app.php.

Introduction

FirstVitals Health and Wellness, Inc., a for-profit technology-driven health management company, partnered with two Medicaid managed care insurers, AlohaCare and Ohana Health plan, to provide a program that offered patients electronic tablets, wireless glucometers, and blood pressure cuffs to help them monitor health indicators and transmit data to care coordinators in real time. Over the course of the award, the program served approximately 400 patients across 19 community health centers. The goal of the FirstVitals intervention was to prevent or minimize complications in patients with diabetes and thereby lower costs of care. This chapter presents summative findings concerning program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[46] For technical details on the methodology reported in this chapter, please see Appendix A.

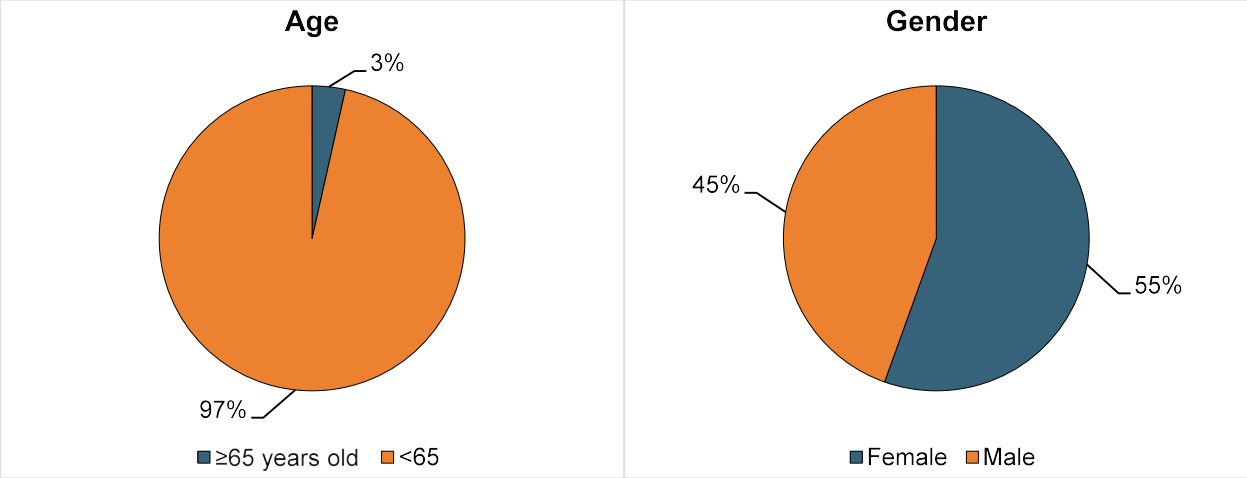
Summative Findings of Program Effectiveness

We analyzed claims to assess the effectiveness of this program in reducing costs and utilization and improving quality of care. For the FirstVitals program, we explored differences in outcomes between intervention patients and comparison patients, focusing on the following measures:

- all-cause hospitalizations
- 30-day readmissions
- emergency department (ED) visits
- total cost of care

Exhibit 4.1 summarizes demographic and other basic information about the FirstVitals patients who are included in our analysis of core outcome measures.[47]

Exhibit 4.1: Descriptive Characteristics of FirstVitals Patients



[46]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[47]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Summative program impact. Exhibit 4.2 summarizes the results of the difference-in-differences (DID) model, which included adjustments for key demographic and other risk factors:[48]

- We observed no statistically significant differences in outcome measures for treatment participants compared with comparison patients.
- FirstVitals participants showed non-significant increases in utilization measures (hospitalizations, 30-day readmissions, and ED visits).
- We also observed a non-significant decrease of $993 per patient in total cost of care for FirstVitals participants relative to the comparison group. However, as with other awardees, calculations of cost savings do not adjust for HCIA program funding from CMS, which was approximately $10,000 per participant.

Exhibit 4.2: Difference-in-Differences Estimates for Core Measures for FirstVitals‡

Average Quarterly Impact	
Outcome Variable	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	2 [-25, 30]
ED Visits per 1,000 Patients	10 [-25, 45]
30-Day Readmissions per 1,000 Patients^	6 [-2, 13]
Total Cost of Care per Patient ($)	-$993 [-$2,693, $707]
Aggregate Impact	
Outcome Variable	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	-$885,983 [-$2,402,415, $630,448]

NOTES: None of these results were statistically significant. ‡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. ^Analysis for 30-day readmissions completed using a patient-clustered logit model.

Quarter-specific program impact. Although we observed a non-significant decrease in cost of care in our summative analysis, we saw a significant decrease in cost of care for FirstVitals participants relative to the comparison group in three of the seven post-intervention quarters (I1, I3, and I6). In addition, we observed a significant reduction in hospitalizations in the first post-intervention quarter. However, we did not see a consistent downward trend for any of the outcome measures. Quarterly fixed effects (QFE) charts of these estimates can be found in Appendix A.

Qualitative Findings

As discussed in our second annual report, a few focus group or phone interview participants (four out of 16) reported that they lowered their HbA1c levels and overall body weight.[49] Below we discuss the drivers behind behavior changes and then outline the major findings that support replicating and scaling up this program in other regions. We also describe contextual factors that challenged the program model as reported by patients.

[48]We adjusted for age, gender, Chronic Illness & Disability Payment System (CDPS) risk score, months enrolled in AlohaCare, and gaps in Medicaid coverage in prior year.

[49]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

The tablet proved to be a valuable incentive for ongoing participation. Participants used their tablets to transmit their blood glucose and blood pressure readings and to find educational materials about diabetes. Many participants used their tablets for basic Web access, job searches, or other activities. Although not an anticipated goal of offering 3G wireless network–ready tablets, FirstVitals found this to be an important benefit for participants who otherwise might not have had Web access. Such secondary benefits might have also encouraged ongoing participation in telemonitoring in order to retain the tablet.

> *"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. I guess that would be more of a plus. That somebody's watching you constantly every day. That's a good thing."*
>
> —Program Participant

Although the tablet incentivized participation, improved self-monitoring of blood glucose was tied to the interpersonal connections that participants made with care coordinators. Participants reported feeling responsible for checking their blood glucose levels and transmitting them regularly because they knew that their care coordinators were monitoring them. Several of those interviewed reported that they expected care coordinators to call if any readings were missing or if their readings seemed off the goal.

Patients credited the tablets with increasing their honesty with primary care physicians. Many of the participants who were interviewed appreciated that they could not interfere with the transmission of their blood glucose and blood pressure levels once they had been taken. Readings were automatically uploaded via Bluetooth technology if the tablet was on or near the patients' measurement devices. Knowing that their providers knew their true readings led patients to have more honest discussions with their providers about their health maintenance behaviors.

> *"If I use that meter in this system, it's kind of error-free. [Before] I would cheat. But then with this it was kind of hard to cheat because I know it's going to store in that [meter] and as soon as I upload it, it's all going.... I have to pay attention to this more often than normal because… my doctor is going to see it."*
>
> —Program Participant

Cross-Site Variation

Health centers' capacity to support FirstVitals' diabetes management intervention varied. Participating health centers, which differed in size, were spread throughout Honolulu, Waimanalo, Wailuku, Lihue, Kahuku, and Kona. Although leadership did not describe the sites in detail by name, they reported that smaller centers were better able to integrate the intervention into clinic workflow than larger ones. They also found the smaller sites to be more organized and to have less pressure to keep up with a high volume of patients. Input from the health centers helped FirstVitals adapt the workforce model to meet the needs of the centers and their patient populations. As described below, centers with less capacity to offer care coordination received more direct support from FirstVitals' care coordinators than those with active care coordination staff and programs.

Workforce

Existing center-based care coordinators found that the intervention improved relationships between their patients and primary care physicians. Depending on the partnering clinic's capacity, existing clinic care coordinators worked with FirstVitals' integrated care coordinators (ICCs) to

implement the FirstVitals intervention components as part of their workflow. Across all program sites, ICCs focused on specific program elements, e.g., training patients to use the technology and troubleshooting problems. Depending on the health center, ICCs also screened and enrolled new patients and trained new care coordination staff in the intervention protocols.

The FirstVitals workforce model evolved so that community health center staff, rather than FirstVitals staff, served as the primary contact with participants. This helped ensure that care delivered through the intervention aligned with the primary care provider's treatment approach. Based on lessons learned during program implementation, FirstVitals' ICCs no longer directly call participants to discuss glucose readings. Instead, the ICCs call the point of contact at the health center—either a clinic care coordinator or other staff person, depending on the site—to make sure that they had the correct results and to encourage them to follow up with the patient.

Context

FirstVitals lost approximately 50 participants as a result of policy changes at the payer and state levels. AlohaCare discontinued its Medicare Advantage plan, which was a source of participants for the intervention. In addition, a change in statewide policy meant that adults from the Marshall Islands and Federated States of Micronesia lost Medicaid coverage in Hawaii unless they were pregnant. FirstVitals continued to provide services to these participants but could no longer track outcomes through insurance records. To compensate for loss of access to claims data, FirstVitals established new relationships with Ohana Health Plan and private practices that accept AlohaCare (as opposed to only community health centers).

Lack of access to affordable vegetables, especially leafy greens, and limited public transportation in Hawaii make it challenging for patients to make positive lifestyle changes. Although diabetes education is not a focus of the FirstVitals intervention, patients emphasized the value of the online health information recommended by care coordinators or what they learned from classes or counseling sessions offered by their health center. Participants expressed frustration that the lack of access to affordable healthy foods and limited transportation options impeded their ability to implement the lifestyle changes they wanted to make.

In their recruitment and education efforts, program leaders and staff recognized Hawaii's cultural diversity. When explaining the importance of diabetes self-management, certain messages resonated with some populations more than with others. For example, staff learned that Micronesians are more motivated to prevent loss of a limb than a heart attack because they believed that they would not be able to "go back to God" if their bodies were different from how they had entered this world. Staff also learned about the nutritional value of a variety of local foods in order to develop appropriate educational materials for participants and their families.

> *"With all the multi-ethnic groups, they're used to different kinds of foods, and not everyone knows what the fat content is… in the different foods. So [it] really helped to pull some of this stuff together and share that not only with the patient recipients, but with their families too."*
>
> —Program Leader

Sustainability, Scalability, and Spread

FirstVitals sustained services that were reimbursable or were paid for through contractual agreements. Providers billed for retinal screening activities. Also, FirstVitals entered into contractual agreements as a durable medical equipment (DME) provider with AlohaCare to cover device upgrades (e.g., wireless glucometers). All enrolled participants kept their tablets for communicating with the participating clinics via wireless Internet (Wi-Fi, not 3G) after the award period.

FirstVitals developed a software service called Carepanion that would allow providers to use telehealth applications to provide and bill for care management. Capitalizing on the American Medical Association's most recent current procedural terminology (CPT) code for chronic care management, which became available in January 2015, Carepanion allows providers to bill for 20 minutes of telehealth-enabled care management per patient per month.

Limitations

Although we were able to estimate DID for readmissions, the results should still be interpreted with caution, as they have limited power because they are based on a total of only12 readmissions during the intervention period. In constructing the comparison group, we were limited to variables available from AlohaCare claims and could not control for all important confounding factors. In particular, race and ethnicity data were incomplete and therefore are not included in the models; there may be residual confounding in our analysis that could account for some of the observed associations.

The racial and ethnic breakdown of the population of Hawaii is distinct from that of the continental United States, with more Asians (37.5 percent versus 5.4 percent) and Native Hawaiians and other Pacific Islanders (10 percent versus 0.2 percent), and fewer whites (26.7 percent versus 77.4 percent) and blacks (2.5 percent versus 13.2 percent).[50] Furthermore, although the prevalence of diabetes is at least twice as high in ethnic minorities compared with whites, one study has shown that its prevalence is three times higher in Native Hawaiians compared with whites.[51] Therefore, we tried to address the limitations in available demographic data by choosing comparison patients from within Hawaii and tried to further adjust for local differences by selecting AlohaCare members who sought care at community health centers in the same regions as AlohaCare members who were participating in the FirstVitals program.

We developed our findings from visits and phone interviews with three of 19 sites. We collected data on the remaining 16 sites by reviewing reports from CMS's implementation contractor and updates that FirstVitals leadership offered during interviews. Because sites participated in recruitment for focus groups and patient interviews, it is possible that a degree of selection bias shaped the positive patient outcomes reported in our second and third annual reports.

[50]U.S. Census Bureau. State & County Quickfacts. 2014 estimates. Available at: https://www.census.gov/quickfacts/table/RHI125215/15,00.

[51]Maskarinec G, Grandinetti A., Matsuura G, et al. Diabetes prevalence and body mass index differ by ethnicity: the Multiethnic Cohort. *Ethn Dis*. 2009;19(1):49-55.

Conclusion and Policy Implications

FirstVitals developed its program to provide telemonitoring and screening for diabetes management by employing a workforce of LHWs and nurses to expand diabetes support in Hawaii. Working with two insurers, AlohaCare and Ohana, FirstVitals targeted beneficiaries with diabetes and offered diabetic peripheral neuropathy (DPN) screenings to determine their risk for microvascular disease. By giving participants 3G data–enabled tablets that electronically transmitted blood glucose and blood pressure readings to care coordinators, FirstVitals used incentives to improve patients' self-monitoring behavior. The main effect of the program (observed qualitatively) appears to be improvement in patients' self-monitoring of their blood glucose levels. Although some participants also attributed their improved HbA1c readings, diet, and exercise behavior to the program, quantitatively, we found no significant impact of the program on participants' overall health status, or on health care costs or utilization. However, the small sample size limits our ability to detect program impacts. After the HCIA funding period, FirstVitals continued to conduct billable screening activities (i.e., DPN and retinal screenings). It also continued its relationship with AlohaCare as a DME provider.

The FirstVitals intervention may be a first step toward better disease self-management because it raises participants' awareness of how their health condition is connected with their blood glucose levels and their diet and exercise. The intervention also appears to have improved communication between the patients and their primary care providers. However, better health outcomes may also require more education and support for behavioral changes related to diet and exercise. Similar interventions may benefit patients by addressing education needs, helping patients overcome barriers to lifestyle change and improving their access to healthy foods. These elements could be built into an intervention like FirstVitals or coordinated through collaboration with community-based education programs or other local public health initiatives.

The George Washington University

Summary. The George Washington University (GWU) implemented a telemonitoring program for end-stage renal disease (ESRD) patients on peritoneal dialysis (PD). The intervention incorporates remote data exchange into patients' self-monitoring regimens. Patients were asked to take daily blood pressure and weight readings for transmission to DaVita clinics. Clinic nurses monitored patient data and followed up with patients as needed.

Awardee Overview

SITES:	10 DaVita clinics across Washington, DC; Maryland; and Virginia	***REACH:***	300 patients
AWARD:	$1,938,945	***TARGETED CONDITION:***	Peritoneal dialysis
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare

Key Findings

These key findings are based on quantitative analysis of Medicare claims (July 2012—December 2015) and qualitative interviews with staff and program participants.

Implementation

Patients may need incentives to correctly use remote monitoring equipment.

Nurse buy-in, planning, and staff support are necessary to incorporate remote monitoring into clinical workflow.

Patients preferred calling or going to the clinic to using video chat features.

Video education about their disease helped reinforce patients' preexisting knowledge.

Utilization

Hospitalizations reduced by 23 per 1,000 patients

Readmissions increased by 106 per 1,000 patients

Cost

No consistent trends in cost

Quality of Care

No reported changes in care

Sustainability

GWU reported that it was unable to secure funding to sustain this program and has therefore discontinued it after the end of the award period.

ESRD programs should consider targeting patients who are not already engaged in self-monitoring activities to maximize program impact.

Introduction

The George Washington University (GWU) provided a remote telemonitoring program for patients with end-stage renal disease (ESRD) through nurses from DaVita (a company specializing in renal care services) clinics across Washington, DC; Maryland; and Virginia. Over the course of the award, the program served 300 patients across 10 DaVita clinics; we have Medicare claims data for 229 of these patients. The goal of this program was to improve health outcomes, increase patient adherence to treatment, minimize preventable health complications, and reduce overall cost of care for patients receiving peritoneal dialysis (PD). This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[52] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

This evaluation analyzed claims data to assess the effectiveness of GWU's program in reducing cost and utilization and in improving quality of care. We examined differences in outcomes between GWU patients and comparison patients before and after the intervention, focusing on the following measures:

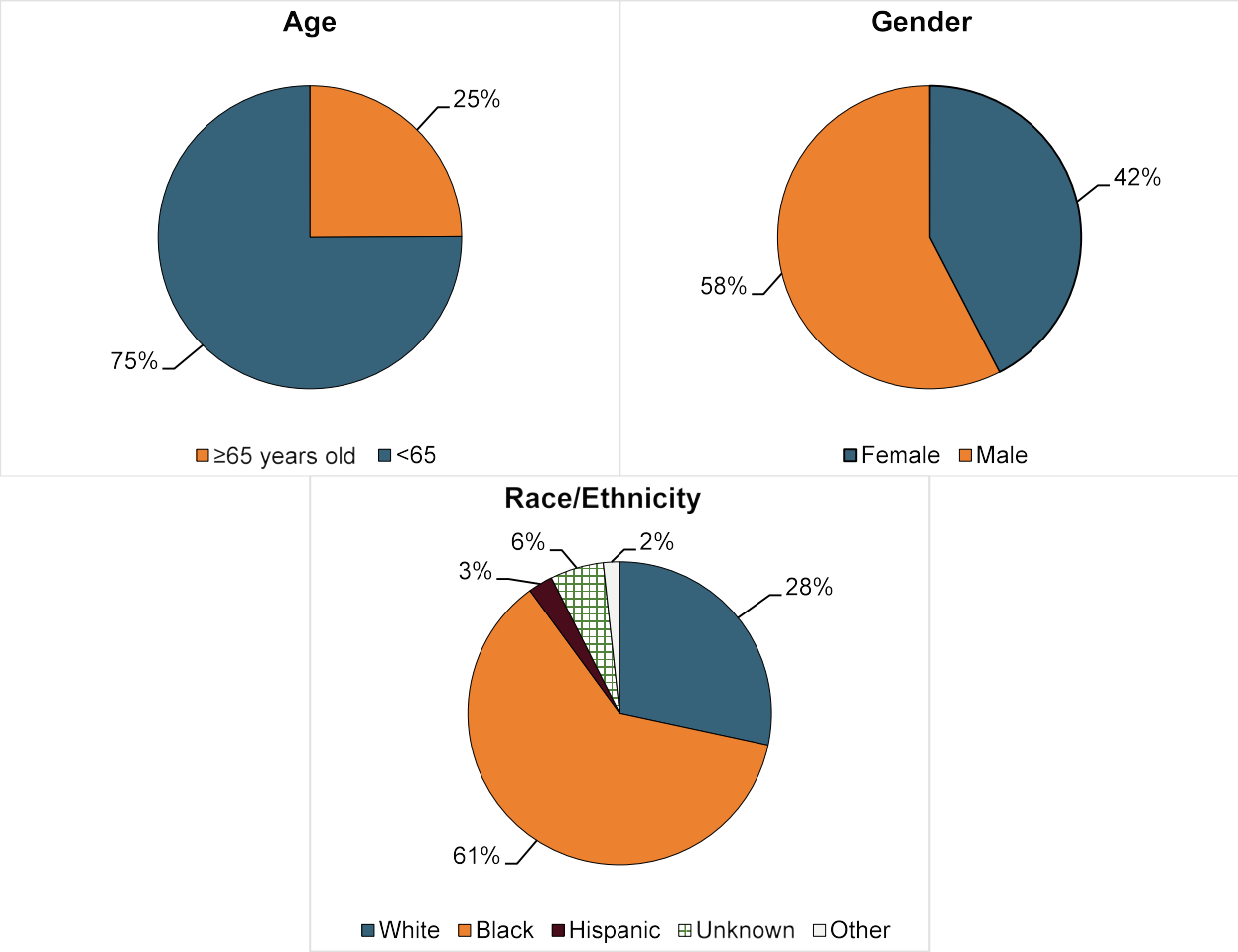
- all-cause hospitalizations
- hospitalizations for ambulatory care sensitive (ACS) conditions
- 30-day readmissions
- emergency department (ED) visits
- total cost of care

Exhibit 5.1 summarizes demographic and other basic information about the GWU patients who are included in our analysis of core outcome measures.[53]

[52]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf

[53]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please see Appendix A.

Exhibit 5.1: Descriptive Characteristics of GWU Patients



Summative program impact. Exhibit 5.2 summarizes the results of our difference-in-differences (DID) model, which included adjustment for key demographic and other risk factors:[54]

- The decline in hospitalizations (23 per 1,000 patients) was greater for participants in the GWU program relative to the comparison group.
- There was an increase in 30-day readmissions for GWU patients relative to the comparison group. However, this measure had a small sample size compared with the other core measures.[55] This increase suggests that there might have been a small cohort of patients whom GWU was unable to manage, specifically those needing post-acute care after a hospitalization.
- There were no significant trends in ED visits, ACS hospitalizations, or total cost of care for patients in the GWU program relative to the comparison group.

[54]We adjusted for age, gender, race, hierarchical condition categories (HCC) score, diabetes, ESRD, hemodialysis, peritoneal dialysis, and dual eligibility.

[55]Since 30-day readmissions are restricted to patients with an index hospitalization in that quarter, the 30-day readmissions measure had a very small sample size (<50) compared with the other core measures.

Exhibit 5.2: Difference-in-Differences Estimates for Core Measures for GWU

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	**-23 [-44, -2]***
ED Visits per 1,000 Patients	1 [-31, 33]
30-day Readmissions per 1,000 Patients Hospitalized	**106 [12, 200]***
ACS Hospitalizations per 1,000 Patients	-2 [-17, 13]
Total Cost of Care per Patient ($)	-$411 [-$2,233, $1,411]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	-$613,999 [-$3,333,567, $2,105,569]

NOTE: ***p<0.01, **p<0.05, *p<0.1

Qualitative Findings

As discussed in our second annual report, patients who participated in focus groups noted no significant changes in utilization, quality of life, or interactions with DaVita clinical staff.[56] One third of the patients we interviewed noted that since joining the program they have monitored their blood pressure and weight more regularly; however, they were already monitoring their blood pressure and weight before the program. Below, we outline the major findings that could inform future telemonitoring ESRD programs.

Telemonitoring systems may not measurably improve outcomes for patients already highly engaged in monitoring their disease. PD is one form of treatment for ESRD that allows patients to receive treatment at home rather than at a clinic. Home therapies require patients to receive extensive education at the onset of treatment and to continuously self-monitor throughout treatment to prevent potential complications such as peritonitis, an inflammation of the membrane lining the abdomen. GWU did not have a process to specifically target patients who were not actively self-monitoring. Consequently, the GWU program involved some patients already in compliance with traditional self-monitoring activities. Participants believed that the nurses were already accessible before the start of the program, and therefore some patients did not see a need to use the telemonitoring equipment.

Video educational modules reinforced participants' preexisting knowledge. Before starting PD, patients received an overview of their treatment. Some patients forgot what they initially learned, so the videos were a helpful reminder of what was important. Participants reported that the videos were short and easy to understand and that they reaffirmed important topics such as how to check blood pressure accurately, how to take care of a dialysis catheter, and what can cause peritonitis.

Workforce

The DaVita nurses' time was not covered under the award, and we found no attempt to modify their clinical workflow; therefore, most nurses did not check participants' telemonitoring results.

[56]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf

GWU sought to test whether the DaVita nurses could incorporate monitoring activities into their days without any incentives or modifications to their workflow. Our findings indicate that they could not. DaVita nurses reported that support from GWU and DaVita medical directors was inadequate to incorporate the necessary time for the program. However, the few nurses who were able to monitor the biometrics through the telemedicine equipment would call participants if results were abnormal. This provided comfort and encouragement to patients who otherwise felt that they were isolated or that their self-monitoring was not important.

Context

Because the principal investigator (PI) was the medical director for PD at one of the DaVita clinics, GWU secured agreement from other DaVita clinics to participate in the program. Nevertheless, because this was the first research relationship between DaVita and GWU, establishing a contract, roles and responsibilities, and a data exchange agreement were more time-consuming than expected.

One of the program's coinvestigators had extensive experience with telemedicine interventions and a long history of working with the program's remote monitoring technology vendor. This existing relationship helped the program team obtain modifications and upgrades to the application without paying additional fees; for example, the vendor was committed to upgrading the equipment without charging GWU the additional fees as new technology emerged.

Sustainability, Scalability, and Spread

GWU is not sustaining their telemonitoring program. As we reported in the second annual report, GWU sought funding to pay the vendor fees for managing the telemonitoring data and believed that DaVita would take over the program. However, GWU could not convince DaVita to continue the program and therefore discontinued it after the end of the award period.

Future programs should consider targeting telemonitoring interventions to patients who can benefit the most and include incentives to encourage patients to use the remote monitoring equipment. Furthermore, it is important to secure nurse buy-in and provide support and modification to nurse workflow to accommodate review of telemonitoring results.

Limitations

The small number of patients served by the program limited our power to detect changes in costs associated with program participation. Our quantitative analysis of readmissions included only patients with an index hospitalization, thereby reducing the sample size and increasing the confidence intervals in these models. Finally, from our qualitative research, we know that adherence to remote monitoring, and therefore dosage of the intervention, varied. Without access to GWU's research database, however, we were unable to quantify different exposures to the intervention.

We developed our findings from visits and telephone interviews with six of 10 sites. We collected data on the remaining four sites by reviewing reports from the implementation contractor and any updates that GWU leadership offered during interviews.

Conclusion and Policy Implications

GWU developed its program to provide telemonitoring to patients with ESRD by employing a workforce of DaVita clinic nurses in Washington, DC; Maryland; and Virginia. Although we found evidence of statistically significant reductions in hospitalizations for GWU patients compared with a matched comparison group, our findings suggest that GWU's program did not substantially change the quality of care provided to patients receiving PD. Ultimately, GWU was unable to secure funding to sustain this program and discontinued it after the end of the award period.

Health Resources in Action

Summary. Health Resources in Action (HRiA) implemented a pediatric asthma home-visiting program. The program used community health workers (CHWs) who made three to four home visits to reduce preventable pediatric asthma-related hospitalizations and costs. With support from certified asthma educators (AE-Cs), CHWs educated families regarding asthma self-management and assessed environmental triggers in the home.

Awardee Overview

SITES:	9 sites across Connecticut, Massachusetts, Rhode Island, and Vermont	***REACH:***	1,145 patients
AWARD:	$4,247,747	***TARGETED CONDITION:***	Pediatric asthma
AWARD DATES:	July 2012—June 2016	***PAYER(S):***	Medicaid
NO-COST EXTENSION:	12 months		

Key Findings

These key findings are based on quantitative analysis of awardee-collected data (December 2012—December 2014), qualitative interviews with staff, and focus groups with caregivers of program participants.

Implementation

Flexible home-visiting models that allow tailoring at the site level can help meet the needs of specific populations.

Intervention staff benefited from frequent communication among sites.

Caregivers found home environmental assessments, medication education, and asthma mitigation supplies helpful.

Staff members who brought cultural knowledge and language skills built strong relationships with families.

Utilization *(awardee-collected data)*

Asthma-related hospitalizations reduced by 214 per 1,000 patients.

Asthma-related ED visits reduced by 362 per 1,000 patients.

Cost

Data were not yet available to evaluate this measure.

Quality of Care

Caregivers of participants reported reduced stress.

Sustainability and Scaling

Four of HRiA's nine sites will continue to deliver limited versions of the original intervention, although none will be able to offer the full range of services that were funded under the award period.

Program leadership and sites continue to foster relationships with providers and payers to work toward reimbursable asthma home-visiting services.

Introduction

The Health Resources in Action (HRiA) pediatric asthma home-visiting program used community health workers (CHWs) and certified asthma educators (AE-Cs) to provide education and subsequent reinforcement in addition to environmental assessments and cleaning supplies for families that included children with asthma. Over the course of the award, the program served approximately 1,100 children across nine sites. HRiA aimed to reduce costs and unnecessary hospitalizations for pediatric asthma patients. This chapter presents summative findings concerning program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[57] Our quantitative analysis uses pre- and post-intervention data supplied by the awardee. For technical details on the data and methods underlying findings reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

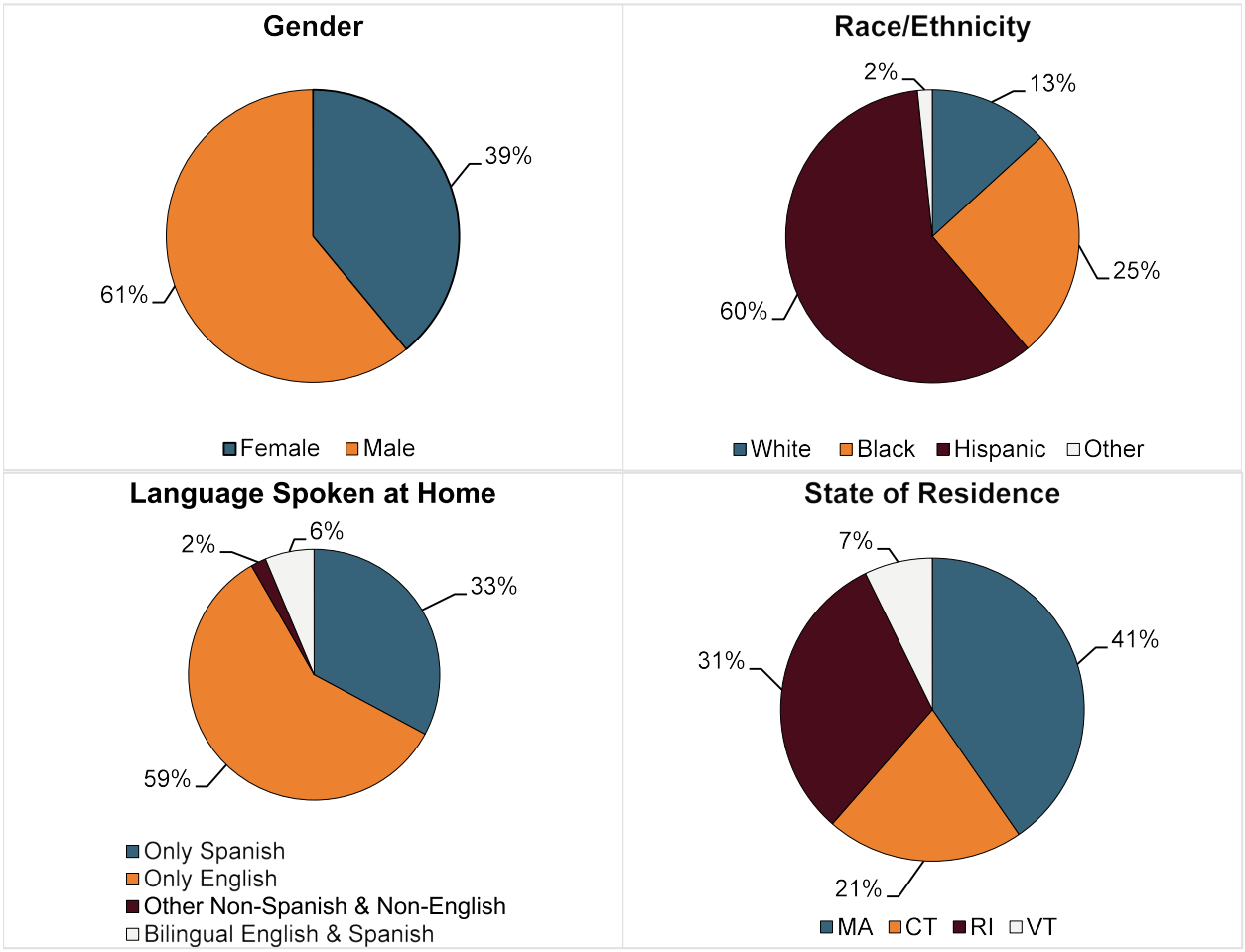
We analyzed caregiver-reported program data regarding their child's health care utilization (subsequently referred to as "caregiver-reported utilization") to assess HRiA's effectiveness in reducing utilization. For HRiA's intervention, we compared caregiver responses about the asthmatic child before and after the intervention, focusing on the following measures:

- asthma-related hospitalizations
- asthma-related emergency department (ED) visits
- asthma-related outpatient urgent care visits
- routine asthma care visits

Exhibit 6.1 summarizes demographic and other basic information about the HRiA patients who are included in our analysis of outcome measures.[58]

[57]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[58]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 6.1: Descriptive Characteristics of HRiA Patients



Impact from awardee-collected data. Exhibit 6.2 summarizes difference estimates for caregiver-reported utilization measures, which included adjustments for demographics and other key factors.[59] We analyzed caregiver-reported utilization data that were collected from 670 participants at the initial home visit and at the final home visit and/or during six- and 12-month follow-up telephone calls. We asked caregivers of participants about asthma-related utilization in the prior six months at the initial and final home visits, then during a six-month and/or 12-month follow-up call. Among the 670 caregivers who completed an initial home visit assessment and at least one follow-up assessment, there were an average of 112 days between visits. In 674 cases, there were gaps of fewer than 180 days, indicating that there could be substantial duplication in reporting of utilization outcomes across repeated assessments. The duration of the gaps between the visit and follow-up assessments were expected, as home visits were typically done within a two- to six-month period, depending on the site.

[59]We adjusted for age, race/ethnicity, gender, caregiver education level, and indicator of enrollment in a Massachusetts site. As mentioned in NORC's second annual report, Massachusetts sites likely benefited from prior experience in home visiting, close ties with training programs, and a larger, more recognized CHW workforce across the state: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

We constructed repeated-measures models to evaluate the changes in utilization from the initial home visit (pre-intervention period) to the final home visit, six-month telephone call, and/or 12-month call (post-intervention period). We analyzed dichotomous outcomes using generalized estimating equation (GEE) regression and specified a logit model with a log link:

Participation in the HRiA program was associated with:

- 214 fewer patients per 1,000 with an asthma-related admission
- 362 fewer patients per 1,000 with an asthma-related ED visit
- 216 fewer patients per 1,000 with an asthma-related urgent care visit
- 194 fewer patients per 1,000 with a routine asthma-related health care visit in the last six months

Exhibit 6.2: Difference Estimates for Caregiver-Reported Utilization Measures (Dichotomous)

Outcome Measure	Pre-Intervention	Post-Intervention	Difference [90% Confidence Interval]
Asthma-Related Hospitalizations in Last Six Months per 1,000 Patients	518	304	**-214 [-247, -182]*** **
Asthma-Related ED Visits in Last Six Months per 1,000 Patients	798	436	**-362 [-399, -326]*** **
Asthma-Related Urgent Care Visits in Last Six Months per 1,000 Patients	669	453	**-216 [-250, -181]*** **
Routine Asthma-Related Health Care Visits in Last Six Months per 1,000 Patients	835	641	**-194 [-227, -161]*** **

NOTE: ***p<0.01, **p<0.05, *p<0.1

Subgroup Analysis: Race and Ethnicity

Along with assessing the overall effectiveness of HRiA's program, we conducted a race/ethnicity subgroup analysis of caregiver-reported utilization data that were collected from 670 caregivers who had completed an initial home visit assessment and at least one follow-up assessment and who had provided race and ethnicity information. For race and ethnicity, caregivers were able to select more than one category for their child, which limited our ability to create mutually exclusive racial/ethnic categories. We first analyzed how race and ethnic groups compared overall and then how they compared to one another. Due to the sample size for this analysis, we are limited in what comparisons can be made between groups.

Exhibit 6.3 shows the difference estimates for caregiver-reported utilization measures for participants selecting Hispanic as their ethnicity (independent of race), non-Hispanic Whites, and non-Hispanic Black participants, which included adjustment for key demographic and other factors.[60] We constructed repeated-measures models to evaluate the changes in utilization from the initial home visit (pre-intervention period) to the final home visit (post-intervention period). We used GEE regression specifying a logit model with a log link.

[60]We adjusted for age, race (White/non-White), gender, caregiver education level, and indicator of enrollment in a Massachusetts site.

- Asthma-related hospitalizations, ED visits, and urgent care visits in the last six months decreased for all three subgroups from pre- to post-intervention. However, the decline was steeper for non-Hispanic Blacks than for Hispanics or non-Hispanic Whites.
- All subgroups reported a decrease in the number of routine asthma-related visits with their provider in the last six months, but this decline was also steepest for non-Hispanic Blacks.
- Asthma-related healthcare utilization in the pre-intervention period was highest for non-Hispanic Blacks across all four measures and lowest for non-Hispanic whites.

Exhibit 6.3: Difference Estimates for Caregiver-Reported Utilization Measures by Race and Ethnicity Subgroup

Variable	All Hispanic			Non-Hispanic White			Non-Hispanic Black		
	Pre Period	Post Period	**Difference [90% CI]**	Pre Period	Post Period	**Difference [90% CI]**	Pre Period	Post Period	**Difference [90% CI]**
Asthma-Related Hospitalizations in Last 6 Months per 1,000 Patients	571	392	**-178 [-221, -135]*** **	152	62	**-89 [-155, -23]** **	650	268	**-382 [-453, -311]*** **
Asthma-Related ED Visits in Last 6 Months per 1,000 Patients	879	542	**-337 [-383, -292]*** **	536	221	**-315 [-408, -223]*** **	886	410	**-476 [-543, -409]*** **
Asthma-Related Urgent Care Visits in Last 6 Months per 1,000 Patients	666	513	**-153 [-196, -110]*** **	611	317	**-294 [-388, -200]*** **	681	355	**-326 [-397, -255]*** **
Routine Asthma-Related Health Care Visits in Last 6 Months per 1,000 Patients	815	624	**-191 [-234, -148]*** **	786	625	**-161 [-246, -76]*** **	900	648	**-252 [-319, -186]*** **

NOTES: ***p<0.01, **p<0.05, *p<0.1; CI, confidence interval; Difference model adjusts for gender, age, caregiver education, and state.

Exhibit 6.4 shows the difference-in-differences estimates for caregiver-reported utilization measures among non-Hispanic Black versus all Hispanic, non-Hispanic White versus all Hispanic, and non-Hispanic Black versus non-Hispanic White participants adjusted for key demographic and other factors:[61]

- Compared with Hispanic participants, non-Hispanic Blacks reported a greater decline in asthma-related hospitalizations, ED visits, and urgent care visits in the last six months.
- Compared with Hispanic participants, non-Hispanic Whites reported a greater decline in asthma-related urgent care visits in the last six months.

[61]We adjusted for age, race/ethnicity, gender, caregiver education level, and indicator of enrollment in a Massachusetts site.

- Compared with non-Hispanic Whites, non-Hispanic Blacks reported a greater decline in asthma-related hospitalizations and ED visits in the last six months.
- There was no difference in the rate of change in routine asthma-related health care visits across all three subgroups.

Exhibit 6.4: Difference-in-Differences Estimates for Caregiver-Reported Utilization Measures, by Race and Ethnicity Subgroup

Variable	Non-Hispanic Black vs. All Hispanic	Non-Hispanic White vs. All Hispanic	Non-Hispanic Black vs. non-Hispanic White
	Difference [90% Confidence Interval]		
Asthma-Related Hospitalizations in Last 6 Months per 1,000 Patients	**-178 [-256, -100]*** **	66 [-23, 156]	**-272 [-381, -164]*** **
Asthma-Related ED Visits in Last 6 Months per 1,000 Patients	**-132 [-216, -49]*** **	19 [-83, 121]	**-163 [-276, -50]** **
Asthma-Related Urgent Care Visits in Last 6 Months per 1,000 Patients	**-154 [-233, -75]*** **	**-123 [-216, -31]** **	-29 [-146, 88]
Routine Asthma-Related Health Care Visits in Last 6 Months per 1,000 Patients	-53 [-131, 25]	52 [-35, 139]	-68 [-179, 43]

NOTE: ***p<0.01, **p<0.05, *p<0.1; Difference model adjusts for gender, age, caregiver education, and state.

Qualitative Findings

As discussed in our second annual report, caregivers who participated in focus groups noted gains in their own quality of life, quality of care for their children, and decreases in their child's utilization.[62] Below, we discuss the drivers behind behavior changes and then outline the major findings that support replicating and scaling up this program in other regions.

> *"[CHW] really takes her time and pinpoints what could be triggering the asthma versus the doctors who give you the brochures and you know, they ask and everything maybe about a plan, but she really does the walking around and sitting down and the one-on-one, and if you have any feelings towards it… she's open about discussing it and like I have a lot of fears."*
>
> —Caregiver of Program Participant

When trusted staff met with caregivers, pointed out demonstrable asthma triggers, provided tailored recommendations, and delivered asthma mitigation supplies, caregivers actively modified housekeeping behaviors. Strong relationships with CHWs and positive initial engagement with families allowed staff to enter homes for multiple visits. Rather than providing general advice, CHWs provided concrete and specific cleaning recommendations tailored to their observations during the home environmental assessment. For example, CHWs recommended that families immediately change shower curtains if mold appeared or recommended that families periodically vacuum (e.g., once a week).

[62] Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

Delivery of asthma mitigation materials (e.g., vacuum cleaners and air purifiers) particularly enhanced families' ability to address home environmental concerns. Almost all caregivers reported using asthma mitigation supplies and appreciated that supplies were provided by the program. One site with relevant experience noted that interventions providing supplies together with home based education, work better than home-based education-only interventions.

> *"The fundamental difference is [that] we had $350 per family to provide HEPA vacuums, wedge pillows, air purifiers.... We did not have something concrete, tangible, free, other than our information under our [previous] program… products we're providing, it's quick, it's easy, they can touch it, feel it, understand it. It didn't end up being confusing, it was focused, to the point, and focused on asthma."*
>
> —Site Director

Quantitative and qualitative data suggest that caregivers used asthma action plans and medication education to control or prevent children's asthma exacerbations and to avoid ED visits. Caregivers consistently reported learning a lot by following an asthma action plan. Caregivers learned about medication types and appropriate dosages based on their child's asthma action plan. As program data from our second annual report[63] showed, caregivers reported large gains in their quality of life and improvements in their children's asthma control. Quantitative findings showing reduced utilization also support these findings.

Despite having few formal clinical program components, HRiA improved participants' quality of care. CHWs referred issues that were beyond their scope to AE-Cs, most of whom had clinical training as nurses. The AE-Cs helped connect patients with primary care providers, accompany families to medical visits, and contact physicians to suggest medication review. Frequent communication between clinician AE-Cs and non-clinician CHWs ensured that CHWs appropriately referred any issues that they observed during home visits.

Cross-Site Variation

Despite differences in approach, we did not find notable variation in implementation effectiveness across sites, suggesting the importance of flexibility rather than strict fidelity to a process. All sites that we visited agreed that ideal program frequency was three to four home visits, but sites used their discretion to determine whether to stop all visits after the prescribed number or to provide an additional visit, meaning that some families received up to four or five total visits (see Exhibit 6.3 for frequency variation by site). We also observed that effective cooperation and communication between AE-Cs and CHWs, rather than the specific delineation of duties between the two, determined program teams' success.

Sites also could make minor changes to program components. A Connecticut site built referrals for allergy testing into its model, and the Vermont site targeted health education to children roughly eight years old and older who were capable of learning about self-management strategies (e.g., breathing techniques). Findings indicate that it's likely that adaptability was facilitated by sites sharing materials and discussing challenges and lessons learned with each other via monthly check-ins. Exhibit 6.5 shows site differences across key areas.

[63]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

Exhibit 6.5: HRiA Differences across Sites

Site	Workforce Model	Dosage (home visits)	Participant Race/Ethnicity	Context
Baystate Medical Center (MA)	■ CHWs conduct all home visits. ■ Clinician with the AE-C credential provides guidance to the CHW offsite but does not attend any home visits.	4	Predominately Hispanic	■ Urban ■ Hospital-based**
Boston Medical Center (MA)		4	Predominately Hispanic, also non-Hispanic Black	■ Urban ■ Hospital-based**
Boston Children's Hospital (MA)		3*		
Hasbro Hospital (RI)	■ CHW and an AE-C conduct the first home visit. ■ CHW independently conducts subsequent home visits.	3	Predominately Hispanic	■ Urban ■ Hospital-based**
St. Joseph's Hospital (RI)			Predominately Hispanic	■ Urban ■ Hospital-based**
Rutland Regional Medical Center (VT)			Predominately Caucasian	■ Rural ■ Hospital-based ■ Hospital has an embedded community health team
Thundermist Health Center (RI)			Predominately Hispanic	■ Based in a Federally Qualified Community Health Center
Children's Medical Group (CT)	■ CHW and an AE-C conduct the first home visit. CHW independently conducts subsequent home visits. ■ Participants have option of receiving asthma education in an initial clinic visit.	3*	Predominately Hispanic and Black	■ Based in a primary pediatric care practice
Middlesex Hospital (CT)			Mix of White, Black, and Hispanic	■ Suburban ■ Hospital-based ■ Affiliated center for chronic care

NOTES: *Additional visit and/or follow-up provided according to staff discretion. **The institution and/or site leadership had previous experience with home-visiting programs. CHW, community health worker; AE-C, certified asthma educator.

Workforce

Site directors and staff stressed the importance of selecting individuals who were the right fit for the job. Both staff and leadership recognized that providing services in homes required trust from families. A nonjudgmental demeanor and strong interpersonal skills emerged as the most desirable staff characteristics.

> *"My biggest sort of criteria was that we felt comfortable hiring people who knew what their boundaries were…. You're not out there to prescribe, you're not out there to change asthma action plans, you're not out there to, you know, be sort of a pretend medical professional. You understand your role as a community health worker to bridge that gap, that cultural and ethnic gap, to build a trusting relationship with the family, to understand that you're a guest in their home."*
>
> —Site Director

Teams benefited from having multiple staff members with bilingual skills and cultural competence. A few sites employed Spanish-speaking AE-Cs who could partner with Spanish-speaking CHWs, but we observed that CHWs with foreign language skills tended to have more responsibilities than their exclusively English-speaking counterparts. Using AE-Cs with foreign language skills would allow CHWs to share the burden of language assistance service and potentially improve interpretation of complex clinical issues. Staff familiar with Hispanic and South American cultures understood why some families were uncomfortable using natural cleansers rather than bleach (considered the "gold standard" for cleaning for many families from these cultures). As a result, CHWs tailored education and reinforcement, while AE-Cs could provide appropriate direction and staff support.

We did not observe staff dissatisfaction or challenges with team dynamics across sites, even though team sizes differed. Two major factors that appeared to be key to staff satisfaction were:

- a reasonable patient caseload per CHW
- AE-C capacity to closely support CHWs

Although staff considered extensive efforts in scheduling and related travel to be a necessary part of CHWs' roles, CHWs consistently discussed this part of the job as challenging. The burden of scheduling and travel related to a CHW's caseload is an important consideration in potential replication and scaling up. In addition, many behind-the-scenes functions relied on AE-Cs. Clinicians should be hired for AE-C roles, and they should expect to spend time managing LHW staff in addition to addressing participants' clinical needs. Although overall team sizes differed, we found that sites hired approximately two CHWs per AE-C, which proved to be an effective ratio that enabled close team communication and appropriate CHW support as sites scaled staffing models up or down to serve their respective patient populations.

Context

Program leads can consider the landscape of similar programs in a given area in order to promote cross-site learning among comparable programs. Sites appreciated opportunities to share lessons learned, to discuss challenges, and to garner emotional support from each other. Partnering with existing home-visiting programs to learn from their expertise or knowledge of the community can benefit these initiatives as they get started. Reviewing existing home-visiting services available in a given area would also help program leaders determine if the area is already saturated or if there are unserved or underserved populations. For instance, one Massachusetts site mentioned that a well-known medical facility tended to

work with Asian Americans, so the program would refer patients to that entity if they encountered language barriers.

Hospital-based programs leveraged multiple institutional resources. Although sites discussed participant recruitment as a challenge, hospital-based sites worked effectively with affiliated EDs to find participants. In terms of sustainability, two hospital-based sites integrated their staffs into preexisting care teams, where they will continue to deliver parts of the intervention. Furthermore, we found that hospital sites tended to be familiar with helpful relevant studies and pilot interventions. For example, experience with past asthma programs at three hospital sites helped them select the right asthma mitigation materials, adjust home visit protocols, and determine how many home visits to deliver.

The involvement of multiple payers complicated data collection and analysis. Since sites were scattered across multiple states and different types of institutions (e.g., teaching hospital, regional hospital, and primary care practice), HRiA and its economic analysis subcontractor, the Center for Health Policy and Research (CHPR) at the University of Massachusetts Medical School, entered into separate data use agreements with each site to obtain patient identifiers and program data. Varying institutional review board rules complicated access to program data. Furthermore, challenges in obtaining Medicaid data from state agencies and managed care plans limited the ability to demonstrate any cost savings that resulted from the program.

Sustainability, Scalability, and Spread

As of March 31, 2015, sites that did not have sustainability plans stopped enrolling participants and ended intervention services on June 30, 2015. During the awardee's no-cost extension period, HRiA secured claims data from six health plans and will ultimately perform a cost-savings analysis. Four sites will continue to deliver limited versions of the original intervention, although none will be able to offer many of the services that were funded under the CMMI award, such as asthma mitigation supplies. Sites continue to engage with payers to work toward reimbursable asthma home-visiting services. Exhibit 6.6 provides an overview of the HRiA sites' sustainability plans.

Exhibit 6.6: HRiA Sustainability Plans by Site

Site	Sustainability Plans and Activities
Boston Children's Hospital (MA)	■ If a bundled payment pilot program through MassHealth is implemented, it will provide fixed reimbursements for home-visiting services. ■ The hospital is also funding a limited program through its Community Benefits Office, then from the Massachusetts Children's High-Risk Asthma Bundled Payment Program after the bundled payment pilot is implemented.
Hasbro Hospital (RI)*	■ Both sites are continuing work to use claims data to demonstrate return on investment. ■ Both sites will operate a scaled-down program through December 2016, funded by a combination of funding from a hospital donor and a small grant from the State Asthma Programs.
St. Joseph's Hospital (RI)*	
Boston Medical Center (MA)	■ Leadership is exploring whether hospital resources can continue the program. ■ The site is in discussions with a private payer to fund a pilot asthma program.

Site	Sustainability Plans and Activities
Baystate Medical Center (MA)	■ Baystate will not continue to deliver asthma home-visiting services as funded under the CMMI award. ■ This site won a planning grant through the Green & Healthy Housing Initiative Social Innovation Financing project that will allow the site to conduct a feasibility analysis. The purpose of this award is to build capacity so that Baystate and their partner may develop pay-for-performance/social innovation financing for asthma home visiting.
Thundermist Health Center (RI)	■ Thundermist will return to its usual care management system, which provides limited asthma home visiting. The program will not continue in its current form. ■ This site is currently in negotiations with a private payer that may reimburse for an asthma home-visiting pilot program.
Middlesex Hospital (CT)**	■ Middlesex has not located a funding source to continue the program. ■ Middlesex will return to its usual care management system, which provides limited asthma home visiting.
Children's Medical Group (CT)**	■ Children's Medical Group has not located a funding source to continue the program and will not offer any enhanced services.
Rutland Regional Medical Center (VT)	■ Rutland incorporated a CHW into a Regional Chronic Care Team using Community Benefit funding from the hospital. A CHW may allocate up to 20 percent of her time to asthma home visiting. This shows the potential to be a long-term-sustainability approach. ■ The site will provide services to referred participants but will not actively recruit and will not provide asthma mitigation supplies to patients going forward.

NOTES: *Hasbro Hospital and St. Joseph's sites function jointly as a single site. **Both Connecticut sites indicated that they continue to advocate with state officials and insurance companies to provide for this or a similar program. CHW, community health worker.

In years one and two of the award, leadership met biweekly with sites to share lessons learned regarding retention, recruitment, and developing goals. In year three, meetings continued on a monthly basis as sites planned dissemination of results and continued fostering relationships with providers, stakeholders, and payers. Because of logistics and other factors beyond the program's control, such as frequent turnover in state Medicaid staff, HRiA leadership and sites developed state-specific strategies. As a convener of the Asthma Regional Council of New England, HRiA secured funding to educate providers and accountable care organizations (ACOs) about asthma home-visiting services, which may yield another path toward scalability and/or sustainability.

Rhode Island sites may have an opportunity to expand or sustain asthma home-visiting services under this initiative through state-based opportunities. For example, the Centers for Disease Control and Prevention's (CDC) 6|18 Initiative targets six common and costly health conditions using 18 proven specific interventions, and the state of Rhode Island chose to implement an evidence-based asthma home visiting intervention.[64] The CDC will provide technical assistance to a variety of entities, including state Medicaid programs, and will collaborate with providers and organizations to increase capacity to deliver 6|18 interventions.[65]

[64]Centers for Disease Control and Prevention. The 6|18 Initiative: Accelerating Evidence into Action. Available at: http://www.cdc.gov/sixeighteen/ .
[65]Centers for Disease Control and Prevention. At-a-glance: The 6|18 Initiative. Available at: http://www.cdc.gov/sixeighteen/docs/at-a-glance.pdf .

HRiA leadership learned valuable lessons with regard to engaging payers and stakeholders. The awardee stressed the importance of continued stakeholder engagement and rebuilding relationships in response to payer staff turnover. To the awardee's disappointment, one health plan decided that it could not fulfill a promise that it would reimburse for program services if Rhode Island sites could show a return on investment. HRiA leadership attributed this shift to changing priorities within the plan. Leadership also noted that payers have greater incentive to focus on cost-driving populations (i.e., adult populations), hard-to-reach populations, or other complex diseases relative to pediatric asthma.

Leadership recommended that future programs allocate enough time for demonstrating cost-savings analysis to ensure that outcomes can be observed and recorded before the program ends. Developing data use and business use agreements with multiple sites and payers can take significantly longer than expected, in addition to waiting for six- and 12-month participant follow-up data. Moreover, not all program participants yielded usable or accessible claims data. Leadership advised that during planning, similar programs should identify the number of participants required to demonstrate program effectiveness and use that number as the basis for establishing enrollment targets. Common challenges in obtaining complete data for participants included lack of identifying data collected by program staff, differing understandings of how to fill out consent forms, challenges in accessing plan data (see Context findings), and other issues.

Planned Analyses for the No-Cost-Extension Period

Through HRiA's internal evaluator, NORC received Medicaid data from Connecticut, Rhode Island, and Vermont. We also expect to receive Medicaid data from Massachusetts. These data are of varying quality, and NORC is currently resolving quality-related issues. Exhibits 6.7, 6.8, and 6.9 summarize characteristics of HRiA participants and comparison patients for the three states listed above. In the no-cost addendum (the final addendum to this report), NORC hopes to use Medicaid data to analyze core measures. Exhibit 6.7 summarizes demographic and other basic information about the treatment and comparison patients from Connecticut sites who are included in our analysis of core outcome measures.

Exhibit 6.7: Descriptive Characteristics of HRiA and Matched Comparison Patients (Connecticut Only)

Variable	HRiA	Comparison
	% (N)	% (N)
Number of Persons	84	84
Age Group		
<5 years old	28.6% (24)	39.3% (33)
5-9 years old	42.9% (36)	27.4% (23)
10-14 years old	22.6% (19)	21.4% (18)
≥15 years old	6.0% (5)	11.9% (10)
Gender		
Female	46.4% (39)	44.1% (37)
Race/Ethnicity		
White	56.0% (47)	55.6% (45)
Black	38.1% (32)	42.0% (34)
Hispanic	4.8% (4)	7.1% (6)
Other	6.0% (5)	2.4% (2)
Comorbidity: Chronic Illness and Disability Payment System (CDPS)		
CDPS risk score (SD)	1.5 (1.0)	1.5 (1.2)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$5,649 ($6,733)	$4,346 ($5,011)
Hospitalizations per 1,000 Patients (SD)	429 (765)	357 (688)
ED Visits per 1,000 Patients (SD)	2,112 (2,397)	2,440 (3,235)
Asthma-Related Hospitalizations per 1,000 (SD)***	405 (730)	119 (326)

NOTE: ***p<0.01, **p<0.05, *p<0.1. ED, emergency department; SD, standard deviation.

Exhibit 6.8 summarizes demographic and other basic information about the treatment and comparison patients from Rhode Island sites who are included in our analysis of core outcome measures.

Exhibit 6.8: Descriptive Characteristics of HRiA and Matched Comparison Patients (Rhode Island Only)

Variable	HRiA	Comparison
	% (N)	% (N)
Number of Patients	218	4,774
Mean Number of Quarters of Claims Available [Range]	7.5 [3-12]	10.0 [5–13]
Gender		
Female	44.5% (97)	41.1% (1962)
Age Group* **		
0–5 years old	58.3% (127)	31.5% (1,504)
6–10 years old	35.3% (77)	37.2% (1,774)
11–15 years old	5.5% (12)	24.2% (1,153)
≥16 years old	0.9% (2)	7.1% (343)
Race/Ethnicity		
White	5.0% (11)	14.3% (684)
Black	1.4% (3)	2.9% (137)
Other	93.6% (204)	82.8% (3,953)
Comorbidity: Chronic Illness and Disability Payment System (CDPS)		
Mean CDPS Score (SD)**	1.60 (1.90)	1.99 (2.96)
Mean Count of CDPS (SD)*	1.48 (0.89)	1.64 (0.93)
Mean Utilization and Cost in Claims (all years)		
Hospitalizations per 1,000 Patients (SD)**	32.1 (0.18)	77.1 (0.35)
ED Visits per 1,000 Patients (SD)*	1,161 (1.55)	781 (1.29)
Total Cost (SD)*	$34,180 ($62,157)	$13,735 ($66,671)

NOTE: ***p<0.01, **p<0.05, *p<0.1. ED, emergency department; SD, standard deviation.

Exhibit 6.9 summarizes demographic and other basic information about the treatment and comparison patients from Vermont sites who are included in our analysis of core outcome measures.

Exhibit 6.9: Descriptive Characteristics of HRiA and Matched Comparison Patients (Vermont Only)

Variable	HRiA	Comparison Pool
	% (N)	% (N)
Number of Patients	56	3,672
Mean Number of Quarters of Claims Available [Range]	7.2 [3-12]	9.2 [5–13]
Gender		
Female	35.7% (20)	42.0% (1,543)
Age Group* **		
0–5 years old	42.9% (24)	39.7% (1,457)
6–10 years old	37.5% (21)	28.3% (1,040)
11–15 years old	19.6% (11)	23.8% (873)
≥16 years old	0.0% (0)	8.2% (302)
Race/Ethnicity		
White	89.3% (50)	74.1% (2,731)
Black	3.6% (2)	2.5% (92)
Other	7.1% (4)	23.4% (849)
Comorbidity: Chronic Illness and Disability Payment System (CDPS)		
Mean CDPS Score (SD)**	1.25 (1.25)	1.15 (1.00)
Mean Count of CDPS (SD)*	1.07 (0.76)	1.11 (0.35)
Mean Utilization and Cost in Claims (all years)		
Hospitalizations per 1,000 Patients (SD)**	17.9 (0.13)	9.3 (0.10)
ED Visits per 1,000 Patients (SD)*	250 (0.64)	79.0 (0.32)
Total Cost (SD)*	$2,927 ($3,864)	$1,326 ($5,791)

NOTE: ***p<0.01, **p<0.05, *p<0.1. ED, emergency department; SD, standard deviation.

Limitations

Quantitative analyses were based on awardee-provided survey measures as reported by participant caregivers and did not have a comparison group. Although our analyses show significant reductions in asthma-related admissions, the findings are based on pre-post data. Some analyses have low power to detect significant associations, and results should be interpreted with caution. In addition, program participants reported utilization in the previous six months, but the average gap between home visits was less than four months, leading to a significant likelihood of duplication of observations across repeated measures. An impact analysis using claims data will be presented in the no-cost-extension addendum report.

Program impacts may be underreported if caregivers left the program after noticing improvement in their child's asthma control. Families who did not complete the program were generally healthier at baseline than families who did.[66] In addition, program staff noted that the more time that passed between program recruitment and an asthma-related hospitalization, the less likely caregivers were to take part in the program. Caregivers often felt that the period without an acute incident meant the asthma had come under control, even if this was not the case. Therefore, if caregivers felt that their child's asthma was better

[66]Participants who had not completed the final home visit were more likely to have an asthma action plan, higher Juniper Pediatric Asthma Caregiver Quality of Life scores, and lower environmental composite scores at the first home visit.

controlled as a result of the initial home visits, they might have been less likely to schedule a subsequent visit.

Qualitative data have several limitations. We developed our findings from visits and phone interviews with seven of nine sites. We collected data on the remaining two sites by reviewing reports from CMS's implementation contractor and any updates that HRiA leadership offered during interviews. In addition, sites led recruitment for focus groups, and therefore it is possible that a degree of selection bias shaped the positive patient and caregiver outcomes reported in our second and third annual reports.

Conclusion and Policy Implications

The HRiA program provided home-visiting services, family education, and environmental assessments to expand pediatric asthma support in Connecticut, Massachusetts, Rhode Island, and Vermont, using a workforce of CHWs and AE-Cs. We found some evidence of reductions in utilization. However, it is important to note that we were unable to construct a comparison group because claims data were not available in time to analyze for this report, and survey results are likely to include duplication across periods. No sites will continue implementing the program in full beyond the award period, but four will implement core components of the intervention, sustained by short-term funding. We expect that sites will continue to build relationships with payers, with the aim of sustaining the program long-term.

HRiA's positive impact on utilization provided further evidence to support the business case for reimbursable CHW-conducted home-visiting programs. Leadership noted challenges involved in engaging payers and state-level stakeholders. For example, state Medicaid staff turn over frequently or face competing priorities. Also, lack of access to payer data for a period of time made it difficult for the program to demonstrate its cost-effectiveness.

Policy makers may facilitate similar efforts by raising the profile of pediatric asthma in state- and national-level policies, such as the CDC's 6|18 Initiative.[67] This would make more payers and stakeholders aware of the importance of addressing this disease. In addition, CHW certification would support the intervention by helping to secure reimbursement for CHW services, make it easier to select individuals with appropriate credentials, ensure consistent training, and define the scope of a CHW's work.

[67]Centers for Disease Control and Prevention. At-a-glance: The 6|18 Initiative. Available at: http://www.cdc.gov/sixeighteen/docs/at-a-glance.pdf.

Trustees of Indiana University

Summary. Indiana University implemented the Aging Brain Care (ABC) program, a care management intervention employing a team of care coordinators (registered nurses), care coordinator assistants (lay health workers), and social workers. Using home visits, the program screened for disease progression and offered caregiver support, education in coping mechanisms, and advance care planning to older adults with dementia and/or depression.

Awardee Overview

SITES:	2 sites — Indianapolis and Lafayette, Indiana	***REACH:***	3,003 patients
AWARD:	$7,836,084	***TARGETED CONDITION:***	Dementia and depression
AWARD DATES:	October 2012—June 2015	***PAYER(S):***	Medicare

Key Findings

These key findings are based on quantitative analysis of Medicare claims (October 2012—December 2015), qualitative interviews with staff, and focus groups with program participants.

Implementation

Screening before hiring lay health workers and rigorous training led to qualified, empathetic staff and staff retention.

The team-based approach assured that clinical and other care needs were addressed by staff having appropriate credentials (e.g., RNs, social workers).

A custom tracking system (eMR-ABC) facilitated the intervention, but it may not integrate with all electronic health records (EHR) systems.

Utilization

Non-significant reductions in hospitalizations and ED visits

Cost

No clear trends for cost of care

Quality of Life and Care

Caregivers reported more stress relief

Improved communication among patients, caregivers, and their providers

Patients and caregivers developed better coping mechanisms

Sustainability and Scaling

The ABC Program has been sustained at both sites beyond the award period. It is a flagship program for Eskenazi Health's new Center for Brain Care Innovation in Indianapolis.

Indiana University also licensed the ABC model and the eMR-ABC case management software to Preferred Population Health Management for sale and distribution.

Introduction

Indiana University's Aging Brain Care (ABC) program provided care management through a team composed of nurses, social workers, and lay health workers (LHWs) for older adult patients with dementia and/or depression at Eskenazi Health in Indianapolis and at Indiana University Health–Arnett in Lafayette, Indiana. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[68] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

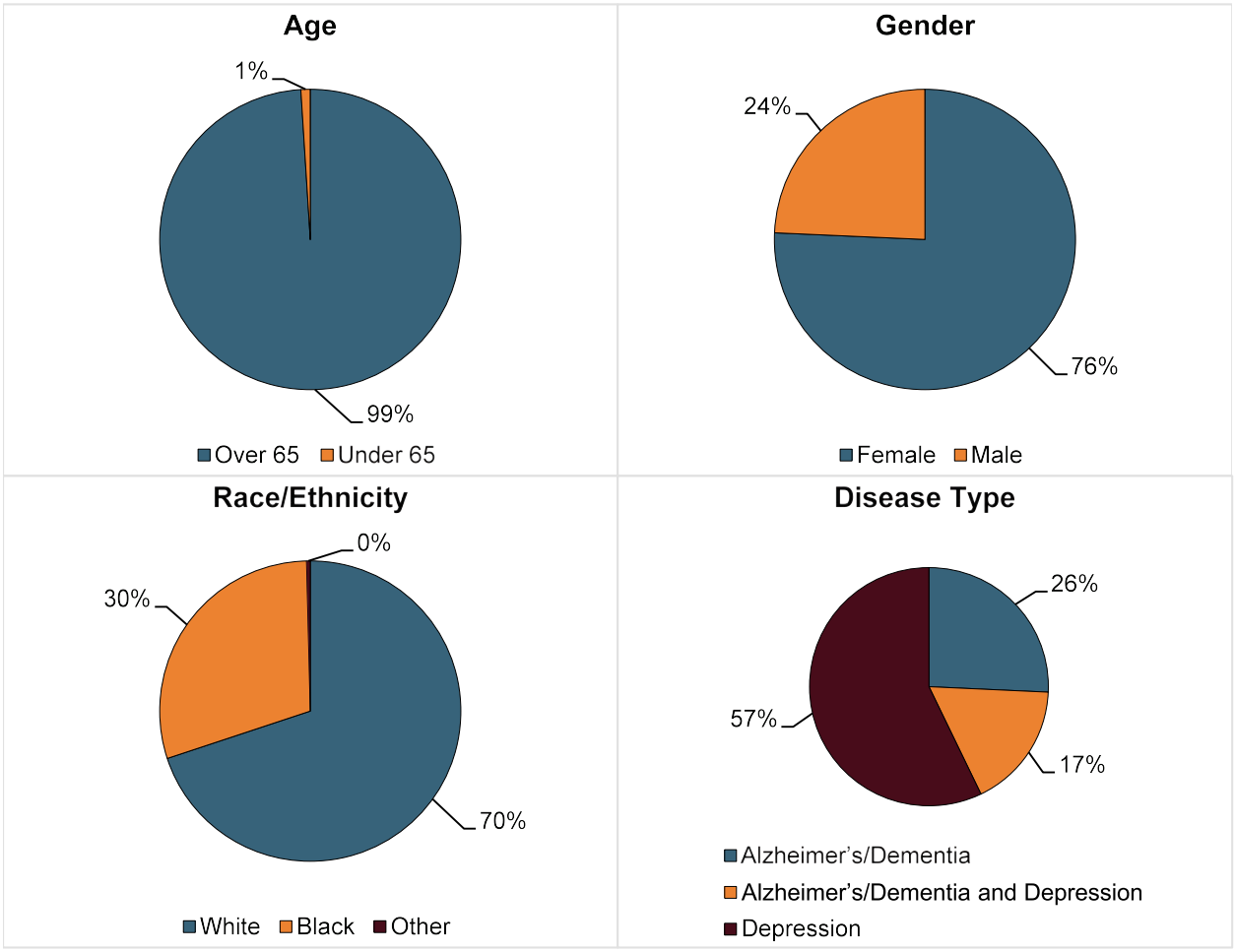
This evaluation analyzed claims data to assess the effectiveness of the ABC program in reducing cost and utilization and in improving quality of care. We examined differences in outcomes between ABC's patients and comparison patients over time, focusing on the following measures:

- all-cause hospitalizations
- hospitalizations for ambulatory care sensitive (ACS) conditions
- 30-day readmissions
- emergency department (ED) visits
- total cost of care

Exhibit 7.1 summarizes demographic and other basic information about the Indiana patients who are included in our analysis of core outcome measures.[69]

[68]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[69]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 7.1: Descriptive Characteristics of Indiana Patients



Summative program impact. Exhibit 7.2 summarizes the results of our difference-in-differences (DID) models, which included adjustment for key demographic and other risk factors.[70]

- There were no significant changes in ED visits, all-cause hospitalizations, 30-day readmissions, ACS hospitalizations, or total cost of care for patients in the Indiana program relative to the comparison group.

[70]We adjusted for dual-eligible status, prior-year ED visit, duration of dementia, age, race, disability, arthritis, hyperlipidemia, prior-year hospitalization, gender, depression, prior-quarter cost, cancer, hierarchical condition categories (HCC) scores, Alzheimer's disease, chronic obstructed pulmonary disease (COPD), chronic kidney disease (CKD), and hip fractures.

Exhibit 7.2: Difference-in-Differences Estimates for Core Measures for Indiana

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	-4 [-14, 6]
ED Visits per 1,000 Patients	2 [-12, 16]
30-day Readmissions per 1,000 Patients Hospitalized	-9 [-39, 21]
ACS Hospitalizations per 1,000 Patients	4 [-1, 9]
Total Cost of Care per Patient ($)	$60 [-$311, $431]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	$496,576 [-$2,589,755, $3,582,907]

NOTES: ***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 model. ED, emergency department; ACS, ambulatory care sensitive.

Quarter-specific program impact. Although the summative analysis showed no significant impacts of the Indiana program, our quarter-specific estimates suggested some positive trends. Quarterly fixed effects (QFE) charts of these estimates can be found in Appendix A, but the key findings include:

- For the first nine quarters, there was a non-significant trend toward fewer all-cause hospitalizations, ACS hospitalizations, and ED visits for Indiana participants relative to the comparison group. Although not statistically significant, in the majority of quarters, the point estimates indicate fewer events for Indiana participants.

Condition-specific Impact Estimates

Exhibit 7.3 summarizes results from a stratified analysis we conducted to determine if the impact of Indiana's program was different based on the patient's qualifying condition.[71] The Indiana program targeted patients with either dementia or depression or both and provided similar services to all patients:

- Similar to the analysis that included all Indiana participants, there were no significant differences in cost or utilization among any of the three condition groups—patients with dementia only, those with depression only, or those with both dementia and depression.

[71]For details on comparison group selection and propensity score methodology, please see Appendix A.

Exhibit 7.3: Difference-in-Differences Estimates for Core Measures for Indiana by Condition

Outcome Measure	DID Estimate [90% Confidence Interval]		
	Dementia	Depression	Both
Hospitalizations per 1,000 Patients	3 [-14, 20]	-4 [-16, 8]	-7 [-35, 21]
ED Visits per 1,000 Patients	-8 [-33, 17]	-2 [-20, 16]	29 [-13, 71]
30-day Readmissions per 1,000 Patients Hospitalized	4 [-54, 62]	-13 [-55, 29]	10 [-48, 68]
ACS Hospitalizations per 1,000 Patients	1 [-8, 10]	5 [-1, 11]	2 [-12, 16]
Total Cost of Care per Patient ($)	$12 [-$672, $696]	-$23 [-$495, $449]	$550 [-$476, $1,576]

NOTES: ***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 model. ED, emergency department; ACS, ambulatory care sensitive.

Long-term Care Placement Analysis

We compared rates of long-term care placement between Indiana participants and the comparison group.[72] These models looked at time to an event and estimated the relative hazard ratio of the event occurring.

- During the intervention period, similar numbers of Indiana participants and comparison patients were admitted to long-term care facilities (18 percent and 17.5 percent, respectively). Overall, there were no differences in the rate of long-term care facility admission for participants enrolled in the Indiana program relative to the comparison group (HR: 1.08; 95% CI: 0.89, 1.33).
- In analysis stratified by condition, there were also no differences in rate of long-term care placement for Indiana participants relative to comparison participants.

Qualitative Findings

As discussed in our second annual report, patients and caregivers who participated in focus groups and telephone interviews noted improvements in their quality of life, quality of care, and utilization.[73] Below, we discuss the drivers behind behavior changes and then outline the major findings that support replicating and scaling up this program in other regions.

Participants reported that the program's home visits reduced their health care utilization. Patients visited their doctors less frequently because care coordinator assistants (CCAs) completed assessments or arranged for nurses to provide treatment in their homes. One caregiver remarked that the nurse's treatment of her husband's injury from a fall was better than care provided previously in the ED and that

> *"I think [the CCA has] given me more confidence. I feel better…. [The CCA explained] how to get along with people that you're meeting for the first time and then manage [their expectations by saying] 'you've got to be pretty specific when you talk with me about this because my memory's not going to hold on to it very well' and that kind of thing. I try to let everybody who I'm social with be aware of what my problem is."*
>
> —Program Participant

[72]For details on comparison group selection and propensity score methodology, please see Appendix A.
[73]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

the CCA had become her main contact with her husband's health care providers.

Participants relied on their CCAs to test for disease progression, reassure them about their symptoms, and teach them coping mechanisms. Participants with early-stage dementia were eager to know whether their condition had deteriorated and appreciated having in-home assessments to "normalize" their condition.

Caregivers and participants appreciated program staff's kindness and caring nature. One caregiver mentioned that the CCA brought his mother her favorite food, and another described how calmly the CCA spoke with her mother when she became incontinent but refused to admit it or address it directly. Participants appreciated the informality and friendly tone of the conversations with the CCA that also served to assess their cognitive state or well-being. Through the support of the CCA, caregivers realized that they needed to take care of themselves as well.

> *"Before this program came in, I was stressed and frustrated. I felt like a lone ranger and that everyone was going about their lives and even though I opted to take care of my mother…. Just to know that someone [like the CCA] cares and that there's some other options out there.... I've calmed down considerably…I'm doing what I need to do for me so that I can take care of them."*
>
> —Caregiver of Program Participant

Cross-Site Variation

Availability of social services and supports varied across sites. Arnett, in Lafayette, Indiana, serves a less urban population than Eskenazi in Indianapolis. Program staff at Arnett described long waiting lists to receive social services in their area and limited transportation options. Although they did not have a social worker on their care team, they built relationships with hospital staff members who were responsible for social services. Arnett staff continued to make referrals and seek voluntary support when possible. They developed and shared a binder of resources to try to help patients directly. In contrast, Eskenazi staff reported having access to resources to address patient needs. Eskenazi also had a social worker on its ABC team to address social issues with participants.

> *"To get help from [an area agency on aging], the timeframe to waiting is so long. And some patients are in their 90s; they do not have two years to wait. It could be home care, home services. Some need someone to come clean their house, or a homemaker service to help cook. They may not need assisted living, but they need that kind of help so it's a long waiting list to get anything like that. We scramble to fill that void."*
>
> —Care Coordinator Assistant

Workforce

Indiana's program sought to address shortages in the geriatric workforce by employing LHWs as CCAs and developed a screening protocol to reliably identify empathetic staff. It adapted the Multiple Mini Interview (MMI) tool—increasingly used to screen medical school applicants—to screen for one or more abilities, including the ability to communicate clearly, to present a reasonable explanation, to explain a protocol, and to describe someone in a kind way.[74] The CCA MMI involved a series of six interviews in which actors simulated older adult patients and caregivers, and the interviewers

[74]Cottingham A, Adler C, Austrom M, et al. New workforce development in dementia care: screening for "caring": preliminary data. *J Am Geriatr Soc*. 2014;62:1364-1368.

scored their performance. Those hired were reassessed after one year and were still found to be suitable for their role. The job retention rate was reported to be 84 percent.

LHWs conducted tasks affecting clinical outcomes, such as monitoring medication adherence and monitoring medications that have the potential to adversely affect disease progression. LHWs were trained to advise patients about taking medications regularly and to notify providers if they suspected that a patient was taking anticholinergic medications, including alternative and over-the-counter medicines. Anticholinergics are used for various conditions—e.g., hypertension, insomnia, or Parkinson's disease—but can also cause confusion, memory loss, worsening of mental function, and other cognitive effects in older adults.[75]

Leadership indicated that, to be effective, LHWs required clear guidance and support. Although committed to working with LHWs, leadership described some challenges in communicating roles and protocols to LHWs as they evolved throughout the implementation period. One member of the leadership team held monthly meetings that served as support groups for the LHWs.

Context

By operating in an area with fewer home and community-based supports for older adults than in other parts of the country, the ABC program supported aging in place. Indiana ranked 42nd in a national scorecard that considered supply and availability of alternatives to nursing homes.[76] In recruiting participants for home visits, CCAs reported that they had to overcome participants' fears that the program would put them in a nursing home. Caregivers reported that, without the help of the CCA, they would have needed to place their loved ones in a nursing home. Conversely, increased attention to participants' social support and physical environment might have facilitated or even encouraged nursing home placements in some cases.

Sustainability, Scalability, and Spread

Eskenazi Health and Arnett continued the intervention beyond the award period. Both sites had internal institutional support that led to ongoing funding for program staff, including the CCAs. Leadership cited positive program outcomes as incentive for institutional support. Eskenazi founded the new Sandra Eskenazi Center for Brain Care Innovation, and the ABC medical home is a flagship program of the new center.

To facilitate spread, program leads licensed the intervention through an agency called Preferred Population Health Management.[77] Their proprietary package includes:

- Software: eMR-ABC, specialized care coordination software used to generate care plans, track care coordination tasks, and monitor patient and caregiver responses to the care protocols
- Paper materials: protocols, handouts for participants, assessments, and training curriculum

[75]Cafasso J. What are anticholinergics used to treat? Available at: http://www.healthline.com/health/anticholinergics#Purpose2.
[76]Long-term Services and Supports. Raising expectations; a state scorecard on long-term services and supports for older adults, people with physical disabilities, and family caregivers; June 19, 2014. Available at: http://www.longtermscorecard.org/.
[77]http://www.preferredphm.com/

- Standard operating procedures: recommended workforce, implementation process, interview and hiring process, and a simulation-forecasting model for payers

As of January 2016, contracts have been signed with two area agencies on aging and one home health agency.[78] In addition, Preferred Population's home health agency will use the ABC model.

Limitations

Indiana's program serves a heterogeneous patient population that included both people with dementia and those with depression. This heterogeneity created challenges in selecting an appropriate comparison group. To mitigate this risk, we exact-matched participants with respect to diagnosis (dementia, depression, or both) and included parameters with residual differences (defined as $p<0.10$ after propensity score selection) in all regression models to ensure that the two groups were similar in observable factors. We also conducted analysis stratified by participant diagnosis and found no differences compared with the main analysis. Our quantitative analysis of readmission included only patients with an index hospitalization, thereby reducing the sample size in these models and limiting our power to detect differences.

We developed our findings from site visits and phone interviews with both sites. We collected data by reviewing reports from CMS's implementation contractor and any updates that Indiana leadership offered during interviews. Sites participated in recruitment for focus groups and telephone interviews, and therefore it is possible that a degree of selection bias shaped the positive patient and caregiver outcomes that we reported.

Conclusion and Policy Implications

Indiana University developed the ABC program to provide team-based care coordination for dementia and/or depression by employing a workforce of nurses, lay health workers, social workers, and physicians in Indiana. For the first nine quarters, we found a non-significant decrease in ED visits and hospitalizations (all-cause and ACS) among Indiana participants relative to a comparison group. This trend was supported by qualitative findings on reduced utilization.

Program leaders, patients, and caregivers also reported that the program reduced caregiver and patient stress in coping with a degenerative condition such as dementia. Patients and staff appreciated the CCAs' kindness and learned more about their condition and how to manage it from lay CCAs. Although Indiana's ABC program did not result in cost savings to Medicare relative to a comparison group, its use of LHWs may make it less expensive than other treatment approaches.

With institutional support to sustain the program at the two intervention sites, the program is trying to disseminate and replicate its model through the distribution of licensed materials. Internal improvements to cost and utilization influenced administrators' decision to continue the program. There is also evidence that Indiana and its large LHW workforce improved quality of care for patients. Both improved quality of

[78]Wall JK. Firm aims to nationally distribute brain care innovation. *Indianapolis Business Journal*. January 9, 2016. Available at: http://www.ibj.com/articles/56560-firm-aims-to-nationally-distribute-brain-care-innovation?utm_source=this-week-in-ibj&utm_medium=newsletter&utm_campaign=2016-01-09.

care and reduced program costs have policy implications for the use of LHWs in geriatric care. Qualitative findings indicate that LHWs helped participants with few home- and community-based service resources to age in place, although we do not observe statistically significant improvements in our analysis of institutional placement. Program costs would be further reduced if LHW services were reimbursable.

Innovative Oncology Business Solutions, Inc.

Summary. Innovative Oncology Business Solutions, Inc. (IOBS) is a New Mexico–based for-profit corporation created for the purpose of administering the Community Oncology Medical Home (COME HOME) model. COME HOME provided integrated, coordinated care to patients with cancer through three main program components: triage pathways, enhanced access, and treatment pathways.

Awardee Overview

SITES:	7 practices across Florida, Georgia, Maine, New Mexico, Ohio, Texas	***REACH:***	5,349 patients[79]
AWARD:	$19,757,338	***TARGETED CONDITIONS:***	Breast, colon, lung, thyroid, pancreas, lymphoma, and melanoma cancer
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare

Key Findings

These key findings are based on quantitative analysis of Medicare claims (July 2012—December 2015), qualitative interviews with staff, and focus groups with program participants.

Implementation

Strong leadership and staff buy-in were critical to successful implementation of the oncology medical home model.

Existing electronic health records (EHRs) and an organizational culture focused on quality improvement facilitated timely implementation.

Capacity to adapt the model while maintaining fidelity to its core components allowed for successful replicability across seven sites.

Utilization

ED visits reduced by 13 per 1,000 patients

ACS hospitalizations reduced by 3 per 1,000 patients

Cost

Significantly lower average cost of care ($612 less per patient per quarter)

Significant decreases in cost of care in the last 30 to 90 days of life ($959–$5,790 per patient)

Quality of Care

May prevent or reduce the need for intensive treatment for patients at the end of life

Sustainability and Scaling

Six of the seven COME HOME practices have continued the program after the end of the award period. All six offer same-day appointments and use the triage and treatment pathways, but only three sites continue to offer extended hours either in the evening or on the weekend.

In addition to the six COME HOME practices, 10 new practices have expressed interest in using the COME HOME triage pathway system.

[79]This number represents patients targeted by COME HOME. An estimated 30,000 received services by the IOBS program.

Introduction

Innovative Oncology Business Solutions, Inc. (IOBS) used licensed practical nurses (LPNs) and registered nurses (RNs) to implement and test the Community Oncology Medical Home (COME HOME) program. COME HOME supported patient symptom management via a triage line and provided enhanced access to outpatient care for symptomatic adult patients with cancer during evenings and weekends. Over the course of the award, the program served approximately 5,300 patients across seven community oncology practices. The goal of the COME HOME program was to reduce emergency department visits, readmissions, and total cost of care for patients with cancer. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[80] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

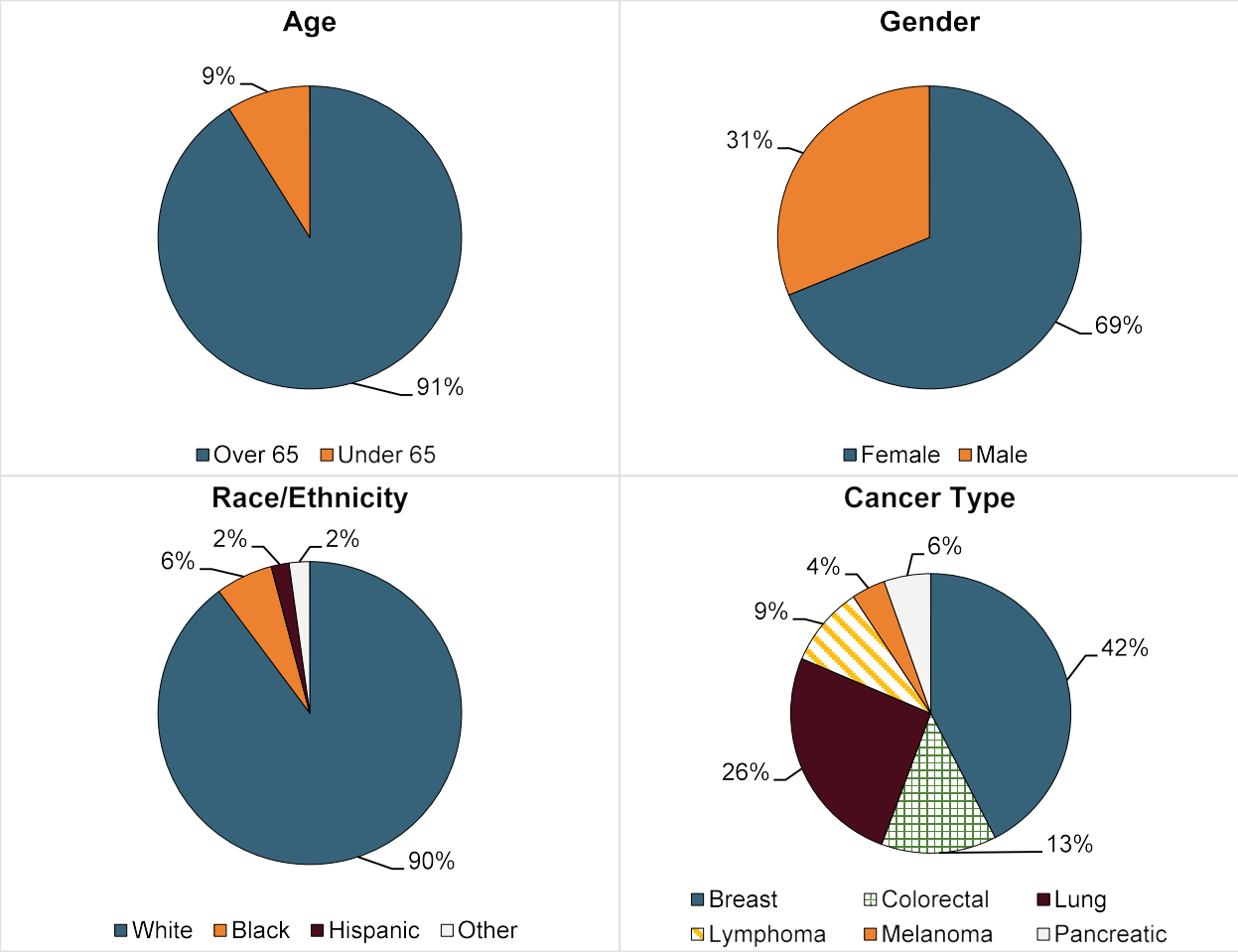
This evaluation analyzed claims data to assess COME HOME's effectiveness in reducing cost and utilization and in improving quality of care. We examined differences in outcomes between COME HOME patients and comparison patients before and after the intervention, focusing on the following measures:

- all-cause hospitalizations
- hospitalizations for ambulatory care sensitive (ACS) conditions
- 30-day readmissions
- emergency department (ED) visits
- total cost of care

Exhibit 8.1 summarizes demographic and other basic information about the IOBS patients who are included in our analysis of core outcome measures.[81]

[80]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[81]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 8.1: Descriptive Characteristics of IOBS Patients



Summative program impact. Exhibit 8.2 summarizes the results of our difference-in-differences (DID) model, which included adjustments for key demographic and other risk factors.[82,83]

- The COME HOME program significantly decreased ED visits (13 per 1,000 patients), ACS hospitalizations (three per 1,000 patients), and total cost of care ($612 per patient) for its participants relative to the comparison group.
- There were no significant decreases in hospitalizations and 30-day readmissions for participants in the COME HOME program relative to the comparison group.[84]

[82]We adjusted for type of cancer, age, gender, race/ethnicity, dual eligibility, disability, ESRD, HCC score, cancer surgery, chemotherapy, radiation, and metastatic cancer.

[83]For the no-cost extension report, we will adjust the DID impact estimate by incorporating baseline (pre-HCIA) provider differences in utilization and cost associated with six-month beneficiary-episodes of incident cancers.

[84]Sample size in readmission models is smaller than other outcomes because readmissions models are limited to patients who had at least one index hospitalization.

Exhibit 8.2: Difference-in-Differences Estimates for Core Measures for IOBS

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	2 [-5, 9]
ED Visits per 1,000 Patients	**-13 [-21, -5]*** **
30-day Readmissions per 1,000 Patients Hospitalized	-16 [-41, 9]
ACS Hospitalizations per 1,000 Patients	**-3 [-6, 0]***
Total Cost of Care per Patient ($)	**-$612 [-$979, -$245]*** **
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	**-$12,887,923 [-$20,612,821, -$5,163,025]*** **

NOTES: ***p<0.01, **p<0.05, *p<0.1. ACS, ambulatory care sensitive; ED, emergency department.

Cross-Site Variation

Variation across sites and its potential influence on programmatic impact remain an important question for the evaluation. Implementation of similar multifaceted cancer care programs suggests variation exists at the individual, organizational, and environmental levels.[85] In this section we explore two research questions related to IOBS's cross-site experience:

- Are there higher-performing sites among the seven sites?
- Is there a relationship between implementation factors and program impact?

Exhibit 8.3 summarizes quantitative findings and two workforce factors, nurse to patient ratio and triage nurse integration, for the seven IOBS sites. Nurse to patient ratio varied from 11 at Dayton Physicians Network to 579 at the Center for Cancer and Blood Disorders. Four of the seven sites had triage nurses broadly integrated into larger interdisciplinary teams. For outcome measures, we found that three sites showed reductions in total cost of care, two showed reductions in readmissions, and two showed reductions in ED visits. One site significantly increased hospitalizations. Northwest Georgia Oncology Centers was the only site that showed reduction in total cost of care as well as utilization.

To answer our first research question, we found that three sites (Northwest Georgia Oncology Centers, Austin Cancer Center, and Space Coast Cancer Center) had the greatest reductions in total quarterly cost of care (ranging from $825 to $1,741). A fourth small site (Dayton Physicians Network) also showed a non-significant but promising trend of $2,168. The remaining three sites had varying strength of evidence. New England Cancer Specialists had no significant findings but a meaningful reduction of $529 per patient quarter. New Mexico Cancer Center, the flagship site, had non-significant increases in total cost of care. The Center for Cancer and Blood Disorders had two unfavorable findings, statistically significant increases in hospitalization and total cost of care.

[85]Clauser SB, Johnson MR, O'Brien DM, et al. Improving clinical research and cancer care delivery in community settings: evaluating the NCI community cancer centers program. Implement Sci. 2009;4:63. Available at: http://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-4-63.

As for our second research question, although there does not appear to be a relationship between nurse-to-patient ratio and program effectiveness, we do observe a potential relationship between triage staff integration and effectiveness. For the three sites where the triage nurse is not integrated into the care team, we observe non-significant increase in total cost of care.

There are many limitations to this brief analysis and we encourage readers to interpret with caution. Few programs in this evaluation portfolio possess the sample size to adequately explore cross-site variation and IOBS is not an exception. Sites having fewer than 500 participants may lack the sample size to detect impacts. However, given the importance of understanding whether there are higher-performing sites, we chose to examine differences in outcome measures for exploratory purposes.

Exhibit 8.3: IOBS Differences across Sites

Site	N§	Key Quantitative Findings			Cross-Site Variation	
		Hospitalizations [90% CI]	ED Visits [90% CI]	Total Cost of Care [90% CI]	Average # Patients/ Triage Nurse	Triage Staff Integrated into Care Team
Northwest Georgia Oncology Centers (Marietta, Georgia)	1,243	4 [-9, 17]	**-36 [-51, -21]*** **	**-$825 [-$1,499, -$151]** **	375	Yes
Austin Cancer Center (Austin, Texas)	505	9 [-10, 28]	-7 [-25, 11]	**-$1,551 [-$2,368, -$734]*** **	476	Yes
Space Coast Cancer Center (Titusville, Florida)	366	-3 [-26, 20]	23 [-3, 49]	**-$1,741 [-$2,881, -$601]** **	209	No
New Mexico Cancer Center (Albuquerque, New Mexico)	347	-17 [-36, 2]	**-33 [-60, -6]** **	$285 [-$999, $1,569]	78	No
Center for Cancer and Blood Disorders (Fort Worth, Texas)	625	**26 [6, 46]** **	0 [-20, 20]	**$1,015 [$3, $2,027]***	579	No
New England Cancer Specialists (Scarborough, Maine)	534	2 [-17, 21]	-16 [-40, 8]	-$529 [-$1,511, $453]	94	Yes
Dayton Physicians Network (Dayton, Ohio)	44	-19 [-80, 42]	-31 [-113, 51]	-$2,168 [-$4,359, $23]	11	Yes

NOTES: ***p<0.01, **p<0.05, *p<0.1. §N = number of treatment beneficiaries in each group. CI, confidence interval.

Subgroup Analysis: Cancer Type

The COME HOME program targeted patients with seven types of cancers. Research has shown that outcomes for cancer care may vary by cancer type.[86] Furthermore, our findings from interviews and focus groups with program participants and staff indicated that patients with certain cancer types may be more inclined to take more advantage of the triage line or may benefit more from the program than others. Therefore, we examined whether the program effects varied by cancer type. Exhibit 8.4 summarizes the impact of the COME HOME program for patients with breast, colon, lung, lymphoma, melanoma, and pancreatic cancers.[87]

- We saw significant reductions in utilization and costs only for breast cancer. The COME HOME program significantly reduced ED visits (23 per 1,000 patients) and total cost of care ($717 per patient) for patients with breast cancer.
- We observed a significant increase in hospitalizations (28 per 1,000 patients) for patients with colon cancer.

Exhibit 8.4: Difference-in-Differences Estimates for Core Measures for IOBS, by Cancer Type

Average Quarterly Impact [90% Confidence Interval]						
Outcome Measure	**Breast Cancer (n = 1,554)**	**Colon Cancer (n = 487)**	**Lung Cancer (n = 940)**	**Lymphoma (n = 342)**	**Melanoma (n = 144)**	**Pancreatic Cancer (n = 197)**
Hospitalizations per 1,000 Patients	-7 [-15, 1]	**28 [4, 52]***	7 [-12, 26]	16 [-8, 40]	3 [-33, 39]	29 [-16, 74]
ED Visits per 1,000 Patients	**-23 [-33, -13]*****	-13 [-34, 8]	-4 [-26, 18]	17 [-11, 45]	30 [-13, 73]	25 [-27, 77]
30-day Readmissions per 1,000 Patients	-17 [-59, 25]	35 [-25, 95]	-18 [-66, 30]	-12 [-94, 70]	77 [-64, 218]	36 [-76, 148]
Total Cost of Care per Patient ($)	**-$717 [-$1,088, -$346]*****	-$558 [-$1,889, $773]	-$584 [-$1,541, $373]	-$924 [-$2,637, $789]	$1,850 [-$771, $4,471]	-$10 [-$1,972, $1,952]

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

Subgroup Analysis: End of Life

Along with assessing the overall effectiveness of the COME HOME program, we explored the program's impact on end-of-life utilization, quality, and cost. We explored the average differences in end-of-life outcomes between deceased COME HOME participants and a comparison group for the following measures:

- utilization in last 30 days of life: hospitalizations and ED visits
- quality of care in last two weeks of life: hospice use and chemotherapy
- total cost of care in last 30, 90, and 180 days of life

[86]Keating NL, Landrum MB, Lamont EB, Bozeman SR, McNeil BJ. Area-level variations in cancer care and outcomes. Med Care. 2012;50(5):366-373.

[87]We exclude thyroid cancer from the subgroup analyses of cancer due to low sample size (n = 12).

For the 1,244 IOBS participants who passed away during the study period, we identified those enrolled in the program 30, 90, and 180 days prior to date of death and selected a group of comparison patients using propensity score matching.[88,89] Exhibit 8.5 summarizes demographic and other basic information about IOBS patients who were included in our end-of-life analysis.[90]

Exhibit 8.5: Descriptive Characteristics of IOBS Patients, End-of-Life Analysis

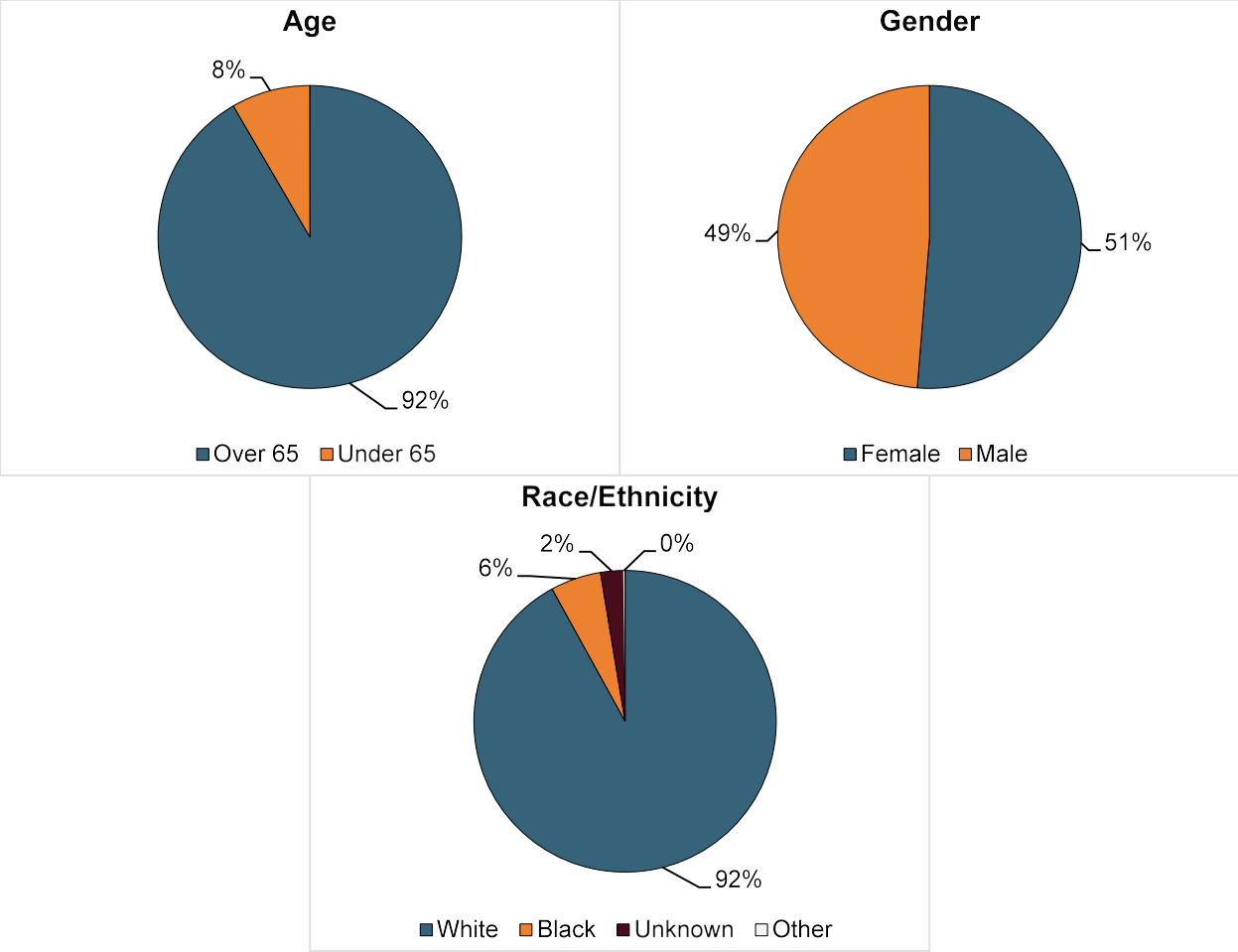


Exhibit 8.6 summarizes the adjusted impact of the COME HOME program in the patients' last days of life.[91]

- COME HOME program participants had lower cost of care relative to the comparison group in the last 30, 90, and 180 days of life.

[88]For 30-, 90-, and 180-day outcome measures, we included in our analytic sample participants enrolled in the IOBS program for 30, 90 and 180 days, respectively.

[89]For details on comparison group selection and propensity score methodology, please see Appendix A.

[90]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

[91]We adjusted for age, gender, race/ethnicity, dual eligibility, HCC score, disability, prior year hospitalizations and cost, chemotherapy, radiation, cancer surgery, metastatic cancer, high-risk cancer, and number of cancer diagnoses.

Exhibit 8.6: Differences in End-of-Life Utilization, Quality, and Cost between IOBS Program Participants and Comparisons

Average Quarterly Impact	
Outcome Measure	**Adjusted Difference [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	-23 [-52, 6]
ED Visits per 1,000 Patients	8 [-18, 33]
Hospice Care in the Last Two Weeks of Life	27 [-1, 56]
Chemotherapy in the Last Two Weeks of Life	-56 [-119, 8]
30-Day Total Cost of Care per Patient ($)	**-$959 [-$1,880, -$39]***
90-Day Total Cost of Care per Patient ($)	**-$3,346 [-$4,811, -$1,880]*****
180-Day Total Cost of Care per Patient ($)	**-$5,790 [-$7,812, -$3,768]*****
Aggregate Impact	
Outcome Measure	**Adjusted Difference [90% Confidence Interval]**
30-Day Total Cost of Care per Patient ($)	**-$1,192,996 [-$2,338,720, -$48,516]*****
90-Day Total Cost of Care per Patient ($)	**-$4,162,424 [-$5,984,884, -$2,338,720]*****
180-Day Total Cost of Care per Patient ($)	**-$7,202,760 [-$9,718,128, -$4,687,392]*****

NOTE: ***p<0.01, **p<0.05, *p<0.1

Qualitative Findings

As discussed in our second annual report, patients and caregivers who participated in interviews noted improvements in their quality of life, quality of care, and utilization.[92] Below, we discuss the drivers behind changes in core measures and outline the major findings that support replicating and scaling up this program in other regions.

Actively managing patients' symptoms in the outpatient setting through enhanced access to the clinic may lead to reductions in ED visits. From the start of the program, clinic staff educated patients about the program and encouraged them to call the triage line early when facing adverse effects from treatment instead of waiting, calling another provider, or going to the ED. Guided by the triage pathways, staff were able to help patients manage symptoms at home or to treat them in the office during same-day appointments or weekend hours. IOBS patients reported that this enhanced access helped them avoid unnecessary ED visits. Patients used this access for urgent issues and felt secure that their care team could immediately address their needs.

Workforce

Our cross-site analysis suggests promising trends across multiple sites despite the variation across sites. As noted in our second annual report,[93] the workforce model varied by site. Existing staffing models and organizational culture determined how sites approached the triage process. For example, at one site medical assistants (MAs) assigned to specific physicians filled the triage role for patients they regularly saw in the office. Similarly, another site used a primary nurse model in which registered nurses (rather than medical assistants) were also assigned to a specific physician and saw the same patients regularly. In

[92]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[93]Ibid.

this model, nurses worked both in the clinic and on the triage line; rather than having specific nurses dedicated only to the triage line, each nurse took calls from their own patients. The more experienced oncology nurses worked the most independently when implementing the triage pathways, whereas MAs often consulted with physicians, who in some cases recommended an approach that deviated from the triage pathways.

Sites also varied in how and where their nursing staff were situated in the practice's overall workflow. At three sites, triage nurses functioned completely independently from the care team. Triage nurses took calls in an office removed from the clinic so that they could focus solely on triage, whereas other sites had nurses who worked both in the clinic and on the triage line. Triage nurses who were located away from the physicians in the clinic managed only the triage line, whereas triage nurses who were in the clinic worked side by side with physicians and participated in patient visits. These nurses had established face-to-face personal relationships with the patients calling the triage line.

Context

The implementation of the COME HOME program varied across all seven oncology practices. Each practice adapted the program to fit its particular organizational culture.

Strong physician leadership and staff buy-in were critical to the successful implementation of an oncology medical home model. Organizational and structural aspects of the COME HOME program required some sites to make a cultural shift. For example, to implement the enhanced access component of the program, some staff members were required to work additional hours beyond the normal clinic hours. One appeal of working for a community practice rather than a hospital is not having to work late hours or on weekends; IOBS therefore noted that this shift could occur only by considering existing staff capacity and perspectives and obtaining their buy-in. Strong physician leadership at each site facilitated implementation by educating other physicians and staff members about how the program works and how it benefits both patients and the practice as a whole.

Sustainability, Scalability, and Spread

Six of the seven COME HOME practices have continued the program to some degree after the end of the CMMI award period. The practice[94] that is not continuing was recently purchased by a nearby hospital system. All six practices offer same-day appointments and use the triage and treatment pathways. The practices pay a monthly licensing fee to maintain their access to the COME HOME triage pathway software. Only three sites are continuing to offer extended hours either in the evening or on the weekend. In addition to these six sites, at least 10 other practices have expressed interest in using the COME HOME triage pathway system. Five of the COME HOME practices[95] are also participating in CMMI's Oncology Care Model (OCM), a new payment model for physician practices that administer chemotherapy.

[94]Space Coast Cancer Center was acquired by Health First, an integrated health system located in central Florida.
[95]The New Mexico Cancer Center, the Center for Cancer and Blood Disorders, Dayton Physicians Network, New England Cancer Specialists, and Northwest Georgia Oncology Centers were selected to participate in the Oncology Care Model.

Although adherence to the three core components of the program—triage pathways, enhanced access, and treatment pathways—remains important, the adaptability of some components may encourage replicability in other settings. The program reported several factors to consider when initiating similar programs. As described by staff, the conditions facilitating successful implementation included:

- strong leadership and staff buy-in
- existing program components in place through medical home accreditation
- an existing EHR system

Limitations

Because our quantitative analyses excluded patients with cancers other than the seven selected ones, as well as patients with multiple cancers, we might not have captured the overall impact of the IOBS program.

Qualitatively, our findings are based on visits and telephone interviews with four of the seven sites. We collected data on the remaining three sites by reviewing reports from the HCIA implementation contractor and any updates that IOBS leadership offered during interviews. Sites led recruitment for patient and caregiver interviews, and it is possible that a degree of selection bias shaped the positive patient and caregiver outcomes reported in our second and third annual reports.

Conclusion and Policy Implications

IOBS developed the COME HOME program to provide integrated, coordinated care to cancer patients across seven community oncology practices in Florida, Georgia, Maine, Ohio, New Mexico, and Texas. We found significant reductions in total cost of care, ED visits, and ACS hospitalizations. These reductions were driven by significant decreases in costs and utilization for patients with breast cancer. Analyses of deceased patients showed that the program significantly reduced end-of-life costs. Six of the seven COME HOME practices continued the program after the end of the CMMI award period.[96] All six offer same-day appointments and use the triage and treatment pathways, but only three sites offer extended hours either in the evening or on the weekend.

In an effort to lower costs and improve care, providers and payers are testing new models of oncology care that promote value-based care such as CMMI's Oncology Care Model (OCM).[97] The COME HOME program's favorable impact on utilization and cost provides further evidence to support models that provide integrated, coordinated care for patients with cancer. However, replicating this model may require significant practice transformation. IOBS specifically selected the seven practices due to their strong leadership, willingness to change, and existing practices that included elements of the model.

[96]Space Coast was acquired by Health First, a hospital system: http://www.floridatoday.com/story/news/local/2015/09/18/health-first-acquires-space-coast-cancer-center/72420684/.
[97]Center for Medicare & Medicaid Services. Oncology care model. Available at: https://innovation.cms.gov/initiatives/oncology-care/.

Joslin Diabetes Center, Inc.

Summary. Joslin Diabetes Center implemented a diabetes education program called On the Road (OTR). OTR used trained lay and clinical community health advocates (CHAs) to deliver community classes focused on diabetes management and prevention, nutrition, and exercise, and offered community-based screenings.

Awardee Overview

SITES:	3 sites across Washington, DC; New Mexico; and Pennsylvania[98]	***REACH:***	5,100 patients
AWARD:	$4,967,276	***TARGETED CONDITION:***	Diabetes
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare, Medicaid, commercial

Key Findings

These key findings are based on quantitative analysis of awardee-collected data (July 2012—June 2015), qualitative interviews with staff, and focus groups with program participants.

Implementation

Sites had flexibility to offer different supplementary education and cooking classes.

The simple curriculum appeals to low-literacy participants, but others may benefit from more in-depth education.

Participants enjoyed learning in groups and sharing with peers.

Staff's lack of clinical credentials may leave some important participant questions unanswered.

Utilization

Significant improvement in HbA1c levels, exercise, diet, sleep, and lower blood pressure among participants with diabetes and those at high risk for diabetes.

Cost

Data are not available to evaluate this measure.

Quality of Care

Most participants made an appointment with a health care provider as a result of the program.

Sustainability and Scaling

Classes will continue at the New Mexico and Pennsylvania sites in partnership with New Mexico State University under grants from the US Department of Agriculture and Pennsylvania State University, respectively. The program will not continue at the DC site.

Joslin will add a new location in Pikeville County, Kentucky, and is pursuing accreditation of OTR through the American Diabetes Association (ADA), which would eventually allow for Medicare and Medicaid reimbursement.

[98]Implementation partners include one hospital and two state university extension offices.

Introduction

The Joslin Diabetes Center's (Joslin) On the Road (OTR) program used trained community health advocates (CHAs) to deliver screening and health information classes on diabetes management and prevention, nutrition, and exercise in community settings. Over the course of the award, the program served approximately 5,100 participants across three sites affiliated with New Mexico State University, Pennsylvania State University's Cooperative Extension Office, and Providence Hospital in Washington, DC. The goals of OTR were to improve educational, clinical, and behavioral indicators associated with diabetes and to engage participants with the health care system. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[99] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

We analyzed awardee-collected data to assess the effectiveness of this program in improving selected clinical indicators, health behavior, and health care system engagement. For the Joslin OTR program, we examined changes in outcomes, focusing on the following measures:

- appointments with primary care physicians
- confidence and understanding in managing diabetes
- measures of diet, exercise, sleep, and seeing a health care provider
- patient activation measure (PAM)
- blood pressure measurement
- hemoglobin A1c (HbA1c) readings

Exhibit 9.1 summarizes population and diabetes measures we were able to use to analyze the effectiveness of the OTR program. Measures of health such as exercise habits, eating fruits and vegetables, and sleeping are continuous measures in addition to a binary measure of whether the respondent did the activity four or more days a week. Measures of confidence in controlling diabetes and ability to explain HbA1c measurement were assessed on strength of agreement. Blood pressure and HbA1c readings were assessed based on clinically significant thresholds (140/90 mmHg and 7.5 percent, respectively).

[99] Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

Exhibit 9.1: Overview of Joslin Outcome Measures

Outcome Measures	Description of Measure
Healthy Behaviors	Exercising 20 minutes or more
	Eating a variety of fruits and vegetables
	Sleeping between 6.5 and 8.5 hours at night
	Making an appointment to see a provider
	Patient Activation Measure (PAM)[100]
Diabetes Measures	I'm confident that I can keep my diabetes under control.
	How well do you think you could explain your HbA1c result to someone else?
	Was HbA1c less than 7.5%?
	Was systolic blood pressure less than 140 and diastolic less than 90?

Exhibit 9.2 summarizes demographic and other characteristics of the program participants, comparing those participants who completed follow-up sessions with those who completed only initial assessments. Joslin provided data files with information from 5,100 participants enrolled in the OTR program. Of these, 3,122 (61 percent) completed both baseline and follow-up surveys.[101] Follow-up refers to a new measurement point rather than to receiving additional program touches. As Joslin implemented the OTR program in areas with high prevalence of diabetes, the majority of the intervention participants (57 percent) had diabetes.[102] Participants who completed a follow-up visit were different from the full group of participants. They were statistically more likely to be White, to be over 65 years old, and to have less than a high school education compared with the full group.

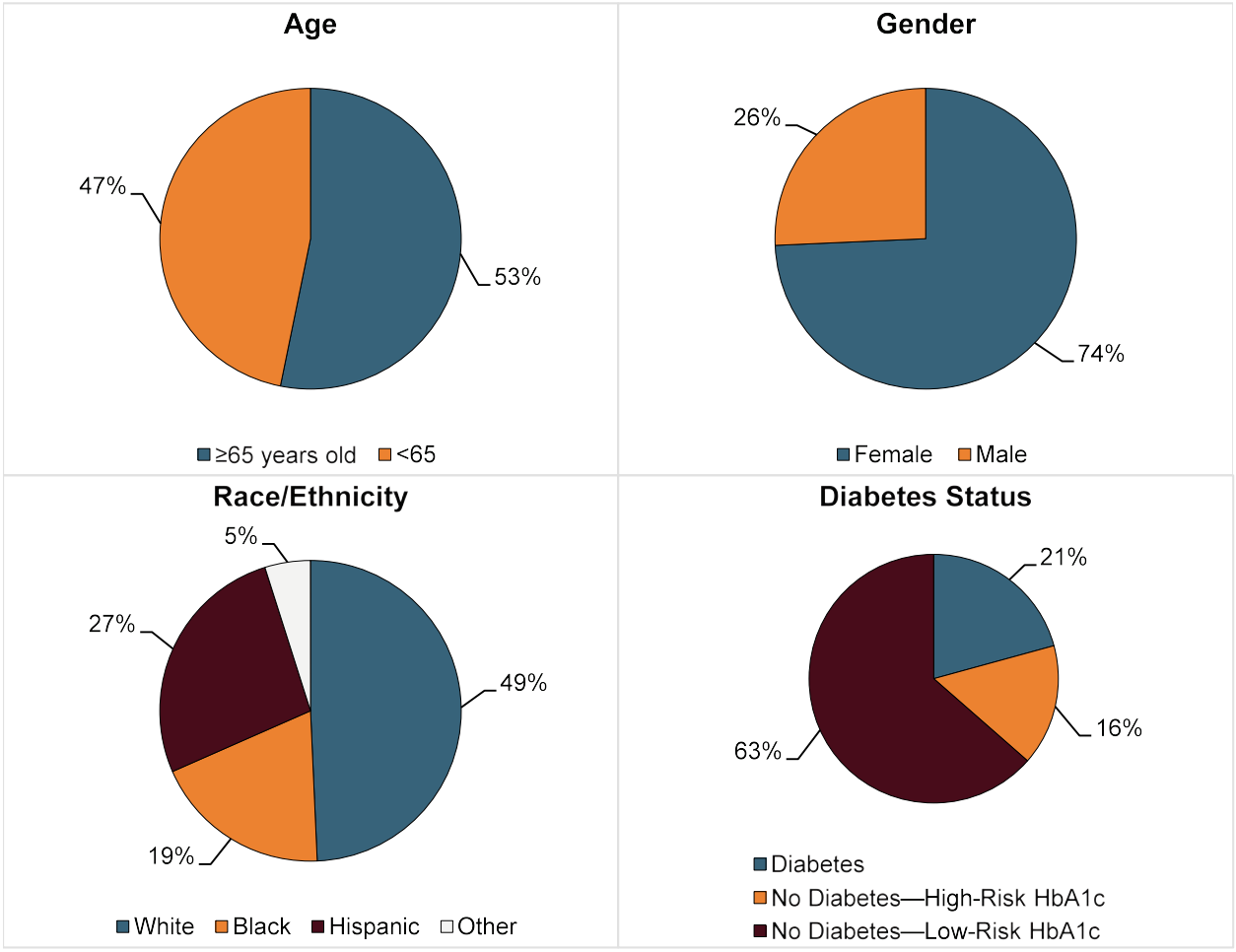
[100]For details on PAM, please see http://www.insigniahealth.com/products/pam-survey.

[101]One hundred seventy-four participants of that 61 percent subpopulation completed a third measurement ("second follow-up") of their blood pressure and HbA1c. Others (39 percent) did not complete the follow-up survey.

[102]Diabetes is defined as responding Yes to the question, "Do you have diabetes?" or reporting using diabetes medications. Participants with a measured HbA1c between 5.7 and 6.4 were classified as having a high-risk HbA1c, and those with a measured HbA1c less than 5.7 were classified as having a low-risk HbA1c.

Exhibit 9.2a: Descriptive Characteristics of All Joslin OTR Participants

Exhibit 9.2b: Joslin OTR Participants with At Least One Follow-Up Survey



Summative program impact. Exhibit 9.3 summarizes improvements in key outcomes as well as the average (mean) change.[103] Persons who already scored at or above the threshold value for a given measure (e.g., already exercised four or more times per week for ≥20 minutes) were not included in that measure:

- Approximately 78 percent of participants with diabetes and 57 percent of persons at high risk for diabetes undertook the effort to engage with the health care system and made an appointment with a provider.
- For participants with diabetes, we observed significant improvements in all measured outcomes.
- Participants at high risk for diabetes significantly improved across all measures of health habits, in their ability to explain their HbA1c results, and in lowering blood pressure to less than 140/90 mmHg.

[103]Engagement with the health care system is assessed by the percentage of patients who have made an appointment to see a provider. All other measures are assessed as the change in percentage of patients meeting a given threshold at baseline of the program compared with completion of the program.

Exhibit 9.3: Joslin's Overall Program Performance for Patients with Diabetes

	Baseline	3-Month Follow-up	N Change	% Change
Full Population with Any Follow-up (N = 3,122)				
Exercising (a)	39.2%	45.8%	176	+6.6%***
Healthy diet (b)	70.9%	80.0%	245	+9.1%***
Good sleep (c)	78.0%	81.0%	81	+3.0%***
Made an appointment to see a health care provider*	n/a	65.2%	1,985	n/a
Persons with Diabetes (n = 1,819)				
Exercising (a)	37.2%	43.6%	99	+9.4%***
Healthy diet (b)	72.8%	79.8%	109	+7.0%**
Good sleep (c)	76.2%	79.0%	45	+2.8%***
Made an appointment to see a health care provider	n/a	77.5%	1,367	n/a
Confidence (d)	60.4%	70.4%	145	+10.0%***
Understanding HbA1c (e)	26.1%	39.8%	226	+13.7%***
HbA1c <7.5%	68.9%	73.6%	80	+4.7%***
Good blood pressure (f)	58.2%	67.3%	156	+9.1%***
Patient Activation Measure (PAM) for People with Diabetes (n = 348)				
Mean PAM Score: (range 0–100)	61.7	68.2	13	+6.5***
Mean PAM Level: (range 1–4)	2.8	3.1	0	+0.3***
Persons without Diabetes, but at High Risk Based on HbA1c Level (n = 454)				
Exercising (a)	40.6%	47.2%	26	+6.6%**
Healthy diet (b)	70.1%	82.0%	47	+11.9%***
Good sleep (c)	79.8%	83.3%	14	+3.5%*
Made an appointment to see a health care provider*	n/a	57.1%	253	n/a
Confidence (d)	61.2%	61.7%	1	0.50%
Understanding HbA1c (e)	20.3%	43.1%	89	+22.8%***
HbA1c <7.5%	100.0%	99.1%	-4	-0.90%
Good blood pressure (f)	70.0%	80.1%	44	+10.1%***
Patient Activation Measure (PAM) for Patients with Prediabetes (n = 348)				
Mean PAM Score: (range 0–100)	60.8	68.6	na	+8.6***
Mean PAM Level: (range 1–4)	2.7	3.1	na	+0.4***

NOTE: (a) Exercising ≥20 minutes ≥4 days per week. (b) Eating a variety of fruits and vegetables ≥4 days per week. (c) Sleeping between 6.5 and 8.5 hours at night ≥4 days per week. (d) Confidence: "Agree" or "Strongly Agree" that I am confident I can keep my diabetes under control. (e) Understanding: Could explain HbA1c result to someone else "very well." (f) Blood pressure: systolic <140 and diastolic <90. *Baseline, change, and p-value fields are not applicable because engagement with the health care system is only measured in the follow-up survey. ***p<0.01, **p<0.05, *p<0.1.

In the text below, we report the odds ratios and 90% confidence intervals in brackets from multivariate logistic regression models that include selected characteristics of the participants and adjustment for key

demographic and other risk factors (please see Appendix A for the complete results).[104, 105] We estimated improvements in the outcomes of each measure for the subpopulation of participants "eligible" for improvement or those who were not already meeting program targets, such as exercising four or more times per week. However, the program did not have a specific target level of patient engagement, and we therefore report changes in PAM scores for all persons with a baseline and follow-up test.

Odds ratios (OR) reflect the odds of the outcome occurring relative to the reference group, controlling for all other covariates listed. Odds ratios >1 reflect higher odds of improvement relative to the reference group; ratios <1 reflect a lower odds. We caution that the sample sizes for some outcomes, particularly for estimating impacts on persons with prediabetes, are small, thereby leading to wide confidence intervals. We observed a number of trends from these analyses:

For participants with diabetes:

- Women had greater odds (OR = 1.5) of improving their exercise frequency compared to men but were less likely to report increased engagement (OR = 0.4).
- Relative to White participants, Black participants were less likely to reduce their blood pressure (OR = 0.4). Hispanic participants were more likely than Whites to increase their exercise levels.
- Persons with public insurance were more likely to improve their frequency of exercise (OR = 2.3) as were persons with private insurance (OR = 2.0) compared with persons with no insurance.
- There were very few statistically significant differences across outcomes by education, with the exception of exercise: participants with at least a college education were more likely to increase their frequency of exercise.
- We found few significant differences in any of the outcomes for persons who completed their follow-up survey more than four months after completing the program.

Women and Black participants were less likely to reduce HbA1c levels below 7.5 percent.

We found few differences at baseline and in change in all outcomes by insurance status.

For participants at high risk of developing diabetes:

- We found no difference between men and women in the likelihood of improvement in healthy behaviors, blood pressure, HbA1c levels, or patient engagement.
- We also found no differences in improved outcomes by age, except that persons ≥75 of age were more likely to improve their confidence in explaining HbA1c results (OR = 3.94, [1.05, 14.83]).
- Relative to White participants, Black participants were more likely to improve their understanding of HbA1c scores (OR = 3.38, [2.21, 5.18]).

[104]We focus the discussion on significant findings. We estimated odds ratios (ORs) where there was sufficient sample size in each category of the characteristics for estimation of the model. Therefore, ORs for some characteristics could not be estimated for all outcomes.

[105]We adjusted for age, gender, race/ethnicity, insurance coverage (public, private, or none), health status (good or better versus fair/poor), and, where the sample size allowed, education, number of sessions attended, site, and whether the survey was taken within less than four months after completing the program.

- Relative to those with private insurance coverage, we found only one difference in outcomes among insurance groups: persons with private coverage were less likely to improve their amount of sleep, relative to persons with no insurance.

Overall, the improvements described in Exhibit 9.3 were not closely associated with any particular participant characteristics. This suggests that the program can be appropriate for, and may be adapted for, different groups. We also examined whether participants who completed a second follow-up survey maintained levels of HbA1c and blood pressure between the three-month follow-up survey and the second follow-up (Exhibit 9.4). On average, participants took the second follow-up 14.5 months after the first follow-up test. We found that approximately 10 percent fewer respondents had blood pressure below 140/90 at the second follow-up relative to the three-month follow-up (63 percent compared with 74 percent). We also found about the same proportion of participants with blood pressure below the recommended 140/90 at baseline compared with second follow-up. We found no significant differences in HbA1c levels between the three-month follow-up survey and the second follow-up, indicating that these participants sustained their control of diabetes.

Exhibit 9.4: Joslin HbA1c and Blood Pressure for Persons Who Completed a Second Follow-Up

Outcome	Blood Pressure (<140/90)	HbA1c (<7.5)
Time	**Percent (N)**	**Percent (N)**
Baseline	66.3 (108)	79.9 (135)
First follow-up	73.6 (120)*	85.2 (144)**
Second follow-up	63.2 (103)**	85.2 (144)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Asterisks indicate statistical significance of t-tests in differences between consecutive tests (baseline compared with first follow-up, follow-up compared with second follow-up). Data are reported for persons with test results at all three time points (N = 163).

Qualitative Findings

As discussed in our second annual report, participants who took part in focus groups and telephone interviews noted gains in their quality of life and quality of care and positive behavior changes.[106] Below, we present findings regarding the drivers behind behavior changes and outline findings specific to potential replication and scaling this program in other regions.

Future programs can add to the OTR curriculum for participants who want in-depth or tailored diabetes information. One site manager reported that participants with low literacy benefited from the simple program materials. However, staff at another site reported that the curriculum did not add to understanding of more complex self-management activities among some participants. Findings presented in the second annual report show that positive outcomes were not consistently associated with higher program dosage. This may suggest that a broader curriculum covering more topics would not reduce the program's impact on retained knowledge and behavior changes.[107] Finally, we note that the current staffing model may not be sufficient to provide more in-depth information or to address participants' complex diabetes questions (please see workforce findings in the section below).

[106]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[107]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

Participants appreciated learning in a group setting and their efforts to achieve lifestyle changes benefited from sharing experiences with peers. Participants across all three sites commented on the value of hearing about other people's experiences. Some noted that they would call and ask each other questions after classes. In New Mexico, six of the 10 interviewed participants kept in touch with their classmates and would discuss their numbers and strategies for improvement after the diabetes class. Likewise, participants in both Washington, DC, and New Mexico reported that they started walking or exercise groups with other participants on their own. A couple of participants mentioned feeling more accountable in a group setting.

> *"You've learned so many little things in these courses and I think the fact that with the support group I think we're going to be able to share things, you know, and see what's working for some people and what's working for others."*
>
> —Program Participant

> *"I think a support group is very important. I know I have been more diligent since I've been coming to this class."*
>
> —Program Participant

Cross-Site Variation

Sites might have benefited from sharing lessons learned about implementation, especially as two sites had prior experience in implementing the program. As mentioned in our first annual report, because sites did not communicate among themselves, they lost an opportunity to share information on supplemental education and materials and recruitment strategies. This might have helped implementation efforts. Exhibit 9.5 provides detail on site variation.

Exhibit 9.5: Joslin Differences across Sites

Site	Educator Qualifications	Participant Recruitment Tools	Supplemental Components
New Mexico*	▪ Training from Ben Archer in health education ▪ Experience as a *promotora*	▪ Flyers ▪ Community connections (churches, clinics, etc.) ▪ Outreach letters/phone calls ▪ Provider referrals ▪ Payment incentives for CHAs	▪ Hour-long sessions ▪ Cooking classes/cookbooks ▪ Exercise bands ▪ Fitness videos and DVDs ▪ Foot care classes ▪ Journals (to record HbA1c levels) ▪ Nutritional information books
Pennsylvania*	Registered dietitians, nutritionists, or educators who taught classes for the PSU extension offices for years	▪ Community connections (senior centers, hospitals, clinics, physician offices, etc.) ▪ Mailed brochures ▪ Newspaper advertisements	▪ Two-hour sessions ▪ Cooking classes/cookbooks ▪ Pedometers ▪ Portion placemats ▪ Supplemental PowerPoint presentations
Washington, DC	Health- or social work–related bachelor's degree	▪ Flyers ▪ Community events (senior centers, health fairs, misc. community events, etc.) ▪ Provider referrals	▪ Exercise bands ▪ Pedometers ▪ Highlighted key information on large sheets of paper instead of using Joslin-provided flip charts

NOTE: *Prior experience in implementing OTR. PSU, Pennsylvania State University.

Supplemental hands-on cooking classes and incentive materials might have driven behavior changes at two sites. Participants appreciated cooking classes, cookbooks, exercise bands, and fitness videos provided by the sites, often citing them as some of the most helpful parts of the program. Participants at the Washington, DC, site received fewer supplemental components (e.g., cooking classes, cookbooks, fitness videos, and so forth), which may explain why they were less likely to improve their exercise habits, compared with New Mexico participants. New Mexico and Pennsylvania participants mentioned using supplemental materials more than DC participants, and a New Mexico CHA reported that the materials helped her recruitment efforts.

Workforce

Employing staff who are credentialed to address specific needs and to provide in-depth clinical information or social support would be a useful improvement to the workforce design across sites. The program could not ensure that participants received answers to their more complex clinical questions. Many participants would have liked to consult with clinical staff during OTR sessions instead of waiting to follow up with their doctors. Participants appreciated having access to clinically licensed nutritionists and dietitians.

The Pennsylvania site, which employed these professionals, saw the most improvement in diabetes outcomes. However, staff noted that there were no formal mechanisms to address community barriers, such as lack of access to affordable, healthy food. Our findings suggest that there are opportunities to enhance the standard educational curriculum with clinical or social work consultations provided by credentialed staff.

Context

The following endogenous characteristics facilitated implementation:

- prior organizational experience in implementing OTR
- experienced or credentialed staff
- preexisting relationships between staff and the community
- preexisting relationships between program and the community

Environmental conditions and knowledge of community characteristics affected program implementation. Staff noted that the dearth of resources in their area (e.g., access to affordable, healthy food, transportation) may partly explain some participants' inability to make changes. Understanding community and population characteristics enabled staff to tailor their teaching and/or engagement approaches. Transportation challenges, weather, and long travel times hampered participants' ability to attend classes, which may be a challenge for future programs that rely on a limited number of program touches. For example, many participants were unable to attend classes in the summer due to vacations or caring for children during the summer break; inclement weather also posed a barrier to attendance, and the program had to reschedule classes due to snowstorms.

Sustainability, Replicability, and Spread

Joslin plans to continue the OTR program in its entirety at the New Mexico site, supported by grants from the US Department of Agriculture, and at the Pennsylvania site, as well as at a new location in Pikeville County, Kentucky. Sites will not continue to be reimbursed $200 for each baseline participants and an additional $100 for each three-month follow-up. The program's principal investigator has trained two staff members at the Pikeville County site to deliver the OTR program with an emphasis on the "Eating Well and Keep Moving, Keep Healthy" curriculum components. The program did not continue at the Washington, DC, site.

Limitations

Our results may not be representative of the entire population that Joslin served, as there are significant differences in the characteristics of the 3,122 individuals who attended follow-up appointments and the 1,978 who did not. As with many self-reported survey measures, we were unable to verify the health habits measures. Analysis would be more robust if claims data were available to supplement the measures presented in this chapter. The small number of participants who completed a second follow-up (N = 174) and the mixed results of the tests administered at that time—showing sustained improvement in HbA1c control but regression to baseline in blood pressure control—suggest the need for additional study to determine whether gains made by the intervention were maintained over time.

Furthermore, we do not have access to claims data to directly measure impact on health care utilization and costs. Based on recent innovation award findings for another prediabetes intervention, it is plausible that Joslin could influence claims-based findings.[108] Sites participated in recruitment for focus groups and participant phone interviews, and it is possible that a degree of selection bias shaped the positive patient outcomes reported in our second and third annual reports.

Conclusion and Policy Implications

Joslin created its diabetes education program to deliver screening and classes on exercise and nutrition. We found significant improvements in HbA1c, diet, exercise, sleep, and blood pressure among participants with diabetes and improvements in exercise, diet, and blood pressure among participants at risk of diabetes. Joslin's OTR program may increase patient understanding of diabetes and HbA1c and increase confidence to manage diabetes among those with the disease. Two sites will continue to implement the program, and the awardee will open a new site in Kentucky.

Prevalence of both diagnosed and undiagnosed diabetes is growing rapidly in the United States.[109] Although we did not definitively find that program participants adopted long-term changes, the demonstrated knowledge gains show a large gap in what those at risk for or diagnosed with diabetes know about this disease. Other diabetes education interventions have shown long-term improvements in diabetes incidence and management. For example, participants in the community-based Diabetes Self-

[108] https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/ActuarialStudies/Downloads/Diabetes-Prevention-Certification-2016-03-14.pdf

[109] Centers for Disease Control and Prevention. National diabetes statistics report, 2014. Both 2014 and 2002 estimates estimate prevalence of diagnosed and undiagnosed diabetes. Available at: http://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf and http://www.the-wow-collection.com/software/ndfs_2003.pdf. Accessed May 26, 2016.

Management Program showed improvements in communication with physicians, patient activation, and self-efficacy at 12 months.[110] Similarly, the Diabetes Prevention Program has been shown to delay or reduce incidence of diabetes over a three-year period, particularly through its lifestyle change components (e.g., healthy diet, exercise, and so forth).[111] Our results in combination with the literature suggest that community-based education classes have the potential to reach undiagnosed or high-risk individuals with education that drives behavioral changes such as those observed in this evaluation.

[110] Lorig K, Ritter PL, Villa FJ, Armas J. Community-based peer-led diabetes self-management: a randomized trial. *Diabetes Educ.* 200;35(4):641-651.
[111] Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl j Med.* 2002;346(6):393-403.

Le Bonheur Community Health and Well-Being

Summary. Le Bonheur Community Health and Well-Being (Le Bonheur) implemented Changing High-Risk Asthma in Memphis through Partnership (CHAMP), a program focused on improving pediatric asthma care management and reducing asthma triggers for high-risk asthma patients. The CHAMP program provided comprehensive asthma care management, education, and social support via home visits using specialist-led clinical care teams and community health workers (CHWs).

Awardee Overview

SITE:	1 hospital in Tennessee	***REACH:***	497 patients
AWARD:	$2,896,415	***TARGETED CONDITION:***	Pediatric asthma
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicaid

Key Findings

These key findings are based on quantitative analysis of Medicaid claims data (July 2012—June 2015), qualitative interviews with staff, and focus groups with caregivers of program participants.

Implementation

CHAMP program supports (e.g., teaching caregivers strategies to manage their child's asthma at home, working with schools in the community, and developing care plans in the clinic) likely contributed to reduced utilization and costs.

The CHAMP program's specialist-based model is difficult to sustain and spread without active engagement of primary care providers for follow-up and ongoing management.

CHWs appreciated opportunities for ongoing training.

Utilization

ED visits reduced by 39 per 1,000 children

Cost

Total cost of care reduced by $536 per child per quarter

Quality of Care

Caregivers of participants reported reduced stress.

Sustainability and Scaling

The CHAMP program will continue to operate with some modifications; the program will restrict CHW case load and CHW contacts and will use a slightly smaller workforce. Program leaders received funding to develop a long-term social impact bond strategy to support the program.

The program will continue to enroll new patients but will limit the number of patients at any given time to 400 and will limit the number of new patients who enrolled during the year to 250.

Introduction

Le Bonheur Community Health and Well-Being's (Le Bonheur) Changing High-Risk Asthma in Memphis through Partnership (CHAMP) program offered integrated specialist care with home-visiting support provided by community health workers (CHWs). During the award period, the program served approximately 500 children with asthma in Memphis and Shelby County, Tennessee. CHAMP aimed to reduce unnecessary hospitalizations and emergency department (ED) visits for participating children. This chapter presents summative findings of program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[112] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

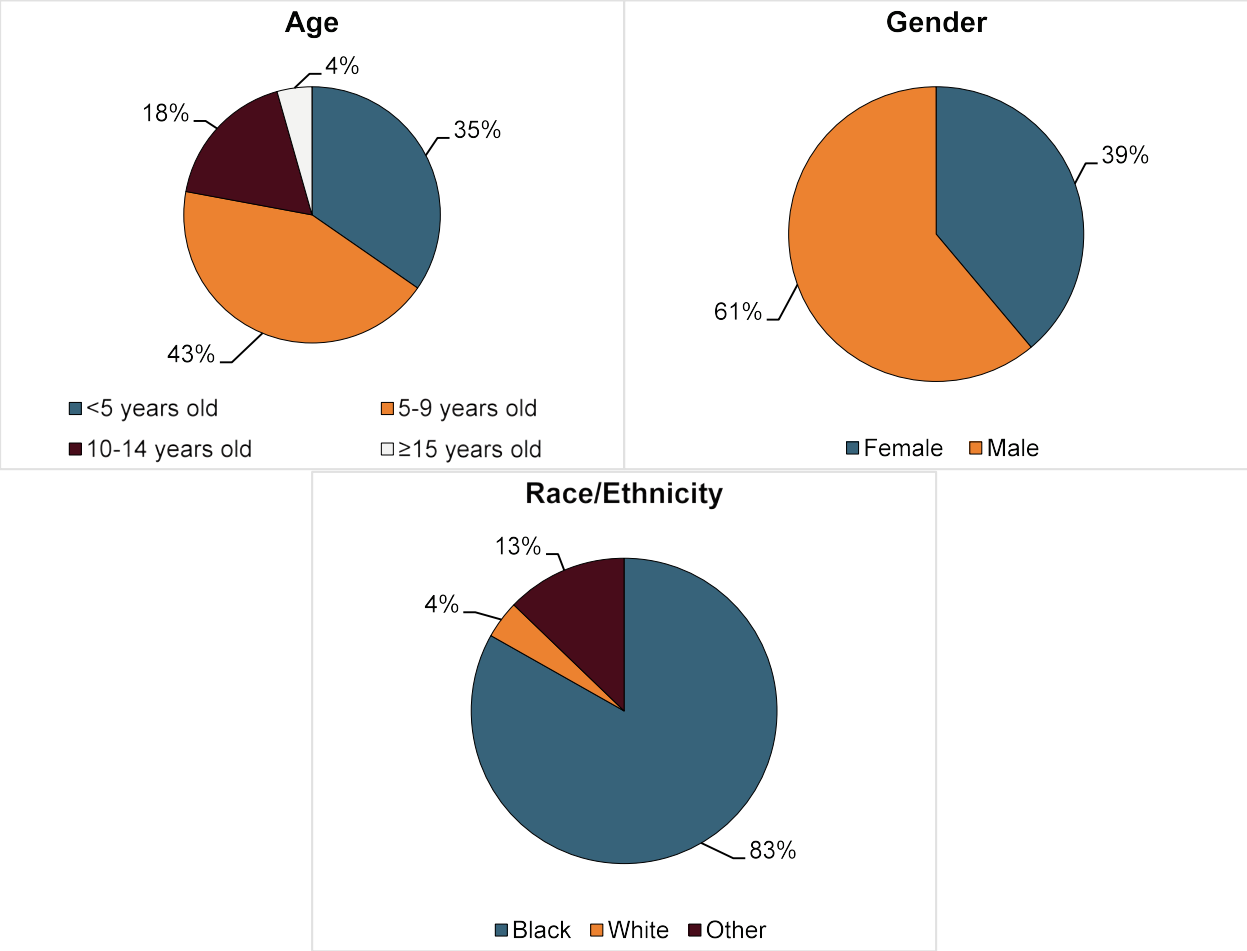
We analyzed claims and program data to assess the effectiveness of the CHAMP program in reducing costs and utilization and in improving quality of care. For the Le Bonheur CHAMP program, we explored differences in outcomes between CHAMP patients and comparison patients, focusing on the following measures:

- all-cause hospitalizations
- asthma-related hospitalizations
- emergency department (ED) visits
- total cost of care

Exhibit 10.1 summarizes demographic and other basic information about the Le Bonheur patients who are included in our analysis of core outcome measures.[113]

[112]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[113]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 10.1: Descriptive Characteristics of Le Bonheur Patients



Summative program impact. Exhibit 10.2 summarizes the results of our difference-in-differences (DID) model, which included adjustments for key demographic and other risk factors:[114,115]

- There was a significant reduction (39 per 1,000 patients) in ED visits for children in Le Bonheur's program relative to the comparison group.
- There was a significant reduction in total cost of care (reduction of $536 per child per quarter) for children in Le Bonheur's program relative to the comparison group. However, this estimate does not account for program costs.
- There were no significant reductions in hospitalizations or asthma-related hospitalizations per 1,000 patients in Le Bonheur's program relative to the comparison group.

[114]We were unable to show DID results for the outcome of 30-day readmissions because there were not sufficient events in the treatment population.

[115]We adjusted for age, race, gender, and prior year CDPS risk score.

Exhibit 10.2: Difference-in-Differences Estimates for Core Measures for Le Bonheur

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	-8 [-19, 3]
ED Visits per 1,000 Patients	**-39 [-67, -11]****
Asthma-Related Hospitalizations per 1,000 Patients	1 [-14, 16]
Total Cost of Care per Patient ($)	**-$536 [-928, -143]****
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	**-$1,696,766 [-$2,939,220, -$454,311]****

NOTE: ***p<0.01; **p<0.05; *p<0.1.

Qualitative Findings

As discussed in our second annual report, caregivers who participated in focus groups noted gains in their quality of life and quality of care and decreases in utilization.[116] Below, we discuss the drivers behind behavior changes and then outline the major findings that support replicating and scaling up this program in other regions.

Patient Experiences

The CHAMP program provides asthma care management support to caregivers in three settings: clinic, home, and community. We hypothesize that this approach contributed to the associated reductions in total cost of care and hospitalizations.

Clinic

The CHAMP clinic team provided individualized and targeted care management by using spirometry testing, allergy testing, and prescription fill history data to develop care plans. During patients' initial CHAMP clinic visits, the CHAMP clinic team collected detailed information, including allergy testing results, spirometry testing results, and medical history. The clinical team also developed an asthma registry that displayed prescription fill data (updated monthly via an electronic claims feed); this helped program staff identify and target participants who either failed to fill prescriptions or who appeared to be overusing medications. They then reached out to these participants to offer additional education and support to encourage proper medication adherence.

> *"I love [the specialist] and she is going to check when his medication is being refilled and how often you are administering it…. She is going to make sure you fill it every 30 days."*
>
> —Caregiver of Program Participant

Home

Asthma education provided by the CHAMP clinical staff and CHWs helped caregivers manage asthma exacerbations at home and reduced ED visits. Participants received asthma education from a

[116] Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

certified asthma educator (AE-C) and physician specialist during their initial clinic visit. This education was reinforced by CHWs during home visits. CHWs also conducted environmental assessments, provided a cleaning kit, and educated caregivers about how best to remediate asthma triggers in the home safely.

Access to the 24/7 CHAMP line also helped caregivers avoid ED visits. After the initial clinic visit, caregivers received access to a 24-hour CHAMP hotline that they were encouraged to call when their child had an asthma exacerbation that required further assistance. The hotline was staffed by emergency medical technicians (EMTs) who followed a protocol developed by CHAMP program staff. The EMTs used the protocol either to help caregivers manage the exacerbation at home or to advise them to seek care at the ED. Le Bonheur reported that, among 157 calls involving breathing problems since the program's inception, 113 (72 percent) were treated at home, 33 (21 percent) were treated in the ED, and only 11 (7 percent) were admitted to the hospital.

Community

Caregivers appreciated CHAMP's outreach and efforts to educate local schools about asthma management, as lack of school engagement caused significant stress for many caregivers. Memphis-area schools are not required to have a school nurse at every school, and school nurse turnover is particularly high. As a result, many caregivers reported that their child's school was not equipped to manage children's asthma symptoms during the school day. Caregivers reported that schools did not administer medication consistently and sent children home or to the ED in the event of an exacerbation. Through the CHAMP program, at least 57.1 percent of participants shared an asthma action plan with their schools. Caregivers in the focus group expressed appreciation for the CHAMP asthma care coordinator's outreach to schools to provide asthma education and instructions about asthma action plans. The CHAMP asthma care coordinator (ACC) role is implemented by a respiratory therapist with certified asthma educator (AE-C) credential and registered nurse who worked in the clinic. Caregivers reported that the ACC's advocacy and education made them feel that their child was safer during school hours.

> *"[ACC] is really good at going out to the schools to show them if there is a plan. Le Bonheur nurses are affiliated with KIPP [Memphis Collegiate Schools] and [ACC] and them will go out and sit with the nurses to figure out what the game plan is before they even enter school."*
>
> —Caregiver of Program Participant

Workforce

The CHAMP specialist-based workforce model may require active engagement of primary care providers to ensure sustainability and facilitate scaling. Although the CHAMP model showed promise, this approach is difficult to sustain over the long term and to scale to a larger population without better integration with primary care. Caregivers appreciated that their child got a thorough physical workup that included allergy testing, spirometry testing, and a full review of all medications during the initial clinic visit. The specialist spent more time with participants than feasible outside of the intervention and developed a thorough care management plan. However, after the initial clinic visit, integration with primary care providers could help maintain or update the care management plan. Participants faced challenges in setting up follow-up visits with the program's busy specialists for asthma exacerbations or seasonal changes.

Le Bonheur experienced many challenges that are typical for new programs with CHW-led interventions, but found solutions over time. In the early stages of implementation, CHWs expressed concerns about lack of a defined role and inadequate supervisor support. CHWs received minimal training at the start of the program and reported feeling uneasy and ill-prepared for the first few home visits. Over time, Le Bonheur addressed these concerns by providing more concrete guidance about roles and responsibilities, particularly in situations where the CHWs' responsibilities might have previously overlapped with the ACCs' roles. In addition, Le Bonheur made staffing changes to ensure that CHWs felt supported by a supervisor with experience in conducting home visits. CHWs also appreciated the opportunity to participate in refresher asthma education training sessions and to receive ongoing training about how to address social needs during home visits.

There were delays in providing primary care physicians with access to information in the CHAMP registry. In addition to serving as a useful internal care coordination tool, the CHAMP implementation team envisioned that Le Bonheur–affiliated primary care providers would be able to access selected information about their own patients in the CHAMP registry to inform their clinical decision making.

The team introduced a feature that allowed primary care physicians to access information, including a summary of critical events and a copy of the CHAMP plan of care. However, the CHAMP team was not able to train primary care physicians and deploy the registry for wider use before the end of the award period. Although the registry was not used by primary care providers, the CHAMP team—including the specialists, ACCs, and CHWs—found the registry to be extremely helpful in coordinating care within their own team as it tracked detailed information about encounters in the home and the clinic. It also allowed them to generate reports across the entire population of participants, allowing them to track program-wide progress against milestones, such as the number of patients with an initial clinic visit.

Context

Le Bonheur made several efforts to address the ongoing challenge of poor access to public transportation in Memphis. The CHAMP program contracted with a taxi service to ensure that patients without access to transportation could travel to clinic appointments. CHAMP also arranged for pharmacy delivery services for patients who could not easily access a local pharmacy to fill prescriptions. Although only 15 families took advantage of the pharmacy delivery service, Le Bonheur reported that they paid for 406 taxi rides over the course of the program. Caregivers who participated in the focus groups appreciated both of these services.

Sustainability, Scalability, and Spread

The CHAMP program will continue to operate with some modifications to the workforce, services, and enrollment strategy. Le Bonheur continues to fund the CHAMP program through the hospital, a grant from the Plough Foundation, and another internal hospital foundation created to support best practices in asthma management. They are also developing a long-term Pay for Success strategy through an award from the Baltimore-based Green and Healthy Homes Initiative. The Pay for Success strategy will expand the CHAMP model to include home modifications by Memphis Habitat for Humanity and legal advocacy through the Le Bonheur Medical Legal Partnership. Discussions with payers—including TennCare, Blue

Cross/Blue Shield, Amerigroup, and United Healthcare—about their potential involvement in the model are underway.

Modifications to the program's enrollment strategy include restricting the patient caseload to 400 active patients and limiting the number of new patients enrolled during the year to 250. Le Bonheur also revised their admission criteria to include only children who had three ED visits in one year, two hospitalizations in one year, two ED visits in a three-month period, or one pediatric intensive care unit (PICU) admission in two years. In addition, they plan to expand the program to include level-2 patients who have experienced only one hospital or ED encounter in the year. These level-2 patients will be managed by their primary care providers with support from the CHAMP program.

The program staff will continue to include a program director, two ACCs, an advanced practice nurse, and a medical assistant. All five of the original CHWs continue to work with the CHAMP program, although two of the five CHWs have recently become AE-Cs and have therefore been promoted to the role of community asthma educator. The program will no longer fund the evaluation scientist, clinical social worker, and CHW supervisor positions. A specialist serving as the medical director and a data analyst will also remain on the project in a part-time capacity. Le Bonheur will rank participants so that the highest-risk participants receive at least three CHW contacts per month, medium-risk participants receive one contact per month, and the remaining participants receive services on an as-needed basis.

Limitations

Data provided by TennCare lacked information on the status and duration of Medicaid enrollment, and therefore children might have not been continuously enrolled in Medicaid during follow-up. As a result, some events may be missing from our analysis, potentially leading to biased results if children with enrollment gaps were significantly different from children with continuous enrollment. We created an indicator of a claims gap of at least three consecutive quarters and observed that very few children met this definition of a claims gap (less than one percent for both the treatment and comparison groups); therefore, we did not run sensitivity analyses excluding children with suspected claims gaps. The awardee led recruitment for focus groups, and it is therefore possible that a degree of selection bias shaped the positive patient and caregiver outcomes reported in our second and third annual reports.

Conclusion and Policy Implications

Le Bonheur developed the CHAMP program employing a workforce of CHWs and clinicians to provide integrated specialist care, home visiting, and social support to children with asthma. We found evidence linking CHAMP to reductions in costs and hospitalizations among children with asthma. Although the caregivers seemed to appreciate the specialist-based model of care, the program would benefit from coordination with participants' primary care providers to ensure ongoing maintenance of the asthma care management plan.

There is a growing body of evidence that CHW interventions for pediatric asthma are associated with positive outcomes such as improvements in asthma symptoms and reductions in ED use.[117] Le Bonheur's

[117]Postma J, Karr C, Kieckhefer G. Community health workers and environmental interventions for children with asthma: a systematic review. *J Asthma*. 2009;46(6):564-576.

CHAMP program is another example of how the integration of CHWs into asthma clinical care management can improve quality of life for caregivers and reduce costs and utilization. However, lack of third-party health care reimbursement for care delivered by CHWs makes it difficult to sustain and scale up these interventions.

Mountain Area Health Education Center, Inc.

Summary. Mountain Area Health Education Center, Inc.'s (MAHEC) Integrated Chronic Pain Treatment and Training Project (ICPTTP) focused on standardizing and streamlining chronic pain care in primary care clinics. The program used multidisciplinary care teams to provide medication management and behavioral health services and offered training in chronic pain management for primary care providers. MAHEC also partnered with Project Lazarus, which conducted community outreach and education regarding prevention of opioid misuse and overdose deaths. Project Lazarus was evaluated separately by the North Carolina State Center for Health Statistics.

Awardee Overview

SITES:	4 in North Carolina	***REACH:***	376 patients
AWARD:	$1,186,045	***TARGETED CONDITION:***	Chronic pain with opioid use
AWARD DATES:	Oct 2012—June 2015	***PAYER(S):***	Medicaid/Medicare

Key Findings

These key findings are based on quantitative analysis of Medicare claims data (Jan 2013—March 2016), awardee-collected data, qualitative interviews with staff, and focus groups with program participants.

Implementation
The capacity to medically treat opioid addiction and overdose facilitated implementation of the chronic pain treatment program.

Although having nurse practitioners and behavioral staff dedicated to the program is ideal, effective implementation of chronic pain protocols requires leadership by primary care providers.

Allowing program staff to treat a mix of patients (not just those with chronic pain) prevents burnout.

Utilization *(awardee-collected data)*
Significant reduction in average daily morphine equivalent dose (MED) after program participation.

25% of participants ceased taking opioids altogether while in the program.

Cost *(Medicare FFS claims)*
Based on pre/post analysis, no consistent trends found in cost.

Quality of Life and Care *(qualitative data)*
Relief from behavioral health issues such as depression, anxiety, and isolation; improved functionality in daily life.

Sustainability and Scaling

All sites will continue operations using their current workforce models. Billing under traditional fee-for-service covers staff time. Integrated care components are incentivized by current accountable care organization (ACO) payment arrangements.

Program staff serve as regional consultants for primary care practices to develop safer and stricter protocols for chronic pain management for their patients.

Introduction

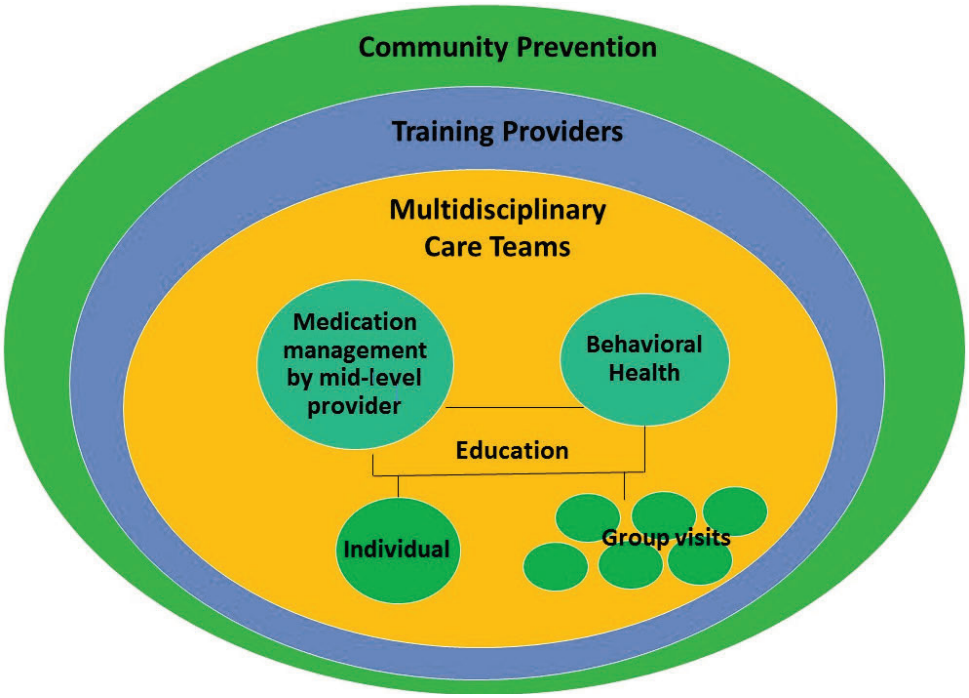
The difficulty of treating chronic pain is well-known among health care providers. Chronic, non-cancer-related pain is generally understood to be a lifelong condition that is intricately connected to depression, anxiety, and distress.[118] During recent decades, patients with chronic pain have had increased access to prescription opioids that may relieve pain, yet may also threaten their lives through accidental overdose.[119] Acquired tolerance for opioids requires increasing dosages to produce a similar effect, although neither higher nor lower dosages correlate with self-reported reductions in pain.[120] A qualitative study found that providers overprescribed when they were unable to convince patients of alternative therapies and when patients' expectations for pain relief were not met with initial opioid prescription dosages.[121]

Informed by the Institute of Medicine report, "Relieving Pain in America: A Blueprint for Transforming Prevention, Care and Education,"[122] MAHEC's Integrated Chronic Pain Treatment and Training Project (ICPTTP) sought to embed multidisciplinary care teams for patients with chronic pain into primary care practices, which are often the first place where chronic pain patients seek treatment. The model included medication management, behavioral health, and education concerning pain self-management, both individually and in group settings. Core providers trained other primary care providers in participating practices on chronic pain protocols in order to standardize safer chronic pain treatment and to detect and prevent opioid abuse or diversion of medications to the wider community.

Exhibit 11.1 depicts the relationship of MAHEC's program components.

[118]Stannard C. Opioids and chronic pain: using what we know to change what we do. *Curr Opin Support Palliat Care*. 2016;10:129-136.
[119]Sullivan MD, Howe CQ. Opioid therapy for chronic pain in the United States: promises and perils. *Pain.* 2013;154:S94-100.
[120]Chen L, Vo T, Seefeld L, et al. Lack of correlation between opioid dose adjustment and pain score change in a group of chronic pain patients. *J Pain.* 2013;14(4):384-392.
[121]McCrorie C, Closs SJ, House A, et al. Understanding long-term opioid prescribing for non-cancer pain in primary care: a qualitative study. *BMC Fam Pract*. 2015;16:121.
[122]Institute of Medicine. Relieving pain in America; a blueprint for transforming prevention, care, education, and research. Available at: https://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2011/Relieving-Pain-in-America-A-Blueprint-for-Transforming-Prevention-Care-Education-Research/Pain%20Research%202011%20Report%20Brief.pdf.

Exhibit 11.1: MAHEC's Program Components



MAHEC's ICPTTP was implemented in four locations: MAHEC's Family Health Center (FHC) and Obstetrics and Gynecology Clinic (OB/GYN) in Asheville; Andrews Internal Medicine (Andrews) in Andrews; and Blue Ridge Community Health Services (Blue Ridge) in Hendersonville. In addition, MAHEC sponsored Project Lazarus, a nonprofit, community-based advocacy organization focused on drug overdose prevention, to implement a community education project in the western North Carolina area. This chapter presents summative findings regarding program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[123] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

We analyzed claims and outcomes data provided by the awardee to assess the effectiveness of this program in cost, utilization, and reducing opiate medication use among patients with chronic pain.

Analysis of awardee-provided data. For MAHEC's intervention, we compared medication use—expressed as morphine equivalent dose (MED) per day—and self-reported pain among program participants, pre- and post-intervention. Medication and pain information was obtained at the start of the program (i.e., pre-intervention) and again at least 160 days later (i.e., post-intervention). All data for this analysis, including some limited demographic information, were obtained from a retrospective medical chart review conducted by the MAHEC team.

[123]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

Exhibit 11.2 summarizes demographic and other basic information about the MAHEC patients who are included in our analysis of core outcome measures.[124]

Exhibit 11.2: Descriptive Characteristics of MAHEC Patients

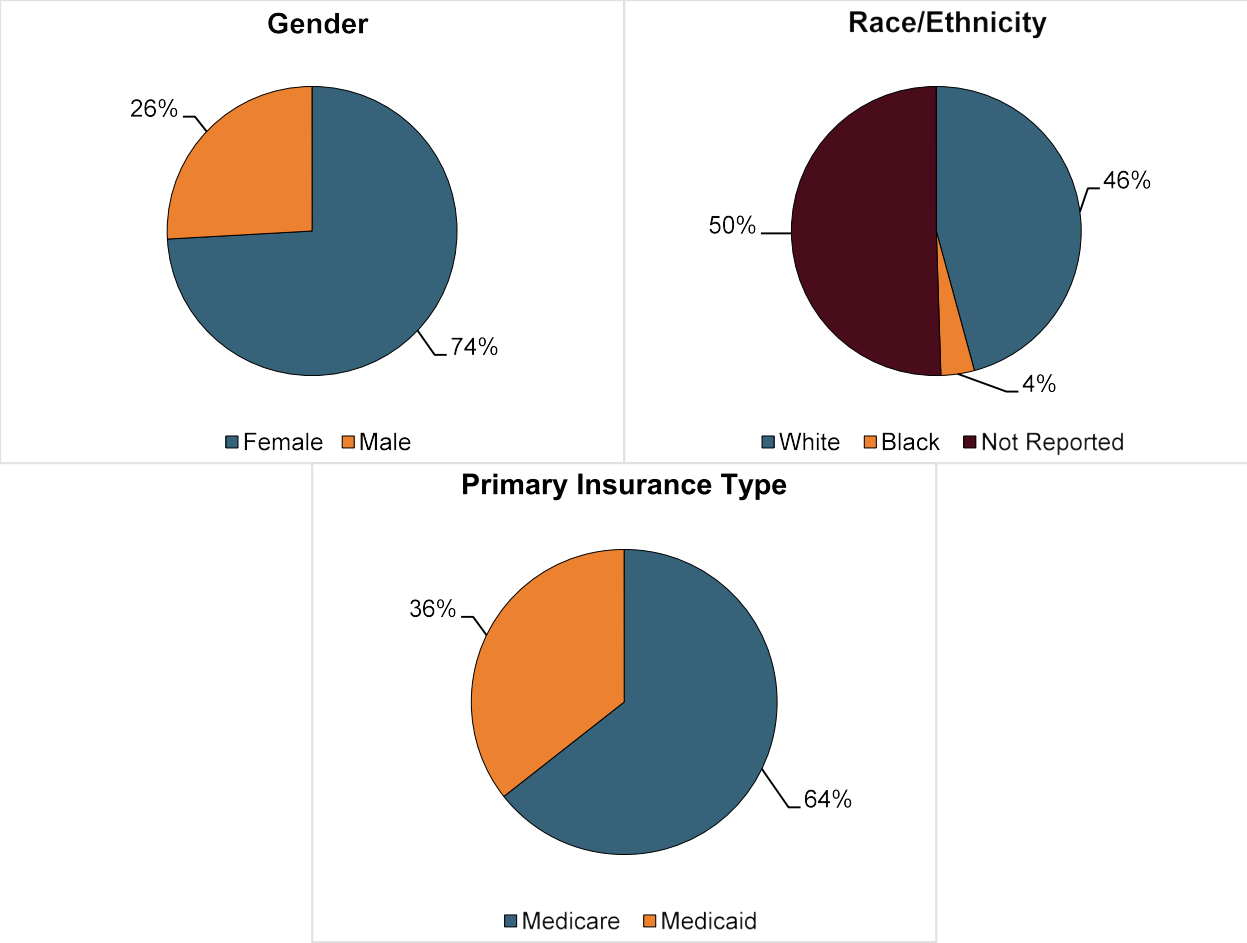


Exhibit 11.3 summarizes the average MED and pain scores at each time point, using paired t-tests to assess changes in these outcomes that were associated with program participation. Linear regression models were used to test which factors were significant predictors of post-intervention medication dose.[125]

- Pain medication use (expressed as average daily MED) decreased among participants, while their pain scores held steady.
- Participants' pain scores and duration of involvement in the program, age, and sex did not significantly predict post-intervention medication dose.

[124]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

[125]Ordinary least squares regression models included pre-intervention MED, duration of program enrollment, pain score, sex, age, and indicator for Medicare enrollment.

Exhibit 11.3: Change for Medication Use and Pain Scores

Variable	Post-intervention Mean (SD)	Pre-intervention Mean (SD)	Change between Post-Pre (SD)
MED (mg/day)	59.4 (89.1)	77.3 (97.8)	-17.9 (57.5)***
Appropriate MED % (n)	80.1 (174)	75.5 (163)	4.6 (11)
Pain score (range 0–10)	6.3 (2.0)	6.2 (2.0)	0.1 (1.9)

NOTE: ***p<.001. P-values are based on paired t-test of the hypothesis that there is no change between pre- and post-intervention. MED, morphine equivalent dose; SD, standard deviation.

In addition to absolute change in MED, we also analyzed the change in the percentage of patients receiving an appropriate MED (defined as <100 mg/day). Pre-intervention, 163 patients (75.5 percent) were receiving an appropriate total daily dose, and this number increased to 174 patients (80.1 percent) at post-intervention assessment.

Finally, a quarter of participants ceased taking opiate medications while participating in the MAHEC program. We investigated whether pre-intervention MED, pain score, or duration of program enrollment was associated with the cessation of opiate medications (Exhibit 11.4):

- In bivariate analysis, using two-sample t-tests, lower MED and shorter enrollment duration, but not pain scores, were associated with opiate cessation. Logistic regression models, which combined MED, enrollment duration, and pain score, produced similar results, with low MED and shorter enrollment duration being significant predictors of opioid cessation.[126]
- Overall, patients entering the program at a lower MED were more likely to discontinue opiates, whereas pain scores were not associated with opiate cessation.
- The shorter durations in the program among patients ceasing opiate medications suggest that participants left the program after discontinuing opiate use.

Exhibit 11.4: Factors Associated with Opiate Cessation

Variable	Continued Opiates Mean (SD)	Stopped Opiates Mean (SD)	p-value
Number of Persons	162	54	n/a
MED (mg/day), Pre-intervention	91.7 (104.5)	34.0 (55.5)	<0.001
Duration of Enrollment (years)	1.55 (0.55)	1.2 (0.53)	<0.001
Pain Score, Pre-intervention	6.1 (1.9)	6.3 (2.2)	0.464
Pain Score, Change (post-, pre-)	-0.08 (2.0)	-0.31 (1.4)	0.441

NOTE: MED, morphine equivalent dose; SD, standard deviation.

[126]Models also adjusted for sex, age, and indicator for Medicare enrollment.

Medicare claims analysis. For the subset of MAHEC participants enrolled in fee-for-service (FFS) Medicare programs (n = 121), we compared hospitalizations, ED visits, and total cost of care pre- and post-intervention (Exhibit 11.5).[127,128]

These were core measures for the Health Care Innovation Award (HCIA) evaluation overall. However, changing utilization was not one of the goals or expected outcomes of the MAHEC chronic pain program:

- There were no significant changes in hospitalizations or ED visits associated with participation in the MAHEC program.
- Total cost of care was higher in the post-intervention period. As there is no comparison group, we were unable to determine if this increase in costs is different than what would be expected for chronic pain patients outside the MAHEC program.

Exhibit 11.5: Differences in Utilization and Cost for MAHEC Participants

Outcome Measure	Adjusted Difference [90% Confidence Interval]
Hospitalizations (per 1,000 Patients)	11 [-11, 32]
ED Visits (per 1,000 Patients)	13 [-13, 40]
Total Cost of Care per Patient ($)	**$817 [$43, $1,591]***
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	**$98,857 ($5,203, $192,511)***

NOTE: ***p<0.01, **p<0.05, *p<0.1.

Qualitative Findings

As discussed in our second annual report, patients and caregivers who participated in focus groups noted gains in their quality of life and quality of care and decreases in utilization.[129] Our qualitative findings from focus groups and staff interviews offered a more nuanced assessment of program effectiveness than the available quantitative data and provided a more positive picture. After our analysis of the qualitative data demonstrated evidence of program effectiveness, we outlined major findings that can inform the replicating and scaling up of this program.

> *"Depression exacerbates physical pain. Physical pain triggers another bout of depression. And it's a very isolating feeling. I'm in pain and now no one understands. Well, now someone understands, someone with some authority, legitimate authority, understands. And that is such an incredibly relieving thing. So I don't feel that my sympathy has run out the moment I leave the latest physician's office. I've got someone in an ongoing relationship with me."*
>
> —Program Participant

The integrated care components and overall accessibility of program staff offered participants relief from the depression, anxiety, and isolation that can be associated with having chronic pain.

[127]We use generalized estimating equations adjusted for age, gender, race, hierarchical condition categories (HCC) score, and arthritis diagnosis.
[128]Because we examined differences pre-and post-intervention and did not utilize a comparison group, we do not present the propensity score models or balance charts for this awardee in the technical appendix.
[129]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

This integrated approach to care in turn led to better pain management. Providers offered patients encouragement and suggestions about how to mentally change their perception of pain in order to endure it and lead active lives. Behavioral health providers used screening instruments to identify underlying behavioral health issues, such as prior trauma or substance abuse, and made referrals for more intensive mental health or substance abuse treatment, as needed.

As seen in the program data, providers successfully weaned some participants off opioids or reduced some participants' opioid dosage. Providers asked all patients to comply with drug screening and other measures intended to detect misuse or diversion of prescriptions. When needed, providers confronted patients who exhibited signs of addiction and refused to prescribe them opioids or referred them to drug addiction treatment. Although some patients dropped out of the program because they disliked these interventions, several of the participants interviewed appreciated the watchful approach.

> *"When [the pain clinic] began, I'll tell you the truth, I was very angry at the things that were being said to me in there. I felt like I was being accused, very definitely accused of selling my drugs…. So now it's taken me over a year to figure out that the pain clinic is worth going to. And I had to apologize to them, I was really angry."*
>
> —Program Participant Weaned off Morphine

Program staff believe that the program has reduced ED visits among participants who are being weaned off their opioid medications. One site indicated that fewer patients were going to the ED for withdrawal symptoms while weaning, but recognized that it would be difficult to demonstrate this effect quantitatively because Medicaid data in North Carolina are unavailable. Staff reported that, instead of going to the ED, such patients made office visits during standing pain clinic hours to see the nurse practitioner with whom they had an ongoing relationship. This increased access to trusted providers during regular business hours and cost less than ED visits.

The program educated patients about the dangers of overuse, misuse, and diversion of opioids. Providers described how patients with low education levels often did not know or understand the potency of the medicines prescribed for them or how others may seek to use them recreationally. A focus group participant learned this hard lesson through the tragedy of someone dying after using narcotic patches that were stolen from her. She explained, "*Nobody ever told me the kind of drugs I was taking until I [came] here.*"

The program helped increase participants' functionality even when it did not reduce their levels of pain. Focus group participants described how program staff encouraged them to try alternatives to medication therapy, such as physical therapy, acupuncture, and counseling in order to lead more active lives with their pain.

> *"And if you stay active and involved, it takes your mind off of the pain rather than if you just sit there all the time. [The nurse practitioner] does listen and make suggestions and got me involved with the psychologist]…. And I have found [acupuncture] to be beneficial as well."*
>
> —Program Participant

Cross-Site Variation

We could not quantitatively assess differences in program effectiveness across sites because only the Family Health Center had the capability to collect and share participant-level data with NORC. Qualitatively, focus group participants at Andrews reported favorable outcomes from the care they

received from its main provider that were similar to those experienced by patients who saw the midlevel provider at FHC, including increased functionality, more manageable pain levels, and safer medication regimens.

Regardless of the variation in workforce structure and availability of alternative therapies by site, focus group participants across sites greatly appreciated the chronic pain management. Sites varied in the availability of nurse practitioners, and existing physicians implemented the program at two sites without NPs. Yet even participants seen by physicians during general practice hours valued the accessibility and reliability of those providers in helping manage their pain. In addition, Ashville-based practices had greater availability of alternative pain management, such as physical therapy, acupuncture, and behavioral health than the other two sites.

At one site, formally scheduled group visits were credited with breaking down the isolation of patients by offering them a chance to meet and learn from one another. Although group visits were implemented only at MAHEC FHC during the HCIA program period, the MAHEC OB/GYN site had plans to begin group visits. Providers noted the challenge of getting people into groups due to the timing and logistics of group scheduling and suggested hiring a staff person who would be dedicated to logistics in order to increase the number of group sessions to more than once per month. Although group visits attracted only a small number of participants (approximately 10 or fewer per session), several individuals attended regularly, and one reported that he was encouraged by the other members to try new things, like treadmills and a stationary bike. The group sessions also allowed patients more time to speak with their medical and behavioral health providers than one-on-one sessions allowed, as group sessions were 1.5 hours long.

> *"In that [group] setting, it's a lot easier to get people engaged on what they want to accomplish [functionally]. So from my perspective, I've seen a huge impact. I've seen folks bonding with each other with similar conditions, seeing their perspective on pain and life in general change. I've seen dosages come down. So I have found it to be incredibly helpful."*
>
> — Provider

Workforce

Although MAHEC's intervention used multidisciplinary care teams meant to provide holistic chronic pain management and treatment, only two of the four sites implemented chronic pain protocols using the proposed staff structures. MAHEC's FHC and OB/GYN sites implemented the program as planned by embedding a nurse practitioner and a behavioral health provider in their practices to comanage the patients with primary care providers. In these clinics, the nurse practitioners primarily offered medication management, and the behavioral health provider identified and addressed behavioral health issues, including depression and anxiety. As needed, both made referrals for more intensive or specialized services, such as psychotherapy, substance abuse treatment, physical therapy, or acupuncture.

Primary care providers implemented the chronic pain protocols at two rural clinics: Blue Ridge and Andrews. Blue Ridge had already embedded a behavioral health provider in their practice but preferred to use a physician for the medication management. Andrews had turnover in the nurse practitioner position, but the physicians continued to implement the chronic pain protocols on their own while recruiting another nurse practitioner. Andrews also had difficulty in recruiting a behavioral health provider for its rural location. They would have preferred to have both types of providers on staff due to

the large number of patients they served, but they were committed to implementing the protocols regardless.

Although primary care physicians can implement the chronic pain protocols successfully, they would appreciate having a behavioral health provider onsite. Behavioral health was seen as a critical but time-consuming part of chronic pain management, so staff considered it important to have a dedicated staff member to screen, treat, and make referrals for more intensive behavioral health treatment. In addition, staff learned the value of having behavioral health staff members trained in addiction and substance abuse, and would advise other chronic pain programs to take this same approach.

> *"I think you ought to start with the behavioral health. If you can't get behavioral health in there, it limits your capacity to do those extra things. Because I believe if behavioral health is there, it's going to reduce my work. So the practitioner will be on board more easily if there's behavioral health there. So I think it really hinges on behavioral health."*
>
> —Primary Care Provider

Program leadership and staff reported the need for more opioid replacement therapy (i.e., buprenorphine) and addiction treatment in conjunction with chronic pain treatment. Specifically, providers felt that collocated addiction treatment services would be a valuable resource to improve chronic pain management.

Context

Significant contextual factors that affected MAHEC's program included the rural versus urban site settings and both the national and the regional opioid abuse epidemics.

Rural sites had difficulty in recruiting nurse practitioners and behavioral health providers for their programs. Leadership in those sites believed that such staff did not want to live in rural areas and accept lower pay than they could earn in or near a city. They also reported higher patient caseloads in rural areas than in cities, which depressed the pay scale even further.

Rural providers reported a shortage of ancillary services that were more readily available in larger cities such as Asheville to support patients with chronic pain. Services in short supply included physical therapy, acupuncture, and yoga, along with other alternative therapies. Low-income patients struggled to pay for these services regardless of the setting. However, providers in Asheville noted that some services were available for free or at low cost.

The role of physicians in the regional and national opioid abuse epidemic put pressure on MAHEC to develop the multidisciplinary chronic pain management and provider training program. Overprescribing could result in opioid abuse and overdose, and patients who receive prescriptions may sell their medications or have them stolen. Furthermore, chronic pain sufferers are often shunned by medical providers as drug-seeking addicts; this attitude puts them at risk for the exacerbation of other chronic health conditions, such as diabetes or cardiovascular disease. MAHEC's program monitored and, when possible, reduced the dosages of opioids and offered medical and nonmedical alternatives that would benefit not only participants themselves but also the wider community.

Sustainability, Scalability, and Spread

MAHEC sustained its nurse practitioners and behavioral health providers through traditional FFS billing. Integrated care models allow for the reimbursement of onsite behavioral health staff. In addition, current ACO payment mechanisms incentivized its integrated care approach. At two of the participating sites (Andrews and Blue Ridge), physicians planned to continue implementing the chronic pain protocols with their existing staff structures, although as described above, at least one site wanted to have a nurse practitioner on site as well.

MAHEC staff members serve as consultants to support the development of chronic pain programs for western North Carolina. Program staff described serving as consultants to a practice where opioids had previously been overprescribed to its patients. They made a total of seven site visits to offer full-day consultations for new and existing staff members after a provider with egregious prescribing practices had retired. In this capacity, a nurse practitioner, a behavioral health provider, and a pharmacist advised physicians regarding how to implement their protocols to:

- reduce the dosage of prescriptions to below 120 mg MED (some patients were on dosages as high as 1,000 mg MED)
- conduct regular urine drug screens and confront patients who had falsified their screenings
- check the controlled substance database to avoid duplicate prescriptions
- prioritize patients based on need
- taper patients receiving high dosages to lower levels or completely wean patients off opioids

> *"So [the practice that we advised has] really gotten that confidence to be able to say no and not escalate therapy. Like if a patient is talking about certain things, just giving them those tools to treat patients for what they need. So in terms of lowering cost, it was huge, and for patient safety it was also a major improvement."*
>
> —Consulting Provider

In addition, MAHEC is taking a leadership role in developing a care process model for chronic pain that could be used throughout health care systems in western North Carolina to try to guide clinical practice in the use of evidence-based guidelines.

MAHEC's training program for primary care providers, including resident physicians, extends chronic pain protocols to new settings. Some residents trained in chronic pain protocols may continue to serve chronic pain patients in their careers, whereas others may choose not to do so. One resident who chose to continue to care for chronic pain patients decided to extend her practice further by becoming a licensed buprenorphine provider in order to offer substance abuse treatment for her patients.

Limitations

Our analysis was limited by several factors. First, MAHEC encountered difficulty in establishing agreements to enable sharing of participant-level data from their partner sites; this prevented us from evaluating the quantitative impact of the program on medication use, pain scores, and health care costs and utilizations at three of the four sites. Our quantitative evaluation is based on data from participants seen at the primary site, and therefore the generalizability of these findings to other sites may be limited.

Second, Medicaid data for the state of North Carolina, where MAHEC operates, were unavailable for the years of program operation. Because Medicaid patients comprise approximately one-third of MAHEC participants, lack of Medicaid data precluded a definitive impacts analysis. With the small number of FFS Medicare beneficiaries served, the available data provided limited power to detect differences that may exist between these beneficiaries and the larger participant group and/or the overall population of chronic pain patients.

The MAHEC program focuses on all patients with chronic pain instead of targeting those with a particular condition, thereby creating challenges in identifying an external comparison group. Without specific diagnoses to use in selecting comparison patients, there was no means to verify comparability between the groups, so we did not construct DID results. Without an external comparison group, we were unable to attribute any observed trends to the MAHEC program; data may reflect secular trends unrelated to the program.

Qualitatively, our data were limited by typical positive-response bias among program staff and participating patients. We were unable to identify or speak to patients who might have dropped out of the program. For that reason, we likely heard the viewpoints of patients who were actively engaged in and benefiting from the program. Similarly, in sites with staff turnover, we did not speak with providers who had left the practice. In addition, our research was unable to address the community-based component run by Project Lazarus, as it was not within the scope of our evaluation.

Conclusion and Policy Implications

MAHEC's program takes an integrated care approach to chronic pain, using advanced practice[130] and behavioral health providers when possible to comanage care with primary care providers and to provide counseling and medication management services. MAHEC developed chronic pain management protocols that could be implemented directly by primary care providers or by program staff dedicated at least in part to a chronic pain clinic. Two of the four participating practices implemented the program with dedicated staff, and the two others integrated the chronic pain protocols into their existing staff structure. Regardless of the implementation model, participants valued the integrated care approach, which offered them access to physical and behavioral health management of their pain.

Although pain levels remained steady, on average, the program seemed to increase participants' functionality and self-efficacy, allowing some of them to have more active lives. It also reduced medication regimens to safer levels and enabled patients to better manage their pain through behavioral modifications. One-on-one and group health visits reduced the isolation that many chronic pain patients felt, and participants received referrals for more intensive behavioral health therapies as needed. Despite these positive outcomes for a complex, high-need population, we found no evidence of beneficial trends in the utilization or the total cost of care measures that we examined for the MAHEC program.

In light of the national attention to the US opioid epidemic, MAHEC's program serves as a potential model for reducing patients' opioid dosages to safer levels and for promoting alternative forms of pain relief. The integration of advanced practice providers who have pain management expertise is

[130]In prior reports, we used the term midlevel provider to describe this position.

reimbursable through traditional FFS billing, making such programs feasible to begin and sustain. In areas with shortages or difficulty in recruiting nurse practitioners or behavioral health providers, we found that the program's straightforward guidelines regarding opioid prescribing could be implemented directly by primary care providers, with some technical assistance from clinicians who have chronic pain management expertise. MAHEC may also help spread evidence-based guidelines on chronic pain management by collaborating and consulting with clinicians in affiliated practices throughout western North Carolina.

Nemours Children's Health System of Nemours Foundation

Summary. Using an enhanced medical home model and community-wide education, the Nemours Children's Health System of the Nemours Foundation (Nemours) program for Optimizing Health Outcomes for Children with Asthma in Delaware focused on improving pediatric asthma care and reducing asthma triggers for high-risk asthma patients.

Awardee Overview

SITES:	3 clinics in Delaware	***REACH:***	490 patients[131]
AWARD:	$3,620,829	***TARGETED CONDITION:***	Pediatric asthma
AWARD DATES:	July 2012—Dec 2015	***PAYER(S):***	Medicaid, private/commercial
NO-COST EXTENSION:	6 months		

Key Findings

These key findings are based on quantitative analysis of Medicaid claims data (July 2012—June 2015), qualitative interviews with staff, and focus groups with caregivers of program participants.

Implementation

Education delivered through home visits by community health workers (CHWs) empowered caregivers to manage their children's asthma symptoms.

Intensity of home visiting is tailored to best meet participants' needs.

Successful and sustained integration of CHWs into medical home teams requires physician buy-in, a clinic-based supervisor, and ongoing training and peer support.

Utilization

The number of children with ED visits reduced by 33 per 1,000 children

The number of hospitalizations reduced by 10 per 1,000 children

Cost

No clear trends

Quality of Care and Life

CHWs helped caregivers feel less overwhelmed.

CHWs educated caregivers about reducing asthma triggers and recognizing and controlling early symptoms of exacerbation in order to avoid ED visits.

Sustainability and Scaling

Nemours has indicated that all of their pediatric practices will use the services of a co-located behavioral health provider and a care coordinator. Community liaisons will also continue to engage in community-based initiatives. Nemours will not support the CHW position in outpatient practices post–Health Care Innovation Award (HCIA), but Nemours did fund one hospital-based CHW for one additional year beyond the award period.

The engagement activities of the community liaisons will continue and will be expanded to other communities and other conditions besides asthma.

[131]Nemours estimates serving 10,446 participants through all components of its program, including behavioral health services to non-asthma patients. In this chapter, we include quantitative analysis on asthma registry participants only.

Introduction

The Nemours Children's Health System Optimizing Health Outcomes for Children with Asthma in Delaware initiative (Nemours) integrated community health workers (CHWs) into patient-centered medical homes to improve asthma care for pediatric patients on their asthma registry and to improve the environments of all children living in the communities surrounding the three participating practices in Dover, Seaford, and Wilmington, Delaware. The program sought to provide enhanced care for patients with asthma in order to reduce unnecessary hospitalizations and emergency department (ED) visits. This chapter presents summative findings concerning program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[132] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

We analyzed Medicaid claims and program data to assess the effectiveness of this program in reducing costs and utilization, and in increasing quality of care. For the children on Nemours' asthma registry,[133] we explored differences in outcomes between registry patients and comparison patients, focusing on the following measures:

- all-cause hospitalizations
- asthma-related hospitalizations
- emergency department (ED) visits
- total cost of care

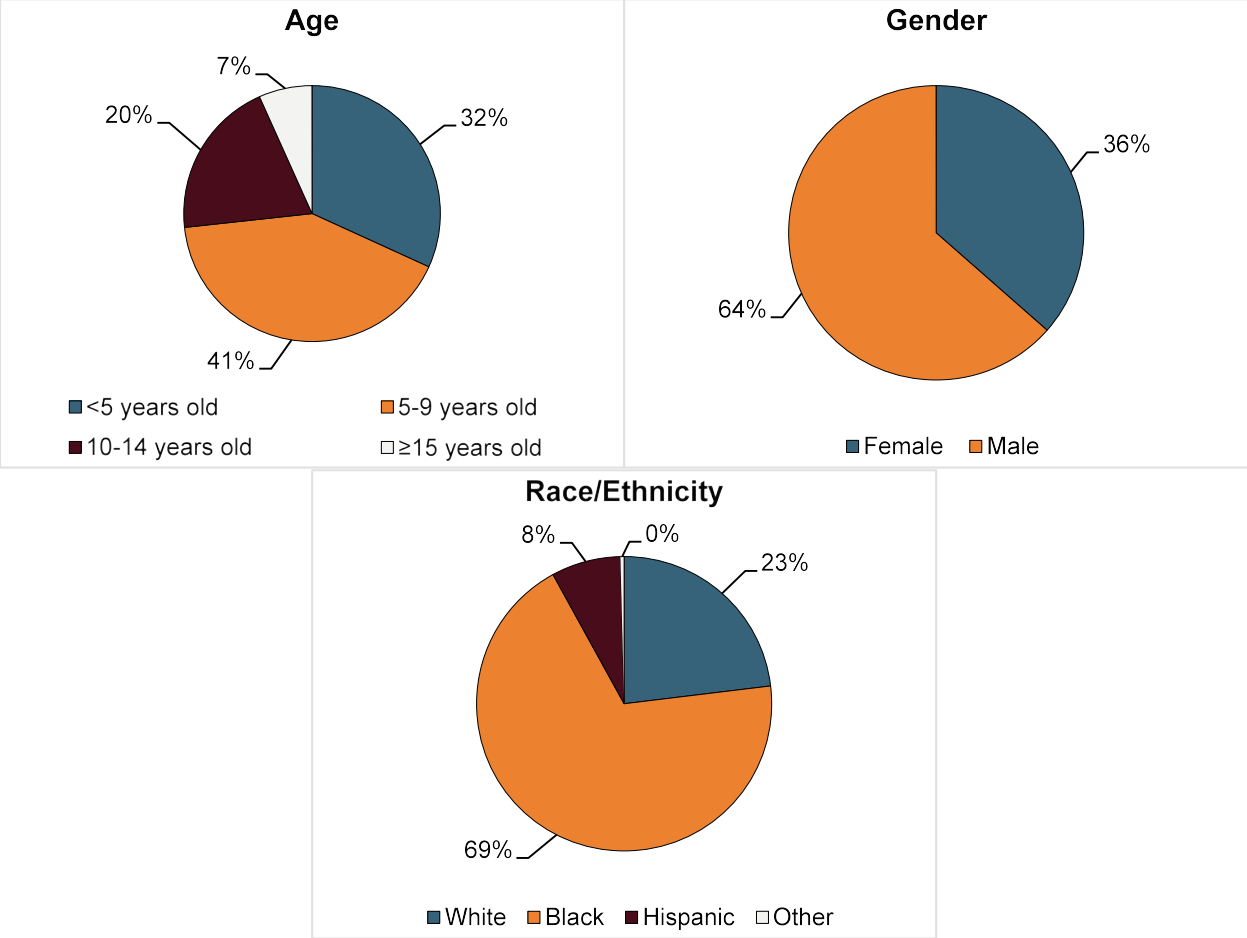
Exhibit 12.1 summarizes demographic and other basic information about the Nemours patients who are included in our analysis of core outcome measures.[134]

Effects of Environmental Improvements?

Nemours' intervention includes initiatives aimed at reducing environmental triggers through public awareness and educational outreach initiatives led by community liaisons. These include training to promote asthma-friendly childcare, integrated pest-management initiatives in public housing units, and clean air/no vehicular idling policies around schools. Such activity is significant, yet challenging to analyze with existing analytic models.

[132]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[133]We included all children on the asthma registry who had a valid date of their first program contact and who could be linked either by Social Security number or Medicaid ID to Medicaid claims data.
[134]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 12.1: Descriptive Characteristics of Nemours Patients



Summative program impact. Exhibit 12.2 summarizes the results of our difference-in-differences (DID) model, which included adjustments for key demographic and other risk factors:[135]

- The reduction in the number of ED visits per 1,000 patients was greater for participants in the Nemours program (33 per 1,000 patients) relative to the comparison group. This result was statistically significant.
- The reduction in hospitalizations per 1,000 patients was also greater for participants in the Nemours program (10 per 1,000 patients) relative to the comparison group. This result was statistically significant.
- There were no significant reductions in asthma-related hospitalizations or total cost of care among program participants relative to the comparison group.

[135]We adjusted for age (categories <5, 5-9, 10-14, ≥15 years), race (White, non-White), disability status, prior year CDPS score, and urbanicity (metropolitan, nonmetropolitan).

Exhibit 12.2: Difference-in-Differences Estimates for Core Measures for Nemours

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	**-10 [-19, -1]***
ED Visits per 1,000 Patients	**-33 [-61, -5]****
Asthma-Related Hospitalizations per 1,000 Patients	-2 [-8, 4]
Total Cost of Care per Patient ($)	$16 [-$174, $205]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	$21,691 [-$24,2062, $285,445]

NOTE: ***p<0.01, **p<0.05, *p<0.1.

Qualitative Findings

During two rounds of site visits, we collected data from the three practice sites in Wilmington, Dover, and Seaford, Delaware, as well as data from the implementation and management team based at the Nemours Health and Prevention Services Division (NHPSD). Our qualitative findings from focus groups and staff interviews offer insight into the drivers of reduced utilization that are depicted in the quantitative data. The sections that follow discuss qualitative evidence of program effectiveness and outline major findings that inform replicating and scaling up this program.

Patient Experience

CHW-delivered home visits appeared to be the program component that drove reductions in utilization and improved caregiver quality of life. Although the Nemours program had several components—including a patient-centered medical home with an embedded care coordinator, a behavioral health provider, and community liaisons engaged in community outreach—CHWs served as the most critical component in improving outcomes for the registry population. Below we describe how CHWs were effective.

> *"I didn't know 'coughing' could be a sign for an asthma attack. I never knew that until a week ago…. Yeah, it's like a lot of things I didn't know, and now that I'm on my fourth child, I'm like, I wish I would have known this before because that would have saved me from a lot of visits to the ER."*
>
> —Caregiver of Program Participant

The CHW intervention enabled caregivers to manage children's asthma symptoms and to control exacerbations, thereby reducing the number of ED visits. CHWs reinforced and supplemented in the home the asthma education that nurses and physicians provided in the office. CHWs reviewed the asthma action plan developed by the child's pediatrician to ensure that caregivers understood how to identify early signs of an asthma attack and the steps that should be taken to address them. In addition, CHWs conducted environmental assessments of participants' homes to point out asthma triggers such as mold, pests, dust mites, scented candles, and others. They also educated caregivers about how to safely remove these triggers (e.g., using vinegar instead of bleach to clean). Several caregivers reported that they avoided trips to the ED as a result of this education.

Caregivers found that education provided by CHWs in the home allowed opportunities to educate a child's multiple caregivers across multiple households. Caregivers expressed appreciation that CHWs took the time to make multiple visits to provide education to more than one family caregiver of the child. CHWs made sure to visit all the homes in which a child lived (e.g., in joint custody situations) to conduct environmental assessments and to reinforce asthma education to ensure that all living environments were asthma-friendly and that all caregivers were equipped to manage the child's asthma.

> *"When my mother and stepfather came to visit us and then took him back to Detroit, [CHW] came right in and explained something to both my spouse and my mother–he actually sat there at my table and took the time to explain something to both my spouse and my mother.… [H]e took the time to just come out of his way because I told him about a week prior to school ending, hey, you know, I'm letting you know that my son is about to go to Detroit [for the summer]."*
>
> —Caregiver of Program Participant

> *"Yeah, but I just work through [CHW]—I don't leave much to the nurses. I don't even care really because like what I went through with my daughter and she sat and talked to my daughter and doctor talked to my daughter. And she put me in the right direction. Because they were about to have her scared of doctors."*
>
> —Caregiver of Program Participant

Because CHWs have formed strong relationships with caregivers, some caregivers may feel more comfortable reaching out to their CHW than to their pediatrician's office or a Nemours extended-hours nurse call line about an immediate clinical need. Caregivers found that CHWs were compassionate and nonjudgmental. They indicated that CHWs were willing to talk about and assist with other concerns besides their child's asthma and that this contributed to building trusting relationships with their CHWs. Some CHWs expressed their concern that families who do not have access to a CHW at the pediatric practice may once again rely on the ED for care.

Workforce

CHW integration into patient-centered medical home clinical teams at the three practice sites facilitated care coordination. Although each of the three practices employed a care coordinator, the CHWs conducted the majority of care coordination for program participants. This included ensuring that participants refilled medications appropriately and reaching out to participants' caregivers after ED visits and hospitalizations to ensure that they scheduled follow-up visits with their child's provider. Caregivers at Dover also noted that their CHW facilitated communication between specialists and primary care providers.

> *"Especially with a primary doctor and a specialist, because my son, he has his primary doctor, but then he has his asthma/allergy doctor, [specialist], who's right in this building. [CHW] helps keep that gap between, okay, the treatments that Nemours [specialist] is giving him and the treatment that [pediatrician] is giving him, and if they conflict, I'll get a call and he'll be like, 'did [specialist] give you a stronger prescription than what's this? Then we're going to cancel this one.'"*
>
> —Family Member of Program Participant

Successful integration of CHWs into clinical practice teams requires support from a supervisor within the practice and buy-in from physician leadership. CHWs and the NHPSD-based supervisor observed that a clinic-based supervisor would be in the best position to advocate for CHWs and to assist them in navigating interprofessional relationships in an office environment that is unaccustomed to the

CHW role. Physician leadership buy-in also facilitates practice staff's acceptance of the CHW role and the new workflows and team dynamics that clinical teams must adapt.

Context

The program adapted to unique contextual factors in each of the three sites. The Wilmington site faced several challenges related to a high incidence of gang violence in the neighborhoods where program participants lived. CHWs limited their home visits to daylight hours and sometimes conducted visits in pairs due to safety concerns. They also always wore clearly labeled Nemours uniform shirts so that it was apparent that they were entering neighborhoods on official medical-related business. The Seaford clinic served a higher percentage of Spanish-speaking patients and therefore hired a bilingual CHW to serve the Spanish-speaking population.

The Dover practice saw many patients who had a parent who worked at the nearby US Air Force base. Some of these patients were transient and may live with different relatives for extended periods of time. During the focus group, one caregiver noted that the CHW in Dover made it a point to conduct an environmental assessment of every home in which the child spends significant time and provided education to all family members involved in the child's care. Access to reliable public transportation was a challenge at all sites, and all of the sites had difficulty in addressing this need consistently for their patient populations. All sites helped patients sign up for the Medicaid-funded nonemergency transportation service provided by LogistiCare. However, caregivers in the focus group reported that the service was unreliable and inconvenient.

Sustainability, Scalability, and Spread

Although Nemours program staff acknowledged the benefit and value of CHWs, Nemours lacked the organizational and state-level infrastructure needed to sustain the role in outpatient practices. Although most program staff members agreed that CHWs were critical to engaging and supporting program participants through the home-visiting intervention, the three practice sites opted not to support the CHW role in their annual budgets. One major factor in this decision is the fact that CHWs are currently not reimbursable by third-party payers in Delaware. Furthermore, Nemours as an organization does not yet have in place the infrastructure or resources—including standard home-visiting protocols, a supervisory structure, and ongoing training program—to support CHWs. Nemours program leaders are actively engaged in conversations with the Delaware State Innovation Model[136] team to facilitate the integration of CHWs as a reimbursable role in Delaware in the future.

Nemours pilot tested the use of a hospital-based CHW but is uncertain about their plans to sustain the position. Based on the success of the outpatient-based CHWs, Nemours opted to support a hospital-based CHW through June 2016. This hospital-based CHW provides asthma education and support to families of children with an asthma-related hospital admission, with the hope of reducing 30-day readmission rates. Unlike the outpatient-based CHWs, the hospital-based CHW follows a protocol that specifies the number and type of CHW interactions (e.g., telephone call or home visit) that a child receives based on risk level. Although program leaders believed that the hospital-based CHW was

[136]Delaware State Innovation Models (SIM) Initiative description available at http://dhss.delaware.gov/dhcc/sim.html.

effective in her role, they indicated that they have not yet determined whether they can continue to support the position beyond June 2016.

Nemours program staff believe that CHWs can effectively address other issues besides asthma. Program staff reported that families receiving services from the outpatient-based CHWs or the hospital-based CHW often had concerns in addition to asthma that make it difficult for them to be receptive to asthma education and asthma self-management support. CHWs often had to address these nonasthma needs (e.g., food instability, referrals to social services) first before they could engage the caregivers in asthma management. One CHW reported that she worked with one family for a year before she was able to address asthma-specific issues. The hospital-based CHW similarly has expanded her role to address other concerns and to provide support to families of children with asthma who were admitted to the hospital for a condition other than asthma.

Limitations

Although our quantitative analysis includes a matched comparison group, the results should be interpreted with some caution. The number of participants enrolled in the intervention for four or more quarters (i.e., those with at least one year of follow-up) and the number of participants experiencing hospitalizations are small, which limits our power to detect differences among all hospitalizations, asthma-related hospitalizations, and readmissions.

We developed our findings from visits and focus groups with two of the three sites. We were able to conduct focus groups only in Wilmington and Dover and therefore cannot comment on the experience of caregivers in Seaford. During our focus groups, we were more likely to hear the positive experiences of caregivers who were actively engaged in and benefiting from the program. Although we were able to interview community organization partners involved in the community-based initiatives led by community liaisons, we were unable to interview community members who may have benefited from these initiatives.

Conclusion and Policy Implications

Nemours developed their program to improve asthma care for pediatric patients by integrating CHWs into patient-centered medical homes. We found evidence that the Nemours asthma program was associated with reductions in ED visits and hospitalizations among children with asthma. Caregivers reported that interactions with CHWs empowered them to manage their child's asthma at home, thereby reducing the need for ED visits.

Although CHWs played an important role in patient engagement, education, and care coordination, practice sites could not sustain the CHW role. To sustain the role, practices would need to be reimbursed for the services that CHWs deliver and have a support system within both the practice and the broader organization, including supervisory structure and ongoing training opportunities. Policies allowing reimbursement of CHWs and other nontraditional health care workers could help support the long-term sustainability of interventions such as Nemours' asthma program.

Ochsner Clinic Foundation

Summary. Ochsner Clinic Foundation in Louisiana developed two programs to coordinate stroke care from emergency department (ED) admission through outpatient rehabilitation. Stroke Central targeted patients at Ochsner Medical Center presenting with suspected stroke symptoms and stroke diagnosis; a program nurse practitioner or physician assistant coordinated patients' care with multidisciplinary teams in the hospital. Stroke Mobile then coordinated these patients' care upon discharge. Stroke Mobile teams consisting of a registered nurse (RN) and a lay health educator conducted monthly home visits with stroke survivors for one year post-discharge and provided clinical care and targeted stroke education for patients, caregivers, and families living in Jefferson and St. Tammany Parishes.

Awardee Overview

SITE:	1 hospital in Louisiana	***REACH:***	3,714 total in Stroke Central and 558 in Stroke Mobile
AWARD:	$3,864,744	***TARGETED CONDITION:***	Stroke
AWARD DATES:	Jan 2013—Dec 2015	***PAYER(S):***	Medicare
NO-COST EXTENSION:	6 months		

Key Findings

These key findings are based on quantitative analysis of Medicare claims (January 2013—June 2015), qualitative interviews with staff, and focus groups and interviews with patients and caregivers.

Implementation

Stroke Central reinforced the team-based approach to clinical care through daily multidisciplinary rounds and coordinated care plans.

Stroke Mobile teams tailored the 12 postdischarge home visits to participants' needs, including more focused education or the timing and location of visits.

Stroke Mobile teams were not prepared and did not have the resources to address social needs identified during home visits.

Utilization

Stroke Central was associated with non-significant overall reductions in 90- and 180-day readmissions, but had significant reductions for the high-risk subgroup.

Cost

No clear trends for cost outcomes

Quality of Life

Stroke Mobile participants and caregivers reported changes in behavior (e.g., reduced sodium intake, increased exercise).

Caregivers of Stroke Mobile participants reported reduced stress.

Sustainability and Scaling

Both programs are being sustained through Ochsner's internal institutional support.

Ochsner's Stroke Mobile team expanded to serve patients in Orleans Parish.

Introduction

Ochsner Clinic Foundation developed its Stroke Central and Stroke Mobile programs to coordinate stroke care from presentation at the emergency department (ED) through outpatient rehabilitation. Stroke Central serves patients admitted to Ochsner Medical Center with suspected stroke symptoms. Stroke Mobile serves a subset of these patients who have had a final discharge diagnosis of stroke and who live in Jefferson and St. Tammany Parishes, Louisiana. This chapter presents summative findings concerning program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[137] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

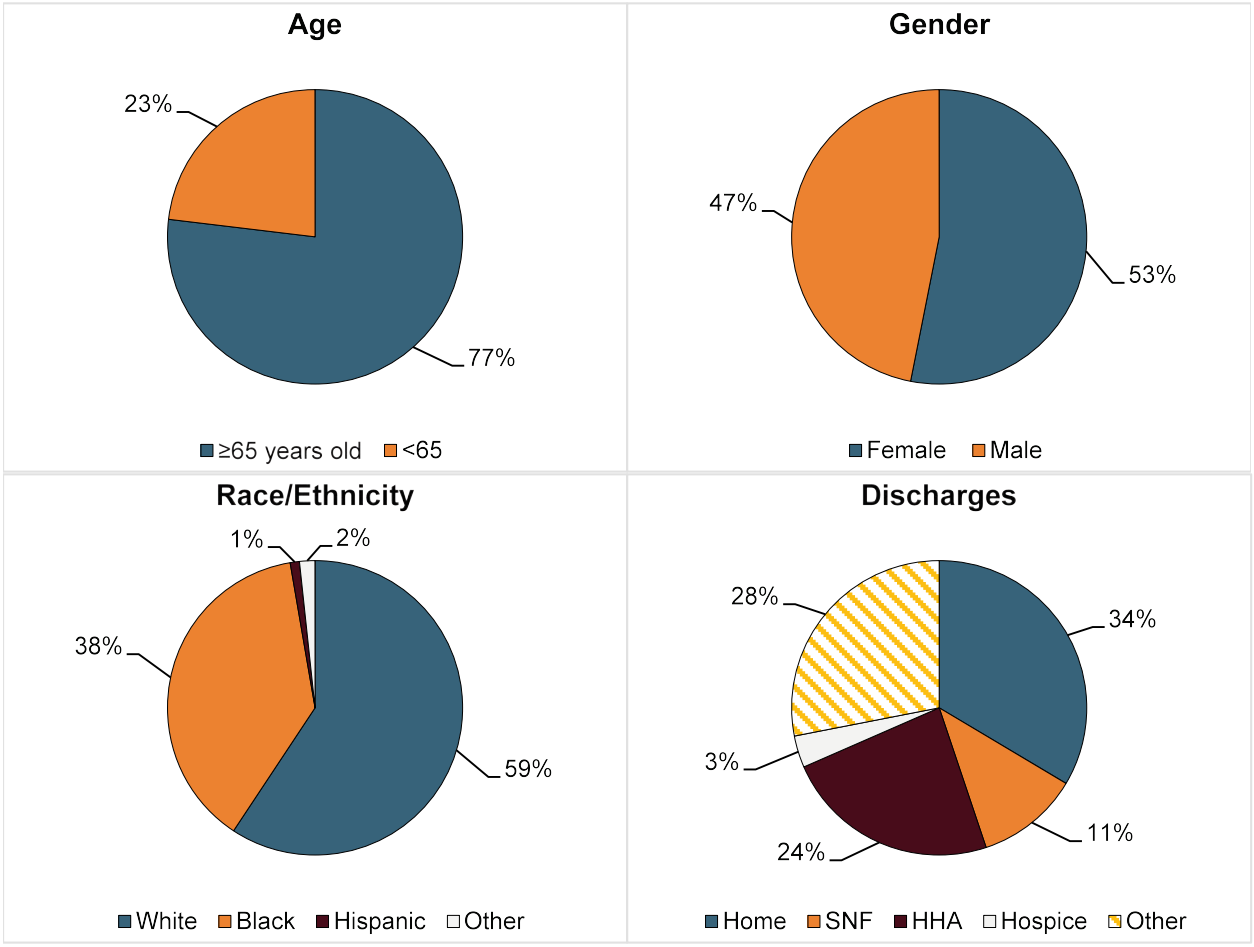
We analyzed claims and program data to assess the effectiveness of this program in reducing cost and utilization and improving quality of care. For the Ochsner Stroke Central program, we examined differences in outcomes between Stroke Central and comparison patient–episodes, focusing on the following measures:

- 30-, 90-, 180-, and 365-day readmissions
- 90- and 180-day ED visits
- 90- and 180-day total cost of care
- 90- and 180-day falls, urinary tract infections (UTIs), or pressure ulcers[138]

Exhibit 13.1 summarizes demographic and other basic information about Ochsner patients with episodes included in our analysis of core outcome measures.[139]

[137]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[138]American Academy of Neurology, American College of Radiology, National Committee for Quality Assurance, American Medical Association-convened Physician Consortium for Performance Improvement®. Stroke and stroke rehabilitation performance measurement set. Available at: https://www.aan.com/uploadedFiles/3Practice_Management/2Quality_Improvement/1Quality_Measures/1All_Measures/2012%20Stroke%20and%20Stroke%20Rehab%20Measurements.pdf.
[139]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 13.1: Descriptive Characteristics of Patients with Episodes in Ochsner Group[140]



Summative program impact. Exhibit 13.2 summarizes the results of our difference-in-differences (DID) model, which included adjustment for key demographic and other risk factors.[141]

- There were no significant decreases in ED visits, falls, UTIs, pressure ulcers, or total cost of care for patient-episodes at Ochsner relative to the comparison group.
- Implementation of the Stroke Central program at Ochsner was associated with non-significant decreases in 90- and 180-day readmissions for patient episodes relative to the comparison group.

[140]Descriptive statistics are based on findings prior to propensity score weighting.

[141]We included the following covariates in our DID models: age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year cost, prior-year ED visits, prior-year HCC score, prior-year fee-for-service (FFS) coverage, discharge status, target condition (ischemic stroke: precerebral and cerebral; hemorrhagic stroke: subarachnoid, intracerebral, and other unspecified intracranial hemorrhage; TIA), history of stroke, and severity of hospitalization, (complication or comorbidity [CC], major complication or comorbidity [MCC], or neither CC nor MCC diagnosis-related group [DRG]).

Exhibit 13.2: Difference-in-Differences Estimates for Core Measures for Ochsner

Average Quarterly Impact	
Outcome Measure (patient-episodes per 1,000, unless noted)	**Adjusted Estimate [90% Confidence Interval]**
30-Day Readmission	13 [-28, 54]
90-Day Readmission	-34 [-81, 13]
180-Day Readmission	-13 [-66, 40]
365-Day Readmission	9 [-52, 70]
90-Day ED Visit	28 [-24, 80]
180-Day ED Visit	38 [-20, 96]
90-Day Falls, UTIs, or Pressure Ulcers	-2 [-19, 15]
180-Day Falls, UTIs, or Pressure Ulcers	2 [-19, 22]
90-Day Total Cost of Care per Patient-Episode ($)	$2,441 [-$1,409, $6,291]
180-Day Total Cost of Care per Patient-Episode ($)	$5,536 [-$385, $11,457]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	$1,540,485 [-$888,848, $3,969,818]

NOTE: ***p<0.01, **p<0.05, *p<0.1.

Quarter-specific program impact. Although the summative analysis of readmissions did not show significant impact, in early post-intervention quarters (I2-I4), Ochsner patient-episodes showed lower rates of 30- and 90-day readmissions than did the comparison group, with significant differences in quarters I3 and I4. Readmissions trended higher in later quarters of the intervention. Quarterly fixed effects (QFE) charts of these estimates can be found in Appendix A.

Subgroup Analysis: High-Risk

Stroke Central offered participants specialized services varying by age, gender, and severity of their health status before and after their strokes. We defined the high-risk subgroup as patient-episodes in the top quartile of hierarchical condition categories (HCC) scores. After adjusting for differences between the two groups, we examined the average differences in core outcomes between high-risk Stroke Central and comparison patient-episodes.[142,143] Exhibit 13.3 summarizes demographic and other basic information about the treatment and comparison patient-episodes included in the high-risk subgroup analysis.

[142]Hierarchical condition categories (HCC) score is a payment methodology based on risk used by the Center for Medicare & Medicaid Services (CMS) to adjust Medicare Advantage health plan payments at the patient level. Risk scores are primarily based on a patient's health status and demographic characteristics. Please see: http://www.healthfusion.com/blog/2014/health-topics/medical-coding/medicare-advantage-hcc-program-optimize-coding/.

[143]Quality of care measures are not included in the subgroup analysis due to sample size.

Exhibit 13.3: Descriptive Characteristics of Patients with Episodes in Ochsner High-Risk Subgroups[144]

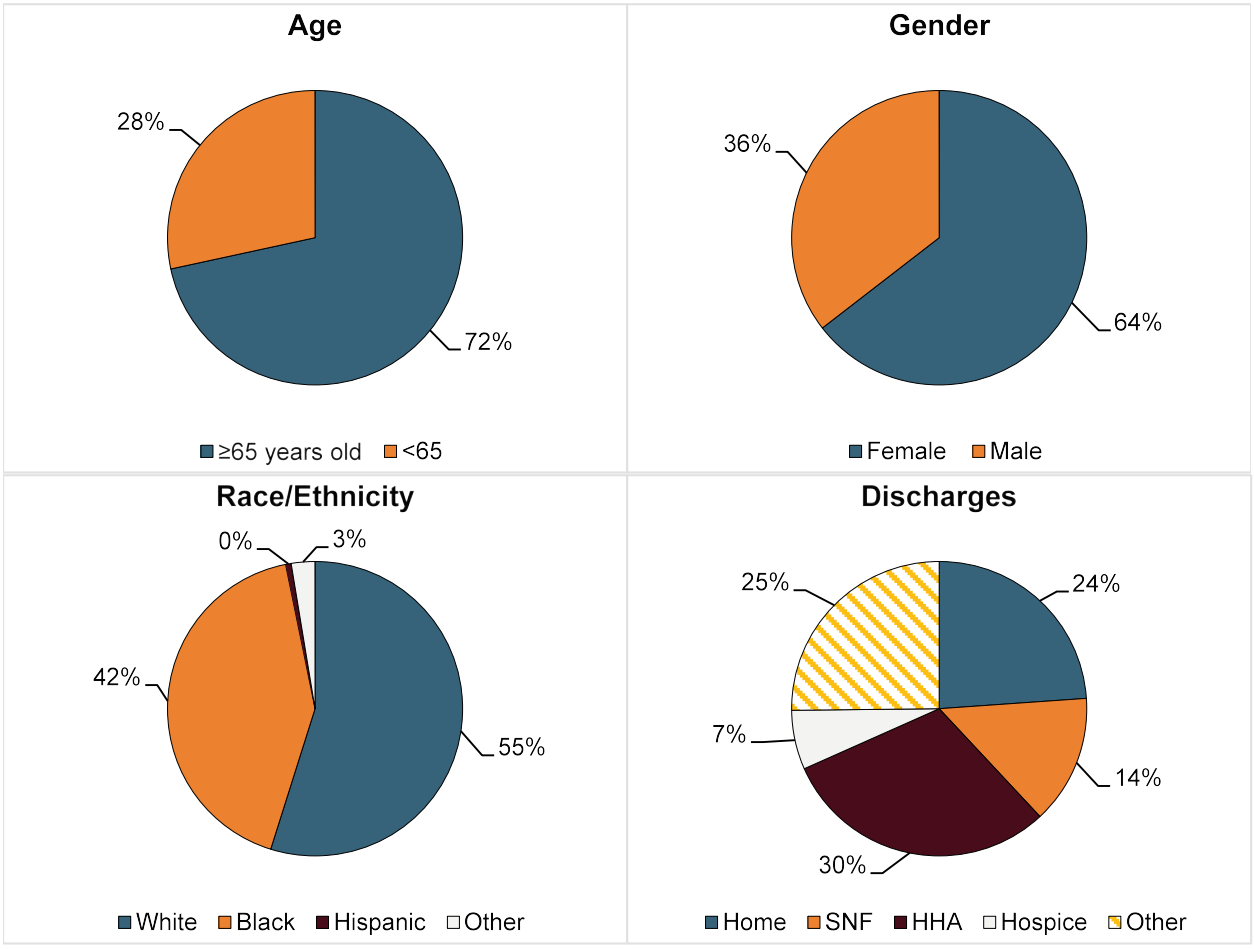


Exhibit 13.4 summarizes the impact of the Stroke Central program for patient-episodes with the highest risk scores:

- For the high-risk subgroup, we observed significant reductions in 90-day (119 per 1,000 beneficiaries) and 180-day (142 per 1,000 beneficiaries) readmissions for patient-episodes at Ochsner relative to the comparison group.
- Findings for the high-risk subgroup showed a non-significant decrease in 30-day and 365-day readmissions and in 90-day and 180-day total cost of care.
- Relative to the comparison group, the high-risk subgroup did not experience decreases in ED visits.

[144]Descriptive statistics are based on findings prior to propensity score weighting.

Exhibit 13.4: Difference-in-Differences Estimates for Core Measures for Ochsner's High-Risk Subgroup[145]

Outcome Measure (Patient-episodes per 1,000, unless noted)	**Adjusted Estimate [90% Confidence Interval]**
30-Day Readmission	-50 [-140, 42]
90-Day Readmission	**-119 [-230, -9]***
180-Day Readmission	**-142 [-255, -28]***
365-Day Readmission	-36 [-167, 95]
90-Day ED Visit	56 [-56, 169]
180-Day ED Visit	5 [-113, 124]
90-Day Total Cost of Care per Patient-Episode ($)	$-442 [-$6,754, $5,869]
180-Day Total Cost of Care per Patient-Episode ($)	-$1,589 [-$11,607, $8,428]

NOTE: *p<0.10, **p<0.05, ***p<0.01.

Subgroup Analysis: Stroke Mobile

In addition to assessing the overall effectiveness of the Stroke Central program, we explored the impact of the Stroke Mobile program on reducing costs and utilization. Stroke Mobile extended the hospital's specialized stroke care to patients' homes and added an educational component on diet and exercise. We explored the average differences in core outcomes between Stroke Mobile and comparison patient-episodes, adjusting for differences between the two groups.[146] Exhibit 13.5 summarizes basic information about treatment and comparison patient-episodes included in our Stroke Mobile analysis.

[145]Due to small sample sizes in each intervention quarter, we report difference-in-differences estimates for the entire post-intervention period.
[146]Quality of care measures are not included in the Stroke Mobile analysis due to sample size.

Exhibit 13.5: Descriptive Characteristics of Patients with Episodes in Stroke Mobile[147]

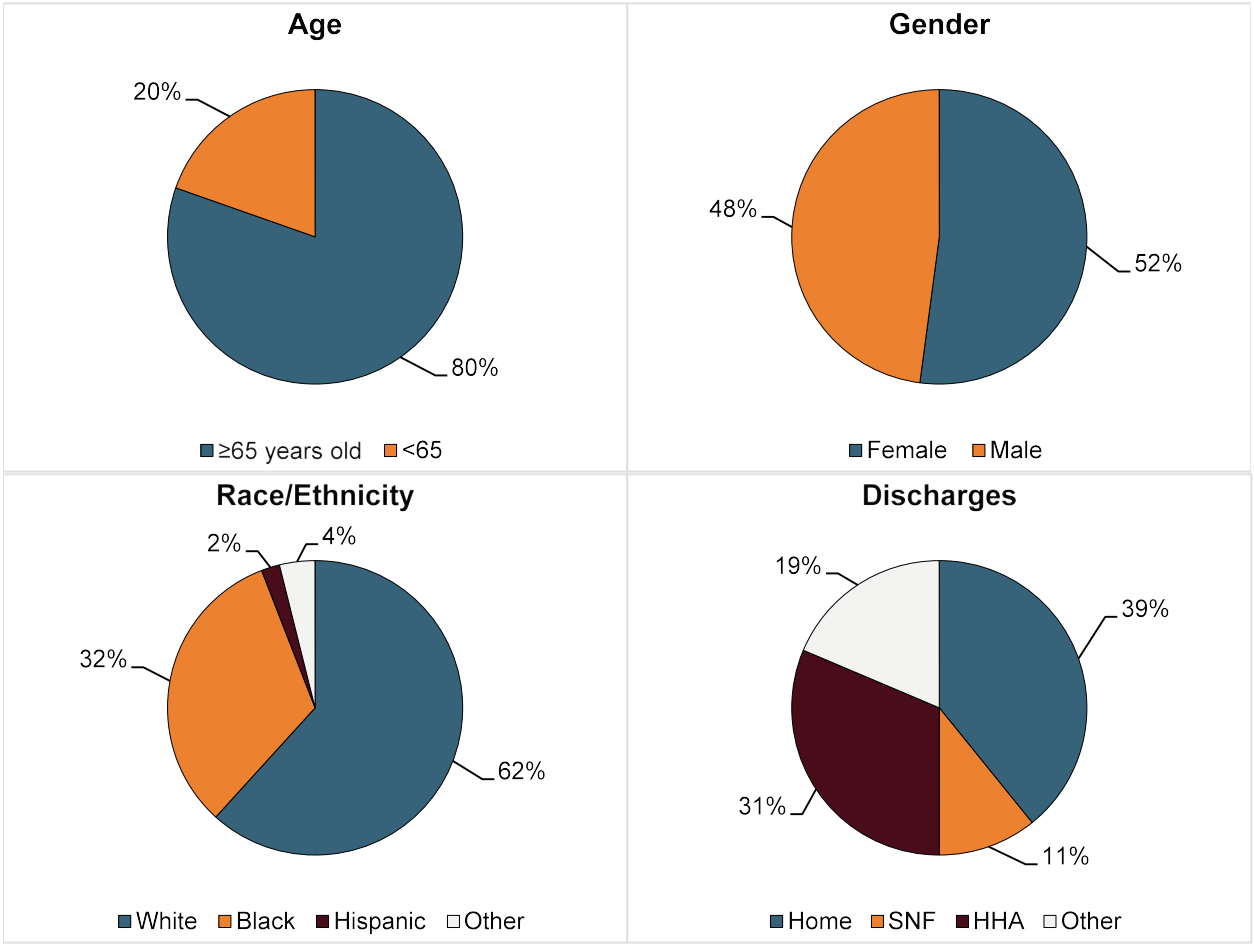


Exhibit 13.6 summarizes the impact of the Stroke Mobile program relative to the comparison group:

- Implementation of the Stroke Mobile program at Ochsner was associated with non-significant decreases in 90- and 180-day readmissions for patient-episodes relative to the comparison group.
- The Stroke Mobile program was not associated with decreases in cost of care or ED visits for patient-episodes at Ochsner relative to the comparison group.

[147]Descriptive statistics are based on findings prior to propensity score weighting.

Exhibit 13.6: Difference-in-Differences Estimates for Core Measures for Ochsner's Stroke Mobile Subgroup[148]

Outcome Measure (Patient-episodes per 1,000, unless noted)	Adjusted Estimate [90% Confidence Interval]
30-Day Readmission	36 [-31, 103]
90-Day Readmission	-48 [-126, 30]
180-Day Readmission	-33 [-119, 53]
365-Day Readmission	72 [-32, 176]
90-Day ED Visit	33 [-52, 119]
180-Day ED Visit	83 [-13, 180]
90-Day Total Cost of Care per Patient-Episode ($)	$3,122 [-$2,877, $9,121]
180-Day Total Cost of Care per Patient-Episode ($)	$2,237 [-$5,406, $9,880]

NOTE: *p<0.10, **p<0.05, ***p<0.01.

Qualitative Findings

> *"Does having them come and keep tabs on us, does that save the Medicare and Medicaid money? Because last year, I went four times to the ER. Now I don't have to. [The Stroke Mobile team is] very helpful. You don't have to call your doctor…. You can get them right away or you can share what your problems are. I am really 100% for it."*
>
> — Program Participant

Qualitative findings support quantitative program effectiveness findings concerning reduced utilization. In addition, focus groups and interviews with patients and caregivers indicated that the program led to lifestyle changes that could prevent stroke reoccurrence. The sections that follow present qualitative findings concerning patient experiences and describe key findings concerning the workforce, context, sustainability, and scalability of this program.

Patients reported that Stroke Mobile helped them avoid going to the ED. Patients called their nurse when they had questions or issues that needed to be addressed between monthly home visits.

> *"They helped me with wanting to change the sedentary lifestyle that I had become accustomed to. Because I had just been diagnosed with fibromyalgia a month before I had my stroke. So I was really not moving much. I needed to move. They got me moving. Their encouragement keeps me going."*
>
> — Program Participant

Participants adhered to the stroke prevention components of the program. Participants did not want to experience another stroke or further complications of a previous stroke and were aware that the Stroke Mobile program was intended to help prevent a reoccurrence. They described learning mental and physical exercises and new low-sodium recipes from the Stroke Mobile teams. Several participants began exercising regularly and changed their diets as a result of the program, with two participants (out of 15 interviewed) reporting significant weight loss (>10 pounds), and one quitting smoking.

[148]Due to the small sample sizes in each intervention quarter, we report difference-in-differences estimates for the entire post-intervention period.

> *"More than anything else, it's not so much the information that I got, but the reassurance that 'you're doing fine, it's looking good, you're doing fine.' I literally [went] from not seeing a doctor or taking a single pill [before the stroke] to seeing a doctor every month or so and taking 10 pills a day [afterward], and that's a big transition."*
>
> — Program Participant

Both caregivers and participants appreciated the compassionate approach of the Stroke Mobile teams. Caregivers appreciated the support and advice offered by the team members, some of whom had personal experience as caregivers of older adults. Participants sensed that the teams cared and looked forward to their visits.

Workforce

During the program, Stroke Mobile's lay health educators began to meet regularly to share their experiences and to support one another. They were the only nonclinical staff in the stroke program and had a relatively limited educational role. Their training as health educators stopped short of enabling them to serve as community health workers (CHWs); and they were not expected to have ties to community resources nor engage professional CHW associations. Therefore, they developed their own support group to exchange information about resources and techniques for working with the target population spread out across broad geographic areas.

Although home visits offered an opportunity to assess social needs, the staffing model for the Stroke Mobile teams did not support addressing these needs. Stroke Mobile staff suggested that having a social worker on their team would help to address patients' nonclinical needs. Alternatively, program advisors suggested that lay health educators' roles could be more fully developed as CHWs in order to address these needs directly.

> *"[A] challenge, I think, of the Ochsner project is that CHWs [or lay health educators] are just kind of isolated within the health care setting. So even though they were doing home visits, they're still really only focused on working within that health care system. CHWs really should be doing a lot of their work outside the health care system…. They should be connecting a lot with social service agencies and things like that, in order to really address the social determinants of health."*
>
> —Program Consultant

Context

Ochsner received its Comprehensive Stroke Center certification on May 17, 2013, from the Joint Commission, making it comparable to other certified stroke centers. As part of the certification, Ochsner was required to provide basic stroke education and training to all nurses who interact with stroke patients and to educate staff about the Stroke Central telephone line. Stroke Mobile further enhanced Ochsner's stroke care capabilities.

Because the intervention coincided with implementation of a new electronic medical records system, the Stroke Central team could customize data collection and reporting instruments. Customization included discrete areas in the records to enter nurses' notes, dashboards of patient information, and prompts for health assessments based on the number of home visits to a patient.

Sustainability, Scalability, and Spread

Institutional support from Ochsner supports the sustainability of both Stroke Central and Stroke Mobile. Ochsner's leadership believes that the cost savings from the reduction in readmissions, prevention of stroke reoccurrence, and quicker access to treatment in case of a reoccurrence will pay for the Stroke Mobile program. They work with a payer to design a bundled payment approach to stroke care. In addition, Stroke Mobile teams expanded their reach to include residents in Orleans Parish.

Limitations

Although our quantitative analysis includes a comparison group of similar patient-episodes, the results should be interpreted with caution. Approximately two-thirds of participants enrolled in Ochsner's intervention received coverage through Medicare Advantage plans and other private insurance. We did not have data to include these beneficiaries in our analysis. Our analyses, therefore, may not reflect the overall impact of the Stroke Central program. In addition, readers should interpret results of the Stroke Mobile analysis with caution due to the small sample size (n = 102).

Qualitative participant data focused on the subset of Stroke Central patients who went on to receive Stroke Mobile services in Jefferson and St. Tammany Parishes. We drew findings from one focus group with Stroke Mobile participants (n = 10), a second focus group with caregivers (n = 8), and phone interviews with caregivers (n = 6) and patients (n = 6), either separately or together. Patients generally had little recollection of Stroke Central as a distinct program in the hospital but could easily recall their experiences with the Stroke Mobile teams. We also interviewed program leadership, staff members, and a consultant during one site visit (n = 6) and by telephone (n = 4).

Conclusion and Policy Implications

Ochsner developed its programs to coordinate stroke care from admission to the ED through outpatient rehabilitation. Our mixed-methods analysis suggests that Ochsner's approach to coordinated stroke care offered limited reduction in utilization and improved the quality of care for stroke patients. Reductions in 90-day and 180-day readmissions were significant for the high-risk participant subgroup. Ongoing counseling and education encouraged patients and their caregivers to make changes to diet and levels of physical activity to prevent a reoccurrence. Ochsner sustained both the Stroke Mobile and Stroke Central programs following the award period and works with a private payer to develop a bundled payment system for stroke care that would expand the program to other facilities throughout Louisiana.

Given the overall lack of significant differences between the treatment and comparison groups, our findings suggest that Stroke Central's performance is similar to other centers that have Comprehensive Stroke Center certification from the Joint Commission. Ochsner's performance is better with respect to reducing utilization among the high-risk population, suggesting that increased attention to individuals at high risk for stroke may produce improved clinical outcomes. Although our analysis found no significant differences between Stroke Mobile participants and a comparison group, Stroke Mobile goes beyond the Comprehensive Stroke Center model. Leaders of similar efforts should consider more fully empowering the lay health workers by helping them access community-based resources in order to help address nonclinical needs.

University of Alabama at Birmingham

Summary. The University of Alabama at Birmingham (UAB) implemented a lay patient navigator program called Patient Care Connect (PCC). The PCC program used lay navigators to improve patients' adherence to care plans and to educate cancer patients and survivors about how to find and use the resources they need, with the goal of empowering patients, caregivers, and patients' families to better advocate for their own care.

Awardee Overview

SITES:	12 hospitals across Alabama, Florida, Georgia, Mississippi, and Tennessee	***REACH:***	9,058 patients
AWARD:	$15,007,262	***TARGETED CONDITION:***	All cancers
AWARD DATES:	July 2012—December 2015	***PAYER(S):***	Medicare
NO-COST EXTENSION:	6 months		

Key Findings

These key findings are based on quantitative analysis of Medicare claims (July 2012—December 2015), qualitative interviews with staff, and focus groups with program participants.

Implementation

Buy-in and engagement from clinic staff and leadership are required for successful integration of lay navigators into the health care team.

It is important to consider existing nurse navigation programs and site-specific workflow culture when implementing the program.

Utilization

Hospitalizations and ED visits were reduced by 11 and 22 per 1,000 patients, respectively.

Reduced end-of-life hospitalizations and ED visits (30 and 34 per 1,000 patients respectively in last 30 days of life).

Cost

Significant decreases in cost of care in the last 30 to 90 days of life ($2,733–$8,093 per patient)

Quality of Care

Significant increases in hospice use in the last two weeks of life

Sustainability and Scaling

UAB and eight of the 12 affiliated sites have received hospital commitments to continue the program for one additional year after the end of the award period.

In an effort to commercialize and expand the lay navigator program nationally, UAB is developing materials and providing consultation services to other organizations that are interested in implementing the lay navigator program.

Introduction

The University of Alabama at Birmingham's (UAB) Patient Care Connect (PCC) program used lay navigators to provide coordinated oncology care for patients. Over the course of the award, the program served approximately 9,000 patients across 12 hospitals in the Deep South. The goal of PCC was to reduce unnecessary hospitalizations and readmissions for patients with cancer. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[149] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

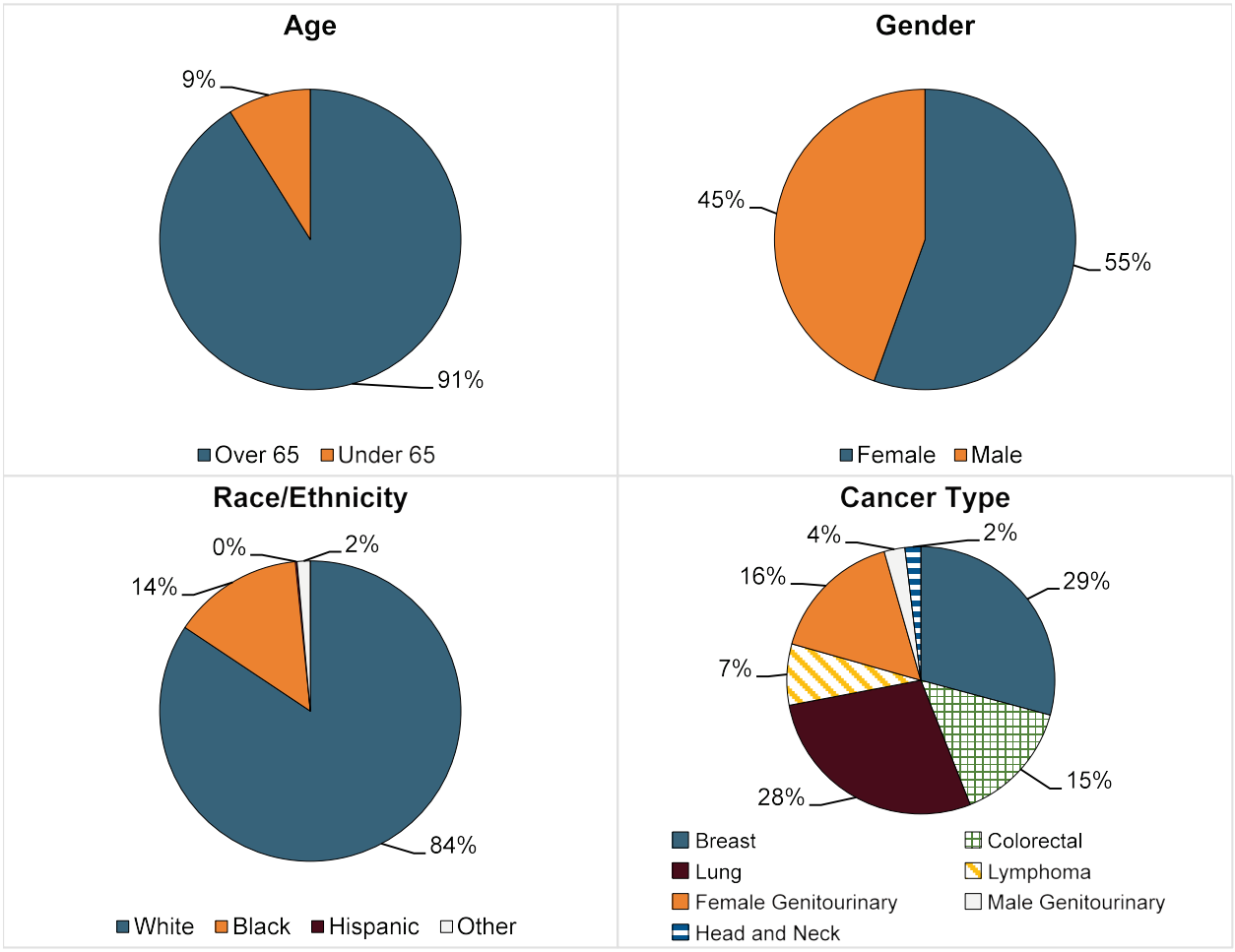
This evaluation analyzed claims to assess the effectiveness of the PCC program in reducing cost and utilization and in improving quality of care. We examined differences in outcomes between PCC patients[150] and comparison patients before and after the intervention, focusing on the following measures:

- all-cause hospitalizations
- hospitalizations for ambulatory care sensitive (ACS) conditions
- 30-day readmissions
- emergency department (ED) visits
- total cost of care

Exhibit 14.1 summarizes demographic and other basic information about the UAB patients who are included in our analysis of core outcome measures.[151]

[149]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[150]Although the PCC program targets patients actively undergoing treatment for cancers, with cancers in remission, and advanced cancers, we limit this analysis to patients undergoing treatment for one of the following seven cancers with adequate sample size: breast, lung, colorectal, head and neck, lymphoma, male genitourinary, female genitourinary cancers. Patients with multiple cancers are excluded from this analysis.
[151]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 14.1: Descriptive Characteristics of UAB Patients



Summative program impact. Exhibit 14.2 summarizes the results of our difference-in-differences (DID) model, which included adjustment for key demographic and other risk factors.[152]

- The PCC program significantly decreased hospitalizations (11 per 1,000 patients) and ED visits (22 per 1,000 patients) for its participants relative to the comparison group.
- There were no significant decreases in 30-day readmissions, ACS hospitalizations, or total cost of care for patients in the PCC program relative to the comparison group.

[152]We adjusted for cancer type, age, gender, race/ethnicity, dual eligibility, disability, ESRD, cancer surgery, radiation, chemotherapy, metastatic cancer, indicator for Comprehensive Cancer Center, and HCC score.

Exhibit 14.2: Difference-in-Differences Estimates for Core Measures for UAB

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	**-11 [-18, -4]****
ED Visits per 1,000 Patients	**-22 [-30, -14]*****
30-day Readmissions per 1,000 Patients Hospitalized	17 [-7, 41]
ACS Hospitalizations per 1,000 Patients	1 [-2, 4]
Total Cost of Care per Patient ($)	-$37 [-$418, $344]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	-$674,293 [-$7,554,313, $6,205,727]

NOTE: ***p<0.01, **p<0.05, *p<0.1

Cross-Site Variation

Although all sites adhered to the core concepts of the lay navigator program, the organizational characteristics of individual hospitals influenced their implementation experience:

- Hospital size might have affected both the workload for each navigator and provider engagement. Smaller sites found it easier to integrate navigators into their health care teams.
- Hospitals in which the physicians were hospital employees had more leeway in influencing physician behavior and garnering physician support for use of lay navigators compared with hospitals in which the physicians were independently employed outside the hospital system.
- Access to inpatient palliative care allowed easy referrals and facilitated advance care planning conversations.
- Sites with existing nurse navigation programs experienced initial challenges in implementing the lay navigator program alongside their existing navigation programs due to role overlap.

Exhibit 14.3 shows the variation in results for each site. In these site-specific analyses of the 12 sites, six sites showed reductions in ED visits, three showed reductions in hospitalizations, and three showed reductions in total cost of care. Memorial Healthcare System in Chattanooga, Tennessee, was the most effective site, with reductions in ED visits, hospitalizations, and total cost of care. Our analysis of the cross-site variations showed no clear trends across all of the sites and found that the program was effective in a variety of settings. Sites of varying sizes, geographic locations, contact modes, and contextual factors demonstrated success with respect to core measures.

Exhibit 14.3: UAB Differences across Sites

Site (State)	N	Key Quantitative Findings	# of Lay Navigators	# of Beds	Navigator Contacts		Physician Employed by Hospital	Inpatient Palliative Care	Nurse Navigation
					Phone	Face-to-Face			
Memorial Healthcare System (Tennessee)	646	Hospitalizations: -24 [-41, -7]** ED visits: -63 [-79, -47]*** Total cost of care: -$1,167 [-$1,957, -$377]**	4	442	93%	7%	No		✓
Mitchell Cancer Institute (Alabama)	438	Hospitalizations: -21 [-42, 0]* Total cost of care: -$1,554 [-$2,441, -$667]***	4	190	38%	62%	Yes		✓
Gulf Coast Medical Center (Florida)	219	ED visits: -45 [-75, -15]** Total cost of care: -$1,322 [-$2,564, -$81]*	2	218	52%	48%	No		✓
Russell Medical Center (Alabama)	105	ED visits: -48 [-93, -3]*	4	81	57%	43%	Yes		
Northeast Alabama Regional Medical Center (Alabama)	290	ED visits: -46 [-74, -18]***	4	338	32%	68%	No	✓	
Northside Hospital (Georgia)	503	ED visits: -39 [-63, -15]***	4	822	95%	5%	No	✓	✓
Singing River Health System (Mississippi)	206	Hospitalizations: -78 [-120, -36]*** ED visits: 55 [5, 105]*	2	400	22%	78%	Yes		
Medical Center of Central Georgia (Georgia)	355	ED visits: -40 [-66, -14]** Total cost of care: $1,946 [$429, $3,463]**	2	637	74%	26%	Mixed	✓	✓
University of Alabama Birmingham (Alabama)	427	No significant findings	4	710	61%	39%	Yes	✓	
Southeast Alabama Medical Center (Alabama)	435	No significant findings	3	420	47%	53%	No		
Marshall Medical Center South and North (Alabama)	242	No significant findings	2	240	26%	74%	Yes		✓
Fort Walton Beach Medical Center (Florida)	69	No significant findings	1	220	71%	29%	No	✓	✓

Subgroup Analysis: Cancer Type

The UAB PCC program targets multiple types of cancer; therefore, we examined whether the program effects varied by cancer type. We hypothesized that patients with cancers requiring greater symptom management (e.g., lung, head and neck) would show greater benefits from the PCC program. Exhibit 14.4 summarizes the impact of the PCC program for patients with breast, lung, colorectal, lymphoma, male and female genitourinary, and head and neck cancers.

- Among all the cancer types, we saw significant reductions in utilization for breast, lung, and male genitourinary cancers, which were the cancers with the largest sample sizes. Analyses for some cancer types were limited in their power to detect differences due to low sample size.
- The PCC program significantly reduced ED visits and total cost of care for patients with breast, lung, and male genitourinary cancers.
- The program was most effective for patients with lung cancer, with reductions in hospitalizations (34 per 1,000 patients) and ED visits (53 per 1,000 patients), partly supporting our hypothesis that patients requiring greater symptom management would show greater benefits from the program.

Exhibit 14.4: Difference-in-Differences Estimates for Core Measures for UAB, by Cancer Type

Average Quarterly Impact [90% Confidence Interval]							
Outcome Measure	**Breast Cancer**	**Lung Cancer**	**Colorectal Cancer**	**Lymphoma**	**Male Genitourinary**	**Female Genitourinary**	**Head and Neck Cancers**
	(n = 1,179)	(n = 1,129)	(n = 598)	(n = 300)	(n = 654)	(n = 102)	(n = 76)
Hospitalizations per 1,000 Patients	4 [-7, 15]	**-34 [-50, -18]*** **	-2 [-24, 20]	5 [-29, 39]	0 [-17, 17]	0 [-48, 48]	-43 [-96, 10]
ED Visits per 1,000 Patients	**-17 [-31, -3]** **	**-53 [-69, -37]*** **	-2 [-26, 22]	21 [-17, 59]	**-29 [-47, -11]*** **	-5 [-55, 45]	57 [-22, 136]
30-day Readmissions per 1,000 Patients Hospitalized	**74 [9, 139]***	-22 [-64, 20]	11 [-41, 63]	90 [2, 178]	-39 [-97, 19]	20 [-105, 145]	**306 [113, 499]*** **
Total Cost of Care per Patient ($)	$381 [-$126, $888]	-$708 [-$1,535, $119]	-$663 [-$2,052, $726]	$1,300 [-$537, $3,137]	$34 [-$732, $800]	-$289 [-$2,224, $1,646]	-$1,684 [-$4,526, $1,158]

NOTE: ***p<0.01, **p<0.05, *p<0.1

Subgroup Analysis: End of Life

Along with assessing the overall effectiveness of the PCC program, we explored the program's impact on reducing end-of-life utilization and cost for patients with advanced cancer. We examined average differences in end-of-life outcomes between deceased UAB participants and a comparison group, for the following measures:

- utilization in last 30 days of life: hospitalizations and ED visits in the last 30 days of life
- quality in last two weeks of life: hospice use and chemotherapy
- total cost of care in last 30, 90, and 180 days of life

For 2,198 UAB participants who passed away during the study period, we identified those enrolled in the program 30, 90, and 180 days prior to date of death and selected a group of comparison patients using propensity score matching.[153, 154] Exhibit 14.5 summarizes demographic and other basic information about UAB patients who were included in our end-of-life analysis.[155]

[153]For 30-, 90- and 180-day outcome measures, we included in our analytic sample participants enrolled in PCC program for 30, 90, and 180 days, respectively.

[154]For details on comparison group selection and propensity score methodology, please see Appendix A.

[155]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 14.5: Descriptive Characteristics of UAB Patients, End of Life Analysis

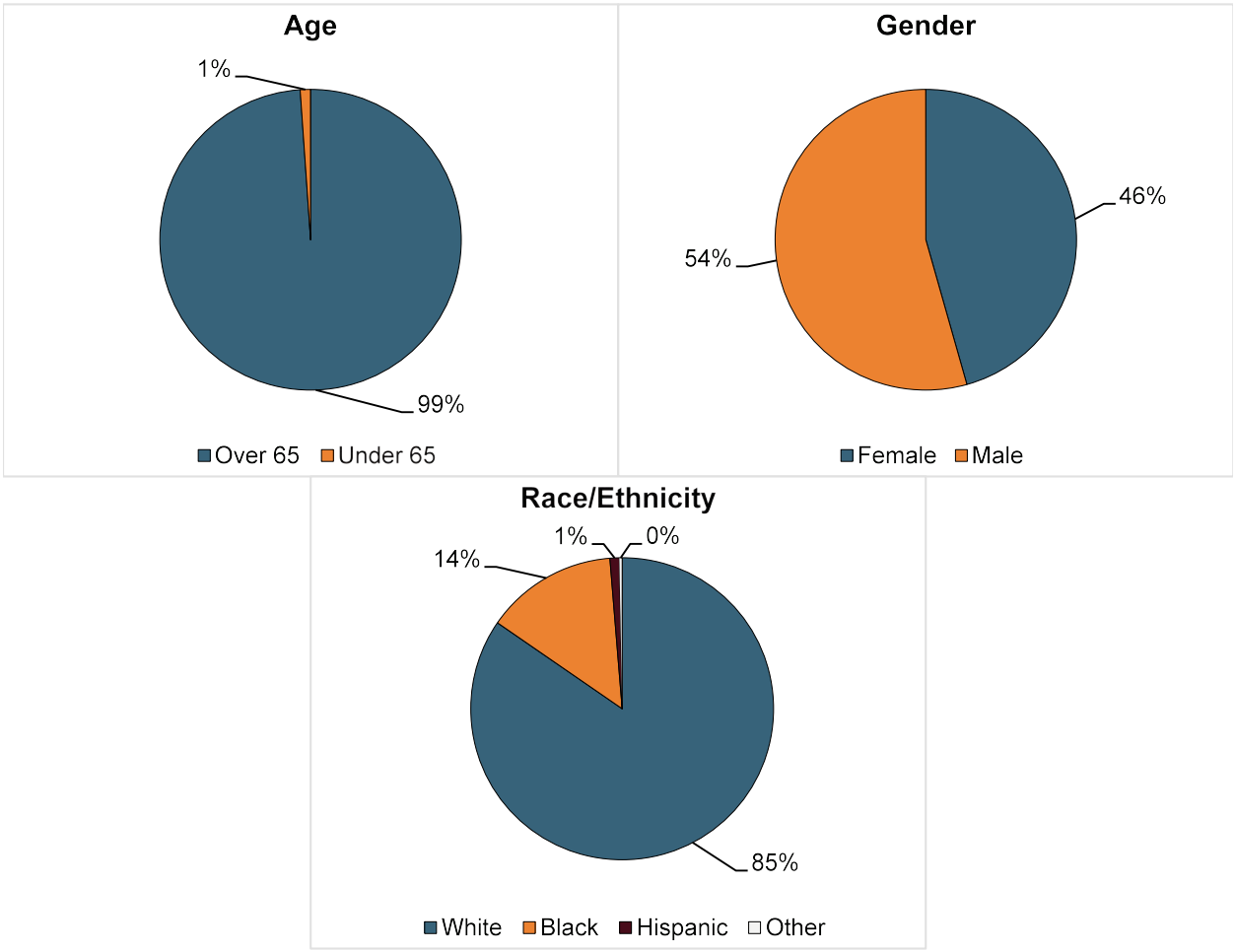


Exhibit 14.6 summarizes the impact of the UAB program in the patients' last days of life.[156]

- For the last 30 days of life, we observed significant reductions in hospitalizations (30 per 1,000 beneficiaries) and ED visits (34 per 1,000 beneficiaries) for participants in UAB's program relative to the comparison group.
- PCC program participants had lower total cost of care relative to the comparison group during the last 30, 90, and 180 days of life. The largest savings in cost occurred in the last 30 days ($2,733 per patient), with diminishing returns when looking back at the last 90 and 180 days of life.
- We also observed significant increases in hospice use in the last two weeks of life.

[156]We adjusted for age, race/ethnicity, gender, dual eligibility, HCC score, disability, prior-year utilization (hospitalizations and ED visits), chemotherapy, radiation, metastatic cancer, high-risk cancer, and number of cancer diagnoses.

Exhibit 14.6: Differences in End-of-Life Utilization, Quality, and Cost between Decedent UAB Program Participants and Comparison Group Participants

Outcome Measure	Adjusted Difference [90% Confidence Interval]
Average Quarterly Impact	
Hospitalizations (Likelihood per 1,000 Patients)	**-30 [-53, -8]****
ED Visits (Likelihood per 1,000 Patients)	**-34 [-54, -15]*****
Hospice Care in the Last Two Weeks of Life±	**85 [63, 108]*****
Chemotherapy in the Last Two Weeks of Life	-22 [-78, 35]
30-Day Total Cost of Care per Patient ($)	**-$2,733 [-$3,701, -$1,766]*****
90-Day Total Cost of Care per Patient ($)	**-$5,824 [-$7,180, -$4,469]*****
180-Day Total Cost of Care per Patient ($)	**-$8,093 [-$9,927, -$6,258]*****
Aggregate Impact	
Outcome Measure	**Adjusted Difference [90% Confidence Interval]**
30-Day Total Cost of Care per Patient ($)	**-$6,007,134 [-$8,134,798, -$3,881,668]*****
90-Day Total Cost of Care per Patient ($)	**-$12,801,152 [-$15,781,640, -$9,822,862]*****
180-Day Total Cost of Care per Patient ($)	**-$17,788,414 [-$21,819,546, -$13,755,084]*****

NOTE: *p<0.10, **p<0.05, ***p<0.01. ED, emergency department, ± The significant increase in hospice use in the last weeks of life is regarded as a favorable improvement for UAB patients.

Qualitative Findings

As discussed in NORC's second annual report,[157] patients and caregivers who participated in focus groups noted improvements in their quality of life and quality of care and decreases in utilization. The sections that follow discuss the drivers behind behavior changes and then outline the major findings that support replicating and scaling up this program in other regions.

Some reductions in utilization may result from participants' calling their navigators rather than going to the ED when they have concerns. UAB encouraged participants to contact their navigators whenever they had questions. Although navigators did not have clinical backgrounds, they had the knowledge and ability to connect patients with their providers to help get their questions answered and concerns addressed. Participants also said that having the navigator's support helped them avoid unnecessary ED visits.

The lay navigator program may be most effective for patients who are undergoing chemotherapy and require active symptom management. Navigators served as a resource for patients because of their understanding of the patient's social situation and potential barriers to treatment adherence. UAB developed evidence-based care maps specifically to manage patients who are in active treatment—e.g., those who are receiving chemotherapy or radiation therapy. Some navigators offered additional support to patients who were receiving treatment by contacting them both before and after appointments.

By offering support across the cancer care continuum, the lay navigator program may prevent or reduce the need for intensive treatment and hospitalization as well as increase the use of hospice for patients at the end of life. Continuous monitoring of program participants supported early identification

[157] Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

of palliative care needs for these patients. Early identification of patient needs may improve the patient's quality of life and help avoid futile or potentially harmful treatments.

Navigation is beneficial for all patients, but it is highly beneficial for those who have no family or social support network because the lay navigator can become the patient's support system. Navigators reported benefits to both patients and family members but saw especially strong benefits for patients without family or another social support system. One navigator observed, "I'm all they have." Physicians particularly noted the value of navigation for patients from disadvantaged backgrounds (e.g., low literacy or socioeconomic status). In these cases, they believed that the navigator was often the only person who could take the time to explain everything clearly to patients.

Workforce

Successful integration of the lay navigators into the health care team required buy-in and engagement from clinic staff and leadership. To implement the program, providers and other clinic staff members had to modify their workflows. For example, some sites implemented extended hours so that nurses could be on hand to help triage patients and to address issues raised by the lay navigators. Staff noted that identifying members of the leadership team or physician champions to promote the program helped facilitate interest in and acceptance of the program.

Program leadership and staff note that, although not necessary, having relevant experience in other health care fields helped navigators to succeed. Prior experience working in health care (e.g., as a medical interpreter or a surgical unit secretary) helped lay navigators understand how the health care system worked and provided some familiarity with the hospital environment.

Context

As shown in our cross-site analysis, the PCC program was effective in a variety of settings. Sites adapted the PCC program to fit their organization's culture and patient population. Although adherence to the core components and principles of the lay navigator program remains important, the adaptability of some program components may encourage replicability in other settings.

Sustainability, Scalability, and Spread

UAB leadership and its affiliated sites continue to seek bridge funding and payer partnerships to move toward their long-term goal of being part of a value-based payment system that includes navigation services. UAB and eight of the 12 affiliated sites (Mitchell Cancer Institute, Gulf Coast Medical Center, Russell Medical Center, Northeast Alabama Regional Medical Center, Northside Hospital, Southeast Alabama Medical Center, Marshall Medical Center South and North, and Fort Walton Beach Medical Center) have received commitments from hospitals to continue the program for one additional year after the end of the CMMI award period. Memorial Healthcare System, Singing River Health System, and Medical Center of Central Georgia are not continuing the program. UAB, Northeast Alabama Regional Medical Center, and Russell Medical Center will continue to implement the full program, and the remaining six sites are moving toward a modified version of the program by adapting it to include a nurse navigator in addition to the lay navigator and/or offering the program to a specific patient population.

In collaboration with two payers—Blue Cross Blue Shield of Alabama and VIVA Health, Inc.—and seven affiliated sites, UAB submitted applications to participate in CMMI's Oncology Care Model (OCM), a new payment model for physician practices that administer chemotherapy. UAB's Health Services Foundation, a faculty practice plan for UAB Medicine, and VIVA Health were selected to participate in the model.

As part of their endeavor to commercialize the lay navigator program, UAB has established a partnership with Medscape, an internet resource for physicians and health professionals, to provide an online lay navigator education program through the Medscape website. The basic training program will be free for public use. For organizations that are interested in implementing the full lay navigator program, UAB will offer additional materials and tools for purchase.

The program reported several factors to consider when initiating similar programs. As described by staff, the conditions facilitating successful implementation included:

- buy-in and engagement from clinic staff and leadership
- clear definition of the lay navigator role
- understanding organizational workflow culture

Limitations

For our quantitative analysis, we excluded patients with cancers other than the seven selected ones (i.e., breast cancer, lung cancer, colorectal cancer, lymphoma, male genitourinary cancers, female genitourinary cancers, and head and neck cancers) and patients with multiple cancers due to small sample sizes. Our analyses, therefore, may not capture the overall impact of UAB's program. Apart from serving patients with cancers who are actively receiving treatment, UAB's program targets those with advanced cancers and cancer survivors. Our current analysis of the program was limited to patients with active cancers. Finally, subgroup analyses for some cancer types and sites are limited in their power to detect differences due to small sample size.

Our qualitative findings are based on visits and telephone interviews with four of 12 sites. We collected data on the remaining eight sites by reviewing reports from the HCIA implementation contractor and any updates that UAB leadership provided during interviews. The sites led recruitment for focus groups, and therefore it is possible that a degree of selection bias shaped the positive patient and caregiver outcomes reported in this and our second annual reports.

Conclusion and Policy Implications

UAB developed the PCC program to provide coordinated oncology care by employing a workforce of lay navigators to expand cancer support in Alabama, Florida, Georgia, Mississippi, and Tennessee. We found that UAB's PCC program significantly reduced hospitalizations and ED visits for its participants relative to a matched comparison group, driven by decreases observed for symptomatic lung cancer patients. Analyses of decedents in the PCC program showed that the program significantly reduced end-of-life costs and increased hospice use. UAB and two of the 12 affiliated sites will continue to implement the full

program for one additional year after the end of the CMMI award period, and six affiliated sites are moving toward a modified version of it.

Many emerging innovations to improve health outcomes rely on lay health workers such as lay navigators to address patient needs that do not require specific clinical training. However, health care systems must pay these workers without the capacity to bill Medicare. Therefore, reimbursement policies for lay health workers present a serious barrier to the adoption and sustainability of models employing nonclinical staff, despite the mounting evidence of their effectiveness. For the UAB program, patients noted that their relationship with a lay navigator enhanced their quality of life and empowered them to improve their communication with providers. Family members and caregivers also reported improved quality of life due to the support from the lay navigators. UAB's favorable impact on utilization, cost, and quality of life provided further evidence to support the business case for reimbursable lay navigator programs.

Regents of the University of California, Los Angeles

Summary. The Regents of the University of California, Los Angeles (UCLA) Alzheimer's and Dementia Care (ADC) program used nurse practitioners as dementia care managers (DCMs) to collaborate with patients' primary care providers (PCPs). DCMs assessed patients' health, offered treatment, developed care plans, and made referrals to outside community-based services for patient and caregiver support services as needed.

Awardee Overview

SITE:	1 hospital in California	***REACH:***	1,574 patients
AWARD:	$3,208,541	***TARGETED CONDITION:***	Dementia
AWARD DATES:	July 2012—Dec 2015	***PAYER(S):***	Medicare
NO-COST EXTENSION:	6 months		

Key Findings

These key findings are based on quantitative analysis of awardee-collected data and Medicare claims (July 2012—December 2015), qualitative interviews with program staff, and focus groups with caregivers.

Implementation

Hiring nonclinical assistants allowed nurse practitioners to keep up with their caseloads and to work "at the top of their license."

Offering vouchers for home and community-based services (HCBS) allowed families to pay for longer-term assistance.

Tracking referrals and payments to community-based organizations offering wrap-around support services assured accountability and follow-up.

Utilization

Reduction in hospitalizations due to ambulatory care sensitive (ACS) conditions (seven per 1,000 patients).

Reductions in 30-day readmissions (41 per 1,000 patients).

25 percent lower rate of nursing home placement.

Cost

Significantly lower average cost of care ($605 less per patient per quarter).

Quality of Life and Care

Improved understanding and management of dementia; improved self-care among caregivers; increased access to community-based support services.

Sustainability and Scaling

Direct philanthropic support and grants will sustain the program for 18 months. UCLA is experimenting with the new Medicare chronic care management fee percent to cover part of its costs.

An adapted version of the program will be implemented in Riverside County, California, as part of the Geriatrics Workforce Enhancement Program. The program also seeks to serve patients of primary care providers who are outside the UCLA network.

Introduction

The Regents of the University of California, Los Angeles, Alzheimer's and Dementia Care (ADC) Program coordinated and managed care for patients with Alzheimer's disease or other forms of dementia and offered support to caregivers via referrals to community-based services. Nurse practitioners (NPs) served as dementia care managers (DCMs) by coordinating and managing patient care. DCMs assessed patient needs, created individualized dementia care plans, and provided caregiver support and education over the telephone, in the ADC office, and in patients' homes. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[158] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

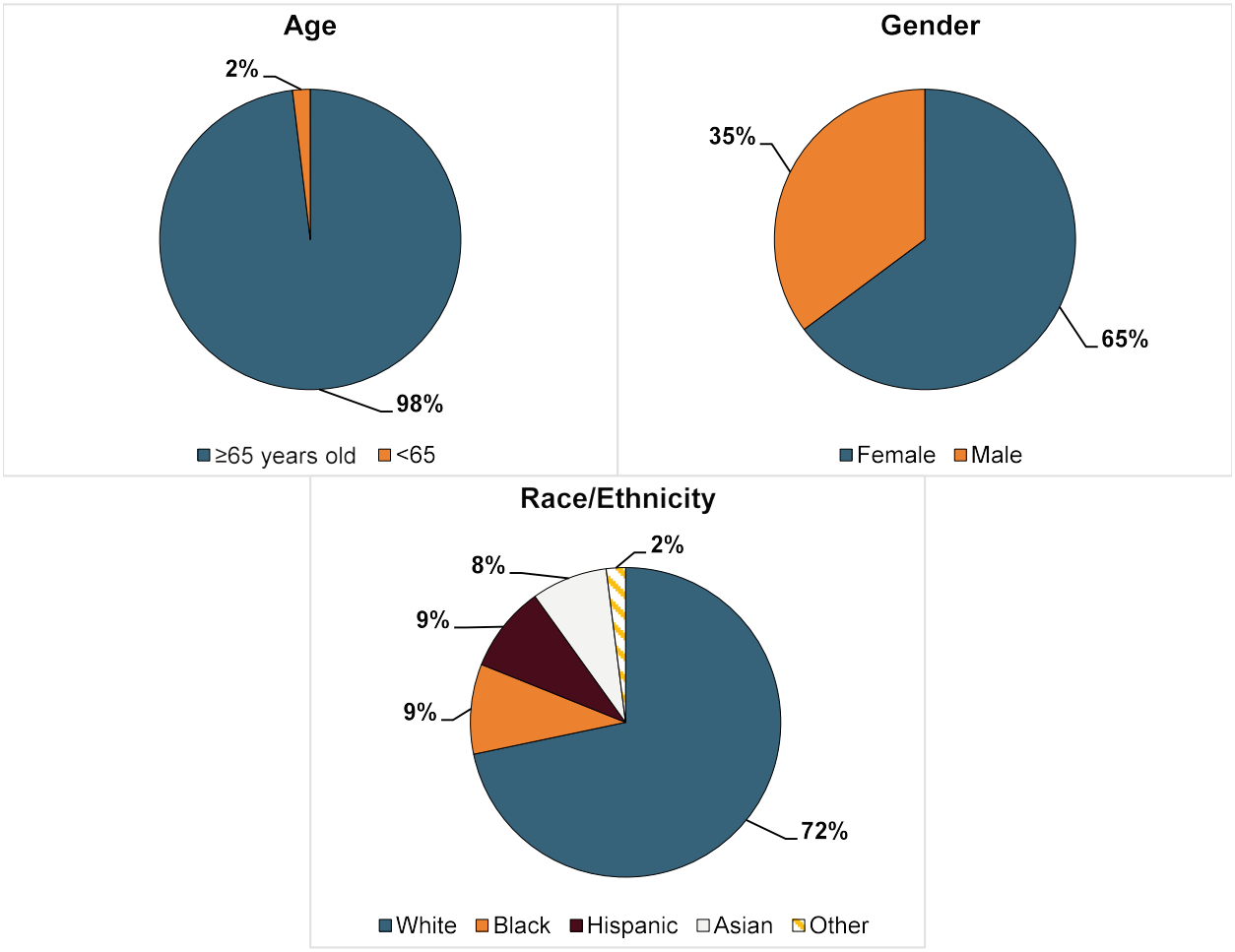
This evaluation analyzed claims to assess the effectiveness of the ADC program in reducing cost and utilization and in improving quality of care. We explored differences between ADC participants and comparison patients before and after the intervention in the following measures:

- all-cause hospitalizations
- hospitalizations for ambulatory care sensitive (ACS) conditions
- 30-day readmissions
- emergency department (ED) visits
- total cost of care
- long-term care placement

Exhibit 15.1 summarizes demographic and other basic information about the UCLA patients who are included in our analysis of core outcome measures.[159]

[158]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf
[159]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 15.1: Descriptive Characteristics of UCLA Patients



Summative program impact. Exhibit 15.2 summarizes the average difference-in-differences (DID) impact per quarter of UCLA's program across the entire post-intervention period.

- We observed a significant reduction in ACS hospitalizations (seven per 1,000 patients) and 30-day readmissions (41 per 1,000 patients) for participants in UCLA's program relative to the comparison group.
- Total cost of care was significantly less for participants in UCLA's program relative to the comparison group ($605 per patient).
- UCLA's program was not associated with significant decreases in all-cause hospitalizations or ED visits.

Exhibit 15.2: Difference-in-Differences Estimates for Core Measures for UCLA

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	-8 [-19, 3]
ED Visits per 1,000 Patients	5 [-10, 20]
30-day Readmissions per 1,000 Patients Hospitalized	**-41 [-76, -6]****
ACS Hospitalization per 1,000 Patients	**-7 [-12, -2]*****
Total Cost of Care per Patient ($)	**-$605 [-1090, -120]****
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	**-$3,473,953 [-$6,259,685, -$688,221]****

NOTE: ***p<0.01, **p<0.05, *p<0.1. ACS, ambulatory care sensitive

Quarter-specific program impact. Although the summative analysis of hospitalization and ED visits did not find significant differences, our quarter-specific estimates suggested that the program had a positive impact on hospitalizations. Quarterly fixed effects (QFE) charts of these estimates can be found in Appendix A, key findings of which include:

- There is a non-significant trend toward fewer hospitalizations for UCLA participants relative to the comparison group. Beginning in the seventh quarter post-implementation, there were fewer hospitalizations for UCLA participants, but these results did not reach statistical significance.
- UCLA's program showed significant reductions in ED visits during the first post-implementation quarter, and no significant reductions or discernible trends in ED visits for the subsequent quarters.

Long-term care placement analysis. We compared rates of long-term care placement between UCLA patients and the comparison group. These models look at time to an event and estimate the relative hazard ratio (HR) of the event occurring.

- During the intervention period, fewer UCLA program participants were admitted to a long-term care facility relative to the comparison group (13% and 22%, respectively). Overall, UCLA participants were 25 percent less likely to be admitted to a long-term care facility (HR: 0.75; 90% CI: 0.60, 0.93).

Qualitative Findings

As discussed in our second annual report, patients and caregivers who participated in focus groups noted improvements in their quality of life, quality of care, and utilization.[160] Qualitative findings support the quantitative program effectiveness findings, particularly concerning reduced utilization. Focus groups with patients and caregivers, as well as interviews with leadership and program staff, suggest that enhanced access and referrals to community-based resources contributed to reductions in hospitalizations and readmissions. Below, we discuss the drivers behind behavior changes and then outline the major findings that support replicating and scaling up this program in other regions.

Community-based service providers helped prevent hospitalization by working with DCMs. UCLA's contracts with community-based providers included two adult daycare service providers that would monitor participants' health status while in their care. Instead of reaching out to the participants' doctors, such providers could instead reach out to DCMs, thereby increasing participant's access to care.

> *"I appreciate that if there is a concern about someone for the program, we can contact the DCM and report. For issues like weight, fluid, food, we can call in alerts, and it is a much quicker turnaround and it avoids hospitalizations. Not having to call a doctor's office, there is a much better connection there and you see a better response."*
>
> —Community-based Service Provider

> *"[DCMs] make it so easy to get help. And with UTIs, [my mother's] new PCP would just say, 'Go to the ER' and would give me a referral and you would see someone three months later. Now we just go to [DCM] and we get seen immediately…. It's been a vast improvement rather than just going to the ER."*
>
> —Caregiver of Program Participant

Although we do not observe this finding in our quantitative analysis, participants reported that increased access to a nurse practitioner reduced their ED visits. The DCMs were seen as an extension of (or even a replacement for) the primary care provider, enabling patients to have quicker access to health care when needed. Specifically, several caregivers reported that access to the DCM prevented ED visits for urinary tract infections.

Mixed-methods analysis indicates that the ADC program helped reduced caregiver strain.

- Our analysis of awardee-collected data indicates that the number of caregivers in the "high-strain" group (Modified Caregiver Strain Index ≥13) was reduced after one year of participation in the program.[161] At baseline, 41 percent (n = 148) of participants were experiencing high caregiver strain, whereas only 28 percent (n = 103) were experiencing high-strain at follow-up.
- Qualitative findings indicate that intensive education sessions, support groups, and counseling helped caregivers learn how to better care for patients with dementia and cope with their own stress in caring for someone with such a difficult condition. Many focus group participants enthusiastically described an annual Dementia Boot Camp that they had attended. They also appreciated ongoing education and counseling offered by partnering community-based organizations (CBOs).

[160] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf

[161] The Modified Caregiver Strain Index is a brief tool that can be used to assess strain among long-term caregivers.

Our quantitative and qualitative data indicate that the program helped caregivers find and use social services in their communities.

- Program data show a three-fold increase, after participating in the program, in the number of caregivers who reported that they were aware of services available to help them and of how to access community services. The proportion of caregivers who had received advice about handling problems and who knew where to turn for answers doubled.
- UCLA reported to CMMI that, during the program's first year, caregivers shifted more responsibilities from informal to paid caregivers.[162]

> *"[The DCM] hooked us up with [an adult day care service provider], which has been great. And she loves music, and taking her there three times a week, although it is costly, it is helpful."*
>
> —Caregiver of Program Participant

Qualitatively, caregivers reported that introductions to community-based support services helped them find longer-term assistance. By accepting the offered vouchers for free community-based services, some caregivers and patients eventually paid for services they found to be beneficial. The program also provided vouchers for longer-term support for those who could not afford to pay out of pocket. One couple reluctantly tried adult daycare only to find that the patient in fact enjoyed it - he began going twice a week, and the caregiver also began counseling for herself.

Workforce

DCM assistants made DCMs' large caseloads more manageable. DCMs met the original goal of having caseloads of 250 patients but faced challenges in completing the documentation necessary for the program and in managing referrals to address patients' nonclinical needs. The addition of two nonclinical DCM assistants relieved some of their workload by helping with tasks such as:

- scheduling telephone or in-person appointments with the DCM, as appropriate
- documenting service provisions in the electronic medical record
- following up with patients categorized as "green," i.e., having stable status
- identifying families in crisis and following protocols to ensure that their needs were met

By partnering with community-based service providers, UCLA extended its workforce capacity and supported existing resources for older adults. Instead of hiring project staff to address nonclinical issues, UCLA relied on community-based providers for psychosocial counseling, education, and support. It developed a voucher system to directly pay providers and refined this system over time to assure that providers were paid based on the actual (rather than the projected) provision of services. Community-based staff included licensed therapists, social workers, and lay health workers trained to serve older adults in general and dementia patients in particular.

[162]UCLA's Fourteenth Quarterly Report to CMMI. January 2016.

Context

> *"We see more and more programs being eliminated in today's world, and as people live longer, their propensity for dementia increases but the services we have are decreasing. They are saying Alzheimer's could bankrupt Social Security, so if support such as [the ADC program] will help lower ED visits, then why not invest in it?"*
>
> —Community-based Service Provider

UCLA staff took advantage of the relatively widespread availability of home and community-based services (HCBS) in California to help patients age in place and avoid nursing home placement. Although DCMs still helped with nursing home transitions for some of the program's participants, UCLA had a 25 percent lower rate of placement than a comparison group. California ranks second in the nation on a scorecard that considers the supply and availability of alternatives to nursing homes.[163] In addition, the state holds six special Medicaid waivers for older adults and people with disabilities that allow Medicaid beneficiaries to receive HCBS.[164]

Sustainability, Scalability, and Spread

UCLA received institutional and philanthropic support to sustain its program. In December 2015, UCLA received a private donation of more than $900,000 to support the ADC program. It also received a two-year grant from the Eisner Foundation and its caregiver respite program, Time Out. UCLA began piloting Medicare's chronic care management fee for non-face-to-face case management of patients with two or more chronic conditions but it's unclear what percentage of program costs will be covered by the effort.

The ADC program will expand to a new location and seeks to collaborate with primary care providers outside the UCLA network. A grant from the Geriatrics Workforce Enhancement Program (funded by the federal Health Resources and Services Administration) allowed implementation of a program modeled on UCLA's program in Riverside County in which registered nurses, instead of nurse practitioners, serve as DCMs.

Limitations

For our quantitative analysis, although we included a matched comparison group in our analysis, the results should be interpreted with caution. We observed a small number of participants enrolled in the intervention for eight or more quarters and a small number of patients who experienced an ACS hospitalization. This limited our power to detect differences. Similarly, analysis of readmissions includes only patients with an index hospitalization, thereby reducing the sample size in these models.

[163]Long-term Services and Supports. Raising expectations; a state scorecard on long-term services and supports for older adults, people with physical disabilities, and family caregivers; June 19, 2014. Available at: http://www.longtermscorecard.org/.
[164]SCAN Foundation. Where is long-term care provided in California? August 2012. Available at: http://www.thescanfoundation.org/sites/default/files/ca_where_is_ltc_provided_aug_2112_fs.pdf .

Our qualitative findings are based on two rounds of interviews with program leaders, staff, and community-based partners, and three focus groups with caregivers. Given the nature of dementia, we had very limited patient participation in evaluation activities; our patient sample included only two dementia patients who attended one caregiver focus group. There may have also been selection bias among caregivers recruited for the focus groups by UCLA.

Conclusion and Policy Implications

UCLA developed the ADC program to provide coordinated care for patients with Alzheimer's disease or other forms of dementia and to support caregivers. Our mixed-methods findings suggest that enhanced access to an advanced care practitioners and community-based supportive services contributed to significant reductions in hospitalizations, readmissions, total cost of care and nursing home placements; and improved quality of life for caregivers and dementia patients. Nurse practitioners serving as DCMs offered personalized care plans and coordinated care between primary care providers and community-based providers. Referrals to community-based social services provided assistance to caregivers in managing both patients' and their own health and well-being; this resulted in a greater ability for participants to age in place. Although DCMs were challenged by large workloads, the program evolved to more of a team-based approach, which allowed nonclinical staff to assist with scheduling, documentation, and referrals for social support. The ADC program has been sustained largely through local philanthropic and UCLA institutional support.

In light of our findings, the ADC program can be viewed as a model to address several goals of the National Plan to Address Alzheimer's Disease, which grew out of the passage of the National Alzheimer's Project Act in 2011. The plan offers guidance on enhancing the quality and efficiency of health care and supporting people with Alzheimer's disease and their families.[165]

[165]US Department of Health and Human Services. National plan to address Alzheimer's disease: 2015 update. Available at: https://aspe.hhs.gov/pdf-document/national-plan-address-alzheimer%E2%80%99s-disease-2015-update.

Trustees of the University of Pennsylvania

Summary. The Trustees of the University of Pennsylvania (UPenn) implemented the Comprehensive Longitudinal Advanced Illness Management (CLAIM) program for individuals with advanced cancer who did not yet qualify for hospice. The program employed a nurse practitioner in conjunction with home health aides, licensed practical nurses, chaplains, and social workers to provide skilled home care. The program offered in-home support, symptom management, crisis management, and emotional and spiritual support to improve the quality of life of patients with advanced cancers and to limit symptoms and pain-related hospitalizations.

Awardee Overview

SITE:	1 hospital in Pennsylvania	***REACH:***	1,286 patients
AWARD:	$4,352,754	***TARGETED CONDITION:***	Advanced cancer
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Commercial, Medicare, and Medicaid

Key Findings

These key findings are based on quantitative analysis of awardee-provided data (November 2012—June 2015) and qualitative interviews with staff and program participants.

Implementation

Having an oncology background is important for staff members working in the program; caring for patients with advanced cancers requires an understanding not only of the disease's clinical aspects but also of its psychological impact on patients.

Future programs should consider formal training programs for staff members who lack oncology experience.

Interoperability between electronic home care systems and the hospital's electronic health records (EHR) is key to seamless communication between CLAIM and hospital staff to ensure the patient's end-of-life plans are met.

Utilization and Cost

Data are not available to evaluate these measures.

Quality of Life and Care

CLAIM performed significantly better than its target goal for managing pain for participants with advanced cancers.

CLAIM improved quality of life for both cancer patients and caregivers by managing pain, providing home-based care, and initiating early discussions of the goals of care.

Patients and caregivers reported a greater sense of confidence as a result of the pain and symptom management services.

Sustainability

UPenn reported that it was unable to sustain the program due to payment and billing restrictions related to home-based care for patients with advanced cancer who were still seeking curative treatment.

Introduction

The Trustees of the University of Pennsylvania's (UPenn) Comprehensive Longitudinal Advanced Illness Management (CLAIM) program provided comprehensive home care, symptom and crisis management, and emotional and spiritual support for patients with advanced cancers. During the award period, the program served approximately 1,300 patients. CLAIM's goal was to reduce hospitalizations and total cost of care for patients with cancer. This chapter presents summative findings on program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[166]

Summative Findings of Program Effectiveness

This evaluation analyzed awardee-provided data to assess the effectiveness of this program in reducing utilization and improving quality of care. We were unable to assess program effectiveness for the awardee using claims data, since more than two-thirds of their program participants had private insurance. In addition, the awardee did not provide the necessary information on their Medicare/Medicaid program participants to conduct such an analysis.[167] Qualitative findings from site visits and telephone interviews with staff, patients, and caregivers support the quantitative findings. As discussed in NORC's second annual report, patients and caregivers noted that the CLAIM program improved their quality of care and quality of life. The sections that follow discuss the drivers behind behavior changes and then outline major findings that inform replicating and scaling up this program.

Exhibit 16.1 Overview of Mixed-Methods Findings for the CLAIM Program

Program Goal	Description of Program Elements	Overview of Findings
Manage pain and other symptoms	▪ The care team conducted routine home visits to assess patient symptoms and to provide palliative care to avoid hospitalizations for symptoms that can be effectively managed in the home, such as nausea, vomiting, and pain.	▪ The CLAIM program brought 76% of participants with pain to a comfortable level within 48 hours of enrollment, thereby exceeding the industry benchmark of 55.5% and the program's benchmark of 66%. ▪ According to an internal evaluation conducted by CLAIM, the program reduced hospitalizations for Medicaid participants by 40%. ▪ Patients and caregivers reported improved quality of life due to the support and disease management offered directly in the home. ▪ Patients also reported that home-based care alleviated the stress and discomfort of clinic appointments and unnecessary emergency department (ED) visits.

[166]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[167]Data provided by the awardee did not include program participants' Social Security number or health insurance claim number, precluding us from identifying participants from Medicare or Medicaid claims.

Program Goal	Description of Program Elements	Overview of Findings
Clarify and document goals for care and initiate advance care planning	■ Social workers and nurses engaged patients to define goals of care and to develop a symptom management plan. ■ The CLAIM program emphasized implementing advance directives to help manage care early in the patient's end-of-life period. ■ The CLAIM program used an NQF/0209 "Comfortable Dying" measure to gauge patients' anxiety level regarding the advanced nature of their disease. ■ Social workers and nurses scanned advance directives and treatment preferences directly into the program's EHR, called Homeworks.	■ According to program leadership, UPenn's focus on establishing care goals and advance directives eased patient and caregiver burdens and minimized overly aggressive treatment. ■ The care team empowered patients and caregivers by providing information about their disease and instilling a greater sense of confidence and comfort.
Provide emotional and spiritual support	■ The CLAIM program used social workers and chaplains to assist patients with advance care planning, to identify potential social services, and to provide psychosocial support.	■ Program leadership noted that, although patients and caregivers used social workers, chaplains were not well used and may not be recognized as a need by this patient population.
Coordinate after-hours calls and crisis management	■ The CLAIM program used a 24/7 triage line to prevent patients from calling emergency services for symptom-related issues.	■ 69% of patients used phone support during the intervention period.

Workforce

The CLAIM program used ongoing, on-the-job training for their workforce. The nurse practitioner led weekly team meetings that included informal trainings for home care workers in how to discuss goals, disease progression, and evidenced-based practices for symptom management and wound care. The nurse practitioner also reviewed case studies of difficult to manage patients who were in the program. CLAIM staff members also participated in pain and symptom management training for all UPenn hospice and home care staff members. However, there was no classroom-based training specific to the CLAIM program.

The emotional and spiritual components of the program were not utilized as much as anticipated. The CLAIM program strove to create a holistic approach to care using an interdisciplinary team, including a chaplain and a social worker. Although the social work services were used, patients and families opted to turn to their own religious institutions rather than the CLAIM program chaplain. Future home care programs should consider whether the target populations are likely to make use of chaplain services.

The nurse practitioner role was the key to improved care delivery for the CLAIM program, with the nurse practitioner serving a multifaceted role. The nurse practitioner managed the care team, trained staff, prescribed medications, and communicated between oncology providers and the program. She championed goals of care discussions with patients. The nurse practitioner used her relationships with oncology providers to effectively recruit patients into hospice care early in the end-of-life period.

Leadership suggested that nurse practitioner–led home-based care could be a national model that would improve the quality of home visits. They suggested working with organizations such as the National Association for Home Care and Hospice (NAHC), the National Hospice and Palliative Care Organization (NHPCO), and the Center to Advance Palliative Care (CAPC) to implement the nurse practitioner model.

Context

Seamless communication is critical to coordinate care for advanced cancer patients at the end of life. CLAIM used the Homeworks software, UPenn's Home Care and Hospice Services' EHR. When a participant established an advance directive during a home visit, nurses immediately scanned the directive into the Home Care and Hospice Services' EHR. However, if the participant was admitted to a hospital, the fact that the patient had this advance directive in place was not apparent in the EHR system. The Home Care and Hospice Services' EHR and the hospital EHR used separate software platforms, so CLAIM staff made a concerted effort to share advance directives and goals of care documentation with the patients' primary care providers. To facilitate communication between both EHRs, the CLAIM program depended on UPenn's secure email system to relay information to different care teams. Leadership noted that communication would be more efficient if the CLAIM program and the hospital shared the same EHR.

Sustainability, Scalability, and Spread

UPenn is not sustaining the CLAIM program. UPenn reported that current payment and billing restrictions prevented them from sustaining the CLAIM program because there are limited home visits reimbursed under Medicare for their home care services. Leadership attempted to engage financial partners to sustain the program but were ultimately unsuccessful.

The program reported several factors to consider when initiating similar programs. As described by staff, the conditions facilitating successful implementation included:

- an established skilled home health care program
- a midlevel provider, e.g., a nurse practitioner, trained in oncology to lead the program
- interoperability between a home care–specific EHR and the hospital's EHR

Limitations

Due to the low evaluability of UPenn's CLAIM program with respect to Medicare/Medicaid populations, our analysis of program effectiveness was limited to the awardee's self-reported performance data on pain management for its patients, with reference to a historical comparison group benchmark. We were unable to assess the effect of the CLAIM program with respect to hospitalizations, readmissions, ED visits, and total cost of care. We were also unable to evaluate CLAIM patients against a comparison group to determine if the program differentially affected pain outcomes.

We developed our findings from visits, telephone interviews, and UPenn-reported information. We were unable to conduct a focus group because the patient population was home-bound and too sick to participate in in-person focus groups. We did conduct a limited number of patient and caregiver

interviews in-person and by telephone to capture the impact of the program. However, these interviewees volunteered, and therefore it is possible that a degree of selection bias shaped the positive patient and caregiver outcomes reported in our annual reports.

Conclusion and Policy Implications

The CLAIM program was formed to provide home-based pain and symptom management for advanced cancer patients who have considerable palliative care needs but are not yet eligible for hospice. Strong quantitative data to evaluate the CLAIM program were lacking for this evaluation. We were unable to assess the impact of CLAIM on hospitalizations, readmissions, ED visits, and total cost of care. However, our analysis showed that the CLAIM program improved quality of life by providing in-home support, symptom management, care coordination, and triage, thereby allowing patients to remain in their homes and receive care for issues that otherwise could have resulted in hospitalization. In addition, we found evidence that the program performed significantly better than its target goal for managing patients' pain in most post-intervention quarters and over the entire post-intervention period. UPenn was unable to sustain the program beyond the HCIA funding period.

Despite the fact that UPenn was unable to sustain the program, the lessons learned from the awardee's experience remain valuable. Caregivers and patients reported a greater quality of life due to the services provided by CLAIM. End-of-life costs are exceptionally high for cancer patients, and programs that focus on improving a patient's quality of life and reducing hospitalization will play an important role as payment models shift away from fee for service. Furthermore, with a shortage of palliative care providers, new approaches to care such as CLAIM should be considered to engage nurses and other support staff.[168]

The CLAIM program may offer some insight for the new CMMI demonstration, Medicare Care Choices Model, a program that allows patients to concurrently seek curative and palliative treatment. Specifically, CLAIM offers insights into training and retention of home care workers, broader care coordination at the end of life, and process for integrating advanced care planning into electronic records.

[168]Casarett D, Teno J. Why population health and palliative care need each other. *JAMA.* 2016;316(1):27-28.

Upper San Juan Health Service District

Summary. The Upper San Juan Health Services District (USJHSD) program focused on reducing cardiovascular disease (CVD) risks for its rural patients living in a medically underserved area of southwestern Colorado. USJHSD included Pagosa Springs Emergency Medical Services (EMS) and the Pagosa Springs Medical Center (Medical Center). USJHSD had three interconnected arms: 1) wellness programs, 2) paramedicine, and 3) telemedicine.

Awardee Overview

SITE:	1 hospital in Colorado	***REACH:***	1,828 patients
AWARD:	$1,724,540	***TARGETED CONDITION:***	Cardiovascular disease
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare, Medicaid, and commercial

Key Findings

These key findings are based on an area-level analysis of Medicare claims (July 2012—July 2014), qualitative interviews with staff members, and focus groups with program participants.

Implementation

Patients preferred in-person visits over telemedicine, and they were willing to make the one-hour drive.

Patient navigators attracted high-risk patients and needed to set boundaries and limit caseloads in order to meet all patients' needs and to prevent burnout.

Utilization

Significant decrease in specialty care transports (SCTs) via air ambulance

Cost

Significant decrease in cost per SCT, although overall significant increase in SCT costs due to higher number of ground transports

Quality of Care

Wellness center screenings for more than 1,600 patients promoted reengagement with primary care providers.

Sustainability and Scaling

The awardee reports that all intervention activities will continue in their entirety through the hospital's operational budget.

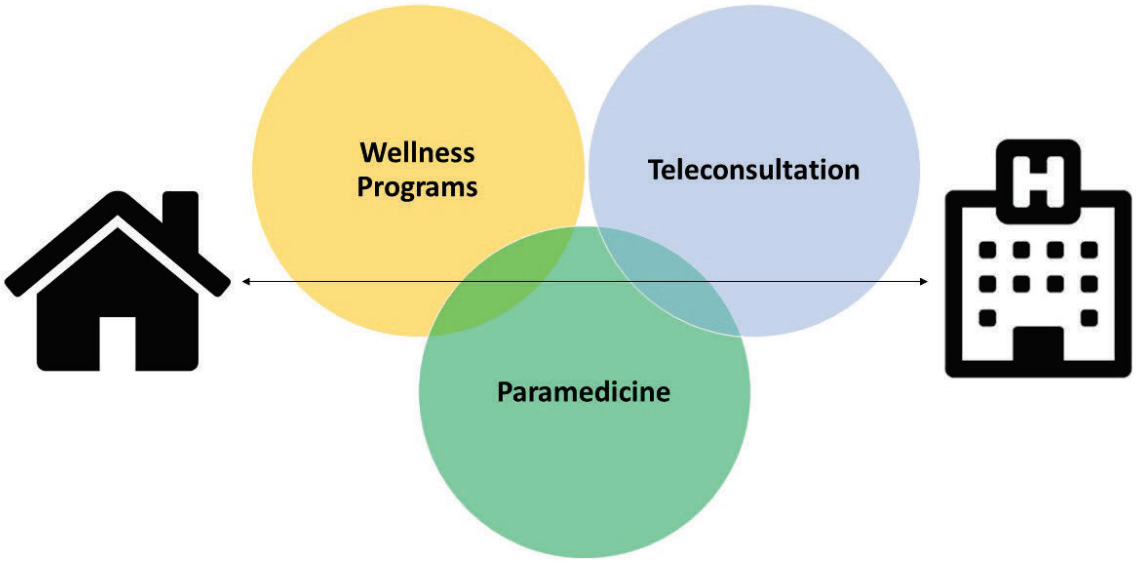
USJHD's telemedicine and paramedicine programs may serve as a model for expanding critical stroke diagnostic services in rural regions. However, facilities must carefully consider the range of services offered because of the large investment relative to the small number of people served.

Introduction

Due to the higher prevalence of cardiovascular disease (CVD) and a greater shortage of health care professionals in rural areas than in urban areas, the Upper San Juan Health Services District (USJHSD) took a comprehensive approach to CVD prevention and treatment in order to increase access to both primary and specialty care providers.[169,170] Because of a shortage of local cardiologists or neurologists, patients either drove long distances for a consultation with a specialist or, in acute situations, required specialty care transportation (SCT) to larger hospitals in the region.

To address gaps in services, USJHSD's program consisted of three components: 1) a wellness program, 2) telemedicine, and 3) paramedicine. As illustrated in Exhibit 17.1, paramedicine overlapped with the two other components, which operated independently of one another. Together, these components sought to better connect patients in their homes and communities with the Pagosa Springs Medical Center and its services. This chapter presents summative findings with respect to program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[171]

Exhibit 17.1: USJHSD Program Components



Summative Findings of Program Effectiveness

Our analysis of USJHSD's program effectiveness is based on an analysis of awardee-collect data on the wellness program and an area-level analysis of claims data. Exhibit 17.2 summarizes our quantitative program effectiveness findings for each component. Analysis of the wellness program is based on awardee-collected data on the participants' biomarkers and survey responses. Since the awardee-collected

[169]O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart disease. *Public Health*. 2012;126:813-820.

[170]Pearson K, Gale J, Shaler G; Flex Monitoring Team. Community paramedicine in rural areas: state and local findings and the role of the State Flex Program. Policy brief #34. February 2014. Available at: http://www.flexmonitoring.org/wp-content/uploads/2014/03/bp34.pdf.

[171]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

wellness data are de-identified and the wellness program outcomes, such as biomarker information, are not available in claims data, this analysis does not include a comparison group. Impact of the patient navigation and outreach paramedicine programs was not assessed due to the small number of patients enrolled in these programs. Unavailability of identifiable information for enrollees in the Critical Care Paramedicine program prevented us from constructing a comparison group of patients from Medicare claims with similar characteristics. Our analysis of the wellness program did not find significant changes in CVD biomarkers or behaviors among program participants. However, we found significant findings related to the central goal of reducing SCT by air. Due to the challenges of performing meaningful quantitative analysis of programs that serve small numbers of participants, these results should be interpreted with caution.

Exhibit 17.2: USJHSD Program Effectiveness

Program Component and Description	Data Sources	Quantitative Evidence of Effectiveness
Wellness: Early-detection screenings; nutrition, physical activity, and wellness education	▪ Awardee-collected data	▪ No statistically significant improvements over time for blood pressure, cholesterol, fiber intake, smoking cessation, weight management, and health-related quality of life (as measured by the VR-12, a brief instrument measuring health-related quality of life[172])
Wellness: Patient navigation for patients with clinical risk factors for CVD	▪ None available	▪ Low evaluability due to small sample size and missing information on patient demographics, comorbidities, and chronic conditions. Impact was not assessed.
Outreach Paramedicine: Specially trained emergency medical technicians (EMTs) targeted vulnerable patients identified by primary care physicians and the patient navigation program for follow-up in their homes	▪ None available	▪ Low evaluability due to small number of patients served (n = 5). Impact was not assessed.
Critical Care Paramedicine: Specially trained EMTs aimed to enhance local capacity to perform critical tests (such as the troponin test, which assesses potential damage to heart muscle that occurs during a heart attack) to inform decisions about the need for critical care transport to tertiary hospitals*	▪ Pre-post area-level analysis using Medicare FFS claims	▪ Non-significant increase in troponin testing rates in the post-period; no evidence that troponin testing led to decrease in number of patients transported by air ambulance ▪ Significant decrease in the proportion of SCTs by air ambulance in the post-period ▪ Statistically significant decrease in cost per SCT and proportion of SCTs by air ambulance in the post-period; however, overall number of SCT cost increased significantly
Teleconsultation: Offered diagnostics and treatment for patients with cardiovascular or neurological symptoms*		

[172]Iqbal SU, Rogers W, Selim A, et al. The veterans RAND 12 item health survey (VR-12): what it is and how it is used. Available at: http://www.hosonline.org/globalassets/hos-online/publications/veterans_rand_12_item_health_survey_vr-12_2007.pdf.

NOTE: *Findings for critical care paramedicine and teleconsultation are combined since they were used together, and results cannot be attributed to one program or the other.

Qualitative Findings

Although our quantitative findings for USJHSD's programs showed limited effectiveness, our qualitative findings from interviews with staff and participant focus groups and interviews suggested promising benefits for patients living in rural areas. The sections that follow offer overviews of the patient experience and of implementation effectiveness related to workforce, context, and sustainability.

Wellness program. Patients accessed services and education that they otherwise could not afford, including screenings for CVD risk factors. Many participants wanted to lose weight and learn how to eat more healthfully, and some reported success in doing so through the program.

> *"I work better at my job. I have more time and energy to play with my child. And it's just all around I feel better. And you know being able to spend time with my daughter, being able to play with her and not feel tired… is huge."*
>
> —Program Participant

Patient navigation. With patient navigation assistance, participants were able to get medications they otherwise could not afford through state-supported and pharmaceutical company patient assistance programs. If needed, the patient navigator could also help them understand when and how to take medications. The patient navigator also coordinated appointments, connected participants to primary care providers, and helped people determine their eligibility for and enroll them in affordable health insurance programs.

Outreach paramedicine. Leadership reported that EMTs extended their practice by performing laboratory tests and medical procedures and by making timely follow-up appointments and referrals for social issues. One participant reported that after he was discharged from the hospital, outreach paramedicine EMTs visited his home daily for a week to check his catheter.

Teleconsultation. In its final report to CMMI in June 2015, USJHSD reported that four patients who were experiencing symptoms were quickly diagnosed with stroke via telemedicine and were immediately administered thrombolytic treatment (to break up blood clots); reductions in lifetime stroke-related costs are expected from this treatment. We did not receive program data on the number of teleconsultations conducted during the award period and cannot calculate how many times teleconsultation resulted in a stroke diagnosis. However, telemedicine in combination with critical care paramedicine enabled more patient transfers to a closer tertiary care facility in Farmington by ground than by air. Specialty teleconsultations allowed for more accurate diagnosis of the severity of the condition, which allowed those who were in less critical condition more time for ground transportation to a closer facility. In addition, the two-hour drive is preferred by patients and families rather than a five-hour drive or a flight to Denver if transported by air. If closer, family can subsequently visit and help care for the patients.

Workforce

USJHSD employed a range of staff members to extend the capacity of primary care providers and to communicate with regional specialists. However, in their final report to CMMI (June 2015), USJHSD indicated that they were understaffed and had underestimated the staffing needed to make a positive

impact on patient or population health. Furthermore, they found the recruitment and retention of all types of staff to be difficult due to the rural location. The limited supply of highly skilled local candidates such as paramedicine staff or nurse care coordinators made it challenging to retain staff for projects with potentially limited duration such as the Health Care Innovation Award (HCIA). Exhibit 17.3 lists lessons learned about workforce by program component.

Exhibit 17.3: Lessons Learned, by Program Component

Program Component	Lesson Learned
Patient Navigation	The patient navigator set boundaries with patients and providers in order to be more effective and to avoid burnout. USJHSD now uses a clear timeline for navigation and establishes a manageable caseload (20 patients per full-time navigator).
Telemedicine	Over time, the emergency department (ED) physicians developed more trusting relationships with the consulting neurologists, leading to an increased number of teleconsultations. Initially, ED physicians were hesitant to receive direction from neurologists because they did not have enough expertise with neurology themselves and were concerned that the neurology consultants would take unnecessary risks with their patients.
Critical Care/Outreach Paramedicine	Paramedics found it challenging to complete simultaneous trainings for both critical care and outreach paramedicine. Although they saw the value of the higher credentials, they found it difficult to complete extensive training requirements (i.e., classroom training plus 196 hours of practical work).

Context

USJHSD cited poor communication with providers as a major challenge to implementation and cause of delays. Providers did not always buy into clinic administrative decisions, and their training had to be repeated due to staff turnover.

State regulations prohibited the implementation of outreach paramedicine as planned. To comply with Colorado regulations, patients needed to call the paramedics' office to request services. Although the intervention is meant to be a proactive (rather than reactive) approach to ongoing management of a patient's health care needs, paramedics were not able to schedule visits in advance of receiving a call. Under Colorado government regulations, outreach and community paramedicine may need to apply for a home health waiver in order to seek reimbursement.

Cardiac telemedicine was underutilized due to the close proximity of cardiology specialists—a one-hour drive for in-person consultations. Due to patients' preference for in-person consultations, telemedicine was found to be most useful in emergencies that required visualization of the acute condition (e.g., stroke) and when the distance to specialists was too burdensome for patients.

The USJHSD service area lacked local resources for treatment of substance abuse or chronic pain, two conditions commonly found among patients referred to the patient navigator. Patients referred to the patient navigator might have met the CVD risk factor criteria, but they were also regarded as high-need and requiring extra attention to address other complicating issues, such as substance abuse and chronic pain. Care for these complicating factors required referrals to resources outside the district that Upper San Juan serves.

Sustainability, Scalability, and Spread

USJHSD committed to sustaining its three main program components through incorporation into their operational budgets. Despite the low evaluability and limited quantitative evidence of program effectiveness, patient satisfaction and increased external professional recognition convinced the hospital administration to continue the programs that were regarded as promising practices for their rural area. For example:

- In 2015, the patient navigation program was recognized by the Centers of Excellence in Care Coordination, a program of the Southwestern Colorado Area Health Education Center.
- The paramedicine program received the 2015 Ambulance Service of the Year Award from the Emergency Medical Services Association of Colorado and the Colorado Department of Public Health and Environment.

In addition, staff highly valued neurology telemedicine's ability to allow providers to administer thrombolytic treatment for stroke patients before they were transported to a tertiary care facility. The awardee sustained this program component because early treatment for stroke is associated with improved patient outcomes and may result in large lifetime cost savings.

In fact, USJHSD offered its institutional commitment despite the lack of direct reimbursement mechanisms for many of its programs. For example, although there are regulatory and administrative burdens involved in billing for outreach paramedicine, leadership believed that this service would increase revenues by increasing patients' follow-up visits with primary care doctors. They expected that increased revenue from such follow-ups could cover the costs of the service. Use of paramedicine was also expected to lead to fewer hospitalizations.

Limitations

The small number of individuals in the wellness analysis limited our ability to detect quantitative changes in utilization measures. Since the analysis of the telemedicine program is based on one follow-up point, it does not capture any long-term improvements in health status or any decreases in cost and utilization that are attributable to thrombolytic therapy facilitated by telemedicine. Finally, we lacked a comparison group and were unable to determine if USJHSD differentially affected outcomes relative to usual care. Therefore, these results should be interpreted with caution.

Our qualitative findings drew upon site visits, one focus group with program participants, eight telephone interviews with program participants, and the program's reports to CMMI. Most participants had experience with the patient navigation program and/or the wellness program, but we found it more difficult to recruit participants who had received outreach paramedicine. Therefore, our findings concerning the other program components are based largely on the perspectives of program staff and leadership. Although staff members were forthcoming about challenges, there was likely some positive response bias.

Conclusions and Policy Implications

USJHSD developed their program to reduce CVD risks for their rural patients in southwestern Colorado. The HCIA program allowed a relatively new health center to launch multiple new programs at the same time in an effort to address CVD by using both preventive and acute care approaches. USJHSD's Pagosa Springs Medical Center opened in 2008 and struggled to recruit and retain primary care providers over the long term in its rural setting. Similarly, they struggled to staff the new programs such as patient navigation, care coordination, and paramedicine because of concern that they would not continue after the award period and limited availability of qualified staff. Once staffed, the low volume of patients made it challenging to evaluate outcomes.

Nevertheless, our evaluation demonstrates that USJHSD might have succeeded in achieving one of its main goals, which was to reduce the number of specialty care transports by air. A combination of neurological telemedicine and critical care paramedicine enabled stroke patients to be transferred to a closer tertiary care center by ground transportation. Patients and their caregivers highly preferred this approach. The program was also able to administer thrombolytic therapy in a more timely manner to some patients (n = 4), and this is expected to achieve lifetime cost savings for those patients. Finally, qualitative outcomes measures such as patient satisfaction and public recognition for its new programs led to institutional support for program sustainability.

Despite the difficulty of recruiting highly specialized staff members to rural areas, the implementation of telemedicine has great potential to improve quality of care and patient outcomes. Policy changes that allow reimbursement for telemedicine consultation in Colorado would further enable its sustainability and spread. The wellness and patient navigation programs hold similar potential and would also benefit from a policy environment that supports reimbursement.

The Rector and Visitors of the University of Virginia

Summary. The Rector and Visitors of the University of Virginia (UVA) implemented a palliative care program for stage four cancer patients, Comprehensive Assessment with Rapid Evaluation and Treatment (known as CARE Track). CARE Track used a patient-reported outcomes questionnaire (My Course) to monitor symptoms and to better control pain, and STAT RAD, a condensed and targeted radiation workflow, to provide rapid pain relief for metastatic cancer patients.

Awardee Overview

SITE:	1 hospital in Virginia	***REACH:***	347 patients
AWARD:	$2,571,322	***TARGETED CONDITION:***	Stage four cancers
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare, Medicaid, commercial

Key Findings

These key findings are based on quantitative analysis of Medicare claims (July 2012—June 2015) and qualitative interviews with staff and program participants.

Implementation

A registered nurse (RN) with a background in oncology is essential for responding to patient-reported outcomes alerts and for triaging stage four cancer patients.

The Supportive Care Tumor Board (SCTB) provides an effective approach for handling complex patient cases and facilitates collaboration among multiple disciplines.

UVA's strong history of palliative care enabled them to successfully incorporate patient-reported outcomes, pain, and symptom management into care plans and workflows.

Utilization

No consistent trends were found in ED visits or hospitalizations in patients' last 30 days of life.

Cost

We observe non-significant yet promising reductions in cost of care at the end of life.

Quality of Care

By focusing on pain and symptom management and using patient-reported outcomes to detect emotional and physical discomfort, CARE Track improved the quality of life for stage four cancer patients.

STAT RAD presents an efficient and effective palliative radiation workflow for patients with bone metastases who need immediate pain relief.

Sustainability and Scaling

The UVA program secured funding to continue the full program over the next three years, with more than $500,000 of institutional support.

UVA has extended the CARE Track model to all cancer patients and has implemented a patient-reported outcomes tool and weekly supportive care meeting for cardiology patients.

Introduction

The Rector and Visitors of the University of Virginia's (UVA) program focused on palliative care and condensed radiation treatment for patients with stage four cancer. During the award period, the program served approximately 350 patients at the Emily Couric Clinical Cancer Center through two programs: CARE Track and STAT RAD. The goal of the UVA program was to improve quality of life and reduce end-of-life utilization and total cost of care for patients with cancer. This chapter presents summative findings concerning program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[173] For technical details on the methodology reported in this chapter, please see Appendix A.

End-of-Life Analysis

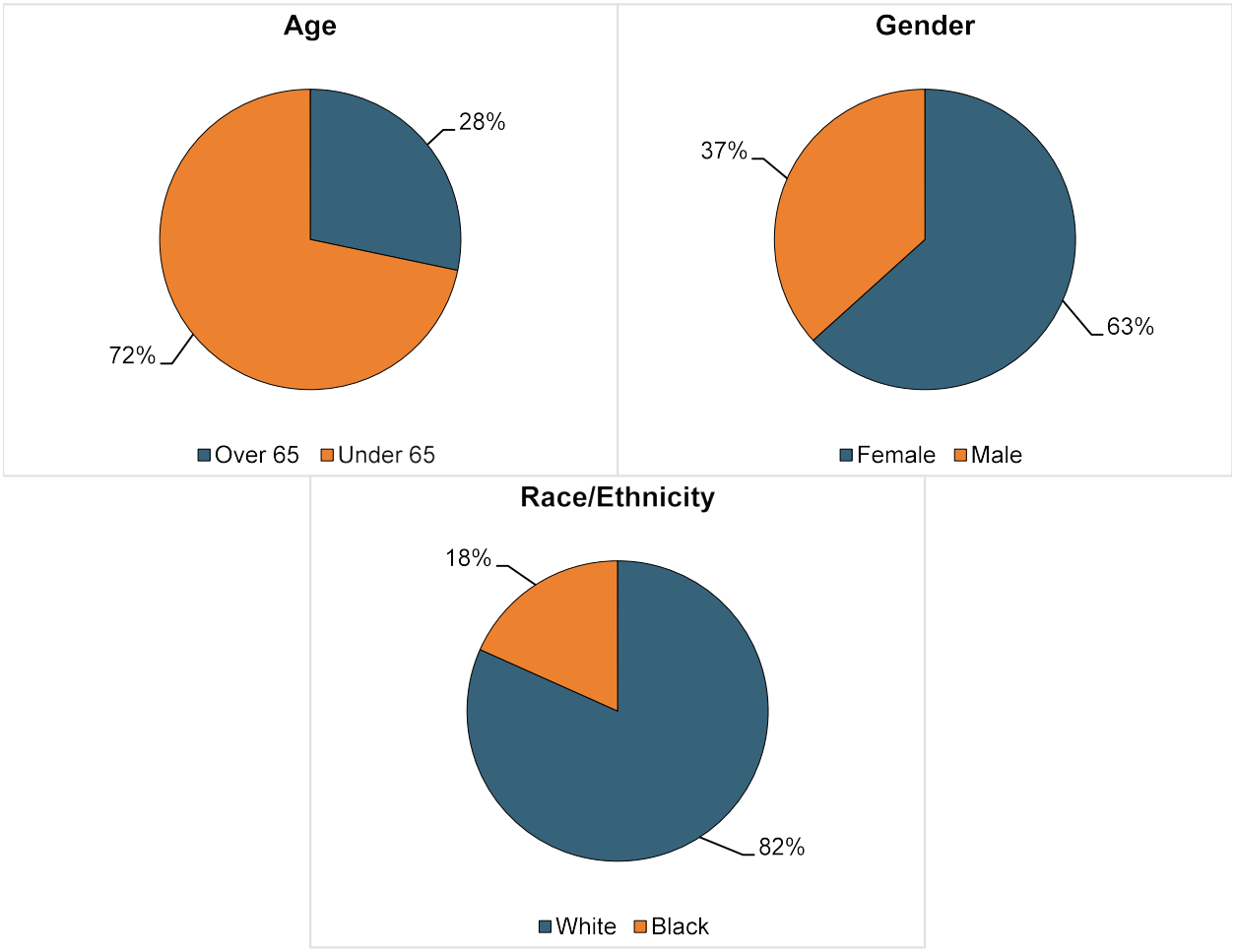
We analyzed claims to assess the effectiveness of UVA's program in reducing cost and utilization, and in improving quality of care at the end of life. For the CARE Track program, we examined differences in outcomes between decedent CARE Track participants and a comparison group for the following measures:

- all-cause hospitalizations in the last 30 days of life
- emergency department (ED) visits in the last 30 days of life
- hospice care in the last two weeks of life
- total cost of care in last 30 days of life
- total cost of care in last 90 days of life
- total cost of care in last 180 days of life

For 60 participants who passed away during the study period, we identified those enrolled in the program 30, 90, and 180 days prior to date of death and selected a group of comparison patients, using propensity score matching.[174,175] Exhibit 18.1 summarizes demographic and other basic information about UVA patients who were included in our end-of-life analysis.[176]

[173]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[174]For 30-, 90-, and 180-day outcome measures, we included in our analytic sample participants enrolled in the CARE Track program for 30, 90 and 180 days, respectively.
[175]For details on comparison group selection and propensity score methodology, please see Appendix A
[176]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 18.1: Descriptive Characteristics of UVA Patients, End-of-Life Analysis



Program impact. Exhibit 18.2 summarizes the impact of CARE Track in patients' last days of life.[177] We present the adjusted difference between the treatment and comparison groups as well as the percentage difference between the two groups, which indicates the magnitude of the treatment effect:

- There were no significant changes in hospitalizations, ED visits, or hospice care for patients in CARE Track relative to the comparison group.
- We observed a non-significant reduction in total cost of care in the last 30 days ($1,677 per patient, 12.9 percent reduction), 90 days ($5,173 per patient, 17.9 percent reduction), and 180 days ($6,287 per patient, 14.5 percent reduction) of life for participants in CARE Track relative to the comparison group.

Although these findings are not significant, they represent meaningful reductions in cost of care for a small sample of the program.

[177]We adjusted for age, gender, race/ethnicity, dual eligibility, HCC score, disability, prior-year hospitalizations and cost, chemotherapy, radiation, metastatic cancer, high-risk cancer, and number of cancer diagnoses.

Exhibit 18.2: Differences in Utilization and Cost between UVA Program Participants and Comparisons in the End of Life

Outcome Measure	Adjusted Difference [90% Confidence Interval]	Percentage Difference
Hospitalizations (per 1,000 Patients)	11 [-114, 135]	3.7%
ED Visits (Likelihood per 1,000 Patients)	51 [-39, 141]	41.2%
Hospice Care in the Last Two Weeks of Life	78 [-50, 207]	11.4%
30-day Total Cost of Care per Patient ($)	-$1,677 [-$5,166, $1,812]	-12.9%
90-day Total Cost of Care per Patient ($)	-$5,173 [-$12,781, $2,434]	-17.9%
180-day Total Cost of Care per Patient ($)	-$6,287 [-$18,054, $5,481]	-14.5%
Aggregate Impact		
30-day Total Cost of Care per Patient ($)	-$100,620 [-$309,960, $108,720]	-12.9%
90-day Total Cost of Care per Patient ($)	-$301,380 [-$766,860, $146,040]	-17.9%
180-day Total Cost of Care per Patient ($)	-$377,220 [-$1,083,240, $328,860]	-14.5%

NOTE: *p<0.10, **p<0.05, ***p<0.01

Workforce

Continual reinforcement that demonstrates the value of the patient-reported outcomes software is crucial to achieve rapid and full-scale adoption. The UVA program struggled to get oncologists to incorporate the patient-reported outcomes tool (My Course) into their patients' care plans. Program leadership reported that, although palliative care physicians relied heavily on patient-reported outcomes to adjust pain and symptom medication so as to improve quality of life, oncologists were less likely to use the information.

The Supportive Care Tumor Board (SCTB) presents a coordinated and streamlined approach that minimizes pain and discomfort for symptomatic stage four cancer patients. The CARE Track team organized a weekly meeting to discuss the most complex patients in the program. Different from a traditional tumor board, which focuses on treatment options, the SCTB's focus is on pain and symptom management. The board comprises a variety of disciplines, including palliative care doctors, oncologists, psychiatrists, pain specialists, social workers, pharmacists, nutritionists, and radiologists. Together, they provide an effective and time-efficient model for improving quality of care at the end of life.

Context

The UVA program benefited from being part of an academic hospital system, which provided support for evaluating the program and disseminating findings, funds to sustain the program, and infrastructure to conduct clinical trials for STAT RAD. The following factors also contributed to the success of the program:

- **The patient-reported outcomes tool was embedded in the hospital EHR.** Seamless interoperability of My Course with the hospital's electronic health records (EHR) allowed CARE Track physicians to track patients' symptoms longitudinally and to provide timely interventions.

- **UVA is a leader in palliative care for patients with cancer.** The Emily Couric Clinical Cancer Center at UVA is a leader in palliative care and symptom management. In 2015, UVA was named as one of 11 Palliative Care Leadership Centers in the United States by the Center to Advance Palliative Care.[178] The large palliative care presence at UVA made it easier to incorporate pain and symptom management and patient-reported outcomes into the care plans of stage four cancer patients.
- **Program leadership had existing relationships with other disciplines.** The program excelled under the leadership of the principal investigator and the head of palliative care, who had strong ties with multiple disciplines throughout the institution. Their presence in the cancer center played a critical part in building enrollment and growing participation in the SCTB.

Limited reimbursement for STAT RAD. STAT RAD provided one-day treatment for patients with metastatic cancer by using a condensed schedule of targeted radiation treatment. The usual model for metastatic cancer requires patients to return to the hospital for 10 separate treatments. The STAT RAD model compressed the entire treatment into a one-day visit, where patients received a single high-dose radiation session. According to program leadership, current billing schemes for radiation therapy do not support this condensed radiation schedule. Instead, current reimbursement practices favor a per diem model that reimburses a multiple-treatment approach and do not reimburse for treatment planning and delivery that are both given on the same day. The principal investigator of the UVA program serves on the American Society for Therapeutic Radiology and Oncology (ASTRO) payment reform committee and is working to implement a value-based approach to radiation therapy for bone metastases.

Sustainability, Scalability, and Spread

UVA is sustaining the full program over the next three years through institutional support totaling $500,000. The funding allows the program to expand CARE Track beyond stage four cancer patients by using the My Course tool to track and monitor symptoms longitudinally for patients with cancer at any stage. The funding also supports a CARE Track program for cardiology patients, using an adapted My Course questionnaire that is appropriate to the symptoms and needs of congestive heart failure (CHF) patients. The CARE Track CHF program incorporates a palliative/supportive clinic that focuses on pain and symptom management and uses a supportive care cardiology meeting modeled on the SCTB. The STAT RAD program is also continuing as a clinical trial for metastatic nonspinal bone cancers.

There are several factors to consider when initiating similar programs. As described by staff, the conditions facilitating successful implementation included:

- an established outpatient palliative care program
- a nurse coordinator with a background in oncology care
- a patient-reported outcomes tool embedded in the hospital EHR

[178]NBC29, Charlottesville. UVA named 1 of 11 U.S. palliative care leadership centers. Available at: http://www.nbc29.com/story/30186931/uva-named-1-of-11-us-palliative-care-leadership-centers.

Limitations

For our quantitative analysis, our evaluation of the UVA program was limited to the end-of-life analysis. The small number of patients we were able to observe in claims limited our power to detect changes in utilization and cost associated with program participation. We are also limited in our ability to identify patients who are on chemotherapy, as we have access only to Medicare Part B claims for these analyses. Part B claims do not include information on prescription drugs (these data are found on Part D claims), so we cannot identify patients who are receiving oral chemotherapy via prescription. It is estimated that approximately 20 percent of patients receive oral chemotherapy, whether alone or in conjunction with intravenous chemotherapy.[179,180]

We developed our findings from a site visit, phone interviews, and awardee-reported information. We were unable to conduct a focus group during the site visit because the patient population was too sick to participate in focus groups. We did conduct a limited number of patient and caregiver interviews by telephone.

Conclusion and Policy Implications

UVA developed CARE Track to provide a systematic and coordinated approach to palliative care using patient-reported outcomes (My Course) and targeted radiation therapy (STAT RAD) to control pain and other symptoms for stage four cancer patients. We observed a non-significant reduction in total cost of care relative to a matched comparison group, in the last 30, 90, and 180 days of life for participants in UVA's program. UVA will sustain the full program for a minimum of three years after the end of the CMMI award period and is scaling up the program to include cancers at all stages as well as CHF.

Although not significant, the program's positive trend toward reducing total cost of care provides further evidence to support and expand palliative care programs. Several studies have demonstrated that the inclusion of palliative care in standard cancer care can improve patient and caregiver quality of life and reduce aggressive treatment at the end of life.[181,182,183] Patients with stage four cancer incur tremendous medical expenditures at the end of life. Following the Institute of Medicine's *Dying in America* consensus report along with national initiatives such as the National Palliative Care Research Center and the End-of-Life Nursing Education Consortium, end-of-life care has grown to play an important part in the national agenda for improving the quality of care for patients. Evidence from the UVA program can help inform new models of oncology care for patients with advanced cancers and can thereby improve overall care and reduce cost.

[179]Weingart SN, Bach PB, Johnson SA, et al. NCCN task force report: oral chemotherapy. *J Natl Compr Canc Netw*. 2008;6:S1-14.
[180]Zerillo JA, Stuver SO, Fraile B, et al. Understanding oral chemotherapy prescribing patterns at the end of life at a comprehensive cancer center: analysis of a Massachusetts payer claims database. *J Oncol Pract.* 2015;11(5):372-377.
[181]Davis MP, Temel JS, Balboni T, Glare P. A review of the trials which examine early integration of outpatient and home palliative care for patients with serious illnesses. *Ann Palliat Med*. 2015;4(3):99-121.
[182]Temel JS, Greer JA, Muzikansky A, et al. Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med*. 2010;363:733-742.
[183]Bakitas M, Lyons KD, Hegel MT, et al. Effects of a palliative care intervention on clinical outcomes in patients with advanced cancer: The Project ENABLE II randomized controlled trial. *JAMA*. 2009;302:741-749.

Vanderbilt University Medical Center

Summary. The Vanderbilt University Medical Center's (VUMC) program used care coordinators to improve chronic disease management, coordination of services, and transition management for patients with one or more targeted conditions. Nurses were deployed as transition care coordinators (TCCs) in inpatient settings and as outpatient care coordinators (OCCs) in outpatient settings. The program took place at Vanderbilt's main campus in Nashville, TN, as well as at Williamson Medical Center in Franklin and Maury Regional Medical Center in Columbia.

Awardee Overview

SITES:	3 hospitals in Tennessee	***REACH:***	108,464 participants, including 20,562 outpatient beneficiaries and 790 inpatient beneficiaries
AWARD:	$18,846,090	***TARGETED CONDITIONS:***	Varied over time and across sites[184]
AWARD DATES:	July 2012—June 2015	***PAYER(S):***	Medicare

Key Findings

These key findings are based on quantitative analysis of Medicare claims data (July 2012—June 2015), qualitative interviews with staff, and focus groups with program participants.

Implementation

To maintain a feasible workload, most of an OCC's panel of about 1,500 patients should be on "surveillance" and only about one-third on "active engagement."

TCCs' success required their integration into the inpatient department's workflow.

Utilization

One site's TCC program reduced 90-day readmissions, but we saw limited impact of the overall TCC program on utilization.

No observed impact of the OCC program on utilization

Cost

No observed impact of the TCC or OCC program on cost

Quality of Care

Patients reported that interactions with OCCs led to improvements in blood pressure and glycemic control.

Sustainability and Scaling

OCC programs were sustained through institutional commitment to the program. At the main VUMC site, the TCC program was integrated into the hospital's existing case management program.

VUMC has expanded its target population to include patients with complex conditions and works with a private payer to test a remote (versus face-to-face) care coordination model.

[184]Included congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), acute myocardial infarction (AMI), pneumonia, hypertension, and diabetes mellitus.

Introduction

The Vanderbilt University Medical Center's (Vanderbilt) program offered care coordination for patients in both inpatient and outpatient settings in three locations: Vanderbilt University Medical Center (VUMC), Williamson Medical Center, and Maury Regional Medical Center. At the VUMC location, nurse transition care coordinators (TCCs) and outpatient care coordinators (OCCs) relied on system-wide health information technology (HIT) to monitor patient information in real time and to offer patient education and chronic disease management. This chapter presents summative findings concerning program effectiveness, quality of care, workforce, context, and sustainability—all updated since NORC's second annual report (March 2016).[185] For technical details on the methodology reported in this chapter, please see Appendix A.

Summative Findings of Program Effectiveness

Transitions Care Coordination Program

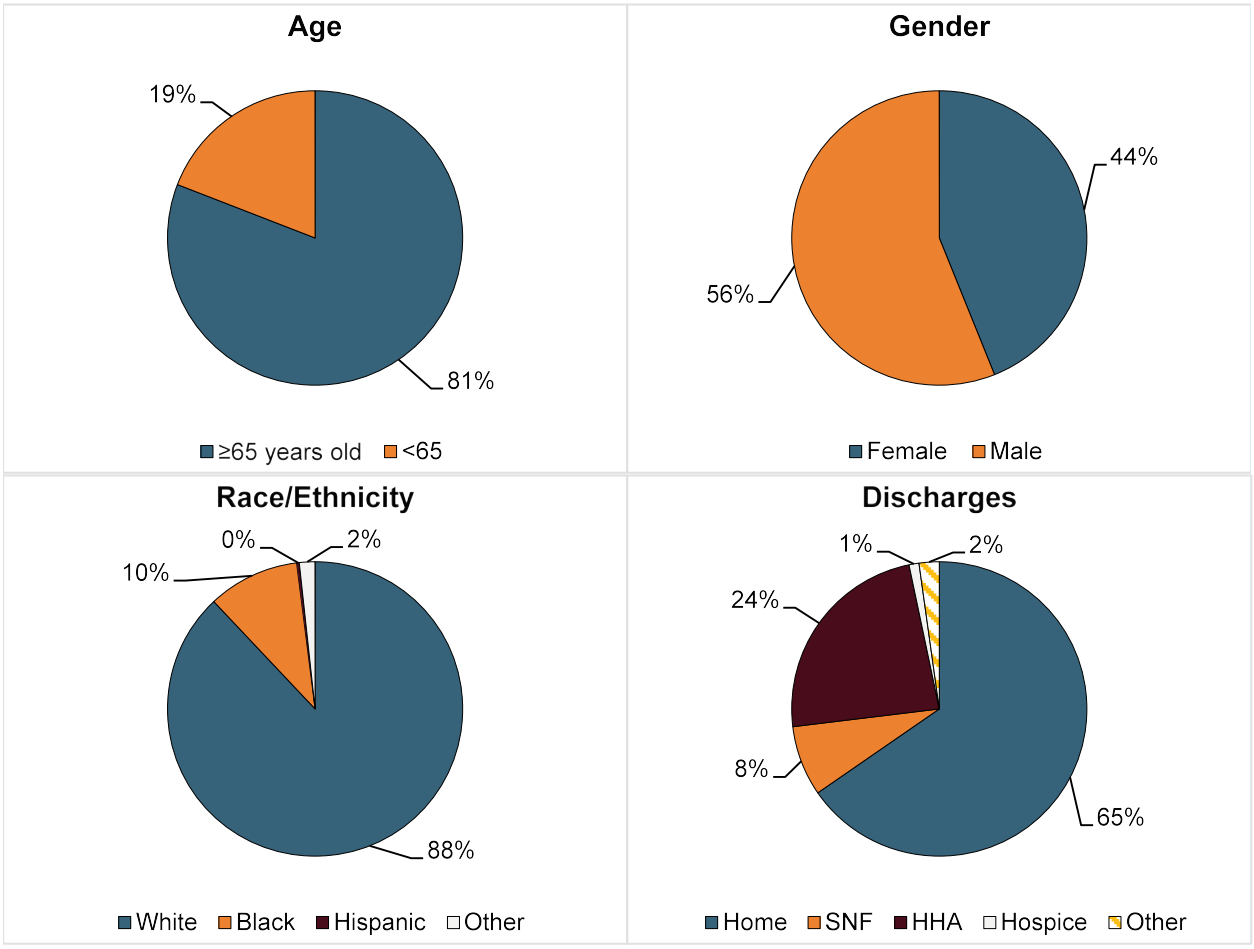
We analyzed claims and program data to assess the effectiveness of Vanderbilt's TCC program in reducing cost and utilization and improving quality of care. For the TCC program, we examined differences in outcomes between TCC and comparison patient-episodes, focusing on the following measures:

- 30- and 90-day readmissions
- 90-day emergency department (ED) visits
- 90-day total cost of care[186, 187]

Exhibit 19.1 summarizes demographic and other basic information about Vanderbilt's TCC patients with episodes included in our analysis of core outcome measures.[188]

[185]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[186]ED visits include ED visits as well as observational stays not resulting in short-term inpatient hospitalizations.
[187]The 30-day readmissions core measure is not applicable to the OCC program since patients admitted to Vanderbilt are enrolled in the TCC program.
[188]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Exhibit 19.1: Descriptive Characteristics of Patients with Episodes in Vanderbilt's TCC Group[189]



Summative program impact. Exhibit 19.2 summarizes the results of our difference-in-differences (DID) model, which included adjustment for key demographic and other risk factors:[190]

- Implementation of the TCC program at Vanderbilt was not associated with significant decreases in readmissions, ED visits, or total cost of care relative to the comparison group.

[189]Descriptive statistics are based on findings prior to propensity score weighting.
[190]We adjusted for age, race/ethnicity, gender, reason for Medicare eligibility, comorbidity, cost, utilization in year prior to index hospitalization, discharge status, and type and severity of target condition (CHF, COPD, AMI, pneumonia).

Exhibit 19.2: Difference-in-Differences Estimates for Core Measures for Vanderbilt TCC

Average Quarterly Impact	
Outcome Measure (Patient-episodes per 1,000, unless noted)	**Adjusted Estimate [90% Confidence Interval]**
30-Day Readmission	-18 [-45, 9]
90-Day Readmission	-5 [-36, 26]
90-Day ED Visit	-4 [-37, 29]
90-Day Total Cost of Care per Patient-Episode ($)	-$464 [-$2,301, $1,373]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	-$453,803 [-$2,250,393, $1,342,787]

NOTE: ***p<0.01, **p<0.05, *p<0.1.

Quarter-specific program impact. Findings from a quarterly fixed effects (QFE) DID model of impact in each intervention implementation quarter are consistent with the average quarterly impact summarized above; please see Appendix A for a summary of these results.

Cross-Site Variation

Exhibit 19.3 shows the key quantitative findings for each TCC program site. In our site-specific analysis, Maury Regional Healthcare System was the most effective site with respect to significantly reducing the likelihood of 90-day readmissions (63 per 1,000 patient-episodes) relative to the comparison group. Both VUMC and Maury also showed non-significant reductions in the likelihood of 90-day ED visits and total cost of care. These findings are consistent with program implementation findings at the TCC sites. Although all three sites adhered to the core concepts of the TCC program, Maury reported better integration of the TCC program into its inpatient department's workflow than did the other two sites. Staff at VUMC and Williamson had difficulty in distinguishing TCC roles from the regular case management workforce and in staff retention.

Exhibit 19.3: Difference-in-Differences Estimates for Core Measures for TCC, by Site

Outcome Measure (Patient-episodes per 1,000, unless noted)	**VUMC** (n = 685)	**Maury** (n = 169)	**Williamson** (n = 124)
30-Day Readmission	-19 [-78, 40]	-1 [-56, 54]	-46 [-124, 32]
90-Day Readmission	11 [-65, 87]	**-63 [-125, -1]***	48 [-48, 144]
90-Day ED Visit	-52 [-127, 23]	-14 [-80, 52]	**116 [15, 217]***
90-Day Total Cost of Care per Patient-Episode ($)	-$1,840 [-$5,603, $1,923]	-$1,306 [$-3,740, $1,128]	$361 [-$3,102, $3,824]

NOTE: ***p<0.01, **p<0.05, *p<0.1

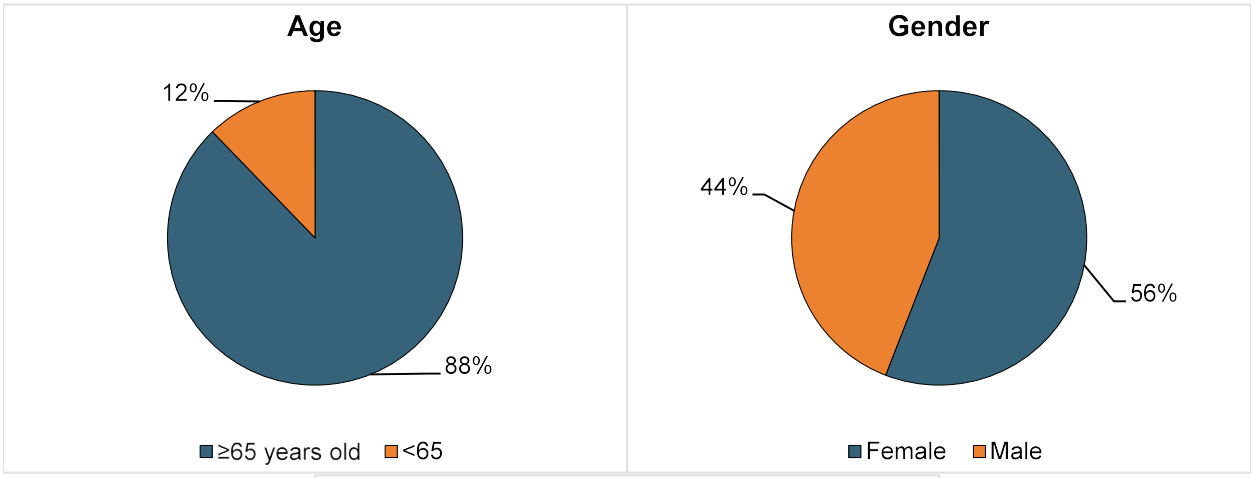
Outpatient Chronic Care Management Program

We analyzed claims and awardee-collected data to assess the effectiveness of Vanderbilt's OCC program in reducing cost, utilization, and quality of care. For the OCC program, we examined differences in outcomes between OCC patients and comparison patients, focusing on the following measures:

- all-cause hospitalizations
- hospitalizations for ambulatory care sensitive (ACS) conditions
- emergency department (ED) visits
- total cost of care

Exhibit 19.4 summarizes demographic and other basic information about Vanderbilt's OCC patients who are included in our analysis of core outcome measures.[191]

Exhibit 19.4: Descriptive Characteristics of Vanderbilt's OCC Patients



[191]For propensity score common support, covariate balance, and more detailed information on the descriptive characteristics, please refer to Appendix A.

Summative program impact. Exhibit 19.5 summarizes the results of our DID model, which included adjustment for key demographic and other risk factors:[192]

- There were no significant decreases in ED visits, hospitalizations, or ACS hospitalizations for patients in the OCC program relative to the comparison group.
- The OCC program was not associated with significant decreases in total cost of care relative to the comparison group.

Exhibit 19.5: Difference-in-Differences Estimates for Core Measures for Vanderbilt OCC

Average Quarterly Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Hospitalizations per 1,000 Patients	3 [-2, 8]
ED Visits per 1,000 Patients	**15 [6, 24]*** **
ACS Hospitalizations per 1,000 Patients	-1 [-4, 2]
Total Cost of Care per Patient ($)	-$10 [-$240, $220]
Aggregate Impact	
Outcome Measure	**Adjusted Estimate [90% Confidence Interval]**
Total Cost of Care ($)	-$175,064 [-$4,136,229, $3,786,101]

NOTE: ***p<0.01, **p<0.05, *p<0.1

Quarter-specific program impact. Findings from a QFE DID model of impact in each intervention enrollment quarter align with the average quarterly impact summarized above; please see Appendix A for a summary of these results.

Analysis of awardee-provided data. In addition to claims data, we analyzed clinical data provided by the awardee to assess the effectiveness of the OCC program in reducing the number of patients with poorly controlled blood pressure (BP) or hemoglobin A1c (HbA1C) levels, but there are no comparison groups for these data.[193, 194]

Exhibit 19.6 shows the proportion of patients with poor control of HbA1c or BP in the pre- and post-intervention periods.[195] We used McNemar's exact tests for repeated measures to look for significant differences in the proportion of patients with uncontrolled HbA1c or BP in the pre- and post-periods:

[192]We adjusted for age, gender, race, ethnicity, disability status, prior-year HCC score, discharge status, and target condition (hypertension and/or diabetes).
[193]Poor control of HbA1c is defined as an HbA1c score >9.0%. This threshold comports with the Physician Quality Reporting System (PQRS) measure for HbA1c control: https://www.ncdr.com/WebNCDR/docs/default-source/diabetes-public-document-library/2016_pqrs_measure_001_11_17_2015.pdf?sfvrsn=2.
[194]Poor control of blood pressure is defined as systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg. These thresholds comport with the PQRS measure for blood pressure control: http://www.mdinteractive.com/files/uploaded/file/CMS2016/2016_PQRS_Measure_236_11_17_2015.pdf.
[195]To compare the history of a patient's control status to his/her control status by the end of the post-period, the pre-period was restricted to observations in the year prior to admission and the post-period to the latest observation.

- Vanderbilt OCC patients were significantly less likely (p<0.001)[196] to have poor HbA1c control by the end of the post-period (7 percent) relative to the pre-period (11 percent).
- Similarly, OCC patients were significantly less likely (p<0.001)[197] to have poor blood pressure control by the end of the post-period (4 percent) relative to the pre-period (25 percent).

Exhibit 19.6: Change in Proportion of Patients with Poor HbA1c and BP Control

Measure	N	Proportion of Patients with Poor Control		Difference	P value
		Pre-Period	Post-Period		
HbA1c	2,121	11%	7%	-4%	p<0.001
BP	964	25%	4%	-21%	p<0.001

In addition to the absolute change in the number of patients with poor control of HbA1c or BP, we analyzed the proportion of patients with poorly controlled HbA1c or BP in the pre-period who attained control by the end of the post-period (please see Exhibit 19.7).

- Of the 237 OCC patients with poorly controlled HbA1c in the pre-period, 66 percent had adequately controlled HbA1c by the end of the post-period (p<0.001).[198]
- Of the 238 OCC patients with poorly controlled blood pressure in the pre-period, 90 percent had adequately controlled blood pressure by the end of the post-period (p<0.001).[199]

Exhibit 19.7: Proportion of Patients with Poor HbA1c and BP Control Who Attained Control

Measure	N	Patients with Poor Control in the Pre-Period	Patients with Poor Control Who Attained Control by the End of the Post-Period	Proportion	P value
HbA1c	2,121	237	156	65.8%	p<0.001
BP	964	238	213	89.5%	p<0.001

[196]Statistical significance was assessed using chi-square test: $x^2_{(1)} = 35.5$, p<0.001.
[197]Statistical significance was assessed using chi-square test: $x^2_{(1)} = 174.45$, p <0.001.
[198] Statistical significance was assessed using a one-tailed z-test: $z = 11.10$, p <0.001.
[199] Statistical significance was assessed using a one-tailed z-test: $z = 5.28$, p<0.001.

Qualitative Findings

As discussed in our second annual report, approximately one-third of the patients in our focus groups (eight out of 26) could report on their experiences with care coordinators, whereas the remainder were generally unaware that they had interacted with a care coordinator.[200] The sections that follow discuss the drivers behind behavior changes and then outline the major findings that show some support for replicating and scaling up this program in other regions.

> *"I went to a new PCP to get blood pressure medicine, and I came home with an aneurysm and two cancers. [An OCC] called and said, 'I'm your care coordinator.' And she didn't explain it that well, but as it progressed, I have figured it out. Of course, I have many doctors.… If I go to kidney, lung, or heart [doctors], [my care coordinator at the PCP office] knows it, knows my history, and knows that my medicines have been changed. I don't have to worry about talking to my PCP because it is already handled. It really helps."*
>
> — Program Participant

Patients who interacted with their OCCs regularly appreciated that the OCC coordinated communication among their health care providers. They found the OCCs to be easy to reach, responsive, and helpful in improving communication with their doctors.

The combination of electronic health records (EHR) and personal health records (PHRs) improved communication among providers and patients and helped patients manage their health. Many focus group participants noted that EHRs relieved them of the need to share information with multiple providers who used the same EHR system. Many also appreciated that they could see their own laboratory results and communicate with their providers electronically through Vanderbilt's MyHealth PHR system. A few participants realized that care coordinators could monitor their health records as they called to discuss laboratory test results. Although some worried about sharing private information online, others appreciated that coordinators could monitor their information.

Cross-Site Variation

> *"I'm not a big privacy guy; it doesn't bother me. You want to look at it? I don't care. It was helpful that I could get advice. But I am most happy that I can look at it [through MyHealth].… If [a lab result] shows up as red, I will get messages from the care coordinator saying, 'Based on this, you need to do X, Y, Z.' But I can see the results [from] 6 months ago [and] see if the changes I am making are making a difference. Are they blowing smoke? Being able to compare and contrast, it is good.... I can see a trend and make a choice."*
>
> —OCC Program Participant

The HIT surveillance system and care coordinator dashboards created by and for VUMC were not available at the Williamson and Maury locations. EHR-integrated HIT enabled VUMC's OCCs to monitor the risk levels of all the patients being seen by particular primary care providers (or patient panels) and to focus their attention on higher-risk patients. OCCs at Williamson and Maury relied on primary care physicians and practice-based nurses to refer patients to them for chronic disease management, and positioned themselves in physician offices to facilitate recruitment. They documented and shared their care coordination activities with Vanderbilt using stand-alone software that did not integrate with their EHRs.

The variation in demographic characteristics and availability of social services by site might have affected participants' engagement with their respective TCC programs. Williamson served patients

[200] Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

with high socioeconomic status, and most focus group participants from that site reported little need for assistance following discharge. Maury served a more rural and lower-income population and included a social worker on its team to help address social needs following discharge. VUMC's patients had access to an array of resources in the large academic medical center and in the urban setting of Nashville.

The three sites targeted different conditions, and the target conditions changed over time. As described in the quantitative analysis section, the sites varied in the number and type of conditions they targeted. For their TCC programs, VUMC and Maury targeted congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), acute myocardial infarction (AMI), and pneumonia; Williamson targeted only CHF. Over the course of the intervention, the OCCs at all three sites expanded their inclusion criteria from hypertension (HTN), CHF, and diabetes mellitus to include active smokers and individuals with multiple or complex health conditions.

Workforce

OCCs reported high satisfaction with their work. High satisfaction was reflected in the low turnover among OCC staff.

> *"I used to work as a PCP nurse. You would see [patients] in clinic, send them home, and not know outcomes. We are the resource between visits, so we see the A1c going down because the patient is on-board with counting carbs [so we can] help them educate their families. You know, they see you as someone they can call on as a resource to them. That is the most satisfying for me."*
>
> —Outpatient Nurse Coordinator

Maury's single TCC was well integrated into the hospital's workflow, whereas multiple TCCs at the other two sites were not. Maury's TCC reported having good communication with inpatient nurses and discharge social workers, as well as support from the hospital administration. She managed the disease-specific portion of the patient's transition to home from the inpatient stay and conducted follow-up, whereas social workers handled all other aspects of the discharge process. In contrast, there was turnover among TCCs at VUMC and Williamson. Williamson's TCCs experienced difficulty integrating into the inpatient team's workflow, and VUMC's TCCs reported being asked to take on more case management and discharge planning than expected. Over time, VUMC and Williamson did not replace the TCCs who left, and only Maury sustained the TCC role as developed through the program.

With the addition of patients with complex concerns to the target conditions, some OCCs worried that they may not have the skills to support patients remotely. They reported that knowledge about CHF, COPD, and diabetes was a fundamental part of their training and practice as nurses. However, patients with complex conditions—including those who had more than two admissions in the past year and sought care from multiple specialists—presented challenges beyond their knowledge and expertise.

Context

As a large teaching and research center, Vanderbilt engaged in many other complementary research projects; this situation might have interfered with our ability to assess the impacts of the HCIA program. For example, Vanderbilt was the recipient of another HCIA grant aimed at reducing hospitalizations among Medicare beneficiaries through a collaboration between VUMC and one of 23 partnering skilled nursing facilities (SNFs) in Tennessee and Kentucky. This essentially removed from the TCC target population all of the patients who were being discharged to a SNF.

Trends in health care toward value-based payments put pressure on Vanderbilt to develop a care coordination program. Health care financing is shifting from fee-for-service to value-based payment models. Although Vanderbilt was not an accountable care organization (ACO), there were two ACOs in the Nashville area and six others throughout the state.

Sustainability, Scalability, and Spread

Vanderbilt sustained its OCC program beyond the award period through internal institutional support. In light of the environmental pressure to move toward value-based care, program leadership committed to sustaining the program beyond the award period despite limited evidence of effectiveness.

> *"Society has demanded improved value, and the payers are demanding it and all the consultants tell the leadership here that care coordination has to be a part of it. So it is sustained."*
>
> —Program Leader

Maury sustained its TCC program through internal institutional support and sought to expand it, whereas the other two sites did not. VUMC reported that it was considering how to integrate the TCC program into its general case management program; Williamson disbanded its TCC program altogether. Hospital staffs at VUMC and Williamson were generally unclear regarding the role of the TCCs and therefore had difficulty integrating the TCC role into the existing case management structure.

Working with a private payer, Vanderbilt began testing a remote model of care coordination using claims data rather than providers' patient panels. OCCs began to recruit patients based on their claims records by calling and sending letters to high-risk patients. They found that many patients at first were skeptical, so they modified their approach by offering face-to-face office visits.

Limitations

For our quantitative analysis of the OCC program, we excluded patients with conditions other than hypertension and/or diabetes mellitus, as those were the only enrollment criteria identifiable in claims. Our analyses, therefore, may not capture the overall impact of the Vanderbilt OCC program. Our OCC analysis only focused on Medicare beneficiaries in part because of the availability of claims and Vanderbilt's policy of not serving Medicaid patients in outpatient settings.

We developed our findings from site visits and telephone interviews with program leaders and staff members and four focus groups with participants at VUMC and Williamson. We also conducted three telephone interviews with patients at Maury. Program staff randomly selected participants who they knew had interacted with a TCC or an OCC, although many participants did not recognize that either of them was part of a special program. Only those who regularly engaged with a care coordinator (eight of 26 participants) could comment on the program.

Conclusion and Policy Implications

Vanderbilt's award program used OCCs and TCCs in an attempt to provide better care and improve patient health through smarter spending. They implemented programs across three sites that differed in size, geographic setting, and technological capacity. VUMC, the largest and most urban site, invested heavily in its HIT to create an electronic surveillance system and a care coordinator dashboard. Its OCCs

managed large panels of primary care patients and interacted with only a third of the members of each panel at any given time. The other two sites—Williamson, serving higher-income suburbanites, and Maury, serving poorer rural residents—relied on physician referrals to their care coordination services. It is not clear which method of identifying patients was better, as evidence of program effectiveness was limited.

Site visit findings suggested that the OCCs improved quality of care by improving communication between patients and their providers; program data also indicate that patients' blood pressure and HbA1c levels were lower while they were enrolled in the OCC program. However, with the exception of Maury's TCC program, our quantitative analysis showed no improvement in utilization or cost among the target population relative to a comparison group. Maury's TCC program reduced 90-day readmissions, perhaps due to that site's relative success in integrating its TCC into inpatient and discharge planning workflows.

Because of the scale of VUMC's endeavor, the extent to which it changed its target conditions over time, and the limitations in available data, it is possible that Vanderbilt's award programs made more of an impact than we could evaluate. Overall, our findings suggest that Vanderbilt's intervention did not substantially change the standard of care received by patients relative to comparison groups in that area.

Cross-Awardee Findings

In this section, we describe mixed-methods cross-awardee findings from HCIA disease-specific awardee interventions. We present two types of analysis combining primary qualitative data collected through November 2015 and secondary quantitative data as recent as June 2015:

1. An examination of the relationship between care coordination workforce models and program effectiveness among the 16 awardees whose interventions meet our basic definition of care coordination
2. A synthesis of implementation and program effectiveness findings for awardees targeting the same disease: asthma (three awardees), cancer (two awardees), dementia (two awardees) and diabetes (three awardees)

For each topic and group of awardees, we aim to produce cohesive understanding of findings using an integrated analysis of survey, claims, and qualitative data. We focus on identifying the successful and replicable elements of awardee programs. For each of the research topics, we focus on the following questions:

- Which program(s) were most successful in terms of the four core measures or relevant program data?
- What drove their success?

Exhibit 20.1 presents additional topic-specific research questions relevant to each analysis.

Exhibit 20.1: Topic-Specific Research Questions for Cross-Awardee Analysis

Topic	Research Questions	Awardees
Care Coordination	▪ Which care coordination activities or workforce practices are related to evidence of program impact?	All awardees except GWU and Joslin
Asthma	▪ Which populations do these awards target? ▪ What are the program components of each award and how are they similar or different? ▪ What evidence of program effectiveness do we observe from claims, survey, and other data? Is there evidence of stronger program impact on specific subpopulations? ▪ What key supports for families may be responsible for reduced utilization and improved quality? How do caregivers benefit?	Nemours, Le Bonheur, HRiA
Cancer	▪ Regarding the two cancer awardee programs, which one was more successful at reducing utilization and cost, relative to a comparison group? ▪ Qualitatively, what program components drove reductions in utilization?	IOBS, UAB[201]
Dementia	▪ How do program components, especially workforce models and implementation, differ between the two dementia care programs? ▪ How do the two programs affect core outcomes? Could differences in outcomes reflect differences in workforce factors or implementation experience? ▪ How do caregivers benefit from the programs?	Indiana, UCLA
Diabetes	▪ Is there a relationship between implementation experience and evidence of program impact? ▪ What are the characteristics of the (1) intervention, (2) the setting, and (3) the processes used that facilitated or posed barriers to program implementation? ▪ What was the degree of impact?	FirstVitals, Joslin, SEDI

A literature review informs each analysis and provides the important policy context for understanding the long-term prospects for innovation, sustainability, and scaling up. Our analyses build on information previously reported by NORC's evaluation and set the stage for our final summative evaluation.

Exhibit 20.2 summarizes key findings across the five analyses.

[201] Although there are four cancer awardees (IOBS, UAB, UVA, and UPenn), we limited our analysis here to IOBS and UAB because they were most comparable as multisite, multi-intervention programs with sizable numbers of patients in the intervention for comparable conditions and claims data.

Exhibit 20.2: Findings for Cross-Awardee Analysis

Topic	Key Findings
Care Coordination	■ No strong connection between specific care coordination activities and evidence of program impact ■ Observable relationship between use of a team-based workforce model and/or home visits and evidence of program impact
Asthma	■ Consistent reductions in health care utilization and cost among Nemours and Le Bonheur program subpopulations ■ In-home individualized asthma education offered by all three programs helped caregivers and family members overcome longstanding misconceptions about asthma.
Cancer	■ UAB's patient navigation program achieved a greater reduction in both ED visits and hospitalizations than IOBS; IOBS program more effective than UAB at reducing total cost of care in general populations.
Dementia	■ UCLA significantly reduced ED visits, total cost of care, 30-day readmissions, ambulatory care sensitive (ACS) admissions, and nursing home placements relative to comparison groups. ■ Both UCLA and Indiana improved caregiver quality of life through use of a multicomponent model for dementia care management. ■ The dementia care programs tailored the composition of their workforce to effectively meet the needs of their target populations: • UCLA's mainly licensed clinical staff offered medication management and best clinical practices in dementia care to an older population with possibly more advanced dementia; assistants addressed logistical and administrative issues and made referrals to community-based organizations (CBOs) for other supportive services. • Indiana's lay health workers helped primarily patients with depression and a smaller number with dementia reestablish connections to the health care system and address social needs. Clinical care coordination staff addressed patients' clinical needs.
Diabetes	■ Having the ability to tailor and adapt interventions rapidly, use technology wisely, and carefully select partnerships enabled the diabetes interventions to address implementation challenges. ■ Modest evidence of program effectiveness, in part due to low evaluability and data-sharing limitations • FirstVitals: non-significant reductions of total cost of care of almost $1,000 per quarter relative to a comparison group • SEDI: reductions in HBA1c levels, similar to findings in the literature • Joslin: significant pre-post improvements in health behaviors

Innovation in Care Coordination

> *"The goal of coordinated care is to make sure that patients, especially the chronically ill, get the right care at the right time, while avoiding unnecessary duplication of services and preventing medical errors."*
>
> —Medicare.gov

Individuals with chronic diseases generally have high rates of hospitalization and emergency department use.[202,203] High utilization has been attributed to difficulties in managing complex health conditions and lack of access to appropriate outpatient care.[204] In its multiple forms, care coordination can address these underlying causes of high utilization by improving disease management, improving access to primary care providers, and integrating the delivery of health care across specialties. Although studies of the outcomes of care coordination show mixed results, care coordination is becoming a standard of care and central to patient-centered care as promoted by the Affordable Care Act.[205,206,207,208] This analysis synthesizes findings regarding primary care coordination intervention components used by a majority of HCIA–Disease Specific programs in order to advance discussion about mechanisms that drive effectiveness..

Care Coordination Models

The Agency for Healthcare Research and Quality (AHRQ) defines care coordination as "deliberately organizing patient care activities and sharing information among all of the participants concerned with a patient's care to achieve safer and more effective care."[209] This broad definition applies to services for varying conditions in multiple contexts, but at its core, care coordination should enable providers across various inpatient and outpatient settings and patients to make complex decisions to improve the quality of care and health outcomes.

With no general agreement among researchers on a single care coordination paradigm, models vary widely in their focus, ranging from patient-facing interventions (e.g., patient navigators, care coordinators) to systems-wide infrastructure (e.g., electronic health records [EHR], clinical decision-making tools, case management software, surveillance). In addition, health systems may implement multiple models simultaneously, making it difficult to disentangle the effects of any individual approach.

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[202]Anderson G, Horvath J. The growing burden of chronic disease in America. *Public Health Rep*. 2004;119(3):263-270.

[203]Medicare Payment Advisory Commission. *A Data Book: Healthcare Spending and the Medicare Program.* Washington, DC: Medicare Payment Advisory Commission; 2008.

[204]McDonald KM, Sundaram V, Bravata DM., et al. Closing the quality gap: a critical analysis of quality improvement strategies. (v. 7: care coordination). *AHRQ Technical Reviews*. 2007. Available at: http://www.ncbi.nlm.nih.gov/books/NBK44015/.

[205]Peikes D, Chen A, Schore J, Brown R. Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries: 15 randomized trials. *JAMA*. 2009;301(6):603-618. Accessed on May 25, 2016 at: http://jama.jamanetwork.com/article.aspx?articleid=183370&resultclick=1.

[206]McDonald KM, Sundaram V, Bravata DM, et al. Closing the quality gap: a critical analysis of quality improvement strategies (v. 7: care coordination). *AHRQ Technical Reviews*. 2007. Available at: http://www.ncbi.nlm.nih.gov/books/NBK44015/.

[207]Burwell SM. Setting value-based payment goals—HHS efforts to improve US health care. *N Engl J Med.* 2015;372(10):897-899.

[208]Patient Protection and Affordable Care Act, 42 U.S.C. § 3021\1115A SSA et seq. (2010). Accessed May 26, 2016 at: http://housedocs.house.gov/energycommerce/ppacacon.pdf.

[209]Agency for Healthcare Research and Quality. Care coordination atlas. Available at: http://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/index.html.

The AHRQ *Care Coordination Atlas* describes specific care coordination activities and approaches considered essential for effective care coordination (Exhibit 21.1). As exemplified by awardees, many care coordination approaches identified by AHRQ could be encompassed in the official organization of care in patient-centered medical homes (PCMHs) and Accountable Care Organizations (ACOs).[210] Altogether, care coordination can be understood as a complex process involving multiple components and activities in a health care system beyond individual care coordinators.

Exhibit 21.1: AHRQ Care Coordination Atlas Activities and Approaches[211]

Activities	Approaches
Establish Accountability or Negotiate Responsibility	Teamwork Focused on Coordination
Communicate	Health Care Home
Facilitate Transitions	Care Management
Assess Needs and Goals	Medication Management
Create a Proactive Plan of Care	Health IT–Enabled Coordination
Monitor, Follow Up, and Respond to Change	
Support Self-Management Goals	
Link to Community Resources	
Align Resources with Patient and Population Needs	

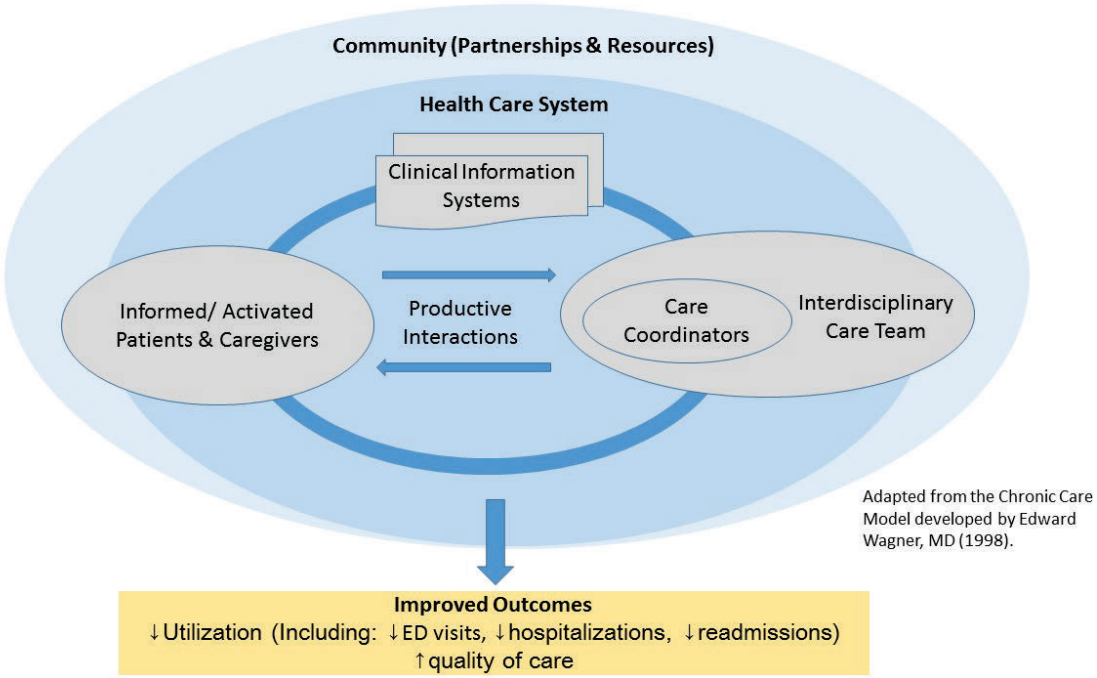
With this context, we drew upon Wagner's expanded chronic care model to develop a conceptual model of how care coordination achieves favorable outcomes, such as reduced health care utilization or improved quality of care.[212] Exhibit 21.2 provides an overview of the primary mechanisms through which care coordination can accomplish the three-part aim of improved health and quality of care while reducing costs.

[210]Rural Health Information Hub. Program Models. Accessed May 20, 2016 at: https://www.ruralhealthinfo.org/community-health/care-coordination/2/program-models.

[211]AHRQ Care Coordination Atlas Update 2014. chap. 3. Care Coordination Measurement Framework. Available at: http://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/atlas2014/chapter3.html.

[212]Wagner E. 2007. Redesigning chronic illness care: the chronic care model. Presented at: Institute for Healthcare Improvement National Forum 2008. December 10, 2007; Orlando, Florida.

Exhibit 21.2: Adapted Chronic Care Model



Care coordination activities from the AHRQ *Care Coordination Atlas* such as communication, facilitating productive transitions, and assessing needs are included in these productive interactions. Care coordinators within interdisciplinary teams work to increase patients' self-management capacities and ensure that care is evidence-based and patient-centered. This usually involves communicating with multiple health care providers within the health care system and identifying community resources. Participants with multiple health or social needs are referred to resources that complement care coordination activities; these resources exist both within the health care system and in the wider community. Conversely, the availability of community resources or policies outside the health care system may affect how care coordination is carried out.

Care Coordination: Composition of Teams and Activities, and Evidence of Program Effectiveness

In this report, we present analysis of care coordination and program effectiveness among 16 awardees in the disease-specific HCIA portfolio.[213] Our analysis here builds upon previously reported qualitative analyses stressing the importance of team-based care, workforce roles, and four common care coordination components found among nearly all of the awardees' programs.[214,215] We derived the four components—clinical care management, communication and service coordination, addressing needs beyond the health care system, and patient education and engagement—from the AHRQ Care Coordination Atlas (described above). In doing so, we have highlighted the importance of care

[213]We included all but two of the 18 awardees in this analysis of care coordination; two awardees (Joslin and GWU) did not focus on providing care coordination to participants.
[214]Available at: https://innovation.cms.gov/files/reports/hcia-ds-firstevalrpt.pdf.
[215]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.

coordination and team-based care to nearly all of the awardees. We use a definition of team-based care developed by Naylor et al. (2010) [216] that is consistent with the World Health Organization's principles of primary health care and is inclusive of the six Institute for Healthcare Improvement aims for improvement: "the provision of comprehensive health services to individuals, families, and/or their communities by at least two health professionals who work collaboratively along with patients, family caregivers, and community service providers on shared goals within and across settings to achieve care that is safe, effective, patient-centered, timely, efficient, and equitable." [217, 218,]

Descriptions of Care Coordination Teams

Identifiable care coordinators played a central role in awardees' team-based care models. For example, MAHEC's family health center integrated behavioral and physical health services, and a nurse practitioner centralized communication with physicians, pharmacists, and behavioral health providers. Similarly, at IOBS, triage nurses coordinated patient-centered cancer care in an outpatient setting; the nurses were patients' first point of contact in coordinating care with their physicians and treatment teams.

Teams that included community health workers (CHWs) often used them as points of contact for participants. Their roles included identifying and addressing social needs, and rarely were they considered part of clinical care teams:

- All three asthma awardees (HRiA, Le Bonheur, and Nemours) employed CHWs to liaise with participants, perform home visits, reinforce education, and connect families with resources.
- CHWs working on interventions that targeted complex diseases offered social and emotional support to caregivers and patients. UAB lay navigators and Indiana care coordinator assistants (CCAs) centered on helping participants navigate the health care system and document/address additional social needs.

Diseases that required intensive assessment and clinical follow-up—such as dementia, stroke, or cardiovascular disease—tended to use clinicians as central care coordinators. We hypothesize that programs targeting patients with advanced and complex diseases needed credentialed staff more than patients with other conditions.

[216]Naylor MD, Coburn KD, Kurtzman ET, et al. Team-Based Primary Care for Chronically Ill Adults: State of the Science. Advancing Team-Based Care. Philadelphia, PA: American Board of Internal Medicine Foundation; 2010.
[217]World Health Organization. World Health Report 2008 Primary Health Care (Now More Than Ever). Available at: http://www.who.int/whr/2008/en/.
[218]Institute for Healthcare Improvement. Across the Chasm: Six Aims for Changing the Health Care System. Available at: http://www.ihi.org/resources/Pages/ImprovementStories/AcrosstheChasmSixAimsforChangingtheHealthCareSystem.aspx.

Care Coordination and Program Effectiveness

To look for connections between care coordination workforce models, activities, and program outcomes, we developed a matrix of the presence or absence of key factors for models with or without positive program impacts. Based on claims or program data and a comparison group design (when feasible), an awardee is considered to have had positive program impact if there is evidence of one of the following:

- Significant reductions in core measures (cost, ED use, hospitalizations, readmissions), using claims-based analysis and comparison groups
- Non-significant reductions in core measures, using claims-based analysis and comparison groups
- Significant reductions in utilization (ED use, hospitalizations, readmissions) from program data, with no comparison group
- Significant improvements in quality of care measures from program data

Our findings are presented in Exhibit 21.3. Details of the specific program effectiveness measures can be found in the awardee chapters.

Exhibit 21.3: Care Coordination Activities, Workforce, and Program Impact

	IOBS	Le Bonheur	Nemours	UAB	UCLA	FirstVitals	Indiana	Ochsner	UVA	HRiA	MAHEC	SEDI	UPenn	Christiana	Vanderbilt	USJHSD
Disease	Cancer	Asthma	Asthma	Cancer	Dementia	Diabetes	Dementia	Stroke	Cancer	Asthma	Chronic Pain	Diabetes	Cancer	CVD	CVD	CVD
Level of Evidence of Program Effectiveness	●●●●	●●●●	●●●●	●●●●	●●●●	●●●	●●●	●●●	●●●	●●	●	●	●			
Workforce Strategy																
Team-based	●	●	●	●	●	●	●	●	●	●	●	●	●			
Lay Health Workers		●	●	●		●	●			●		●				●
Activities and Tools																
Home Visits		●	●		●		●			●		●	●			
Assess Needs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Support Self-Management Goals	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Link to Community Resources		●	●	●	●		●		●		●	●	●	●	●	
Care Plans		●	●		●		●	●						●	●	
Health Information Technology	●	●	●		●	●	●							●	●	

KEY	
●●●●	Significantly positive finding on ≥2 core measure using claims and comparison group design
●●●	Positive finding using claims and comparison group design that was not statistically significant
●●	Significantly positive finding on utilization using program data and time-series design/no comparison group
●	Significantly positive quality-of-care measure using program data/no comparison group
	Non-significant or significantly negative findings on core measures or quality-of-care measures

We observed improvements in utilization, costs, or other clinical outcomes among awardees that implemented a team-based approach to care coordination. Multidisciplinary teams were deployed to improve the quality of care for patients across a broad range of diseases, and each team developed its own workflow and implementation process. Among many awardees, this process was replicated across multiple sites, with sites given discretion to adapt their models and processes to better suit their teams. As suggested in the conceptual model, coordination of care within care teams is central to productive interactions with patients and caregivers and is associated with positive outcomes.

The majority of teams with positive program effectiveness findings included lay health workers as a primary contact for participants. Qualitatively, participants commonly reported how comfortable they felt communicating with CHWs and how the general accessibility to CHWs improved participants' overall access to health care. CHWs shared information gathered from participants directly with treating providers so that patients did not have to do so; clinicians could then follow up on reported needs. In general, CHWs could be seen as facilitating productive interactions in health care settings by mediating communication between clinicians and patients.

We observed positive program impacts among awardees that used home visits. Seven of the awardees used home visits in their service delivery models, including five that included CHWs in home-visiting teams. Home visits gave staff and providers enhanced information about participants' unique social needs. Information gathered during home visits offered insight into why it was easy or difficult for participants to adhere to care plans and medication regimens, as well as to adopt or sustain behavior changes. Awardees found that patient engagement was most effective when tailored to participants' needs in a comfortable setting and in a judgment-free way. The relationships that staff must build so that they can enter participants' homes led participants to trust the education and advice delivered by program staff, thereby enhancing the program's overall effect.

Limitations

For this analysis, we included only awardees that offered care coordination services (n = 16). We used claims data and a comparison design to assess program impact among most awardees. However, we were not able to access claims data for all awardees due to requirements contained in different data use agreements with health systems or difficulties in accessing data owned by private payers or state Medicaid offices. For three awardees, we analyzed program data to identify any reductions in costs and utilization and improvements in health maintenance behavior or health outcomes; we were not able to use comparison groups in the analysis. Moreover, the programs in the disease-specific portfolio focus on a range of diseases that may require different approaches. Therefore, there are too few programs under each type of disease to draw conclusions about the effectiveness of specific program components or combinations of components. Further research is needed to compare care coordination activities that target particular chronic conditions.

Finally, because awardees whose programs address cardiovascular disease had limited program effectiveness in terms of core measures—due to the incremental nature of improvements in measures of cardiovascular health—we should acknowledge that improved heart disease or stroke prevention and treatment may take longer to demonstrate impacts than could be measured during the award period.

Summary

The HCIA awardees demonstrate how care coordination happens at both systemic and individual patient-facing levels. Care coordination involving team-based care, lay health workers, and/or home visits is common among awardees that showed evidence of program effectiveness. Other key features of care coordination include assessing needs, supporting self-management goals, care plans, and health information technologies. Altogether, our findings support the theory that productive interactions between care teams and patients can lead to improved outcomes, such as reduced utilization or costs or enhanced quality of care.

Decreased Utilization and Improved Quality of Life for Pediatric Asthma Patients and Families

According to the most recently published estimates, pediatric asthma affects nearly 7 million children in the United States.[219,220] Approximately 4 percent of pediatric patients have uncontrolled asthma, and in 2011 asthma accounted for approximately 611,000 emergency department (ED) visits by children under the age of 15 years.[221,222]

In this chapter, we examine the effectiveness of three pediatric asthma programs in the HCIA disease-specific portfolio. We use a mixed-methods approach to identify factors associated with program success, taking into account variation in program components and the populations served. We also consider these programs' potential benefits to caregivers as well as to participants themselves.

Innovations in pediatric asthma care typically use multiple components to address social determinants, education for caregivers and patients, and medication management. Recent research suggests that the more components used in a given program, the greater the program's likelihood of reducing asthma exacerbations and improving asthma control.[223] Systematic reviews of pediatric asthma interventions suggest that the most successful programs incorporate assessment, education, and remediation in different ways. For example, these interventions may use environmental assessments and remediation (e.g., giving remediation supplies to participants) as well as education concerning environmental triggers that are associated with asthma exacerbations. These interventions also often link participants to needed social services and offer education in self-management and general asthma care.[224]

In particular, the medical literature shows that home-based interventions focused on participants' environments can reduce the number of asthma-symptom days. In these cases, the ability of program staff to visit participants in their homes is a critical component of a program's effectiveness.[225] The literature also shows promising results with programs that focus on asthma education generally. These programs can reduce hospital admissions and ED visits for children with asthma. For education-only interventions, research shows that providing education over multiple sessions (rather than only one) and conducting one-on-one education can improve program effectiveness.[226,227]

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[219]Akinbami L, Simon A, Rossen, L. Changing trends in asthma prevalence among children. *Pediatrics*. 2016;137(1).
[220]Bloom B, Jones LI, Freeman G. Summary health statistics for U.S. children: National Health Interview Survey, 2012. National Center for Health Statistics. *Vital Health Stat*. 2013;10(258):1-81.
[221]Liu AH, Gilsenan AW, Stanford RH, et al. Status of asthma control in pediatric primary care: results from the pediatric Asthma Control Characteristics and Prevalence Survey Study (ACCESS). *J Pediatr*. 2010;157(2):276-281.
[222]National Hospital Ambulatory Medical Care Survey: 2011 Emergency Department Summary Tables. National Center for Health Statistics. Available at: http://www.cdc.gov/nchs/data/ahcd/nhamcs_emergency/2011_ed_web_tables.pdf.
[223]Bravata DM, Gienger AL, Holty JE, et al. Quality improvement strategies for children with asthma: a systematic review. *Arch Pediatr Adolesc Med*. 2009;163(6):572-581.
[224]Bravata DM, et al. 2009 Jun; 163(6): 572-581.
[225]Crocker DD, Kinyota S, Dumitru GG, et al. Task Force on Community Preventive Services. Effectiveness of home-based, multi-trigger, multicomponent interventions with an environmental focus for reducing asthma morbidity: a community guide systematic review. *Am J Prev Med*. 2011;41:S5-S32.
[226]Coffman JM, Cabana MD, Halpin HA, Yelin EH. Effects of asthma education on children's use of acute care services: a meta-analysis. *Pediatrics*. 2008;121(3):575-586.
[227]Guevara JP, Wolf FM, Grum CM, et al. Effects of educational interventions for self-management of asthma in children and adolescents: systematic review and meta-analysis. *BMJ*. 2003;326:1308-1309.

Several interventions described in the literature target low-income populations by using community health workers (CHWs). Prior research indicates that this model can help build connection and trust between program staff and participants, thereby increasing patients' readiness to talk openly about their needs.[228] Interventions that offer education about medication administration benefit from employing pharmacists or nurse specialists to lead this component.[229]

This analysis focuses on the three awardee innovations that address pediatric asthma. Each employs a different approach to home visiting and uses a different staffing model. Our analysis considers how this variation affects program success among the three.

Research Questions

For this analysis, we focus on four research questions of interest for the pediatric asthma awardees:

1. Which **populations** do these awardees target?
2. What are the **program components** of each intervention, and how are they similar or different?
3. What evidence of **program effectiveness** do we observe from claims, survey, and other data? Specifically, is there **evidence of stronger program impact** for subpopulations who received **a higher "dose"** of intervention?
4. What are the **drivers of program effectiveness**? Specifically, which key supports to families may be responsible for reduced utilization and improved quality of care for children? How do caregivers benefit?

Data Sources

We use data from semi-structured interviews with all levels of program leadership and staff as well as focus groups conducted with caregivers whose children participate in the programs. We also reviewed and drew findings from quarterly progress and implementation reports submitted by awardees to CMMI. Secondary data sources include Medicaid claims or encounter data obtained from Tennessee's TennCare for Le Bonheur and Delaware's Alpha-MAX data for Nemours. We also used program data on dosage that were collected by Le Bonheur and Nemours staffs. Complete claims data are not available for HRiA participants, and therefore we used self-reported utilization data by caregivers of program participants at the two home visits and at six and 12 months after the last home visit.

Program Components and Program Populations

Le Bonheur, HRiA, and Nemours each implemented multicomponent interventions to address pediatric asthma. Exhibit 22.2 shows the program components by awardee. A darker-shaded box denotes an intensive focus on a component, whereas a lighter-shaded box indicates less focus relative to other program components.

[228]Crocker, et al. 2011;41:S5-32.
[229]Bravata DM, et al. 2009;163(6):572-581.

Exhibit 22.1: Asthma Program Components

Function or Activity	Le Bonheur	Nemours	HRiA
Asthma Education	■	■	■
Asthma Action Plan	■	■	■
Home Environmental Assessment	▪	■	■
Addressing Social Needs/Providing Social Support	■	■	▪
Medication Management	■	■	□
Delivery of Asthma Mitigation Supplies	▪	▪	■
Care Coordination	▪	▪	□
Advocacy and Outreach to Schools	■	▪	
Enhanced Access to Care	■	▪	□
Community-based Outreach and Advocacy	▪	■	

Key: ■ intensive focus ▪ less intensive focus □ minimal or no focus

Le Bonheur's and Nemours's programs employed more components than the HRiA intervention. Le Bonheur emphasized clinical management of the disease by a physician specialist coupled with support provided by CHWs and asthma care coordinators. The intensive clinical component focused on the needs of the sicker patients. This component included a comprehensive clinic visit during which patients received allergy testing and spirometry testing (lung test of inhales and exhales) and met with a physician specialist. Caregivers of participants also received a 24-hour telephone service line that they could call in the event of an asthma exacerbation. The service line was staffed by emergency medical technicians (EMTs) who followed both an overarching protocol developed by the specialist physician and each participant's individualized asthma action plan, with the goal of helping caregivers bring the exacerbation under control at home. In addition, using access to TennCare prescription history data, Le Bonheur's program could identify patients who were not consistently picking up medications and then target additional support and education to them and their caregivers.

Nemours drew program participants from patients of Nemours pediatricians. Through their award, Nemours offered these participants additional social support and education from CHWs. Nemours also had a team of community liaisons focused on improving education and awareness of asthma in the communities where program participants lived.

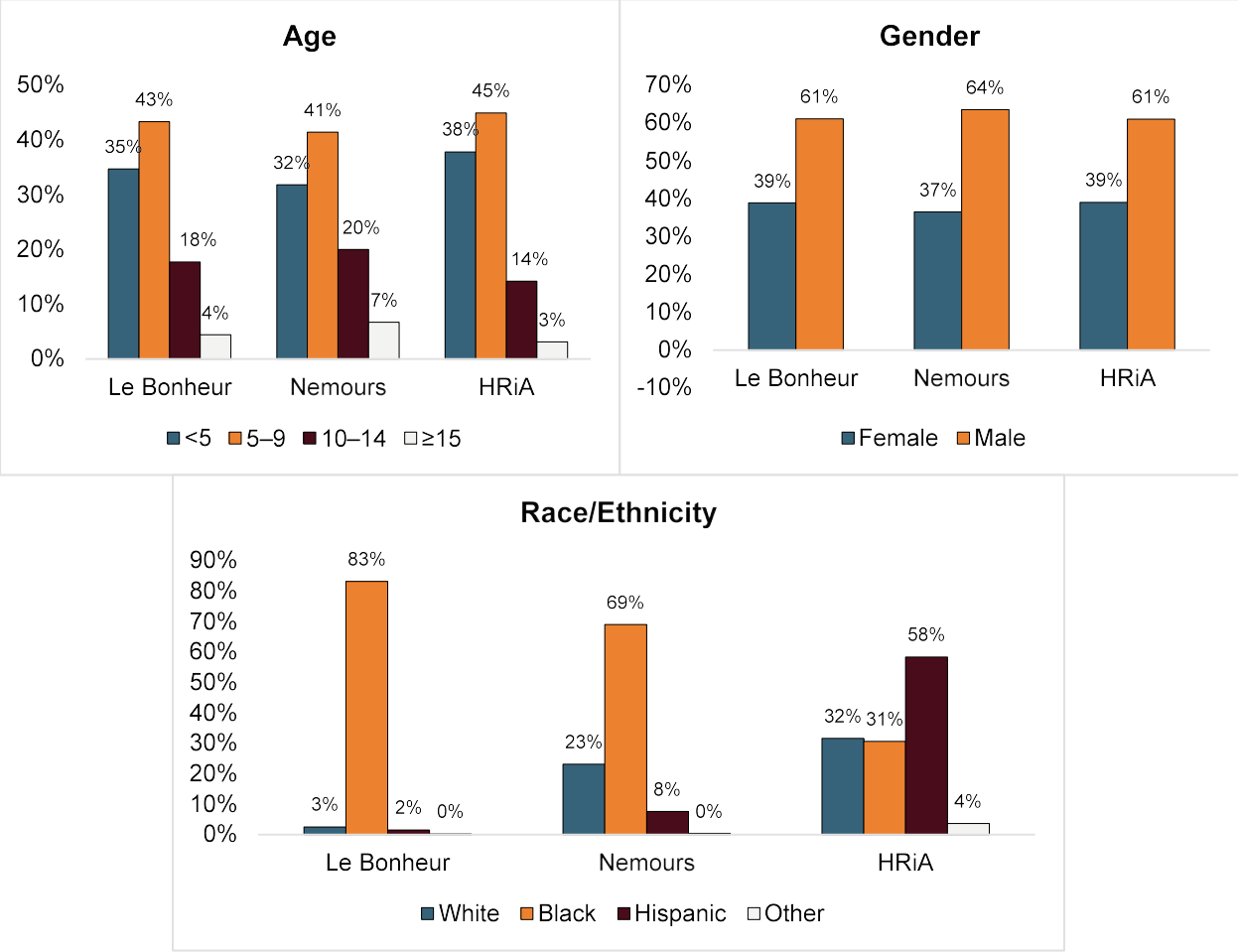
In addition to providing home-based asthma education, HRiA program sites strongly emphasized conducting environmental assessments as part of the first home visit. These assessments helped increase awareness and education about participants' exposure to triggers in their everyday home environments. On subsequent visits to the same home, program staff would deliver mitigation supplies to address specific triggers.

All three pediatric asthma programs used interdisciplinary care teams to carry out their interventions:

- HRiA paired CHWs with certified asthma educators (AE-Cs), who had clinical backgrounds as nurses or respiratory therapists.
- Le Bonheur's program included CHWs and a range of clinical staff that included physician specialists, a registered nurse, a nurse practitioner, a clinical social worker, and respiratory therapists who are AE-Cs.
- The Nemours intervention team included CHWs and community liaisons who engaged in community-based outreach initiatives. The CHWs and community liaisons worked as members of practice-level medical home teams that included physicians, nurses, medical assistants, and a psychologist.

Exhibit 22.2 presents characteristics of the participants served by each pediatric asthma awardee. The data presented are limited by the lack of claims for HRiA participants. All three awardees target children ages two to 17 or 18 years who have asthma and use bronchodilators. The majority of the participants served by the awardees reside in urban areas; however, there are substantive differences among populations served by each awardee. For example, Le Bonheur predominantly serves Black participants (83 percent). HRiA and Nemours, although still substantially focused on racial and ethnic minorities, serve a more diverse mix of White, Black, and Hispanic participants. Although the majority of their participants are urban residents, both Nemours and HRiA implemented their programs in a mix of urban, suburban, and rural locations.

Exhibit 22.2: Descriptive Characteristics of Le Bonheur, Nemours, and HRiA Participants



In addition to these demographic characteristics, we would like to point out a few additional factors that might have impacted program performance. Le Bonheur participants had more than twice as many ED visits per 1,000 patients in the year prior to enrollment than Nemours participants. Le Bonheur participants also had higher rates of hospitalization, asthma-related hospitalizations, and readmissions, suggesting that they served a higher-risk population.

Variation in participant enrollment mechanisms may drive the apparent differences in participant risk level between Nemours and Le Bonheur. Le Bonheur primarily enrolls eligible participants identified following a visit to the ED or an inpatient hospital stay for an asthma-related condition. In contrast, the Nemours program identified participants through referrals from participating primary care providers. Without claims data, we are unable to present comparable findings from HRiA.

Program Effectiveness

In this section, we consider the outcomes presented to date, differences in the program populations, and new analyses of subpopulations of participants who received a higher "dose" of the three asthma

programs. In the last annual report, we reported favorable claims-based outcomes for Nemours. Here we present claims-based outcomes for both Nemours and Le Bonheur. Because claims data were not yet available for HRiA, we report on caregiver-reported utilization outcomes for participating children:

- **HRiA.** Our analysis focuses on children who attended the first and final home visits of the program (N = 670), approximately 63 percent of the 1,060 participants enrolled in HRiA as of March 2015.
- **Le Bonheur.** Our analysis includes 476 participants. Nearly all participants enrolled prior to March 2015.
- **Nemours.** Our quantitative analysis is limited to the 490 participants enrolled in the most intensive aspect of Nemours program (i.e., those who received services from a CHW), approximately 57 percent of the 855 children enrolled in Nemours prior to January 2014. We are unable to link more participants to claims because Delaware Alpha-MAX data are currently available only through 2013, which restricts our findings to children enrolled in the earlier portion of the intervention.[230]

Exhibit 22.3 summarizes the outcome measures and comparisons used in this analysis. Specifically, we compare Nemours and Le Bonheur with respect to claims-based outcomes and compare HRiA and Le Bonheur with respect to Juniper Caregiver Quality of Life Survey scores. HRiA participant caregivers were also asked to report on asthma-related healthcare utilization. Although Le Bonheur and Nemours claims data include separate measures for asthma-related hospitalizations and all-cause hospitalizations, we did not differentiate the cause of ED visits, so we are unable to present outcomes for ED visits specifically related to asthma.

Exhibit 22.3: Availability of Outcome Measures by Asthma Awardee

Outcome Measure	Le Bonheur	Nemours	HRiA±
Claims-Based Utilization Measures			
Hospitalizations per 1,000 Patients	■	■	unknown
Asthma-related Hospitalizations per 1,000 Patients	■	■	■
ED Visits per 1,000 Patients	■	■	unknown
Total Cost of Care per Patient ($)	■	■	unknown
Asthma-related ED Visits per 1,000 Patients	N/A	N/A	■
Asthma-related Urgent Care Visits per 1,000 Patients	N/A	N/A	■
Routine Asthma-related Health Care Visits per 1,000 Patients	N/A	N/A	■

NOTE: ±For the HRiA claims analysis, we used self-reported utilization data from caregivers for all measures. Analysis for Nemours used Delaware Alpha-MAX, and analysis for Le Bonheur used Tennessee Medicaid claims from the state.

[230]Alpha-MAX data are usually updated every six months. However, there were no new data provided in the recent data refresh.

Exhibit 22.4: Utilization and Cost Outcomes for Patients with Asthma

Awardee	N	ED Visits per 1,000 Patients	Hospitalizations per 1,000 Patients	Asthma-related Hospitalizations per 1,000 Patients	Total Cost of Care per Patient ($)
Le Bonheur	474	**-39 [-67, -11]****	-8 [-19, 3]	1 [-14, 16]	-$536 [-928, -144]**
Nemours	490	**-33 [-61, -5]****	**-10 [-19, -1]***	-2 [-8, 4]	16 [-173, 205]

NOTES: ***p<0.01, **p<0.05, *p<0.1. Model-based estimates for cost measure using generalized estimating equation model with log link and Poisson distribution. Count measures estimated using population-averaged logit models. Please see Appendix A for more information on our approach.

Exhibit 22.5: Difference Estimates for HRiA Caregiver-Reported Utilization Measures

Asthma-related Hospitalizations in Last 6 Months per 1,000 Patients	Asthma-related ED Visits in Last 6 Months per 1,000 Patients	Asthma-related Urgent Care Visits in Last 6 Months per 1,000 Patients	Routine Asthma-related Health Care Visits in Last 6 Months per 1,000 Patients
-214 [-247, -182]* **	**-362 [-399 , -326]*** **	**-216 [-250, -181]*** **	**-194 [-227, -161]*** **

NOTE: ***p<0.01, **p<0.05, *p<0.1

Results of the analyses (Exhibit 22.4 and Exhibit 22.5) show that both the Le Bonheur and Nemours programs reduced ED visits per 1,000 patients (39 and 33 visits per 1,000 patients, respectively). The Nemours program also had 10 fewer hospitalizations per 1,000 patients relative to the comparison group, whereas Le Bonheur reduced total cost of care among participants by $536 per patient relative to the comparison group. For HRiA we find that caregivers reported statistically significant reductions in asthma-related hospitalizations, asthma-related ED visits, asthma-related urgent care visits, and asthma-related health care visits per 1,000 patients in the last six months; HRiA's findings in particular should be interpreted with caution since they are based on self-reported recall of events and there is no comparison group.

We conducted an analysis to better understand whether the "dosage" of the program influenced program effectiveness. We grouped participants in Nemours and Le Bonheur in either a "high-dose" subgroup or a "low-dose" subgroup (for details see Technical Appendix A). For Le Bonheur and Nemours, we then conducted a difference in differences (DID) analysis using available claims data to see how the impact on cost and utilization differed between the two dosage groups. HRiA participants were included in either a "full-dose" or a "partial-dose" subgroup. There were no post-intervention data for HRiA participants who received a partial dose; therefore, we compared demographic and other characteristics to identify any statistically significant differences between participants who received a full dose and those who received only a partial dose.

There are several important limitations to this analysis. Program data on dosage for each awardee varied in quality and completeness, resulting in varying definitions of dose (Exhibit 22.6). The sample sizes for each awardee were relatively small for this type of analysis, and we focused the analysis on dividing patient experience into two categories. This analysis may not be adequately powered to detect differences. Nevertheless, we felt that it was an important research question to explore to identify avenues that may need further investigation in future research and model development. .

Exhibit 22.6: Data Source and Definition of Dosage Analysis

Awardee	Data Source	Definition
Le Bonheur	Program touch data from registry that provided the number of interactions with the CHAMP program team, including the specialists, CHWs, asthma care coordinators, and certified asthma educators	▪ **High dose**: ≥15 program touches over the course of the program (median number of encounters among all participants) ▪ **Low dose**: <15 program touches over the course of the program
Nemours	CHW encounter data recorded in Epic EHR that provided the number and type of CHW interactions (phone, home visit, clinic)	▪ **High dose**: ≥15 CHW encounters over the course of the program (median number of encounters among all participants) ▪ **Low dose**: <15 CHW encounters over the course of the program
HRiA *	Assessment data that served as a proxy for whether a participant received a first home visit (i.e., had an initial assessment) and a follow-up assessment (i.e., had a final home visit, six-month follow-up call, or 12-month follow-up assessment)	▪ **Full dose:** Completed initial assessment and at least one follow up assessment (final home visit, six-month, or 12-month) ▪ **Partial dose**: Completed initial assessment but no follow-up assessment

NOTE:*The number of home visits varies by site, and therefore we are unable to use the median number of visits/encounters for HRiA.

Exhibit 22.7: Difference-in-Differences Estimates for Patients with Higher Dosage

Awardee	N	ED visits per 1,000 Patients	Hospitalizations per 1,000 Patients	Asthma-related Hospitalizations per 1,000 Patients	Total Cost of Care per Patient ($)
Le Bonheur	474	12 [-23, 47]	16 [-1, 32]	15 [0, 31]	**$523 [322, 724]*** **
Nemours	490	-1 [-39, 37]	5 [-8, 18]	3 [-7, 12]	$262 [-531, 1054]

NOTES: ***p<0.01, **p<0.05, *p<0.1. Reference group is participants who received lower dosage. Split is based on the upper and lower 50% of contacts. Smaller sample sizes did not allow us to divide the groups further.

- **Le Bonheur.** High-dose participants had smaller cost savings than low-dose participants, although costs decreased for both groups in the post-intervention period. High-dose participants tended to be younger compared with the partial dose group, and it is possible that their asthma was more severe, although disease severity is not verifiable.
- **Nemours.** No statistical differences in outcomes. High-dose participants were more likely to be White and disabled compared with low-dose participants.
- **HRiA.** We observe significant differences between full-dose and partial-dose participant groups in age, site, gender, race/ethnicity, caregiver education, language, urbanicity (for the 81 percent of participants for whom zip code is available), and past health care utilization (based on responses to the first assessment).

Overall, we do not observe a clear trend between dosage and effectiveness. This could be a result of participants and their families getting the needed intervention with only a partial dose, or it could be a function of the small sample size's inability to detect differences.

Drivers of Program Effectiveness

As noted earlier, quantitative data suggest that both the Le Bonheur and Nemours programs are reducing health care utilization (hospitalization, asthma hospitalization, or ED visits) for target populations. Although many traditional programs that target chronic conditions take a "one size fits all" approach, these awardees have asthma programs that are designed to provide tailored education and individualized care management support, which may be driving the consistent reductions in utilization across the entire program population. Unfortunately, claims data are not available for HRiA, and therefore we cannot measure changes in utilization among the children it served. However, survey data and caregiver focus group findings suggest that quality of life for participants' caregivers improves after receiving home-visit services through the program. In turn, this finding may suggest that asthma symptoms were better managed and controlled in children participating in the program.

Qualitative data offer insights into how components of the three asthma programs contribute to program effectiveness.

Program staff and caregivers across all three programs noted that asthma education and reinforcement provided during home visits were more effective than education alone in a clinical setting because:

- CHWs used culturally and linguistically appropriate education and tailored education based on what they saw in the home.
- CHWs were able to spend more time educating patients than clinicians could during medical visits.
- Families were less stressed when speaking with a trusted program point-person and therefore more open and receptive to education in the home environment.
- Reinforcement and repetition were key to overcoming long-standing caregiver misconceptions and misinformation about asthma (medications, triggers, and so forth).
- Other family members (aunts, uncles, grandparents, older siblings) who lived in the home and cared for the patient were often present at home visits.

Both caregivers and program staff cited the personalized asthma action plan as one of the most important educational tools for caregivers. All three awardees designed their asthma action plan template as a simple color-coded tool that reminded caregivers about how to manage their child's asthma, depending on symptoms—i.e., following the green instructions for normal days and yellow or red instructions for periods of mild to moderate and severe exacerbations, respectively. Each participant received a personalized asthma action plan that included the patient's specific medication regimen and treatment plan. Several caregivers noted that the asthma action plan empowered them to take control of the situation during an asthma attack and helped them to avoid trips to the ED.

> *"They gave me this great sheet of paper that I was able to hang on my refrigerator and say, 'ok…red means this one.' Now I know what names are the Albuterol and Ventolin and Flovent, and I feel more educated. When he has an asthma attack, I don't feel like, 'Oh my God, what do I do?' There's no more sleepless nights. I go to the treatment plan when the first sign starts of the coughing and the wheezing. And then go from there. We have our two or three days, and then if it's still on a sick day plan, call the pediatrician. We haven't had to go to the hospital."*
>
> —HRiA Caregiver of Program Participant

The three programs vary regarding staff roles in developing the asthma action plan and in how staff shared the plan with caregivers:

- Across the HRiA sites, the CHW or AE-C (at Connecticut sites) reviewed a child's asthma action plan with the caregiver(s) during the first home visit. If a child did not have an asthma action plan, the program staff would reach out to the patient's primary care physician to obtain one.
- At Le Bonheur, the CHAMP physician specialists developed an asthma action plan for each participant during the initial clinic visit. During this visit, the CHAMP physician and the AE-C asthma care coordinators reviewed the asthma action plan with the caregiver.[231] The CHWs would then reinforce the asthma action plan with the caregivers and the child (when appropriate) during home visits. In addition, the asthma care coordinators ensured that the child's school and primary care provider received a copy of the asthma action plan.
- The primary care physicians of the three participating Nemours pediatric practices developed an asthma action plan using a standard template in their EHR system and reviewed this plan with caregivers during office visits. The CHWs also reviewed the asthma action plan again with families during home visits.

Caregivers across all awards and sites praised CHWs for being nonjudgmental. The personal relationships between CHWs and participant families helped the CHWs to identify and address health behaviors that influenced their child's asthma. The trust established between CHWs and participant families helped to keep participants engaged throughout the intervention and facilitated their willingness to modify behaviors. Physicians at Nemours and Le Bonheur noted that participants and caregivers revealed behaviors during home interactions with CHWs that they could not typically identify in a clinic visit.

Caregivers reported that better medication management reduced ED visits and hospitalizations. Improved understanding of which medications to use for maintenance or for exacerbations helped to keep asthma under control and prevented escalations that would otherwise have resulted in ED visits or hospitalization. They also appreciated the knowledge about how to prevent exacerbations by recognizing and limiting or eliminating exposures to triggers in the home.

[231] A majority (84 percent) of Le Bonheur primary caregivers are mothers, and the remaining 16 percent are mostly fathers, with a handful of other family members, such as aunts or grandparents.

> *"CHAMP teaches you how to administer your child's medicine every day and ways to prevent triggers of asthma and going to [the] ED. Tell parents that CHAMP helped teach us methods and then pass on the knowledge to our child.… We haven't been back to the ED for years. The child knows now how to set up the medicine, how many times a day to take it, and that it prevents going to the ED and that crazy prednisone medicine, which can have negative health effects. We learn[ed] prednisone isn't good for your body and that if you take your daily medicine you won't need it. Through the CHAMP program, I learned to be preventative and not be at the ED at the end of the month, missing work, school, neglecting your other children. I would say it has affected my children and educated my family. I take the materials to my [child's] school to show them."*
>
> —Le Bonheur Caregiver of Program Participant

Across all three awardees, CHWs performed environmental assessments during home visits. The assessments helped to identify potential asthma triggers in the home, including dust mites, pets, tobacco smoke, pests (e.g., cockroaches, mice), household items such as scented candles, and cleaners such as bleach. We found variation in the ways in which staff were trained to perform environmental assessments and in the way that environmental assessments were completed; however, we were unable to determine how these differences impacted outcomes across sites.

- Of the three awardees, HRiA performed home environmental assessments most consistently, generally during the first home visit. CHWs at HRiA also received the most rigorous training in how to identify triggers in the home.

- In the first year of the program, Le Bonheur CHWs had the least rigorous training in how to perform home environmental assessments. The CHWs also noted that in the first year they often used self-report from caregivers to complete environmental assessments if the caregiver did not allow the CHW to walk through the home. In the second year of the program however, CHWs attended "healthy homes" training sessions. They also were able to provide cleaning supplies to participants based on needs identified during the environmental assessment of the home in the second year of the program. CHWs noted that the families appreciated that the cleaning supplies helped them to reduce triggers in their home.
  - In addition to environmental assessments of the home, Le Bonheur's program performed allergy testing on program participants during clinic visits, which provided families an additional source of information about potential asthma triggers in the home.
- Nemours CHWs attempted to complete home environmental assessments for every family visited. Dover and Wilmington caregiver focus group participants reported that they had received an environmental assessment and tips to asthma-proof their homes.

Participants were most receptive to education and support after an asthma-related ED visit or hospitalization. Le Bonheur staff noted that they found that participants were less likely to miss their initial CHAMP clinic visit if the visit was scheduled soon after a hospitalization or ED visit had occurred. Staff from both Nemours and HRiA similarly noted that caregivers were more willing to allow a CHW to conduct a home visit soon after a hospital admission or ED visit. Staff noted that caregivers were often less receptive to the program-provided education and support when they believed that their child's asthma was under control, despite having a diagnosis of persistent asthma and a history of asthma-related hospitalizations and ED visits.

Le Bonheur and Nemours CHWs provided more social support to program participants than HRiA's CHWs provided to theirs:

- Le Bonheur and Nemours CHWs had no limit on the number of home visits they made to a participant's family, and they were able to spend more time with families who had greater needs (both clinical and social). In contrast, HRiA program sites limited home visits to three or four visits, with few exceptions, which might have contributed to the stronger relationships observed between CHWs and some participants in the Nemours and Le Bonheur programs.
- The Le Bonheur program provided support to participants who struggled with transportation by offering a taxi service to clinic appointments and a pharmacy delivery service for caregivers who could not easily pick up asthma medications.
- Le Bonheur and Nemours focus group participants noted that the support provided by CHWs was a connection to social services and resources, as well as providing moral support and friendship.
- For HRiA, CHWs who serve the populations in Boston seemed to provide more social support to participants than their counterparts in Connecticut, Rhode Island, and Vermont. This support often included advocacy with landlords and housing management to take care of unsafe housing conditions. CHWs in Boston had more resources to which they could refer participants. In addition, many of the CHWs in Boston had prior experience in social services, which might have made it easier for them to identify resources and advocate for the families they worked with.

> *"I've been through my kid's asthma and it feel like you by yourself and you're alone. Now that I have her involved in my asthma I feel like it, it's better because I'm not so alone, where I have a problem I can go talk to her. It really helps me."*
>
> —Nemours Wilmington Caregiver or Program Participant

Caregivers noted forms of individualized support unique to specific programs:

- HRiA caregivers appreciated the asthma trigger mitigation supplies, particularly the vacuums and bedding covers. They also appreciated that CHWs helped to assemble and set up the supplies and demonstrate their proper use. Staff members felt that assembly helped ensure usage; their goal was to make asthma mitigation as easy as possible for caregivers.
- Le Bonheur caregivers appreciated that one of the CHAMP asthma care coordinators was responsible for conducting outreach and provided education to their child's school. This asthma care coordinator ensured that participants' schools received their asthma action plans. She also worked with school staff to ensure that they understood the proper way to administer medication to the CHAMP patients.

When asked for suggestions about how to improve the asthma programs, only HRiA caregivers provided feedback and suggested that:

- the program include additional home visits;
- CHWs come to the home at times of the day when children are present (as opposed to during school hours) so that the targeted child could benefit from the education CHWs provided;

- the program help identify resources for children that would allow them to stay active despite their asthma (e.g., summer camps, sports).

Implications for Future Programs

When considered together, the asthma awardee programs have important implications for program developers. Our findings suggest that:

- CHWs can reach, engage, support, and educate caregivers and children beyond the traditional office setting.
- CHWs are most effective when trained in home environmental assessments, asthma education, and social service resources.
- CHWs need the support of a certified asthma educator or other clinician to whom they could escalate medical concerns.
- CHWs benefited from a peer support network with whom they could discuss common challenges and lessons learned.
- Programs are most effective when there are open and clear communication channels with participants' primary care providers to ensure updates to asthma action plans, reinforcement of medication regimens at home and in the clinic, and development of a whole-person perspective regarding patients, including consideration of social circumstances that could affect care.
  - Ideally, asthma programs would benefit from being embedded within a primary care practice, but if that is not possible, there should be a feedback loop between the program and the primary care or pediatric practice.

Limitations and Next Steps

Our aim is to expand our analysis to include claims data for HRiA if available for the no-cost extension report. We also intend to examine the effects of different program components (e.g., dose) on the core measures of health care utilization and cost and to add a quality measure of medication adherence. Risks to our planned analyses include potential delays in receipt of Medicaid data that preclude analysis of the entire HCIA period of performance. We expect to add additional quarters of analysis for Nemours and Le Bonheur in future reports, pending updates to Delaware Alpha-MAX and a refreshed TennCare data set. As noted earlier, cost data are not standardized across awardees, and therefore we do not recommend direct cost comparisons among the awardees.

Summary

Although the three programs implemented slightly different approaches, all used CHWs, who acted as a point of contact and provided home-based education, environmental assessments, and social support. Our analysis shows consistent reductions in health care utilization and cost among Nemours and Le Bonheur program subpopulations. Caregiver-reported utilization also shows reductions in utilization for HRiA. Although our analysis did indicate effectiveness of the programs overall, analysis showed no clear association between the dosage of intervention and the utilization and cost outcomes measured. This

could be a result of participants and their families getting the needed intervention with only a partial dose, or it could be a function of the small sample size's inability to detect differences.

Findings from site visit interviews and focus groups suggest that caregivers deeply appreciated the asthma education they received through the programs. Findings indicate that increased adherence to medication regimens and reduced in-home exposure to asthma triggers are evidence of program effectiveness. Asthma action plans were an important education tool that increased caregivers' confidence in managing exacerbations, thereby helping to avoid trips to the ED.

Overall, staff and caregivers found that asthma education delivered in the home was particularly effective. The hands-on nature of home visits and the capacity of staff to demonstrate or help set things up made families less stressed and more receptive to receiving information at home rather than in clinical settings. Asthma education provided by CHWs over several home visits helped families overcome longstanding misconceptions about asthma and benefited other family members living in the home. CHWs' support helped caregivers feel less isolated in dealing with their child's asthma. Finally, referrals to social services allowed caregivers to resolve challenges, and that helped them focus on managing their child's asthma.

Caregiver feedback suggests that CHW-led education is effective at reducing unnecessary health care utilization as well as need for utilization among children with asthma, while simultaneously improving caregivers' quality of life. In summary, evidence indicates that individualized asthma education delivered in the home by CHWs, review of asthma action plans, and referrals to social supports helped to reduce utilization and total cost of care for participants and to improve quality of life for caregivers.

Decreased Utilization and Improved Quality of Care Outcomes for Patients with Cancer

Two awardees in the disease-specific portfolio—Innovative Oncology Business Solutions (IOBS) and University of Alabama at Birmingham (UAB)—aimed to use alternative models of oncology care to decrease utilization and costs while improving quality of care for patients with cancer. IOBS implemented their patient-centered oncology medical home (PCMH) model in seven outpatient sites. The model supported patient symptom management via a triage line and provided extended access to outpatient care during evenings and weekends for symptomatic adult patients with cancer. IOBS based their model on PCMH principles developed by the American Academy of Family Physicians, the American College of Physicians, and the American Osteopathic Association. Oncology medical home models emphasize cohesive team-based care, incorporating a per-member-per-month fee to cover medical and support services.[232]

UAB's patient navigation model, implemented at 12 sites, paired patients with lay navigators who actively helped with symptom and care management and alleviated burdens on caregivers. Navigation models foster improved care by supporting patients as they receive a complex array of cancer care services, coordinating the delivery of services and facilitating the exchange of information between patients and providers.[233]

In this chapter, we present a comparison of the impacts for the IOBS and UAB programs. We take a mixed-methods approach to identify programmatic features that were associated with successful outcomes and generate hypotheses about likely mechanisms of action that support reduced utilization and costs and improved quality of care for patients with cancer. Details about our analysis of each program are available in the awardees chapters and the appendix of this report.

UAB and IOBS implemented multisite, multistate interventions with different approaches to oncology care, although there were overlaps geographically and in terms of practices and staffing models. Exhibit 23.1 displays the locations for UAB and IOBS sites, and Exhibit 23.2 compares features of the two programs.

[232]Sprandio JD. Oncology patient-centered medical home. *J Oncol Pract*. 2012;8:47s-49s.
[233]Freeman HP. Patient navigation: a community centered approach to reducing cancer mortality. *J Cancer Educ*. 2006;21:S11-S14.

Exhibit 23.1: UAB and IOBS Site Locations

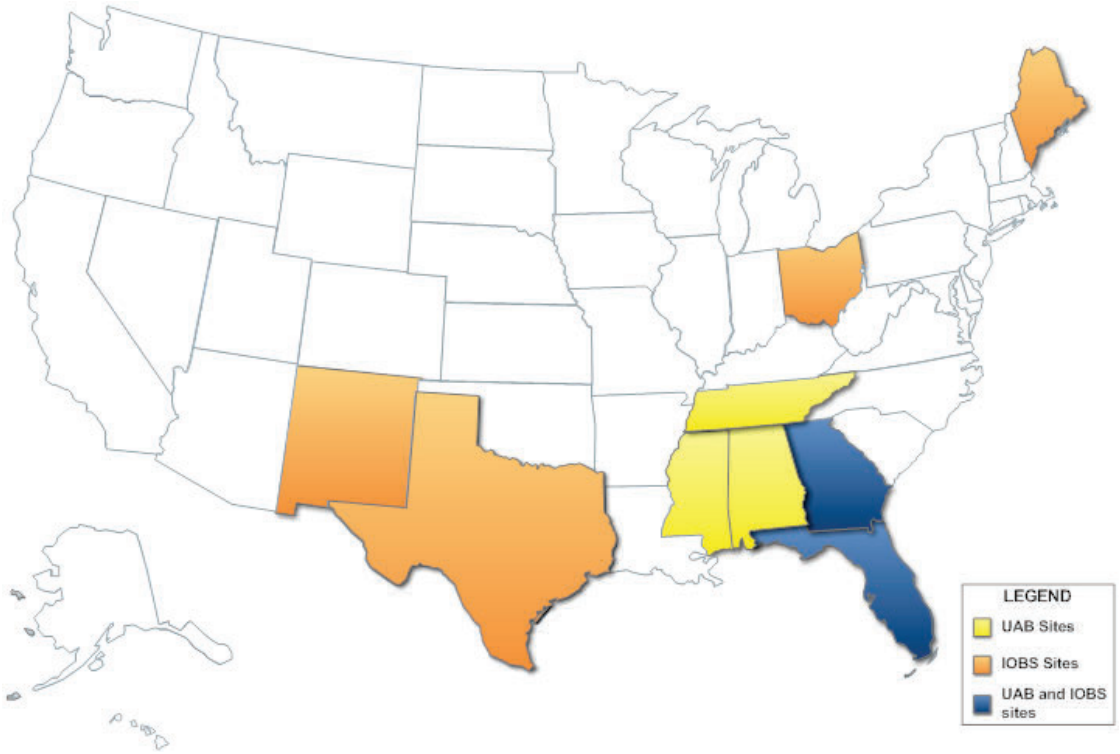


Exhibit 23.2: Comparison of Oncology Medical Home and Patient Navigation Models

	IOBS	UAB
Program Overview	▪ The Community Oncology Medical Home (COME HOME) program is an oncology patient-centered medical home model that provided integrated, coordinated care to cancer patients through three main program components: 1) triage pathways, 2) enhanced access, and 3) treatment pathways.	▪ UAB's Patient Care Connect (PCC) program used lay navigators to help improve adherence to care plans and to educate cancer patients and survivors about 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.
Program Goals	▪ Improve health outcomes, enhance patient care, and reduce cost for active cancer patients	▪ Improve patient-centered outcomes across the cancer care continuum (e.g., active cancer, cancer in remission, and advanced cancer)
Setting	▪ Seven oncology practices in New Mexico, Texas, Georgia, Ohio, Florida, and Maine	▪ 12 communities throughout Alabama, Florida, Georgia, Mississippi, and Tennessee
Participant Population	▪ Medicare patients with breast, colorectal, lung, thyroid, pancreas, lymphoma, and melanoma cancer	▪ Medicare patients with all cancers

	IOBS	UAB
Site Characteristics	▪ Seven community oncology sites ▪ Practice size ranged from 12 beds with nine physicians to 55 beds with 18 physicians ▪ All sites had electronic health records in place prior to implementing COME HOME	▪ 12 hospital sites ▪ Hospital size ranged from 81 beds with four physicians in urban Alabama to 822 beds with 109 physicians in Atlanta, Georgia ▪ Some sites had existing nurse navigation programs and/or social work staff
Program Components		
Dosage	▪ Varied depending on patient need (patients initiate contact with the intervention)	▪ Amount and type of interaction with navigators varied across site, depending on site structure and patient need
Workforce Model	▪ Triage nurses were the main workforce; approximately 16 licensed practical nurses (LPNs) and 60 registered nurses (RNs) across all sites ▪ Supervisor for triage nurses varied by site (nurse manager, director of operations, director of support services, and others)	▪ Lay navigators with no clinical background were the main workforce; approximately 28 lay navigators and 12 management/ administrators across all sites ▪ RN site managers served as clinical supervisors for lay navigators
Assessment Tools	▪ Triage software that followed evidence-based pathways to assess patients' needs; the software was used by dedicated telephone nurses who had the authority to make some decisions and orders without needing to consult a physician first	▪ Distress thermometer, an assessment tool used to evaluate the patient's global level of distress and any reported barriers that may interfere with the patient's ability to receive treatment
"One-stop Shop"	▪ In-house services, including radiation therapy, imaging, laboratory, genetic counseling, case management, pharmacy, and other (varied by site)	▪ While being a one-stop shop was not directly a part of UAB's navigation program, several sites offered colocation of infusion and lab services
Access to Care and Other Resources	▪ Integrated/coordinated care with physician-directed care team ▪ Triage nurse served as main point of contact and liaison between patient and physician ▪ Enhanced access to care through same-day appointments and extended and weekend hours	▪ Physician-directed care team, with navigators considered part of the team ▪ Navigators served as the link to interdisciplinary team and as a resource to understand patient's social situation and potential barriers to treatment adherence ▪ Navigators served as liaisons with other community resources that could support participants through the cancer care continuum ▪ Some navigators attended appointments with participants and assisted them in asking questions and making sure they understood information from providers
Clinical Pathways	▪ Treatment pathways developed by physicians in accordance with National Comprehensive Cancer Network (NCCN) guidelines and periodically updated based on new literature	▪ Treatment pathways developed by physicians in accordance with NCCN guidelines and periodically updated based on new literature
Supporting Software	▪ COME HOME software to serve as triage dashboard	▪ Medical concierge software to document navigation activities

	IOBS	UAB
Anticipated Impacts	▪ Decrease in ED visits ▪ Decrease in hospital admissions for participants receiving chemotherapy ▪ Estimated cost saving of $1 million per physician[234]	▪ Decrease in ED visits ▪ Decrease in avoidable hospitalizations ▪ Decrease in end-of-life utilization ▪ Estimated cost saving of $10 million per year[235] ▪ Better patient-reported outcomes

Research Question

In our analysis, we investigated how IOBS and UAB compared with respect to evidence of reduced utilization and cost. For each outcome measure, we posed the following research questions:

- Between the two cancer awardee programs, which program was more successful at reducing utilization and cost, relative to a comparison group?
- Qualitatively, what program components drove reduced utilization?

Reductions in Utilization and Quality-of-Life Improvements

To answer this question, we analyzed outcomes for the entire population served by each cancer awardee program, as well as three subgroups for each awardee. Exhibit 23.3 describes these populations and the rationale for performing the analysis of each group.

Exhibit 23.3: Populations and Rationale for Analyses for IOBS and UAB

Population	Description	Rationale for Inclusion in Analysis
All targeted participants[236]	All program participants for whom Medicare fee-for-service claims data are available	Full program population results provide a baseline for comparison of subpopulations.
Participants with cancers seen in both IOBS and UAB programs	Population restricted to cancers that are common to both the IOBS and UAB programs (breast cancer, lung cancer, colorectal cancer, or lymphoma)	Restricting to these cancers will reduce bias introduced by including participants with cancers not targeted by both UAB and IOBS.
Participants with cancer common to both programs undergoing chemotherapy	Population restricted to participants with breast cancer, lung cancer, colorectal cancer, or lymphoma that have claims indicators for chemotherapy	We hypothesize that both programs may be more effective for patients undergoing chemotherapy or requiring active symptom management.
Non-White participants with cancer common to both programs	Population restricted to participants with breast cancer, lung cancer, colorectal cancer, or lymphoma who identified as non-White	Non-White participants may face greater psychosocial barriers to care that attenuate program impacts. We wanted to explore whether these programs had a greater impact on this population.

[234]Patel K, Thoumi A, Nadel J, O'Shea J, McClellan M. Transforming oncology care: payment and delivery reform for person-centered care. *Am J Manag Care*. 2015;21(5):388-393.

[235]University of Alabama Birmingham. Health Care Innovation Challenge Application. Center for Medicare & Medicaid Innovation. 2012.

[236]Patients with active cancers in IOBS included those with breast, lung, colorectal, lymphoma, melanoma, and pancreatic cancer. Patients with active cancers in UAB included those with breast, lung, colorectal, lymphoma, male genitourinary cancers, and female genitourinary cancers.

Methods

This evaluation analyzed claims data to assess the effectiveness of the IOBS and UAB programs in reducing cost and utilization and in increasing quality of care. For our quantitative analysis, we compared difference-in-differences (DID) estimates from IOBS and UAB, focusing on the following measures:

- hospitalizations per 1,000 patients
- ED visits per 1,000 patients
- 30-day readmissions per 1,000 patients
- total cost of care per patient

For each subgroup within a program, we present a DID estimate and compare the two awardee programs. For model specifications and more detailed information on DID models, please refer to the Technical Appendix.

Exhibit 23.4 presents descriptive characteristics for the IOBS and UAB program participants. Both programs enrolled a majority of female participants and had a plurality of participants between 65 and 69 years of age. However, there were significant differences between the two populations. Twice as many UAB participants were Black and were more likely to be under 65 years of age, to have had less severe comorbidities as measured by the hierarchical condition categories (HCC) score, and to have had higher total Medicare costs in the year prior to enrollment compared with IOBS participants. IOBS had a higher percentage of participants with breast cancer and lymphoma than UAB had.

Exhibit 23.4: Descriptive Characteristics of Program Participants with Common Cancers, IOBS and UAB

Variable	IOBS	UAB
	% (N)	% (N)
Number of Persons	3,323	3,206
Mean Number of Quarters Enrolled [Range]	6.0 [1-13]	4.4 [1 -11]
Cancer Type		
Breast Cancer***	46.8% (1,554)	36.8% (1,179)
Colorectal Cancer***	14.7% (487)	18.7% (598)
Lung Cancer***	28.3% (940)	35.2% (1,129)
Lymphoma	10.3% (342)	9.4% (300)
Gender		
Female***	72.3% (2,404)	66.1% (2,120)
Age		
<65 years old***	9.6% (318)	0.2% (8)
65-69 years old***	25.7% (853)	31.1% (997)
70-74 years old	24.4% (812)	25.9% (831)
75-79 years old***	18.7% (622)	22.6% (725)
80-84 years old**	12.0% (399)	13.8% (442)
≥85 years old***	9.6% (319)	6.3% (442)
Race		
Black***	6.4% (212)	13.5% (434)
Comorbidities		
Mean HCC Score (Standard Deviation)***	2.5 (2.3)	3.1 (2.3)
Utilization and Cost of Care in Year Prior to Enrollment		
Total Medicare Cost (SD)***	$17,105 ($22,123)	$23,837 ($27,701)
Hospitalizations per 1,000 Patients (SD)***	512 (895)	664 (1,097)
ED Visits per 1,000 Patients (SD)**	852 (1,856)	957 (1,940)

NOTE: ***p<0.01, **p<0.05, *p<0.1

Exhibit 23.5 summarizes the results from our analyses comparing UAB and IOBS with respect to core outcomes in four populations: 1) all participants served by the awardee programs; 2) participants with breast, lung, lymphoma, or colorectal cancer; 3) participants with breast, lung, lymphoma, or colorectal cancer undergoing chemotherapy; and 4) non-White participants with breast, lung, lymphoma, or colorectal cancer:

- Comparing **all participants** in each program, the IOBS program demonstrated significant decreases in ED visits and total cost of care. UAB's program demonstrated a significant decrease in hospitalizations and ED visits; this decrease in ED visits is larger than that seen among IOBS patients.

- Among **participants with lymphoma, breast, lung, or colorectal cancer**, IOBS had significant reductions in ED visits and total cost of care. There were significant decreases in hospitalizations and ED visits for UAB patients but not a decrease in total cost of care.
- For **participants undergoing chemotherapy**, UAB demonstrated greater decreases in ED visits than IOBS and had significant decreases in hospitalizations. Neither program significantly affected the total cost of care.
- For **non-White participants**, IOBS significantly reduced readmissions, and UAB significantly reduced hospitalizations, although neither program significantly reduced costs or ED visits.

Exhibit 23.5: DID Estimates for Utilization and Quality Outcomes, IOBS and UAB

Awardee	N	Hospitalizations	30-Day Readmissions[237]	ED Visits	Total Cost of Care
All Participants Served by Awardee Program					
IOBS	3,664	2 [-5, 9]	**-16 [-41, 9]**	**-13 [-21, -5]*** **	**-$612 [-$979, -$245]*** **
UAB	4,038	**-11 [-18, -4]** **	17 [-7, 41]	**-22 [-30, -14]*** **	-$37 [-$418, $344]
Participants with Breast, Lung, or Colorectal Cancer, or Lymphoma					
IOBS	3,323	1 [-6, 8]	**-23 [-49, 3]**	**-15 [-23, -7]*** **	**-$675 [-$1,046, -$304]*** **
UAB	3,206	**-11 [-20, -2]** **	17 [-11, 45]	**-22 [-32, -12]*** **	$6 [-$443, $455]
Participants with Breast, Lung, or Colorectal Cancer, or Lymphoma Undergoing Chemotherapy					
IOBS	1,957	1 [-9, 11]	-21 [-56, 14]	**-18 [-29, -7]*** **	-$146 [-$746, $454]
UAB	2,139	**-13 [-24, -2]** **	17 [-18, 52]	**-28 [-41, -15]*** **	-$19 [-$659, $621]
Non-White Participants with Breast, Lung, or Colorectal Cancer, or Lymphoma					
IOBS	357	**-11 [-35, 13]**	**-103 [-194, -12]***	**-4 [-30, 22]**	$1,066 [-$583, $2,715]
UAB	483	**-23 [-44, -2]***	31 [-45, 107]	**-21 [-48, 6]**	$66 [-$1,256, $1,388]

NOTES: ***p<0.01, **p<0.05, *p<0.1 for statistical significance relative to a comparison group of similar patients. For more details on comparison selection, please see Technical Appendix A.

We hypothesized that some reductions in utilization resulted from participants' calling their physician practice or navigator rather than going to the ED if they had concerns. IOBS encouraged patients to call the triage line as their first move and encouraged patients to take advantage of same-day appointments and extended and weekend hours. In interviews, IOBS patients expressed appreciation for this enhanced access and felt that it helped them to avoid unnecessary ED visits.

> *"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 aftercare and on the weekends."*
>
> *"I've had enough experience with cancer and breast cancer and whatever else—that you get your medicine, and you go home, and if you feel sickly, you can call the emergency room. Well, I see this is a program that you don't have to do that, and I love it. If I had issues—if I'm not feeling well or if I thought I was running out of my medicine—and I've had this happen to me. I thought this is what people do when they're sick, they go to the ER. But that's not true in this case: I call the center."*
>
> —IOBS Program Participants

[237]The analytic sample for the 30-day readmissions measure is restricted to participants with an index hospitalization.

UAB encouraged participants to contact their navigators whenever they had questions. Although navigators were strictly nonclinical, they had the knowledge and ability to connect patients with their providers to help get their questions answered and their concerns allayed. UAB program participants also said that having the navigator helped them avoid making unnecessary ED visits.

> *"I know I'd call my navigator because there were times after my chemo I'd start running a fever and she would say if it gets to this point then don't hesitate to call me. And I did call her and she asked me what have you done, have you thought about doing this, and she would give me a couple more things to do to get me through it, and I ended up never having to go to the emergency room when a lot of other people did."*
>
> —UAB Program Participant

The observation that reductions in utilization were greater for UAB participants than for IOBS patients may be due to the geographic characteristics of the different sites. IOBS program leaders explained that sites in more rural areas, where patients must drive long distances to get to the cancer center, may have more difficulty in reducing utilization: It is easier and faster for patients to go to a nearby emergency room or hospital in the evening or on weekends than to the primary clinic site with extended hours.

Limitations

Differences in the target populations of the two awardees limit their comparability. Although the UAB program included patients with active cancers, advanced cancers, or cancers in remission, the IOBS program included only patients with active cancers. We also excluded participants with multiple cancers from our analyses, due to the difficulty of identifying comparison patients with a specific combination of cancers from claims information. This limits our ability to draw conclusions about the entire program population.

We are also limited in our ability to identify patients who are on chemotherapy, as we had access only to Medicare Part B claims for these analyses. Part B claims do not include information about prescription drugs (which is found on Part D claims), and therefore we were unable to identify patients who were receiving oral chemotherapy via prescription. It is estimated that approximately 20 percent of patients receive oral chemotherapy, either alone or in conjunction with intravenous chemotherapy.[238, 239]

Summary

In our quantitative analysis for the two cancer awardees, we observed substantial variation across subpopulations. Both programs were effective at reducing ED visits in most populations. Although both models produced significant results, UAB's patient navigation program typically achieved a greater reduction in both ED visits and hospitalizations, and the IOBS program reduced total cost of care.

[238]Weingart SN, Bach PB, Johnson SA, et al. NCCN Task Report: Oral Chemotherapy. National Comprehensive Cancer Network; 2008. *J Natl Comp Canc Netw*. 2008;6:S1-S14.
[239]Zerillo JA, Stuver SO, Fraile B, et al. Understanding oral chemotherapy prescribing patterns at the end of life at a Comprehensive Cancer Center: analysis of a Massachusetts payer claims database. *J Oncol Pract.* 2015;11(5):372-377.

Qualitative findings showed how components of the IOBS and UAB programs might have driven reductions in utilization. For example, IOBS and UAB encouraged patients to call their physician practice or navigator first rather than going directly to the ED if they had concerns. Participant demographics and prevalence of cancer type also might have driven reductions in utilization and cost outcomes.

Considered together, these two cancer awardee programs have important implications for program developers. Our findings suggest that among multisite programs targeting multiple types of cancer, programs can expect to see differences in impact across sites and by target condition. In addition, increased access to care can help reduce utilization, whether offered by clinical staff or by lay navigators.

Decreased Utilization and Improved Caregiver Quality of Life for Patients with Dementia

Dementia affects nearly 15 percent of individuals over the age of 70 years, costing the US medical system an estimated $109 billion per year.[240] Medicare, which covers much of these costs, spends three times more per beneficiary for individuals with dementia compared with those without dementia. In addition, people living with dementia and a comorbid chronic disease experience significantly higher health care costs than those with dementia alone. Dementia also places a high burden on caregivers. In 2015, caregivers provided an estimated 18.1 billion hours of unpaid care, valued at $221.3 billion, to individuals with dementia.[241]

This analysis focuses on two awardees that aim to use a collaborative care model to improve cost and quality outcomes for persons with dementia: Indiana University's Aging Brain Care program (Indiana) and the University of California, Los Angeles's Alzheimer's and Dementia Care Program (UCLA). We use a mixed-methods approach to identify workforce models and program features associated with successful outcomes and to generate hypotheses about likely mechanisms of action that support reduced utilization and cost and improved quality of care. We also consider these two programs' potential benefits to caregivers.

Primary care physicians often lack the time, relevant training, and skills to manage the complex range of medical, behavioral, and psychosocial needs of patients with dementia.[242] Although many existing community resources support these patients' social and medical needs, these services are often uncoordinated or inadequately integrated into the health care system. In response to these shortcomings, many health care systems have developed dementia care models that employ different types of staff (e.g., lay health workers, nurses, social workers) to coordinate patient care, engage family members, counsel caregivers, and leverage local social services and community resources.[243, 244]

Dementia care models may include a variety of components intended to improve patient and caregiver quality of life. Evidence suggests that multicomponent models can effectively promote well-being, delay nursing home placement, and reduce caregiver burden among individuals living in the community with

[240]Hurd MD, Martorell P, Delavande A, Mullen KJ, Langa KM. Monetary costs of dementia in the United States. *N Eng J Med*. 2013;368:1326-1334.
[241]Alzheimer's Association. 2016 Alzheimer's disease facts and figures. Available at: http://www.alz.org/facts/.
[242]Bradford A, Kunik ME, Schulz P, Williams SP, Singh H. Missed and delayed diagnosis of dementia in primary care: prevalence and contributing factors. *Alzheimer Dis Assoc Disord*. 2009;23(4):306-314.
[243]Reilly S, Miranda-Castillo C, Malouf R, et al. Case management approaches to home support for people with dementia. *Cochrane Database Syst Rev*. 2015;1:CD008345.
[244]Low LF, Yap M, Brodaty H. A systematic review of different models of home and community care services for older persons. *BMC Health Serv Res*. 2011;11:93.

dementia.[245, 246, 247] However, there is limited literature on how the effectiveness of these models may vary based on patient characteristics and stage of dementia.

To understand the relative effectiveness of multicomponent models, we examined two awardees that implemented models to improve dementia care. In this report, we compare the specific components of two awardees and examine how each program affects core outcomes and caregiver experience.

Research Questions

In this report, we present data to answer three research questions of interest for the dementia awardees:

1. How do program components, especially **workforce models and implementation,** differ between the two programs?
2. How do the two programs compare with respect to **core outcomes**? Could differences reflect differences in workforce or implementation?
3. How do **caregivers** benefit from the programs?

Data Sources

Primary data sources for this report include interviews conducted with care coordination staff and supervisors during two rounds of site visits; focus groups conducted with program participants, caregivers, and partnering primary care providers; and awardee quarterly reports. Secondary data sources include awardee-provided data and Medicare claims data.

Program Components, Workforce Models, and Implementation

Exhibit 24.1 provides a brief overview of each program, summarizing the overall program and the key elements of the approach, including workforce model, setting, intensity, and patient population.

[245]Acton G, Kang J. Interventions to reduce the burden of caregiving for an adult with dementia: a meta-analysis. *Res Nurs Health*. 2001;24(5):349-360.
[246]Brodaty H, Arasaratnam C. Meta-analysis of nonpharmacological interventions for neuropsychiatric symptoms of dementia. *Am J Psychiatry*. 2012;169:946-953.
[247]Spijker A, Vernooij-Dassen M, Vasse E, et al. Effectiveness of nonpharmacological interventions in delaying the institutionalization of patients with dementia: a meta-analysis. *J Am Geriatr Soc.* 2008;56(6):1116-1128.

Exhibit 24.1: Overview of Dementia Care Programs

	Indiana	UCLA
Program Overview	Aging Brain Care (ABC) program provides individualized care management for patients with dementia through a team of lay health workers, nurses, social workers, and a supervising physician. Care teams assess and monitor patient needs and deliver education on self-management through home visits.	Alzheimer's and Dementia Care (ADC) program nurse practitioners comanage dementia with patients' primary care providers. Patients are assessed and receive individual care plans and referrals to outside community-based services (as needed).
Workforce Model	Lay care coordinator assistants (CCAs), supervised by registered nurse	Nurse practitioner dementia care manager
Setting	Home visits	Medical office
Intensity	Home visits every three months, with monthly phone calls	Annual visits, with quarterly phone check-in
Participant Population	Patients receiving care from affiliated hospitals and health clinics[248]	Patients with primary care providers within UCLA medical system

We identify three primary areas of difference between the two programs:

Each program serves patients in distinctive care settings, which contributes to differences in each program's care focus. In the Indiana program, lay workers conduct home visits quarterly, with monthly telephone contact between visits. Because the program focuses on the home environment, Indiana staff members are able to identify and address barriers to receiving care and adhering to care plan recommendations. Lay health worker staff (called care coordinator assistants [CCAs]) at Indiana are trained to identify needs for assistive devices in the home (e.g., shower bar), hazards around the house (e.g., throw rugs are a fall risk), and other concerns (e.g., improper medication use). Staff use both informal conversations and structured assessments for some health needs. In contrast, the UCLA program employs nurse practitioners (NPs) as dementia care managers (DCMs) to conduct annual visits in a medical office, using structured cognitive and functional assessments. This program focuses on directly addressing patients' medical and health needs (e.g., medication changes) and the caregiver's support needs (e.g., respite services, education, counseling, support groups), with a lesser focus on barriers to receiving care.

Awardees employ different types of staff to help address gaps in providing effective care for older adults with dementia. The shortage of primary care physicians and physicians with specific training in geriatric care, along with limited clinical time available per patient, has led to a professional consensus that physicians alone cannot meet the needs of patients with dementia.[249] DCMs at UCLA and CCAs at Indiana receive specific training in dementia care and provide services to patients and their families that complement the other care that patients are receiving:

[248]Indiana also delivers care to patients with depression. Our analysis in this chapter focuses on dementia; for this reason, we have left references to depression out of our descriptions.

[249]Warshaw GA, Bragg EJ. Preparing the health care workforce to care for adults with Alzheimer's disease and related dementias. *Health Aff*. 2014;33(4):633-641.

- Primary care providers working with the UCLA team rely on DCMs for recommendations about prescribing dementia medications and potential drug interactions.
- At Indiana, primary care providers recognize that the services and resources provided by CCAs help to remove barriers to receiving health care and adhering to medical recommendations for their patients.

Consistent with the difference in staff credentials between programs, Indiana and UCLA take different approaches to care coordination. At UCLA, DCMs comanage with the patient's primary care provider dementia care for enrolled patients. The DCMs can provide medical recommendations about a patient's dementia care plan and directly coordinate with primary care providers as needed. At Indiana, program staff work in teams. The CCA is the primary contact for patients and their families, while nursing and medical staff members supervise the CCAs' work and mediate interactions with primary care providers.

In addition to differences in overall approach, each awardee has uniquely tailored a common set of program components, as outlined in Exhibit 24.2. These components include patient cognitive and physical assessments, needs assessment, medication management, caregiver support and education, coordination with other providers, and social needs.

Exhibit 24.2: Dementia Care Program Components

Function or Activity	Indiana	UCLA
Patient cognitive and physical assessments	Mini-mental State Exam (MMSE) and PHQ-9 (depression scale)	MMSE, functional status assessments, Cornell scale for depression in dementia, neuropsychiatric inventory (NPI-Q), Montreal Cognitive Assessment (MOCA)
Caregiver burden assessments	Four questions as part of a broader assessment (HABC Monitor[250])	Modified Caregiver Strain Index, PHQ-9 (depression scale), caregiver rating of dementia care and self-efficacy
Needs assessment	Yes, used to develop care plan	Yes, used to develop care plan
Medication management	Reviews and documents all medications, provides advice regarding best practices for taking medication (e.g., daily pill packs)	Reviews dementia-related medications and works with PCP to adjust if necessary
Caregiver support and education	Advance care planning, resource connections for caregivers (e.g., in-home services, support groups, adult daycare), and ad hoc caregiver skills building conducted by lay care coordinators (e.g., education about behaviors to expect from the patient, how to interact productively with the patient)	Support groups, formal care-giving course referrals, online educational videos, and informal support and education from care coordinator
Case management	Lay health workers assist patients and families in navigating the health care system, including relaying questions to providers and scheduling appointments	Not a significant component of program
Coordination with other providers	Care plan shared with physician through EHR; coordinate through RN to discuss any concerns that arise	Care plans are uploaded to EHR, and physicians must sign off on medical recommendations
Addressing social needs	Staff are trained in problem-solving therapy, referrals to local resources for behavioral health, insurance counseling, and other support services	Referrals to partnering community-based organizations providing counseling, adult daycare, and other support services

Program Effectiveness and Core Outcomes

This section considers the claims-based findings for core measures, differences in the two awardees' program populations, and analysis of their ability to prevent or delay placement in a long-term-care (LTC) facility. We compare DID estimates using data from Indiana, UCLA, and comparison participants, estimating five measures of utilization and cost:

- hospitalizations per 1,000 patients
- ambulatory care sensitive (ACS) hospitalizations per 1,000 patients
- emergency department (ED) visits per 1,000 patients
- 30-day readmissions per 1,000 patients
- total cost of care per quarter

[250]The HABC Monitor is a tool for screening, diagnosis, and management of dementia. It helps clinicians determine the nature and severity of a patient's cognitive, functional, behavioral, and psychological problems, as well as the level of caregiver stress. There are two versions of the tool: one for caregivers to report on each measure and one for patients to self-report.

Patients with dementia have a high risk of moving from the community into LTC.[251] To investigate placement in an LTC facility, we used survival analysis methods (Cox proportional hazards models). For model specification and more detailed information on core measure and LTC outcomes analysis using DID and Cox models, please refer to Technical Appendix A.

Both programs target their enrollment to older adults who have a diagnosis of dementia and are living in the community. In addition to patients with dementia, the Indiana program also serves older adults with depression. To compare the two programs and assess their impacts on outcomes for persons living with dementia, we have excluded from our analysis Indiana participants without dementia.

Exhibit 24.3 summarizes the characteristics of patients with dementia enrolled in both interventions. Despite using similar inclusion criteria to select patients with dementia, participants in the two programs differed with respect to demographic factors:

- UCLA program participants were significantly older than Indiana participants (42 percent and 29 percent ≥85 years old, respectively; $p<0.001$). Changing outcomes for this oldest category of participants poses specific challenges, since they have higher rates of functional limitations and often require in-home supports.[252] In addition to being younger, Indiana participants were also more likely to be dual-eligible and disabled and to have visited an ED in the last year.
- Indiana had a higher percentage of black participants than UCLA (28.8 versus 9.4 percent).
- Rates of Alzheimer's type dementia are higher for UCLA participants than Indiana program participants. Mini-mental Status Examination (MMSE) data, provided by the awardees for a subset of participants, also suggest less severe dementia among the Indiana participants.[253] Nearly 60 percent of UCLA participants had MMSE scores <20, which is indicative of moderate or severe dementia, whereas only 28 percent of Indiana participants had scores in the same range (59.4 percent and 27.5 percent, respectively; $p<0.01$).

[251]Waidmann T, Thomas S. U.S. Department of Health and Human Services. Estimates of the risk of long-term care: assisted living and nursing home facilities. 2003. Available at: https://aspe.hhs.gov/sites/default/files/pdf/72741/riskest.pdf.
[252]Congressional Budget Office. Rising demand for long-term services and supports for elderly people. Available at: https://www.cbo.gov/sites/default/files/113th-congress-2013-2014/reports/44363-LTC.pdf.
[253]Tombaugh TN, McIntyre NJ. The Mini-Mental State Examination: a comprehensive review. *J Amer Geriat Soc*. 1992;40(9):922-935.

Exhibit 24.3: Descriptive Characteristics of Dementia Program Participants

Variable	Indiana	UCLA
	% (N)	% (N)
Number of Persons	473	1,082
Mean Enrollment Quarters***	10.8 [4-14]	7.5 [1-15]
Condition		
Alzheimer's***	53.5% (253)	68.8% (744)
Depression	35.9% (170)	37.4% (405)
Duration of Disease		
Duration of Dementia (Years)	2.6 (3.1)	2.9 (3.2)
Gender* **		
Female	65.5% (310)	64.8% (701)
Age* **		
<65 years old	0.8% (4)	1.9% (21)
65-69 years old	11.6% (55)	5.0% (54)
70-74 years old	14.6% (69)	8.8% (95)
75-79 years old	20.7% (98)	19.7% (213)
80-84 years old	23.0% (109)	22.5% (243)
≥85 years old	29.2% (138)	42.1% (456)
Race/Ethnicity		
White	71.2% (337)	71.7% (776)
Black	28.8% (136)	9.4% (102)
Other	0.0% (0)	1.6% (17)
Asian	0.0% (0)	7.9% (85)
Hispanic	0.0% (0)	9.0% (97)
Dual Eligibility* **		
Duals	32.3% (153)	15.3% (166)
Coverage Reason* **		
Old Age	83.9% (397)	94.1% (1,018)
Disability	15.9% (75)	5.7% (62)
End-stage Renal Disease (ESRD)	0.0% (0)	0.2% (2)
Hierarchical Condition Categories (HCC)		
Mean HCC Score (SD)	1.8 (1.2)	1.8 (1.2)
Mean Count of HCCs (SD)	3.0 (2.4)	3.1 (2.4)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Hospitalizations per 1,000 Patients (SD)	464 (878)	492 (997)
ED Visits per 1,000 Patients (SD)***	1,375 (216)	1,082 (196)
Total Medicare Cost (SD)***	$12,107 ($22,640)	$17,183 ($27,499)

NOTE: ***p<0.01, **p<0.05, *p<0.1

In Exhibit 24.4, we compare estimates of outcomes across the Indiana and UCLA programs for measures of utilization and cost.[254]

Exhibit 24.4: Utilization, Cost, and Quality Outcomes for Patients with Dementia

Outcome	Indiana	UCLA
	DID Estimator [90% CI]	
Hospitalizations	3 [-12, 18]	-8 [-19, 3]
30-day Readmissions	-15 [-62, 32]	**-41 [-76, -6]****
ACS Admissions	3 [-4, 10]	**-7 [-12, -2]*****
ED Visits	4 [-17, 25]	5 [-10, 20]
Total Cost of Care	$8 [-$550, $566]	**-$605 [-$1090, -$120]****
Nursing Home Placement (HR)±	1.03 [0.81, 1.31]	**0.75 [0.60, 0.93]*****

NOTES: ***p<0.01, **p<0.05, *p<0.1 for statistical significance relative to a comparison group of similar patients. For more details on comparison group selection, please see Technical Appendix A.

± HR <1 indicates that program participants are entering nursing homes at a slower rate than comparison patients; the converse is true for HR >1. ACS, ambulatory care sensitive; CI, confidence interval; DID, difference in differences; ED, emergency department; HR, hazard ratio

Based on our comparison of DID findings (Exhibit 24.4) with qualitative findings regarding overall awardee approach (Exhibit 24.1) and program components (Exhibit 24.2), we make the following observations:

- **Impact on hospitalizations was significant for UCLA and not significant for the Indiana program.** For UCLA, there are reductions in hospitalizations, but this only reaches statistical significance for ACS hospitalizations and readmissions. The 24-hour hotline as part of the UCLA program reaches on-call program staff for consultation when one of their patients visits the ED. UCLA staff report that these consultations can help to avoid hospital admission for persons presenting to the ED by offering the ED providers more context on the patient's medical history and reassurance that there is a care plan in place if the patient is released to go home.
- **We see divergent trends between UCLA and Indiana with respect to LTC placement.** This likely results from the two programs' different focuses:
  - As an explicit goal, UCLA helped patients and their families find ways to age in place and avoid LTC placement if possible. We see this reflected in the lower rates (25 percent less than comparison group) of LTC placement for UCLA participants. Conversely, interviews with caregivers and staff from the Indiana program found that the program helped overwhelmed caregivers place participants in LTC as a service, as well as make referrals for in-home services.

[254] Since our last report, we have made several changes that result in differences in the overall estimates for this exhibit. We have updated the analytic samples to include the entire participant population and all follow-up time for both awardees. Most notably, this added 300 new participants to the UCLA population. As a proxy for dementia severity, we have added to our propensity models the number of years a patient has had dementia. These analytic changes resulted in a change to the magnitude of the effect size for both awardees.

- This difference in focus may relate to the availability of home- and community-based services in each state. California ranks second in a national scorecard that factors in supply and availability of alternatives to nursing homes, whereas Indiana ranks 42nd.[255]

Caregiver Experience

We evaluated the experience of caregivers using data from focus groups and interviews with caregivers from both Indiana and UCLA. Caregivers are an important focus for dementia care models because the caregiver–care recipient relationship is a crucial aspect of dementia care.[256] Reducing caregivers' stress and enhancing their skills can improve their ability to provide care and increase the quality of life for both the caregiver and the dementia patient.[257] We find consistent trends for both awardees, including:

Caregivers in both programs report increased confidence in their care-giving abilities. They primarily attribute this increased confidence to the education they received directly from program staff and resources (e.g., educational seminars, support groups, or counseling). This education provides information to caregivers regarding the types of behaviors to expect from dementia patients, advice on productive ways to interact with and care for patients in light of their current condition, and information on what to expect in the future as a patient's dementia progresses. Caregivers report that the educational efforts improved their relationship with their care recipient. Much of the education and resources at UCLA is provided through contracted services offered by community partners. At Indiana, interactions with CCAs represent a larger proportion of caregivers' education and access to additional resources that are provided by the program.

Caregivers in both programs report that the program reduced their stress levels. Several factors are cited as contributing to reductions in stress:

- knowing that, when needed, they could contact the program for assistance to discuss how to solve problems and receive guidance;
- emotional support that encouraged caregivers to take care of themselves and find strategies to reduce their stress;
- referrals to support groups, counseling, and respite services (e.g., adult daycare). In particular, UCLA caregivers received vouchers to pay for these services and noted that this support helped them to feel less alone and to manage their stress. Caregivers greatly appreciated and enjoyed the break they experienced when patients went to adult daycare or received other care-giving services.

Caregivers in both programs report that access to advice from program staff reduced utilization of health care services. Caregivers report that the program staff members were very accessible when they contacted them. A few caregivers reported that talking to the program staff helped them obtain medical advice or services to address concerns about their dementia patient without having to visit the doctor. In

[255]AARP. Raising expectations, 2014: a state scorecard on long-term services and supports for older adults, people with physical disabilities, and family caregivers. Available at: http://www.longtermscorecard.org/.
[256]Brodaty H, Donkin M. Family caregivers of people with dementia. *Dialogues Clin Neurosc*. 2009;11(2):217-228.
[257]Ibid.

particular, caregivers from Indiana found that the supplies and advice received following home visits helped to reduce the risk for falls.[258]

Implications for Future Programs

When considered together, these two dementia awardee programs have important implications for program developers. Our findings suggest that:

- Whether clinic-based or in the home, having dedicated staff with dementia care expertise yields positive outcomes both qualitatively and quantitatively.
  - Caregivers find access to advice and education to be helpful in reducing their stress.
  - In the case of UCLA, more timely access to medical advice through direct consultations or referrals to primary care providers results in reduced hospitalizations.
- Home visits are important for patients who have limited access to care and in communities with fewer home- and community-based services (HCBS) for the elderly.
  - Home visits might have facilitated a preference for LTC in nursing homes for families living in rural areas and other areas with few HCBS.
  - For patients who remained in the home, home visits help mitigate environmental hazards for dementia patients.

Summary

Our findings show that both the Indiana and UCLA programs have led to improvements in caregiver quality of life, and the UCLA program led to reductions in hospitalization and total cost of care. Both programs use a multicomponent model for dementia care management. Although both programs target patients with dementia, the characteristics of the patients they serve differ. At UCLA, program participants are primarily ≥85 years—i.e., the oldest old—whereas Indiana patients tend to be younger and are more likely to be of minority race and to show evidence of higher rates of disability and more frequent ED visits. These demographic differences suggest different health care needs.

We see key differences in the workforce and program components at UCLA and Indiana that are suited to meet the specific needs of their patient populations. Serving older patients with potentially more advanced dementia, UCLA mainly uses licensed clinical staff and focuses on providing best practices in dementia care. This often includes working with the treating physician to employ cognition-enhancing medications to minimize symptoms. In addition, UCLA focuses on caregiver needs and utilizes referrals to adult daycare services. In some ways, their services may make up for the treating clinicians' potential lack of specific training in dementia.

Indiana's patients may need different kinds of support to meet their goals. The program's mainly lay staff members go into patients' homes and work to reestablish connections to the health care system and to address social needs that may prevent patients from achieving their optimal health. The lay staff are

[258]Tools include environmental redesign (e.g., removing loose rugs) and refrigerator reminders (e.g., how to avoid agitation in a person with dementia or positive self-talk for persons with dementia).

supported by clinical care coordination staff if clinical needs arise. Our findings show that the effectiveness of dementia care programs may depend on the extent to which they tailor their workforce model and services to the particular population that they serve.

Improved Diabetes Outcomes in Large Health Systems

The Centers for Disease Control and Prevention (CDC) has estimated that 29 million people, 9.3 percent of the US population, had diabetes, and one in three American adults over age 20 (86 million individuals) are at a high risk of developing the disease.[259] Of these adults with prediabetes, 15 to 30 percent will go on to develop type 2 diabetes within five years.[260] Diabetes can lead to many complications, including heart disease, stroke, blindness, kidney failure, and lower-limb amputation. In 2012, diabetes and its complications were associated with $176 billion in direct medication costs and $69 billion in indirect costs, such as disability, work loss, and premature death.[261,262]

In 2011, the Center for Medicare & Medicaid Innovation (CMMI) funded multiple interventions aimed at improving diabetes outcomes. These included awards to FirstVitals Health and Wellness, Inc. (FirstVitals), Joslin Diabetes Center's On the Road (OTR) program (Joslin), and the Southeastern Diabetes Initiative (SEDI). FirstVitals implemented a health center–based diabetes telemonitoring program that was staffed by lay and clinical personnel. Joslin's OTR program provided community-based diabetes education and screening for individuals who have diabetes or were at risk of developing diabetes. SEDI implemented three interventions that focused on populations that were at low, medium, or high risk for diabetes-related hospitalization and/or death. Despite their differences, all three awardees implemented their programs at multiple sites, suggesting that all programs can be implemented in a variety of settings. FirstVitals was the only program to offer patient-facing technology components. SEDI employed an electronic health record (EHR)–based risk stratification tool and geospatial mapping to identify communities in which the risk for diabetes and prediabetes was high. All three awardees partnered with various other entities, ranging from health centers to a health plan and a board of health. Exhibit 25.1 describes the interventions and staffing models in more detail.

Exhibit 25.1: Description of Diabetes Programs

Awardee (Reach)	Sites (n)	Program Description	Staffing Model
FirstVitals (N = 398)	19	Provided patients a technologically enhanced diabetes management program through 19 participating health centers	CCs with nursing credentials, lay ICCs
Joslin (N = 5,100)	3	Provided two to four diabetes education classes delivered by CHAs that focused on diabetes management and prevention, nutrition, and exercise; the program also offered community-based screening	CHAs (nurses, health educators, nutritionists, recent college graduates) New Mexico site also used culturally competent lay *promotoras* [263]
SEDI (N = 546 for high-risk arm; estimated	4	**High Risk:** Provided a home-visiting diabetes management program	Multidisciplinary care teams made up of: CHWs, NPs, nurses, social workers, nutritionists, registered dietitians, CNAs, LPN, LCSW [*teams differed by site*]

[259]Centers for Disease Control and Prevention. National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Available at: https://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf.
[260]Ibid.
[261]Ibid.
[262]Stratton IM, Adler AI, Neil HA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *BMJ*. 2000;321(7258):405-412.
[263]A Spanish-speaking community health worker. Please see: http://www.cdc.gov/minorityhealth/promotores/.

Awardee (Reach)	Sites (n)	Program Description	Staffing Model
27,000 patients across all arms) [264]		**Medium Risk:** Provided a telephone support program	CHWs, CNAs, LPN
		Low Risk: Provided community outreach and education; geospatial mapping offered to sites to inform targeting of the intervention but was utilized by only one site	CHWs, pharmacist

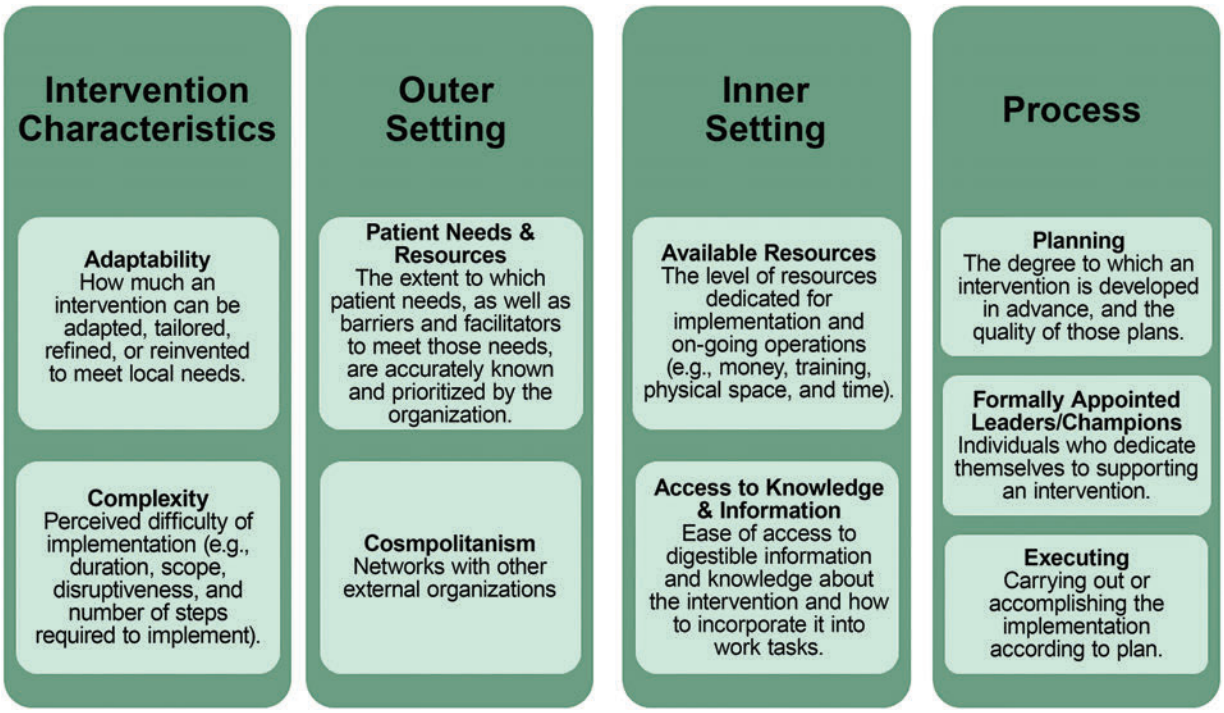
NOTES: CC, care coordinator; CHA, community health advocate; CNA, certified nursing assistant; CHW, community health worker; ICC, integrated care coordinator; LCSW, licensed clinical social worker; LPN, licensed practical nurse; NP, nurse practitioner

Consolidated Framework for Implementation Research: Assessing Barriers and Facilitators to Program Implementation

This analysis drew on domains and subdomains highlighted under the Consolidated Framework for Implementation Research (CFIR) to examine key barriers and facilitators to program implementation. The CFIR offers an overarching typology to promote implementation theory development and to verify which implementation works in which situation and why.[265, 266] Exhibit 25.2 summarizes four major CFIR domains: (1) intervention characteristics, (2) outer setting, (3) inner setting, and (4) process.[267] The CFIR's flexibility to adapt to different contexts allowed us to look across three relatively different diabetes-focused programs. Specific subdomains—determined by our analytic framework; data availability; research questions across the wider evaluation; and thematic coding analysis of staff, leadership, and partner interviews—emerged as particularly relevant to program implementation.[268, 269] Exhibit 25.2 summarizes the CFIR domains and subdomains that were most relevant to our research questions and the themes that emerged from coded interview data. Please see Appendix A for a summary of all CFIR domains and subdomains.

[264]In this chapter, we include quantitative analysis of SEDI's high-risk intervention participants only.
[265]Chin MH, Goddu AP, Ferguson MJ, Peek ME. Expanding and sustaining integrated health care-community efforts to reduce diabetes disparities. *Health Promot Pract*. 2014;15:29S-39S.
[266]Damschroder LJ, Aron DC, Keith RE, et al. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci*. 2009;4:50.
[267]CFIR has a fifth domain, "characteristics of individual," that is not included in this analysis due to lack of sufficient qualitative data.
[268]Berry SH, Concannon TW, Gonzalez-Morganti K, et al. CMS Innovation Center Health Care Innovation Awards Evaluation Plan. *RAND*. 2013:1-109.
[269]Cromwell J, Bir A, Kahwati L, et al. Health Care Innovation Awards (HCIA) meta-analysis and evaluators collaborative. *RTI International*. November 20, 2013. Available at: https://innovation.cms.gov/Files/reports/hcia-metaanalysis-evalcollab.pdf.

Exhibit 25.2: Adapted Domains of the Consolidated Framework for Implementation Research[270]



Research Questions

We focused on two research questions for the diabetes awardees:

1. Regarding the domains specified in the CFIR, what are the characteristics of (1) the intervention, (2) the inner/outer settings, and (3) the processes that facilitated or posed barriers to program implementation?
2. Is there a relationship between implementation experience and evidence of program impact?

Data Sources and Methods

Primary data sources for this report include interviews with 111 individuals—program staff members, supervisors, leaders, and partners (e.g., community-based organizations, partner payers)—during two rounds of site visits; focus groups and phone interviews with 92 program participants; and awardee quarterly reports. Qualitative data inform our understanding of the relationship between program effectiveness and successful implementation of a program. We coded qualitative data to analyze overlap with themes identified by the meta-evaluation.[271] Secondary data sources include self-reported participant experiences and outcomes data from SEDI and Joslin as well as Medicaid claims data for FirstVitals

[270]Definitions slightly adapted from Consolidated Framework for Implementation Research. Available at: http://cfirguide.org/constructs.html.
[271]Cromwell J, Bir A, Kahwati L, et al. Health Care Innovation Awards (HCIA) meta-analysis and evaluators collaborative. *RTI International*. November 20, 2013. Available at: https://innovation.cms.gov/Files/reports/hcia-metaanalysis-evalcollab.pdf.

participants.[272] Exhibit 25.3 summarizes the quantitative outcome measures used in the analysis of each awardee.

Exhibit 25.3: Data Sources and Quantitative Outcome Measures

Awardee	Interviews** (#)	Quantitative Data Sources	Quantitative Measures
FirstVitals	Staff (11) Participants (17)	Medicaid claims	All-cause hospitalizations; 30-day readmissions; ED visits; total cost of care
Joslin	Staff (19) Participants (54)	Program-collected data	Appointments with PCPs; confidence in managing/ understanding diabetes; diet, exercise, and sleep; PAM scores; blood pressure measurement; HbA1c levels
SEDI*	Staff (81) Participants (21)	Program-collected data	Global mental health; global physical health; PAM scores; Morisky medication adherence; screening for clinical depression; diabetes self-care (DCP); HbA1c levels

NOTES: *High-risk intervention only. **The term "staff" includes leadership and partners who participated in implementing the program. DCP, Diabetes Care Profile; ED, emergency department; HbA1c, hemoglobin A1c; PAM, patient activation measure; PCP, primary care provider

Key Findings on Program Implementation

An analysis of qualitative coded data from staff, leadership, partner, and participant interviews revealed three factors related to implementation success: (1) site-level flexibility to tailor program components, (2) effective use of technology, and (3) strong partnerships. Because the diabetes programs were diverse in nature, we used the CFIR to frame our cross-awardee findings under three major themes: adaptability and complexity, innovative use of technology, and partnerships.[273]

Adaptability and Complexity

This section discusses the *adaptability* of the three interventions and their related intervention *complexity*.[274] We focus on these two CFIR subdomains of the Intervention Characteristics domain because tailoring program components to address specific local needs and using different types of staff effectively and consistently emerged as important factors in the success of an implementation.

Diabetes interventions tailored community education components seamlessly because they could implement community classes with little or no coordination among providers and care settings. SEDI low-risk staff and Joslin community health advocates (CHAs) were accustomed to being flexible and considering incentives to attend class, marketing based on what appeals to participants, and addressing barriers to attendance, such as transportation challenges. Considerations such as these gave the respective staffs insight into how to optimally tailor their programs for their communities. Joslin offered diabetes education classes in either one- or two-hour blocks, and sites developed their own class materials such as cookbooks, exercise videos, and placemats that illustrated portion sizes. Similarly, SEDI's low-risk intervention offered different exercise and nutrition classes across sites to accompany community

[272]For model specification and more detailed information on the FirstVitals difference-in-differences (DID) model, please refer to Appendix A.
[273]Consolidated Framework for Implementation Research. Available at: http://cfirguide.org/constructs.html.
[274]Complexity means the perceived intricacy or difficulty of the innovation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement. Please see: http://cfirguide.org/wiki/index.php?title=Complexity.

education. Both Joslin and SEDI participants valued these tailored, hands-on activities and instructional materials, which they felt reinforced behavior changes.

The awardees implemented programs that could adapt to a range of staff credentials and roles. Across all three awardees, individual sites had discretion over the types of staff they hired (e.g., lay workers, clinicians), as well as their approach to outreach and recruitment:

- FirstVitals staffing models depended on each health center's capacity. Registered nurse (RN) integrated care coordinators (ICCs) typically implemented the program on their own and were points of contact for participants. At one site that had preexisting care coordinator staff (also RNs), however, the health center's own staff worked with participants rather than use the ICCs employed by FirstVitals. This approach reduced the number of people engaged with participants and helped assure that the intervention was well-coordinated with participants' primary care.
- SEDI leadership designated a physician and a nurse at each site to be point persons for the program. For SEDI, this appeared appropriate, since each site required specific guidance concerning tailored program components and the particular makeup of the care teams. One site that had difficulty recruiting Hispanic patients added a *promotora* to recruit and serve Spanish-speaking low-risk participants.
- Joslin sites hired an array of staff members who brought different benefits or faced distinct challenges based on their backgrounds. New college graduates at one site expressed enthusiasm about their role, but their lack of community connections made it more difficult for them to locate resources. In New Mexico, culturally and linguistically competent *promotoras* brought both enthusiasm and preexisting experience within the community to their work, and they could easily locate resources and recruit participants.

Sites might have benefitted from sharing strategies and challenges with each other throughout the implementation process. Only FirstVitals included a centralized cross-site role by hiring a central director of care coordination, who worked with the sites to determine how staff should deliver the intervention's components at each site. However, cross-site communication does not necessarily have to take the form of a single, coordinating staff member; the FirstVitals program director pointed out that it might also have been useful if staff members of the same level or role shared best practices with each other. Both Joslin and SEDI staff stated that sharing ideas and talking with other sites as implementation issues arose would have been helpful.

All three awardees delivered interventions in locations that were convenient for patients. For example, SEDI's home-visiting program and their medium-risk telephone intervention and FirstVitals' telemonitoring features were especially suitable for participants who had limited transportation options or mobility issues. Likewise, Joslin's community education classes and SEDI's low-risk intervention were held in community settings (e.g., libraries, churches, public health departments, apartment complexes) so that participants in the targeted neighborhoods could access services and encounter fewer transportation barriers. These community education teams also held classes at various locations so that different populations would have access to participate.

Innovative Use of Technology

Awardees achieved mixed success in implementing some of the interventions' technological features. FirstVitals' telemonitoring system or SEDI's EHR-dependent risk algorithm, geospatial mapping system, and data exchange with clinics yielded valuable lessons about accessing and leveraging knowledge, expertise, and information systems, as specified in the CFIR's inner setting domain.[275] We found that integrating technology into interventions also overlapped with the CFIR process domain, which includes planning, executing, and using program champions.

A partnership with a single centralized data source was more efficient and effective than partnerships with multiple entities in terms of access to data on participants. FirstVitals partnership with AlohaCare, a local health plan, offered fast and easy access to Medicaid claims data across all sites; the program used these data to recruit and track patients. On the other hand, SEDI's separate partnerships with multiple entities required an investment in staff resources to draft and execute separate data-sharing agreements. These complications delayed the rollout of the risk algorithm and geospatial mapping components, which were based on analysis of EHR data. Furthermore, limited access to EHRs because of some sites' inadequate IT capabilities complicated communication both within teams and with external providers.[276]

Investment and expertise from program leadership facilitated innovative use of technology. SEDI's principal investigator prioritized the use of the diabetes risk algorithm and geospatial mapping, and she had special expertise in innovative data use in the area of chronic disease management. However, after this individual left the program during implementation, the program's emphasis on data and technology declined. FirstVitals leadership took local social needs into account as they designed their data exchange system. Because many Medicaid patients did not have regular access to the Internet, FirstVitals placed participants on a shared data plan and established a private network for them. FirstVitals leadership's experience with Medicaid patients allowed them to see that mobility and lack of a permanent address posed challenges to disease management initiatives. Therefore, providing portable glucose meters and electronic tablets with embedded 4G mobile broadband capabilities helped to address these barriers.

Assessing consumer technological knowledge and comfort and the usability of the application should be established before program implementation. Troubleshooting issues with the tablet and wireless medical devices after the project start date required more of FirstVitals staff time than anticipated because older participants were initially reluctant to use wireless technology, and a few participants felt that there were no resources available when their devices malfunctioned. In response, staff members learned that strong relationships with participants helped overcome some technology barriers and drove effective use of program equipment. It might, however, have been valuable to conduct usability testing of the application and the devices' interface before implementation to ensure that they featured user-centered design, rather than troubleshooting issues that arose after implementation.

Programs encountered barriers from external technology and data systems that were beyond their control. Some technological challenges remained unsolved at the end of the award period:

[275]Joslin's OTR program did not require access to EHRs and did not include any technology-based components. It is, therefore, not included in this section.

[276]Ideally, integration of program data into an EHR system—which occurred at a federally qualified health center (FQHC) that partnered with SEDI—enhanced communication within teams and with other providers.

- Differences in diagnostic entries by outside providers made EHR data cleaning and validation time-intensive; this delayed implementation of the risk algorithm (SEDI).
- Unexpected mobile provider outages sometimes prevented participants from sending readings to clinics (FirstVitals).
- Local mobile dead zones prevented participants from sending readings via tablets and devices (FirstVitals).

Partnerships

Partnerships were key drivers of implementation effectiveness across all three programs, and awardees relied on partners to collect data and to implement programs. The three programs were networked with external organizations and prioritized meeting patient needs so that they could learn about barriers and facilitators to meeting those needs (see CFIR "Outer Setting"). Exhibit 25.4 summarizes the types of partnership and their functions.

Exhibit 25.4: Description of Diabetes Programs

Awardee	Partners	Partner Functions
FirstVitals	Medicaid managed care plan AlohaCare	AlohaCare gave access to claims data to identify and track patients
	Community health centers in AlohaCare network	Health centers recruited patients and used existing staff to implement the program
Joslin	Two state university extension offices and one hospital	Partner sites implemented the program, recruited patients, and were knowledgeable about local needs
SEDI	Community advisory boards (CABs) comprising local stakeholders	CABs convened providers, located spaces for community events, planned staff events, and identified gaps in local resources
	Two local health departments, county-based diabetes coalitions, federally qualified health centers (FQHCs), acute care hospitals, one health system, one community-based organization, two universities, and primary care clinics	Partner sites implemented the program, recruited patients, and were knowledgeable about local needs

Each program's ability to provide targeted disease management to patients incentivized community health centers to partner with awardees. Community health centers have limited resources to offer on-site disease management support and follow-up monitoring. The Joslin program provided a health center at their New Mexico site with an opportunity to train their health educator in diabetes management through the program. SEDI provided extra staff for community health centers that had limited resources to implement targeted disease management of high-cost and resource-intensive patients. FirstVitals staff furnished health centers with the support to ensure that all components of a screening and telemonitoring program could be implemented.

Awardees needed local partners with insight into how to tailor programs to local populations.[277] Because awardees were not necessarily tied to the communities they hoped to serve, their partners

[277] SEDI's Durham site is an exception to this statement.

adapted the project to available local resources and hired staff who could best engage the target population. One SEDI site worked with local partners to successfully start a community garden because staff noted that patients could not easily access healthy foods; leadership claimed that the garden helped transform the diet and lifestyle of at least one of its members. The partner organizations were able to make hiring decisions based on local workforce availability and to tailor the program content, particularly the educational content, to the target population. Although having local partners implement the program was valuable, the awardees encountered challenges in coordinating the sharing of lessons learned across sites, because the partners had no preexisting relationships or incentive to sustain relationships beyond the project period.

Long-standing relationships between partners and awardee organizations facilitated implementation. FirstVitals leadership's previous experience in working with AlohaCare made forming partnerships more efficient. In contrast, initiating new partnerships was challenging and time-consuming at SEDI, where providers in larger health systems were concerned that SEDI would take away their patients or modify their treatments. In addition, SEDI's in-house geospatial mapping team continued to work with the site with which it already had a relationship but failed to develop new relationships with the other three sites. As a result, those sites were unable to benefit from the geospatial mapping. Even with the help of AlohaCare, FirstVitals' director of care coordination found it time-consuming and challenging to establish relationships with the community health centers with which she did not already have relationships. Once FirstVitals demonstrated implementation success and strong customer service at health centers, they found it easier to develop partnerships with additional health centers. Staff at Joslin's Washington, DC, site found recruitment of partners to be challenging because they had few ties with the community and local organizations.

Key Findings: Program Effectiveness

Exhibit 25.5 presents descriptive characteristics for SEDI, Joslin, and FirstVitals program participants. Joslin participants were mostly female and over 65 years of age; the majority of FirstVitals participants were non-White, under age 65, and covered by Medicaid; and most SEDI participants were also over 65 years of age, with nearly equal proportions of Black and White participants. Furthermore, FirstVitals participants were part of Medicaid managed care plans, whereas Joslin and SEDI participants had a combination of insurance types.

Exhibit 25.5: Descriptive Characteristics of FirstVitals (n = 229), Joslin (n = 3,122), and SEDI (n = 488) Participants

Program effectiveness and implementation. We weighed evidence of program impact against implementation challenges and successes. The awardees appeared to be responsive and adaptable when

they encountered most implementation challenges, and all of them showed some type of positive program impact. Using difference-in-differences (DID) estimates, we found non-significant but favorable reductions in cost of care at FirstVitals. Joslin and SEDI participants showed significant improvements in HbA1c levels, diabetes self-care, and other behaviors such as exercise and healthier eating. Qualitatively, participants across all three interventions reported improved diabetes management behaviors, quality of life, and quality of care in focus group and telephone interviews. As nonrepresentative qualitative samples, these results should be interpreted with caution as there might have been selection bias or recall bias among participants. This challenge was the same across all three awardees. Exhibit 25.6 summarizes quantitative and qualitative findings across awardees.

Exhibit 25.6: Outcomes across the Diabetes Awards

Awardee	Quantitative Results		Positive Findings from Qualitative Focus Groups		
	Data Source	Key Finding(s)	Diabetes Management Behavior	Quality of Life	Quality of Care
FirstVitals	Medicaid data	Non-significant trend toward reductions in total cost of care	✓	✓	✓
Joslin	Awardee-collected data	Significant improvements in blood pressure, exercise, sleep, diet, and patient activation for participants at risk for diabetes Significant improvements in HbA1c, blood pressure, exercise, diet, sleep, patient activation, and confidence in self-care for participants with diabetes	✓	✓	✓
SEDI*	Awardee-collected data	Significant improvements in diabetes HbA1c levels (≥1%), diabetes self-care, and medication adherence	✓	✓	✓

NOTE: *SEDI high-risk intervention only

Program effectiveness and program components. We also considered which intervention components may lead to favorable impacts. SEDI stands out in this comparison as the most complex intervention because it offered the most comprehensive health education, care team coordination, and behavioral health services. Although FirstVitals participants reported positive changes, staff members expressed doubt that participants would maintain those changes and continue to monitor their blood pressure and HbA1c.

Notably, this program did not offer basic diabetes management education as SEDI and Joslin did, and it is probable that, without these additional supports, both establishing behavior changes and maintaining them for the long term would be difficult. Joslin's OTR program is designed for both participants diagnosed with diabetes and those at high risk for developing diabetes, but we were unable to measure the program's impact on preventing diabetes. In terms of the specific education that was offered, some participants with diabetes found the curriculum too elementary for their needs. Whether diabetes education programs would be more effective if they focused separately on high-risk populations or on clinically diagnosed populations remains an open question.

Sustainability. FirstVitals, Joslin, and SEDI are sustaining parts of their interventions through different funding mechanisms. FirstVitals continues to conduct billable screening activities (HbA1c, diabetic

peripheral neuropathy, and retinal screenings) and maintains its relationship with AlohaCare. Joslin will continue the OTR program in its entirety at the New Mexico and Pennsylvania sites, but not at the Washington, DC, site because of a lack of internal institutional support for the program at that site. SEDI's Durham and Mingo sites will continue both parts of the high-risk and low-risk interventions under grant funding, although neither site will continue the medium-risk intervention. The program did not continue at the Cabarrus or Quitman sites due to lack of funding. Please see specific awardee chapters in this report for details on sustainability.

Implications for Future Programs

When considered together, the diabetes programs have important implications for program development. Our findings suggest that:

- A balance between site-specific adaptability and cross-site communication to discuss barriers and facilitators is helpful to programs.
- Partners can play a significant role in securing access to EHRs and patient information.
- Patient-facing technology may have higher chance of success if accompanied by tech support for participants, and when strong relationships between staff and participants coincide with effective use of technology.
- Partners' knowledge of local communities and resources can inform program adaptation and tailoring to specific populations.
- Leveraging existing relationships can be an efficient way to locate partners; forming relationships from scratch can be time-consuming and resource-intensive.

Limitations

A number of data-sharing challenges limited our analysis. We were not able to report on claims data for the SEDI high-risk and Joslin programs because the pool of participants with identifiers that we could link to claims was too small. SEDI was not able to provide data on the low- or medium-risk interventions; therefore, an analysis only of the high-risk participants is included in our findings. Although we were able to estimate DID for FirstVitals, the overall sample size is small, which limited the power to detect differences.

Although there was considerable overlap between the interview domains and the CFIR, not all of the domains of the implementation framework were covered in interviews. Therefore, we focused on relevant subdomains in this particular analysis, namely adaptability and complexity of interventions; patient needs and resources; cosmopolitanism; structural characteristics; networks and communications; available resources; access to knowledge and information; planning, engaging, and executing interventions; and the roles of champions.

We developed our qualitative findings from two rounds of visits and/or telephone interviews with sites. Due to logistical and/or resource challenges, we were unable to speak with all staff members or all sites, and therefore not all viewpoints may be represented. In terms of patient focus group and interview recruitment, we used three approaches to try to maximize response rates from participants who were familiar with the program. We either:

- Led recruitment by requesting participant lists and contact information from awardees then contacting participants directly;
- Collaborated with awardees to recruit participants using NORC generated flyers that referred participants to us for more information;
- Relied on awardees to conduct all outreach and recruitment of awardees.

Exhibit 25.7 describes the recruitment methods we used for the three diabetes awardees.

Exhibit 25.7: Patient Focus Group and Interview Recruitment Methods

Awardee	Recruitment Type: Round 1	Recruitment Type: Round 2
FirstVitals	NORC-Awardee Collaboration	NORC-led**
Joslin	NORC-Awardee Collaboration	Awardee-led*
SEDI	NORC-led**	NORC-led**

*Conducted one-on-one patient interviews on site in place of focus groups

**Conducted telephone interviews

Although we did not observe any particular biases in participant selection and recruitment of participants among any of the diabetes intervention sites, selection bias and recall bias should be considered when considering qualitative findings.

Conclusion

In our quantitative analysis of the three diabetes awardees, we observed overall trends ranging from lower costs to improvements in HbA1c levels, blood pressure, diet, exercise, and patient empowerment (e.g. activations). Improvements in diabetes-related outcomes were significant for SEDI and Joslin; although claims results for FirstVitals were favorable, there were non-significant reductions in cost of care. Though based on small samples of program participants, qualitative findings showed how components of the FirstVitals, Joslin, and SEDI programs might have driven improvements in quality of life and care in addition to the positive behavior changes among participants. For example, Joslin's program encouraged participants to make appointments with a health care provider so that they could become more connected to the health care system, and SEDI's home-visiting staff persons helped patients address their behavioral health and social needs. Trusting relationships between participants and staff members might also have contributed to the positive changes.

Our findings suggest that, among multisite programs targeting diabetes education and management, programs find benefit from allowing a degree of flexibility so that sites can tailor components to different patient populations. Partners who are knowledgeable about local populations can help implementers tailor interventions to patients In addition, health IT and EHR information exchanges may prove challenging, and personal relationships, advance planning, as well as strategic partnerships can help alleviate these challenges.

TECHNICAL APPENDICES

Appendix A: Quantitative Methods

This section presents our quantitative analytic methods for 18 disease-specific awardees. In consultation with the Center for Medicare & Medicaid Innovation (CMMI), we base the analytic approach for each awardee 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 the availability of health care claims for that group influence the data source selection for cost and utilization measures.
- Intervention Type: Based on setting and goals of the intervention, awardee interventions can be separated into two groups: (1) post-acute care (PAC) interventions focused on improving patient outcomes during or immediately after an index hospitalization; (2) ambulatory care interventions that identify and engage participants with a chronic disease in the outpatient setting.
- Comparison Group: The feasibility of constructing a comparison group and the likelihood of sufficient power to detect a statistically significant difference-in-differences (DID) estimate between participants and a comparison group affect the type of analysis conducted.[278]
- Analysis: Selection of statistical analysis methods takes into consideration the intervention type, data source, and availability of a comparison group.

This appendix provides details on dataset construction (data sources, population, and measure specification) and comparison group selection, followed by analytic methods.

Exhibit A.1: Summary Quantitative Analysis Methods

Awardee	Data Source	Intervention Type	Comparison Group	Analysis
Christiana	Medicare	PAC	Yes	DID
SEDI	Awardee data	Ambulatory care	No	Custom[279]
FirstVitals	Medicaid	Ambulatory care	Yes	DID
GWU	Medicare	Ambulatory care	Yes	DID
HRiA	Awardee data	Ambulatory care	No	Custom
Indiana	Medicare	Ambulatory care	Yes	DID
IOBS	Medicare	Ambulatory care	Yes	DID
Joslin	Awardee data	Ambulatory care	No	Custom
Le Bonheur	Medicaid	Ambulatory care	Yes	DID
MAHEC	Medicare Awardee data	Ambulatory care	No	Time series Custom
Nemours	Medicaid	Ambulatory care	Yes	DID
Ochsner	Medicare	PAC	Yes	DID
UAB	Medicare	Ambulatory care	Yes	DID
UPenn	Awardee data	Ambulatory care	No	Custom

[278]Inclusion of a comparison group is not feasible for SEDI, HRiA, Joslin, UPenn, and USJHSD because the analysis is based on awardee data. We also did not include a comparison group for MAHEC, where the sample size was small and defining a comparison group from claims difficult.

[279]Because of the variability in data among 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
UCLA	Medicare	Ambulatory care	Yes	DID
USJHSD	Awardee data	Ambulatory care	No	Custom
UVA	Medicare	Ambulatory care	Yes	Custom
Vanderbilt TCC[280]	Medicare	PAC	Yes	DID
Vanderbilt OCC		Ambulatory care	Yes	DID

Dataset Construction

Construction of analytic files is similar for both 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 datasets separately for the two intervention types, PAC and ambulatory care interventions.

In addition to core measures, each analytic file includes:

- available patient demographics: age, gender, race/ethnicity, dual eligibility, and reason for Medicare/Medicaid eligibility (e.g., age, disability, end stage renal disease)
- Centers for Medicare & Medicaid Services (CMS) region, state, county, and zip code of residence
- Medicare or Medicaid fee-for-service (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[281, 282, 283]
- 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)
- utilization of hospital and outpatient emergency department care for the 12 months before enrollment in the program

[280]Vanderbilt's HCIA program includes two interventions serving different populations: (1) inpatient care coordination for patients admitted with acute myocardial infarction, congestive heart failure, chronic obstructive pulmonary disease, and pneumonia, and (2) outpatient chronic care management for patients with diabetes and hypertension who are living in the community. We treated these interventions separately for analysis.

[281]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 Medicare Advantage plans, groups diagnostic codes for beneficiaries in 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 diagnostic 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.

[282]Pope GC, Kautter J, Ellis RP, et al. Risk adjustment of Medicare capitation payments using the CMS-HCC model. *Health Care Financ Rev.* 2004;25(4):119-141.

[283]Kronick R, Gilmer T, Dreyfus T, Lee L. Improving health-based payment for Medicaid beneficiaries: CDPS. *Health Care Financ Rev.* 2000;21.3:29-64.

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. 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:

- patient-episodes as the unit of analysis because each episode of acute/post-acute care provides the awardee an opportunity to intervene to improve outcomes[284]
- analysis of time using calendar quarters before and after implementation of the intervention

Data source. The CMS Virtual Research Data Center (VRDC) and participant enrollment information from awardees are 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 below in the "Comparison Group Selection" section.)

- We include participants enrolled before June 30, 2015. We then apply a claims run-off period of 90 days and construct measures from claims through September 30, 2015. For Christiana and Vanderbilt, this is the final quarter of available data on their participants. For Ochsner, we include additional quarters of data in the no-cost extension (NCE) report to cover their participant enrollments during the NCE period (enrollment through December 2015).
- All patient-episodes and associated measures are assigned to the calendar quarter during which hospital discharge occurs. Therefore, the last quarter of data presented in this report is Q2 2015.
- The final dataset includes four distinct groups, defined based on time and location (please see Exhibit A.2). Only patient-episodes meeting the stated enrollment criteria for each intervention are included in the dataset. For example, Christiana enrolls patients upon discharge following a revascularization procedure; therefore, all treatment and comparison episodes included in the dataset have been discharged from a hospital after revascularization.[285]

Exhibit A.2: Distinct Groups Included in PAC Analytic Files

Location	Time Period	Description
Awardee Intervention Site	Pre-intervention	Episodes for patients discharged from the awardee intervention site (e.g., Christiana hospital) during the eight quarters before implementation of the intervention
	Post-intervention	Episodes for patients discharged from the awardee intervention site after implementation of the intervention and included in the awardee enrollment file

[284]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.
[285]More details on awardee inclusion criteria and operational definitions for selecting comparisons are provided later in this appendix.

Location	Time Period	Description
Comparison Site	Pre-intervention	Episodes for patients discharged from a comparison site during the eight quarters before implementation of the intervention at the awardee site
	Post-intervention	Episodes for patients 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[286]

Measure	Definition
Post-discharge (ED) Visits	Proportion of episodes for patients with an ED visit within 90, 180, and 365 days of index hospital discharge
Post-discharge Readmissions[287]	Proportion of episodes for patients readmitted to an acute care hospital within 30, 90, 180, and 365 days of index hospital discharge
Post-discharge Total Cost of Care[288]	Total cost of Medicare Parts 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 those at FirstVitals, GWU, Indiana, IOBS, Le Bonheur, MAHEC, Nemours, UAB, UCLA, UVA, and Vanderbilt's outpatient care coordination (OCC) program. Ambulatory care interventions focus on 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. For some programs, active agreement to participate was required and therefore not all patients would be enrolled. Regardless, there is a potential for selection bias by enrolling patients who come to the program.

[286]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.
[287]Our core measures are 90-day measures. We added the 30-day readmission measure because it is a policy-relevant measure and may provide a way to compare impact across other initiatives.
[288]Total cost of care is expressed in 2013 dollars, after adjusting for medical care consumer price index. Costs of nonhospital services are suitably inflated to 90, 180, or 365 days for partial periods of patient enrollment.

- The unit of analysis for these awardees is patient-quarters before or after patient 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. Data sources are CMS's 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 that identify program participants and their enrollment dates. We link awardee program files to Medicare/Medicaid claims. Participants who have at least one post-intervention quarter of enrollment are included.[289] 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 (please 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[290]	Proportion of patients per 1,000 admitted to a short-term inpatient facility for ACS conditions in a quarter
Total Cost of Care[291]	Total cost of Medicare (Parts A and B services) or Medicaid per patient in a quarter

Comparison Group Selection

We include a comparison group for 12 awardees: Christiana, FirstVitals, GWU, Indiana, IOBS, Le Bonheur, Nemours, Ochsner, UAB, UCLA, UVA, and Vanderbilt. For each awardee, we use a three-stage process to define the comparison group:

[289]Both PAC and ambulatory awardees have a cutoff of January 1, 2015, but PAC awardee participants need to be discharged/enrolled by June 30, 2015, in order to have a 90-day follow-up by the cutoff date. We have set a minimum of 90 days follow-up for PAC awardees to ensure that we can capture the 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.

[290]Agency for Healthcare Research and Quality. Prevention quality chronic composite technical specifications; prevention quality indicators #92; May 2013. Available at: http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V45/TechSpecs/PQI%2092%20Prevention%20Quality%20Chronic%20Composite.pdf.

[291]Total cost of care is expressed in 2013 dollars, after adjusting for medical care consumer price index. Costs of nonhospital services are suitably inflated to 90 days for partial periods of patient enrollment in the quarter.

- 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 with respect to potential confounding factors[292]

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 and [293, 294, 295] is a potential source of bias for our evaluation if not well controlled. Therefore, we explicitly consider geographic- and provider-level factors in selecting sampling frames:

- **Residence-based**: For Indiana, Nemours, Le Bonheur, UCLA, and Vanderbilt OCC, the participants' place of residence was used to define the primary sampling frame.
  - Indiana: Propensity score models identify comparison counties based on sociodemographic factors, health care service availability and utilization, and disease burden in the county.
  - Nemours and Le Bonheur: The entire state was used as the comparison sampling frame.
  - UCLA: The comparison zip codes are the same as the zip codes where the treatment population resided. [296]
- **Practice-based**: For FirstVitals, GWU, IOBS, UAB, and UVA, awardees for which the intervention was implemented across multiple practices, similar practices serve as our sampling frame.
  - IOBS: selected comparison oncology practices by propensity score matching with respect to practice characteristics.
  - UAB: selected two comprehensive cancer centers (and affiliates) in the South.
  - FirstVitals and GWU: community health centers or treatment centers where the interventions were implemented.
  - UVA: selected cancer centers of cancer hospitals in Virginia that provide a similar volume of oncology care.
- **Hospital-based**: To select a comparison sampling frame for PAC interventions, we developed a propensity score model for a national pool of hospitals paid by Medicare to identify comparison hospitals most similar to each awardee hospital with respect to a set of selected hospital characteristics. We used this method for Christiana, Ochsner, and Vanderbilt TCC.

[292]We use propensity score weighting for PAC awardees because we use a serial cross-section design in which we compare outcomes across patient-episodes within each calendar quarter. We use propensity score matching for ambulatory awardees.
[293]Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care. *Ann Intern Med.* 2003;138: 273-287.
[294]Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care. *Ann Intern Med.* 2003;138: 288-298.
[295]Welch HG, Sharp SM, Gottlieb DJ, et al. Geographic variation in diagnosis frequency and risk of death among Medicare beneficiaries. *JAMA.* 2011;305: 1113-1118.
[296]Our expectations of resulting comparison group size prompted us to use different geographic sampling frame definitions for different awardees.

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 score is the probability of the county, practice, or hospital being a part of the awardee's program. $\mathbf{T_i}$ 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- or 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 summarizes the sampling frame and the approach to identifying comparison providers/areas for the 12 awardees.

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
FirstVitals	Propensity score-matched AlohaCare community health centers in the same regions as FirstVitals	Community health centers serving predominantly AlohaCare (Medicaid Managed Care) members in Honolulu, Waimanalo, Wailuku, Lihue, Kahuku, Kona, and Waianae
GWU	DaVita clinics at which the treatment population was seen	DaVita clinics in Washington, DC; Virginia; and Maryland
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 Associates, 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, PC, CT; Berkshire Hematology Oncology, MA; Commonwealth Hematology-Oncology, PC, MA **NGOC, GA:** Integrated Community Oncology Network, FL; Greater Florida Emergency Group, FL; Peachtree Hematology Oncology Consultants, GA **NMOH, 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
Le Bonheur	Children enrolled in TennCare	State of Tennessee, TennCare (TN Medicaid) enrollees
Nemours	Zip codes in the state of Delaware	State of Delaware, Medicaid enrollees

Awardee	Sampling Frame	Comparison Areas/Providers
Ochsner	Propensity score-matched hospitals in the same CMS region as Ochsner	United Regional Health Care System, TX; Memorial Hermann Texas Medical Center, TX
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 treatment population resides
UVA	Cancer centers of cancer hospitals in Virginia providing a similar volume of oncology care as UVA	Medical Colleges of Virginia/VCU Hospitals, VA; Inova Fairfax Hospital, VA; Sentara Norfolk Hospital, VA
Vanderbilt TCC	Propensity score-matched hospitals in the same CMS region as Vanderbilt hospitals	**VUMC:** University of Louisville Hospital, KY **Maury:** Henry County Medical Center, TN, Cookeville Regional Medical Center, TN **Williamson:** Indian River Memorial Hospital, FL, Lee Memorial Hospital, FL
Vanderbilt OCC	Nashville and neighboring hospital service areas (HSAs)	**HSAs:** Nashville; Columbia; Franklin; Clarksville; Murfreesboro; and Madison, TN

Limit to qualified patients. After identifying the sampling frame, 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.[297] 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 times 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.

[297]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 National Provider Identifier (NPI) or provider ID.

Pre- and post-intervention quarters for the treatment group patients for most awardees are based on the enrollment date, defined as the date when patients actually enrolled in the program. For awardees such as 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[298]
Christiana	Medicare FFS beneficiaries 18+ years old 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:** (ICD9P 36.1X, 36.2, 36.3X; BETOS P2A; CPT 335XX)
FirstVitals	AlohaCare beneficiaries with evidence of diabetes in 2013 or 2014 and not enrolled in the FirstVitals intervention	**Diabetes:** 250.XX
GWU	Medicare FFS beneficiaries 18+ years old who have at least one peritoneal dialysis claim at an eligible DaVita clinic in Washington, DC; Maryland; or Virginia	**Dialysis:** 585.6
Indiana	Medicare FFS beneficiaries 65+ years old 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), and no diagnoses for similar cancers in 2012	**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
Le Bonheur	Medicaid children (TennCare) 2–17 years old 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
Nemours	Medicaid children 2–17 years old 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

[298] All codes are International Classification of Diseases (ICD)-9 codes unless otherwise specified.

Awardee	Target Population	Diagnoses/Procedure Codes[298]
Ochsner	Medicare FFS beneficiaries admitted to Ochsner with ischemic or hemorrhagic stroke, or transient ischemic attack (TIA)	**Hemorrhagic**: ICD9D 430.XX-432.XX **Ischemic:** ICD9D 434.XX **TIA:** 433.XX; 435.XX
UAB	Medicare FFS beneficiaries 65+ years old with one of six specific types of cancer (breast, lung, colorectal, lymphoma, or male or 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 old with Alzheimer's disease or other forms of dementia and living in the community (not residing in a nursing facility)	**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
UVA	Medicare FFS beneficiaries with a diagnosis of metastatic cancer during the last year of life, deceased before December 31, 2015, having a hospital admission with primary or secondary diagnosis of cancer in the year prior to death	**Cancer Hospitalization:** 140-208 or 239.0-239.9, excluding V codes
Vanderbilt TCC	Medicare FFS beneficiaries admitted to Vanderbilt with congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), acute myocardial infarction (AMI), or pneumonia	**CHF:** 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428,20-428.23, 428.30-428.33, 428.40-428.43, 428.9 **COPD:** 491.21, 491.22, 491.8, 491.9, 492.8, 493.20-493.22, 496, 518.81, 518.82, 518.84, 799.1 **AMI:** 410.00, 410.01, 410.10, 410.11, 410.20, 410.21, 410.30, 410.31, 410.40, 410.41, 410.50, 410.51, 410.60, 410.61, 410.70, 410.71, 410.80, 410.81, 410.90, 410.91 **Pneumonia:** 480.0-480.3, 480.8, 480.9, 481, 482.0-482.2, 482.30-482.32, 482.39-482.42, 482.49, 482.81-482.84, 482.89, 482.9, 483.0, 483.1, 483.8, 485, 486, 487.0, 488.11

Awardee	Target Population	Diagnoses/Procedure Codes[298]
Vanderbilt OCC	Medicare FFS beneficiaries 18+ years old with hypertension and/or diabetes mellitus	**Hypertension:** 362.11, 401.0, 401.9, 402.00, 402.01, 402.10, 402.11, 402.90, 402.91, 403.00, 403.01, 403.10, 403.11, 403.90, 403.91, 404.00-404.03, 404.10-404.13, 404.90-404.93, 405.01, 405.09, 405.11, 405.19, 405.91, 405,99, 437.2 **Diabetes:** 249.00, 249.01, 249.10, 249.11, 249.20, 249.21, 249.30, 249.31, 249.40, 249.41, 249.50, 249.51, 249.60, 249.61, 249.70, 249.71, 249.80, 249.81, 249.90, 249.91, 250.00-250.03, 250.10-250.13, 250.20-250.23, 250.30-250.33, 250.40-250.43, 250.50-250.53, 250.60-250.63, 250.70-250.73, 250.80-250.83, 250.90-250.93, 357.2, 362.01-362.06, 366.41

Select similar patients. Finally, for ambulatory care awardees we use propensity score models to select a subset of the comparison pool who most closely match the treatment group participants with respect to 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.[299] The results of these model diagnostics are included in this technical appendix as awardee-specific supplements. We then compare the two groups—treated and comparison—to estimate the effects of the intervention.

[299]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, 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 comorbidities (CHF, stroke, hypertension, diabetes, atrial fibrillation, ESRD, and AMI)
FirstVitals	Aloha care members with evidence of diabetes and diabetes peripheral neuropathy in 2013 or 2014, and not enrolled in FirstVital's intervention	Age (in categories <35, 35-44, 45-54, 55-64, ≥65), gender, CDPS risk score, prior-year hospitalizations, prior-year ED visits, prior-year cost, insulin use, CVD severity (low, medium, high), hypoglycemia, chronic kidney disease, foot ulcers, blindness, peripheral neuropathy, and advanced eye disease (diabetic macular edema or retinal edema); race not included*
GWU	Nearest neighbor 1:1 matching based on PS—without replacement	Age (in categories 18-40, 41-59, 60-74, ≥75), gender, race (White, Black), HCC score, disability, prior year ED visit, prior year cost, years with a chronic kidney disease diagnosis, and ESRD
Indiana	Exact match by diagnosis (dementia or depression) followed by nearest neighbor 1:1 matching based on PS—without replacement	Condition (dementia, depression, or both dementia and depression), age (centered at 60), gender, race (White, Black), prior cancer diagnosis, heart diseases, arthritis (RA or OA), hyperlipidemia, CKD, hip fracture, prior-year ED visits, prior-year hospitalizations, prior-year HCC score, prior quarter cost, prior-year cost ratio, prior-year cost and time to dementia diagnosis
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);[300] cancer severity (metastatic cancer); age (in categories <65, 65-69, 70-74, 75-79, 80-84, ≥85); race (White, other); disability; ESRD; and comorbidity (HCC score in year before enrollment in program)
Le Bonheur	Nearest neighbor 1:1 matching based on PS—without replacement	Age (continuous); race (White, Black, other); gender; CDPS score in year before enrollment; prior-year Medicaid costs; prior-year hospitalizations; prior-year ED visits; number of hospitalizations in the quarter prior; and number of post-intervention quarters; urban vs. rural[301]
Nemours	Nearest neighbor 1:1 matching based on PS—without replacement	Age (continuous); gender; race (White, non-White); ethnicity; prior-year CDPS score; prior-year Medicaid costs, prior-year asthma-related hospitalizations, and prior-year ED visits
Ochsner	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, disability status, ESRD, prior-year hospitalizations, prior-year ED visits, extent of prior-year FFS coverage, prior-year cost, prior-year HCC score, discharge status, target condition (ischemic stroke, hemorrhagic stroke, TIA), history of stroke, and severity of hospitalization (CC, MCC, or neither CC nor MCC DRG)

[300]For IOBS, we use mode of cancer treatment—surgery, chemotherapy, and radiation therapy—to adjust for differences in severity of cancer because of limited information on cancer severity on claims.

[301]US Department of Agriculture. Rural classifications. Available at: http://www.ers.usda.gov/topics/rural-economy-population/rural-classifications.aspx.

Awardee	Propensity Score (PS) Approach	Variables Used for Propensity Score Model
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);[302] cancer severity (metastatic cancer); type of cancer hospital (CCC or affiliated hospital); age (in categories <65, 65-69, 70-74, 75-79, 80-84, ≥85); race (White); disability; ESRD; and comorbidity (HCC score in year before enrollment in program)
UCLA	Nearest neighbor 1:1 matching based on PS—without replacement	Alzheimer's-type dementia, age (centered at 60), gender, race (White), prior cancer diagnosis, heart diseases, arthritis (RA or OA), hyperlipidemia, CKD, hip fracture, depression, prior-year ED visits, prior-year hospitalizations, prior-year HCC score, prior-quarter cost, prior-year cost ratio, prior-year cost and time to dementia diagnosis
UVA	Nearest neighbor 1:1 matching based on PS—without replacement	Age, gender, HCC score, race (White, Black), chemotherapy, cost in year prior to death, hospitalizations in year prior to death, high-risk cancer, radiation, multiple cancer diagnoses
Vanderbilt TCC	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, disability status, ESRD, prior-year hospitalizations, prior-year ED visits, prior-year cost, prior-year HCC score, discharge status, target condition (CHF, COPD, AMI, pneumonia), and severity of hospitalization (CC, MCC, or neither CC nor MCC DRG)
Vanderbilt OCC	Nearest neighbor 1:1 matching based on PS—without replacement	Age (in categories <65, 65–69, 70–74, 75–79, 80–84, ≥85), gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year cost, prior-year HCC score, indicators for chronic conditions (CHF, anemia, COPD, CKD, dementia, osteoporosis, atrial fibrillation, stroke, AMI, hip fracture), and target conditions (hypertension and/or diabetes)

NOTE: *Race/ethnicity data are frequently unavailable in Medicaid claims and utilization data because they have to be merged from distinct systems. We have requested these data from FirstVitals several times, but they have not provided it yet.

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.

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 also describe the Cox proportional hazards model used to determine changes in rates of nursing home placement among two awardees. We then summarize methods using awardee data to estimate changes from the baseline, including analysis of dosage for asthma awardees. Finally, we describe how we estimated program costs for our mixed-methods return on investment analysis.

Claims-Based Analysis:

Below is a description of methods of analyzing claims-based data. This includes DID, Cox proportional hazards model, and time series analysis.

[302]For UAB, we use the mode of cancer treatment—surgery, chemotherapy, and radiation therapy—to adjust for differences in severity of cancer because of limited information on cancer severity on claims.

Difference-in-Differences

We use DID analyses for awardees with comparison groups to estimate the average treatment effect on the treated (ATT).[303] 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.[304]

For each outcome, we conduct DID analyses employing suitable serial cross-sectional designs (PAC awardees) or longitudinal population average models (ambulatory awardees) with the appropriate functional form for the dependent variable (please see Exhibit A.8).

Exhibit A.8: Functional Form for Regression Models

Measure	Functional Form
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[305]	Costs converted to 2013 dollars and modeled using a gamma distribution with a log link, modeled using xtgee command in Stata®

We run quarterly fixed-effects DID models that estimate quarter-to-quarter program impact for awardees. In order to obtain overall impact estimates for the entire implementation period, we calculate a weighted average of the quarter-specific estimates using the lincom command in Stata®.[306] The general specification for the model 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 quarterly fixed effects (QFE) models, **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.

[303]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, whereas ATE is the expected gain for treating a randomly selected unit from the population.
[304]More details on the selection of comparison groups for each awardee can be found in the Comparison Group Selection section.
[305]We used modified Park test to identify the best link and variance function for each outcome.
[306]Stata. Lincom—linear combinations of estimators. Available at: http://www.stata.com/manuals13/rlincom.pdf.

Variables in the model are detailed in Exhibit A.9, showing differences between PAC and ambulatory care awardee programs in how variables are specified.

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	Vector of dummy variables for calendar quarters before and after program implementation at the awardee site. The interaction term includes only 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 includes only dummy variables for quarters after program enrollment
$Patient_i$	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 to those that continue to be associated with outcomes. This results 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.

Cox Proportion Hazards Model

To estimate the impact on nursing home placement for dementia awardees, we use Cox proportional hazards models (hazards models).[307, 308] These models are common for the analysis of time-to-event data. From these models, we are able to study not only differences in the number of patients admitted to a nursing home but also the timing of those admissions. Hazards models combine information on whether an event happened with data on the length of time before an event occurred. This is particularly useful for studying nursing home admissions among patients with dementia, where it may be more feasible to delay nursing home entry instead of prevent it completely.

[307]Cox DR. Regression models and life tables. *Journey of the Royal Statistical Society, Series B.* 1972; 34: 187-220

[308]Hosmer DW, Lemeshow S. *Applied Survival Analysis: regression modeling of time to event data*. New York, NY: John Wiley & Sons Inc; 1999

For this analysis, we use the same program participants and comparison patients as we use for the DID analysis. For each patient, we identify two new parameters: (1) whether the patient enters a nursing home during the intervention period and (2) the number of days until admission to a nursing home, or if there is no admission to a nursing home, the total observation time. The model specifications are:

$$\text{Log}[\lambda(t|X)] = \log[\lambda_0(t)] + \beta_1 \text{Treatment} + \beta_2 \text{Patient}$$

Where $\boldsymbol{\lambda_0(t)}$ is an unspecified and arbitrary baseline hazard function, $\boldsymbol{\beta_1}$ represents the effect of participating in the awardee program, and $\boldsymbol{\beta_2}$ is a vector of patient demographic and clinical variables at the time of enrollment in the program. For this model, we estimate a hazard ratio (HR), interpreted as the relative rate of nursing home admission of participants in the awardee program to comparison patients. An HR greater than one indicates that the awardee program has a higher rate of nursing home admissions, and an HR less than one indicates lower rates of nursing home admissions.

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 allow us to study the impact of an awardee's program compared with what would have been expected under usual care, which can be inferred by comparing with outcomes in the period before the intervention.[309] 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-average models with the appropriate functional form for the dependent variable (please see Exhibit A.8 for model details on each outcome).

We run QFE interrupted time series models for the PAC and ambulatory awardees to assess the impact on outcomes of each quarter of the awardee's program (comparable to the DID models described above). Similar to the DID model, we obtain an overall impact estimate using the lincom command in Stata to calculate a weighted average of the quarter-specific estimates.[310] The general specification for the model is:

$$Y_i = \beta_0 + \beta_1 \text{Time}_i + \beta_2 \text{Patient}_i + \varepsilon_i$$

In this 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.

[309]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.

[310]Stata. Lincom—linear combinations of estimators. Available at: http://www.stata.com/manuals13/rlincom.pdf.

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	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
Patient	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 some cases, we use awardee-collected data for evaluating the awardee's program. Awardee-collected data include surveys, administrative program data, electronic health records data, clinical measures, and/or patient-reported outcomes. The awardee-collected data vary greatly by type, outcome, completion, validity, sample size, and quality. Because no overarching analytical method applies, details on the analytic approach, measures, and statistical methods are provided in the awardee chapters. Below we present a description of our analysis of the impact of program dosage, or the amount of the program that participants were exposed to or engaged in, on program effectiveness among the asthma awardees.

Dosage Analysis

For Nemours and Le Bonheur, we used program encounter data provided by the awardees to determine dosage. We defined a full dose as a total count of program encounters that was higher than or equal to the median (≥15 for both awardees). We also conducted an additional Le Bonheur analysis using an alternate definition of full dose to include participants meeting all of the following conditions:

- Certified asthma educator (AE-C) for patient/family within 12 months or AE-C by other for patient/family within 12 months
- Medication review with patient/family within 12 months
- American Association of Pediatrics (AAP) to patient's school OR AE-C for school review OR medication review with school
- Home visit within 12 months
- AAP to family
- Environmental assessment performed

Once we categorized treatment participants as having received a full dose or partial dose, we used Medicaid claims data to conduct difference-in-differences (DID) analyses to compare outcomes for full-dose and partial-dose participants. We created DID estimates for four core measures:

- all-cause hospitalization rate
- ED visit rate
- asthma-related hospitalization rate
- total cost of care

Variables included in the regression models include.

- Le Bonheur: Time variable, pre-post- flag, prior-year CDPS risk score, gender, race (Black, non-Black), age (continuous), urbanicity (metropolitan, nonmetropolitan)[311]
- Nemours: Time variable, pre-/post- flag, age (categories), race (White, non-White), disability status, and urbanicity (metropolitan, nonmetropolitan)

For HRiA, we used survey data from the awardee as the source of dosage information. We defined a full dose as completing the initial assessment and at least one follow-up assessment[312] and partial dose as completing only the initial assessment. Because there were no post-intervention data for the participants who received a partial dose, we were unable to conduct an outcome analysis. We compared demographic and other characteristics to identify any statistically significant differences between those participants who received a full dose and those who received only a partial dose.

Program costs Analysis

Three awardees—IOBS, Le Bonheur, and UCLA—demonstrated cost savings per beneficiary in our DID analysis. However, the cost savings do not reflect the costs of implementing and maintaining the intervention. Therefore, we conducted a return on investment (ROI) analysis to determine if these programs saved money relative to their operating costs. First, we calculated the program costs per beneficiary per quarter. We started by calculating the average number of participants served by each program per year. We took the total number of participants reached over the entire program period (as reported by the awardees to CMMI) and multiplied that number by the average number of years participants were enrolled in the programs (calculated from the finder files) divided by the total number of program years (i.e., three years):

(reach/year) = total reach * (years enrolled/total program years)

We calculated the annual program costs based on the personnel and nonpersonnel costs reported in the awardees' applications and on any other budget revisions submitted to CMMI by the awardees over the course of the program. We checked these figures against information gathered from leadership and staff

[311] US Department of Agriculture. 2010 rural-urban commuting area (RUCA) codes. Available at: http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/documentation.aspx.

[312]To conduct the dosage analysis, we had to stratify the population. There was a split between participants receiving two visits (initial assessment and one follow-up) and those receiving subsequent visits, so we stratified based on this split. Due to the small sample size, there were limited options to conduct the dosage analysis.

during site visits and then submitted draft calculations of program costs to the awardees for review. All three awardees commented on their budgets, and we made revisions accordingly. Total annual program costs were divided by the total number of participants per year, then divided by four to calculate the total program costs per participant per quarter. This figure was then compared to the total savings per participant per quarter to determine the net return on investment. Exhibits A.11, A.12, and A.13 show the worksheets we used to calculate program costs per participant per quarter for IOBS, LeBonheur, and UCLA, respectively.

Exhibit A.11: Program Costs per Participant per Quarter Worksheet for IOBS

Average Number of Participants Served Per Year			**533**
Annual Program Costs			
Personnel Expenses	**Annual Salary**	**FTEs**	**Total**
Patient Care Coordinator (Triage)	$35,110	1	$35,110
Triage Telephone Operator (Triage)	$35,360	1	$35,360
Registered Nurse (Triage)	$80,500	2	$161,000
Licensed Practical Nurse (Triage)	$51,750	2	$103,500
Patient Care Coordinator (Weekend Clinic)	$35,110	0.25	$8,778
Medical Assistant (Weekend Clinic)	$32,554	0.25	$8,139
Triage Telephone Operator (Weekend Clinic)	$35,360	0.25	$8,840
Registered Nurse (Weekend Clinic)	$80,500	0.3	$24,150
Front Desk Clerk (Weekend Clinic)	$37,556	0.25	$9,389
Clinic Manager (Weekend Clinic)	$75,664	0.25	$18,916
Data Manager	$10,950	1	$10,950
Help Desk	$32,500	1	$32,500
Chief Operating Officer & Chief Executive Officer	$18,500	1	$18,500
Nonpersonnel Expenses			
IOBS COME HOME Software License			$4,500
Fringe Benefits			$178,065
Office Supplies			$4,245
Equipment			$28,800
		Annual Program Cost	$690,741
		Program Cost per Participant per Year	$1,296
		Program Costs per Participant per Quarter	$324

Exhibit A.12: Program Costs per Participant per Quarter Worksheet, Le Bonheur

Average Number of Participants Served Per Year			331
Annual Program Costs			
Personnel Expenses	**Annual Salary**	**FTEs**	**Total**
Project Director	$97,732	0.5	$48,866
Program Evaluator	$91,000	0.2	$18,200
Social worker (CHW Supervisor)	$54,000	0.5	$27,000
Asthma Care Coordinator (Respiratory Therapist)	$68,976	0.7	$48,283
Asthma Care Coordinator (Registered Nurse)	$64,000	0.7	$44,800
Administrative Assistant	$29,500	1	$29,500
CHWs (Health Care Coordinators in application)	$31,000	5	$155,000
Non-Personnel Expenses			
Medical Supplies			$7,000
Emergency Patient Transportation Assistance			$8,400
Staff Mileage Reimbursement			$15,000
Communication (Phones/Wireless)			$11,400
Lease			$26,500
Training and Education Material			$6,080
Postage			$1,200
Asthma Collaborative Stipends			$1,350
Annual Program Cost			$448,579
Program Cost per Participant per Year			$1,355
Program Costs per Participant per Quarter			$339

Exhibit A.13: Program Costs per Participant per Quarter Worksheet, UCLA

Average Number of Participants Served Per Year			721
Annual Program Costs			
Personnel Expenses	**Annual Salary**	**FTEs**	**Total**
Dementia Care Managers	$124,119	5	$806,774
Project/Medical Director	$179,700	0.5	$116,805
Program Managers	$44,768	0.5	$30,890
Patient Service Representatives	$40,000	1	$116,000
Dementia Care Manager Assistants	$49,100	2	$135,516
Nonpersonnel Expenses			
Community Based Organizations			$200,000
Support groups			$20,000
Translation services			$2,000
Technology infrastructure fee			$2,550
Travel			$3,000
Maintenance of case management system			$50,000
Annual Program Cost			$1,483,534
Program Cost per Participant per Year			$2,058
Program Costs per Participant per Quarter			$514

Supplements for Awardee Chapters

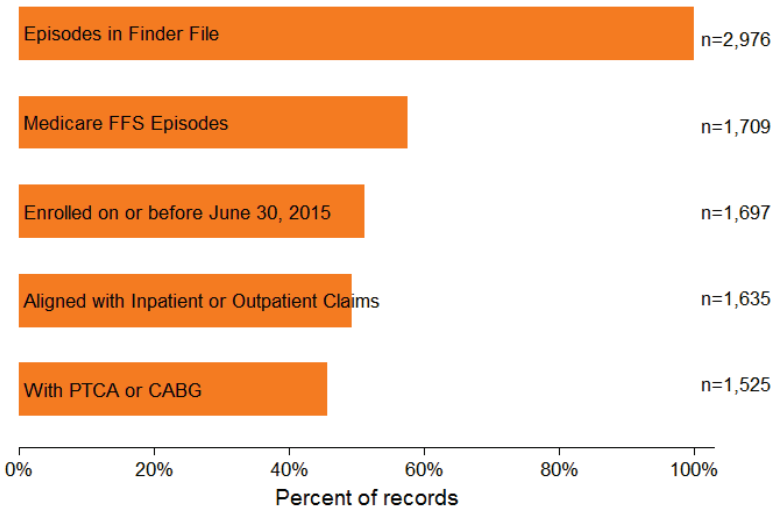
The materials presented in the following awardee-specific supplements are particular to the analysis conducted for that awardee. Therefore, the number and type of exhibits, along with the accompanying text, will vary.

Christiana Care Health System

Treatment and Comparison Group Creation

- We worked with Christiana's finder file listing Bridges participants to identify Medicare FFS patients with coronary revascularization episodes in each post-intervention quarter from April 1, 2013, through June 30, 2015, (n = 1,525) (please see Exhibit S1.1).
- We restrict our treatment group to patient-episodes from Medicare FFS claims, including cardiac revascularization through percutaneous transluminal coronary angioplasty (PTCA) or coronary artery bypass graft (CABG). Since the clinical criteria used to enroll patient-episodes with acute myocardial infarction (AMI) are not available in Medicare claims, we exclude these patient-episodes from our analysis.[313, 314]
- We add a group of baseline Medicare FFS coronary revascularization patient-episodes at Christiana in the pre-Health Care Innovation Award (HCIA) period, from April 1, 2011, through March 31, 2013, to serve as a historical cohort.

Exhibit S1.1: Patient-Episodes Identified through Christiana Finder File



Comparison group selection. To identify a pool of external comparison patient-episodes, we select FFS coronary revascularization patient-episodes (pre- and post-intervention) at four comparison hospitals selected for their similarity to Christiana.[315, 316] We run propensity score models to produce standard mortality ratio (SMR) weights. We then incorporate SMR weights into our analysis to minimize observed

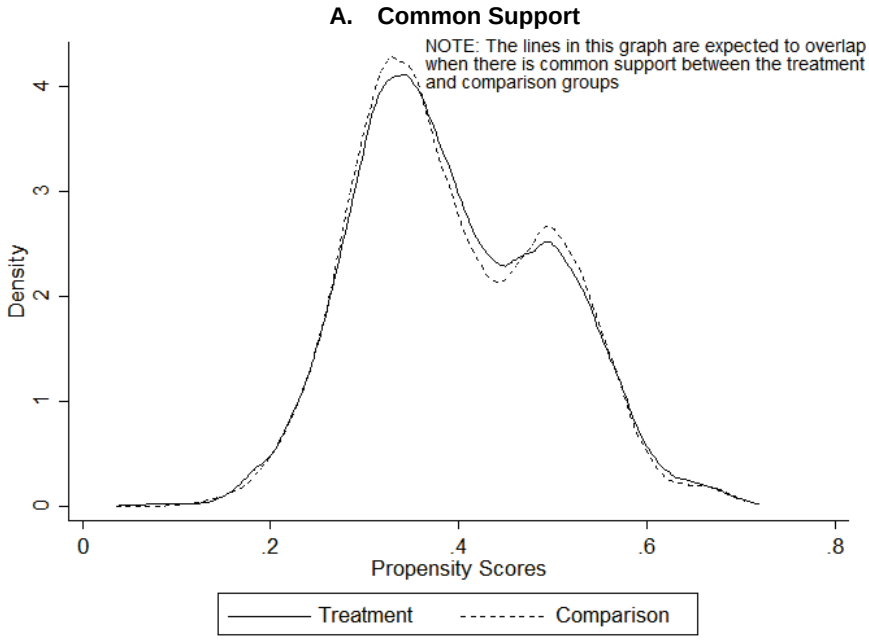
[313]The clinical criteria for myocardial infarction are elevated troponin and catheterization defined by at least a 50 percent stenosis of one lesion.
[314]We exclude approximately 5 percent of patient-episodes present in the finder file.
[315]University of Pittsburgh Medical Center Presbyterian Shadyside, PA; Abington Memorial Hospital, PA; Main Line Hospital Bryn Mawr Campus, PA; and Thomas Jefferson University Hospital, PA.
[316]We considered the following hospital characteristics: geographic region, population density, teaching status, ownership type, number of beds, target diagnosis/procedure volume, demographics of hospital population, and availability of cardiothoracic surgery and cardiac catheterization.

differences in covariates across Christiana and comparison group patient-episodes included in our propensity score models. For more details on comparison group selection and SMR weighting, please see Technical Appendix A above.

Exhibit S1.2 summarizes results after we incorporate SMR weights into our analysis. Panel A shows the similarities between the treatment and comparison groups after SMR weighting, and panel B shows the distribution of covariates before and after weighting.

- After weighting, we observe a high level of overlap in distribution of estimated propensity scores across Christiana and comparison group patient-episodes (panel A).
- On the balance chart (panel B), we show that weighting achieved balance (i.e., reduced the difference between Christiana and comparison patient-episodes to <10% standardized difference) with respect to demographic characteristics, comorbidity, and severity of hospitalization for CABG and PTCA. This includes major complications or comorbidities and severity of procedures for inpatient CABG (e.g., one or more arteries) and PTCA (e.g., drug-eluting or non-drug-eluting stent).

Exhibit S1.2: Common Support and Covariate Balance for Christiana and Comparison Patient-Episodes



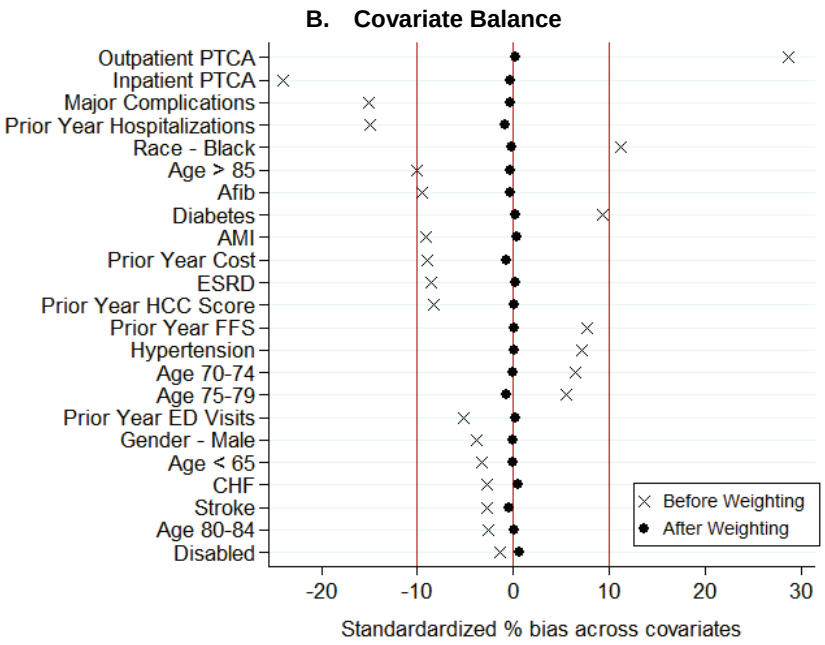


Exhibit S1.3 summarizes demographic and other basic information about the treatment and comparison patients with episodes included in our analysis of core outcome measures.[317] Relative to Christiana episodes, comparison patients with post-intervention episodes were more likely to be older (≥85 years) and White; to have higher morbidity, hospital utilization, and cost of care at baseline; less likely to have outpatient PTCA; and more likely to be discharged to a skilled nursing facility (SNF) after hospitalization.[318] We used propensity score weighting to adjust for these observable differences.

Exhibit S1.3: Descriptive Characteristics of Patients with Episodes in Christiana and Comparison Group[319]

Variable	Pre-intervention Christiana	Pre-intervention Comparison	Post-intervention Christiana	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Number of Patient-Episodes	1,923	3,015	1,525	2,950
Age Group* **				
<65 years old	12.8% (246)	14.9% (449)	12.1% (185)	12.3% (363)
65–69 years old	23.3% (448)	23.4% (706)	24.9% (379)	24.1% (710)
70–74 years old	21.3% (410)	18.7% (564)	24.1% (368)	21.2% (624)
75–79 years old	20.0% (385)	16.4% (495)	16.9% (258)	16.6% (491)
80–84 years old	13.9% (268)	15.8% (475)	14.3% (218)	14.2% (420)
≥85 years old	8.6% (166)	10.8% (326)	7.7% (117)	11.6% (342)
Race/Ethnicity* **				
White	85.2% (1,639)	89.3% (2,691)	84.1% (1,282)	87.5% (2,580)

[317]Cost of the index hospital episode is not included in the total cost of care core outcome measure.

[318]Place of discharge was excluded from propensity models but was adjusted for difference-in-differences (DID) regression models because the Bridges intervention may influence discharge disposition.

[319]Descriptive statistics are based on findings prior to propensity score weighting.

Variable	Pre-intervention Christiana	Pre-intervention Comparison	Post-intervention Christiana	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Black	11.5% (221)	8.2% (247)	12.4% (189)	8.8% (261)
Hispanic	0.5% (10)	0.2% (5)	0.4% (6)	0.0% (1)
Other	2.8% (53)	2.4% (72)	3.1% (48)	3.7% (108)
Gender				
Female	35.4% (680)	33.4% (1,008)	35.0% (534)	33.4% (985)
Comorbidities: Hierarchical Condition Categories (HCCs)				
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)
Utilization Year Prior to Index Hospitalizations				
No. Hospitalizations/Year***	0.7 (1.5)	0.9 (1.5)	0.5 (1.2)	0.7 (1.3)
No. ED Visits/Year	0.6 (1.6)	0.7 (1.7)	0.7 (1.8)	0.7 (2.0)
Prior-Year Cost***	$16,782 ($30,681)	$19,116 ($31,730)	$14,999 ($26,405)	$18,306 ($32,640)
Coverage Reason				
Old Age	77.3% (1,487)	75.0% (2,262)	77.5% (1,182)	77.7% (2,293)
Disability	21.1% (405)	21.9% (660)	21.1% (322)	19.9% (586)
ESRD	0.6% (11)	1.2% (37)	0.5% (8)	0.8% (25)
Disability and ESRD	1.0% (20)	1.9% (56)	0.9% (13)	1.6% (46)
Discharges* **				
Home	64.8% (1,247)	61.5% (1,854)	61.5% (938)	59.8% (1,763)
SNF	9.4% (181)	14.1% (424)	10.5% (160)	13.2% (390)
HHA	23.1% (444)	19.6% (591)	25.4% (388)	22.1% (652)
Hospice	0.4% (8)	0.3% (8)	0.5% (8)	0.4% (13)
Other	2.2% (43)	4.6% (138)	2.0% (31)	4.5% (132)
Disease Composition				
Inpatient PTCA***	50.0% (961)	61.6% (1,856)	47.0% (717)	59.5% (1,754)
Outpatient PTCA***	25.9% (498)	13.3% (401)	27.0% (411)	16.4% (485)
Inpatient CABG	24.1% (464)	25.1% (758)	26.0% (397)	24.1% (711)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance assessed using Chi-squared tests for proportions and t-tests for continuous variables, comparing characteristics of patient-episodes at Christiana and the comparison group during the post-intervention period. CABG, coronary artery bypass graft; ESRD, end-stage renal disease; HHA, home health aide; PTCA, percutaneous transluminal angioplasty; SNF, skilled nursing facility

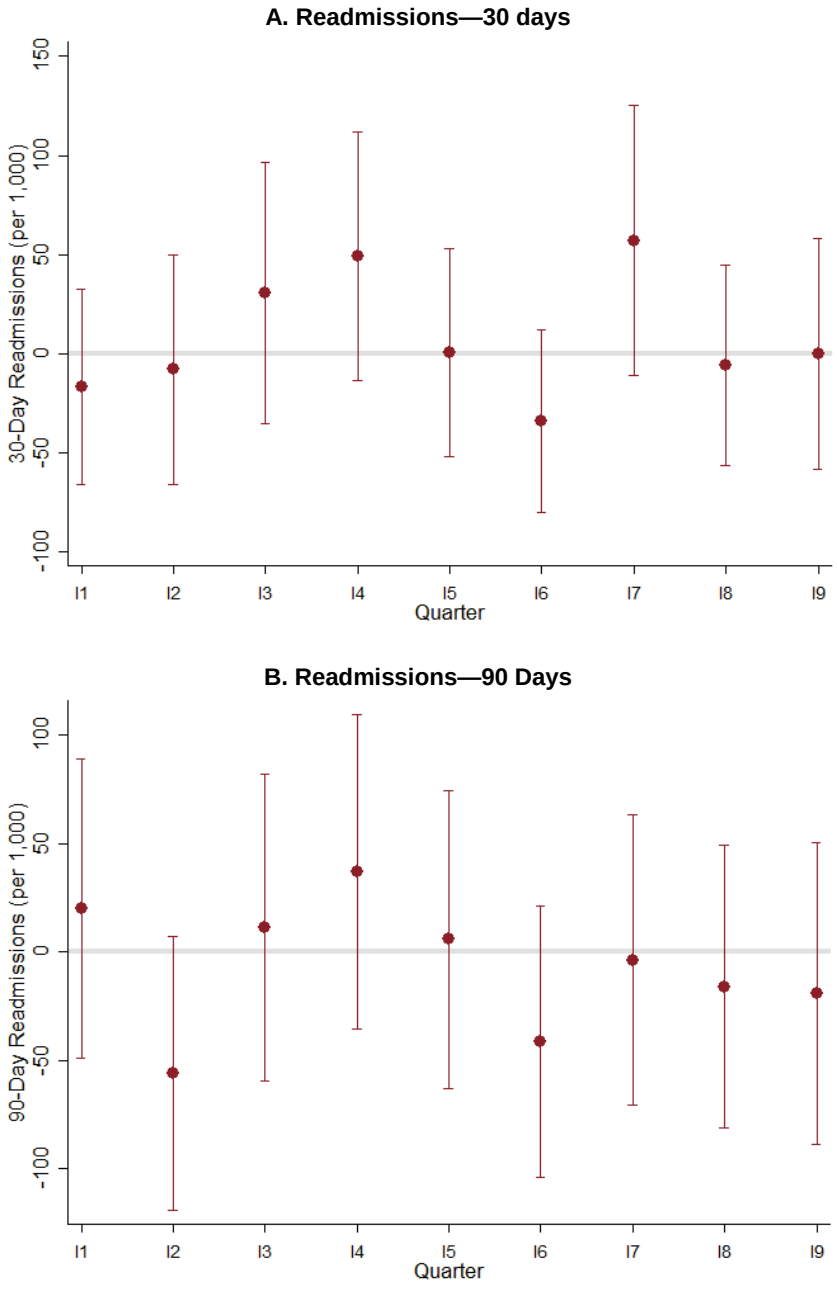
Quarter-specific program impact. Exhibit S1.4 summarizes the results of QFE DID models as the adjusted marginal effect of Christiana's Bridges intervention on readmissions, ED visits, total cost of care, and repeat revascularizations or acute myocardial infarction (AMI) in each post-intervention quarter.[320] We present readmissions at 30, 90, and 180 days post-discharge; and ED visits, total cost of care, and repeat revascularizations or AMI at 90 and 180 days post-discharge.

- For readmission, ED visit, and total cost of care measures, there are no consistent trends toward increased or decreased utilization or spending for patient-episodes in the Christiana program relative to the comparison group.

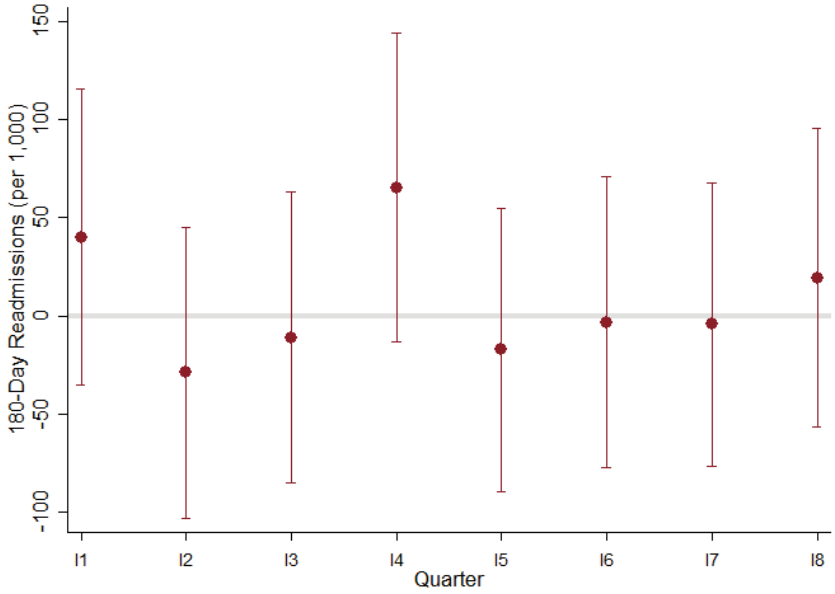
[320]The ED visits measures include ED visits as well as observation stays not resulting in a short-term inpatient hospitalizations.

- Relative to the comparison group, we observe a decreasing trend in patient-episodes with 180-day repeat revascularization or AMI in quarters I6-I8.

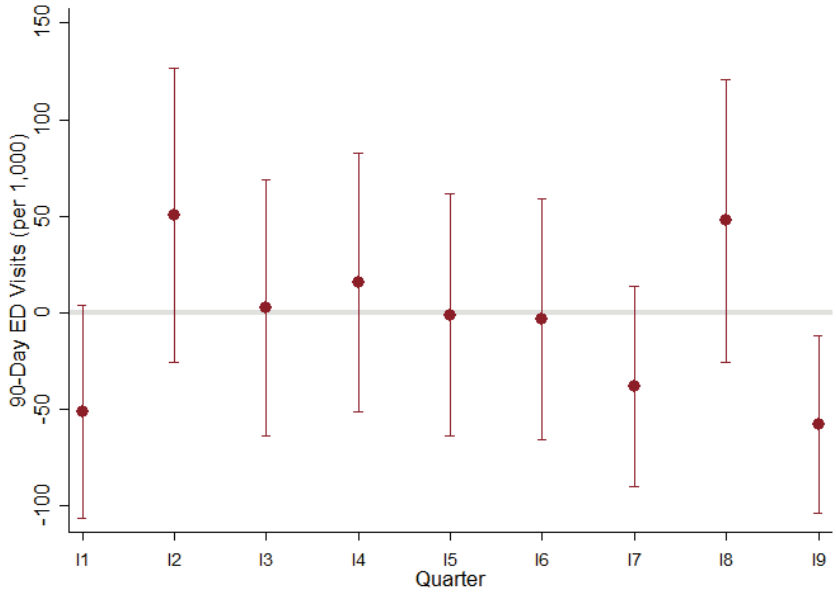
Exhibit S1.4: Adjusted Rates for Core Measures for Christiana by Quarter



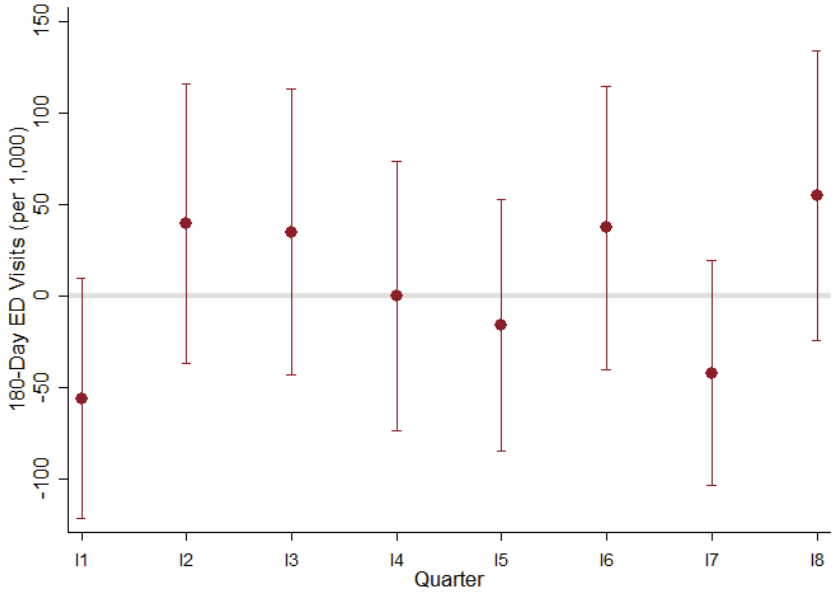
C. Readmissions—180 Days



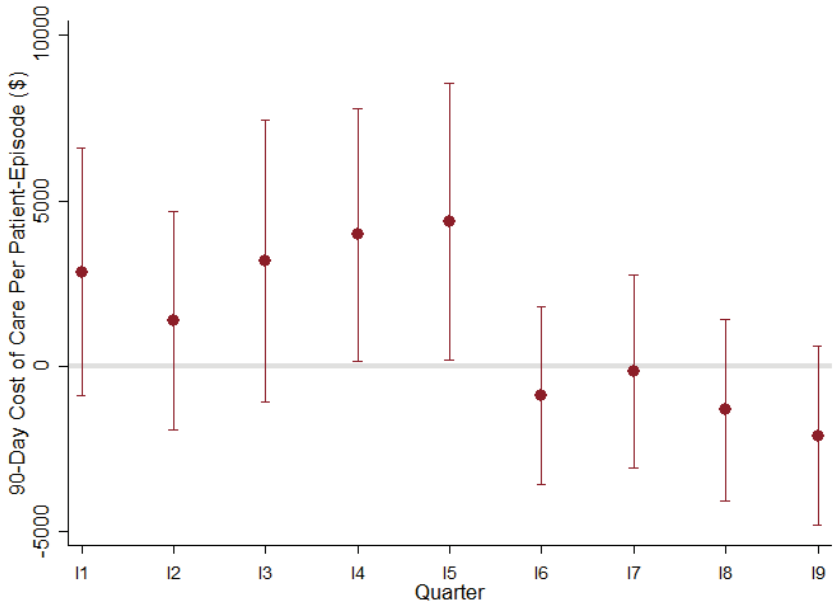
D. ED Visits—90 Days



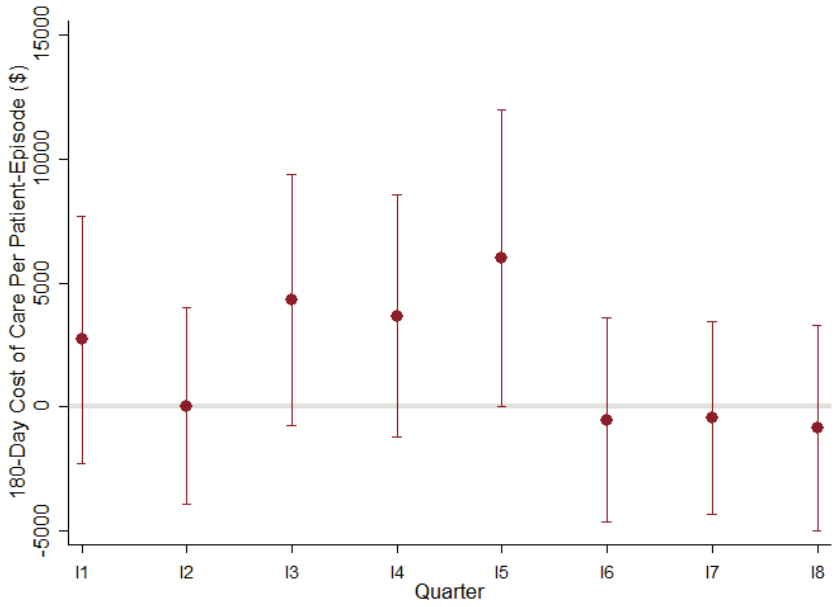
E. ED Visits—180 Days



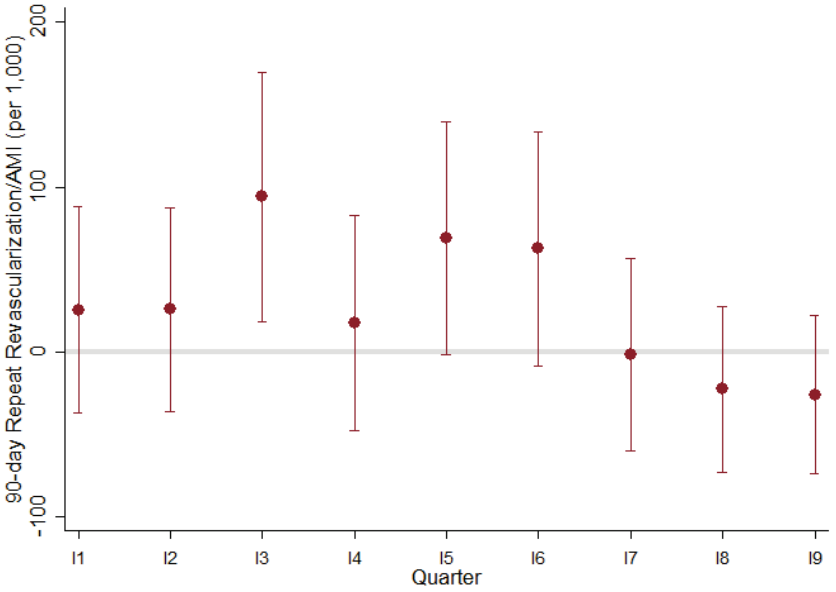
F. Total Cost of Care—90 Days

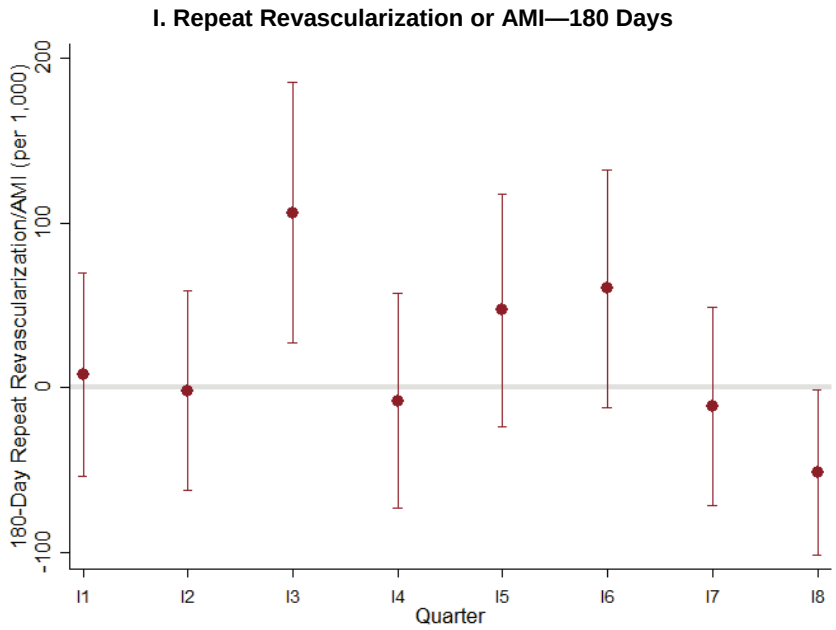


G. Total Cost of Care—180 days



H. Repeat Revascularization or AMI—90 Days





Second Year Analysis

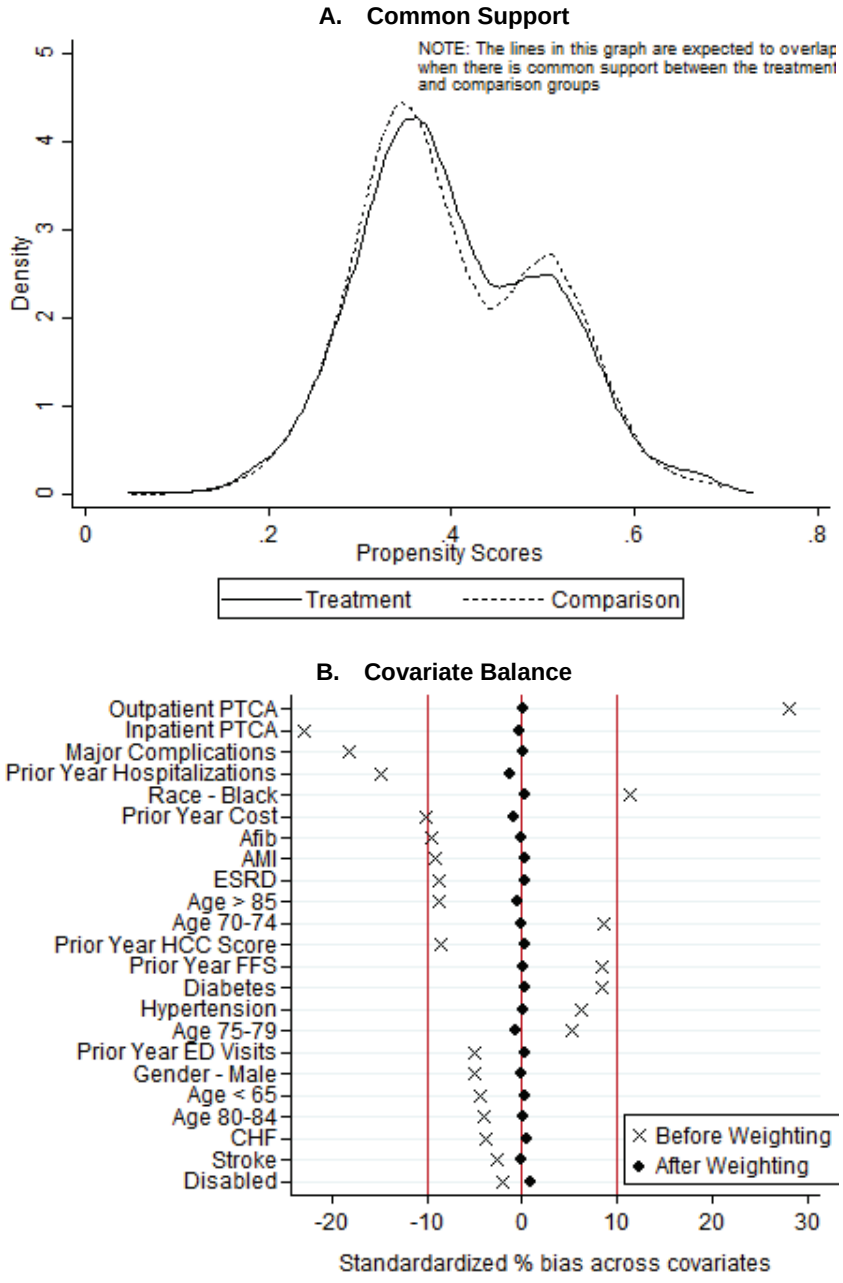
Comparison group selection. To examine the impact of the Christiana Bridges intervention after a yearlong "ramp-up" period, we selected a subgroup of fully implemented Christiana and comparison group patient-episodes starting in year two of implementation (beginning April 1, 2014). We run propensity score models to produce SMR weights. We then incorporate SMR weights into our analysis to minimize observed differences in covariates across Christiana and comparison group patient-episodes for this fully implemented subgroup. For more details on comparison group selection and SMR weighting, please see Technical Appendix A above.

Exhibit S1.5 summarizes results after we incorporate SMR weights into our analysis. Panel A shows the similarities between the treatment and comparison groups after SMR weighting, and panel B shows the distribution of covariates before and after weighting.

- After weighting, we observe a high level of overlap in distribution of estimated propensity scores across Christiana and comparison group patient-episodes (panel A).
- On the balance chart (panel B), we show that the standardized difference between Christiana and comparison patient-episodes across all covariates was negligible after incorporating propensity score weighting.

Results from this subgroup analysis are available in the main awardee chapter.

Exhibit S1.5: Common Support and Covariate Balance for Fully Implemented Christiana and Comparison Patient-Episodes



Duke University's Southeastern Diabetes Initiative

High-Risk Intervention Analysis

To understand which subgroups are more or less likely to benefit from participation, we built multivariate regression models, which included measures for demographic characteristics, improvement from baseline through follow-up visit, and site. We used a population-averaged model that adjusts for correlation within person over time.

Exhibit S2.1 summarizes demographic and other characteristics of this group. We observe an even split by gender, and most high-risk program participants were less than 65 years of age. Although not reflected in the below table, the racial and ethnic characteristics of the participants varied considerably across sites.

Exhibit S2.1: Descriptive Characteristics of SEDI High-Risk Intervention Participants

Variable	% (N)
Number of Patients	537
Gender	
Female	54.8% (294)
Male	45.3% (243)
Age Group	
<65 years old	69.3% (372)
≥65 years old	30.7% (165)
Race/Ethnicity	
White	48.2% (259)
Black	45.8% (246)
Hispanic	4.3% (23)
Other/Unknown	1.7% (9)
Insurance Status	
Medicare Only	31.8% (171)
Medicaid Only	19.7% (106)
Dual Medicare/Medicaid	19.4% (104)
Neither Medicare/Medicaid	8.0% (43)
Unknown	21.0% (113)
Site	
Cabarrus, NC	26.6% (143)
Durham, NC	37.2% (200)
Mingo, WV	30.2% (162)
Quitman, MS	6.0% (32)

Exhibit S2.2 summarizes the results for time since baseline. From these analyses, we observe:

- Significant improvements in diabetes care profile (DCP) and HbA1c were sustained over the 24-month follow-up period, with HbA1c scores showing improvement in later follow-ups. The DCP

measure is reported for all participants, whereas the HbA1c measure is reported only for participants scoring >8% at baseline.

- Medication adherence, as measured by participants' Morisky Medication Adherence Scale (MMAS-8) scores, significantly declined when measured at the six-month follow-up and continued to decline in subsequent follow-up visits.
- Outcomes for the Cabarrus site were better than for all three other sites with respect to five of the seven measures.[321]

Exhibit S2.2: Change in SEDI Outcomes over the Duration of the High-Risk Intervention

Outcomes	GMH (higher is better)	GPH (higher is better)	PAM (higher is better)	MMAS-8 (higher is better)	PHQ-2 (lower is better)	DCP (higher is better)	HbA1c among Enrollees at >8.0 at Baseline (lower is better)
Scale	**4–20**	**4–20**	**0–100**	**0–8**	**0–6**	**1–5**	**0-16**
Time of Measurement, from Baseline							
Six-month	0.20 [-0.06, 0.46]	0.20 [-0.03, 0.44]	1.08 [-0.07, 2.23]	0.31*** [0.17, 0.45]	0.04 [-0.34, 0.42]	0.28*** [0.22, 0.34]	-1.54*** [-1.77, -1.31]
12-month	0.41* [0.12, 0.70]	0.32* [0.06, 0.58]	0.92 [-0.37, 2.20]	0.46*** [0.29, 0.62]	-0.03 [-0.42, 0.37]	0.32*** [0.25, 0.39]	-1.65*** [-1.90, -1.40]
18-month	0.26 [-0.11, 0.62]	0.20 [-0.12, 0.53]	0.99 [-0.59, 2.57]	0.67*** [0.47, 0.88]	-0.31 [-0.73, 0.12]	0.33*** [0.24, 0.42]	-1.90*** [-2.20, -1.60]
24-month	0.05 [-0.44, 0.54]	0.37 [-0.06, 0.80]	2.10* [0.02, 4.18]	0.77*** [0.49, 1.04]	0.06 [-0.41, 0.53]	0.47*** [0.35, 0.59]	-1.77*** [-2.19, -1.36]

NOTE: *p<0.10, **p<0.05, ***p<0.01

Exhibit S2.3 summarizes the multivariate regression results for demographic characteristics:

- Participants >65 years of age were less likely to see improvements in patient activation but reported higher levels of overall mental and physical health.
- Female participants reported lower levels of overall mental and physical health, lower confidence in their ability to manage their diabetes, and greater indicators of depressed mood.

Exhibit S2.3: SEDI Factors Associated with Improved Outcomes for the High-Risk Intervention

Outcomes	GMH (higher is better)	GPH (higher is better)	PAM (higher is better)	MMAS-8 (lower is better)	PHQ-2 (lower is better)	DCP (higher is better)	HbA1c among Enrollees at >8.0 at Baseline (lower is better)
Scale	**4–20**	**4–20**	**0–100**	**0–8**	**0–6**	**1–5**	**0–16**
Gender (ref = male)							
Female	-0.60* [-1.00, -0.20]	-0.96*** [-1.37, -0.56]	0.90 [-0.48, 2.28]	-0.14 [-0.34, 0.05]	0.48*** [0.24, 0.72]	-0.29*** [-0.37, -0.21]	0.16 [-0.12, 0.45]
Age (ref = ≥65 years)							

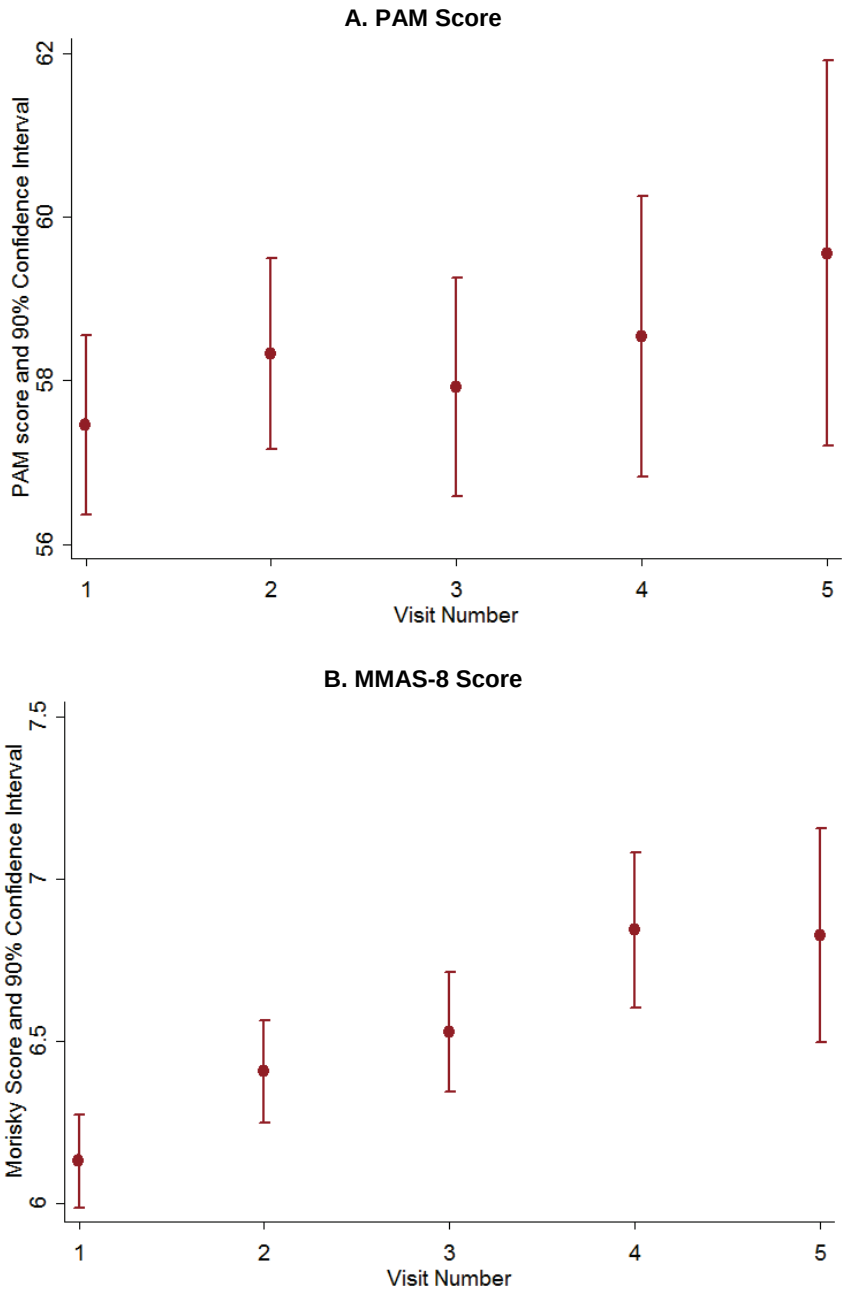
[321]Estimates for the Quitman site should be interpreted with caution due to the small number of patients included in the analysis (n = 31, 6.3% of all participants).

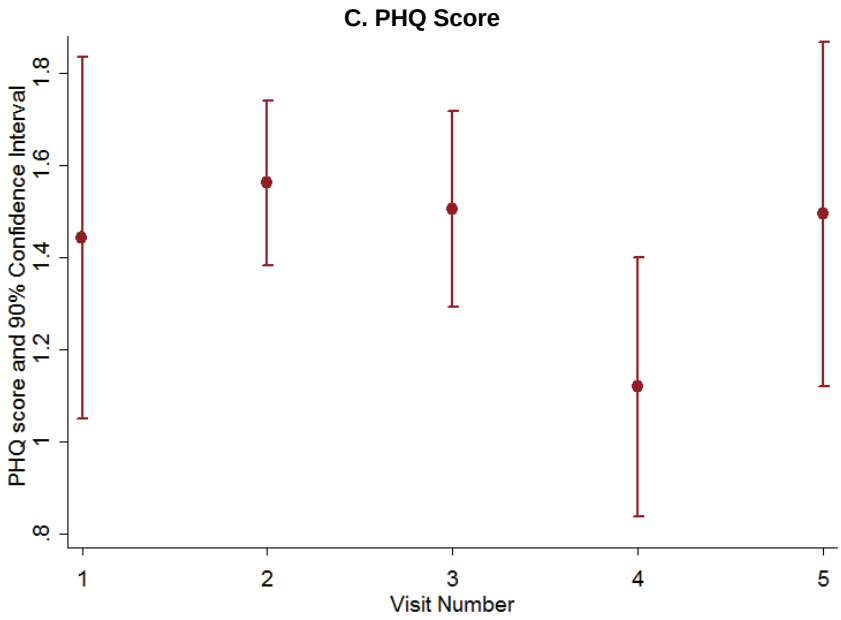
Outcomes	GMH (higher is better)	GPH (higher is better)	PAM (higher is better)	MMAS-8 (lower is better)	PHQ-2 (lower is better)	DCP (higher is better)	HbA1c among Enrollees at >8.0 at Baseline (lower is better)
<65 Years	-0.53* [-1.06, -0.00]	-1.23*** [-1.75, -0.70]	3.38 [1.59, 5.17]	-0.37* [-0.63, -0.12]	0.41* [0.11, 0.72]	-0.13* [-0.23, -0.02]	0.54* [0.17, 0.91]
Race/Ethnicity (ref = White)							
Black	0.99** [0.41, 1.57]	1.09** [0.50, 1.67]	0.96 [-1.04, 2.96]	0.17 [-0.12, 0.46]	-0.42* [-0.78, -0.07]	0.15* [0.03, 0.27]	0.14 [-0.31, 0.58]
Hispanic/ Latino	1.86** [0.79, 2.94]	1.61* [0.53, 2.69]	-4.16* [-7.85, -0.47]	0.57* [0.03, 1.11]	-0.19 [-0.83, 0.46]	0.28* [0.06, 0.05]	0.68 [-0.20, 1.57]
Insurance Status (ref = Medicaid only)							
Medicare Only	1.61*** [0.96, 2.25]	1.46*** [0.81, 2.10]	3.71** [1.53, 5.89]	0.26 [-0.05, 0.57]	-0.43 [-0.80, 0.46]	0.17* [0.04, 0.30]	-0.22 [-0.66, 0.22]
Duals	0.46 [-0.20, 1.13]	0.33 [-0.34, 0.99]	2.22 [-0.03, 4.47]	0.40* [0.07, 0.73]	-0.53* [-0.92, -0.13]	0.15* [0.02, 0.29]	-0.09 [-0.57, 0.38]
Neither	1.87*** [1.03, 2.72]	1.85*** [0.99, 2.70]	3.24* [0.26, 6.22]	0.09 [-0.33, 0.52]	-0.63* [-1.15, -0.12]	0.22* [0.05, 0.39]	0.42 [-0.18, 1.02]
Unknown	0.45 [-0.20, 1.10]	0.90* [0.25, 1.56]	0.52 [-1.74, 2.77]	0.20 [-0.12, 0.53]	0.06 [-0.33, 0.45]	0.08 [-0.05, 0.21]	0.27 [-0.18, 0.71]
Site (ref = Cabarrus)							
Durham	-2.34*** [-2.92, -1.77]	-1.82*** [-2.40, -1.24]	-1.63 [-3.64, 0.38]	-0.31* [-0.60, -0.03]	0.1 [-0.25, 0.45]	-0.35*** [-0.46, -0.23]	0.35 [-0.09, 0.80]
Mingo	-2.45*** [-3.02, -1.87]	-1.85*** [-2.43, -1.27]	-6.87*** [-8.89, -4.85]	-0.98*** [-1.27, -0.69]	0.68** [0.32, 1.04]	-0.55*** [-0.66, -0.43]	-0.61* [-1.03, -0.18]
Quitman	-2.24*** [-3.21, -1.26]	-2.20*** [-3.16, -1.25]	-4.28* [-7.49, -1.06]	0.14 [-0.32, 0.60]	0.54 [-0.02, 1.11]	-0.1 [-0.29, 0.08]	0.09 [-0.82, 1.01]

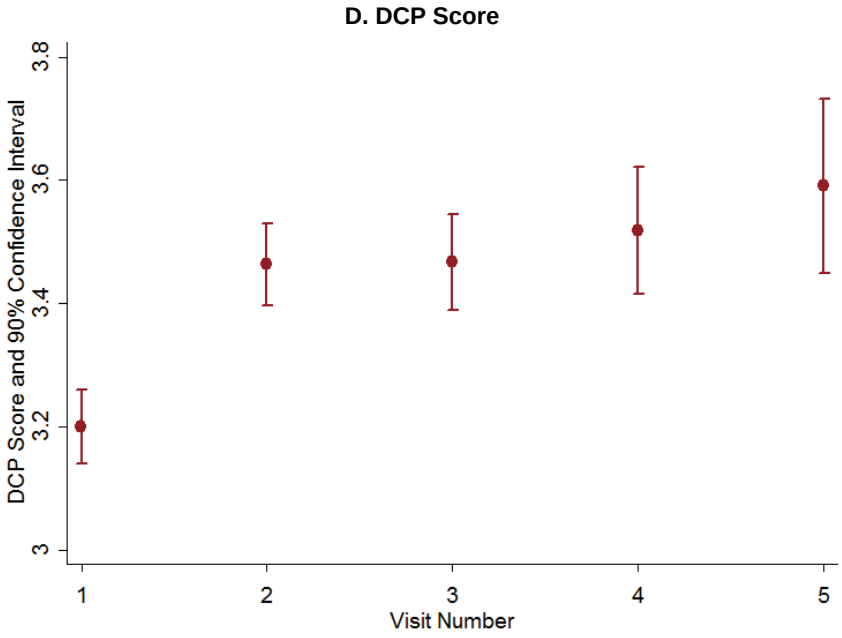
NOTE: *p<0.10, **p<0.05, ***p<0.01. Estimates for the Quitman site should be interpreted with caution due to the small number of patients included in the analysis (n = 31, 6.3% of all participants).

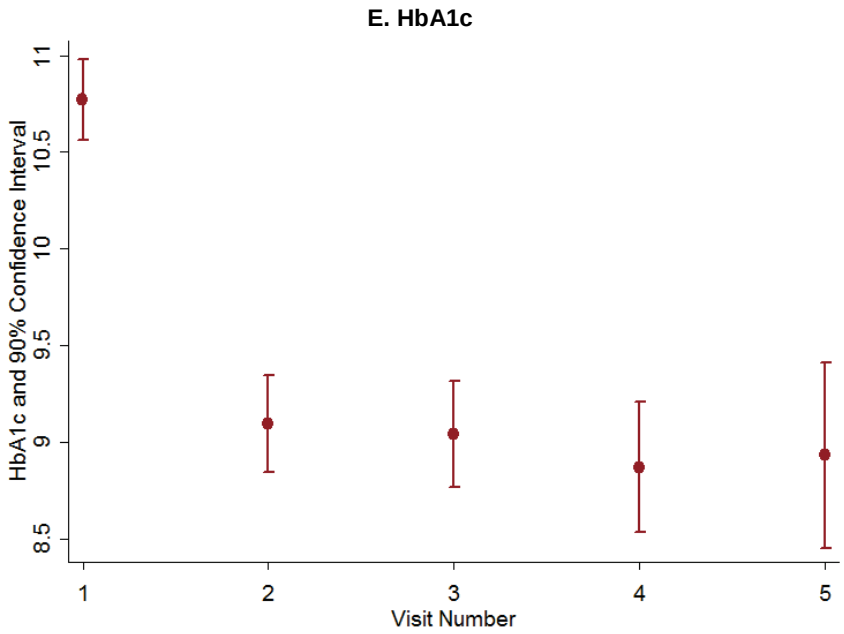
Outcomes over time. Exhibit S2.4 illustrates the changes in each measure relative to baseline (denoted visit number 1 in the charts), including both an estimate and the 90% confidence interval (CI). The significant and persistent improvements in DCP and HbA1c are clearly visible, as is the decrease in medication adherence measured by MMAS-8 scores.

Exhibit S2.4: SEDI Improvement in Program Outcomes over Time




C. PHQ Score
PHQ score and 90% Confidence Interval
.8
1
1.2
1.4
1.6
1.8
1
2
3
4
5
Visit Number


D. DCP Score
DCP Score and 90% Confidence Interval
3
3.2
3.4
3.6
3.8
1
2
3
4
5
Visit Number



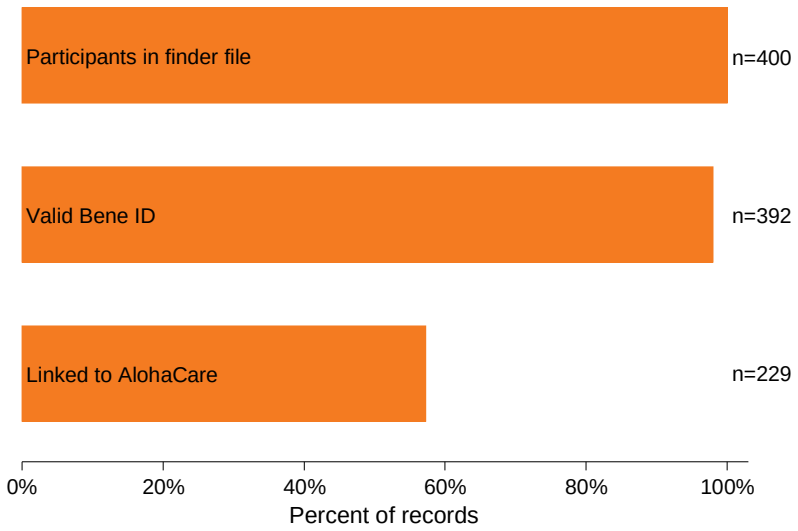
NOTE: Visit 1 represents the baseline value of each measure, with subsequent visits corresponding to 6-month, 12-month, 18-month, and 24-month follow-ups.

FirstVitals Health and Wellness, Inc.

Treatment and Comparison Group Creation

- We restricted our treatment group to Medicaid participants who were enrolled in FirstVitals' program for one or more quarters, from February 1, 2013, through March 5, 2015.[322] For all of the analyses, we used data provided by the FirstVitals team, a finder file listing program participants, and AlohaCare claims records for both participants and a comparison group.
- We worked with FirstVitals' finder file, which lists participants and their enrollment dates, to identify Medicaid claims from AlohaCare data for individuals in our treatment group (please see Exhibit S3.1).[323] Of the 400 participants who were ever enrolled in the intervention, 57 percent (229 participants) had at least one claim during the intervention period. These 229 individuals comprised the intervention group for our analysis.[324]
- The AlohaCare claims file included a pool of potential comparison patients. Comparison patients were AlohaCare enrollees who were not enrolled in the intervention. Comparison patients had a diagnosis of diabetes, an assigned primary care provider, and at least one claim during the observation period. After applying these criteria, we had a pool of 2,213 potential comparison patients.

Exhibit S3.1: Patients Identified through FirstVitals Finder File



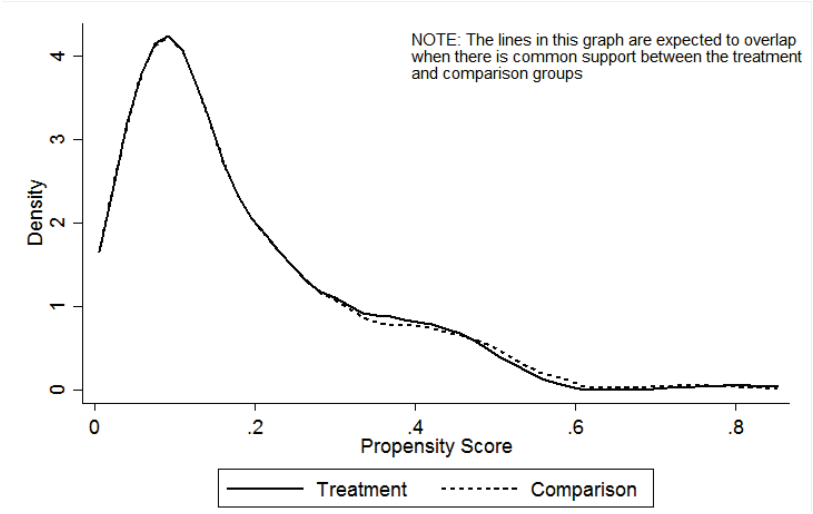
[322]Data was lost for 80 participants because of a change in plan coverage.
[323]Both the finder file and AlohaCare claims were provided by FirstVitals.
[324]Where no claims were found for intervention or comparison patients, we assumed that they had no health care encounters that were billed to AlohaCare. This could be because patients (1) did not see a health care provider, (2) had another source of health insurance, or (3) were not enrolled in AlohaCare. For the intervention group in particular, we know from our qualitative findings that a large number of patients were disenrolled from the intervention after an unexpected change in AlohaCare's eligibility rules.

Comparison group selection. We used propensity score models to match intervention to comparison patients with respect to demographics, comorbidities, and prior utilization. For more details on comparison group selection and matching, please see Technical Appendix A above. Exhibit S3.2 summarizes the results from our propensity score matching. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B displays the distribution of covariates before and after matching.

- After matching, we observed that the two groups had nearly identical distributions of propensity scores, suggesting that—at least with respect to the factors included in the propensity model—these groups are well matched.
- The balance chart (panel A) shows that matching has achieved balance (i.e., reduced the difference between FirstVitals participants and comparison patients to <10% standardized bias) with respect to all of the demographic, comorbidity, and prior-year utilization covariates.

Exhibit S3.2: Common Support and Covariate Balance for FirstVitals and Comparison Patients

A. Common Support



B. Covariate Balance

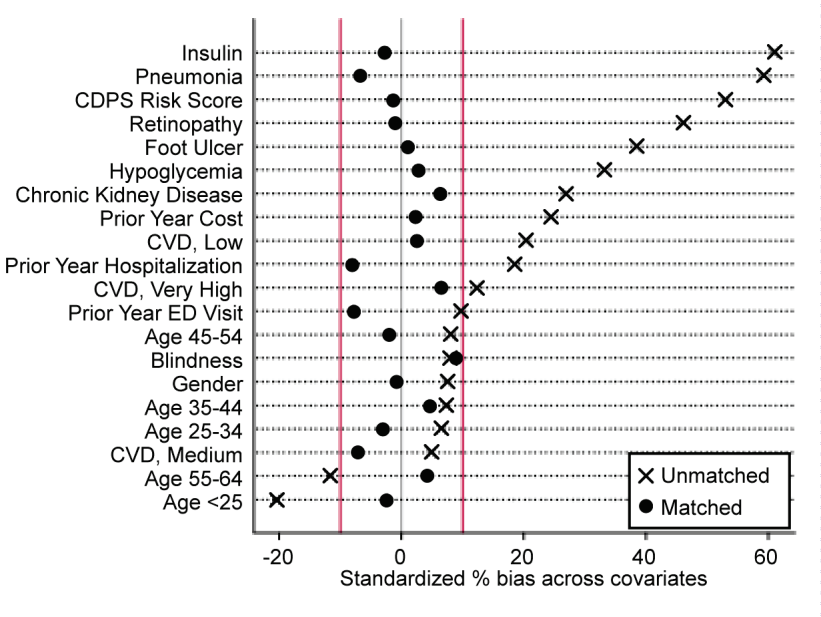


Exhibit S3.3 summarizes demographic and other basic information about the treatment and comparison patients who were included in our analysis of core outcome measures. Because information on race and ethnicity was incomplete in the AlohaCare claims, we could not adjust for differences between the intervention and comparison groups with respect to these potentially important confounding factors.[325] After matching, we observed no significant difference between participants at FirstVitals and comparison patients with respect to other demographic characteristics, comorbidities, or prior utilization.

Exhibit S3.3: Descriptive Characteristics of FirstVitals and Matched Comparison Patients

Variable	FirstVitals	Comparison
	% (N)	% (N)
Number of Patients	229	229
Mean Number of Quarters Enrolled (SD)	3.9 (2.0)	3.9 (2.0)
Gender		
Female	55.5% (127)	55.9% (128)
Age Group		
<35 years old	10.9% (25)	11.8% (27)
35-44 years old	23.1% (53)	24.5% (56)
45-54 years old	34.9% (80)	32.8% (75)
55-64 years old	27.5% (63)	28.4% (65)
≥65 years old	3.5% (8)	2.6% (6)
Comorbidities		
Mean CDPS Risk Score (SD)	3.2 (1.8)	3.2 (2.2)
Foot Ulcers	31.4% (72)	31.0% (71)
Retinopathy	38.0% (87)	38.4% (88)

[325]Although FirstVitals provided a file with available information on race and ethnicity from the treatment and comparison groups, the variable was missing for most of the comparison patients and we were not able to include this variable in the analysis.

Variable	FirstVitals	Comparison
	% (N)	% (N)
Chronic Kidney Disease	28.4% (65)	25.8% (59)
Pneumonia	45.9% (105)	48.9% (112)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Hospitalizations per 1,000 Patients (SD)	283 (683)	362 (920)
ED Visits per 1,000 Patients (SD)	943 (1,824)	1,087 (2,111)
Medicaid Cost ($)	$7,943 ($15,599)	$7,622 ($17,259)

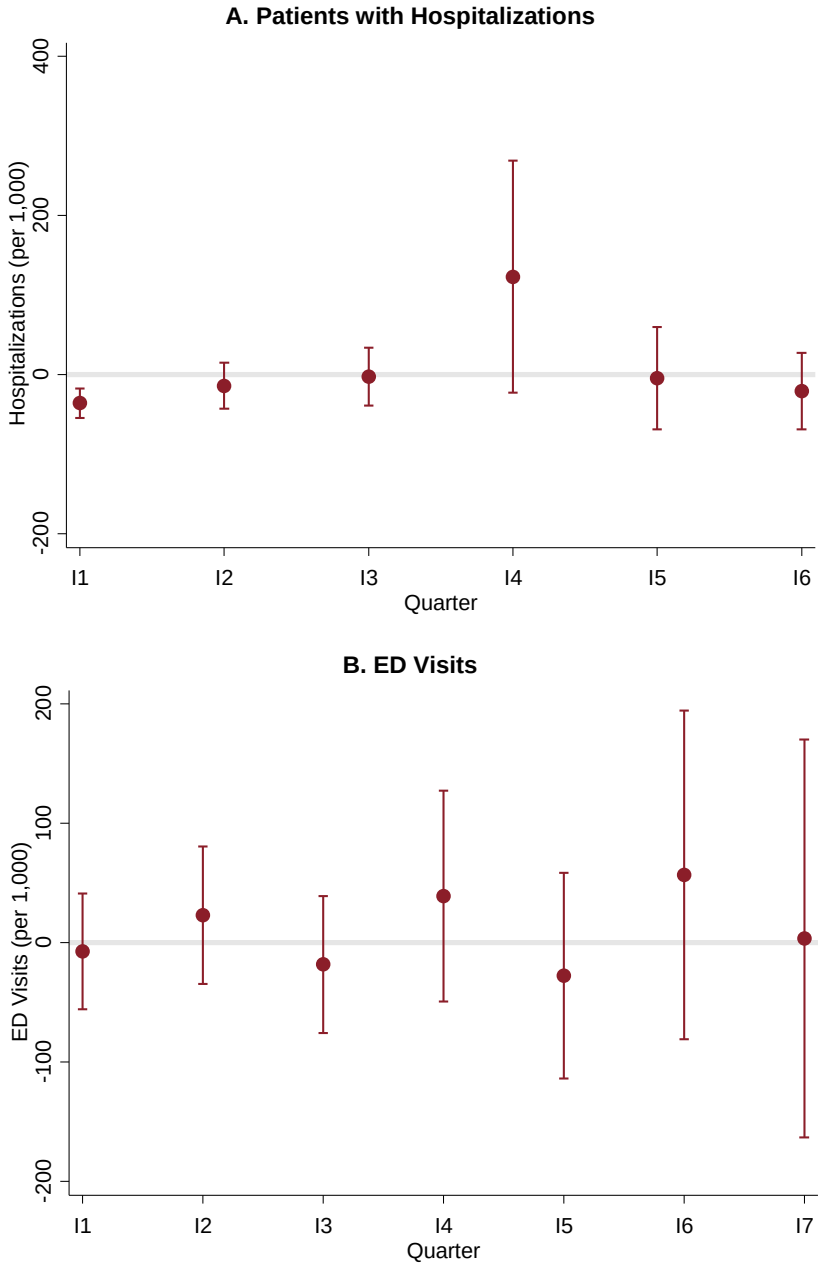
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. CDPS, chronic disease and disability payment system (diagnostic classification system that Medicaid programs can use to make health-based capitated payments for certain Medicaid beneficiaries); CVD, cardiovascular disease; ED, emergency department; SD, standard deviation.

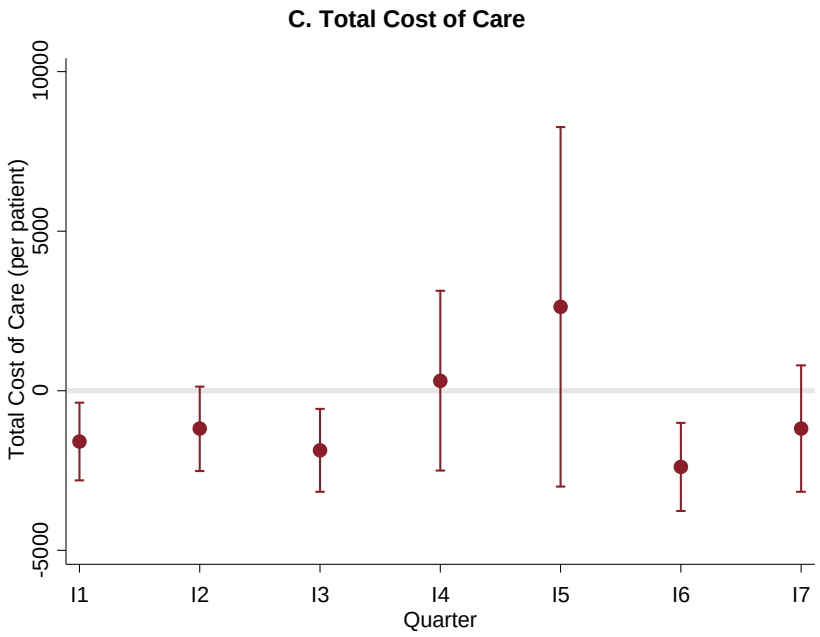
Quarter-specific program impact. Exhibit S3.4 presents the results of the QFE DID models as the adjusted marginal effect of the FirstVitals intervention on hospitalizations, ED visits, and total cost of care.[326] The effect is displayed as the average difference between treatment and comparison per 1,000 patients (and 90% confidence interval [CI]) for each quarter during the post-intervention period (I1–I7).[327] Total cost of care is expressed per patient.

- For hospitalizations, there are no consistent trends toward increased or decreased utilization for participants in the FirstVitals program relative to the comparison group. However, we observe a significant decrease in hospitalizations in the first post-intervention quarter. We observe no trends regarding ED visits.
- For total cost of care, we observe a significant decrease for FirstVitals participants relative to the comparison group for three of the seven post-intervention quarters (I1, I3, and I6).

[326]Adjustment factors include age, gender, CDPS risk score, months enrolled in AlohaCare, and gaps in Medicaid coverage in prior year.
[327]There were too few 30-day readmissions (no more than five) and ED visits (no more than seven) in each quarter to calculate QFE. We present overall DID estimates for these measures in the awardee chapter.

Exhibit S3.4: Adjusted Utilization Rates for Core Outcome Measures for FirstVitals by Quarter



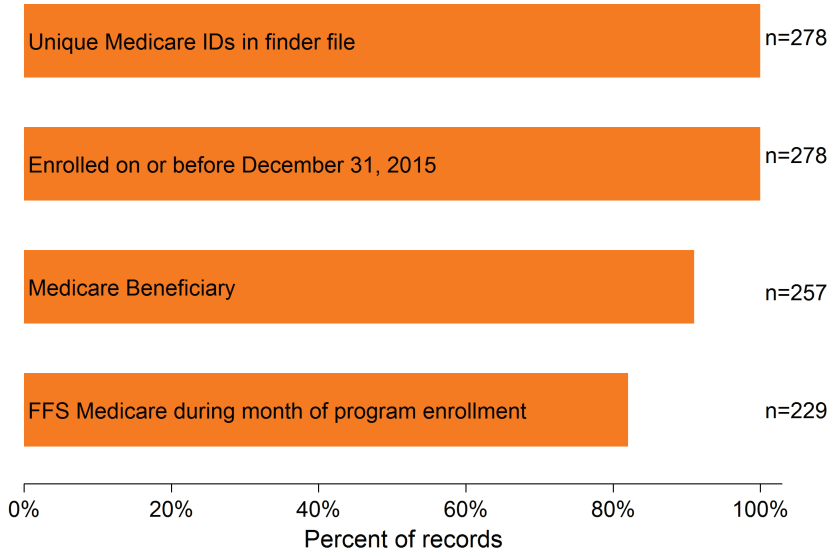

C. Total Cost of Care
Total Cost of Care (per patient)
10000
5000
0
-5000
I1
I2
I3
I4
I5
I6
I7
Quarter

The George Washington University

Treatment and Comparison Group Creation

- We worked with GWU's finder file of participants and enrollment dates to identify FFS Medicare claims for individuals in our treatment group (please see Exhibit S4.1).
- We restricted our treatment group to Medicare FFS participants who were enrolled in GWU's program for one or more quarters, from July 1, 2012, through June 30, 2015, which is the last enrollment date provided in the finder file.
- To identify a pool of comparison patients, we selected FFS beneficiaries with a diagnosis of 585.6 (end-stage renal disease [ESRD]) who were seen at the same DaVita clinics as the treatment group.

Exhibit S4.1: Patients Identified through GWU Finder File



Comparison group selection. We used propensity score models to select comparison patients who had ESRD and characteristics similar to GWU participants with respect to demographics, comorbidities, and prior utilization. Exhibit S4.2 summarizes the results from our propensity score–based comparison selection. Panel A shows the common support between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

- After matching, we observed that treatment and comparison groups had nearly identical distributions of propensity scores, suggesting that these groups are well matched—at least with respect to the included factors.
- The balance chart (panel A) shows that matching has achieved balance (i.e., reduced the difference between GWU participants and comparison group participants to <10% standardized bias) with respect to demographic characteristics, comorbidities, and prior-year utilization and costs.

Exhibit S4.2: Common Support and Covariate Balance for GWU and Comparison Participants

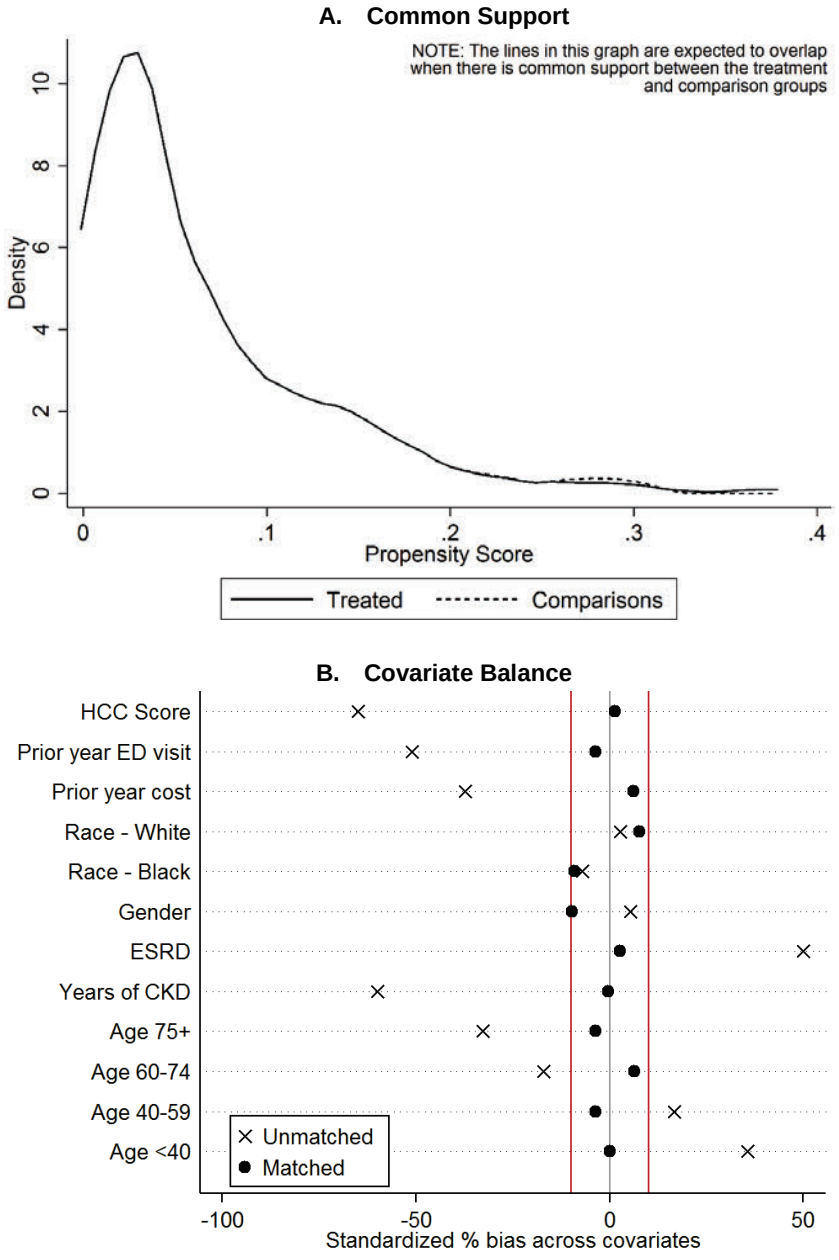


Exhibit S4.3 summarizes demographic and other basic information about the treatment and comparison patients who are included in our analysis of core outcome measures. GWU patients were less likely to be dually eligible than comparison patients. We used covariate adjustment in the regression models to adjust for these observable differences.

Exhibit S4.3: Descriptive Characteristics of GWU and Matched Comparison Patients

Variable	GWU	Comparison
	% (N)	% (N)
Number of Patients	229	229
Age Group		
<40 years old	18.8% (43)	18.8% (43)
40-59 years old	40.2% (92)	41.9% (96)
60-74 years old	31.9% (73)	28.8% (66)
≥75 years old	9.2% (21)	10.5% (24)
Race/Ethnicity		
White	28.4% (65)	24.9% (57)
Black	61.6% (141)	65.9% (151)
Hispanic	2.6% (6)	4.4% (10)
Other	1.7% (4)	1.3% (3)
Gender		
Female	42.4% (97)	37.6% (86)
Dual Status**		
Dually Eligible	24.5% (56)	35.4% (81)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$43,404 ($61,386)	$39,343 ($39,688)
Hospitalizations per 1,000 Patients (SD)	736 (1,271)	801 (1,760)
ED Visits per 1,000 Patients (SD)	705 (1,732)	882 (2,117)

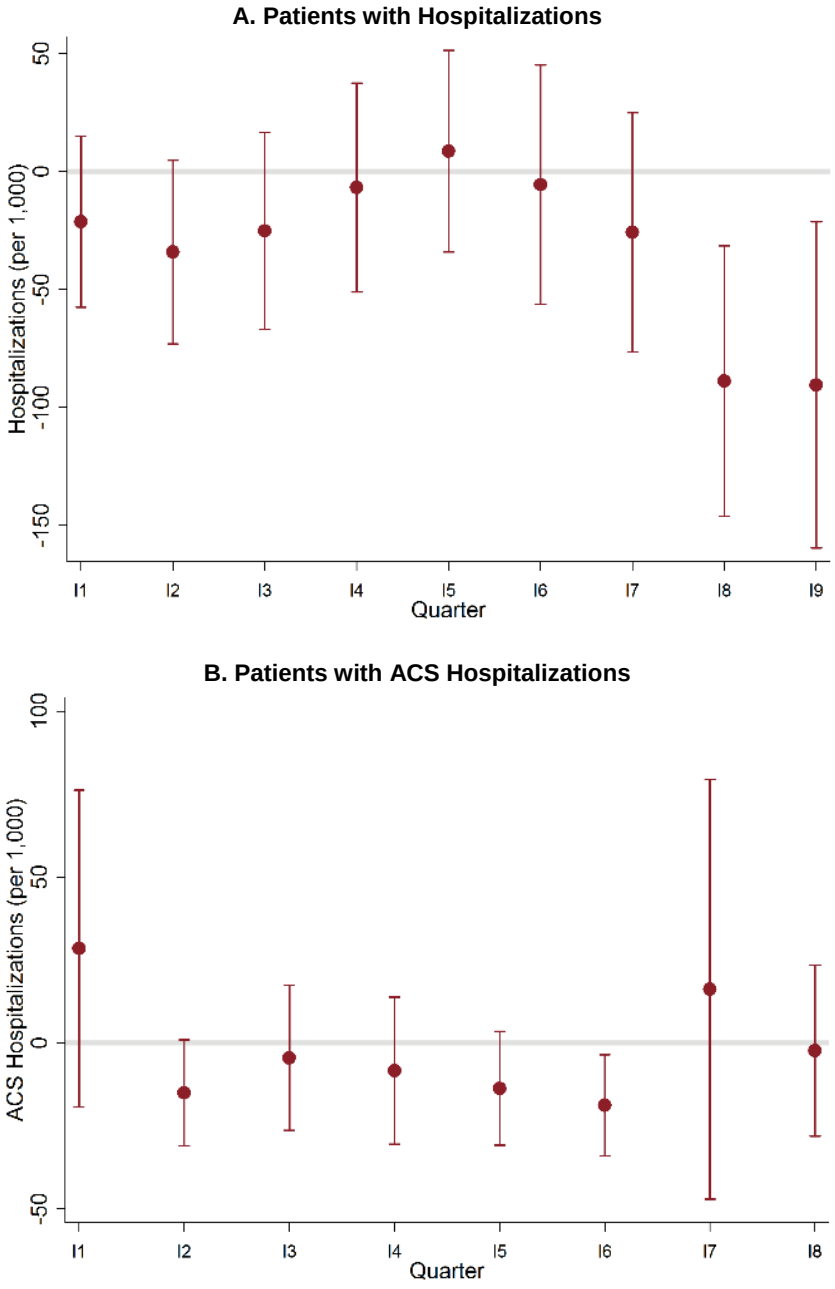
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. SD, standard deviation

Quarter-specific program impact. Exhibit S4.4 summarizes the results of the QFE DID models as the adjusted marginal effect of GWU's intervention on hospitalizations, ACS hospitalizations, 30-day readmissions, ED visits, and total cost of care.

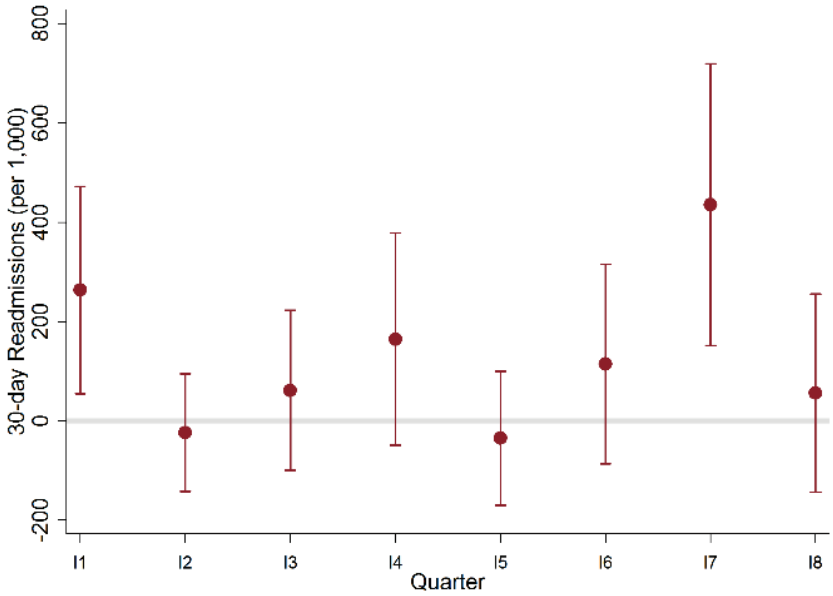
- Relative to comparison patients, GWU's program participants had significantly fewer hospitalizations in the eighth and ninth quarters. GWU program participants also had significantly fewer ACS hospitalizations in the sixth quarter.
- There was a statistically significant decrease in the total-cost-of-care measure in the eighth quarter.
- GWU's program was not associated with any significant reductions in 30-day readmission or ED visits in any of the post-intervention quarters.

For most measures, the uncertainty in estimates (indicated by the confidence interval) is larger in later quarters of the post-intervention period. This reflects the smaller number of participants enrolled in the program for this length of time.

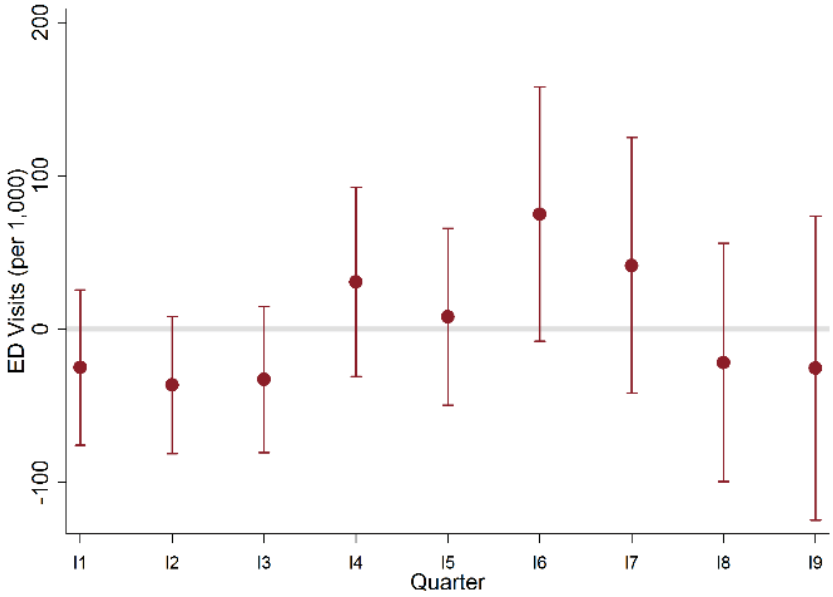
Exhibit S4.4: Adjusted Utilization Rates for Core Measures for GWU by Quarter

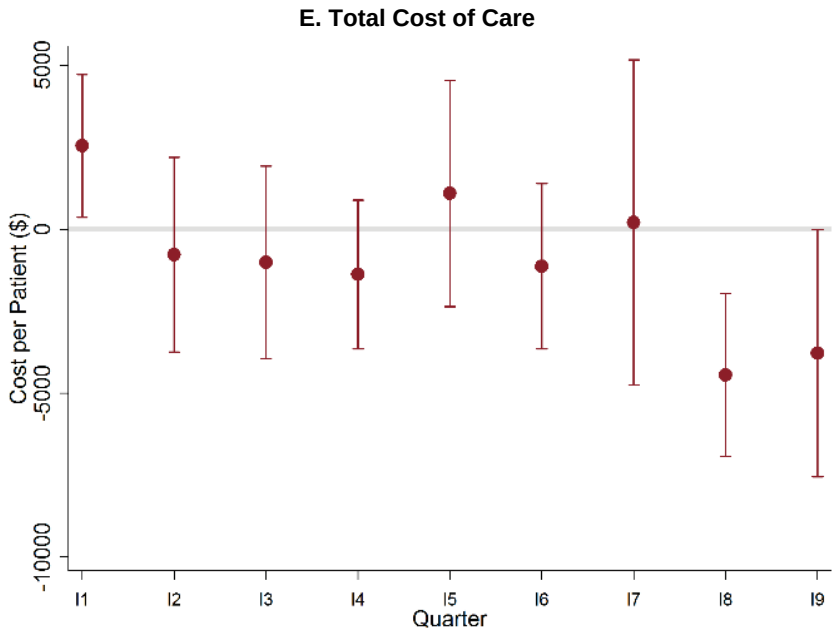


C. Patients with 30-day Readmissions



D. Patients with ED Visits




E. Total Cost of Care
Cost per Patient ($)
5000
0
-5000
-10000
I1
I2
I3
I4
I5
I6
I7
I8
I9
Quarter

Health Resources in Action

Exhibit S5.1 summarizes demographic and other basic information about program participants we included in our analysis of core outcome measures. We included only participants who completed the initial home visit and at least one follow-up contact (N = 670). We were unable to estimate outcomes for the remaining participants who did not complete at least one follow-up contact due to lack of data. In addition, we were missing valid zip codes for 19 percent of participants, preventing us from adding a measure of urbanicity to our models. For the participants for whom zip codes were provided, only those in Vermont were in nonmetropolitan areas.

Exhibit S5.1: Descriptive Characteristics of HRiA Patients

Variable	% (N)
Number of Patients	670
Age	
Mean age in years (SD)	6.2 (3.5)
Site	
Baystate Medical Center (MA)	8.4% (56)
Boston Medical Center (MA)	8.7% (58)
Boston Children's Hospital (MA)	23.0% (154)
Children's Medical Group (CT)	14.9% (100)
Middlesex Hospital (CT)	6.0% (40)
RI Hasbro & St. Joseph's (RI)	26.3% (176)
Rutland Regional Hospital (VT)	7.2% (48)
Thundermist Health Center (RI)	5.7% (38)
Gender	
Female	39.0% (261)
Race/Ethnicity	
White	12.8% (86)
Black	23.3% (156)
Hispanic/Latino	57.8% (387)
Other	3.1% (21)
Missing	3.0% (20)
Caregiver Education Level	
8th grade or less	8.2% (55)
Some high school but did not graduate	18.2% (122)
High school graduate or GED	31.5% (211)
Some college, vocational, or technical school	26.1% (175)
Graduated from college/graduate school	12.7% (85)
Other	1.5% (10)
Language Spoken Most at Home	
Spanish	38.8% (260)

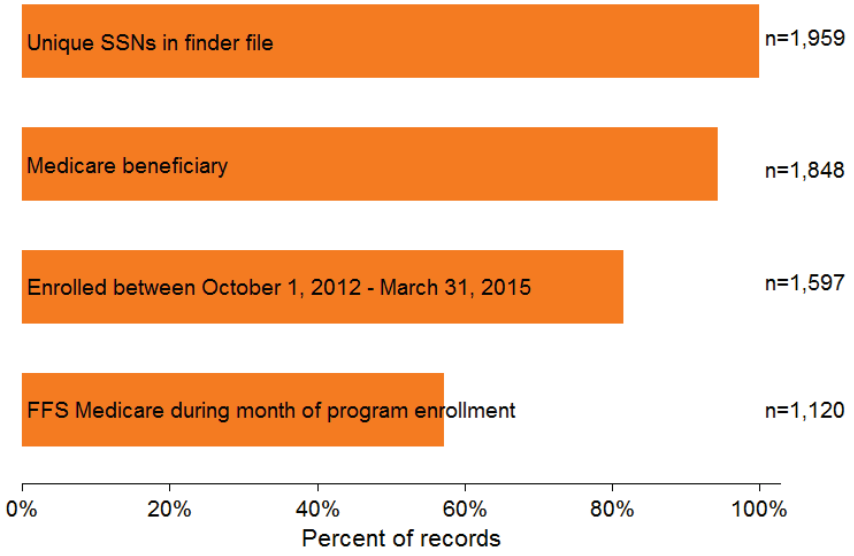
NOTE: *Metropolitan area is only available for HRiA participants who provided a valid zip code (81% of all participants).

Trustees of Indiana University

Treatment and Comparison Group Creation

- We worked with Indiana's finder file of participants and enrollment dates to identify Medicare FFS claims for individuals in our treatment group (please see Exhibit S6.1).
- We restricted our treatment group to Medicare FFS participants enrolled in Indiana's program between October 1, 2012, and March 31, 2015. Furthermore, participants needed to be enrolled in FFS Medicare at the time of entry into the Indiana program.
- To identify a pool of comparison patients, we selected FFS beneficiaries who had a history of dementia or depression and who lived in selected comparison counties. For each Indiana implementation site, we selected five comparison counties, using propensity score matching.[328]

Exhibit S6.1: Patients Identified through Indiana Finder File[329]



Comparison Group Selection: We used propensity score models to select comparison patients from within the selected counties who were similar to the Indiana participants with respect to demographics, comorbidities, and prior utilization. Indiana participants and comparison patients were exact matched with respect to qualifying condition and site (i.e., comparisons for program participants seen at the Eskenazi site are drawn from the five counties matched to the Eskenazi site). For more details on comparison group selection, please see Technical Appendix A above. Exhibit S6.2 summarizes the results of our propensity score–based comparison selection. The top graph shows the common support between the treatment and

[328]Comparison counties for the Eskenazi site are Sangamon County, IL; Lucas County, OH; St. Louis County, MO; Wayne County, MI; and Dakota County, MN. Comparisons for the Arnett site are 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 above.

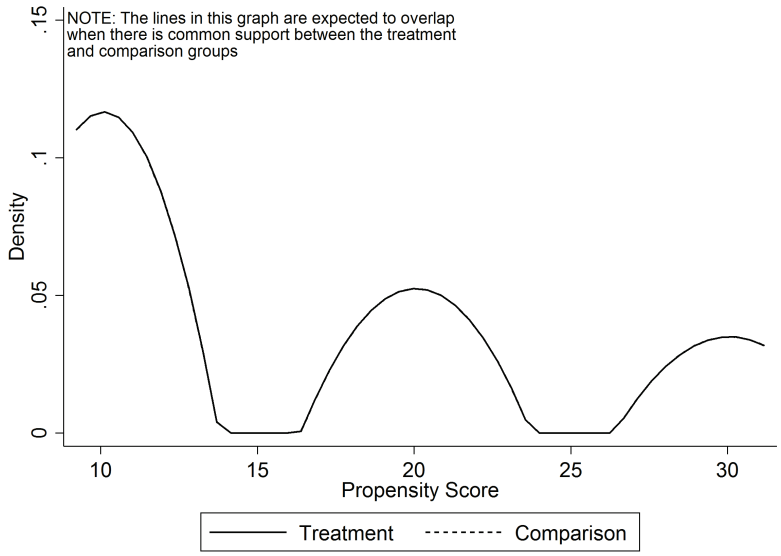
[329]The finder file that Indiana shared with our team included both patients enrolled in the program and those eligible for the program (a total of 3,066 records). For this chart, we have limited findings to patients enrolled in the program.

comparison groups after propensity score matching, and the bottom graph shows the distribution of covariates before and after matching.

- Exact matching with respect to the qualifying condition was used to ensure equal numbers of treatment and comparison patients diagnosed with dementia only, depression only, and comorbid dementia and depression. The top graph shows distinct peaks for each of these three groups.
- After matching, we observed that treatment and comparison groups had nearly identical distributions of propensity scores, suggesting that these groups are well matched—at least with respect to the included factors.
- The balance graph shows that matching achieved balance (i.e., reduced the difference between Indiana participants and the comparison group to <10% standardized bias units) with respect to demographic characteristics, comorbidity, and prior-year utilization covariates.

Exhibit S6.2: Common Support and Covariate Balance for Indiana and Comparison Patients

A. Common Support



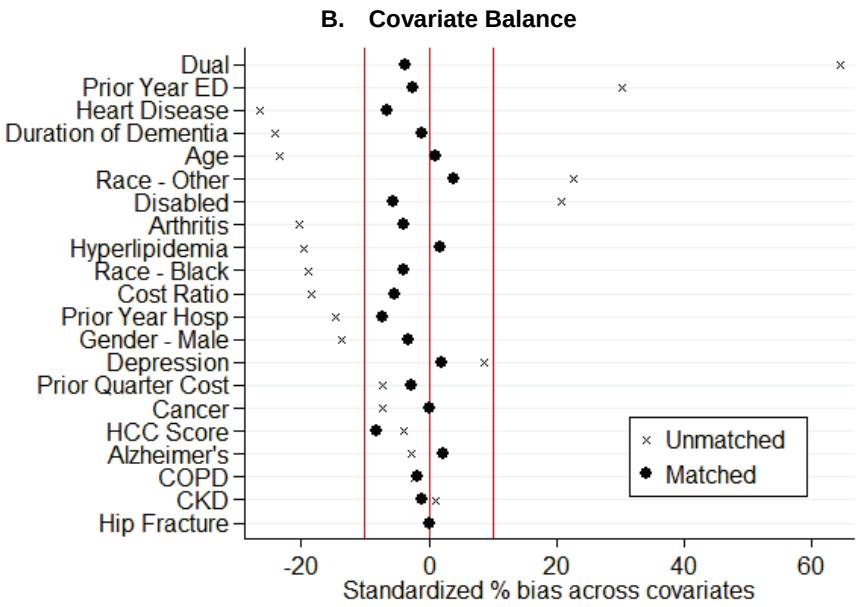


Exhibit S6.3 summarizes demographic and other basic information about treatment and comparison patients who are included in our analysis of core outcome measures. After propensity score selection and despite achieving balance in all factors, small differences between participants in the Indiana and the comparison groups remained with respect to age, hierarchical condition categories (HCC) scores, and prior utilization. To minimize any residual confounding, these factors were all included as covariates in regressions models.

Exhibit S6.3: Descriptive Characteristics of Indiana and Matched Comparison Patients

Variable	Indiana	Comparison
	% (N)	% (N)
Number of Patients	1,120	1,120
Mean Number of Quarters Enrolled [Range]	7.5 [1–13]	7.5 [1–13]
Conditions		
Alzheimer's/Dementia	25.7% (288)	25.7% (288)
Alzheimer's/Dementia and Depression	17.1% (192)	17.1% (192)
Depression	57.1% (640)	57.1% (640)
Gender		
Female	75.7% (848)	74.3% (832)
Age Group* **		
<65 years old	1.0% (11)	2.7% (30)
65–69 years old	26.6% (298)	30.6% (343)
70–74 years old	22.3% (250)	19.6% (220)
75–79 years old	17.3% (194)	13.9% (156)
80–84 years old	15.6% (175)	12.7% (142)
≥85 years old	17.1% (192)	20.4% (229)
Race/Ethnicity		
White	69.2% (775)	71.0% (795)
Black	29.4% (329)	27.7% (310)

Variable	Indiana	Comparison
	% (N)	% (N)
Other	0.4% (5)	0.2% (2)
Provider Site		
Eskenazi Health	64.7% (725)	64.7% (725)
IU Health Arnett	35.3% (395)	35.3% (395)
Eligibility		
Dual Eligible	47.1% (527)	48.8% (546)
Coverage Reason		
Old Age	73.8% (826)	71.3% (799)
Disability	26.0% (291)	28.5% (319)
ESRD	0.0% (0)	0.1% (1)
Hierarchical Condition Categories (HCC)		
Mean HCC Score (SD)**	1.6 (1.2)	1.7 (1.3)
Mean Count of HCCs (SD)*	2.6 (2.3)	2.8 (2.5)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Hospitalizations per 1,000 Patients (SD)**	445 (931)	533 (1,138)
ED Visits per 1,000 Patients (SD)*	1,422 (221)	1,206 (223)
Total Medicare Cost (SD)*	$11,447 ($20,987)	$13,076 ($19,910)

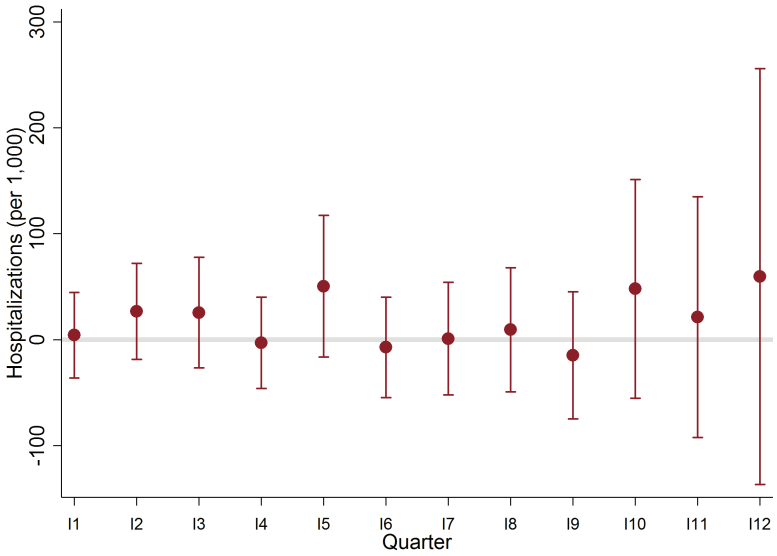
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. ED, emergency department; ESRD, end-stage renal disease; HCC, hierarchical condition categories; SD, standard deviation

Quarter-specific program impact. Exhibits S6.4 and S6.5 summarize the results of QFE DID models as the adjusted marginal effect of Indiana's intervention on hospitalizations, ACS hospitalizations, 30-day readmissions, ED visits, and total cost of care for each post-intervention quarter among participants with dementia and those with depression.

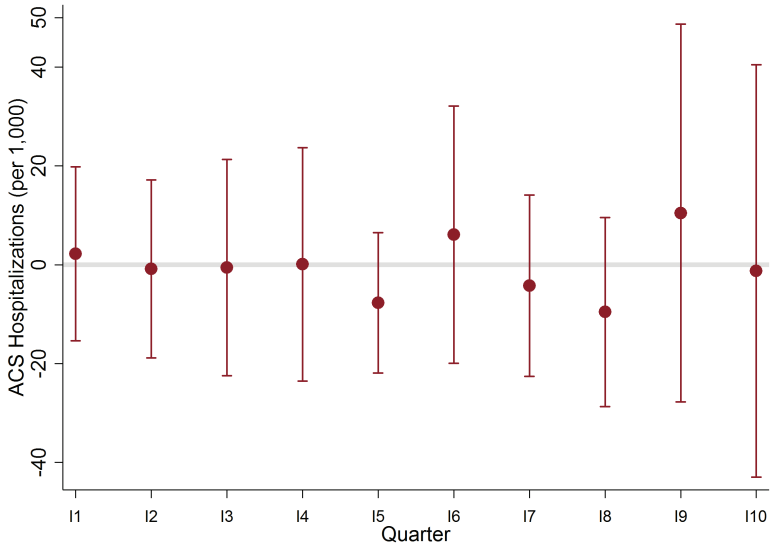
- Relative to comparison patients, there are few significant differences in utilization and cost for Indiana's program participants. Indiana participants with depression and those with dementia both had lower costs and fewer ED visits in the first quarter.

Exhibit S6.4: Adjusted Utilization Rates for Core Measures for Indiana Participants with Dementia by Quarter

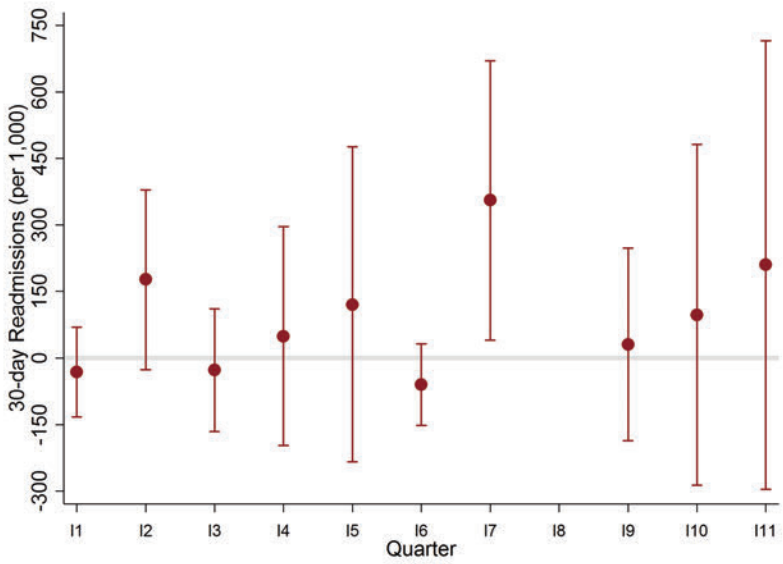
A. Patients with Hospitalizations



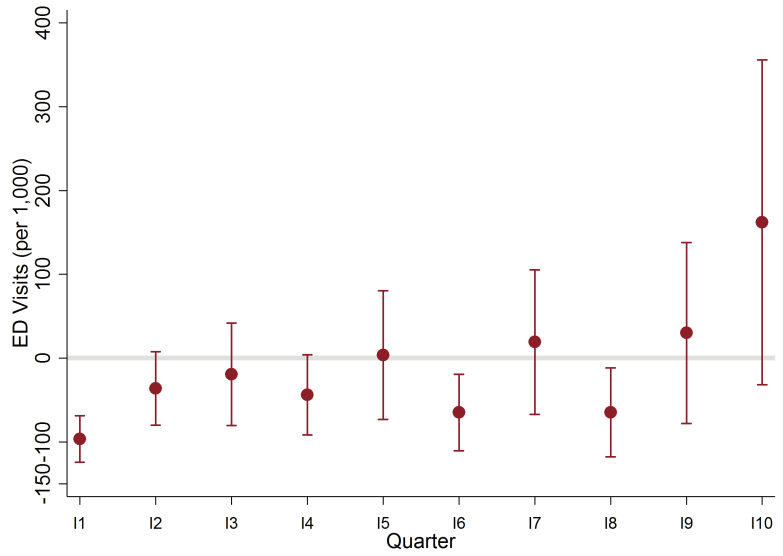
B. Patients with ACS Hospitalizations



C. Patients with 30-day Readmissions



D. Patients with ED Visits



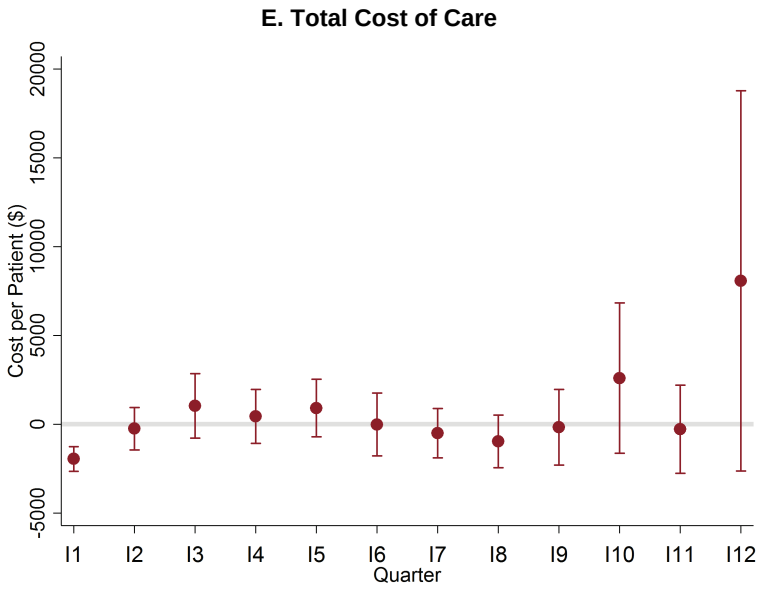
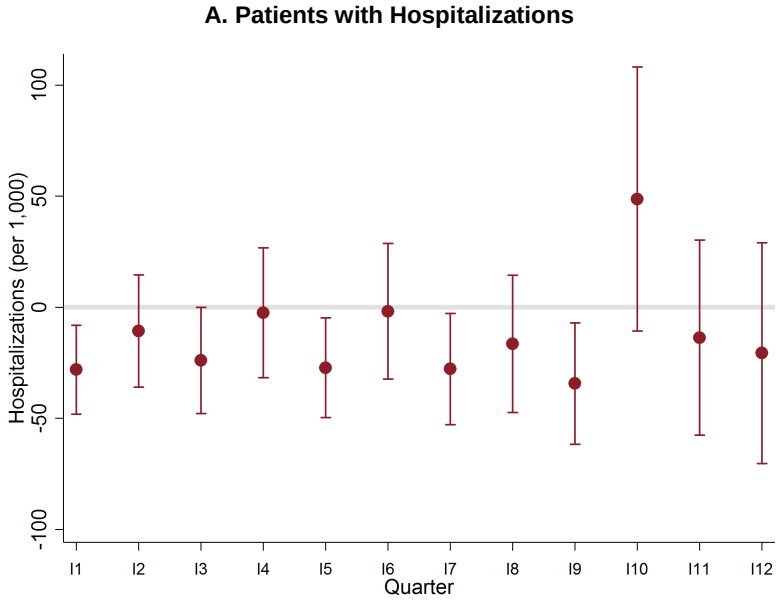
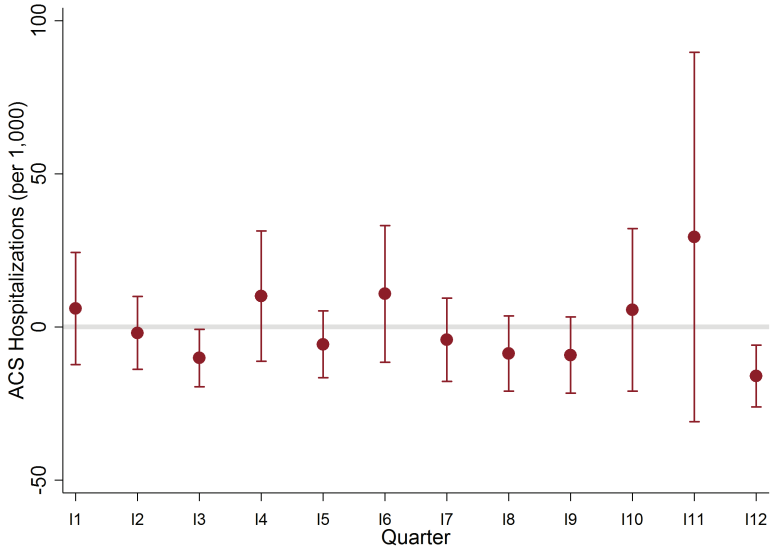


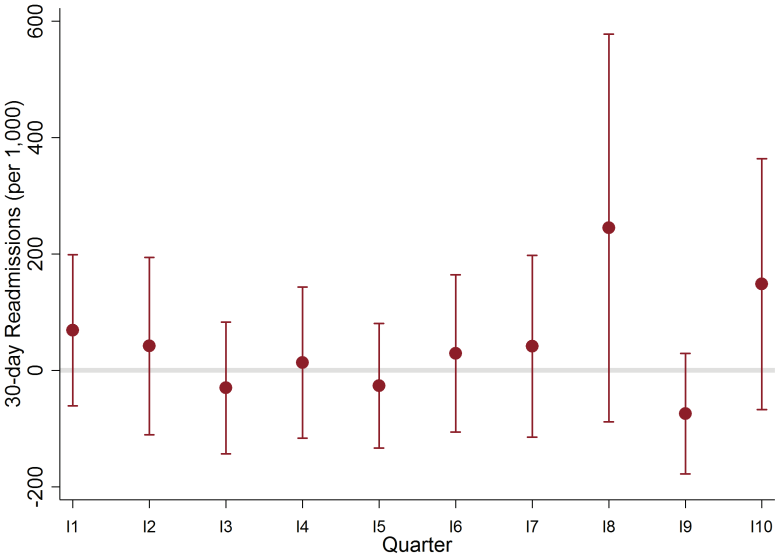
Exhibit S6.5: Adjusted Utilization Rates for Core Measures for Indiana Participants with Depression by Quarter



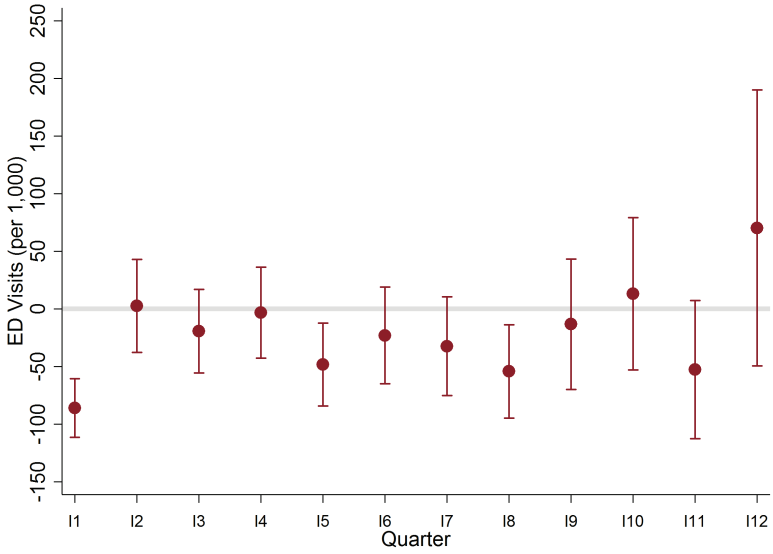
B. Patients with ACS Hospitalizations



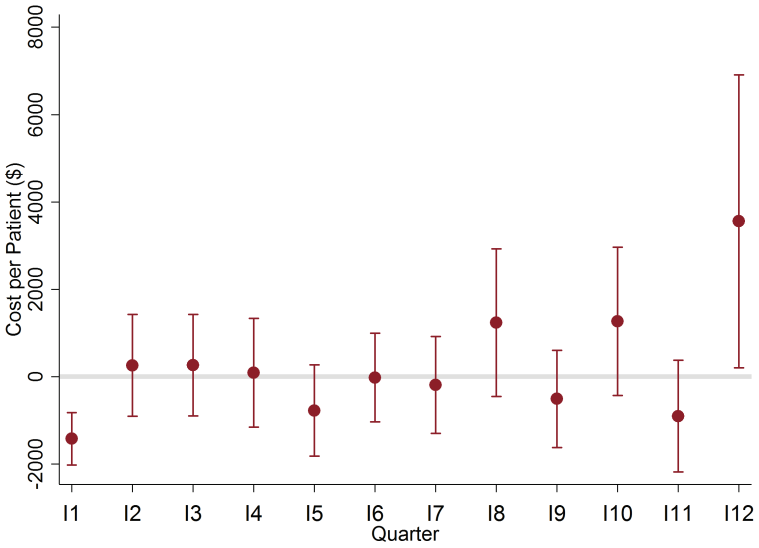
C. Patients with 30-day Readmissions



D. Patients with ED Visits



E. Total Cost of Care



Innovation Oncology Business Solutions, Inc.

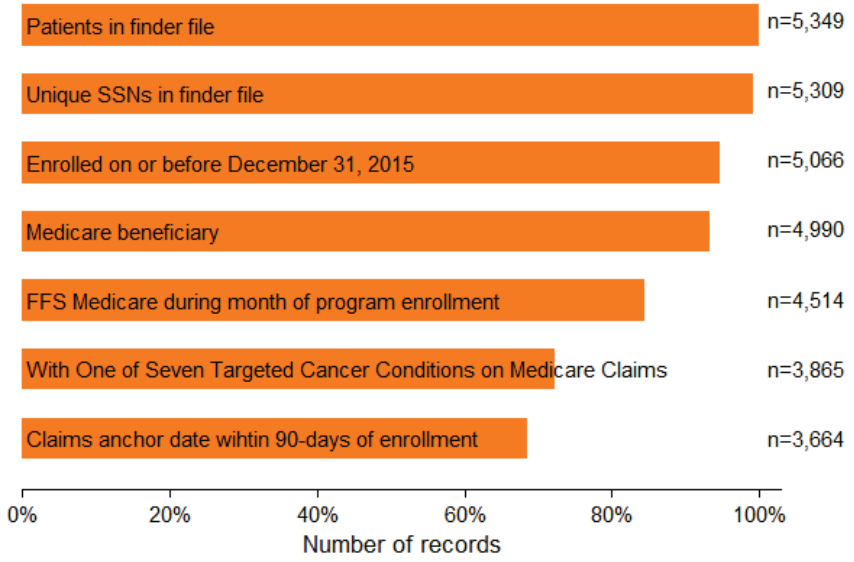
Treatment and Comparison Group Creation

- We worked with IOBS' finder file listing participants and their enrollment dates to identify FFS Medicare claims for individuals in our treatment group (please see Exhibit S7.1). We redefine the enrollment date based on a claims anchor date and limit to individuals with claims anchor dates within 90 days of the program enrollment date listed on the finder file.[330]
- We restricted our treatment group to Medicare FFS participants enrolled in IOBS' program for one or more quarters from October 1, 2012, through June 30, 2015. We included in our analyses Medicare claims two years prior to a participant's enrollment in the COME HOME program through all quarters of enrollment in the program until June 30, 2015.
- IOBS' program targeted adult patients with incident or recurrent cancers of one of the following seven types: breast, colon, lung, thyroid, pancreatic, lymphoma, and melanoma. We limited our evaluation of the treatment group to breast, colon, lung, lymphoma, melanoma, and pancreatic cancer because we deemed these six cancer groups to be evaluable, with more than 100 patients in each group.
- To identify a pool of comparison patients, we selected FFS beneficiaries with incident or recurrent cancers in 2013, limited to the six selected cancers, who were treated at comparison oncology practices in the same Medicare region as one of the seven IOBS sites.[331] As with the treatment group, we defined enrollment date based on the claims anchor date. Comparison oncology practices were selected using propensity score matching after employing a propensity score model that included both oncology practice-level characteristics and characteristics of the counties in which the practices are located.

[330]We defined claims anchor date as the date when we observe a diagnostic code for one of the selected cancers on inpatient, outpatient, or physician visit claims.

[331]Comparison practices matched to IOBS' seven practice sites include the following: ACC, TX: Central Texas Medical Specialists, TX; Oncopath Laboratory, TX; Northshore Oncology Associates, 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. NMOH, 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.

Exhibit S7.1: Patients Identified through IOBS Finder File



Comparison group selection. We used propensity score models to match intervention to comparison patients with respect to demographic characteristics, comorbidities, and prior utilization. Exhibit S7.2 summarizes the results from our propensity score matching. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B displays the distribution of covariates before and after matching.

- After matching, we observed that the treatment and comparison groups have nearly identical distributions of propensity scores, suggesting that these groups are well matched—at least with respect to the included factors.
- The balance chart shows that matching has achieved balance (i.e., reduced the difference between IOBS participants and comparison group patients) with respect to demographic characteristics, comorbidity, and prior-year costs.
- Due to the paucity of information regarding severity of cancer in claims, we used 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.

Exhibit S7.2: Common Support and Covariate Balance for IOBS and Comparison Participants

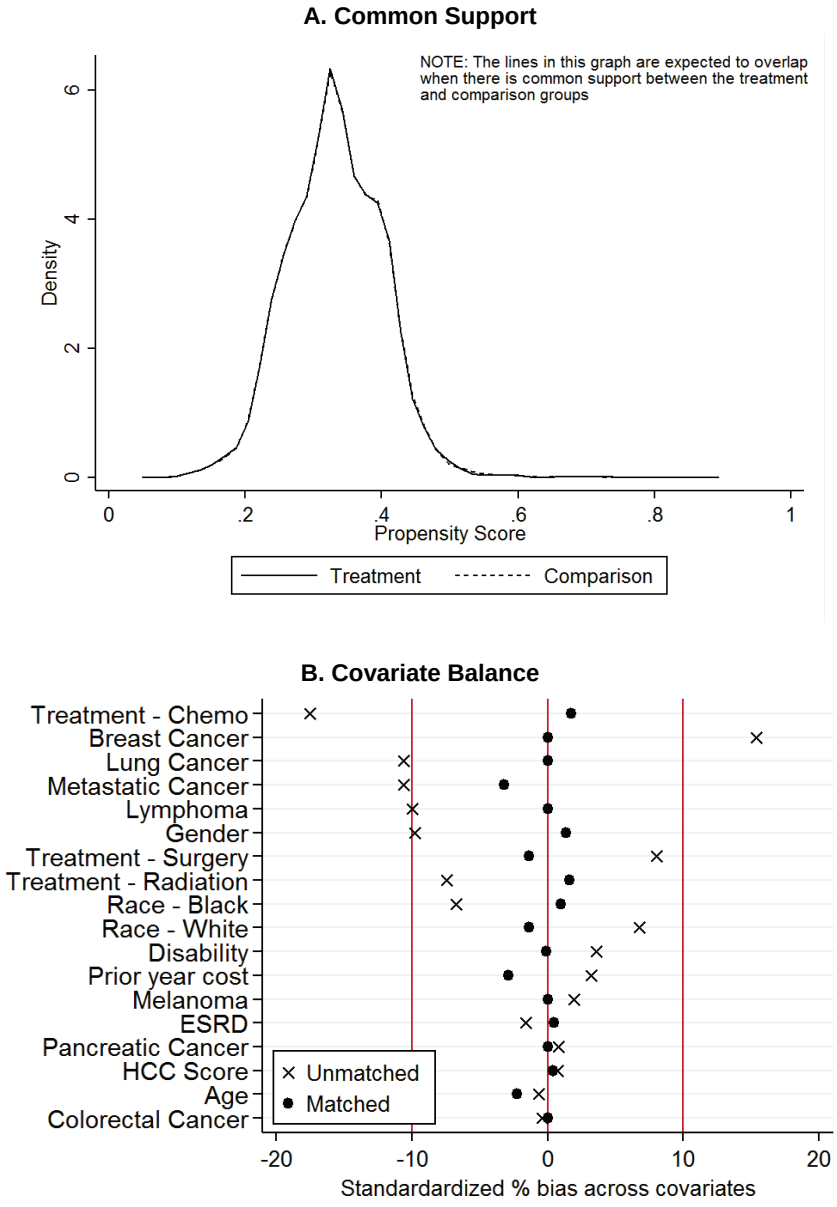


Exhibit S7.3 summarizes demographic and other basic information about treatment and comparison patients who were included in our analysis. Despite improvements in the comparison group after propensity score matching, we observed some differences between IOBS and the comparison group with respect to demographics and prior utilization. IOBS patients had significantly lower rates of ED use and significantly higher rates of hospitalization prior to enrollment. IOBS patients were also more likely to be Hispanic. To minimize any residual confounding, these factors were all included as covariates in regressions models.

Exhibit S7.3: Descriptive Characteristics of IOBS and Matched Comparison Patients

Variable	IOBS	Comparison
	% (N)	% (N)
Number of Patients	3,663	3,663
Mean Number of Quarters Enrolled [Range]	6.0 [1-13]	6.0 [1-13]
Cancer Condition		
Breast	42.4% (1,554)	42.4% (1,554)
Colorectal	13.3% (487)	13.3% (487)
Lung	25.7% (940)	25.7% (940)
Lymphoma	9.3% (342)	9.3% (342)
Melanoma	3.9% (144)	3.9% (144)
Pancreatic	5.4% (197)	5.4% (197)
Age Group		
<65 years old	8.9% (325)	9.3% (340)
65–69 years old	24.6% (901)	25.1% (921)
70–74 years old	23.9% (875)	24.2% (888)
75–79 years old	19.1% (700)	19.0% (695)
80–84 years old	13.2% (484)	12.3% (450)
≥85 years old	13.2% (484)	12.3% (450)
Race/Ethnicity		
White	89.9% (3,292)	89.8% (3,289)
Black	6.1% (223)	6.0% (221)
Hispanic***	1.9% (69)	1.1% (39)
Other	2.2% (79)	3.1% (114)
Gender		
Female	68.8% (2,521)	69.4% (2,541)
Dual Status		
Dually eligible	14.4% (526)	15.7% (576)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$17,575 ($23,331)	$17,225 ($22,175)
Hospitalizations per 1,000 Patients (SD)***	598 (994)	523 (904)
ED Visits per 1,000 Patients (SD)***	675 (1,264)	850 (1,853)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation

Quarter-specific program impact. Exhibits S7.4 summarize the results of the QFE DID models as the adjusted marginal effect of IOBS' intervention on hospitalizations, ACS hospitalizations, 30-day readmissions, ED visits, and total cost of care.[332]

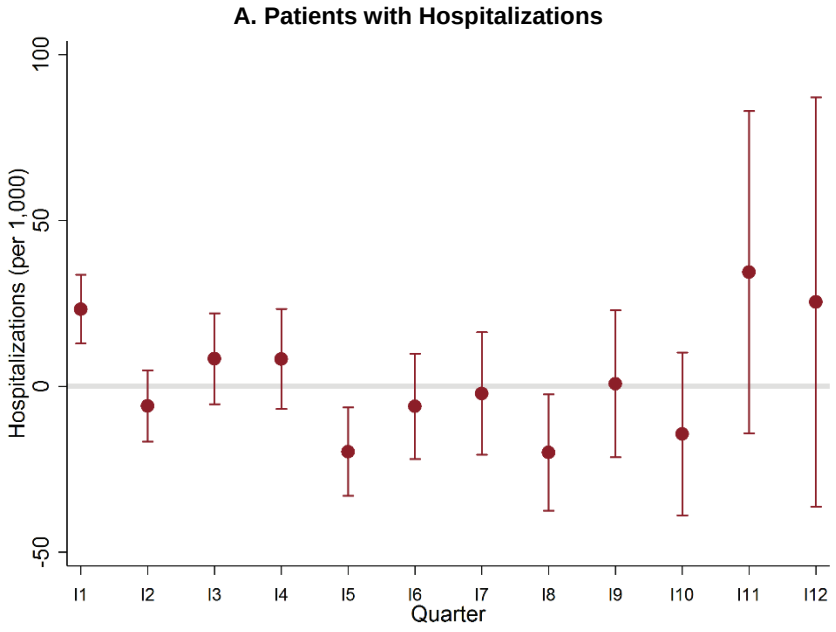
- Relative to comparison patients, IOBS patients showed significant reductions across all the core measures.

[332]Adjustment factors include cancer type; age; gender; race/ethnicity; dual eligibility; disability status; end-stage renal disease (ESRD); hierarchical condition categories (HCC) score; and indicators for cancer surgery, radiation therapy, chemotherapy, metastatic cancer, and treatment at a comprehensive cancer center.

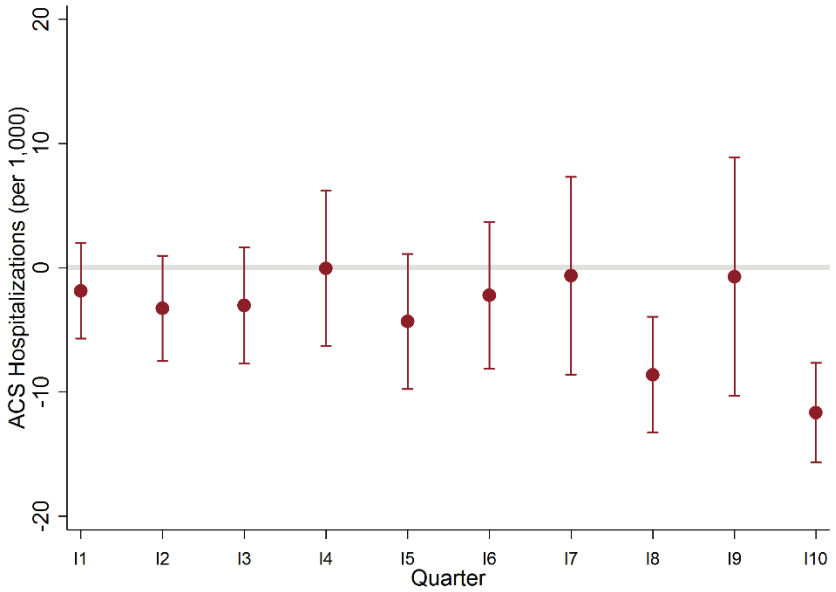
- IOBS patients had significantly fewer hospitalizations in the fifth and eighth quarters and significantly fewer ACS hospitalizations in the eighth and tenth quarters.
- There was also a significant reduction in readmissions in the third quarter and in total cost of care for several quarters during the post-intervention period (I2, I5, I6, I8, I10, and I12).
- In addition, there was a statistically significant decrease in ED visits from the fifth to the ninth quarter.

For most measures, the uncertainty in estimates (indicated by the confidence interval) is larger in later quarters of the post-intervention period. This reflects the smaller number of participants enrolled in the program for this length of time.

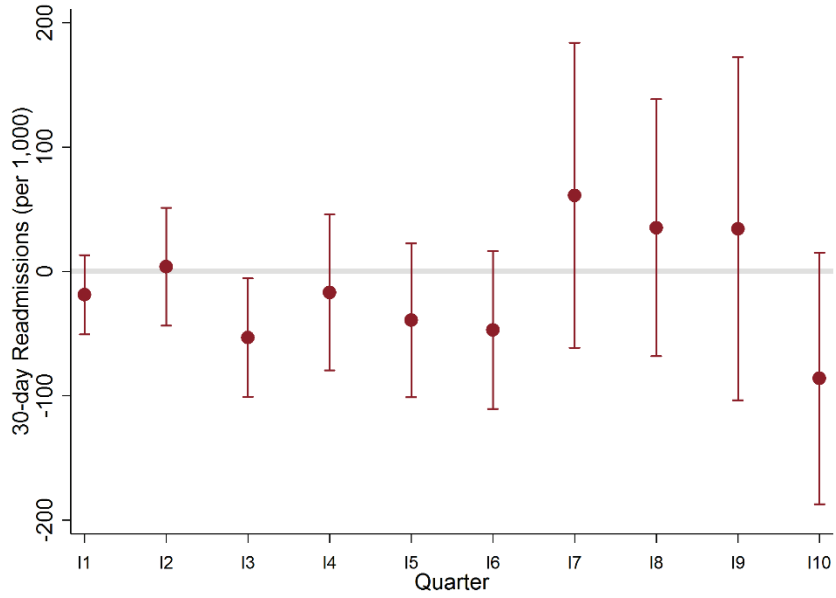
Exhibit S7.4: Adjusted Utilization Rates for Core Measures for IOBS by Quarter

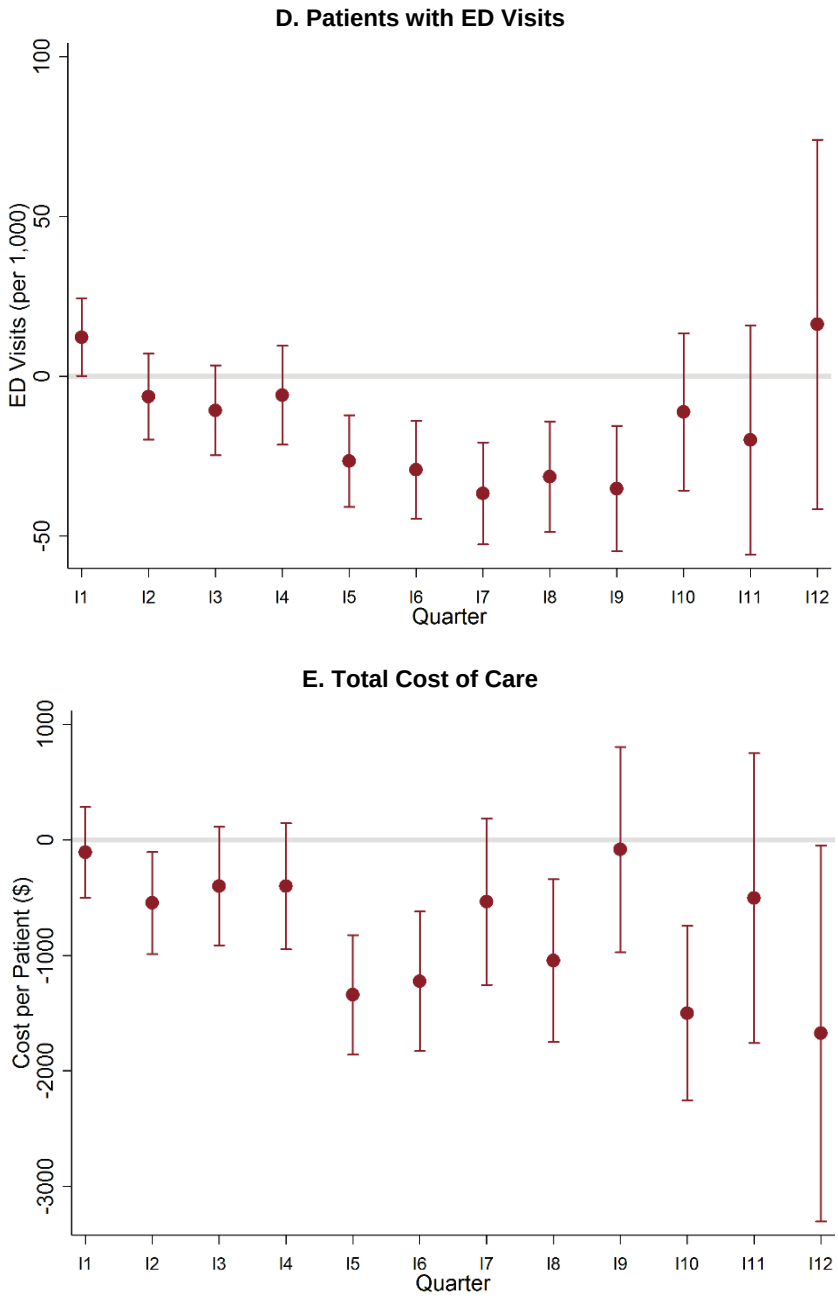


B. Patients with ACS Hospitalizations



C. Patients with 30-day Readmissions





End-of-Life Analysis

Comparison group selection. We used propensity score models to select comparison patients who had the same cancer type and characteristics similar to COME HOME participants with respect to demographics, comorbidities, and prior utilization.

Exhibit S7.5 summarizes the results from our propensity score–based comparison group selection. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

- After matching, we observe that the treatment and comparison groups have nearly identical distributions of propensity scores.
- In the matched sample, we were able to attain balance across all measures, and the graph indicates that propensity score matching greatly improved the comparability of the treatment and comparison groups.

Results from this subgroup analysis are available in the main awardee chapter.

Exhibit S7.5: Common Support and Covariate Balance for IOBS and Comparison Participants, End-of-Life Analysis

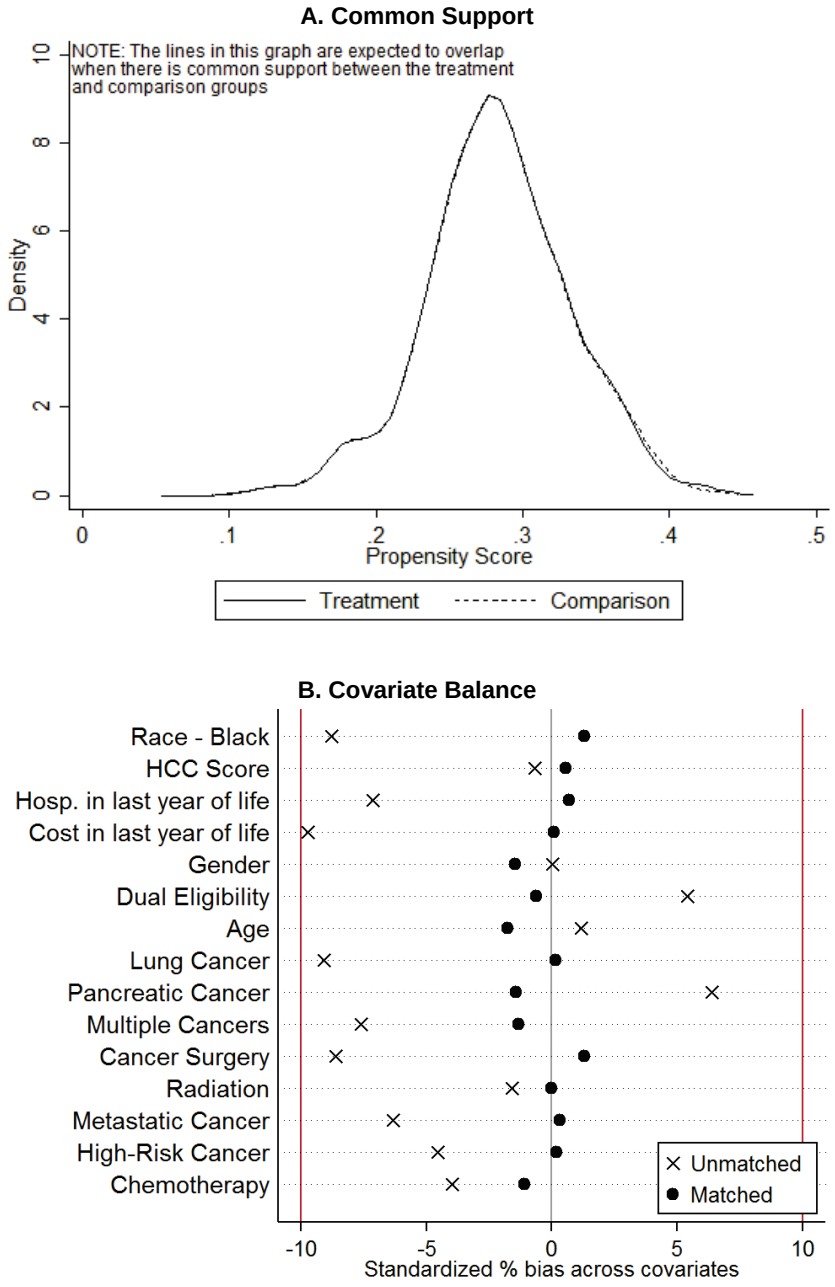


Exhibit S7.6 summarizes demographic and other basic information about the treatment and the matched comparison patients who were included in our end-of-life analysis. After matching, there were no significant differences between the groups with respect to demographic and other characteristics.

Exhibit S7.6: Descriptive Characteristics of IOBS and Matched Comparison Patients, End-of-Life Analysis

Variable	IOBS	Comparison
	% (N)	% (N)
Number of Patients	1,244	1,244
Age Group		
<65 years old	8.4% (105)	7.5% (93)
65–69 years old	18.6% (232)	21.9% (272)
70–74 years old	23.0% (286)	20.3% (252)
75–79 years old	20.8% (259)	19.3% (240)
80–84 years old	14.6% (182)	15.8% (197)
≥85 years old	14.5% (180)	15.3% (190)
Race/Ethnicity		
White	92.0% (1,144)	91.7% (1,141)
Black	5.4% (67)	5.1% (63)
Other	2.4% (30)	3.1% (38)
Unknown	0.2% (3)	0.2% (2)
Cancer Severity		
High-Risk Cancer	70.2% (873)	70.1% (872)
Metastatic Cancer	39.4% (490)	39.2% (488)
3+ Cancer Diagnoses	65.8% (819)	65.2% (811)
Cancer Treatment		
Chemotherapy	25.3% (315)	25.8% (321)
Radiation	11.7% (145)	11.7% (145)
Gender		
Female	51.3% (638)	50.6% (629)

NOTE: *** p<0.01, **p<0.05, *p<0.1. SD, standard deviation

Joslin Diabetes Center, Inc.

In Exhibits S8.1 and S8.2 we summarize the likelihood of various intended program outcomes for Joslin participants with diabetes and at high risk for diabetes. Likelihood is measured in odds ratios of program outcomes by participant characteristics. Due to the width of these tables, each is divided into two with participant characteristics repeated in the first column on the left and unique program outcomes appearing in columns to the right.

Exhibit S8.1: Odds Ratios for Program Outcomes by Characteristics of Joslin Participants with Diabetes

Participant Characteristics	Program Outcomes							
	Exercising 20 Minutes or More ≥4 Days/Week		Eating a Variety of Fruits/Veggies ≥4 Days/Week		Sleeping 6.5 – 8.5 Hours/Night		Confidence Can Control Diabetes	
Gender (Ref = Female)								
Male	**1.47****	**[1.13, 1.91]**	1.18	[0.77, 1.83]	0.98	[0.61, 1.58]	0.68	[0.41, 1.12]
Age Group (Ref = 18 to 64)								
65 to 74	1.00	[0.73, 1.37]	0.78	[0.46, 1.32]	1.01	[0.62, 1.67]	0.79	[0.44, 1.43]
75+	1.04	[0.74, 1.47]	0.77	[0.41, 1.44]	0.88	[0.51, 1.51]	1.28	[0.69, 2.38]
Race/Ethnicity (Ref = White)								
Black	1.13	[0.72, 1.78]	2.09	[0.84, 5.17]	0.72	[0.38, 1.34]	1.52	[0.65, 3.58]
Hispanic	**2.26***	**[1.09, 4.67]**	1.89	[0.55, 6.46]	0.65	[0.20, 2.07]	1.06	[0.37, 3.07]
Unknown	0.78	[0.41, 1.49]	0.28	[0.07, 1.08]	1.3	[0.40, 4.19]	1.16	[0.37, 3.57]
Insurance (Ref = None)								
Any Public	**2.33****	**[1.34, 4.07]**	1.73	[0.74, 4.03]	0.47	[0.17, 1.30]	2.41	[0.87, 6.66]
Private	**1.99***	**[1.11, 3.57]**	0.97	[0.39, 2.38]	0.58	[0.20, 1.73]	1.23	[0.41, 3.72]
Health Status (Ref = Fair/Poor)								
Good Health	1.1	[0.87, 1.38]	1.26	[0.83, 1.90]	1.38	[0.92, 2.05]	0.94	[0.60, 1.46]
Education (Ref = Less Than High School)								
HS Grad or GED	1.27	[0.87, 1.85]	1.09	[0.60, 1.96]	0.83	[0.45, 1.54]	0.84	[0.45, 1.59]
Some College	1.11	[0.74, 1.66]	1.59	[0.80, 3.18]	0.83	[0.42, 1.65]	0.81	[0.40, 1.67]
College Grad or Higher	**1.87****	**[1.22, 2.87]**	1.38	[0.66, 2.91]	0.85	[0.41, 1.73]	0.71	[0.33, 1.52]
Unknown	0.96	[0.49,1.88]	1.63	[0.46,5.75]	**0.25***	**[0.07, 0.88]**	1.33	[0.40, 4.42]
Number of Sessions (Ref = 1)								
2	0.6	[0.31, 1.17]	0.71	[0.22, 2.32]	2.19	[0.86, 5.55]	0.37	[0.11, 1.25]
3	0.66	[0.37, 1.17]	**0.34***	**[0.12, 0.95]**	2.22	[0.99, 4.97]	0.65	[0.25, 1.65]
Site (Ref = Pennsylvania)								
New Mexico	0.58	[0.30, 1.14]	0.67	[0.21, 2.14]	0.44	[0.15, 1.35]	0.48	[0.17, 1.33]
Washington, DC	0.51	[0.23, 1.11]	**0.23***	**[0.06, 0.86]**	0.71	[0.21, 2.41]	0.7	[0.19, 2.56]
Retest Conducted 4+ Months after Baseline (Ref ≥3)								
4+ Months	0.92	[0.70, 1.20]	0.97	[0.61, 1.54]	0.88	[0.56, 1.39]	1.15	[0.69, 1.89]

Exhibit S8.1: Odds Ratios for Program Outcomes by Characteristics of Joslin Participants with Diabetes (continued)

Participant Characteristics	Program Outcomes							
	Participant Can Explain HbA1c Result		Blood Pressure <140/90		HbA1c <7.5%		PAM Score	
Gender (Ref = Female)								
Male	0.67	[0.43, 1.03]	1.08	[0.86, 1.35]	**0.57***	**[0.35, 0.94]**	**0.43***	**[0.20, 0.93]**
Age Group (Ref = 18 to 64)								
65 to 74	1.15	[0.65, 2.03]	**0.56*****	**[0.42, 0.75]**	1.11	[0.60, 2.07]	0.84	[0.38, 1.87]
75+	1.47	[0.83, 2.61]	**0.36*****	**[0.26, 0.49]**	1.28	[0.65, 2.55]	0.8	[0.31, 2.05]
Race/Ethnicity (Ref = White)								
Black	2.02	[1.00, 4.09]	**0.39*****	**[0.26, 0.59]**	**0.35***	**[0.14, 0.85]**	0.75	[0.18, 3.18]
Hispanic	0.71	[0.17, 3.03]	0.6	[0.33, 1.10]	0.32	[0.10, 1.05]	1.09	[0.20, 5.99]
Unknown	1.04	[0.30, 3.68]	0.74	[0.42, 1.32]	0.69	[0.18, 2.67]	1.77	[0.34, 9.21]
Insurance (Ref = None)								
Any Public	3.37	[0.59, 19.22]	1.3	[0.76, 2.23]	0.68	[0.28, 1.64]	1.27	[0.46, 3.51]
Private	1.91	[0.30, 12.11]	1.04	[0.59, 1.82]	0.47	[0.18, 1.23]	0.65	[0.22, 1.91]
Health Status (Ref = Fair/Poor)								
Good Health	0.81	[0.53, 1.22]	**1.58*****	**[1.28, 1.94]**	1.56	[0.98, 2.49]	1.02	[0.56, 1.84]
Education (Ref = Less Than High School)								
HS Grad or GED	1.50	[0.79, 2.84]	0.73	[0.53, 1.02]	0.76	[0.39, 1.50]	0.46	[0.19, 1.11]
Some College	1.12	[0.55, 2.27]	0.74	[0.52, 1.06]	0.86	[0.42, 1.73]	0.91	[0.32, 2.55]
College Grad or Higher	0.56	[0.23, 1.31]	0.84	[0.58, 1.23]	0.92	[0.42, 2.05]	1.33	[0.47, 3.77]
Unknown	1.16	[0.37, 3.63]	0.93	[0.52, 1.66]	**4.09***	**[1.03, 16.22]**	0.78	[0.19, 3.14]
Number of Sessions (Ref = 1)								
2	0.80	[0.35, 1.85]	0.95	[0.55, 1.66]	1.70	[0.47, 6.12]	0.76	[0.18, 3.18]
3	**0.43***	**[0.20, 0.92]**	0.85	[0.53, 1.36]	2.32	[0.72, 7.53]	1.00	[1.00, 1.00]
Site (Ref = Pennsylvania)								
New Mexico	2.22	[0.53, 9.23]	**0.39*****	**[0.21, 0.71]**	**0.24****	**[0.08, 0.73]**	1.10	[0.19, 6.21]
Washington, DC	1.36	[0.29, 6.29]	0.82	[0.41, 1.63]	0.29	[0.07, 1.18]	1.46	[0.22, 9.68]
Retest Conducted 4+ Months after Baseline (Ref ≥3)								
4+ Months	1.01	[0.64, 1.58]	1.09	[0.86, 1.38]	**1.91****	**[1.15, 3.19]**	0.76	[0.33, 1.75]

NOTE: *p<0.10, **p<0.05, ***p<0.01. n/a = insufficient sample to estimate odd ratios (ORs).

Exhibit S8.2: Odds Ratios for Program Outcomes by Characteristics of Joslin Participants at High Risk for Diabetes

Participant Characteristics	Program Outcomes							
	Exercising 20 Minutes or More ≥4 Days/Week		Eating a Variety of Fruits/Veggies ≥4 Days/Week		Sleeping 6.5 – 8.5 Hours/Night		Confidence Can Control Diabetes	
Gender (Ref = Female)								
Male	1.15	[0.60, 2.23]	1.06	[0.38, 2.99]	1.94	[0.78, 4.84]	1.82	[0.56, 5.96]
Age Group (Ref = 18 to 64)								
65 to 74	0.73	[0.36, 1.52]	n/a	n/a	0.61	[0.21, 1.78]	n/a	n/a
75+	1.64	[0.68, 3.96]	n/a	n/a	0.6	[0.19, 1.91]	n/a	n/a
Race/Ethnicity (Ref = White)								
Black	1.04	[0.33, 3.32]	0.82	[0.26, 2.62]	0.52	[0.19, 1.43]	1.81	[0.54, 6.12]
Unknown	0.79	[0.25, 2.43]	1.11	[0.35, 3.55]	0.59	[0.18, 1.88]	1.47	[0.46, 4.66]
Insurance (Ref = None)								
Any Public	0.85	[0.38, 1.90]	1.67	[0.54, 5.20]	0.27	[0.07, 1.15]	1.22	[0.34, 4.36]
Private	0.49	[0.23, 1.03]	0.62	[0.17, 2.19]	**0.22***	**[0.05, 0.94]**	0.98	[0.22, 4.31]
Health Status (Ref = Fair/Poor)								
Good Health	1.2	[0.72, 2.02]	0.84	[0.38, 1.87]	n/a	n/a	n/a	n/a
Education (Ref = Less Than High School)								
HS Grad or GED	1.93	[0.93, 4.02]	1.49	[0.44, 5.03]	n/a	n/a	0.89	[0.26, 3.07]
Some College	1.63	[0.74, 3.58]	0.63	[0.20, 1.98]	n/a	n/a	0.74	[0.18, 2.99]
College Grad or Higher	0.82	[0.38, 1.80]	1.11	[0.26, 4.72]	n/a	n/a	1.08	[0.28, 4.17]
Unknown	0.8	[0.23, 2.81]	1.1	[0.12, 9.86]	n/a	n/a	1	[1.00, 1.00]
Site (Ref = Pennsylvania)								
New Mexico	0.59	[0.18, 1.88]	n/a	n/a	n/a	n/a	n/a	n/a
Washington, DC	0.39	[0.10, 1.48]	n/a	n/a	n/a	n/a	n/a	n/a
Retest Conducted 4+ Months after Baseline (Ref ≥3)								
4+ Months	0.95	[0.52, 1.76]	**0.21****	**[0.08, 0.61]**	n/a	n/a	1.85	[0.65, 5.27]

NOTE: *p<0.10, **p<0.05, ***p<0.01. n/a = insufficient sample to estimate ORs.

Exhibit S8.2: Odds Ratios for Program Outcomes by Characteristics of Joslin Participants at High Risk for Diabetes (continued)

Participant Characteristics	Program Outcomes					
	Participant Can Explain HbA1c Result		Blood Pressure <140/90		PAM Score	
Gender (Ref = Female)						
Male	1.03	[0.69, 1.54]	1.36	[0.75, 2.46]	0.74	[0.20, 2.82]
Age Group (Ref = 18 to 64)						
65 to 74	0.83	[0.52, 1.34]	n/a	n/a	n/a	n/a
75+	1.29	[0.75, 2.21]	n/a	n/a	n/a	n/a
Race/Ethnicity (Ref = White)						
Black	**3.38*** **	**[2.21, 5.18]**	1.01	[0.33, 3.08]	1.05	[0.20, 5.59]
Unknown	1.44	[0.93, 2.24]	1.41	[0.53, 3.73]	1.16	[0.37, 3.66]
Insurance (Ref = None)						
Any Public	0.79	[0.48, 1.30]	1.15	[0.53, 2.52]	0.79	[0.48, 1.30]
Private	0.86	[0.55, 1.36]	1.58	[0.64, 3.91]	0.86	[0.55, 1.36]
Health Status (Ref = Fair/Poor)						
Good Health	n/a	n/a	**0.55***	**[0.32, 0.94]**	1.08	[0.42, 2.78]
Education (Ref = Less Than High School)						
HS Grad or GED	n/a	n/a	1.38	[0.65, 2.91]	0.84	[0.24, 2.96]
Some College	n/a	n/a	1.31	[0.59, 2.89]	1.85	[0.49, 6.93]
College Grad or Higher	n/a	n/a	1.98	[0.83, 4.73]	1.9	[0.41, 8.82]
Unknown	n/a	n/a	0.84	[0.26, 2.69]	1	[1.00, 1.00]
Site (Ref = Pennsylvania)						
New Mexico	n/a	n/a	0.43	[0.14, 1.33]	0.43	[0.14, 1.33]
Washington, DC	n/a	n/a	0.42	[0.12, 1.49]	0.42	[0.12, 1.49]
Retest Conducted 4+ Months after Baseline (Ref ≥3)						
4+ Months	n/a	n/a	0.79	[0.46, 1.38]	n/a	n/a

NOTE: *p<0.10, **p<0.05, ***p<0.01. n/a = insufficient sample to estimate ORs.

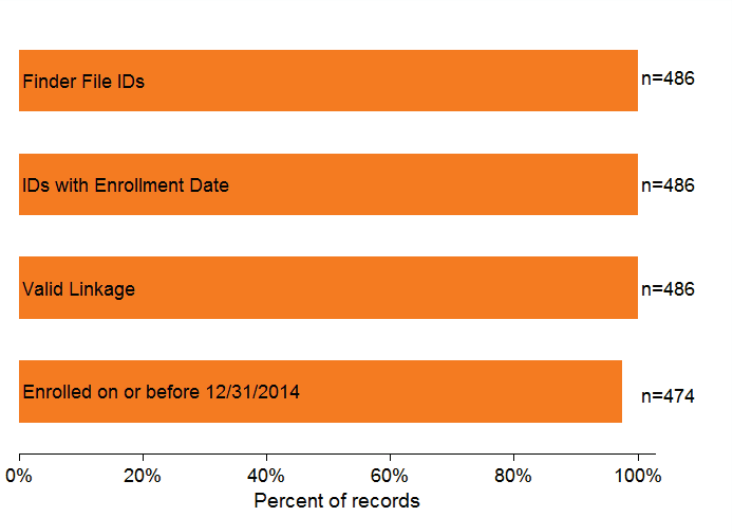
Le Bonheur Community Health and Well-Being

Treatment and Comparison Group Creation

We used DID analyses to evaluate Le Bonheur's program impact on core measures (all-cause hospitalizations, hospitalizations for asthma, ED visits, and total cost of care).

- We restricted our treatment group to Medicaid children enrolled in Le Bonheur's program for at least one quarter from Dec 20, 2012, through Dec 31, 2014.[333]
- We worked with Le Bonheur's finder file listing participants and their enrollment dates to identify Medicaid claims for these participants, using TennCare claims for the state of Tennessee (please see Exhibit S9.1). Claims were available through December 2015.
- To identify a pool of comparison children with asthma, we used Tennessee's TennCare claims.[334] We limited our comparison group to children who were not included in Le Bonheur's asthma registry, reside in Tennessee, were enrolled in Medicaid (TennCare), and have been diagnosed with asthma in an office visit. The enrollment date for children in the comparison group was the date of the first office visit for asthma during the period in which claims were available.

Exhibit S9.1: Patients Identified through Le Bonheur Finder File



Comparison group selection. We used propensity score models to match intervention patients to comparison patients with respect to demographics, comorbidities, and prior utilization. For more details on comparison group selection and propensity score matching, please see Technical Appendix A above. Exhibit S9.2 summarizes the results from our propensity score matching. Panel A shows the similarities

[333]Tennessee's TennCare data were available through December 31, 2014.

[334]Comparison group qualifications were: residence in the state of Tennessee, ages 2–17 years, enrollment in Medicaid, and an office visit for asthma during the available claims period.

between the treatment and comparison groups after propensity score matching, and panel B displays the distribution of covariates before and after matching.

- Before matching, we observed substantial similarities between Le Bonheur's patients and the comparison group, indicating that propensity scores are similar in both groups. After matching, we observed nearly identical characteristics in the two populations.
- We were able to achieve balance for all covariates.

Exhibit S9.2: Common Support and Covariate Balance for Le Bonheur and Comparison Patients

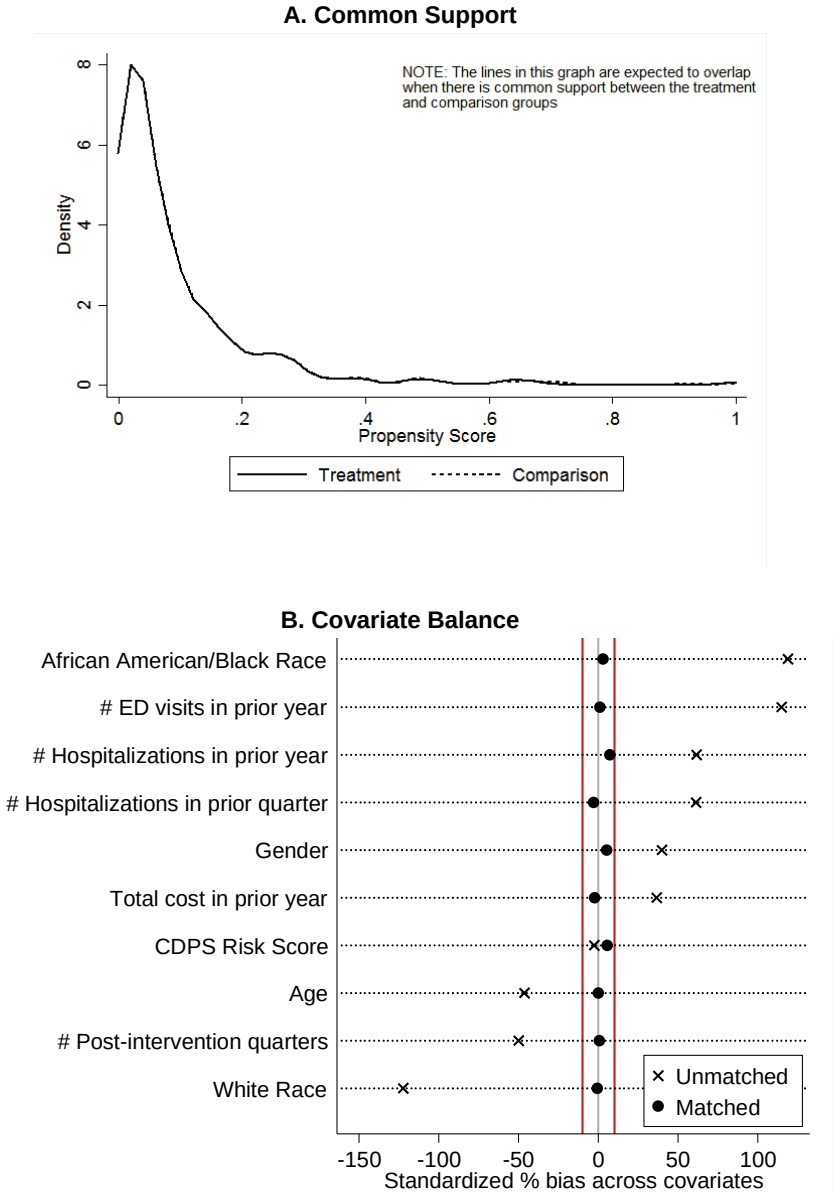


Exhibit S9.3 summarizes demographic and other basic information about the treatment and comparison patients included in our analysis of core outcome measures. After matching, the Le Bonheur participants were slightly younger ($p<0.1$), were more likely to live in an urban area ($p<0.01$), and had more asthma-related hospitalizations per 1,000 patients ($p<0.01$) compared with matched comparison patients.

Exhibit S9.3: Descriptive Characteristics of Le Bonheur and Matched Comparison Patients

Variable	Le Bonheur	Comparisons
	% (N)	% (N)
Number of Patients	476	476
Age Group*		
<5 years old	34.7% (165)	38.9% (185)
5–9 years old	43.3% (206)	37.6% (179)
10–14 years old	17.7% (84)	16.0% (76)
≥15 years old	4.4% (21)	7.6% (36)
Gender		
Female	38.9% (185)	41.4% (197)
Race		
Black	83.2% (396)	81.9% (390)
Asthma Flags		
Diagnosis of Asthma	99.8% (475)	100% (476)
Bronchodilator Use*	99.6% (474)	98.5% (469)
Comorbidity: Chronic Illness and Disability Payment System (CDPS)		
Weighted CDPS Score, standard deviation (SD)	1.7 (1.2)	1.6 (1.6)
Utilization/Cost of Care in Year Prior to Enrollment		
Total Medicaid Cost (SD)	$7,360 ($7,529)	$7,623 ($24,393)
Hospitalizations per 1,000 Patients (SD)	391 (713)	351 (795)
ED Visits per 1,000 Patients (SD)	2,979 (2,279)	2,962 (3,321)
Asthma-related Hospitalizations per 1,000 Patients***	368 (691)	210 (533)
Urbanicity		
Metropolitan area***	99.4% (472)	84.9% (404)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. CDPS, chronic disease and disability payment system (diagnostic classification system that Medicaid programs can use to make health-based capitated payments for certain Medicaid beneficiaries); ED, emergency department; SD, standard deviation.

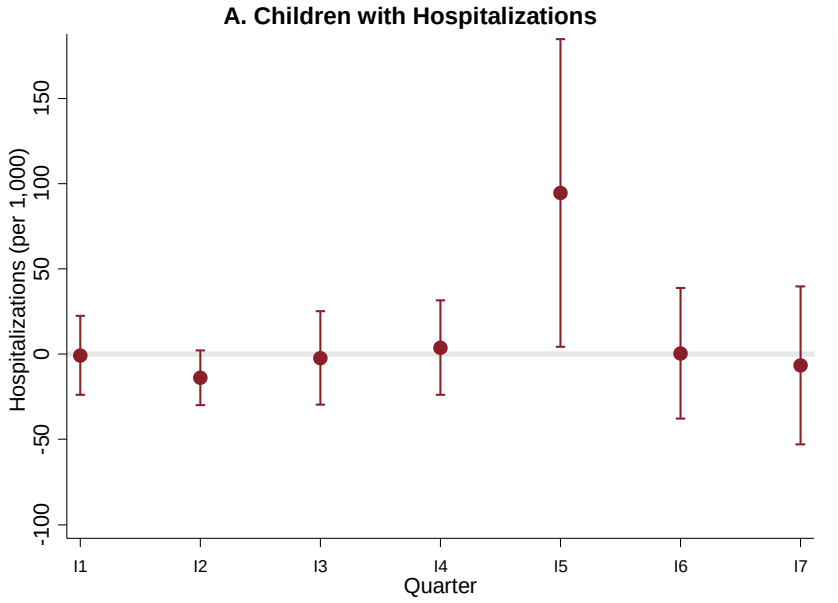
Quarter-specific program impact. Exhibit S9.4 presents the results of the QFE DID models as the adjusted marginal effect of the Le Bonheur program on hospitalizations, ED visits, and total cost of care in each post-intervention quarter.[335] The effect is displayed as the average difference between treatment

[335]We were unable to show QFE DID results for all quarters for all-cause hospitalizations and asthma-related hospitalizations due to an insufficient numbers of events. We were unable to show QFE DID results for readmissions due to insufficient numbers for these events in the treatment and comparison groups.

and comparison groups per 1,000 patients (90% confidence interval) for each quarter during the post-intervention period (I1–I10) after adjusting for pre-intervention differences between the two groups.[336]

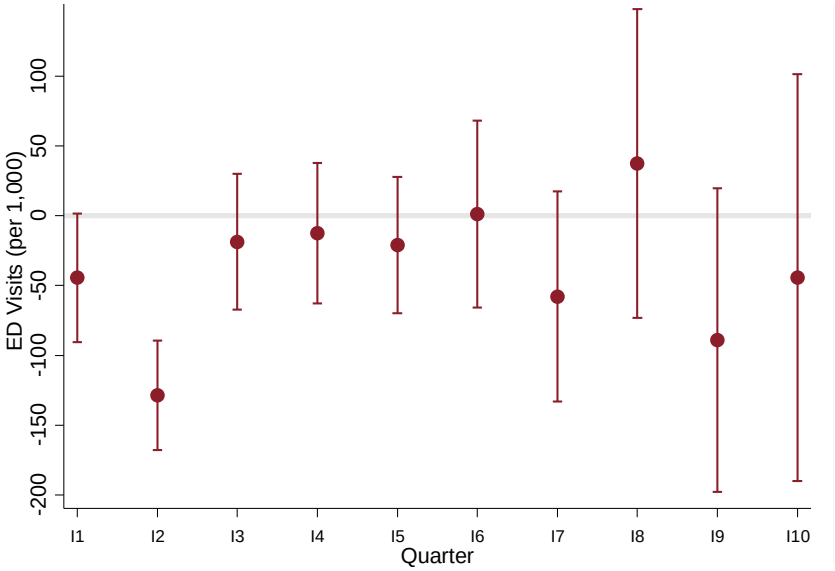
- We did not observe any overall trend in hospitalizations or asthma-related hospitalizations. However, we noted significantly higher point estimates in the fifth quarter for hospitalizations, compared with the matched comparison group.
- Cost of care trended lower overall, with significantly lower point estimates in the first two post-intervention quarters, compared with the matched comparison group.
- There were significantly lower point estimates for ED visits in the second quarter compared with the matched comparison group, but no significant differences or consistent trends in ED visits were observed for the other quarters.

Exhibit S9.4: Adjusted Utilization Rates for Core Measures for Le Bonheur by Quarter

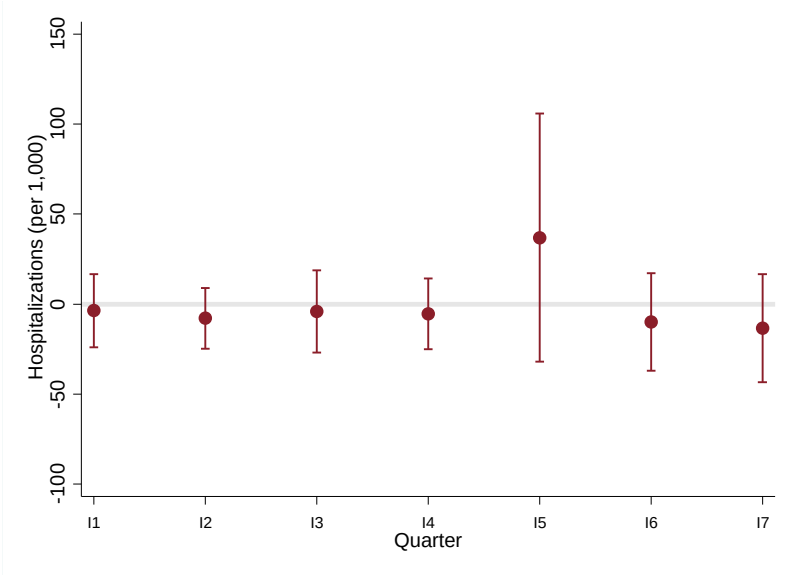


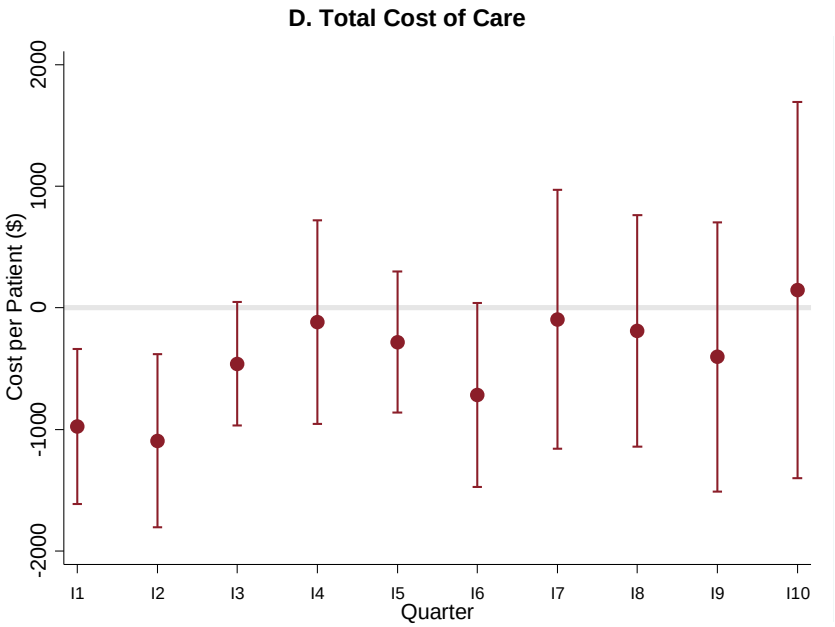
[336]Adjustment factors include age, race, gender, CDPS risk score, and urbanicity.

B. Children with ED Visits



C. Children with Asthma-related Hospitalizations




D. Total Cost of Care
Cost per Patient ($)
2000
1000
0
-1000
-2000
I1
I2
I3
I4
I5
I6
I7
I8
I9
I10
Quarter

Mountain Area Health Education Center, Inc.

Quantitative analysis of MAHEC's data examined differences pre- and post-intervention and did not utilize a comparison group. Therefore, we do not present the propensity score models or balance charts for this awardee. However, results of quarterly fixed effects analysis of core measures for MAHEC's sample are presented in Exhibit S10.2.

Exhibit S10.1 summarizes the demographics for MAHEC's program participants who were included in the program data used for this analysis. These data include participants seen at the main implementation site—Mountain Area Health and Education Center in Asheville, North Carolina, and not at the other three sites. Participants who had a current cancer diagnosis and those not returning for follow-up visits were excluded from analysis.

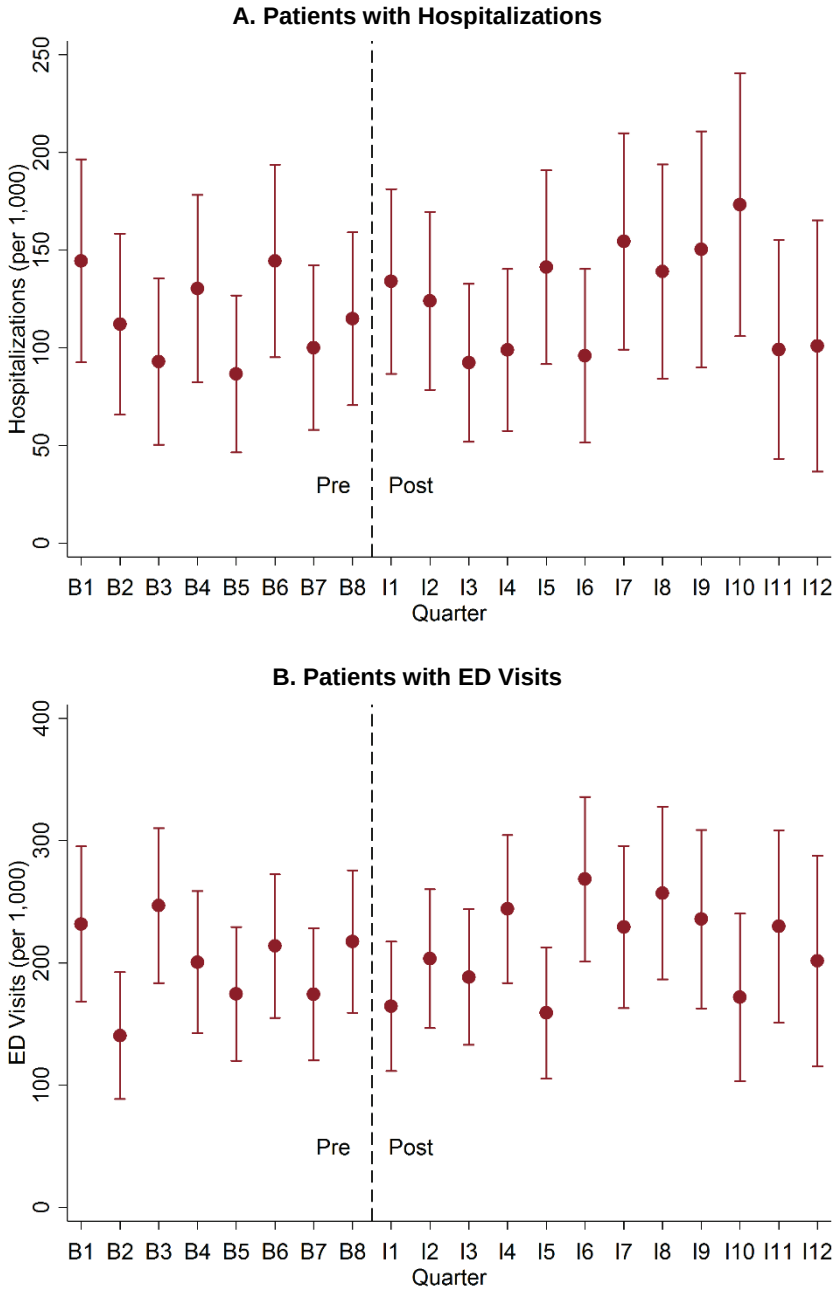
Exhibit S10.1: Descriptive Characteristics of MAHEC Participants[337]

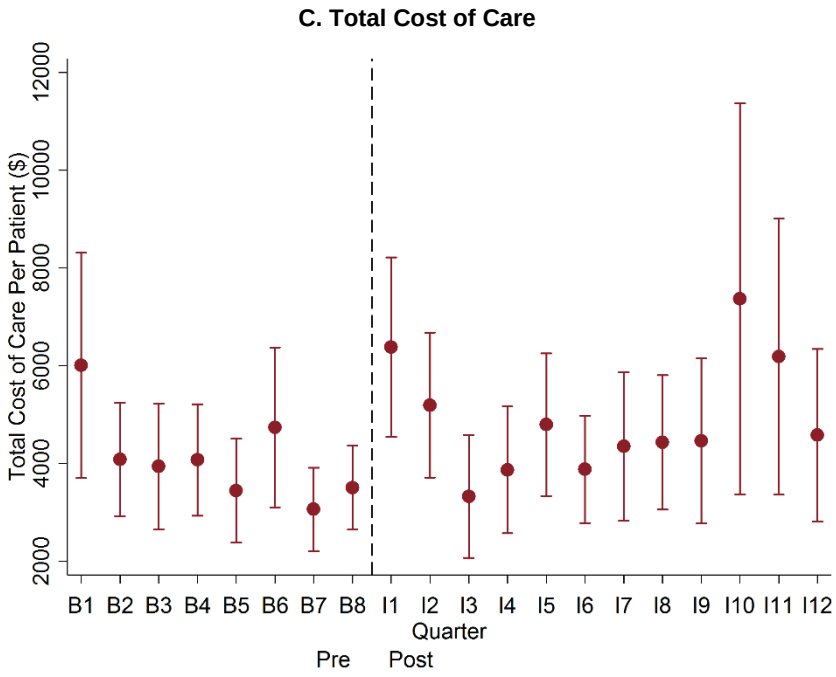
Variable	Treatment
	% (N)
Number of Persons	216
Age—Mean Age in Years (SD)	56.4 (15.6)
Duration of Enrollment—Mean in Years (SD)	1.47 (0.56)
Gender	
Female	74.1% (160)
Male	25.9% (56)
Race	
White	45.4% (98)
Black	3.7% (8)
Not reported	50.1% (110)
Primary Insurance Type	
Medicare	64.4% (139)
Medicaid	35.6% (77)

NOTE: SD, standard deviation.

[337]Demographic data are from awardee-provided data, not claims data. They include the subset of participants who were seen at the main program site (MAHEC Family Health Center) for at least 160 days and who did not have a cancer diagnosis.

Exhibit S10.2: Adjusted Utilization Rates for Core Measures for MAHEC by Quarter



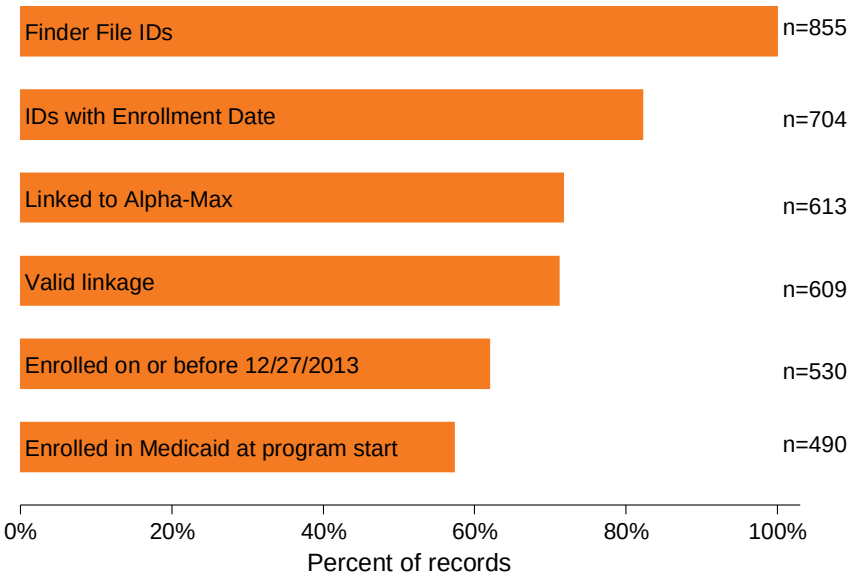

C. Total Cost of Care
Total Cost of Care Per Patient ($)
2000
4000
6000
8000
10000
12000
B1 B2 B3 B4 B5 B6 B7 B8 I1 I2 I3 I4 I5 I6 I7 I8 I9 I10 I11 I12
Quarter
Pre
Post

Nemours Children's Health System of Nemours Foundation

Treatment and Comparison Group Creation

- We used the Nemours finder file that listed registry participants and their enrollment dates to identify Medicaid claims from Delaware's Alpha-MAX files for our treatment group (please see Exhibit S11.1). There were 704 unique IDs with an enrollment date in the finder file, 490 of which were included in the analysis.
- We improved upon the comparison group methodology presented in our second annual report.[338] In this report, we selected pediatric Medicaid beneficiaries who had an office visit for asthma and were prescribed bronchodilators between September 1, 2012, and December 31, 2013, and who reside in the state of Delaware.[339] Potential comparisons who were listed on the Nemours registry were excluded from the comparison group. To assign an enrollment date to the comparisons, we used the date of the first evaluation and management (E&M) visit for asthma that occurred during the September 1, 2012, through December 31, 2013 period.

Exhibit S11.1: Patients Identified through Nemours Finder File[340]



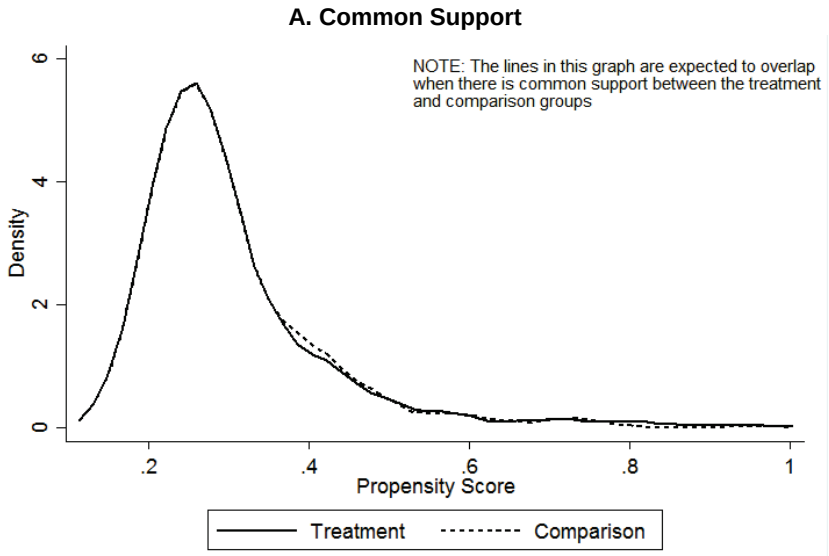
Comparison group selection. We use propensity score models to match intervention to comparison participants with respect to demographics, comorbidities, and prior utilization. For more details on comparison group selection and matching, please see Technical Appendix A above. Exhibit S11.2 summarizes the results of our propensity score matching. Panel A shows the similarities between the

[338]Available at: https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-secondevalrpt.pdf.
[339]For more details on the criteria used to define the comparison group, including diagnostic codes used to define asthma, please see exhibit A.6 above.
[340]Only minimal additional follow-up was available in Delaware's Alpha-MAX files, and data did not extend beyond December 31, 2013. Therefore, the number of participants has not increased since our last report, but some participants have gained a few additional months of follow-up.

treatment and comparison groups after propensity score matching, and panel B displays the distribution of covariates before and after matching.[341]

- After matching, we observed that the two groups had nearly identical distributions of propensity scores, suggesting that, at least with respect to the included factors, these groups are well matched.
- The balance chart (panel B) shows that matching has achieved balance (i.e., reduced the difference between Nemours participants and comparison group to <10% standardized bias) with respect to demographics, comorbidity, and prior-year utilization and costs, with the exception of the number of hospitalizations in the prior year, which nearly achieves balance. However, the balance in this variable is an improvement on the propensity score model in the second annual report. On average, Nemours participants had a higher rate of hospitalizations in the prior year relative to the comparison group but were balanced with respect to the rate of asthma-related hospitalizations in the prior year.

Exhibit S11.2: Common Support and Covariate Balance for Nemours and Comparison Patients



[341]Final propensity score models included age, gender, race/ethnicity, chronic disease and disability payment system (CDPS) risk score, prior utilization measures of asthma-related hospitalizations and ED visits, and total cost of care in the prior year.

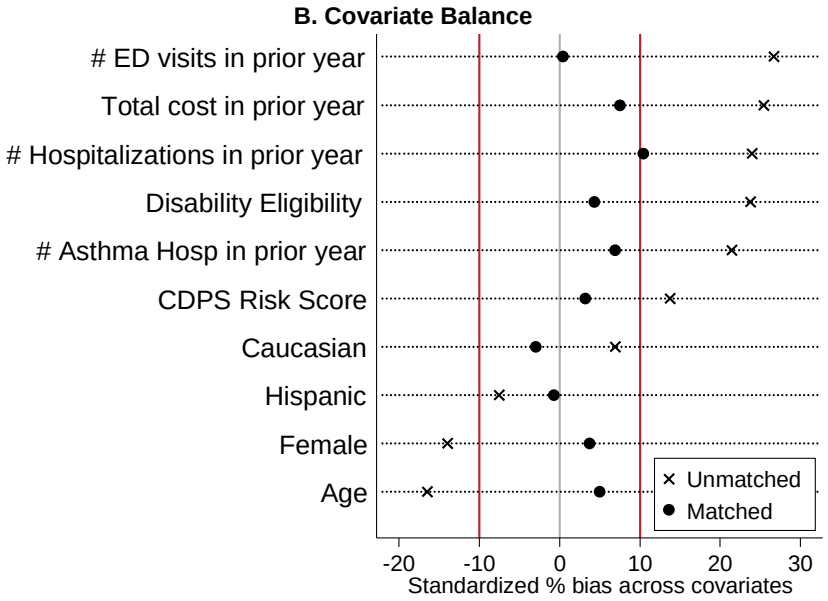


Exhibit S11.3 summarizes demographic and other basic information about treatment and matched comparison participants included in our analysis of core outcome measures. There were no significant differences between participants at Nemours and comparison patients with respect to demographic characteristics, comorbidities, or prior utilization. There was a statistically significant difference in urbanicity, with a slightly higher percentage of Nemours participants living in an urban area compared with comparison patients (94.5 percent versus 98.6 percent).[342]

Exhibit S11.3: Descriptive Characteristics of Nemours and Matched Comparison Patients

Variable	Nemours	Comparison
	% (N)	% (N)
Number of Patients	490	490
Mean Number of Quarters Enrolled	2.9 [1-5]	2.9 [1-5]
Female Gender	36.5% (179)	34.7% (170)
Age Group		
<5 years old	31.8% (156)	33.5% (164)
5–9 years old	41.4% (203)	41.0% (201)
10–14 years old	20.0% (98)	19.8% (97)
≥15 years old	6.7% (33)	5.7% (28)
Race/Ethnicity		
White	23.1% (113)	24.3% (119)
Black	69.0% (338)	66.5% (326)
Hispanic	7.6% (37)	7.8% (38)
Other	0.4% (2)	1.4% (7)

[342] US Department of Agriculture. 2010 rural-urban commuting area (RUCA) codes. Available at: http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/documentation.aspx.

Variable	Nemours	Comparison
	% (N)	% (N)
Basis of Eligibility (BOE)		
Blind/disabled	16.7% (82)	15.3% (75)
Urbanicity		
Metropolitan area***	94.5% (463)	98.6% (483)
Chronic Illness and Disability Payment System Risk Score (CDPS)		
Mean CDPS score (SD)	2.1 (3.5)	2.0 (2.2)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicaid Cost (SD)	$5,769 ($9,888)	$5,159 ($8,697)
Hospitalizations per 1,000 (SD)	145 (480)	104 (383)
ED Visits per 1,000 (SD)	1,298 (1,793)	1,292 (1,930)

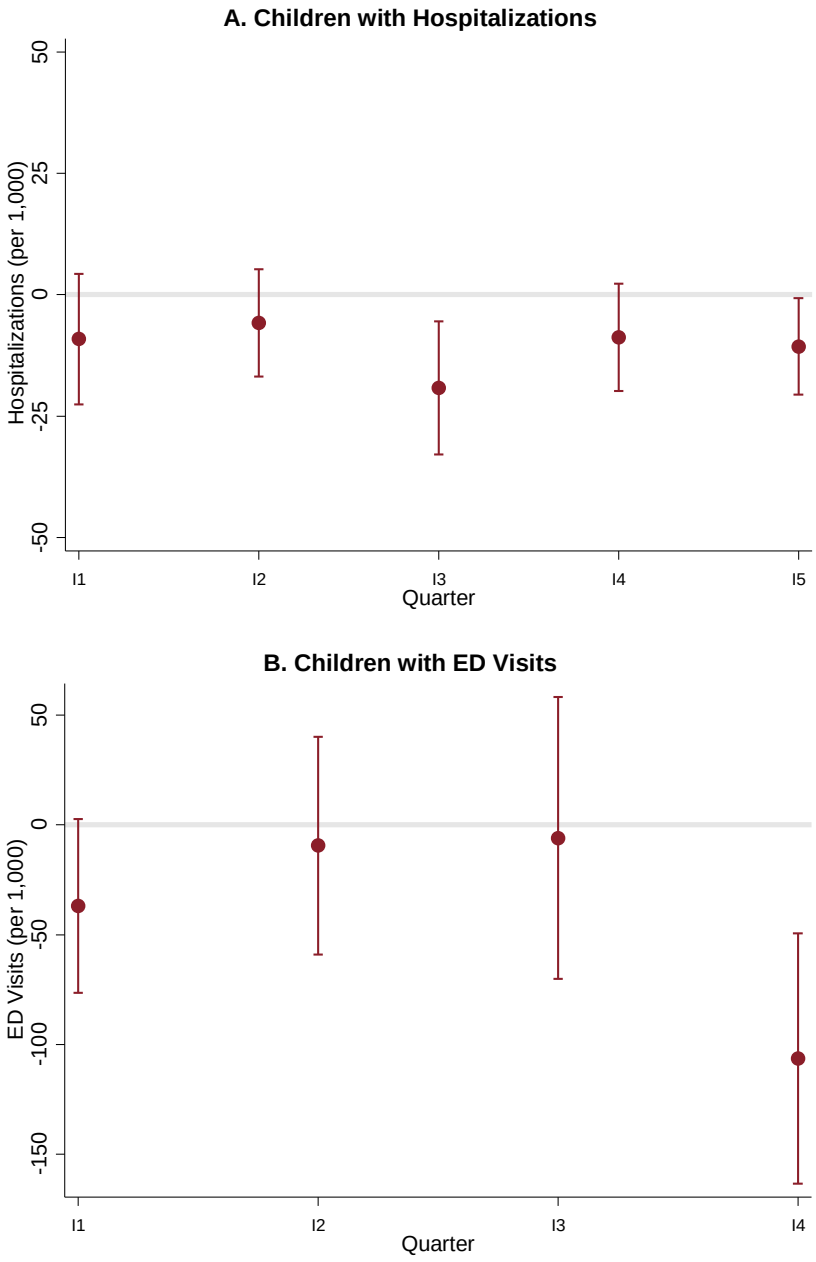
NOTES: ***p <0.01, **p <0.05, *p <0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. CDPS, chronic disease and disability payment system (diagnostic classification system that Medicaid programs can use to make health-based capitated payments for certain Medicaid beneficiaries); ED, emergency department; SD, standard deviation.

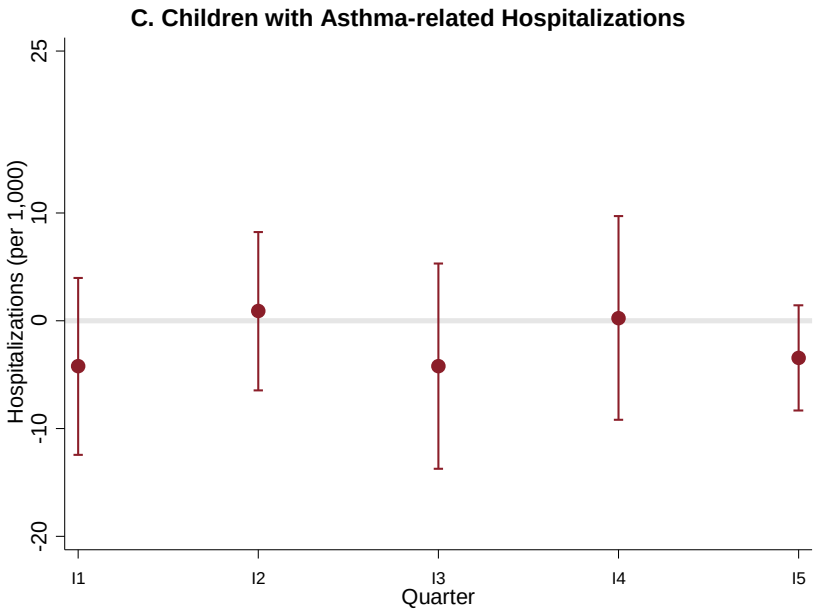
Quarter-specific program impact. Exhibit S11.4 summarizes the results of the QFE DID models as the adjusted marginal effect of Nemours' intervention on hospitalizations, ED visits, asthma-related hospitalizations, and total cost of care.[343]

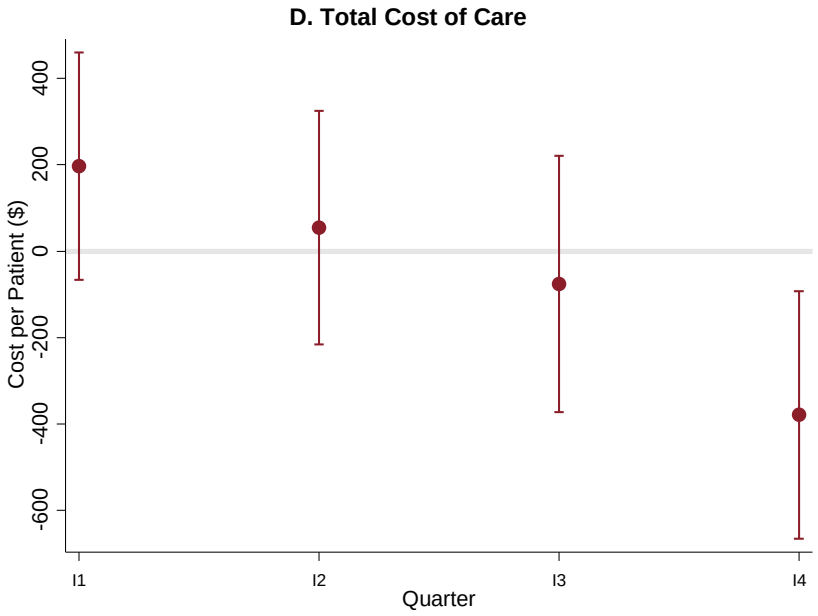
- Hospitalizations trended lower overall, with significantly lower point estimates in two quarters (I3 and I5), compared with the matched comparison group.
- We observed no consistent trend in asthma-related hospitalizations.
- ED visits trended lower overall, with a significantly lower point estimate in quarter I4.
- Cost-of-care estimates declined over time, with a significantly lower point estimate in one quarter (I4), compared with the matched comparison group.

[343]Adjustment factors: age (in categories <5, 5-9, 10-14, 15+), race (White), disability status, prior-year CDPS risk score, and urbanicity (metropolitan area).

Exhibit S11.4: Adjusted Utilization Rates for Core Measures for Nemours by Quarter




C. Children with Asthma-related Hospitalizations
Hospitalizations (per 1,000)
25
10
0
-10
-20
I1
I2
I3
I4
I5
Quarter


D. Total Cost of Care
Cost per Patient ($)
400
200
0
-200
-400
-600
I1
I2
I3
I4
Quarter

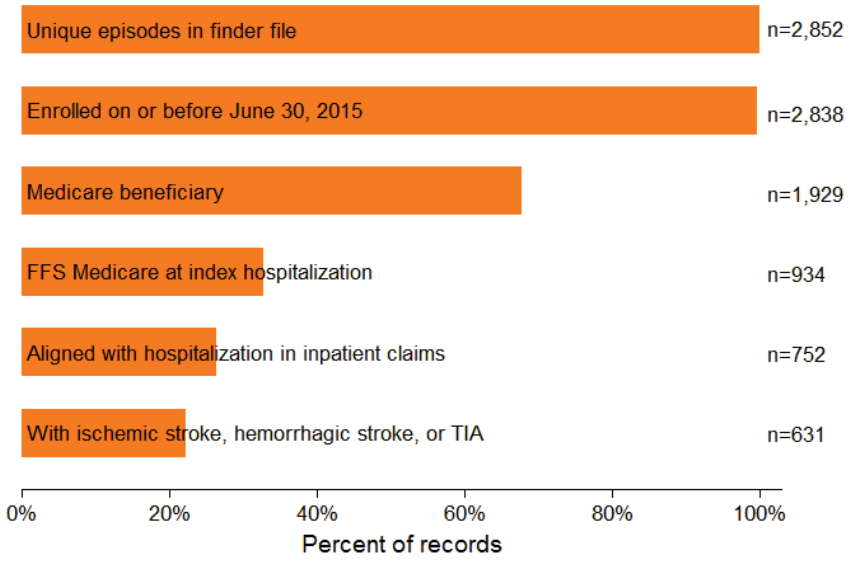
Ochsner Clinic Foundation

Stroke Central

Treatment and Comparison Group Creation

- We worked with Ochsner's finder file listing of Stroke Central participants to identify Medicare FFS patient-episodes for stroke in each post-intervention quarter from January 1, 2013, through June 30, 2015 (N = 631) (please see Exhibit S12.1). Approximately two-thirds of participants enrolled in Ochsner's intervention received coverage through Medicare Advantage plans and other private insurance. We did not have data to include these beneficiaries in our analysis.
- We restricted our treatment group to patient-episodes from Medicare FFS claims and those including ischemic stroke, hemorrhagic stroke, or transient ischemic attack (TIA).
- We added a group of baseline Medicare FFS patient-episodes for stroke at Ochsner in the pre–Health Care Innovation Award period, from January 1, 2011, through December 31, 2012.

Exhibit S12.1: Patient-Episodes Identified through Ochsner Finder File[344]



Comparison group selection. We included FFS Medicare patient-episodes for stroke (pre- and post-intervention) at two comparison hospitals selected for their similarities to Ochsner.[345,346] We ran propensity score models to produce standard mortality ratio (SMR) weights. We then incorporated the SMR weights into our analysis to minimize observed differences in covariates across Ochsner and

[344]A total of 121 patient-episodes aligned with hospitalization and inpatient claims also had a history of a target condition: ischemic stroke, hemorrhagic stroke, or TIA. However, the index admission was for a non-target condition unrelated to stroke; therefore, these patient-episodes were not included in AR3 analysis.

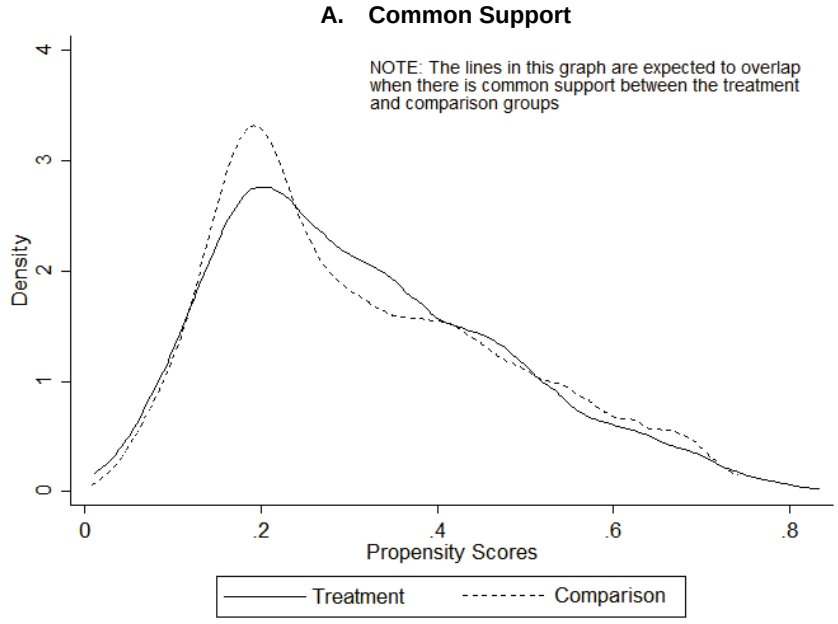
[345]The comparison sites are United Regional Health Care System, TX, and Memorial Hermann Texas Medical Center, TX.

[346]We considered the following characteristics: geographic region, population density, teaching status, ownership type, number of beds, target diagnosis/procedure volume, demographics of hospital population, volume of inpatient stroke hospitalizations, and Stroke Center certifications.

comparison group patient-episodes included in our propensity score models. For more details on comparison group selection and SMR weighting, please see Technical Appendix A above. Exhibit S12.2 summarizes results after we incorporated SMR weights into our analysis. Panel A shows the similarities between the treatment and comparison groups after SMR weighting, and panel B shows the distribution of covariates before and after weighting.[347]

- After weighting, we observed a high level of overlap in distribution of estimated propensity scores across Ochsner and comparison group patient-episodes (panel A).
- On the balance graph (panel B), we show that the standardized difference between the Ochsner and the comparison patient-episodes across all covariates was negligible after incorporating propensity score weighting.

Exhibit S12.2: Common Support and Covariate Balance for Ochsner and Comparison Patient-Episodes



[347]We include the following covariates in the propensity score model: age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year cost, prior-year ED visits, prior-year HCC score, prior-year FFS coverage, discharge status, target condition (ischemic stroke: precerebral and cerebral; hemorrhagic stroke: subarachnoid, intracerebral, and other unspecified intracranial hemorrhage; TIA), history of stroke, and severity of hospitalization, (CC, MCC, or neither CC nor MCC DRG).

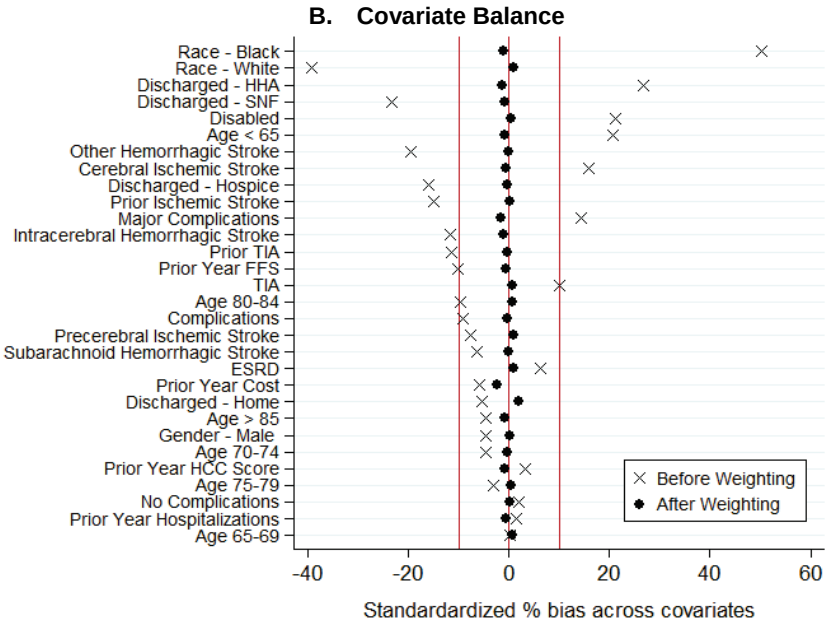


Exhibit S12.3 summarizes demographic and other basic information about the treatment and comparison patients with episodes included in our analysis of core outcome measures. Relative to Ochsner, comparison patients who had post-intervention stroke episodes were more likely to be older and White; have higher cost of care at baseline; be less likely to be covered due to disability; be covered due to older age; and be discharged to a skilled nursing facility (SNF) or home after hospitalization.

Exhibit S12.3: Descriptive Characteristics of Patients with Episodes in Ochsner and Comparison Groups[348]

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Number of Patient-Episodes	660	1,941	631	2,324
Age Group* **				
<65 years old	19.7% (130)	12.6% (245)	23.1% (146)	14.4% (334)
65–69 years old	17.7% (117)	17.3% (336)	18.1% (114)	18.2% (422)
70–74 years old	17.4% (115)	17.9% (348)	15.8% (100)	18.7% (435)
75–79 years old	15.2% (100)	17.6% (341)	15.8% (100)	15.7% (366)
80–84 years old	14.7% (97)	16.7% (325)	11.3% (71)	16.2% (376)
≥85 years old	15.3% (101)	17.8% (346)	15.8% (100)	16.8% (391)
Race/Ethnicity* **				
White	58.0% (383)	78.0% (1,514)	59.3% (374)	75.6% (1,756)
Black	38.8% (256)	16.3% (316)	38.0% (240)	16.9% (392)
Hispanic	0.5% (3)	2.9% (56)	1.0% (6)	4.2% (97)
Other	2.7% (18)	2.8% (55)	1.7% (11)	3.4% (79)

[348]Descriptive statistics are based on findings prior to propensity score weighting.

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Gender				
Female	55.5% (366)	52.7% (1,022)	53.1% (335)	51.5% (1,196)
Comorbidities: Hierarchical Condition Categories (HCCs)				
Number of HCCs^	3.0 (2.9)	2.8 (3.0)	2.8 (2.8)	3.0 (2.9)
HCC Score	1.7 (1.4)	1.6 (1.4)	1.6 (1.4)	1.6 (1.3)
Utilization Year Prior to Index Hospitalization				
No. Hospitalizations/Year	0.8 (1.4)	0.8 (1.4)	0.6 (1.2)	0.6 (1.2)
No. ED Visits/Year	1.4 (3.2)	1.1 (2.1)	1.2 (2.2)	1.2 (2.2)
Prior 1-year Cost**	$22,194 ($39,879)	$21,341 ($36,058)	$15,572 ($27,562)	$20,912 ($39,672)
Coverage Reason* **				
Age	70.2% (463)	78.0% (1,514)	64.0% (404)	75.6% (1,757)
Disability	27.3% (180)	20.4% (395)	33.4% (211)	22.7% (528)
ESRD	1.2% (8)	0.9% (17)	0.5% (3)	0.5% (12)
Disability and ESRD	1.4% (9)	0.8% (15)	2.1% (13)	1.2% (27)
Discharges* **				
Home	40.0% (264)	42.0% (816)	33.6% (212)	37.3% (867)
SNF	10.0% (66)	17.8% (345)	11.3% (71)	19.6% (456)
HHA	22.3% (147)	12.3% (238)	23.6% (149)	13.3% (308)
Hospice	3.9% (26)	7.3% (142)	3.5% (22)	7.4% (171)
Other	23.8% (157)	20.6% (400)	28.1% (177)	22.5% (522)
Disease Composition* **				
Ischemic Stroke	67.0% (442)	65.3% (1,267)	75.9% (479)	67.1% (1,559)
Hemorrhagic Stroke	13.0% (86)	21.4% (416)	13.6% (86)	22.2% (516)
TIA	20.0% (132)	13.3% (258)	10.5% (66)	10.7% (249)

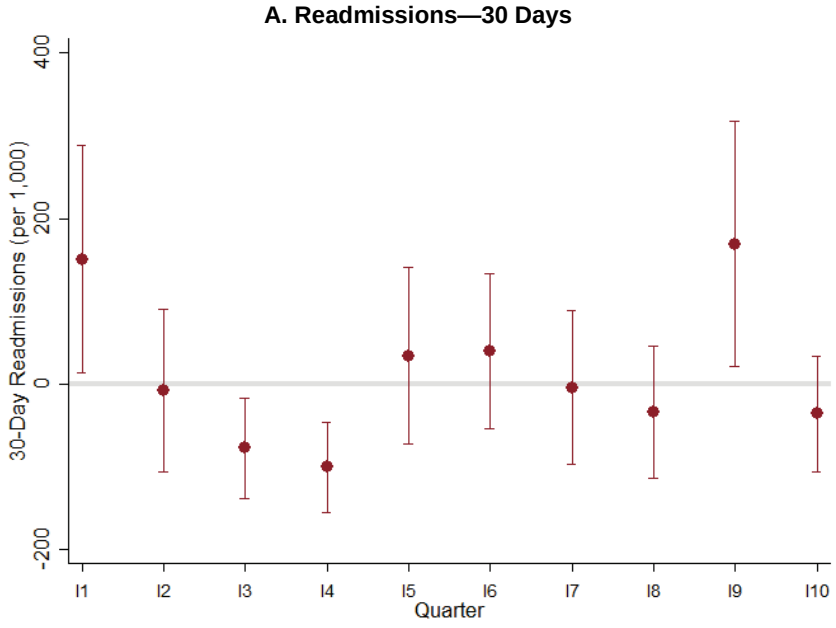
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. ^Due to missing data, means were calculated using different denominators for this measure: pre-Ochsner = 656, pre-comparison = 1,928, post-Ochsner = 627, post-comparison = 2,316; ESRD, end-stage renal disease; HCC, hierarchical condition categories; HHA, home health aide; SNF, skilled nursing facility; TIA, transient ischemic attack.

Quarter-specific program impact. Exhibit S12.3 summarizes the results of the QFE DID models as the adjusted marginal effect of Ochsner's Stroke Central intervention on readmissions, ED visits, and total cost of care in each quarter after implementation.[349] We present readmissions at 30, 90, 180, and 365 days post-discharge. We present ED visits and total cost of care at 90 and 180 days post-discharge.

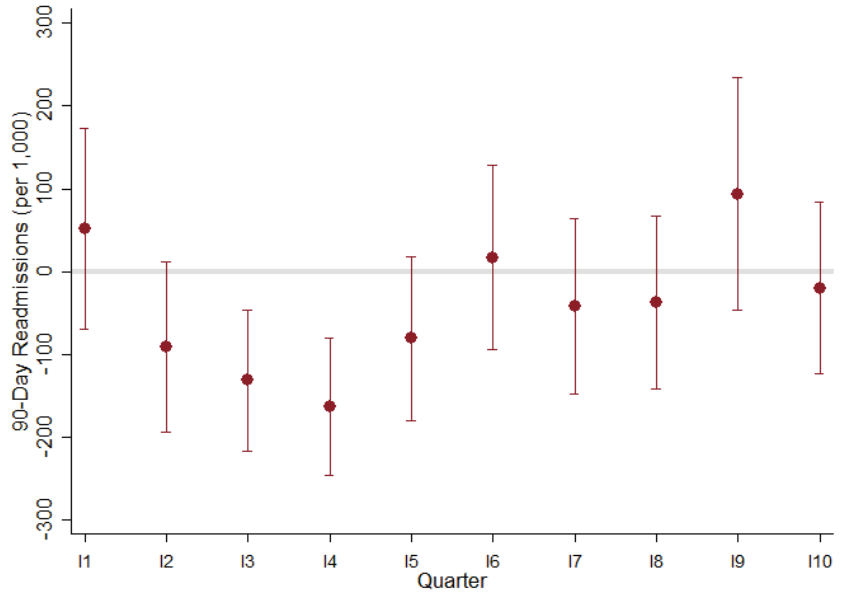
[349]Adjustment factors include age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year cost, prior-year ED visits, prior-year HCC score, prior-year FFS coverage, discharge status, target condition (ischemic stroke: precerebral and cerebral; hemorrhagic stroke: subarachnoid, intracerebral, and other unspecified intracranial hemorrhage; TIA), history of stroke, and severity of hospitalization, (CC, MCC, or neither CC nor MCC DRG).

- In early post-intervention quarters (I2-I4), Ochsner's patient-episodes had lower rates of 30-day and 90-day readmissions than the comparison group (significant difference in quarters I3 and I4). Readmissions trended higher in later quarters of the intervention.
- The difference in ED visits between Ochsner and the comparison group remained unchanged in the post-intervention period.
- We observed similar trends for the 90-day and 180-day total cost of care and readmission measures. Costs for Ochsner's patient-episodes, which were initially higher than those of the comparison group, decreased across early post-intervention quarters, reaching significance in the fourth quarter after implementation (I4). We observed non-significant increases in cost of care for Ochsner's patient-episodes versus the comparison group in subsequent post-intervention quarters.

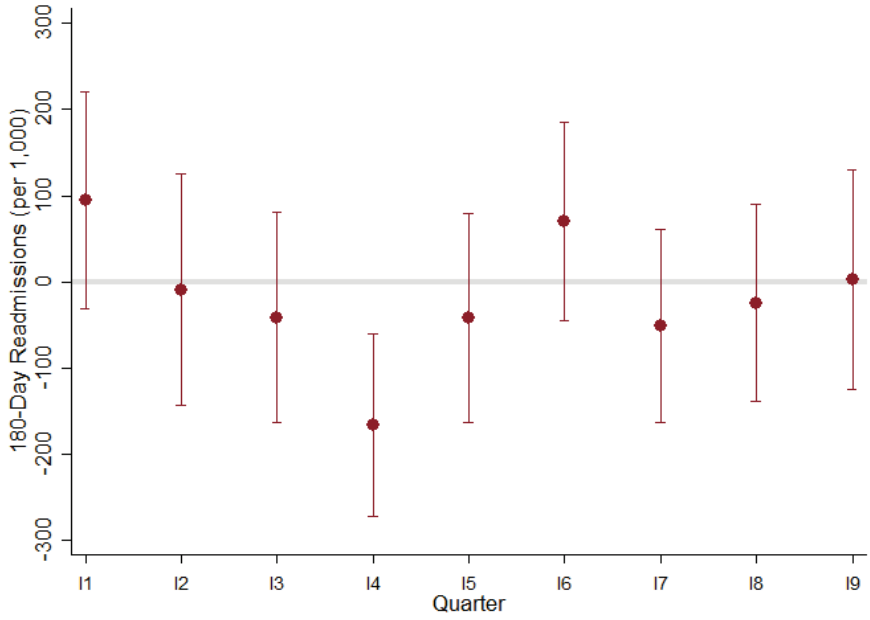
Exhibit S12.4: Adjusted Rates for Core Measures for Ochsner by Quarter



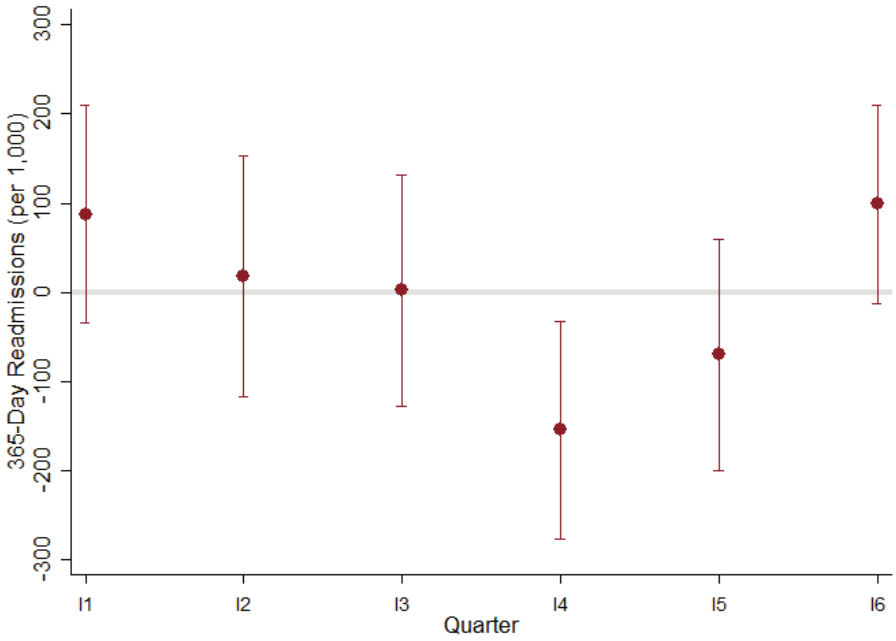
B. Readmissions—90 Days



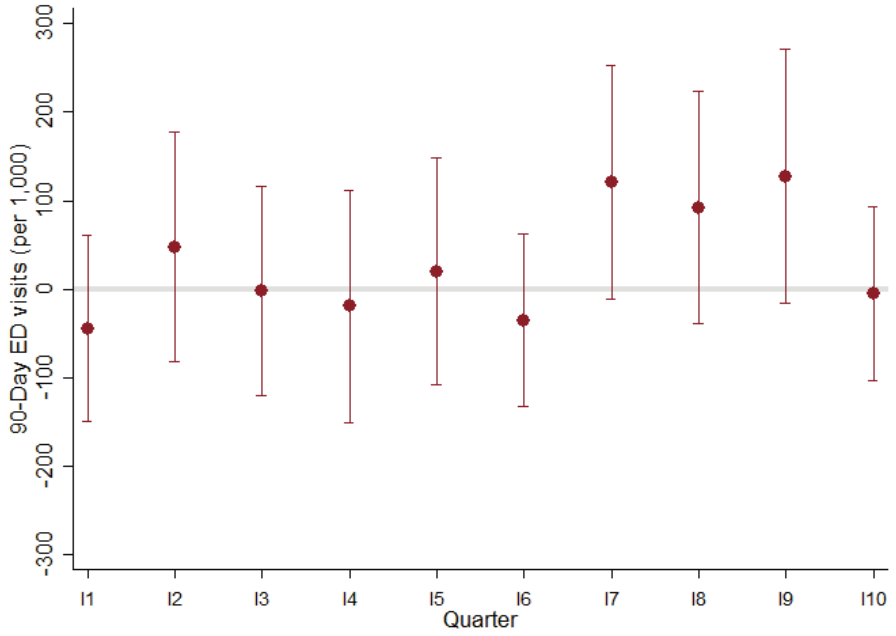
C. Readmissions—180 Days



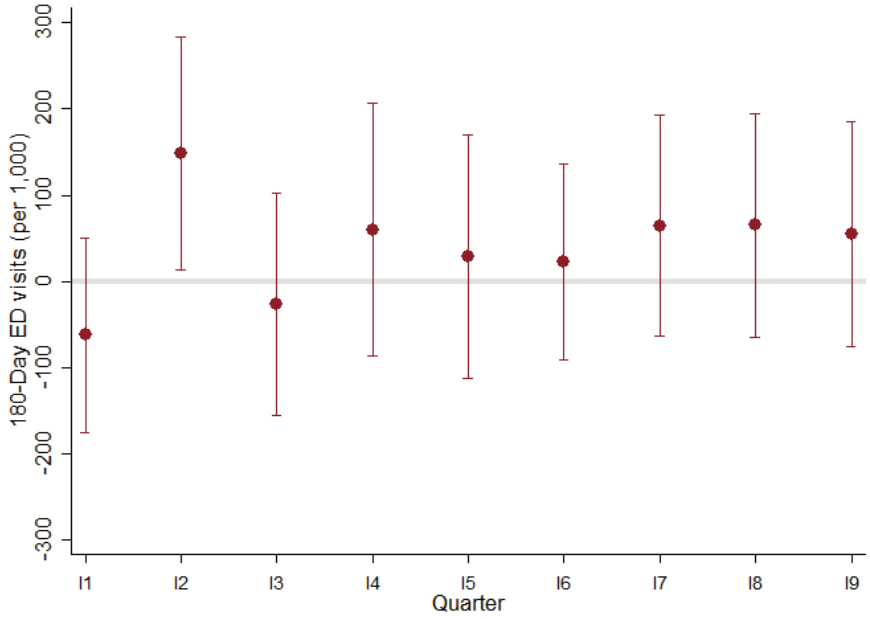
D. Readmissions—365 Days



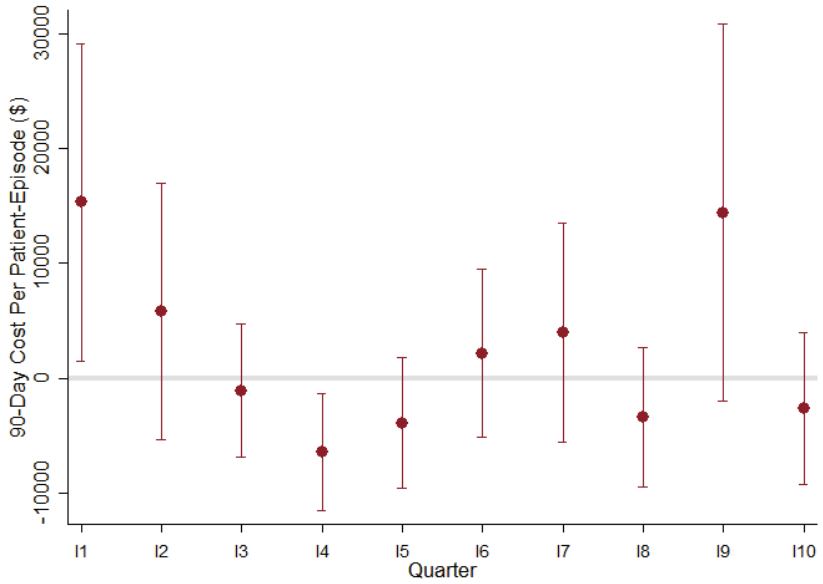
E. ED Visits—90 Days

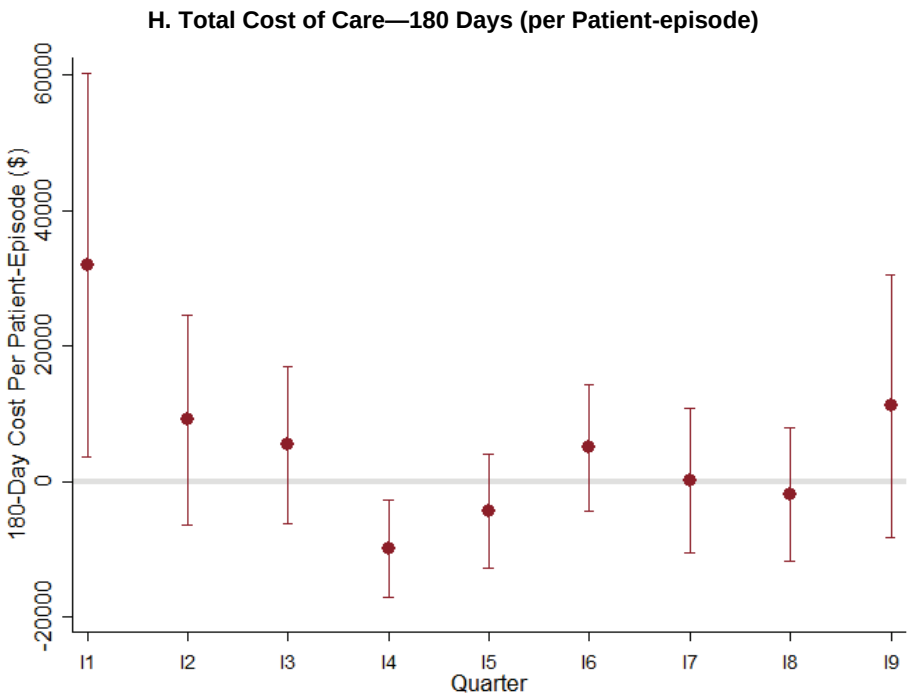


F. ED Visits—180 Days



G. Total Cost of Care—90 Days (per Patient-episode)





High-Risk Analysis

Comparison group selection. For a subgroup of patient-episodes with the highest HCC scores (top 25 percent) in Stroke Central and the comparison group, we used propensity score models to produce SMR weights. We then incorporated SMR weights into our analysis to minimize the observed differences in covariates across Ochsner and comparison group patient-episodes for this high-risk subgroup. For more details on comparison group selection and SMR weighting, please see Technical Appendix A above. Exhibit S12.5 summarizes results after we incorporate SMR weights into our analysis. Panel A shows the similarities between the treatment and comparison groups after SMR weighting, and panel B shows the distribution of covariates before and after weighting.

- After weighting, we observed reasonable overlap in the distribution of estimated propensity scores across Ochsner and comparison group patient-episodes (panel A).
- On the balance chart (panel B), we show that the standardized difference between Ochsner and comparison patient-episodes across all covariates is negligible, after incorporating propensity score weighting.

Exhibit S12.5: Common Support and Covariate Balance for Ochsner and Comparison High-Risk Patient-Episodes

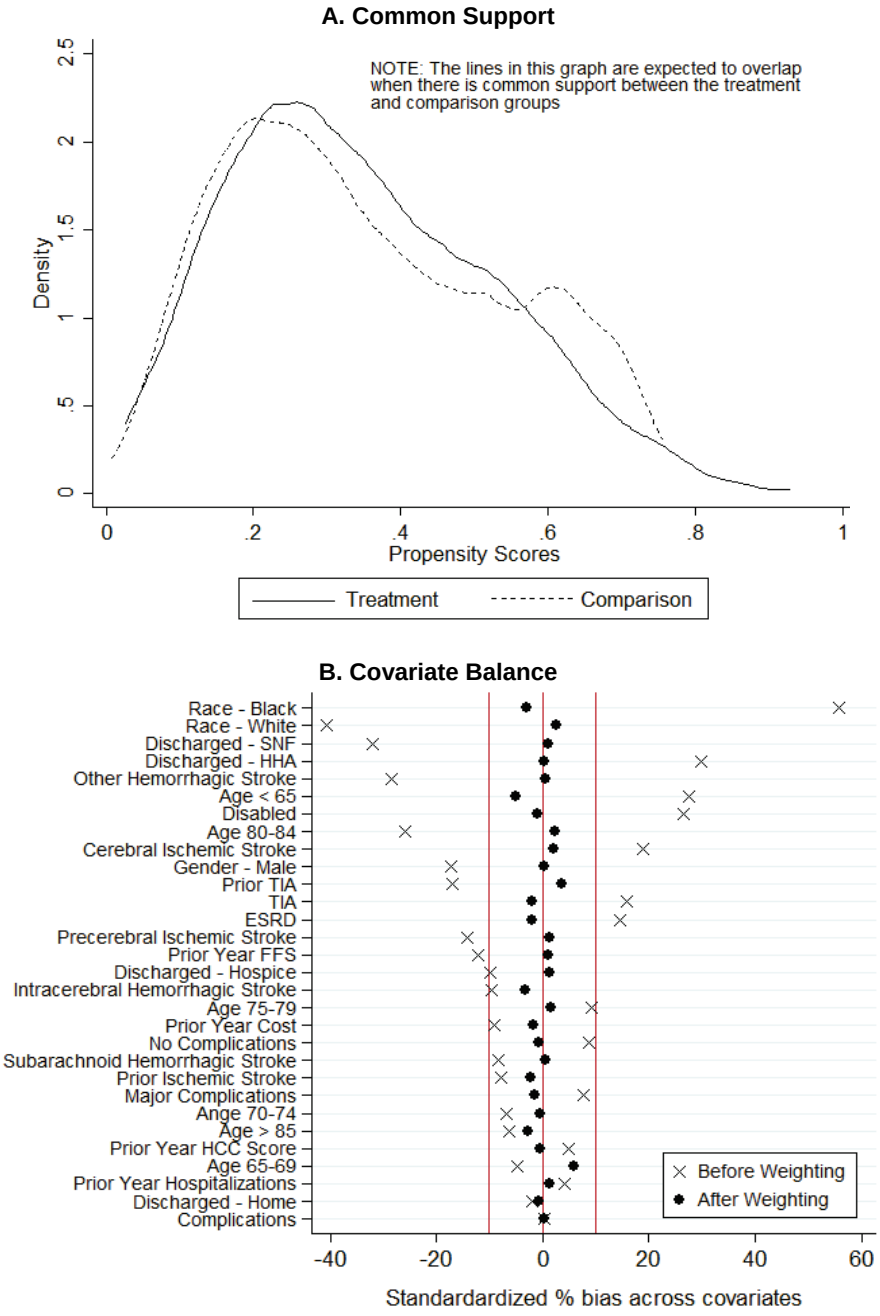


Exhibit S12.6 summarizes demographic and other basic information about the treatment and comparison patient-episodes included in the high-risk subgroup analysis.

Exhibit S12.6: Descriptive Characteristics of Patients with Episodes in Ochsner and Comparison High-Risk Subgroups[350]

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Number of Patient-Episodes	173	450	155	610
Age Group**				
<65 years old	30.1% (52)	18.2% (82)	28.4% (44)	17.2% (105)
65–69 years old	9.8% (17)	10.9% (49)	11.0% (17)	12.6% (77)
70–74 years old	14.5% (25)	16.4% (74)	14.8% (23)	17.7% (108)
75–79 years old	22.5% (39)	16.4% (74)	18.1% (28)	17.0% (104)
80–84 years old	7.5% (13)	18.9% (85)	11.6% (18)	17.9% (109)
≥85 years old	15.6% (27)	19.1% (86)	16.1% (25)	17.5% (107)
Race/Ethnicity***				
White	51.4% (89)	73.3% (330)	54.8% (85)	71.6% (437)
Black	46.8% (81)	19.8% (89)	41.9% (65)	19.2% (117)
Hispanic	0.0% (0)	4.0% (18)	0.6% (1)	6.1% (37)
Other	1.7% (3)	2.9% (13)	2.6% (4)	3.1% (19)
Gender**				
Female	57.2% (99)	48.4% (218)	64.5% (100)	54.9% (335)
Comorbidities: Hierarchical Condition Categories (HCCs)				
Number of HCCs (SD)	6.7 (2.6)	7.0 (2.9)	6.6 (2.5)	6.8 (2.4)
HCC Score (SD)	3.6 (1.3)	3.6 (1.4)	3.6 (1.3)	3.5 (1.3)
Utilization Year Prior to Index Hospitalization				
No. Hospitalizations/Year (SD)	1.9 (1.9)	2.0 (1.8)	1.6 (1.6)	1.5 (1.4)
No. ED Visits/Year (SD)	2.9 (4.9)	2.1 (2.6)	2.4 (3.2)	2.5 (3.4)
Prior 1-year Cost** (SD)	$55,165 ($57,548)	$56,707 ($53,036)	$42,177 ($42,207)	$51,633 ($55,436)
Coverage Reason***				
Age	56.6% (98)	70.0% (315)	52.3% (81)	66.6% (406)
Disability	35.8% (62)	26.4% (119)	40.6% (63)	29.2% (178)
ESRD	3.5% (6)	1.8% (8)	1.3% (2)	1.6% (10)
Disability and ESRD	4.0% (7)	1.8% (8)	5.8% (9)	2.6% (16)
Discharges***				
Home	34.1% (59)	32.2% (145)	23.9% (37)	28.7% (175)
SNF	9.8% (17)	22.0% (99)	14.2% (22)	25.6% (156)
HHA	26.0% (45)	16.0% (72)	30.3% (47)	15.7% (96)
Hospice	8.1% (14)	8.7% (39)	6.5% (10)	11.1% (68)
Other	22.0% (38)	21.1% (95)	25.2% (39)	18.9% (115)
Disease Composition***				

[350]Descriptive statistics are based on findings prior to propensity score weighting.

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Ischemic Stroke	61.3% (106)	61.8% (278)	74.8% (116)	64.4% (393)
Hemorrhagic Stroke	11.6% (20)	23.1% (104)	12.3% (19)	21.6% (132)
TIA	27.2% (47)	15.1% (68)	12.9% (20)	13.9% (85)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. ESRD, end-stage renal disease; HCC, hierarchical condition categories; HHA, home health aide; SNF, skilled nursing facility; TIA, transient ischemic attack.

Stroke Mobile Analysis

Comparison group selection. For a subgroup of patient-episodes in Stroke Mobile and the comparison group, we used propensity score models to produce SMR weights. We then incorporated the SMR weights into our analysis to minimize the observed differences in covariates between the two groups. For more details on comparison group selection and SMR weighting, please see Technical Appendix A above. Exhibit S12.7 summarizes results after we incorporated SMR weights into our analysis. Panel A shows the similarities between the treatment and comparison groups after SMR weighting, and panel B shows the distribution of covariates before and after weighting.

- After weighting, we observed a high level of overlap in distribution of estimated propensity scores across Ochsner and comparison group patient-episodes (panel A).
- On the balance chart (panel B), we show that the standardized difference between Ochsner and comparison patient-episodes across all covariates was negligible after incorporating propensity score weighting (panel B).

Exhibit S12.7: Common Support and Covariate Balance for Stroke Mobile and Comparison Patient-Episodes

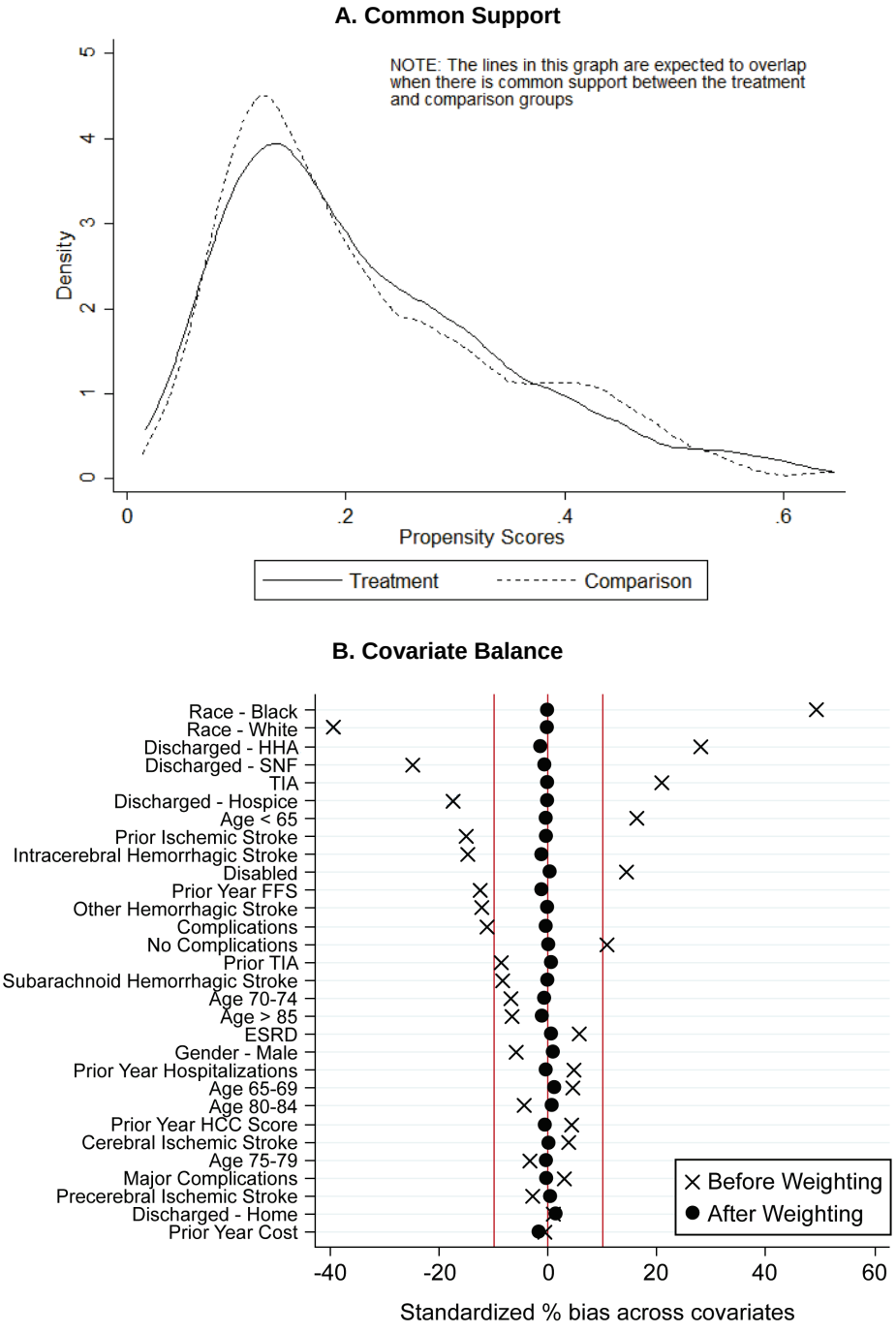


Exhibit S12.8 summarizes basic information about treatment and comparison patient-episodes included in our Stroke Mobile analysis.

Exhibit S12.8: Descriptive Characteristics of Patients with Episodes in Stroke Mobile[351]

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Number of Patient-Episodes	660	1941	102	610
Age Group* **				
<65 years old	19.7% (130)	12.6% (245)	19.6% (20)	14.4% (334)
65–69 years old	17.7% (117)	17.3% (336)	31.4% (32)	18.2% (422)
70–74 years old	17.4% (115)	17.9% (348)	4.9% (5)	18.7% (435)
75–79 years old	15.2% (100)	17.6% (341)	16.7% (17)	15.7% (366)
80–84 years old	14.7% (97)	16.7% (325)	15.7% (16)	16.2% (376)
≥85 years old	15.3% (101)	17.8% (346)	11.8% (12)	16.8% (391)
Race/Ethnicity* **				
White	58.0% (383)	77.9% (1,513)	61.8% (63)	75.6% (1,756)
Black	38.8% (256)	16.3% (316)	32.4% (33)	16.9% (392)
Hispanic	0.5% (3)	2.9% (56)	2.0% (2)	4.2% (97)
Other	2.7% (18)	2.9% (56)	3.9% (4)	3.4% (79)
Gender				
Female	55.5% (366)	52.7% (1,022)	51.0% (52)	51.5% (1,196)
Comorbidities: Hierarchical Condition Categories (HCCs)				
Number of HCCs (SD)	3.0 (2.9)	2.8 (3.0)	2.6 (3.0)	3.0 (2.9)
HCC Score (SD)	1.7 (1.4)	1.6 (1.4)	1.5 (1.5)	1.6 (1.3)
Utilization Year Prior to Index Hospitalization				
No. Hospitalizations/Year (SD)	0.8 (1.4)	0.8 (1.4)	0.5 (1.2)	0.6 (1.2)
No. ED Visits/Year** (SD)	1.4 (3.2)	1.1 (2.1)	0.7 (1.3)	1.2 (2.2)
Prior 1-year Cost** (SD)	$22,194 ($39,879)	$21,341 ($36,058)	$12,716 ($27,682)	$20,912 ($39,672)
Coverage Reason				
Old Age	70.2% (463)	78.0% (1,514)	69.6% (71)	75.6% (1,757)
Disability	27.3% (180)	20.4% (395)	28.4% (29)	22.7% (528)
ESRD	1.2% (8)	0.9% (17)	0.0% (0)	0.5% (12)
Disability and ESRD	1.4% (9)	0.8% (15)	2.0% (2)	1.2% (27)
Discharges* **				
Home	40.0% (264)	42.0% (816)	39.2% (40)	37.3% (867)
SNF	10.0% (66)	17.8% (345)	10.8% (11)	19.6% (456)
HHA	22.3% (147)	12.3% (238)	31.4% (32)	13.3% (308)
Hospice	3.9% (26)	7.3% (142)	0.0% (0)	7.4% (171)
Other	23.8% (157)	20.6% (400)	18.6% (19)	22.5% (522)
Disease Composition				
Ischemic Stroke	67.0% (442)	65.3% (1,267)	67.6% (69)	67.1% (1,559)

[351]Descriptive statistics are based on findings prior to propensity score weighting.

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Hemorrhagic Stroke	13.0% (86)	21.4% (416)	16.7% (17)	22.2% (516)
TIA	20.0% (132)	13.3% (258)	15.7% (16)	10.7% (249)

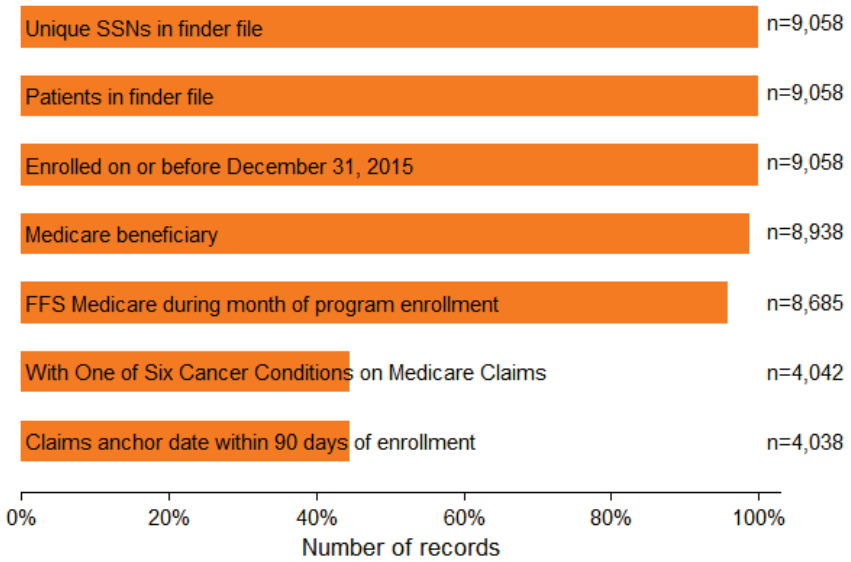
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variable; ESRD, end-stage renal disease; HCC, hierarchical condition categories; HHA, home health aide; SNF, skilled nursing facility; TIA, transient ischemic attack.

University of Alabama at Birmingham

Treatment and Comparison Group Creation

- We worked with UAB's finder file of participants and enrollment dates to identify FFS Medicare claims for individuals in our treatment group (please see Exhibit S13.1). We defined the enrollment date for the treatment group based on a claims anchor date, which is the first date when we observe a diagnosis code for cancer on a patient's inpatient, outpatient, or physician visit claims. Individuals in the treatment group were limited to those with claims anchor dates within 90 days of the program enrollment date listed on the finder file.
- We restricted our treatment group to Medicare FFS participants who were enrolled in UAB's program for one or more quarters, from July 1, 2012, through June 30, 2015, which is the last enrollment date provided in the finder file.
- Although UAB's program targeted Medicare patients with all types of cancers, we limited our evaluation to cancers for which at least 70 patients received care at one of the participating hospitals: breast cancer, lung cancer, colorectal cancer, lymphoma, male genitourinary cancers, female genitourinary cancers, and head and neck cancers.
- To identify a pool of comparison patients, we selected FFS beneficiaries treated for one of the seven selected cancers at one of two National Cancer Institute Comprehensive Cancer Centers (NCI CCCs) and its affiliated facilities.[352] We defined enrollment date for the comparison pool patients using the same rules for claims anchor date as the treatment group.

Exhibit S13.1: Patients Identified through UAB Finder File



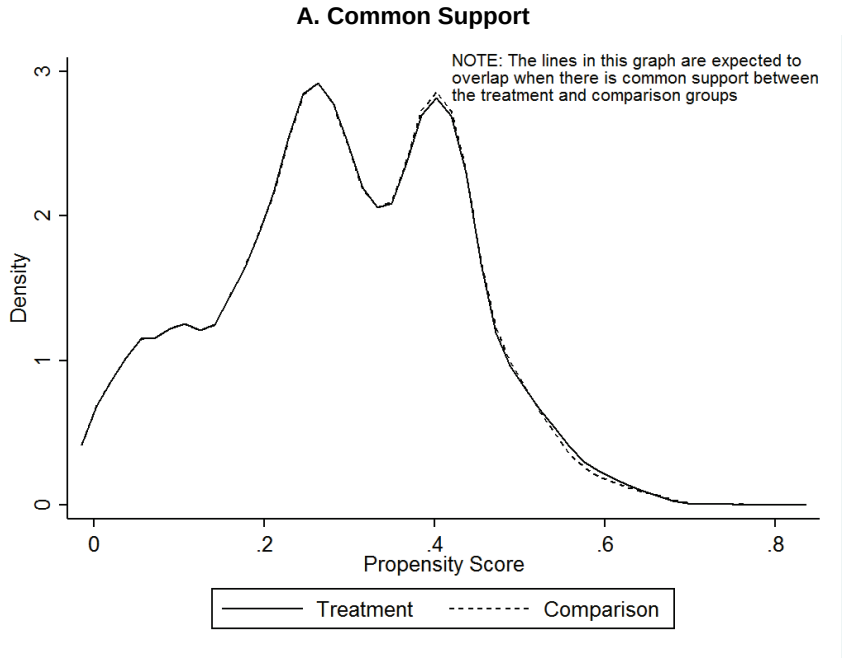
Comparison group selection. We used propensity score models to select comparison patients who had the same cancer type and characteristics similar to UAB participants with respect to demographics,

[352]We chose these two NCI CCCs and their affiliated facilities because they were closest geographically to the awardee institution and mirrored the arrangement between UAB's CCC and its affiliated hospital sites.

comorbidities, and prior utilization. Exhibit S13.2 summarizes the results from our propensity score–based comparison selection. Panel A shows the common support between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

- After matching, we observed that treatment and comparison groups had nearly identical distributions of propensity scores, suggesting that these groups are well matched—at least with respect to the included factors.
- The balance graph (panel A) shows that matching has achieved balance (i.e., reduced the difference between UAB participants and the comparison group to <10% standardized bias) with respect to demographic characteristics, comorbidities, and prior-year utilization and costs.
- Due to the paucity of information on claims regarding cancer severity, we used four variables as proxies in our propensity score model: metastatic cancer, surgery for cancer, chemotherapy for cancer, and radiation therapy for cancer.

Exhibit S13.2: Common Support and Covariate Balance for UAB and Comparison Participants



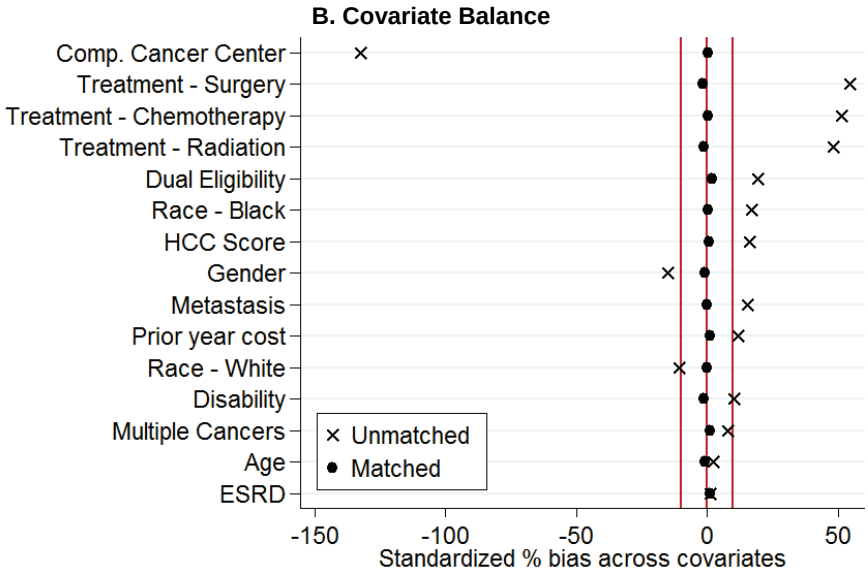


Exhibit S13.3 summarizes demographic and other basic information about the treatment and matched comparison patients who are included in our analysis of core outcome measures. After matching, there were no significant differences between participants at UAB and the comparison group with respect to demographic characteristics or prior utilization.

Exhibit S13.3: Descriptive Characteristics of UAB and Matched Comparison Patients

Variable	UAB	Comparison
	% (N)	% (N)
Number of Patients	4,038	4,038
Mean Number of Quarters Enrolled [Range]	4.4 [1-11]	4.4 [1-11]
Cancer Condition		
Breast	29.2% (1,179)	29.2% (1,179)
Colorectal	14.8% (598)	14.8% (598)
Lung	28.0% (1,129)	28.0% (1,129)
Lymphoma	7.4% (300)	7.4% (300)
Female Genitourinary	16.2% (654)	16.2% (654)
Male Genitourinary	2.5% (102)	2.5% (102)
Head and Neck	1.9% (76)	1.9% (76)
Age Group		
<65 years old	0.2% (10)	0.6% (23)
65–69 years old	31.4% (1,266)	31.0% (1,253)
70–74 years old	26.1% (1,055)	27.4% (1,106)
75–79 years old	22.2% (898)	20.7% (836)
80–84 years old	13.5% (546)	12.9% (519)
≥85 years old	6.5% (546)	7.5% (519)
Race/Ethnicity		
White	84.3% (3,405)	84.4% (3,407)

Variable	UAB	Comparison
	% (N)	% (N)
Black	14.0% (567)	14.0% (565)
Hispanic	0.2% (8)	0.1% (4)
Other	1.4% (58)	1.5% (62)
Gender		
Female	55.5% (2,242)	55.1% (2,226)
Dual Status		
Dually Eligible	13.3% (537)	12.8% (516)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$22,954 ($26,974)	$22,682 ($29,428)
Hospitalizations per 1,000 Patients (SD)	642 (1,081)	642 (1,148)
ED Visits per 1,000 Patients (SD)	936 (2,109)	996 (2,538)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables; ED, emergency department; SD, standard deviation.

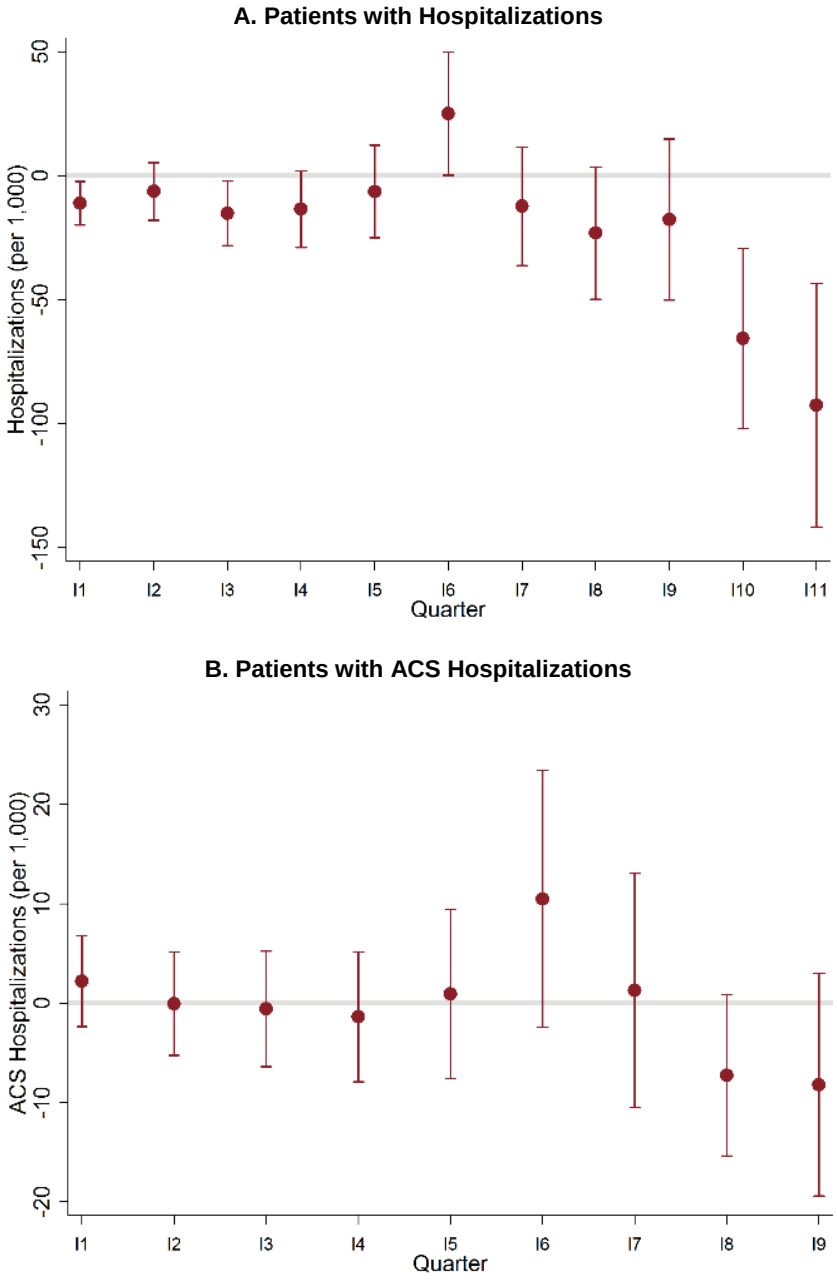
Quarter-specific program impact. Exhibit S13.4 summarize the results of the QFE DID models as the adjusted marginal effect of UAB's intervention on hospitalizations, ACS hospitalizations, 30-day readmissions, ED visits, and total cost of care.[353]

- Relative to comparison patients, UAB's program participants had significantly fewer ED visits from the first to third quarter, and there was a statistically significant decrease from the seventh to the 11th quarter.
- UAB's program participants also had significantly lower total cost of care than the comparison patients in the eighth, 10th, and 11th quarters.
- There was a statistically significant decrease in hospitalizations in the first, third, 10th, and 11th quarters.
- UAB's program was not associated with any significant reductions in 30-day readmissions or ACS hospitalizations in any of the post-intervention quarters.

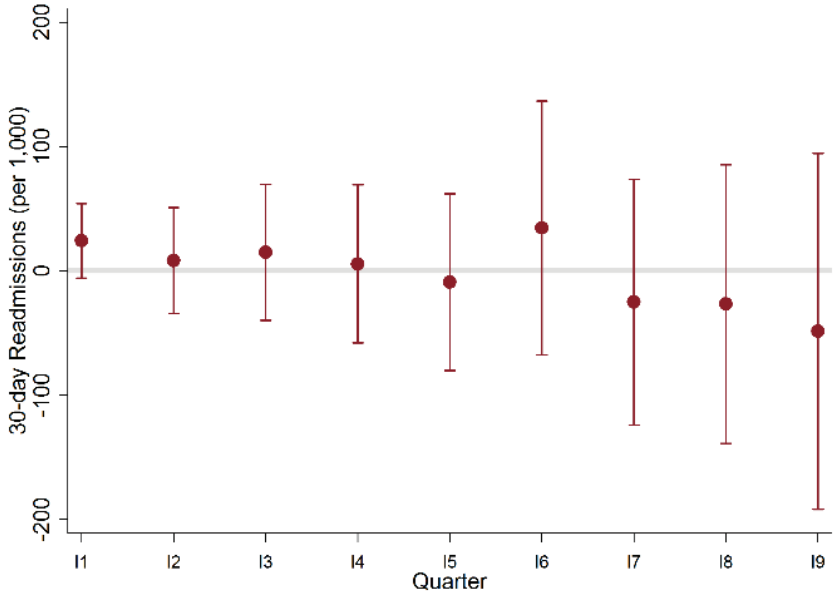
For most measures, the uncertainty in estimates (indicated by the confidence interval) is larger in later quarters of the post-intervention period. This reflects the smaller number of participants enrolled in the program for this length of time.

[353]Adjustment factors include cancer type; age; gender; race/ethnicity; dual eligibility; disability status; ESRD; HCC score; and indicators for cancer surgery, radiation therapy, chemotherapy, metastatic cancer, and treatment at a comprehensive cancer center.

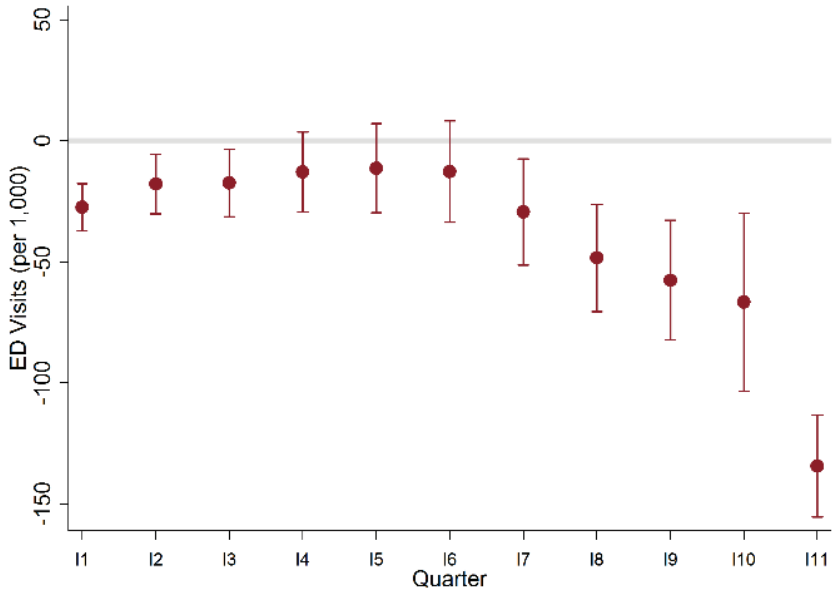
Exhibit S13.4: Adjusted Utilization Rates for Core Measures for UAB by Quarter

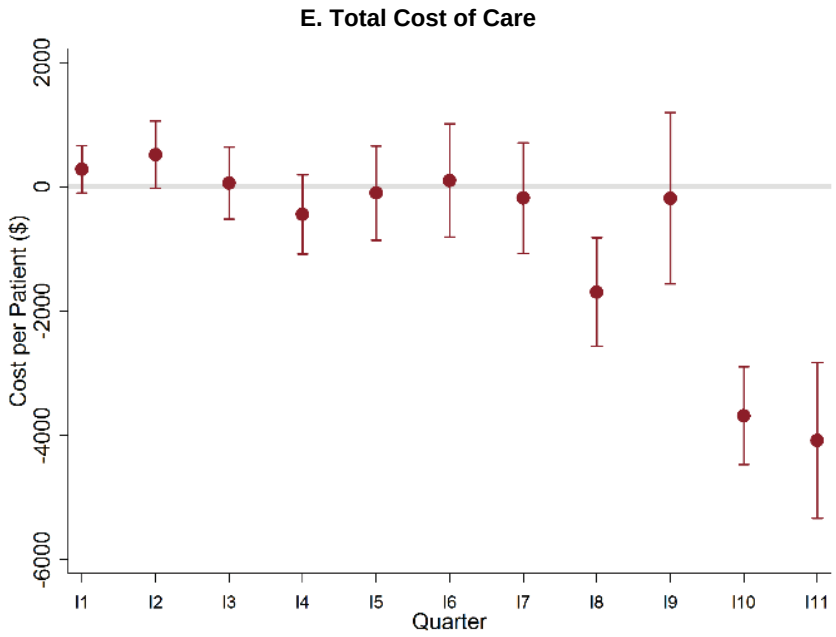


C. Patients with 30-day Readmissions



D. Patients with ED Visits





End-of-Life Analysis

Comparison group selection. We used propensity score models to select comparison patients who had the same cancer type and characteristics similar to UAB participants with respect to demographics, comorbidities, and prior utilization.

Exhibit S13.5 summarizes the results from our propensity score–based comparison group selection. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

- After matching, we observed that the treatment and comparison groups had nearly identical distributions of propensity scores.
- In the matched sample, we were able to attain balance across all measures, and the chart indicates that propensity score matching greatly improved the comparability of the treatment and comparison groups.

Results from this subgroup analysis are available in the main awardee chapter.

Exhibit S13.5: Common Support and Covariate Balance for UAB and Comparison Participants, End-of-Life Analysis

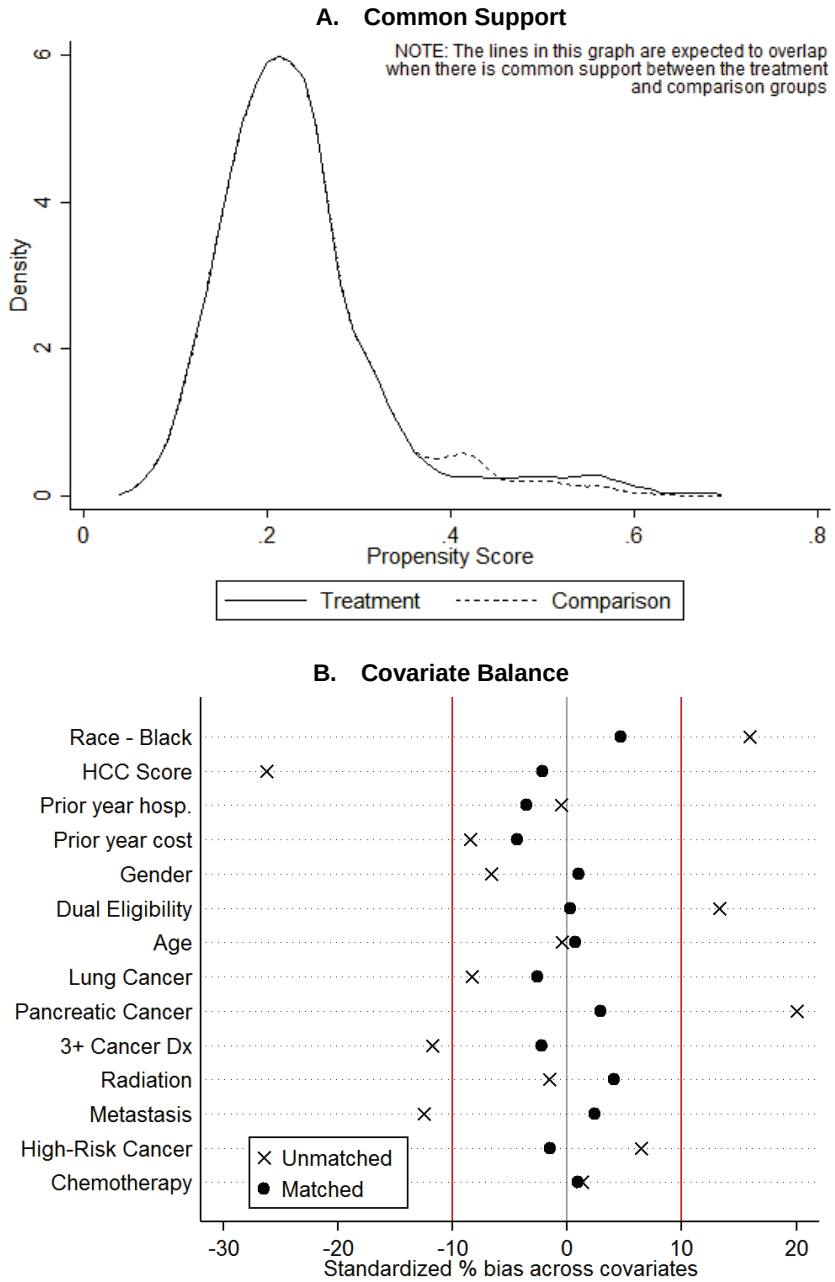


Exhibit S13.6 summarizes demographic and other basic information about the treatment and the matched comparison patients who were included in our end-of-life analysis. After matching, there were no significant differences in demographic characteristics between the groups.

Exhibit S13.6: Descriptive Characteristics of UAB and Matched Comparison Patients, End-of-Life Analysis

Variable	UAB	Comparison
	% (N)	% (N)
Number of Patients	2,198	2,198
Age Group		
<65 years old	1.1% (24)	0.5% (11)
65–69 years old	25.0% (549)	27.1% (595)
70–74 years old	25.1% (552)	25.8% (568)
75–79 years old	21.6% (474)	20.5% (451)
80–84 years old	16.2% (355)	14.0% (308)
≥85 years old	11.1% (244)	12.1% (265)
Race/Ethnicity		
White	84.7% (1,862)	83.0% (1,824)
Black	14.1% (309)	12.6% (276)
Hispanic	1.0% (21)	4.1% (90)
Other	0.3% (6)	0.4% (8)
Gender		
Female	45.6% (1,002)	46.1% (1,013)

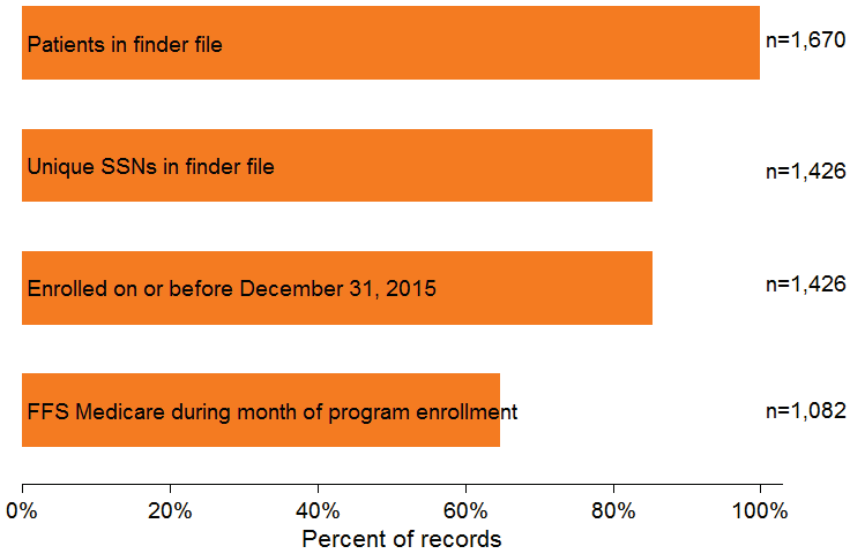
NOTES: ***p<0.01, **p<0.05, *p<0.1. SD, standard deviation

Regents of the University of California, Los Angeles

Treatment and Comparison Group Creation

- We worked with UCLA's finder file of participants and enrollment dates to identify Medicare FFS claims for individuals in our treatment group (please see Exhibit S14.1).
- We restricted our treatment group to Medicare FFS participants enrolled in UCLA's program for one or more quarters, from July 1, 2012, through December 31, 2015, which is the last enrollment date provided in the finder file.
- To identify a pool of comparison patients, we selected FFS beneficiaries who had a history of Alzheimer's disease or other forms of dementia and resided in the same zip codes as program participants. For more details on comparison group selection, please see Technical Appendix A above.

Exhibit S14.1: Patients Identified through UCLA Finder File



Comparison group selection. We used propensity score models to select comparison patients with dementia who were similar to UCLA participants with respect to demographics, comorbidities, and prior utilization. For more details on comparison group selection, please see Technical Appendix A above. Exhibit S14.2 summarizes the results of our propensity score–based comparison selection. Panel A shows the common support between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

- After matching, the two groups had nearly identical distributions of propensity scores. The distributions suggest a favorable match between these groups—at least with respect to the included factors.

- The balance chart shows that matching has achieved balance (i.e., reduced the difference between UCLA participants and the comparison group to <10% standardized bias) with respect to demographic characteristics, comorbidities, and prior-year utilization and costs.

Exhibit S14.2: Common Support and Covariate Balance for UCLA and Comparison Participants

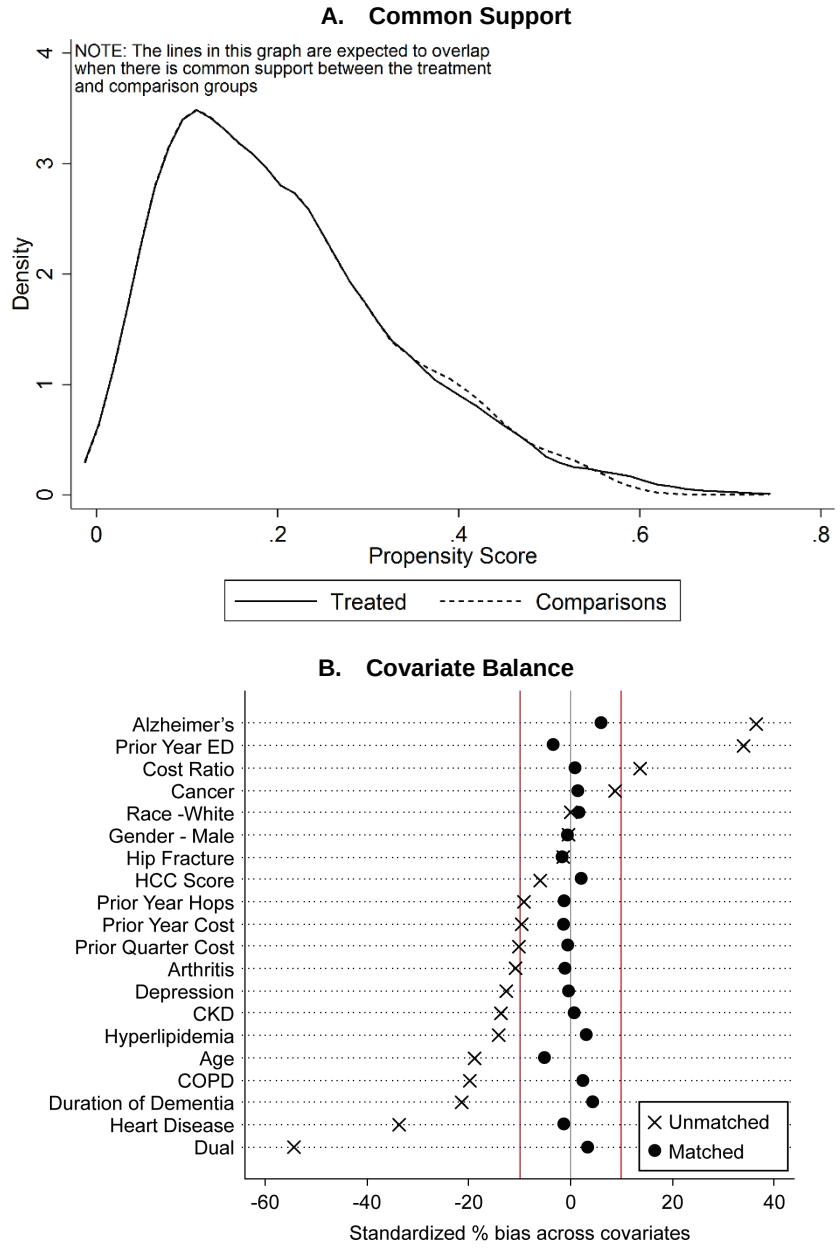


Exhibit S14.3 summarizes demographic and other basic information about treatment and comparison patients included in our analysis of core outcome measures. After matching, we observed no significant

difference between participants at UCLA and comparison participants with respect to demographic characteristics, comorbidities, or prior utilization.

Exhibit S14.3: Descriptive Characteristics of UCLA and Comparison Patients

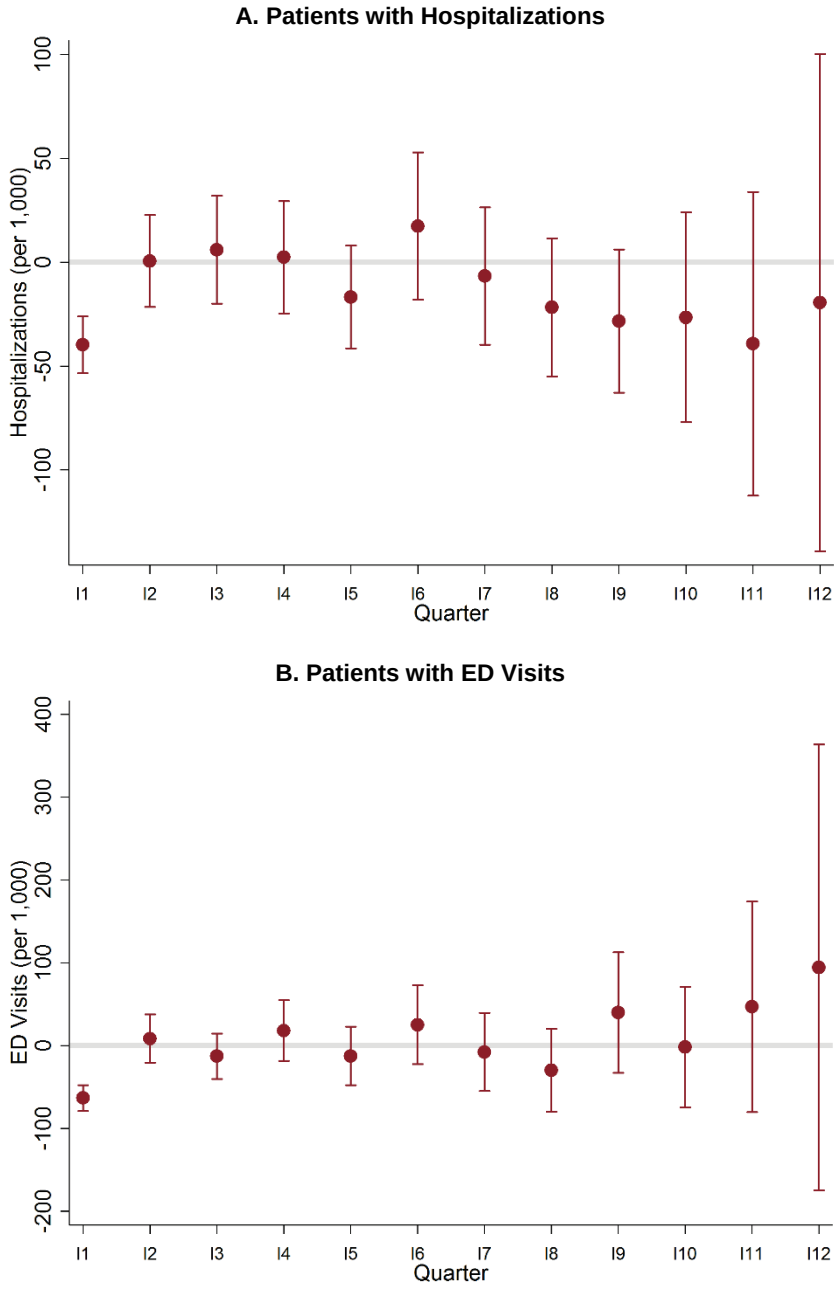
Variable	UCLA	Comparison
	% (N)	% (N)
Number of Persons	1,082	1,082
Mean Number of Quarters Enrolled [range]	5.3 [1–13]	5.3 [1–13]
Age Group		
<65 years old	1.9% (21)	1.6% (17)
65–69 years old	5.0% (54)	5.8% (63)
70–74 years old	8.8% (95)	9.5% (103)
75–79 years old	19.7% (213)	16.6% (180)
80–84 years old	22.5% (243)	22.7% (246)
≥85 years old	42.1% (456)	43.7% (473)
Race/Ethnicity		
White	71.7% (776)	71.0% (768)
Black	9.4% (102)	10.4% (112)
Hispanic	9.0% (97)	6.5% (70)
Asian	7.9% (85)	8.8% (95)
Other	2.0% (22)	3.3% (36)
Gender		
Female	64.8% (701)	64.6% (699)
Hierarchical Condition Categories (HCC)		
Mean HCC Score (SD)	1.8 (1.2)	1.8 (1.4)
Mean Count of HCCs (SD)	3.1 (2.4)	2.9 (2.7)
Coverage Reason		
Disability	5.7% (62)	5.8% (63)
ESRD	0.2% (2)	0.1% (1)
Dual Status		
Dually Eligible	15.3% (166)	13.9% (150)
Dementia Type		
Alzheimer's type dementia	68.8% (744)	65.7% (711)
Time Since Dementia Diagnosis		
Mean years (Range)	2.9 (0–16.3)	2.7 (0–14.6)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$17,183 ($27,499)	$17,501 ($33,428)
Hospitalizations per 1,000 Patients (SD)	492 (997)	486 (979)
ED Visits per 1,000 Patients (SD)	1,082 (196)	905 (186)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. ESRD, end-stage renal disease; HCC, hierarchical condition categories; SD, standard deviation

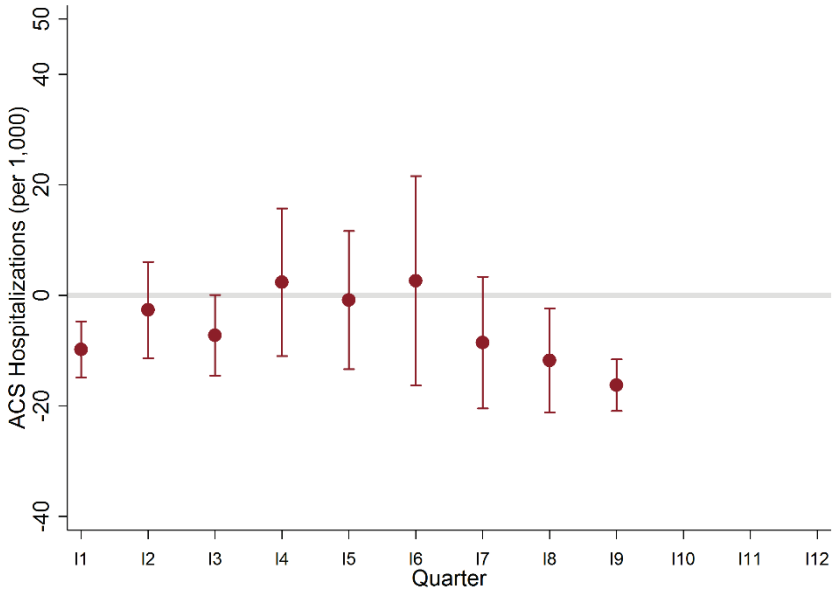
Quarter-specific program impact. Exhibit S14.4 summarizes the results of QFE DID models as the adjusted marginal effect of UCLA's intervention on hospitalizations, ACS hospitalizations, 30-day readmissions, ED visits, and total cost of care for each post-intervention quarter.

- Relative to comparison patients, there are few significant differences for UCLA's program participants. UCLA participants had significantly fewer ACS hospitalizations in the first, eighth, and ninth quarters. UCLA program participants also had significantly fewer readmissions in the sixth quarter. In the first and 11th quarters, costs were lower for UCLA participants.

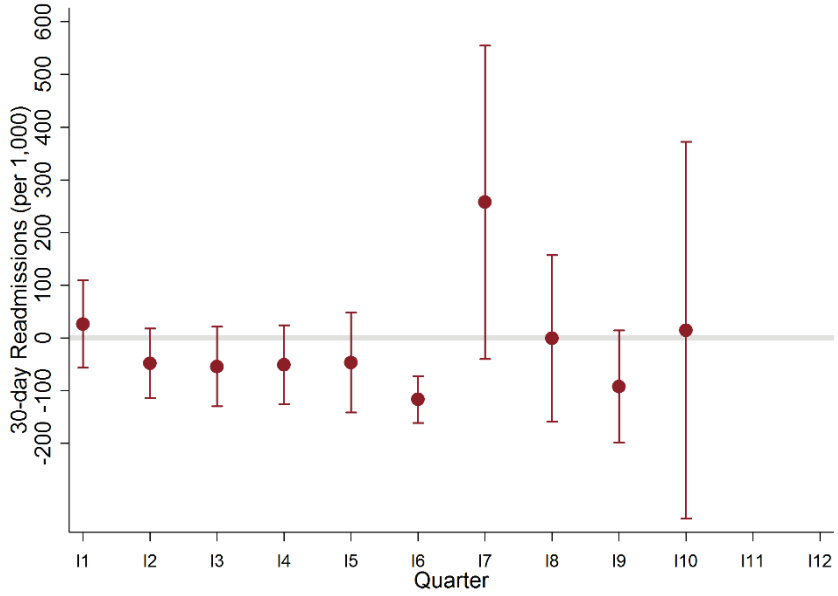
Exhibit S14.4: Adjusted Utilization Rates for Core Measures for UCLA by Quarter

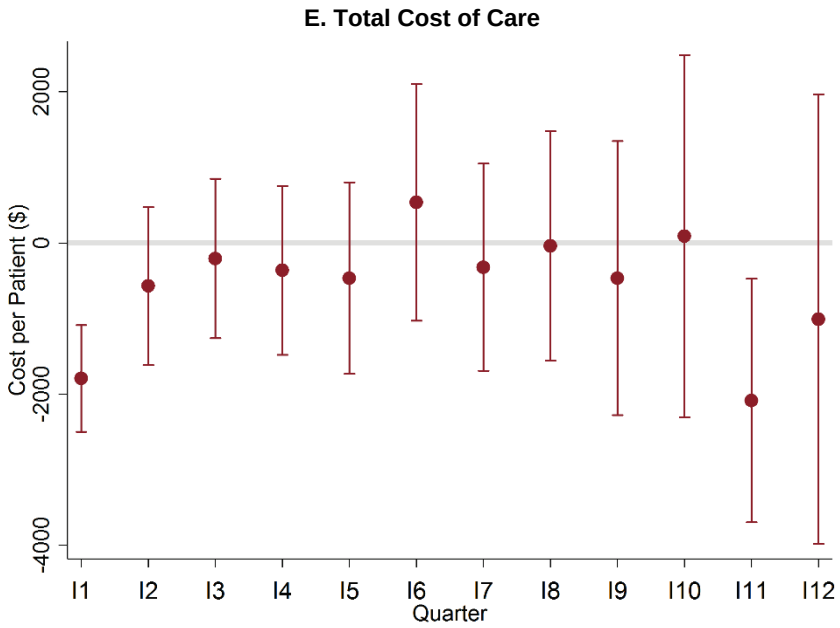


C. Patients with ACS Hospitalizations



D. Patients with 30-day Readmissions



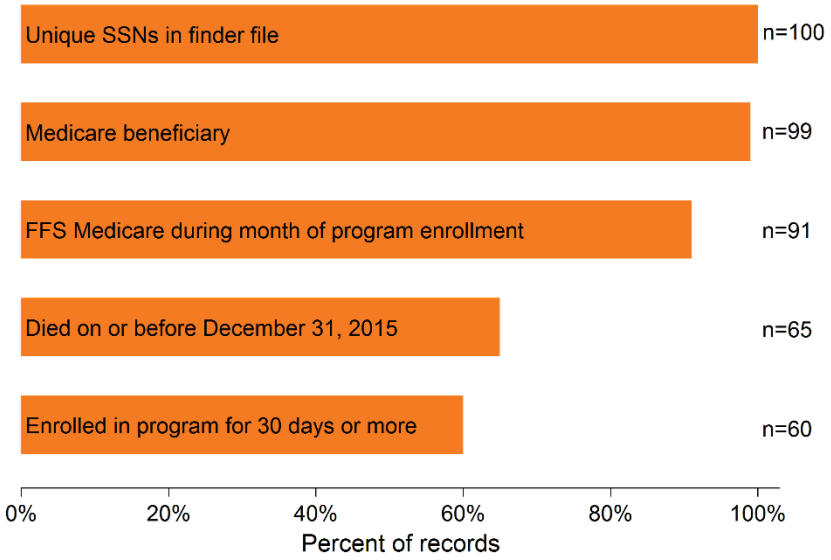

E. Total Cost of Care
Cost per Patient ($)
2000
0
-2000
-4000
I1
I2
I3
I4
I5
I6
I7
I8
I9
I10
I11
I12
Quarter

The Rectors and Visitors of the University of Virginia

Treatment and Comparison Group Creation

- We worked with UVA's finder file of participants and enrollment dates to identify FFS Medicare claims for individuals in our treatment group who died before December 31, 2015, (please see Exhibit S15.1).
- We restricted our treatment group to Medicare FFS participants who were enrolled in UVA's program for one or more quarters, from October 1, 2012, through April 15, 2015, which is the last enrollment date provided in the finder file.
- To identify a pool of comparison patients, we selected FFS beneficiaries diagnosed with metastatic cancer during the last year of life, deceased before December 31, 2015, having a hospital admission with primary diagnosis of cancer, or a secondary diagnosis of cancer in one of three comparison hospitals in the year preceding the last year of life.[354]

Exhibit S15.1: Participants Identified through UVA Finder File



End-of-Life Analysis

Comparison group selection. We used propensity score models to select comparison patients who had the same cancer type and characteristics similar to UVA participants with respect to demographics, comorbidities, and prior utilization. Exhibit S15.2 summarizes the results from our propensity score–based comparison group selection. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

[354]Comparison hospitals included Medical Colleges of Virginia/VCU Hospitals (Richmond, VA); Inova Fairfax Hospital (Falls Church, VA); and Sentara Norfolk Hospital (Norfolk, VA).

- After matching, we observed that treatment and comparison groups had very similar distributions of propensity scores.
- In the matched sample, we were able to attain balance across all measures with the exception of chemotherapy. Overall, the chart indicates that propensity score matching greatly improved the comparability of the treatment and comparison groups.

Exhibit S15.2: Common Support and Covariate Balance for UVA and Comparison Participants, End-of-Life Analysis

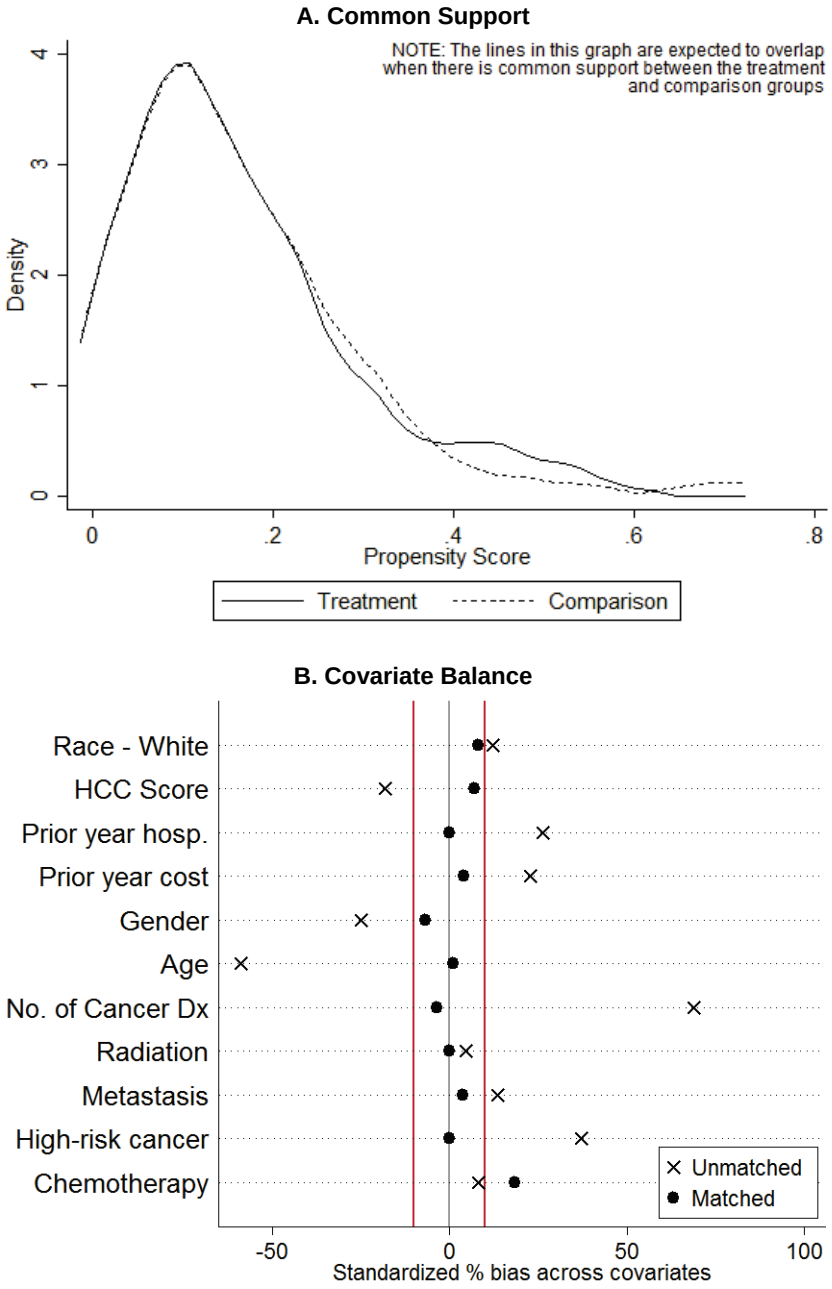


Exhibit S15.3 summarizes demographic and other basic information about treatment and comparison patients included in our end-of-life analysis, after propensity score matching. After matching, there were no significant differences between the groups with respect to demographic and other characteristics.

Exhibit S15.3: Descriptive Characteristics of UVA and Matched Comparison Patients, End-of-Life Analysis

Variable	UVA	Comparison
	% (N)	% (N)
Number of Patients	60	60
Gender		
Female	63.3% (38)	60.0% (36)
Age Group		
<65 years	28.3% (17)	23.3% (14)
65–69 years	26.7% (16)	28.3% (17)
70–74 years	20.0% (12)	15.0% (9)
75–79 years	6.7% (4)	18.3% (11)
80–84 years	13.3% (8)	6.7% (4)
≥85 years	5.0% (3)	8.3% (5)
Race/Ethnicity		
White	81.7% (49)	78.3% (47)
Black	18.3% (11)	21.7% (13)
Dual Eligibility		
Dually Eligible	25.0% (15)	23.3% (14)
Hierarchical Condition Categories (HCC)		
Mean HCC Score (SD)	3.3 (2.1)	3.2 (2.2)
Mean Number of HCCs (SD)	3.9 (2.9)	3.9 (3.1)

NOTES: ***p<0.01, **p<0.05, *p<0.1. SD, standard deviation

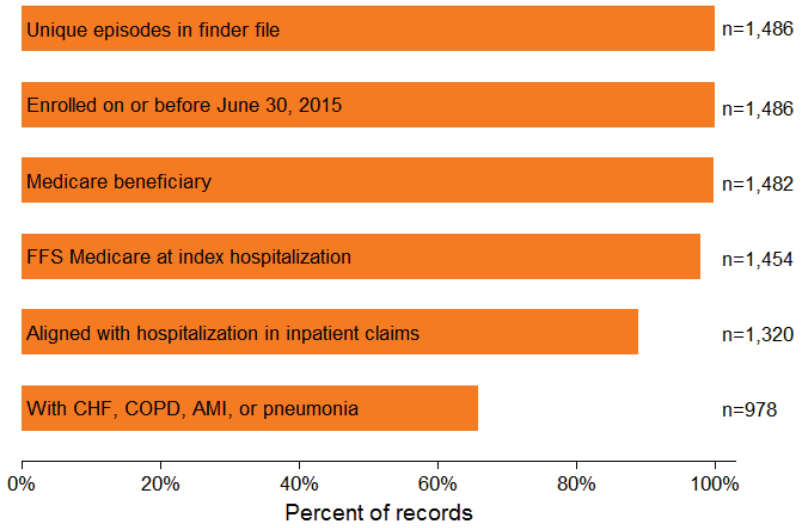
Vanderbilt University Medical Center

Transitions Care Coordination (TCC) Program

Treatment and Comparison Group Creation

- We worked with Vanderbilt's finder file listing TCC participants to identify Medicare FFS patient-episodes for the targeted conditions in each post-intervention quarter from April 1, 2013, through June 30, 2015 (n = 978) (please see Exhibit S16.1).
- We restrict our treatment group to patient-episodes from Medicare FFS claims and those including congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), acute myocardial infarction (AMI), or pneumonia.
- We add a group of baseline Medicare FFS patient-episodes for the targeted conditions at Vanderbilt in the pre-HCIA period, from April 1, 2011, through March 31, 2013.

Exhibit S16.1: Patient-Episodes Identified through Vanderbilt TCC Finder File[355]



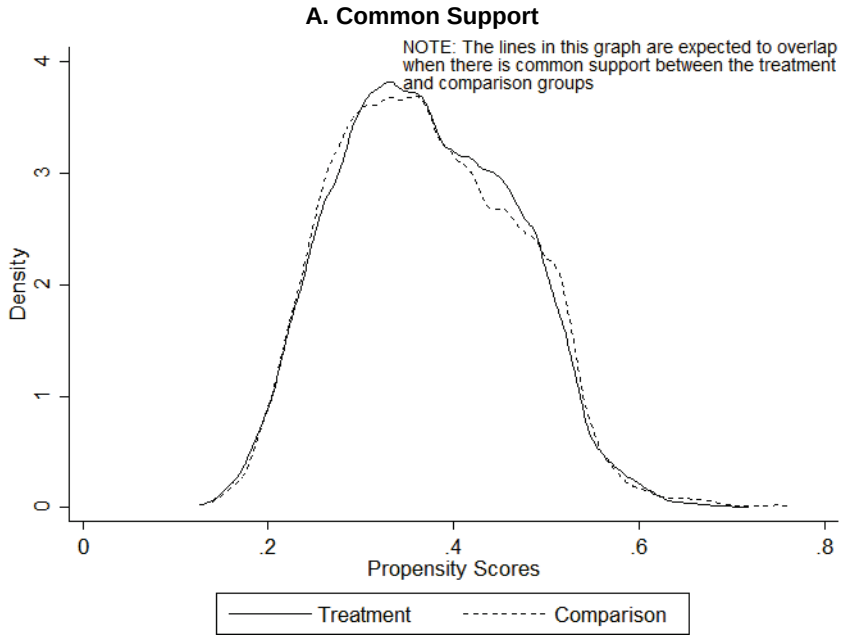
Comparison group selection. We include Medicare FFS patient-episodes for targeted conditions (pre- and post-intervention) at five comparison hospitals selected for their similarities to the Vanderbilt TCC hospitals.[356, 357] We run propensity score models to produce standard mortality ratio (SMR) weights. We then incorporate SMR weights into our analysis to minimize the observed differences in covariates across TCC and comparison group patient-episodes included in our propensity score models. For more details on comparison group selection and SMR weighting, please see Technical Appendix A above. Exhibit S16.2

[355] A total of 342 patient-episodes aligned with hospitalization and inpatient claims but had an index admission for a condition not consistently targeted throughout the intervention; therefore, these patient-episodes were not included in AR3 analysis.
[356] The comparison sites are University of Louisville Hospital, KY; Cookeville Regional Medical Center, TN; Southwest Florida Regional Medical Center, FL; Indian River Memorial Hospital, FL; and Henry County Medical Center, TN.
[357] We considered the following characteristics: geographic region, population density, teaching status, ownership type, number of beds, target diagnosis/procedure volume, demographics of hospital population, and volume of inpatient CHF, COPD, AMI, and pneumonia hospitalizations.

summarizes results after we incorporate SMR weights into our analysis. Panel A shows the similarities between the treatment and comparison groups after SMR weighting, and panel B shows the distribution of covariates before and after weighting.[358]

- After weighting, we observe a high level of overlap in the distribution of estimated propensity scores across the TCC and comparison group patient-episodes (panel A).
- On the balance graph (panel B), we show that the standardized difference between TCC and comparison patient-episodes across all covariates is negligible after incorporating propensity score weighting.

Exhibit S16.2: Common Support and Covariate Balance for Vanderbilt and Comparison Patient-Episodes



[358]We include the following covariates in the propensity score model: age, gender, race/ethnicity, disability status, prior-year hospitalizations, prior-year cost, prior-year HCC score, prior-year FFS coverage, discharge status, target condition (CHF, COPD, AMI, pneumonia), history of stroke, and severity of hospitalization, (CC or MCC DRG).

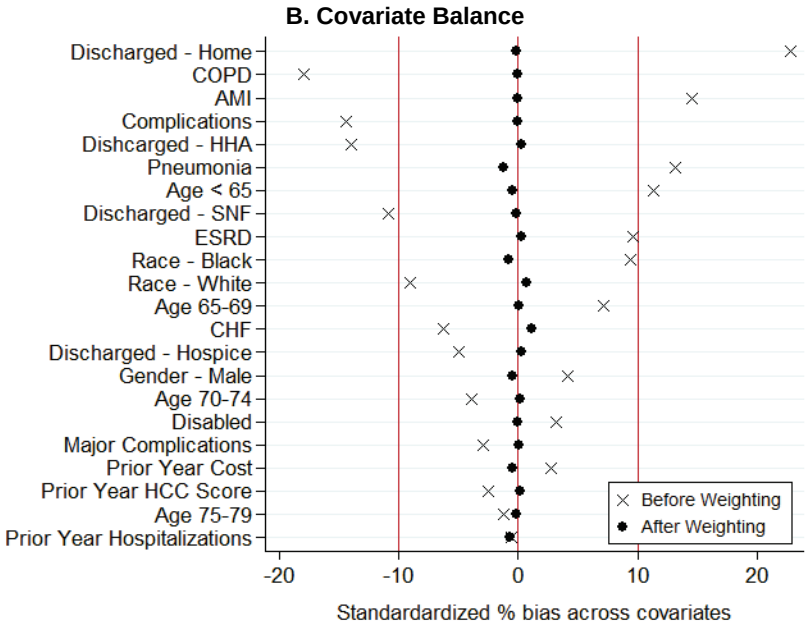


Exhibit S16.3 summarizes demographic and other basic information about the treatment and comparison patients whose episodes we include in our analysis of core outcome measures. Relative to TCC participants, comparison patients with post-intervention episodes were more likely to be older (>85 years of age), White, and female; more likely to have higher morbidities, hospitalizations, and cost of care at baseline; less likely to be covered due to old age; more likely to be covered due to disability; and more likely to be discharged to a skilled nursing facility (SNF) after hospitalization.

Exhibit S16.3: Descriptive Characteristics of Patients with Episodes in TCC and Comparison Groups[359, 360]

Variable	Pre-intervention Vanderbilt TCC	Pre-intervention Comparison	Post-intervention Vanderbilt TCC	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Number of Patient-Episodes	4,738	5,538	978	5,338
Age Group* **				
<65 years old	25.5% (1,209)	20.3% (1,126)	19.1% (187)	19.1% (1,021)
65–69 years old	16.7% (791)	14.9% (825)	20.3% (199)	14.5% (774)
70–74 years old	15.3% (725)	15.5% (858)	18.4% (180)	17.3% (921)
75–79 years old	14.4% (680)	15.1% (835)	15.2% (149)	14.8% (789)
80–84 years old	13.0% (618)	14.7% (815)	13.0% (127)	13.8% (739)
≥85 years old	15.1% (715)	19.5% (1,079)	13.9% (136)	20.5% (1,094)
Race/Ethnicity*				
White	87.3% (4,138)	90.4% (5,006)	87.9% (860)	90.2% (4,815)

[359]Descriptive statistics are based on findings prior to propensity score weighting.
[360]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.

Variable	Pre-intervention Vanderbilt TCC	Pre-intervention Comparison	Post-intervention Vanderbilt TCC	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Black	11.2% (533)	8.5% (468)	10.0% (98)	8.1% (431)
Hispanic	0.1% (6)	0.5% (25)	0.3% (3)	0.6% (32)
Other	1.3% (61)	0.7% (39)	1.7% (17)	1.1% (60)
Gender* **				
Female	49.4% (2,340)	50.7% (2,805)	43.9% (429)	50.3% (2,686)
Comorbidities: Hierarchical Condition Categories (HCCs)				
Number of HCCs (SD)	4.6 (3.2)	4.6 (3.3)	4.6 (3.1)	4.7 (3.3)
HCC Score** (SD)	2.6 (1.8)	2.6 (1.8)	2.5 (1.7)	2.6 (1.8)
Utilization Year Prior to Index Hospitalization				
No. Hospitalizations/Year** (SD)	1.7 (2.2)	1.7 (2.4)	1.4 (1.8)	1.6 (2.3)
No. ED Visits/Year (SD)	1.8 (3.9)	1.5 (2.7)	1.9 (3.5)	1.9 (3.9)
Prior 1-year Cost** (SD)	$35,322 ($46,597)	$33,678 ($42,685)	$30,789 ($40,399)	$33,025 ($41,319)
Coverage Reason**				
Old Age	59.1% (2,798)	61.8% (3,425)	65.5% (641)	61.8% (3,297)
Disability	37.5% (1,775)	36.3% (2,009)	32.1% (314)	36.5% (1,951)
ESRD	0.7% (35)	0.7% (37)	1.0% (10)	0.7% (36)
Disability and ESRD	2.7% (130)	1.2% (67)	1.3% (13)	1.0% (54)
Discharges* **				
Home	58.1% (2,754)	47.9% (2,652)	65.3% (639)	48.3% (2,577)
SNF	15.3% (726)	17.6% (973)	7.7% (75)	18.4% (984)
HHA	17.7% (837)	25.3% (1,400)	23.6% (231)	23.6% (1,259)
Hospice	3.1% (149)	3.5% (196)	1.1% (11)	3.8% (205)
Other	5.7% (272)	5.7% (317)	2.2% (22)	5.9% (313)
Disease* **				
CHF	37.5% (1,775)	42.6% (2,357)	51.7% (506)	43.5% (2,320)
COPD	20.1% (953)	26.4% (1,461)	11.3% (111)	25.8% (1,376)
AMI	17.2% (816)	13.4% (742)	23.1% (226)	12.5% (669)
Pneumonia	25.2% (1,194)	17.7% (978)	13.8% (135)	18.2% (973)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. AMI, acute myocardial infarction; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department; ESRD, end-stage renal disease; HHA, home health aide; SNF, skilled nursing facility.

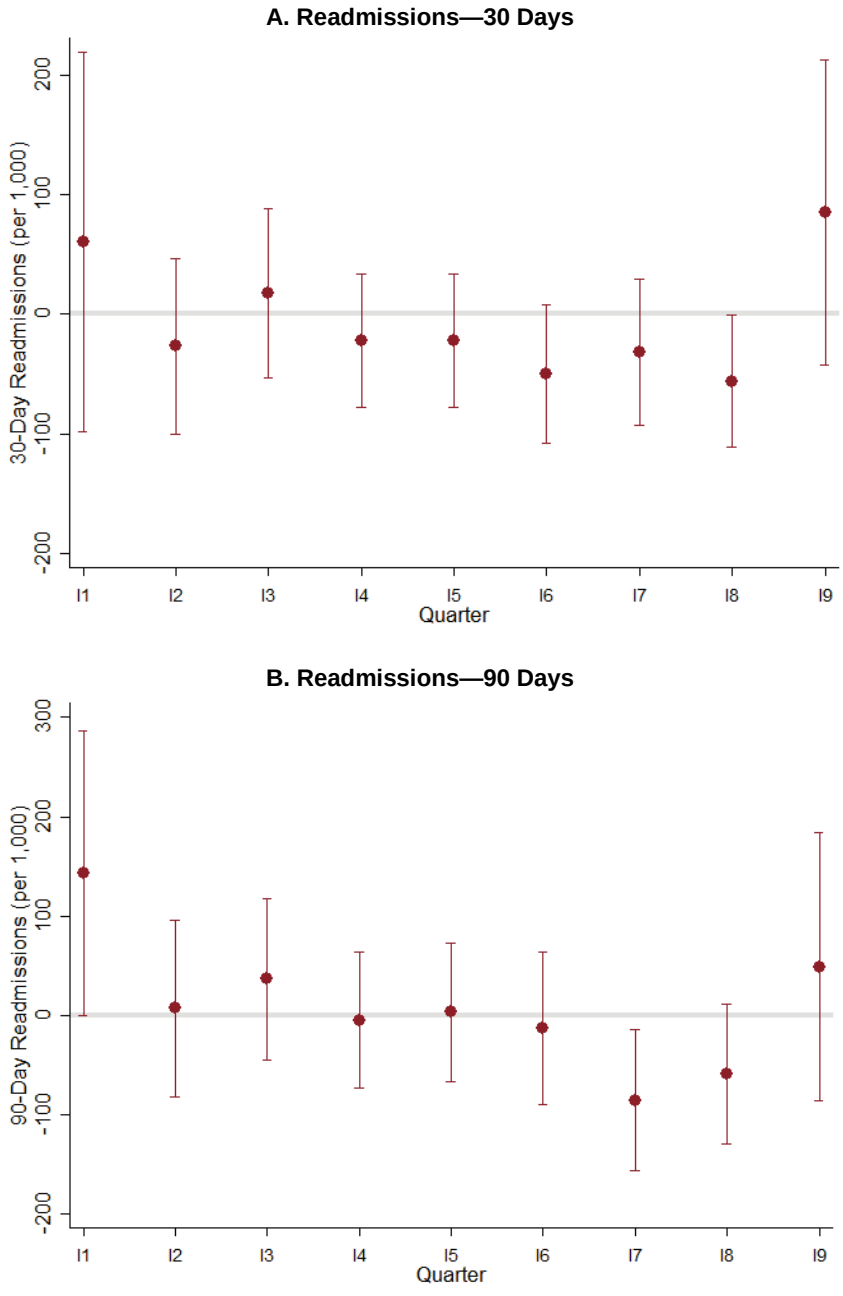
Quarter-specific program impact. Exhibit S16.4 summarizes the results of the QFE DID models as the adjusted marginal effect of Vanderbilt's TCC intervention on readmissions, ED visits, and total cost of care in each quarter after implementation.[361] We present readmissions at 30 and 90 days post-discharge. We present ED visits and total cost of care at 90 days post-discharge.

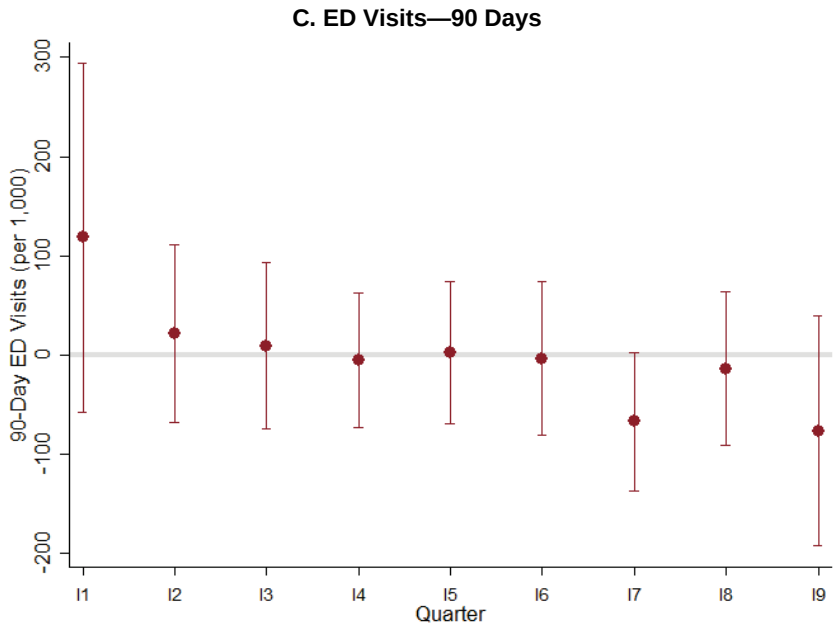
- Relative to the comparison group, Vanderbilt TCC patient-episodes had significantly fewer 90-day readmissions in the seventh quarter after implementation (I7).

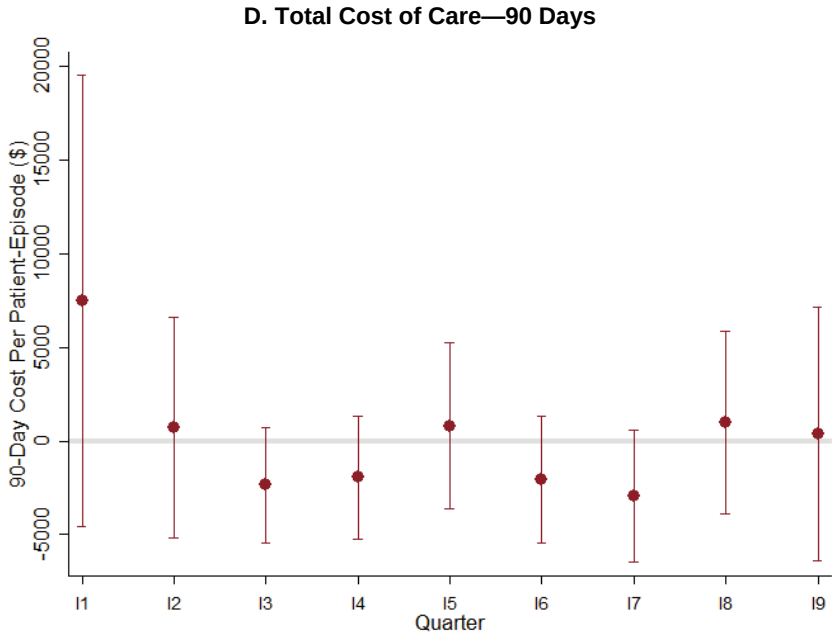
[361]Adjustment factors include age, race/ethnicity, gender, reason for Medicare eligibility, comorbidity, cost, utilization in year prior to index hospitalization, discharge status, and type and severity of target condition (CHF, COPD, AMI, and pneumonia).

- Relative to the comparison group, we observe no significant decreases in 30-day readmissions, ED visits, or total cost of care for TCC patient-episodes.

Exhibit S16.4: Adjusted Utilization Rates for Core Measures for Vanderbilt TCC by Quarter







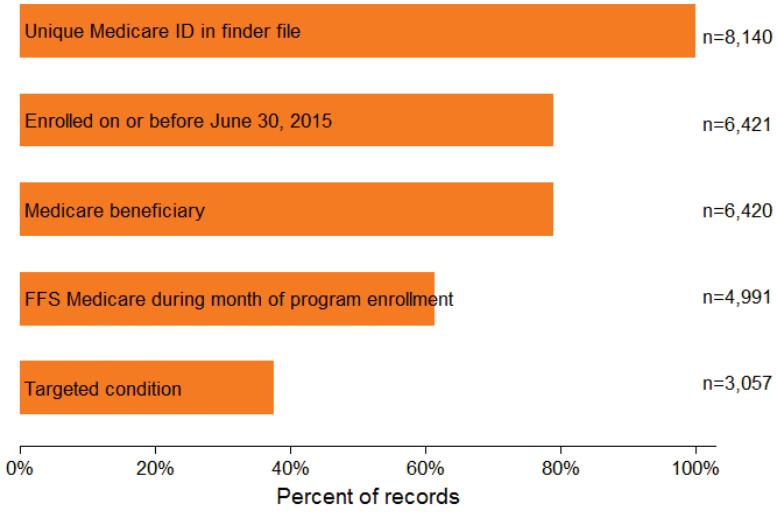
Outpatient Chronic Care (OCC) Management Program

Treatment and Comparison Group Creation

- We worked with Vanderbilt's OCC finder file of participants and enrollment dates to identify Medicare FFS claims for individuals in our treatment group (n = 3,057) (please see Exhibit S16.5).

- We restrict our treatment group to Medicare FFS participants enrolled in Vanderbilt's OCC program for one or more quarters, from September 30, 2012, through June 30, 2015, which is the last enrollment date provided in the finder file.
- To identify a pool of comparison patients, we select FFS beneficiaries with a history of the targeted conditions (hypertension and/or diabetes) residing in the same or neighboring counties as participants. For more details on comparison group selection, please see Technical Appendix A above.

Exhibit S16.5: Patients Identified through Vanderbilt OCC Finder File[362]



Comparison group selection. We use propensity score models to select comparison patients with the same target conditions and similar to Vanderbilt OCC participants with respect to demographics, comorbidities, and prior utilization. For more details on comparison group selection, please see Technical Appendix A above. Exhibit S16.6 summarizes the results from our propensity score–based comparison selection. Panel A shows the common support between the treatment and comparison groups after propensity score matching, and panel B shows the distribution of covariates before and after matching.

- After matching, the two groups have nearly identical distributions of propensity scores (Panel A). The distributions suggest a favorable match between these groups with respect to the included factors.
- On the balance graph (panel B), we show that matching has achieved balance (i.e., reduced the difference between OCC participants and the comparison group to <10% standardized bias) with respect to demographic characteristics, comorbidities, and prior-year utilization and costs.

[362]The reduction of patients in the treatment group was due to (1) inclusion of beneficiaries enrolled in the baseline period in the finder file (n ≈ 1,700) and (2) inclusion of beneficiaries with no target conditions of hypertension and/or diabetes (n ≈ 1,900).

Exhibit S16.6: Common Support and Covariate Balance for OCC and Comparison Participants

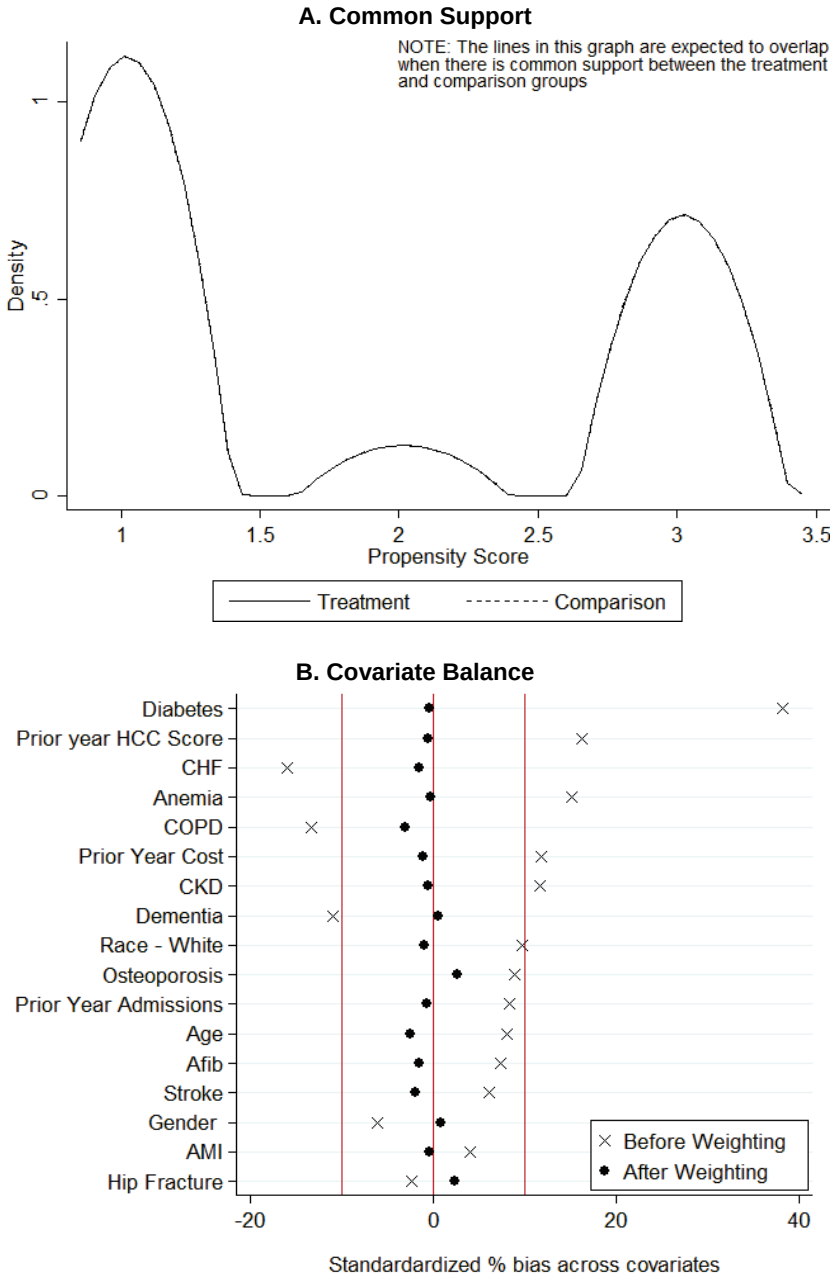


Exhibit S16.7 summarizes demographic and other basic information about the treatment and comparison patients who are included in our analysis of core outcome measures. Because we matched the comparison group to the OCC program group, we observed few differences with respect to demographic characteristics and prior health care utilization. After propensity score matching, OCC patients had significantly higher rates of ED use ($p<0.01$). In addition, OCC patients were less likely to be dually enrolled ($p<0.01$). We adjusted for dual eligibility and prior utilization in our analytic models for core outcomes.

Exhibit S16.7: Descriptive Characteristics of OCC and Matched Comparison Patients

Variable	Vanderbilt OCC	Comparison
	% (N)	% (N)
Number of Patients	3,057	3,057
Age Group		
<65 years old	12.2% (372)	12.4% (380)
65–69 years old	17.6% (537)	16.7% (510)
70–74 years old	25.0% (763)	24.0% (735)
75–79 years old	18.8% (575)	18.7% (571)
80–84 years old	13.9% (426)	15.1% (461)
≥85 years old	12.6% (384)	13.1% (400)
Race/Ethnicity		
White	86.1% (2,633)	86.5% (2,644)
Black	10.9% (334)	10.5% (321)
Hispanic	0.3% (10)	0.4% (12)
Other	2.6% (80)	2.6% (80)
Gender		
Female	55.9% (1,710)	56.3% (1,722)
Dual Status		
Dually Eligible***	8.3% (254)	16.1% (492)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$10,861 ($22,915)	$11,070 ($21,215)
Hospitalizations per 1,000 (SD)	353 (830)	358 (910)
ED Visits per 1,000 (SD)***	937 (2,487)	525 (1,429)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables; ED, emergency department; SD, standard deviation

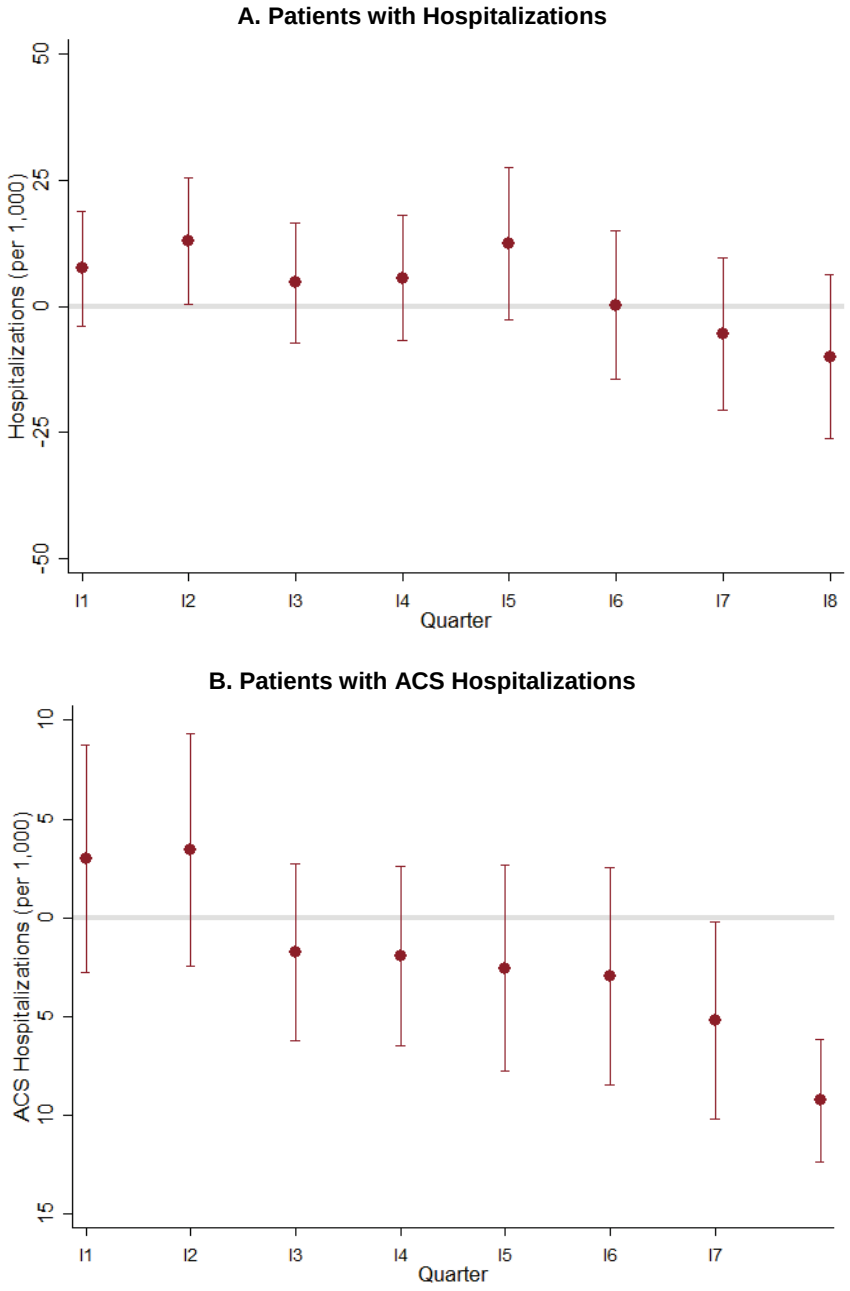
Quarter-specific program impact. Exhibit S16.8 summarizes the results of the QFE DID models as the adjusted marginal effect of Vanderbilt's OCC intervention on hospitalizations, ACS hospitalizations, ED visits, and total cost of care.[363]

- ACS hospitalizations for OCC patients, which are initially higher than the comparison group, steadily decrease across all post-intervention quarters, reaching significance in the seventh and eighth quarters.
- In late post-intervention quarters (I6-I8), OCC patients trend toward lower rates (non-significant) of hospitalizations than the comparison group.
- Vanderbilt's OCC program was not associated with any significant reductions in ED visits or total cost of care in any of the post-intervention quarters.

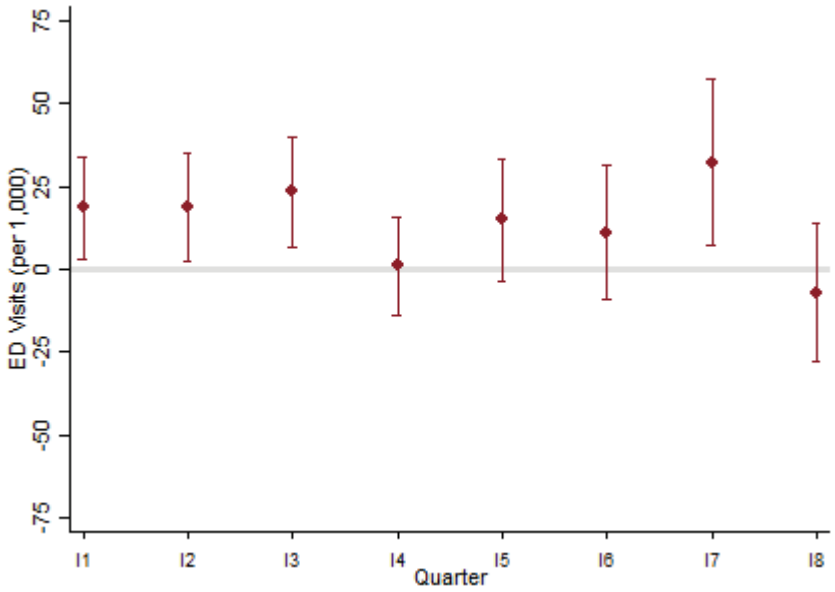
For most measures, the uncertainty in estimates (indicated by the confidence interval) is larger in later quarters of the post-intervention period. This reflects the smaller number of participants enrolled in the program for this length of time.

[363]Adjustment factors include: age, gender, race/ethnicity, disability status, prior-year HCC score, discharge status, and target condition (hypertension and/or diabetes).

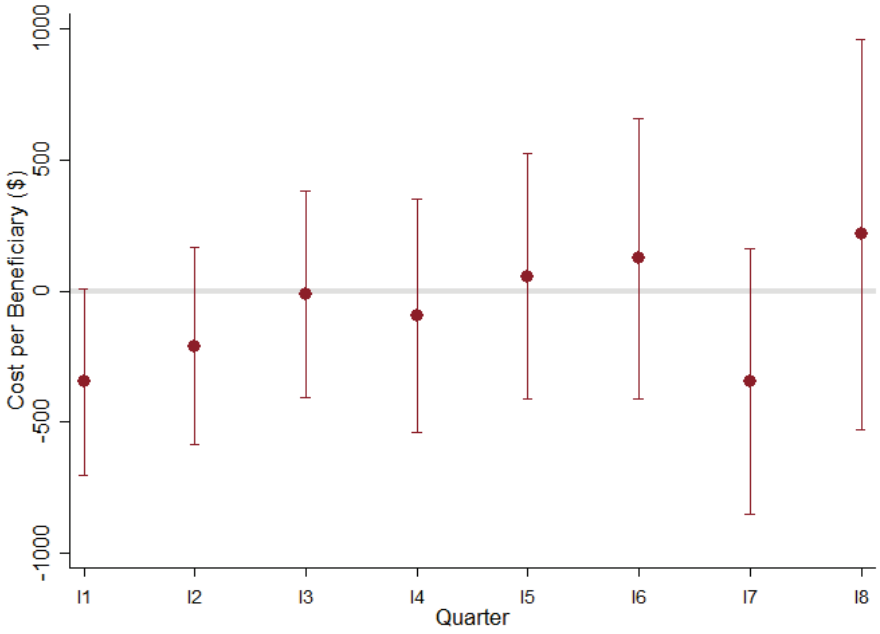
Exhibit S16.8: Adjusted Utilization Rates for Core Measures for Vanderbilt OCC by Quarter



C. Patients with ED Visits



D. Total Cost of Care



Diabetes Cross-Awardee Supplement

Exhibit S17.1: Consolidated Framework for Implementation Research Constructs[364]

Domain	Construct	Short Description
I. Intervention Characteristics	Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed
	Evidence Strength and Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes
	Relative Advantage	Stakeholders' perception of the advantage of implementing the intervention compared with an alternative solution
	Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs
	Trialability	The ability to test the intervention on a small scale in the organization and to be able to reverse course (undo implementation) if warranted
	Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, intricacy and number of steps required to implement
	Design Quality and Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled
	Cost	Costs of the intervention and costs associated with implementing the intervention, including investment, supply, and opportunity costs
II. Outer Setting	Patient Needs and Resources	The extent to which patient needs, as well as barriers and facilitators to meeting those needs, are accurately known and prioritized by the organization
	Cosmopolitanism	The degree to which an organization is networked with other external organizations
	Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented interventions or are in a bid for a competitive edge
	External Policy and Incentives	A broad construct that includes external strategies to spread interventions, including policy and regulations (government or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting
III. Inner Setting	Structural Characteristics	The social architecture, age, maturity, and size of an organization
	Networks and Communications	The nature and quality of social networks and the nature and quality of formal and informal communications within an organization
	Culture	Norms, values, and basic assumptions of an organization
	Implementation Climate	The absorptive capacity for change, involved individuals' shared receptivity to an intervention, and the extent to which use of that intervention will be rewarded, supported, and expected within their organization
	Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change
	Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals; how those align with individuals' own norms, values, and perceived risks and needs; and how the intervention fits with existing workflows and systems
	Relative Priority	Individuals' shared perception of the importance of the implementation within the organization

[364]Consolidated Framework for Implementation Research. CFIR constructs. Available at: http://cfirguide.org/constructs.html.

Domain	Construct	Short Description
	Organizational Incentives and Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions and raises in salary, and less tangible incentives such as increased stature or respect
	Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals
	Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation
	Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention
	Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation of an intervention
	Available Resources	The level of resources dedicated to implementation and ongoing operations, including money, training, education, physical space, and time
	Access to Knowledge and Information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks
IV. Characteristics of Individual	Knowledge and Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention, as well as familiarity with facts, truths, and principles related to the intervention
	Self-Efficacy	Individuals' belief in their own capabilities to execute courses of action to achieve implementation goals
	Individual Stage of Change	Characterization of the phase an individual is in as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention
	Individual Identification with Organization	A broad construct related to how individuals perceive the organization and their relationship and degree of commitment to that organization
	Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style
V. Process	Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance and the quality of those schemes or methods
	Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and similar activities
	Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention
	Formally Appointed Internal Implementation Leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role
	Champions	Individuals who dedicate themselves to supporting, marketing, and "driving through" an implementation, overcoming indifference or resistance that the intervention may provoke in an organization
	External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction
	Executing	Carrying out or accomplishing the implementation according to plan
	Reflecting and Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation, accompanied by regular personal and team debriefing about progress and experience

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 round took place from February to June 2015.[365] During those 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 telephone or videoconference to gather data from five sites that we did not visit during either round of in-person data collection.[366] Data collection also included 40 focus groups, 134 one-on-one patient and/or caregiver interviews, and more than 300 structured interviews with program leadership, staff, and partners. Exhibit B.1 provides an overview of key themes covered in the interviews by type of key informant.

[365]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 visited only Birmingham, Alabama.

[366]Some interviews by phone occurred with sites we had previously visited in person. This conserved staff time and resources. These calls supplemented or were a substitute for in-person site visits; 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.

Exhibit B.1: 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 regarding 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 nonparticipants (e.g., family or community) ■ Experiences working with an interdisciplinary team, when relevant ■ Perceptions of the program's impact on patient outcomes
Patients and Caregivers	■ Motivation to join the program ■ Perception of the goals of the intervention ■ Perception of key staff involved in delivering the intervention ■ Impact on health and health maintenance behaviors

Qualitative data analyses. For both rounds of site visits, transcripts were coded using NVivo (QSR International Pty Ltd., version 10, 2012), using conventional approaches for coding themes. 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 to develop cross-cutting analyses across practices in place of coding. This approach is well suited for a rapid-cycle evaluation.[367]

Qualitative Coding

Between October and December, 2015, we coded 168 transcripts from our second round of data collection, which consisted of interviews with program leadership, management, and staff using NVivo (QSR International Pty Ltd., version 10, 2012).[368] We also coded 163 transcripts from focus groups and phone interviews with patients and/or caregivers from both rounds of qualitative data collection. We did not code the data team or evaluation team interviews, as the content tended to fall under a limited number of codes; themes from these discussions could be easily gleaned from notes taken during the site visit.

We developed the original codebook deductively based on a framework established by The RAND Corporation and the meta-evaluation domains.[369,370] In this second round of coding, the codebook was revised to modify or delete codes that were unclear to the coding team and to refine both code definitions and inclusion and exclusion criteria (please see Exhibits B.2–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 express a standalone thought.

We trained a team of four coders over four weeks; three of four coders had been previously trained and had coded transcripts from the first round of site visits.[371] We calculated inter-rater reliability (IRR) during each week of training. We set an IRR benchmark at 70%, which falls in the middle of the 61% to 80% range of Kappa scores that is considered "substantial agreement." IRR from 81 to 100 constitutes almost perfect agreement.[372,373] Once IRR had reached ≥70% calculating via Cohen's Kappa, staff began independently coding transcripts for their assigned awardees. Quality assurance measures such as spot-checking by a third party, consultation with content experts, and consensus-building discussions continued as needed during independent coding.

[367]Hamilton AB. Qualitative methods in rapid turn-around health services research. Presented at the US Department of Veterans Affairs Health Services Research and Development Cyberseminar Spotlight on Women's Health; December 11, 2013. Available at: http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/780-notes.pdf. Accessed July 13, 2015.

[368]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.

[369]Berry SH, Concannon TW, Gonzalez-Morganti K, et al. CMS Innovation Center Health Care Innovation Awards Evaluation Plan; RAND; 2013. 1-109.

[370]Cromwell J, Bir A, Smith K, et al. Health Care Innovation Awards (HCIA) meta-analysis and evaluators collaborative. RTI International. November 22, 2013.

[371]One or more members of each NORC site visit team participated in transcript cleaning and coding. Tapping site visit 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 the capacity to propose refinements to the codebook that capture meaningful developments while retaining a parsimonious approach to coding.

[372]Viera A, Garret JM. Understanding interobserver agreement: the Kappa statistic. *Fam Med.* 2005;35(5):360-363.

[373]We calculated IRR using NVivo files that reflected independent coding before they were updated to reflect consensus decision, which would have positively skewed IRR.

Exhibit B.2: Main Code Families Used for Leadership, Staff, and Stakeholder Interviews

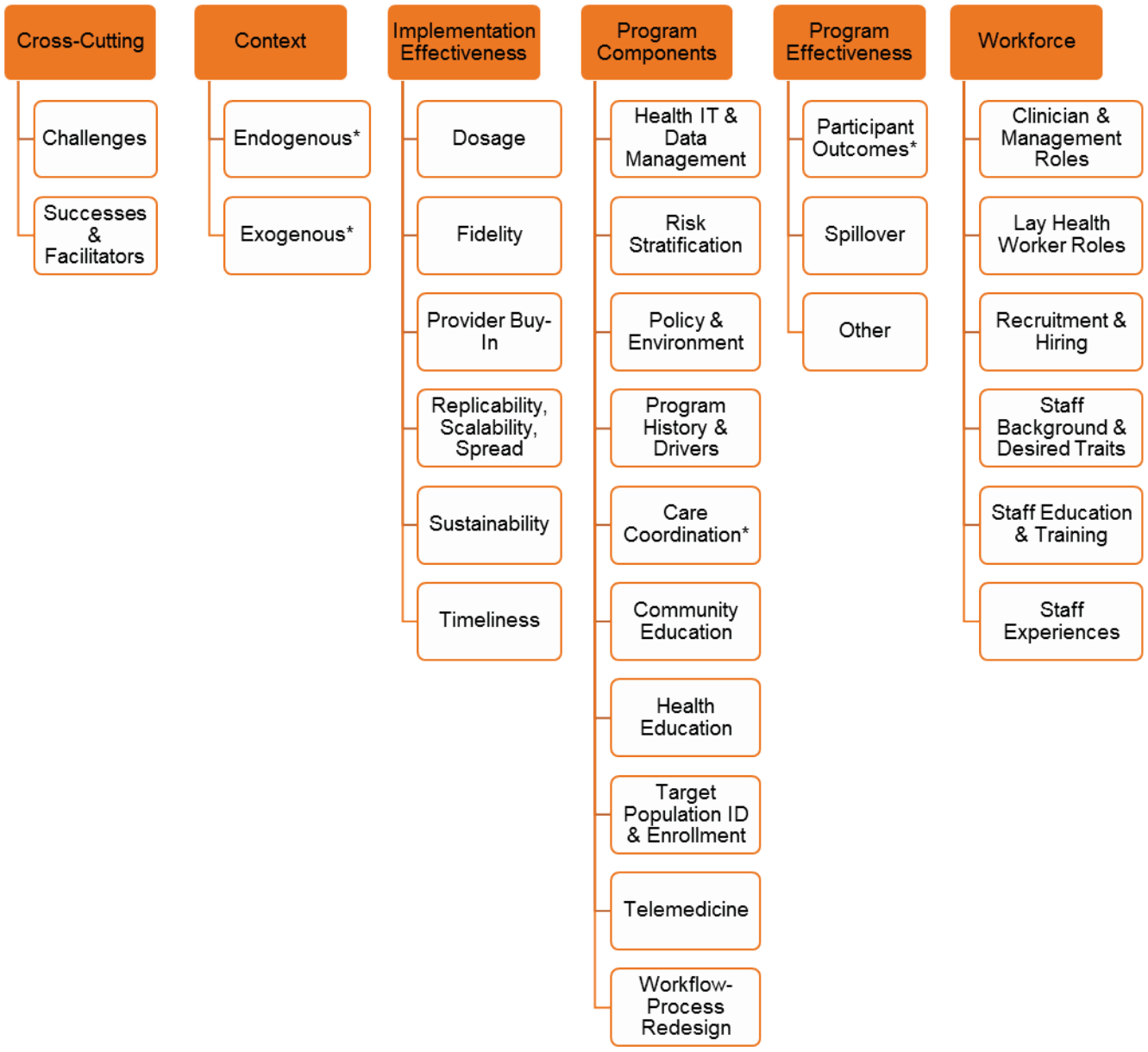


Exhibit B.3: Subcodes Used in Leadership, Staff, and Stakeholder Interview Coding

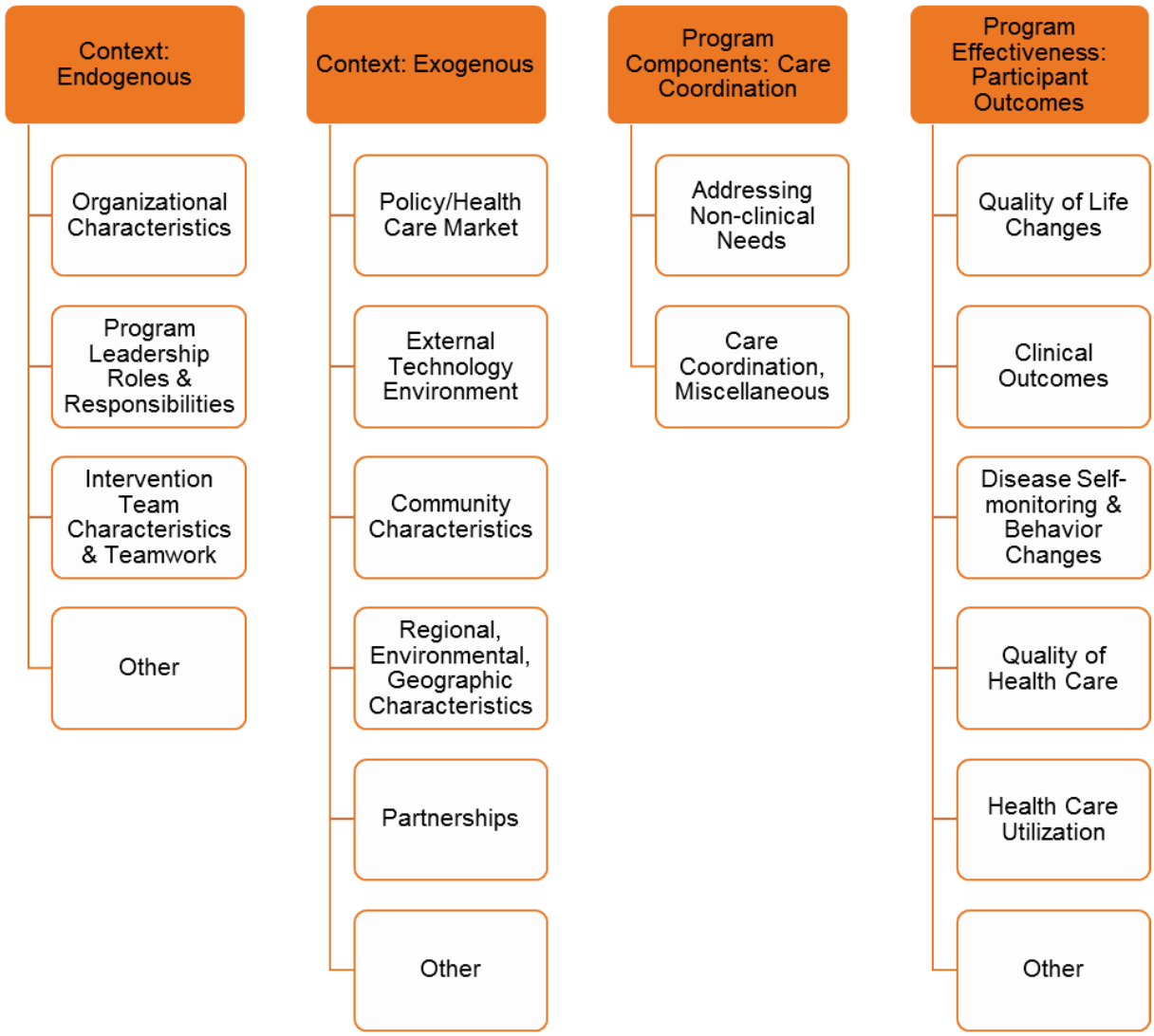


Exhibit B.4: Main Code Families Used for Patient and Caregiver Interviews

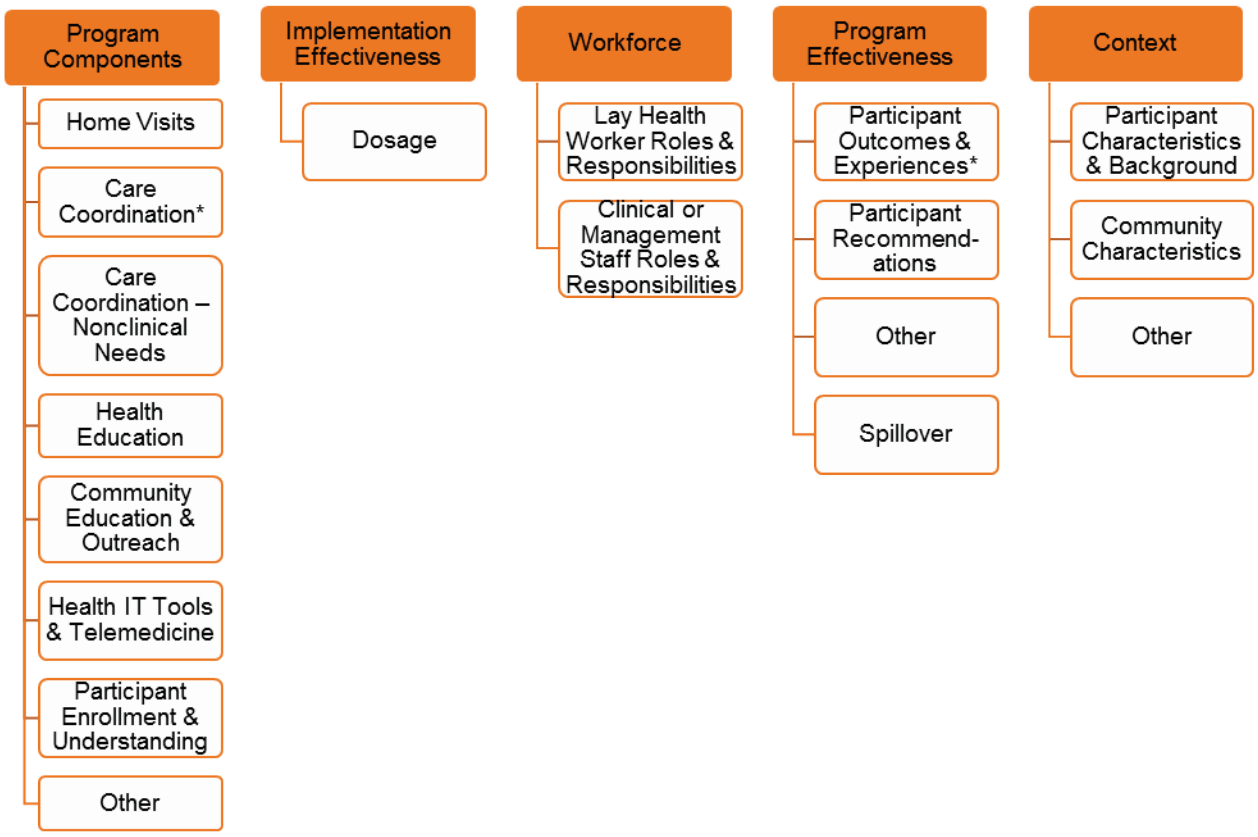


Exhibit B.5: Subcodes Used in Patient and Caregiver Interview Coding