THIRD ANNUAL REPORT ADDENDUM

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
Health Resources in Action, Inc.	HRiA
Innovative Oncology Business Solutions, Inc.	IOBS
Le Bonheur Community Health and Well-Being	Le Bonheur
Ochsner Clinic Foundation	Ochsner
University of Alabama at Birmingham	UAB
Regents of the University of California, Los Angeles	UCLA

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Report Overview

This report is an addendum to NORC's third annual report[1] and is the final report that NORC will produce for its evaluation of 18 of the first-round Health Care Innovation Awardee (HCIA) interventions, conducted under contract with the Center for Medicare & Medicaid Innovation (CMMI). The 18 awardees in the disease-specific portfolio focus on seven conditions considered priority because of their cost, prevalence, and seriousness: Alzheimer's disease and dementia; cancer; cardiovascular disease (CVD) and stroke; chronic pain; diabetes; end-stage renal disease (ESRD); and pediatric asthma.

This report covers evaluation activities and findings for the no-cost extension (NCE) period of the evaluation (July 2015 through June 2016). We present new findings for five awardees who received no-cost extensions (NCEs) (Christiana, HRiA, Ochsner, UAB, and UCLA), as well as two awardees who received extended time for orderly closeout (IOBS and SEDI).[2] Additionally, we present findings for one awardee which did not receive an NCE, but for which additional data during the award period was available since NORC's third annual report (Le Bonheur). Additional data on these awardees extends or complements prior findings. Exhibit 1.1 summarizes the data included in this report. The Technical Appendix provides details on quantitative methods; please see the third annual report[3] for an overview of the evaluation, detailed information for each awardee program, and quantitative findings on awardees not presented in this report.

Exhibit 1.1: Data Included in Addendum Report

Awardee	Awardee Status	Data Used in Current Report
Christiana	No-cost extension (NCE); did not enroll new participants during the NCE period	Update to claims data on participants reported on in AR3
Duke/SEDI	Extended time for orderly closeout	First claims-based analysis
HRiA	NCE; did not enroll new participants during the NCE period	First claims-based analysis
IOBS	Extended time for orderly closeout	Update to claims data on participants reported on in AR3
Le Bonheur	Did not receive an NCE or an orderly closeout	Update to claims data on participants reported on in AR3
Ochsner	NCE; enrolled new participants during the NCE period	Update to claims data on participants reported on in AR3 and new participants
UAB	NCE; enrolled new participants during the NCE period	Update to claims data on participants reported on in AR3 and new participants
UCLA	NCE; enrolled new participants during the NCE period	Update to claims data on participants reported on in AR3 and new participants

In the awardee-specific chapters that follow, we present new analyses of core measures—cost, hospital readmissions, emergency department (ED) visits, and all-cause hospitalizations—for all eight awardees,

[1] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[2] In the disease-specific HCIA portfolio, six awardees had NCEs. We have new claims data for five of the awardees (Christiana, HRiA, Ochsner, UAB, and UCLA) but do not have new data to present for one awardee (Nemours).

[3] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

using a difference-in-differences (DID) design. All analyses presented here build on those presented in NORC's third annual report.

Exhibit 1.2 summarizes utilization and total cost of care findings presented in the awardee chapters. We identified two broad groups of interventions among the disease-specific awardees: post-acute care (PAC) interventions and ambulatory care programs. PAC interventions focused on improving patient outcomes during or immediately after a hospitalization. Ambulatory care interventions generally focused on improving health, increasing quality of care, and reducing spending for patients with chronic conditions living in the community. Of the eight awardees we analyze in this report, two are PAC interventions and six are ambulatory care programs.

We show the difference in average utilization rates and costs pre- and post-intervention. Positive values suggest increased utilization or cost in the intervention group relative to the comparison group following implementation, and negative values suggest decreased cost or utilization in the intervention group relative to the comparison group following implementation. For each awardee and outcome, we indicate whether the difference between the pre- and post-intervention averages in the intervention versus comparison group is statistically significant. For quantitative findings on awardees not presented in this table, please see the third annual report.[4]

Exhibit 1.2: Program Impact: Quarterly Estimates[§] for Core Measures of Utilization

Awardee	Hospitalizations per 1,000 Participants±	30-day Readmissions per 1,000 Participants	ED Visits per 1,000 Participants	Total Cost of Care per Participant
Christiana – PAC^	Not applicable	4	0	$1,552
Duke/SEDI – ambulatory	27	66	44**	$1,339
HRiA – ambulatory	9*	Not applicable	-15	$1,554***
IOBS – ambulatory	2	-15	-13***	-$601***
Le Bonheur –ambulatory	-20***	Not applicable	-67***	-$545***
Ochsner – PAC	-42†	10	20	$1,927
UAB – ambulatory	-6†	24†	-7	$141
UCLA – ambulatory	12	-2	6	-$365

NOTES: ***p<0.01, **p<0.05, *p<0.1; †p<0.2 § 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.
±For post-acute awardees, hospitalizations reflect 90-day readmission rates for patient-episodes, relative to an index hospitalization.
^180-day estimates

To summarize, we identified the following key findings for awardees:

- One awardee (Le Bonheur) significantly reduced hospitalizations for their participants.
- Two awardees (IOBS and Le Bonheur) significantly reduced participants' ED visits. The same two awardees also reduced total cost of care for their participants.
- We observed no significant reductions for readmissions for any of the awardees.

[4] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Awardee-Specific Chapters

Christiana Care Health System

Highlights: Third Annual Report Addendum

Awardee 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 consisted of two intervention components—transitional care coordination and longitudinal care management—providing varying levels of support from admission to one year after admission. Please see the third annual report[5] for additional details on the awardee's program.

This chapter is an addendum to NORC's third annual report. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from March 2013 to June 2015. Christiana did not enroll any new patients during the no-cost extension period, but the updated analysis presented here considers outcomes in the 180-day period following a hospitalization (i.e., six-month period post-discharge), which require a longer claims run-off period.

With more follow-up time, more patient-episodes occurring at Christiana and comparison hospitals can be included in the 180-day measures. The current analysis of 180-day measures includes an additional quarter of claims data that became available after the third annual report was published (i.e., nine post-intervention quarters instead of eight, or an additional 168 patient-episodes), capturing the entire award period previously reported on for 7, 30, and 90-day measures.[6] Similar to findings in our third annual report, we observed no clear overall trends in 180-day measures of quality of care, cost of care, or utilization for patient-episodes at Christiana relative to the comparison group.

Utilization and Cost

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

Quality of Care

No significant change in repeat revascularization or AMI.

Findings for CMMI Core Measures

This chapter presents summative findings on program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the Christiana program's impact on cost, utilization, and quality of care over a 180-day period. For demographic characteristics and information regarding the creation of the treatment and comparison groups, please see the Christiana Awardee Chapter Supplement accompanying this report. For technical details on the methodology

[5] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[6] For more information on sample size and descriptive characteristics for the treatment and comparison group, please refer to the Christiana Awardee Chapter Supplement.

reported in this chapter as well as information regarding the creation of the treatment and comparison groups, please see Appendix A of the third annual report.[7]

Summative program impact. Exhibit 2.1 summarizes the results of our DID model, which included adjustment for key demographic and other risk factors.[8,9]

- There were no significant decreases in 180-day readmissions, 180-day ED visits, 180-day total cost of care, and 180-day repeat revascularization or AMI for patient-episodes at Christiana relative to the comparison group.

Exhibit 2.1: 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**	**80% Confidence Interval**
180-Day Readmissions	4	-28, 36	-21, 29
180-Day ED Visits	0	-32, 32	-25, 25
180-Day Total Cost of Care per Patient-episode ($)	$1,552	-$579, $3,683	-$109, $3,213
180-Day Repeat Revascularization/AMI	10	-18, 38	-12, 32
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
180-Day Total Cost of Care per Patient-episode ($)	$2,366,956	-$883,189, $5,617,101	-$165,983, $4,899,895

NOTES: ***p<0.01, **p<0.05, *p<0.1; †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

Limitations

We present the limitations of our quantitative analysis in our third annual report.[10]

Conclusion

Over the entire award period, we observed no clear overall trends in 180-day measures of quality of care, cost of care, or other measures of utilization for patient-episodes at Christiana relative to the comparison group; these findings are consistent with those presented in the third annual report.

[7] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[8] 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 (coronary artery bypass graft [CABG]: one artery, two arteries, three arteries, four or more arteries, or other; percutaneous transluminal coronary angioplasty [PTCA]: drug-eluting stent, non-drug-eluting stent, or other), and relevant chronic conditions (congestive heart failure [CHF], stroke, diabetes, atrial fibrillation, end-stage renal disease, and AMI).

[9] Findings are interpreted as significant where p<0.1.

[10] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Duke University's Southeastern Diabetes Initiative

Highlights: Third Annual Report Addendum

Awardee 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. Please see the third annual report[11] for additional details on the awardee's program.

This chapter is an addendum to NORC's third annual report and presents the first claims-based analysis for SEDI. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from October 2012 to December 2014.

Utilization
ED visits increased by 44 per 1,000 patients.
No significant change in hospitalizations or 30-day readmissions after an ED visit.

Cost
No significant change in overall total cost of care.

Quality of Care
No significant change in ACS hospitalizations.

Findings for CMMI Core Measures

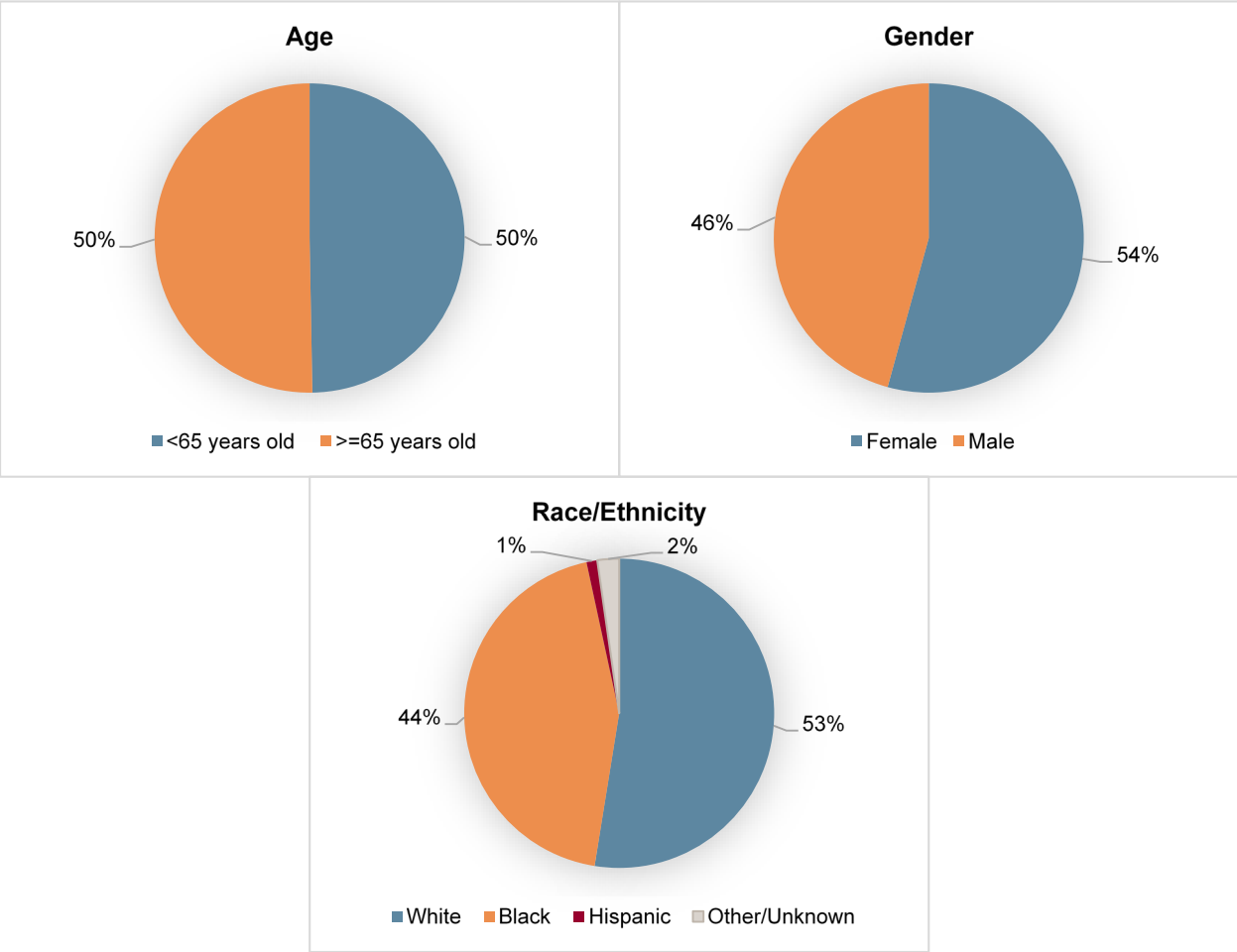
This chapter presents summative findings on program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the SEDI high-risk program's impact on core outcome measures: hospitalizations, ambulatory care sensitive (ACS) hospitalizations, 30-day readmissions, emergency department (ED) visits, and total cost of care. For details on methodology, please see the Technical Appendix.

We were able to link 175 treatment group patients with Medicare data, representing approximately 33 percent of all SEDI high-risk program patients (see Exhibit S1.1). Valid identifiers (Social Security numbers or health insurance claim numbers) were not available to successfully link the remaining patients. Exhibit 3.1 summarizes demographic and other basic information about the 175 SEDI patients who are included in our analysis of core outcome measures.[12]

[11] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

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

Exhibit 3.1: Descriptive Characteristics of SEDI High-Risk Intervention Participants Included in Claims Analysis (n=175)



Summative program impact. Exhibit 3.2 summarizes the results of our DID model, which included adjustment for key demographic and other risk factors.[13,14]

- SEDI participants had significantly more ED visits (44 per 1,000 patients) relative to the comparison group. The program was not associated with significant changes in hospitalizations, 30-day readmissions, or ACS hospitalizations.
- The SEDI program was associated with a non-significant increase in total cost of care relative to the comparison group.

[13]We adjusted for age, gender, race/ethnicity, disability status, dual eligibility, and mean hierarchical condition categories (HCC) score.

[14]Findings are interpreted as significant where $p<0.1$.

Exhibit 3.2: Difference-in-Differences Estimates for Core Measures for SEDI High-Risk Intervention

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	27	-11, 65	-3, 57
ED Visits	44**	5, 83	14, 74
30-day Readmissions	66	-30, 162	-9, 141
ACS Hospitalizations	27	-6, 60	1, 53†
Total Cost of Care per Patient ($)	$1,339	-$558, $3,236	-$139, $2,817
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	$1,981,839	-$825,394, $4,789,072	-$205,926, $4,169,604

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

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 3.2; please see the Technical Appendix for presentation of these results.

Limitations

Although our quantitative analysis included a matched comparison group, the results should be interpreted with caution. Because SEDI identified high-risk participants based on information that was not available in the claims data, we were unable to test whether our treatment and comparison group beneficiaries were well matched on the characteristics used by SEDI to identify high-risk participants. While we matched on Medicare cost in the year prior to enrollment (used as a proxy for risk level), we were not able to duplicate SEDI's more refined algorithm for enrollment in the high-risk program. Because of missing identifiers, we were able to match only 33 percent of SEDI participants with Medicare data. The small sample gave us limited power to detect changes in costs and utilization associated with program participation. We also observed only a small number of patients who experienced an ACS hospitalization, which especially limited our power to detect differences for this measure. Similarly, our analysis of readmissions was limited to patients with an index hospitalization, which reduced the sample size in this model to only 109 participants, or 62 percent of the 175 high-risk participants included in the full analysis.

Conclusion

SEDI developed the high-risk diabetes management program to provide coordinated care by multidisciplinary teams via home visits. This chapter offers findings on the analysis of claims data that were previously unavailable in the third annual report. We found that among participants with valid identifiers, the SEDI high-risk program was associated with a significant increase in ED visits and was not associated with significant changes in hospitalizations, total cost of care, or quality of care outcomes.

SEDI faced a variety of challenges that may have influenced outcomes, including staffing changes and workforce understaffing. Challenges were particularly notable at the Durham, NC site, one of the two largest sites, and at the Quitman, MS site. In addition, many of the study participants were low-income, and the site staff believed that their inability to provide free medication severely hampered their ability to improve health. Reported increases in ED visits may have been impacted by home visits during which study team members detected urgent health concerns, such as extremely high blood glucose levels or blood pressure, which are problems exacerbated by participants' lack of access to prescribed medications. It is important to note that as this program targets high-risk patients who have high rates of ED visits and hospitalizations, the likelihood of realizing reductions in utilization without reducing the quality of care or improvements in the quality of care without increasing spending may be low.

Health Resources in Action

Highlights: Third Annual Report Addendum

Awardee 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 helped families develop asthma self-management strategies and remediate environmental triggers in the home. Please see the third annual report[15] for additional details on the awardee's program.

This chapter is an addendum to NORC's third annual report and presents the first claims-based analysis for HRiA. We base findings presented in this chapter on quantitative analysis of Medicaid claims for beneficiaries enrolled from January 2013 to November 2015.

Utilization

Hospitalizations increased by nine per 1,000 patients.

Cost

Total cost of care increased by $1,554 per patient per quarter.

Findings for CMMI Core Measures

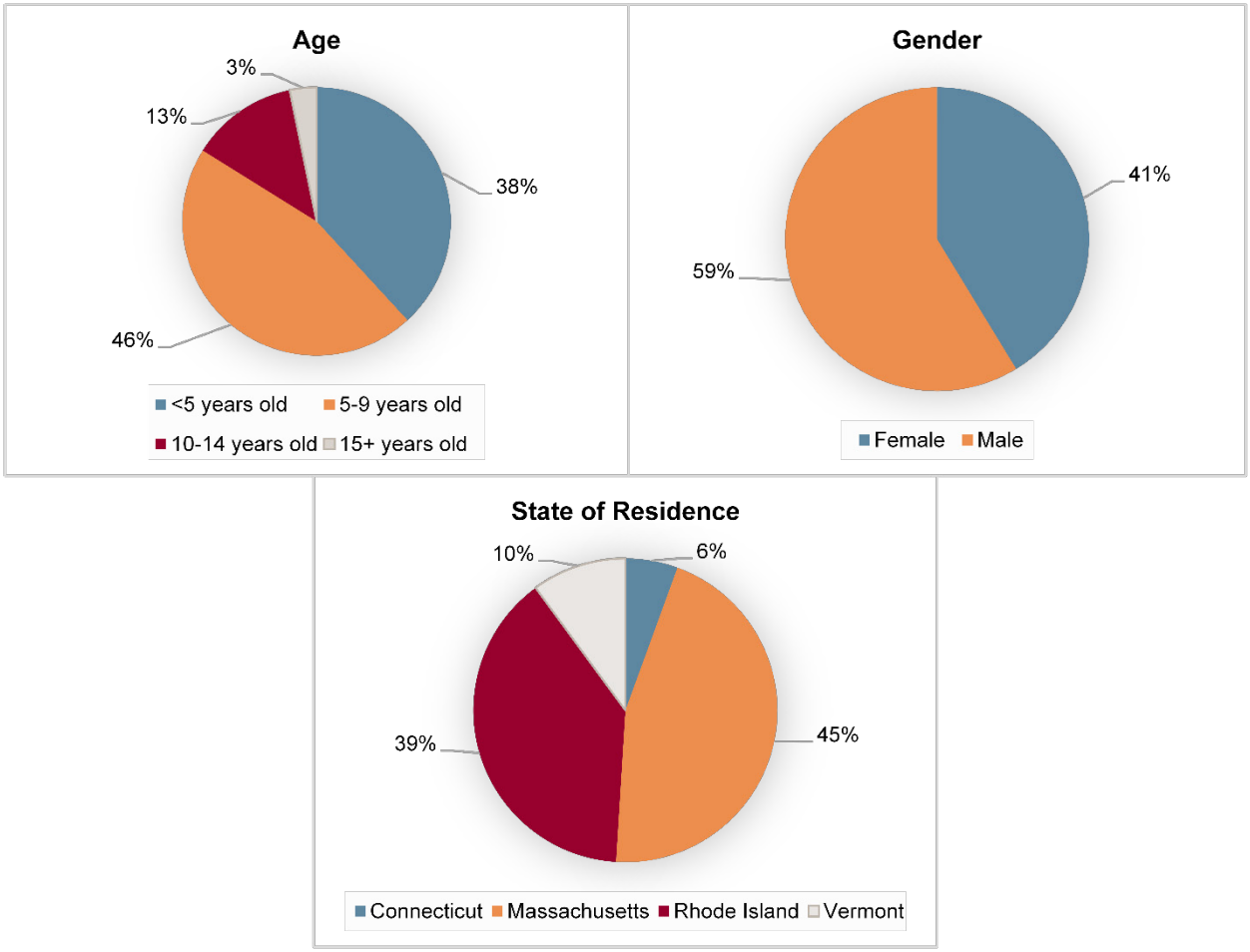
This chapter presents summative findings regarding program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the HRiA program's impact on core outcome measures: hospitalizations, asthma-related hospitalizations, emergency department (ED) visits, and total cost of care. For details on methodology, please see the Technical Appendix.

HRiA enrolled approximately 1,100 participants, 54 percent of whom (n=557) were linked with their Medicaid data – HRiA (see Exhibit S2.1). Exhibit 4.1 summarizes demographic and other basic information about the 557 HRiA patients who are included in our analysis of core outcome measures.[16] Data on race-ethnicity was not consistently available.

[15] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

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

Exhibit 4.1: Descriptive Characteristics of HRiA Participants Included in Claims Analysis (n=557)



Summative program impact. Exhibit 4.2 summarizes the results of our DID model, which included adjustment for key demographic and other risk factors.[17,18]

- We observed a significant increase in all-cause hospitalizations relative to the comparison group (nine hospitalizations per 1,000 patients). We saw no significant differences in ED visits or asthma-related hospitalizations relative to the comparison group.
- We observed a significant increase in total cost of care relative to the comparison group ($1,554 per patient per quarter).

[17]We adjusted for age, gender, chronic illness and disability payment system (CDPS) risk score, prior-year cost, prior-year utilization, and state of residence. We were unable to adjust for race or ethnicity due to missing data.

[18]Findings are interpreted as significant where $p<0.1$.

Exhibit 4.2: Difference-in-Differences Estimates for Core Measures for HRiA

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	9*	1, 17	2, 16
ED Visits	-15	-36, 6	-31, 1
Asthma-Related Hospitalizations	3	-4, 10	-3, 9
Total Cost of Care per Patient ($)	$1,554***	$996, $2,112	$1,119, $1,989
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	$6,086,953***	$3,901,544, $8,272,362	$4,383,795, $7,790,111

NOTES: ***p<0.01, **p<0.05, *p<0.1; †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

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 4.2; please see the Technical Appendix for presentation of these results.

Sensitivity analysis. Given the inconsistency in data availability across states, we evaluated the quality of our comparison group separately for each state (see Exhibit S2.3). These analyses show that we were able to achieve acceptable covariate balance for Rhode Island and Vermont; however, we faced challenges in doing so for Massachusetts and Connecticut. Therefore, we also ran a second set of analyses including data only from Rhode Island and Vermont, where we received Medicaid data for all treatment patients and were confident that our treatment and comparison groups were well matched.[19] In these models, we found no statistically significant differences in outcomes for treatment patients relative to the comparison group (see Exhibit 4.3).

Exhibit 4.3: Difference-in-Differences Estimates for Core Measures for HRiA – Rhode Island and Vermont Only

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	2	-6, 10	-4, 8
ED Visits	-1	-32, 30	-25, 23
Asthma-Related Hospitalizations	-3	-8, 2	-7, 1
Total Cost of Care per Patient ($)	$208	-$105, $521	-$36, $452
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	$399,961	-$203,466, $1,003,388	-$70,309, $870,231

NOTES: ***p<0.01, **p<0.05, *p<0.1; †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

[19]We adjusted for age, gender, Chronic Illness & Disability Payment System (CDPS) risk score, prior year cost, prior year utilization, and state of residence. We were unable to adjust for race or ethnicity due to missing data.

Limitations

The results for HRiA should be interpreted with caution. Availability of data on race varied significantly by state and overall these data were missing for more than half of the treatment and comparison participants. As a result, we were unable to select comparison groups balanced on race and ethnicity and could not include variables for race-ethnicity in any of our multivariate models. This might have produced bias in our analysis.

In addition, the data we received from HRiA's partners matched only 73 percent of HRiA participants to Medicaid records, and the match rate varied widely by state. All HRiA participants from Rhode Island and Vermont could be linked to Medicaid records, but only 78 percent of Massachusetts and 19 percent of Connecticut participants could.

Conclusion

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 certified AE-Cs. This chapter offers findings on the analysis of claims data that were unavailable for the third annual report. We found evidence of increases in utilization and cost. However, it is important to note that we were unable to include race or ethnicity in our models due to missing data, and we received Medicaid data for only 56 percent of HRiA patients; thus, results should be interpreted with caution. 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 program elements long-term.

Innovative Oncology Business Solutions, Inc.

Highlights: Third Annual Report Addendum

Awardee 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. Please see the third annual report[20] for additional details on the awardee's program.

This chapter is an addendum to NORC's third annual report. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from July 2012 to June 2015. IOBS did not receive a no-cost extension for the COME HOME program, but we were able to update the AR3 analyses to include covariates for practice-level differences in cost and utilization estimates between the IOBS and comparison practices in the six months prior to the start of the HCIA program. These new covariates minimize the effect of any systematic differences in care between IOBS and comparison practices resulting from innovative practices used at the COME HOME sites during the baseline period.

Because the analyses presented in the third annual report covered the entire HCIA performance period for the COME HOME program, no additional participants or patient-quarters were included in this updated analysis; in both reports, 3,664 IOBS participants were included in our analyses.[21] The effect of adjusting the models for practice-level characteristics was ultimately small; our findings of significant reductions in ED visits (-13 per 1,000 beneficiaries per quarter) and total cost of care (-$601 per beneficiary per quarter) are very similar to those reported in the third annual report.

Utilization
ED visits reduced by 13 per 1,000 patients.

Cost
Significantly lower average cost of care ($601 less per patient per quarter).

Quality of Care
ACS hospitalizations reduced by three per 1,000 patients.

[20] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[21] For more information on sample size and descriptive characteristics for the treatment and comparison group, please refer to the IOBS Awardee Chapter Supplement in this report.

Findings for CMMI Core Measures

This chapter presents summative findings on program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the IOBS program's impact on core outcome measures: hospitalizations, emergency department (ED) visits, readmissions, ambulatory care sensitive (ACS) hospitalizations, and total cost of care.[22] We updated our analysis to adjust for average practice-level cost and utilization for patients, stratified by cancer type, in the six months prior to participation in the COME HOME program. For demographic characteristics and information regarding the creation of the treatment and comparison groups, please see the IOBS Awardee Chapter Supplement accompanying this report. For more technical details on the methodology reported in this chapter, please see Appendix A of the third annual report.[23]

Summative program impact. Exhibit 5.1 summarizes the results of our DID model, which included adjustment for key demographic covariates, other risk factors, and practice-level variables.[24,25]

- The COME HOME program was associated with decreased ED visits (13 per 1,000 patients), ACS hospitalizations (three per 1,000 patients), and total cost of care ($601 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.

Exhibit 5.1: Difference-in-Differences Estimates for Core Measures for IOBS

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	2	-5, 9	-4, 8
ED Visits	**-13*** **	**-21, -5**	**-19, -7**
30-Day Readmissions	-15	-40, 10	-35, 5
ACS Hospitalizations	**-3***	**-6, -1**	**-5, -1**
Total Cost of Care per Patient ($)	**-$601*** **	**-$969, -$233**	**-$887, -$315**
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	**-$12,648,712*** **	**-$20,384,927, -$4,912,497**	**-$18,677,787, -$6,619,637**

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.20. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

[22]For more information on outcome measures, including the difference between hospitalizations and ACS hospitalizations, please see the Technical Appendix of the third annual report.

[23]https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[24]We adjusted for age, gender, race, ethnicity, dual eligibility, disability status, end-stage renal disease (ESRD), hierarchical condition categories (HCC) score, method of cancer treatment (surgery, radiation therapy, chemotherapy), metastatic cancer, indicator for cancer type (breast, lung, colorectal, lymphoma, pancreatic, melanoma).

[25]Findings are interpreted as significant where p<0.1.

Limitations

We present the limitations of our quantitative analysis in our third annual report.[26]

Conclusion

Over the entire award period, we observed significant reductions in ED visits, ACS hospitalizations, and total cost of care for IOBS participants, relative to the comparison group. These findings are consistent with those presented in the third annual report.

[26] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Le Bonheur Community Health and Well-Being

Highlights: Third Annual Report Addendum

Awardee summary: Le Bonheur Community Health and Well-Being (Le Bonheur) implemented Changing High-Risk Asthma in Memphis through Partnership (CHAMP). The program focused on improving pediatric asthma care management and reducing asthma triggers for high-risk asthma patients through comprehensive asthma care management, education, and social support via home visits using specialist-led clinical care teams and community health workers (CHWs). Please see the third annual report for additional details on the awardee's program.[27]

This chapter is an addendum to NORC's third annual report. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from December 2012 to December 2014. The updated analysis presented here includes an additional three quarters of data obtained since the third annual report. Because the analyses presented in the third annual report covered the entire HCIA performance period for the CHAMP program, no additional participants were included in this updated analysis; in both reports, 476 Le Bonheur participants were included in our analyses. The inclusion of additional quarters of data strengthened previous results showing CHAMP's impact on patient outcomes. Similar to our findings in the third annual report, we found a significant reduction in ED visits (-67 per 1,000 beneficiaries) and total cost of care (-$545 per beneficiary per quarter). In addition, our updated analysis shows significant reductions in asthma-related hospitalizations (-25 per 1,000 beneficiaries) and all-cause hospitalizations (-20 per 1,000 beneficiaries) relative to the comparison group.

Utilization

ED visits reduced by 67 per 1,000 children, hospitalizations reduced by 20 per 1,000 children, and asthma-related hospitalizations reduced by 25 per 1,000 children.

Cost

Total cost of care reduced by $545 per child per quarter.

Findings for CMMI Core Measures

This chapter presents summative findings regarding program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the Le Bonheur program's impact on core outcome measures: all-cause admissions, asthma-related admissions, emergency department (ED) visits, and total cost of care. We updated our analysis with three additional quarters of Medicaid data. For demographic characteristics and information regarding the creation of the treatment and comparison groups, please see the Le Bonheur Awardee Chapter Supplement accompanying this report. For technical details on the methodology reported in this chapter, please see Appendix A of the third annual report.[28]

[27] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[28] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Summative program impact. Exhibit 6.1 summarizes the results of our DID model, which included adjustment for key demographic and other risk factors.[29,30]

- We observed a significant decrease in all-cause hospitalizations (20 per 1,000 children), as well as asthma-related hospitalizations (25 per 1,000 children), relative to the comparison group. In addition, there was a significant decline in ED visits (67 per 1,000 children).
- We observed a significant decrease in total cost of care ($545 per child per quarter) relative to the comparison group.

Exhibit 6.1: Difference-in-Differences Estimates for Core Measures for Le Bonheur

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	**-20*** **	**-30, -10**	**-28, -12**
ED Visits	**-67*** **	**-93, -41**	**-88, -46**
Asthma-Related Hospitalizations	**-25*** **	**-33, -17**	**-32, -18**
Total Cost of Care per Patient ($)	**-$545*** **	**-$706, -$384**	**-$670, -$420**
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	**-$2,511,630*** **	**-$3,252,913, -$1,770,347**	**-$3,089,335, -$1,933,925**

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

Limitations

We present the limitations of our quantitative analysis in our third annual report.[31]

Conclusion

Le Bonheur developed the CHAMP program to provide integrated specialist care, home visiting, and social support to children with asthma by employing a workforce of CHWs and clinicians. We found evidence linking participation in CHAMP to reductions in costs, hospitalizations, and ED visits among children with asthma. These findings are consistent with those presented in the third annual report. Caregivers seemed to appreciate the specialist-based model of care, but felt that the program would benefit from coordination with participants' primary care providers to ensure ongoing maintenance of the asthma care management plan.

[29]We adjusted for age, gender, race/ethnicity, urbanicity, chronic illness and disability payment system (CDPS) risk score, and prior-year hospitalizations.

[30]Findings are interpreted as significant where p<0.1.

[31]https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Ochsner Clinic Foundation

Highlights: Third Annual Report Addendum

Awardee summary: Ochsner Clinic Foundation in Louisiana developed two programs (Stroke Central and Stroke Mobile) 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 patients' care upon discharge. Please see the third annual report[32] for additional details on the awardee's program.

This chapter is an addendum to NORC's third annual report. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from January 2013 to December 2015. The updated analysis presented here includes 99 additional patient-episodes occurring in two additional quarters during the no-cost extension period; a total of 730 Ochsner patient-episodes are included in this final analysis.[33] We also present outcomes for repeat stroke measures not reported in the third annual report.

This update captures the entire period of performance for the Ochsner Stroke Central program. Similar to our findings in the third annual report, we observed limited reductions in readmissions and no clear overall trends in quality of care, cost of care, or ED visits for patient-episodes at Ochsner relative to the comparison group.

Utilization

Stroke Central was associated with non-significant overall reductions in 90-,180-, and 365-day readmissions, but we observed no clear trends for ED visits.

Cost

No significant change in overall total cost of care.

Quality of Care

We observed no significant reductions in repeat strokes, falls, urinary tract infections (UTIs), or pressure ulcers in the program.

[32] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[33] For more information on sample size and descriptive characteristics for the treatment and comparison group, please refer to the Ochsner Awardee Chapter Supplement.

Findings for CMMI Core Measures

This chapter presents summative findings on program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the Ochsner program's impact on core outcome measures: readmissions, emergency department (ED) visits, total cost of care, and repeat stroke.[34] For demographic characteristics and information regarding the creation of the treatment and comparison groups, please see the Ochsner Awardee Chapter Supplement accompanying this report. For more technical details on the methodology reported in this chapter, please see Appendix A of the third annual report.[35]

Summative program impact. Exhibit 7.1 summarizes the results of our DID model, which included adjustment for key demographic and other risk factors.[36,37]

- There were no significant decreases in ED visits; falls, UTIs, or pressure ulcers; total cost of care; or repeat stroke for patient-episodes at Ochsner relative to the comparison group.
- Implementation of the Stroke Central program was associated with non-significant decreases in 90-, 180-, and 365-day readmissions for patient-episodes relative to the comparison group.

[34]Repeat stroke was identified using International Classification of Diseases (ICD)–9 principal diagnosis codes for ischemic stroke, hemorrhagic stroke, or transient ischemic attack (TIA) within 30-, 90-, 180-, and 365-days of index discharge.

[35]https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[36]We adjusted for age, gender, race, ethnicity, disability status, prior-year hospitalizations, prior-year cost, prior-year ED visits, prior-year hierarchical condition categories 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]).

[37]Findings are interpreted as significant where $p<0.1$.

Exhibit 7.1: 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**	**80% Confidence Interval**
30-Day Readmission	10	-29, 49	-20, 40
90-Day Readmission	-42†	-87, 3	-77, -7
180-Day Readmission	-7	-58, 44	-47, 33
365-Day Readmission	-10	-65, 45	-53, 33
90-Day ED Visit	20	-30, 70	-19, 59
180-Day ED Visit	39	-16, 94	-4, 82
90-Day Falls, UTIs, or Pressure Ulcers^	0	-16, 16	-13, 13
180-Day Falls, UTIs, or Pressure Ulcers^	3	-17, 23	-13, 19
30-Day Repeat Stroke^	10	-12, 31	-7, 26
90-Day Repeat Stroke^	9	-17, 36	-12, 30
180-Day Repeat Stroke^	15	-17, 47	-10, 40
365-Day Repeat Stroke^	6	-35, 46	-26, 37
90-Day Total Cost of Care per Patient-episode ($)	$1,927	-$1,678, $5,532	-$882, $4,736
180-Day Total Cost of Care per Patient-episode ($)	$3,862	-$1,442, $9,166	-$272, $7,996
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
90-Day Total Cost of Care per Patient-episode ($)	$1,406,634	-$1,224,925, $4,038,193	-$644,223, $3,457,491

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.2. ^Due to small sample sizes in each intervention quarter, we report difference-in-differences estimates for the entire post-intervention period. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

Limitations

We present the limitations of our quantitative analysis in our third annual report.[38]

Conclusion

Over the entire award period, we observed limited reductions in readmissions and no clear overall trends in quality of care, cost of care, or ED visits for patient-episodes at Ochsner relative to the comparison group. These findings are consistent with those presented in the third annual report.

[38] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

University of Alabama at Birmingham

Highlights: Third Annual Report Addendum

Awardee 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. Please see the third annual report for additional details on the awardee's program. [39]

This chapter is an addendum to NORC's third annual report. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from July 2012 to June 2016. The updated analysis presented here includes five updates since the third annual report: 1) inclusion of additional data from participants enrolled during the no-cost extension period; 2) inclusion of additional quarters of data; 3) use of direct matching on Comprehensive Cancer Center (CCC) status (i.e., whether the participant is seen at a CCC or at an affiliate); 4) inclusion of variables in the regression models that account for differences in cost and utilization for cancer patients at UAB and comparison sites prior to the HCIA program; and 5) a sensitivity analysis to test whether limiting the analysis to the actively enrolled period affected findings.[40]

UAB received a no-cost extension through June 30, 2016; however, during the NCE period, very few participants enrolled in the PCC program. In the third annual report, 4,038 participants were included in our analyses, and in this report 4,040 participants were included in the analyses, for an addition of only two participants to the analysis.[41] We present estimates based on fifteen quarters of claims data in this report, four additional quarters of data compared to the eleven included in the analyses for the third annual report.

In addition to adding the participants enrolled through June 2016, we updated our analyses to include covariates for practice-level differences in cost and utilization estimates between the UAB and comparison practices in the six months prior to the start of the HCIA program. These covariates were analyzed in order to minimize the effect of any systematic difference in care between UAB and comparison practices resulting from innovative practices used at the UAB sites during the baseline period. We also sought to better match the treatment and comparison beneficiaries' experience of care by matching directly on whether they were seen at a CCC or a related affiliate.

The final addition to this chapter is a sensitivity analysis examining the effect of UAB's patient navigation program during only the time in which participants were actively engaged with a navigator. As in past reports, our main analysis presented is an intent-to-treat analysis, investigating the downstream effects of UAB's program. As described in past reports, UAB's program is intended to benefit patients from diagnosis through survivorship, with active navigation happening only during a period determined by the participants' symptomatic and social needs. The intention is that the program will continue to benefit patients even after the active navigation stage. This new sensitivity analysis provides an additional lens through which to view the program's impact. Based on the results from this analysis, we conclude that the PCC program is able to impact cost and utilization during the time in which participants are actively engaged in the program, but there are few long-term effects that are sustained beyond the termination of navigation activities.

Utilization
We observed no clear utilization trends for the program; during the actively enrolled period, we observed significant reductions in hospitalizations (23 per 1,000 patients) and total cost of care ($536 per patient).

Cost
We observed no significant change in overall total cost of care.

Quality of Care
We observed no significant change in ACS hospitalizations.

Findings for CMMI Core Measures

This chapter presents summative findings on program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the UAB program's impact on core outcome measures: hospitalizations, emergency department (ED) visits, readmissions, ambulatory care sensitive (ACS) hospitalizations, and total cost of care. For demographic characteristics and information regarding the creation of the treatment and comparison groups, please see the UAB Awardee Chapter Supplement accompanying this report. For more technical details on the methodology reported in this chapter, please see Appendix A of the third annual report.[42]

Summative program impact (intent-to-treat). Exhibit 8.1 summarizes the results of our DID model, which included adjustment for key demographic covariates, other risk factors, and practice-level variables.[43,44]

- There were no significant decreases in hospitalizations, ED visits, readmissions, or total cost of care for patients in UAB's program relative to the comparison group.

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

[40] We defined the actively enrolled period based on dates of first and last contact with the program, provided in the UAB finder file.

[41] For more information on sample size and descriptive characteristics for the treatment and comparison group, please refer to the UAB Awardee Chapter Supplement.

[42] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[43] We adjusted for age, race/ethnicity, gender, cancer type, dual eligibility, disability, end-stage renal disease (ESRD), indicator for cancer treatment (surgery, radiation, chemotherapy), metastatic cancer, indicator for being seen at a Comprehensive Cancer Center, hierarchical condition categories (HCC) score, and provider-level variables (180-day cost, hospitalization, and ED visits).

[44] Findings are interpreted as significant where $p<0.1$.

Exhibit 8.1: Difference-in-Differences Estimates for Core Measures for UAB

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	-6†	-13, 1	-12, 0
ED Visits	-7	-16, 2	-14, 0
30-Day Readmissions	24†	0, 48	5, 43
ACS Hospitalizations	1	-2, 4	-1, 3
Total Cost of Care per Patient ($)	$141	-$244, $526	-$159, $441
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	$3,275,173	-$5,656,789, $12,207,135	-$3,685,785, $10,236,131

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

Summative program impact (sensitivity analysis). Because the average length of enrollment among participants in UAB's program was much shorter than the length of time of our analysis,[45] we included a sensitivity analysis in which patient-quarters are included in the analysis only if the quarter begins before the participant is disenrolled from UAB's program. Disenrollment occurred for participants who no longer reported barriers to care, exhibited low scores on UAB's distress assessment, changed care settings, or shifted into a different care phase (e.g., patient completed an intensive course of chemotherapy and no longer needed frequent contact with the navigator). Exhibit 8.2 summarizes the results of our DID model for this sensitivity analysis, which included adjustment for key demographic covariates, other risk factors, and provider-level variables.[46,47]

- UAB's program significantly decreased hospitalizations (23 per 1,000 patients) and total cost of care ($536 per patient) for its participants relative to the comparison group. There was also a significant increase in 30-day readmissions for UAB participants (39 per 1,000 patients), relative to the comparison group.
- There were no significant decreases in ED visits or ACS hospitalizations for UAB participants relative to the comparison group.

[45]The average length of program enrollment for UAB participants was 242 days (i.e., less than three quarters). This was measured by the first and last contact date indicated in the finder file provided by UAB. Approximately one-fourth of participants in the finder file had the first and last contact dates reported as the same day.

[46]We adjusted for age, race/ethnicity, gender, cancer type, dual eligibility, disability, ESRD, indicator for cancer treatment (surgery, radiation, chemotherapy), metastatic cancer, indicator for being seen at a Comprehensive Cancer Center, HCC score, and provider-level variables (180-day cost, hospitalization, and ED visits).

[47]Findings are interpreted as significant where p<0.1.

Exhibit 8.2: Difference-in-Differences Estimates for Core Measures for UAB, Sensitivity Analysis

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	**-23*** **	**-33, -13**	**-31, -15**
ED Visits	-11†	-23, 1	-20, 0
30-Day Readmissions	**39***	**3, 75**	**11, 67**
ACS Hospitalizations	-1	-6, 4	-8, 6
Total Cost of Care per Patient ($)	**-$536***	**-$1,053, -$19**	**-$939, -$133**
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	**-$4,346,363***	**-$8,536,504, -$156,222**	**-$7,611,871, -$1,080,855**

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.2. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

Limitations

We present the limitations of our quantitative analysis in our third annual report.[48]

Conclusion

In contrast to findings in the AR3[49], we observed no clear overall trends in utilization, quality of care, or cost of care for UAB participants relative to the comparison group for the main analysis over the entire award period. For the new sensitivity analysis presented in this chapter, we limited our analysis only to participants during the actively enrolled period. We observed significant decreases in hospitalizations and total cost of care for UAB participants relative to the comparison group. This indicates that UAB's navigation program is able to impact outcomes during the time in which participants are being actively navigated, but there are few effects that are sustained beyond the end of navigation activities. UAB has recently partnered with Guideway Care to expand the Patient Care Connect program nationally.[50]

[48] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[49] In AR3, we found significant reductions in hospitalizations, ED visits, end-of-life hospitalizations, end-of-life ED visits, and significant decreases in cost of care in the last 30 to 90 days of life.

[50] Guideway Care. About Us. Guideway Care Website. http://www.guidewaycare.com/. Accessed April 17, 2017.

Regents of the University of California, Los Angeles

Highlights: Third Annual Report Addendum

Awardee 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. Please see the third annual report[51] for additional details on the awardee's program.

This chapter is an addendum to NORC's third annual report. We base findings presented in this chapter on quantitative analysis of Medicare claims for beneficiaries enrolled from July 2012 to December 2015. The updated analysis presented here includes participants enrolled during the no-cost extension (NCE) period and additional quarters of claims data since the third annual report. In addition, we include analysis of risk of long-term care placement for program participants versus the comparison group.

Analysis included in the third annual report contained little information on participants enrolled during the NCE period (187 participants; 17% of the analytic sample). For these participants we had on average only one quarter of data. For this report, we have added two additional quarters of data for these NCE enrollees and the participants enrolled during the HCIA performance period. Our analysis during this NCE period finds reductions in total cost of care for the UCLA program, although the reduction is smaller than those reported in the third annual report (-$365 in this report and -$605 in third annual report) and is no longer statistically significant.

Utilization and Cost

The ADC program was associated with non-significant overall reductions in 30-day readmissions and total cost of care. We observed no reductions in hospitalizations or ED visits.

Quality of Care

We observed significantly lower risk of long term care admission for participants in the program. No significant reductions in ACS hospitalizations were observed for the program.

Findings for CMMI Core Measures

This chapter presents summative findings on program effectiveness, updated since NORC's third annual report. We used difference-in-differences (DID) analyses to evaluate the ADC program's impact on core outcome measures: hospitalizations, emergency department (ED) visits, readmissions, ambulatory care sensitive (ACS) hospitalizations, and total cost of care. We also conducted analysis of the risk of long-

[51] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

term care placement for ADC program participants using Cox proportional hazards models. We present demographic information and other basic information about ADC participants included in our analysis in the UCLA Awardee Chapter Supplement accompanying this report. For more technical details on the methodology reported in this chapter please see Appendix A of the third annual report.[52]

Summative program impact. Exhibit 9.1 summarizes the results of our DID model, which included adjustment for key demographic covariates, comorbidities, and other risk factors.[53,54]

- There were no significant decreases in hospitalizations, ED visits, ACS hospitalizations, or total cost of care for patients in the ADC program, relative to the comparison group.
- The ADC program showed non-significant decreases in readmissions rates and total cost of care.

Exhibit 9.1: Difference-in-Differences Estimates for Core Measures for UCLA

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	12	-1, 25	2, 22†
ED Visits	6	-10, 22	-6, 18
30-Day Readmissions	-2	-47, 43	-37,33
ACS Hospitalizations	0	-5, 5	-4, 4
Total Cost of Care per Patient ($)	-$365	-$861, $131	-$752, $22
Aggregate Impact			
Outcome Measure	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Total Cost of Care per Patient ($)	-$2,348,078	-$5,537,939, $841,783	-$4,834,036, $137,880

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.20. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

Long-term care facility admission. In order to understand the ADC program's impact on long-term care facility admission, we compared rates of long-term care admission between UCLA patients and the comparison group and used time-to-event models to estimate the relative hazard ratio (HR) of an admission to a long-term care facility.

- 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).
- Over the entire follow-up period (a mean of 6.3 quarters), UCLA participants were 34 percent less likely to be admitted to a long-term care facility (HR: 0.66; 90% CI: 0.53, 0.81).

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

[53] We adjusted for age, gender, race (White), ethnicity, dual eligibility, disability status, end-stage renal disease, hierarchical condition categories (HCC) score, prior cancer diagnosis, heart disease, arthritis, hyperlipidemia, chronic kidney disease, hip fracture, depression, prior-year ED visits, prior-year year hospitalizations, prior-year HCC score, prior-quarter cost, prior-year cost ratio, prior-year cost, and time to dementia diagnosis.

[54] Findings are interpreted as significant where p<0.1.

Limitations

We present the limitations of our quantitative analysis in our third annual report.[55]

Conclusion

While estimates of difference in utilization outcomes (e.g., ED visits and hospitalizations) are not statistically significant for the utilization outcomes, the estimates are similar to previous findings in both direction and magnitude. The observed differences in utilization are small and close to zero. Compared to findings in the third annual report, the size of change in total cost of care is smaller. We observed an average savings per quarter of $605 per patient in the third annual report, while in this report the average savings per quarter is $365 and not statistically different from zero (90% CI -$861, $131). Exploring the data further to understand this change in the size of the cost saving estimate, we found that new data added between the third annual report and this report (approximately six months of follow-up) tended to diminish the size of individual quarter specific estimates, bringing them closer to zero. When these estimates were averaged together and weighted by the number of participants, the overall estimate was also lower and closer to zero.[56] We continued to see significant reductions in long-term care placement, which increased quality of life for UCLA participants and over the long term may lower cost of care.

[55] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[56] It is possible that if the UCLA program size were larger giving us more statistical power, we would find that cost savings of the observed size ($365) are statistically different from zero. See the Awardee Chapter Supplement for additional analyses related to total cost of care.

Technical Appendix

Quantitative Methods

This appendix provides details regarding dataset construction (data sources, population, and measure specification) and comparison group selection. For more details on the analytic methods and other methodology presented in this report, please see Appendix A of the third annual report.[57]

Since the third annual report, we have added quantitative analyses for two awardees, Southeastern Diabetes Initiative (SEDI) and Health Resources in Action (HRiA); all other awardee analyses remain the same as in the third annual report. Exhibit A.1 outlines the key considerations for selecting an analytic approach for these two awardees:

- **Data Source:** The primary payer group for participants enrolled and the availability of health care claims for that group influenced the data source selection for cost and utilization measures.
- **Intervention Type:** Based on setting and goals of the intervention, awardee interventions were separated into two groups: (1) post-acute care (PAC) interventions focused on improving patient outcomes during or immediately after an index hospitalization, and (2) ambulatory care interventions that identified and engaged 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 affected the type of analysis conducted.
- **Analysis:** Selection of statistical analysis methods takes into consideration the intervention type, data source, and availability of a comparison group.

Exhibit A.1: Summary Quantitative Analysis Methods

Awardee	Data Source	Intervention Type	Comparison Group	Analysis
SEDI	Medicare	Ambulatory care	Yes	DID
HRiA	Medicaid	Ambulatory care	Yes	DID

Dataset Construction

To construct analytic files, we began with claims-level data and identified participants using unique patient identification numbers and selecting all claims for those patients during the relevant time period. For more details on the methods used to build these datasets for the two intervention types, PAC and ambulatory care (including SEDI and HRiA) interventions, please see Appendix A in the third annual report.[58]

[57] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf
[58] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Comparison Group Selection

For more details on comparison group selection for Christiana, IOBS, Le Bonheur, Ochsner, UAB, and UCLA, please see Appendix A in the third annual report.[59] Comparison group selection for SEDI and HRiA is outlined below. For HRiA, we did not have direct access to Medicaid claims data to identify a comparison pool. Instead, HRiA's research partner, the Center for Health Policy and Research (CHPR), established data-sharing agreements to receive data from health plan partners and state Medicaid sources in Connecticut, Massachusetts, Rhode Island, and Vermont.

For each awardee, we used a three-stage process to define the comparison group:

- identify sampling frame: select area 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[60]

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 is well documented[61,62,63] and, if not well controlled, is a potential source of bias for our evaluation. Therefore, we explicitly considered geographic factors in selecting sampling frames. The participant place of residence was used to define the primary sampling frame for both SEDI and HRiA.

Exhibit A.2 summarizes the sampling frame and the approach to identifying areas for SEDI and HRiA.

Exhibit A.2: Sampling Frame for Comparison Groups, SEDI and HRiA

Awardee	Sampling Frame	Comparison Areas
SEDI	Zip codes in North Carolina, Mississippi, and West Virginia	Zip codes where treatment population resides
HRiA	Children in Connecticut, Massachusetts, Rhode Island, and Vermont	Medicaid enrollees in Connecticut, Massachusetts, Rhode Island, and Vermont

[59] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[60] 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.

[61] 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.

[62] 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.

[63] 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.

Limit to qualified patients. After identifying the sampling frame, we applied the same criteria that the awardee used to enroll patients in their programs. This limited the comparison pool to all Medicare fee-for-service (FFS) or Medicaid patients within the sampling frame during 2013 who would have been eligible for the program under study.[64] For more details on how this is operationalized for our analyses, please see Appendix A of the third annual report.[65] Exhibit A.3 provides an overview of awardee enrollment criteria and claims-based rules used to identify comparison patients for SEDI and HRiA.

Exhibit A.3: Claims Rules Used to Identify Comparison Patients, SEDI and HRiA

Awardee	Target Population	Diagnoses/Procedure Codes[66]
SEDI	FFS Medicare beneficiaries with a diabetes chronic condition indicator on Medicare claims	**Diabetes:** 250.XX
HRiA	Medicaid children 18 years old or younger who had an outpatient office visit with a diagnosis of asthma	**Asthma:** 493.00–493.02, 493.10–493.12, 493.20–493.22, 493.81–493.82, 493.90–493.92

Select similar patients. Finally, we selected similar patients to include in the final analytic sample. For more details on how propensity scores are generated and used in the analyses for ambulatory and PAC awardees, please see Appendix A in the third annual report.[67] Exhibit A.4 summarizes the approach to propensity score models and the variables that we used for SEDI and HRiA.

Exhibit A.4: Approach and Variables Used in Propensity Score Models, SEDI and HRiA

Awardee	Propensity Score (PS) Approach	Variables Used for PS Model
SEDI	Nearest neighbor 1:1 matching based on PS—without replacement	Age (continuous), race (White, other), gender, disability status, prior-year cost, prior-year hospitalizations, prior-year ED visits
HRiA	Exact match by state followed by nearest neighbor 1:1 matching based on PS—without replacement	Age (continuous), gender, CDPS risk score, lag-year cost, lag-year asthma-related hospitalizations, lag-year hospitalizations, lag-year ED visits

NOTE: CDPS, chronic illness and disability payment system

[64]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.

[65]https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[66]All codes are International Classification of Diseases (ICD)–9 codes unless otherwise specified.

[67]https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Supplements for Awardee Chapters

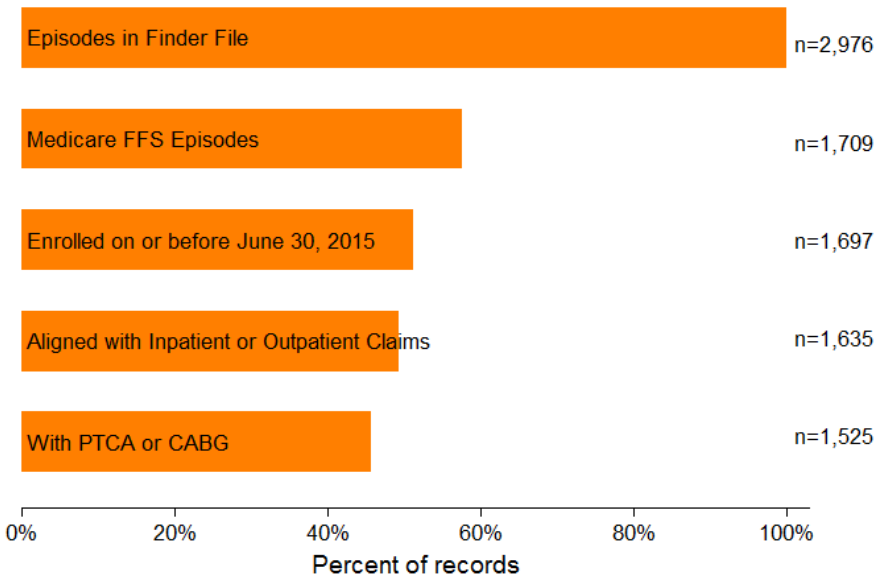
The materials presented in the following awardee-specific supplements are particular to the analysis conducted for each awardee. Therefore, the number and type of exhibits, along with the accompanying text, will vary.

Christiana Care Health System

Treatment and Comparison Group Creation

- We worked with Christiana's finder file listing Bridges participants to identify Medicare fee-for-service (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.[68,69]
- 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



[68]The clinical criteria for myocardial infarction are elevated troponin and catheterization defined by at least a 50 percent stenosis of one lesion.

[69]We exclude approximately 5 percent of patient-episodes present in the 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[70, 71] We run propensity score models to produce standard mortality ratio (SMR) weights. We then incorporate SMR weights into our analysis to minimize observed differences in covariates across Christiana and comparison group patient-episodes included in our propensity score models. For more details on comparison group selection and SMR weighting, please see Technical Appendix A in the third annual report.[72]

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).

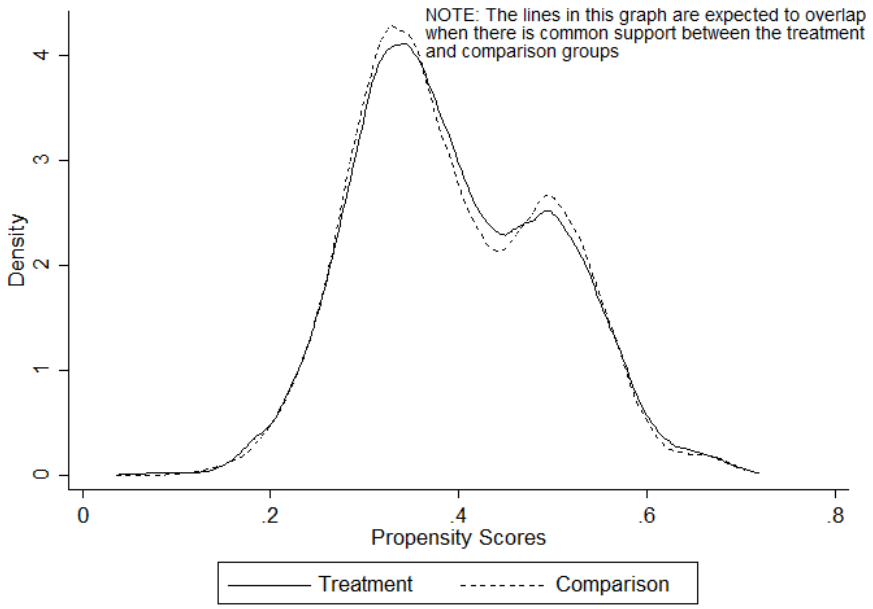
[70]University of Pittsburgh Medical Center Presbyterian Shadyside, PA; Abington Memorial Hospital, PA; Main Line Hospital Bryn Mawr Campus, PA; and Thomas Jefferson University Hospital, PA.

[71]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.

[72]https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Exhibit S1.2: Common Support and Covariate Balance for Christiana and Comparison Patient-Episodes

A. Common Support



B. Covariate Balance

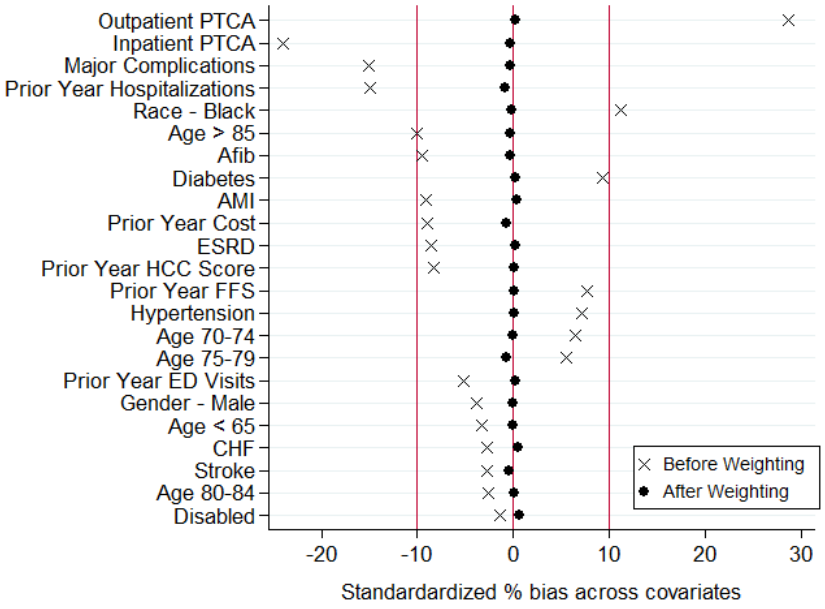


Exhibit S1.3 summarizes demographic and other basic information about the treatment and comparison patients with episodes included in our analysis of core outcome measures.[73] Relative to Christiana episodes, comparison patients with post-intervention episodes were more likely to be older (≥85 years) 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.[74] 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[75]

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	2,951
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% (625)
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% (2,581)
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)	$18,300 ($32,643)

[73]Cost of the index hospital episode is not included in the total cost of care core outcome measure.

[74]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.

[75]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)
Coverage Reason				
Old Age	77.3% (1,487)	75.0% (2,262)	77.5% (1,182)	77.7% (2,294)
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% (1,764)
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% (651)
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% (133)
Disease Composition				
Inpatient PTCA***	50.0% (961)	61.6% (1,856)	47.0% (717)	59.4% (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% (712)

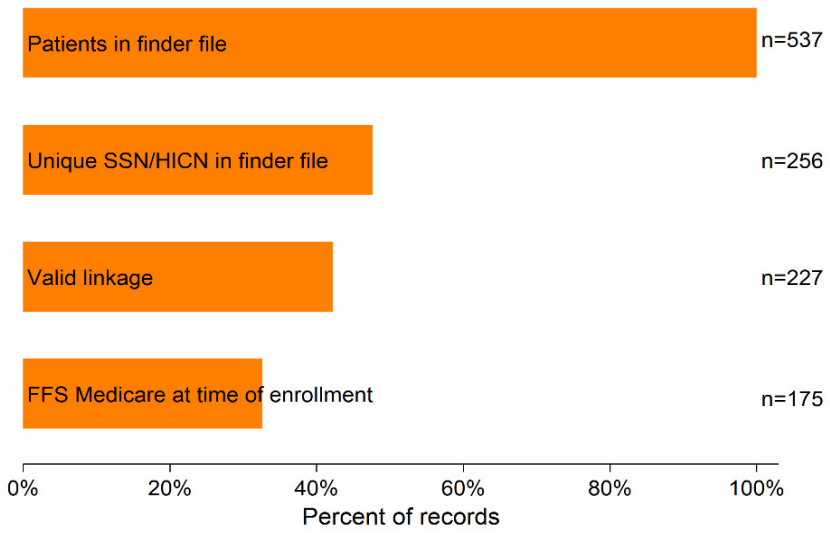
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance assessed using Chi-squared tests for proportions and t-tests for continuous variables, comparing characteristics of patient-episodes at Christiana and the comparison group during the post-intervention period. CABG, coronary artery bypass graft; ESRD, end-stage renal disease; HHA, home health aide; PTCA, percutaneous transluminal angioplasty; SNF, skilled nursing facility

Duke University's Southeastern Diabetes Initiative

Treatment and Comparison Group Creation, High-Risk Intervention Analysis

- We worked with SEDI's finder file listing high-risk participants and their enrollment date to identify fee-for-service (FFS) Medicare claims for these participants (please see Exhibit S2.1).
- We restricted our treatment group to Medicare FFS participants who were enrolled in SEDI's high-risk program for one or more quarters from July 2012 through December 2014, which is the last enrollment date provided in the finder file. Furthermore, participants needed to be enrolled in FFS Medicare at the time of entry into the SEDI program.
- To identify a pool of comparison patients, we selected FFS beneficiaries with a diabetes chronic condition indicator on Medicare claims who resided in the same zip codes as program participants.[76] The enrollment date for the comparison group was the date of the first diabetes management visit during the period in which claims were available.

Exhibit S2.1: Patients Identified through SEDI 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. We present comparison group selection and propensity score matching information in the above Technical Appendix. Exhibit S2.2 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:

[76]Center for Medicare and Medicaid Services. CMS chronic condition warehouse (CCW). CCW condition algorithms. Available at: https://www.ccwdata.org/web/guest/condition-categories.

- 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 shows that matching has achieved balance (i.e., reduced the difference between SEDI participants and comparison group patients) with respect to demographic characteristics, comorbidity, and prior-year utilization (hospitalization and ED visits) and costs.

Exhibit S2.2: Common Support & Covariate Balance for SEDI and Comparison Patients

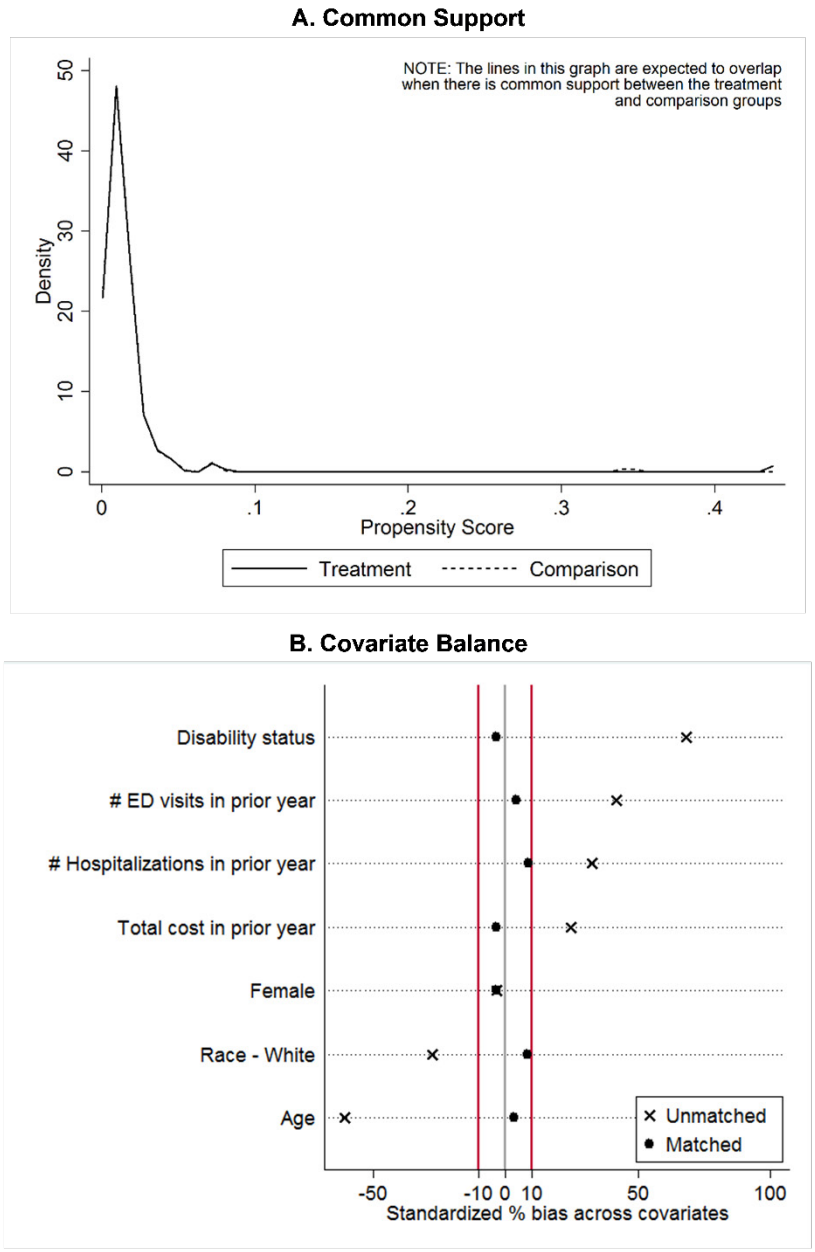


Exhibit S2.3 summarizes demographic and other basic information about the treatment and comparison patients included in our analysis of core outcome measures. After matching, the SEDI participants were slightly older ($p<0.05$), were more likely to be dually enrolled ($p<0.05$), had a higher mean hierarchical condition categories (HCC) score ($p<0.05$), and had more comorbidities ($p<0.1$) relative to matched comparison patients. To minimize any residual confounding, these factors were all included as covariates in regression models.

Exhibit S2.3: Descriptive Characteristics of SEDI and Matched Comparison Patients

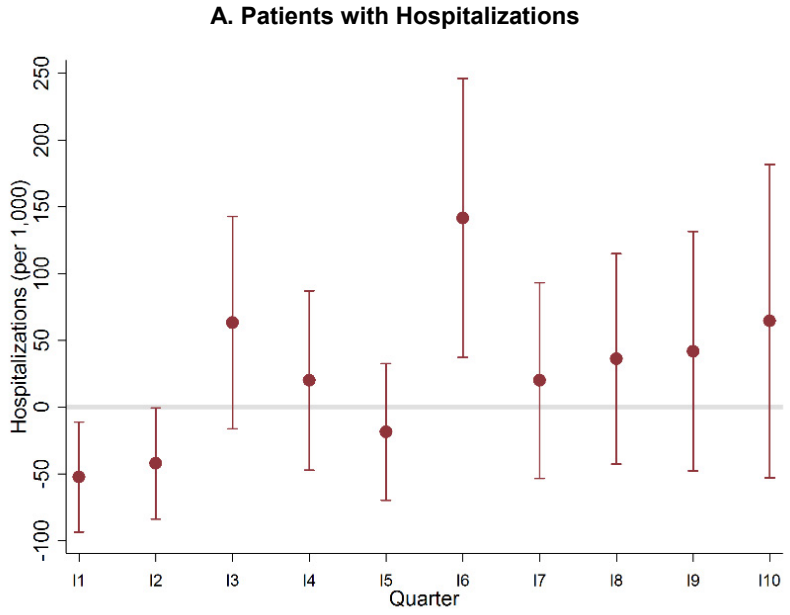
Variable	SEDI	Comparison
	% (N)	% (N)
Number of Persons	175	175
Mean Number of Enrollment Quarters [Range]	10.0 [7-13]	10.0 [7-13]
Gender		
Female	45.7% (80)	44.1% (77)
Age Group**		
<50 years old	10.9% (19)	18.3% (32)
50-59 years old	25.7% (45)	16.6% (29)
60-69 years old	34.3% (60)	36.0% (63)
70-79 years old	29.3% (46)	20.6% (36)
≥80 years old	2.9% (5)	8.6% (15)
Race/Ethnicity		
White	53.1% (93)	49.1% (86)
Black	44.6% (78)	47.4% (83)
Hispanic	1.1% (2)	0.6% (1)
Other	2.3% (4)	3.4% (6)
Dual Eligibility		
Dual Enrolled**	58.9% (103)	46.9% (82)
Coverage Reason		
Old Age	30.3% (53)	29.1% (51)
Disability	64.6% (113)	65.1% (114)
ESRD	1.1% (2)	0.6% (1)
ESRD & Disability	4.0% (7)	5.1% (9)
Hierarchical Condition Categories (HCC)		
Mean HCC Score (SD)**	1.9 (1.4)	1.6 (1.3)
Mean Number of HCC (SD)*	3.7 (2.6)	3.2 (2.6)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost	$15,405 ($23,895)	$16,193 ($28,490)
Hospitalizations per 1,000	754 (1,517)	646 (1,213)
ED Visits per 1,000	2,057 (3,979)	1,926 (4,561)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-squared tests for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation; ESRD, end-stage renal disease.

Quarter-specific program impact. Exhibit S2.4 summarizes the results of the quarterly fixed effects DID models as the adjusted marginal effect on hospitalizations, ACS hospitalizations, 30-day readmissions, ED visits, and total cost of care of SEDI's high-risk intervention.[77]

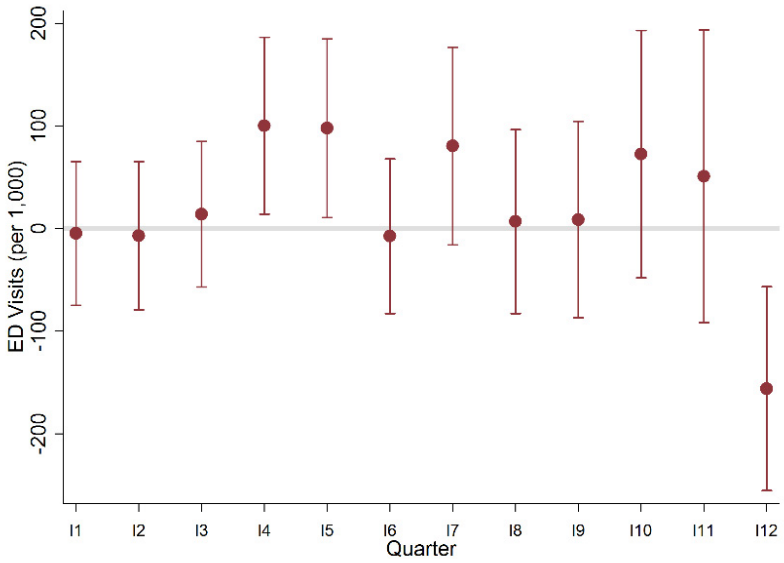
- **Utilization measures:** Significantly fewer SEDI participants experienced ED visits in quarter I12 relative to a comparison group, and significantly more SEDI participants experienced ED visits in quarters I4 and I5. There were no clear trends in hospitalizations over the post-intervention period. However, significantly fewer SEDI participants experienced hospitalizations in quarter I1 and significantly more in quarter I6 relative to the comparison group.
- **Cost:** The SEDI program was associated with a significant decrease in total cost of care in the first post-intervention quarter relative to the comparison group. We also observed a significant increase in cost for SEDI participants in quarter I10 relative to the comparison group.
- **Quality of care measures:** There were no significant differences in ACS hospitalizations in any post-intervention quarters relative to the comparison group. Significantly more SEDI participants experienced 30-day readmissions in quarter I3, but no other quarters reached statistical significance.

Exhibit S2.4: Adjusted Utilization Rates for Core Measures for SEDI High-Risk Intervention by Quarter

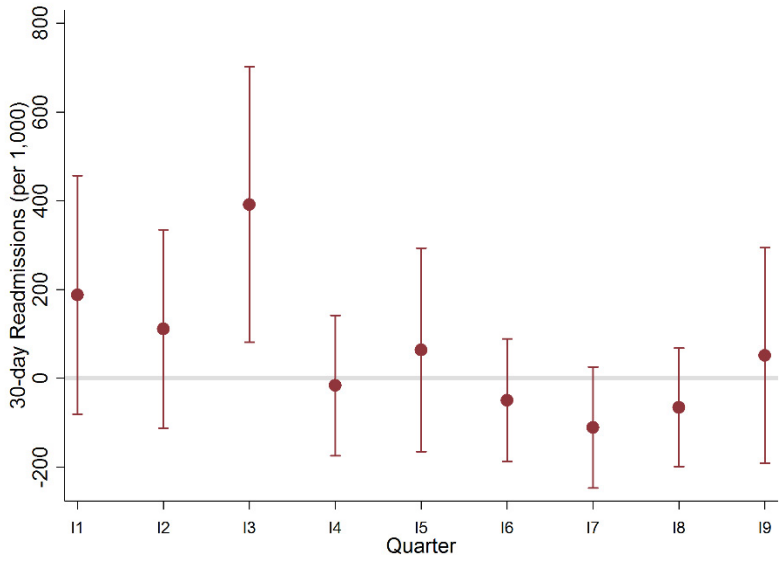


[77]Adjustment factors include age, gender, race/ethnicity, disability status, dual eligibility, and mean hierarchical condition categories (HCC) score.

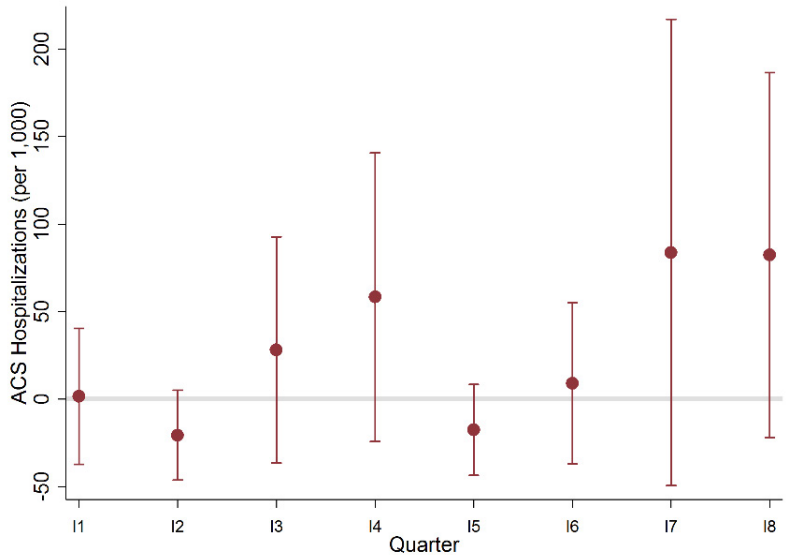
B. Patients with ED Visits



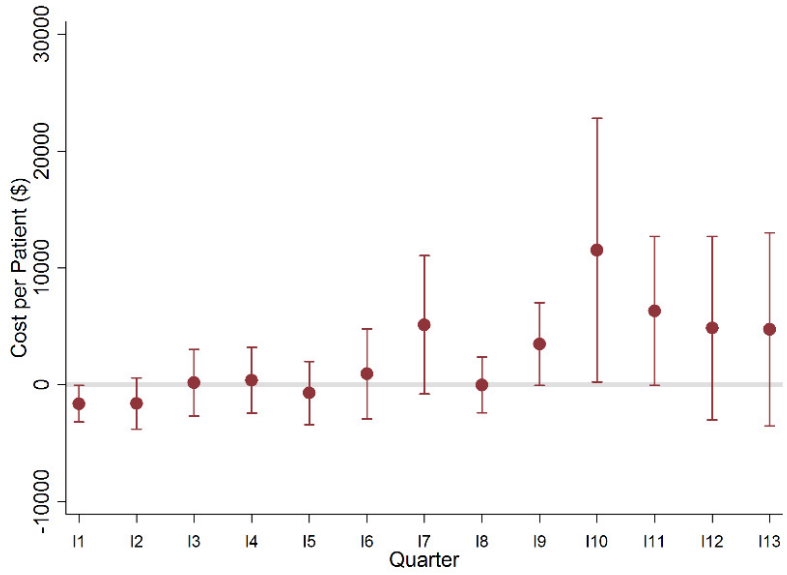
C. Patients with 30-day Readmissions



D. Patients with ACS Hospitalizations



E. Total Cost of Care



Health Resources in Action

Treatment and Comparison Group Creation

- HRiA's research partner, Center for Health Policy and Research (CHPR), established data-sharing agreements to receive data from health plan partners and state Medicaid sources. CHPR used a finder file they maintained from Connecticut, Massachusetts, Rhode Island, and Vermont listing participants and their enrollment dates to identify Medicaid claims for these participants (please see Exhibits S3.1 and S3.2). Claims were available through December 2015.
- To identify a pool of comparison children with asthma for each state, CHPR requested claims data in one of two ways. For Massachusetts Medicaid, CHPR was able to pull a comparison pool with their direct access. For Connecticut, Rhode Island, and Vermont, CHPR, as part of their data sharing agreements, asked the health plan partners to limit the comparison group to children who were not included in HRiA's asthma registry, were 18 years old or younger, were enrolled in Medicaid, and had an office visit for asthma between January 1, 2013, and September 31, 2015. The enrollment date for children in the comparison group was the date of the evaluation and management office visit for asthma during the period in which claims were available.

Exhibit S3.1: Patients Identified through HRiA Finder File

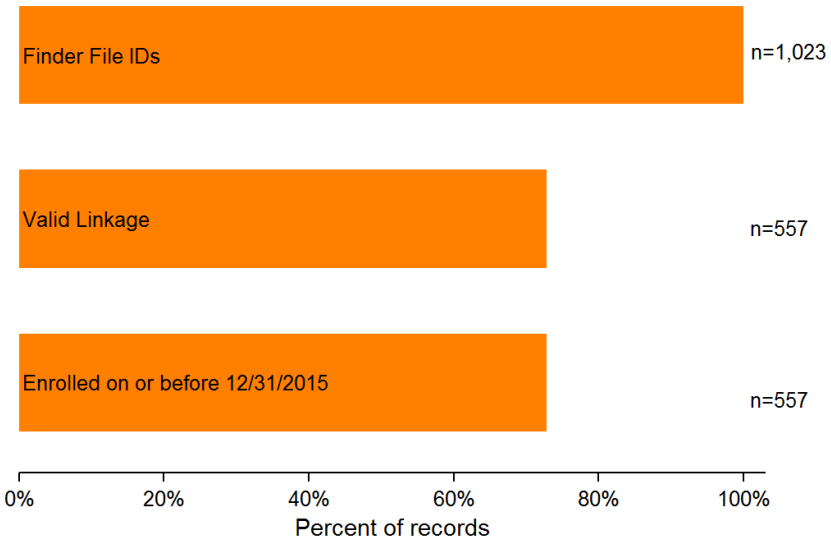


Exhibit S3.2: Patients Identified through HRiA Finder File, by State

	Connecticut	Massachusetts	Rhode Island	Vermont
Finder File IDs	167	325	217	56
Valid Linkage	31	253	217	56
Percentage of Beneficiaries Included in Analytic File	**19%**	**78%**	**100%**	**100%**

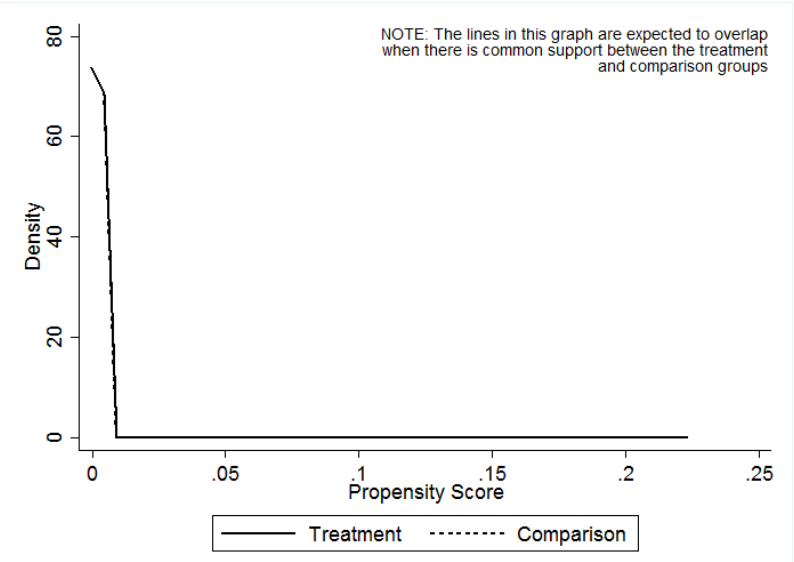
Comparison group selection. We used propensity score models to match intervention patients in each state separately to comparison patients in the same state, matching with respect to available demographics, comorbidities, and prior utilization. Race/ethnicity was missing for too many participants and comparison group members to include as a variable for matching. We present comparison group selection and propensity score matching information in the above Technical Appendix. Exhibit S3.3 summarizes the results from our propensity score matching for each state. 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. We do not present results from our propensity score matching for the overall comparison group across states because we calculated the standardized differences separately for each population.

- After matching, we observed similar characteristics in the two populations for all states.
- We were not able to achieve balance for all covariates in all states, particularly with respect to prior utilization and costs. We also could not achieve balance for gender in Connecticut, age in Massachusetts, and CDPS risk score in Vermont. We controlled for all of these variables in the DID model.

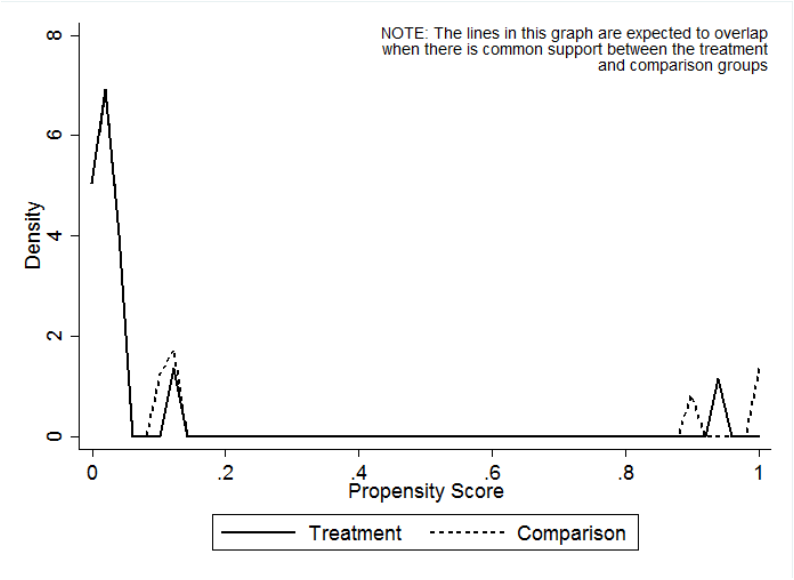
Exhibit S3.3: Common Support & Covariate Balance for HRiA and Comparison Patients

A. Common Support

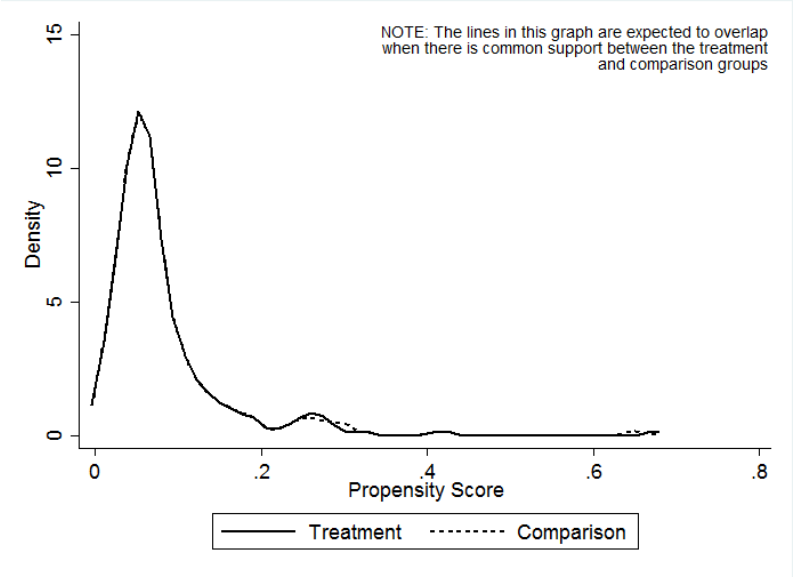
Connecticut



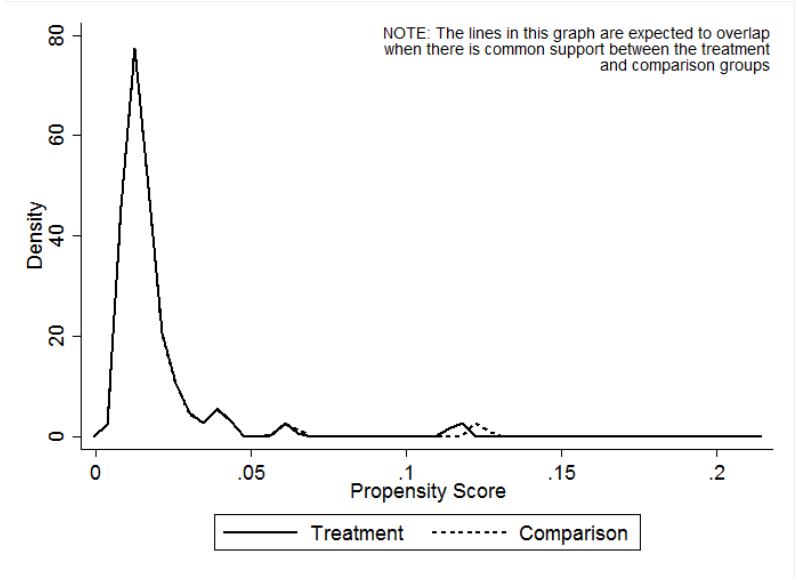
Massachusetts



Rhode Island

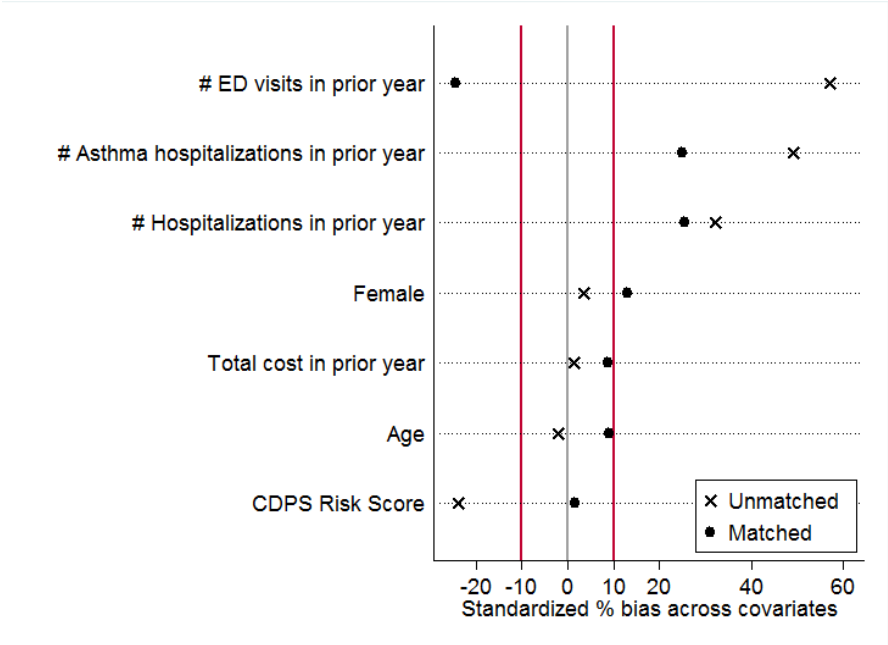


Vermont

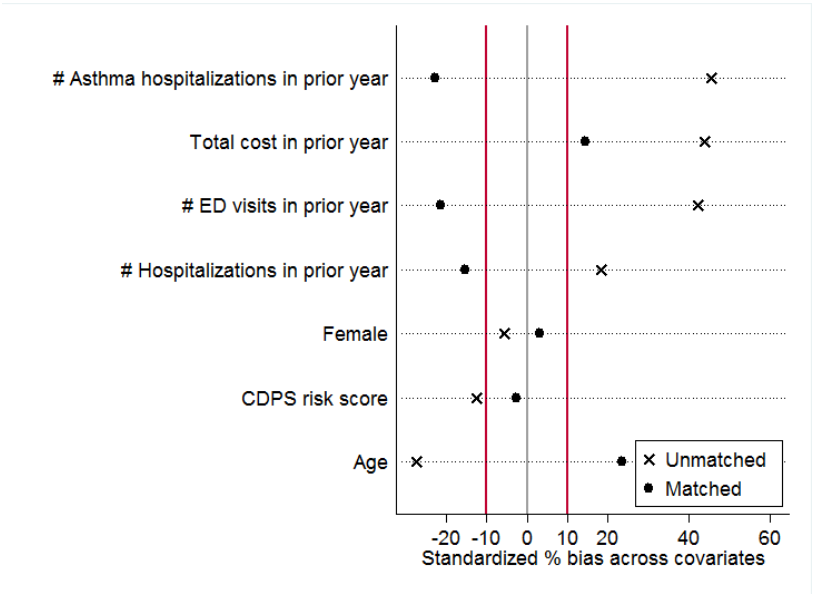


B. Covariate Balance

Connecticut



Massachusetts



Rhode Island

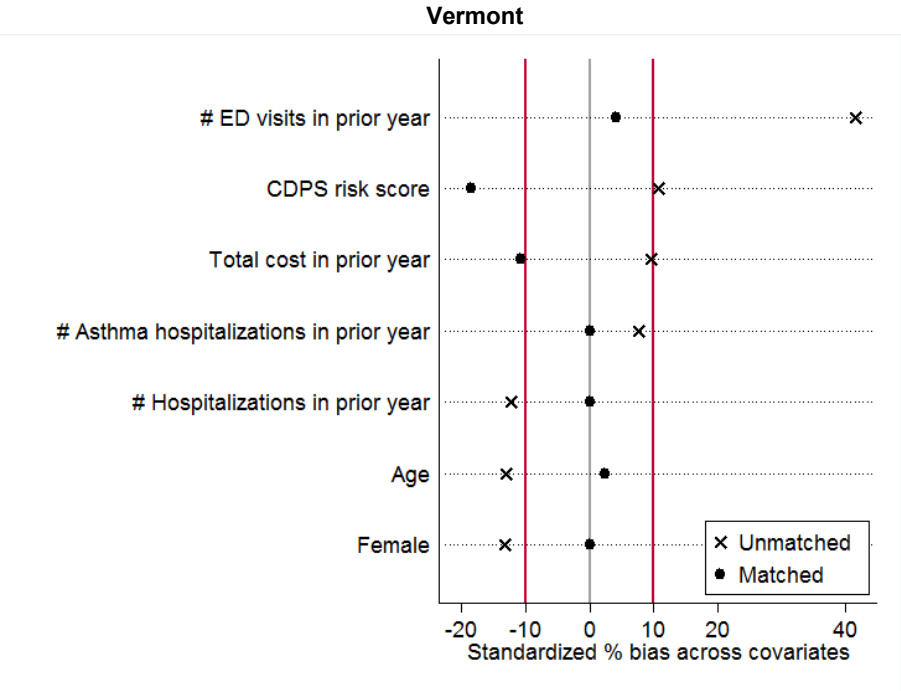

Vermont
ED visits in prior year
CDPS risk score
Total cost in prior year
Asthma hospitalizations in prior year
Hospitalizations in prior year
Age
Female
Unmatched
Matched
-20
-10
0
10
20
40
Standardized % bias across covariates

Exhibit S3.4 summarizes demographic and other basic information about the treatment and comparison patients included in our analysis of core outcome measures. After matching, the HRiA participants were slightly older ($p<0.01$) and were less likely to have an asthma diagnosis ($p<0.01$) relative to matched comparison patients.

Exhibit S3.4: Descriptive Characteristics of HRiA and Matched Comparison Patients

Variable	HRiA	Comparison
	% (N)	% (N)
Number of Patients	557	557
Age Group* **		
<5 years old	38.2% (213)	48.3% (269)
5-9 years old	45.8% (255)	34.1% (190)
10-14 years old	12.8% (71)	13.8% (77)
≥15 years old	3.2% (18)	3.8% (21)
Gender		
Female	41.3% (230)	40.4% (225)
Asthma Flags		
Diagnosis of Asthma***	98.2% (547)	100% (557)
Bronchodilator Use	97.7% (544)	97.1% (541)
Comorbidity: Chronic Illness and Disability Payment System (CDPS)		
Weighted CDPS Score, standard deviation (SD)	1.8 (2.3)	1.9 (3.0)
Utilization/Cost of Care in Year Prior to Enrollment		
Total Medicaid Cost (SD)	$14,952 ($47,004)	$11,745 ($64,355)
Hospitalizations per 1,000 Patients (SD)	147 (423)	190 (600)
ED Visits per 1,000 Patients (SD)	1,795 (1,971)	1,991 (3,142)
Asthma-related Hospitalizations per 1,000 Patients	131 (410)	165 (541)
State		
Connecticut	5.6% (31)	5.6% (31)
Massachusetts	45.4% (253)	45.4% (253)
Rhode Island	39.0% (217)	39.0% (217)
Vermont	10.1% (56)	10.1% (56)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-squared tests for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation.

Quarter-specific program impact. Exhibit S3.5 summarizes the results of the quarterly fixed effects DID models as the adjusted marginal effect on hospitalizations, asthma-related hospitalizations, ED visits, and total cost of care of HRiA's intervention.[78]

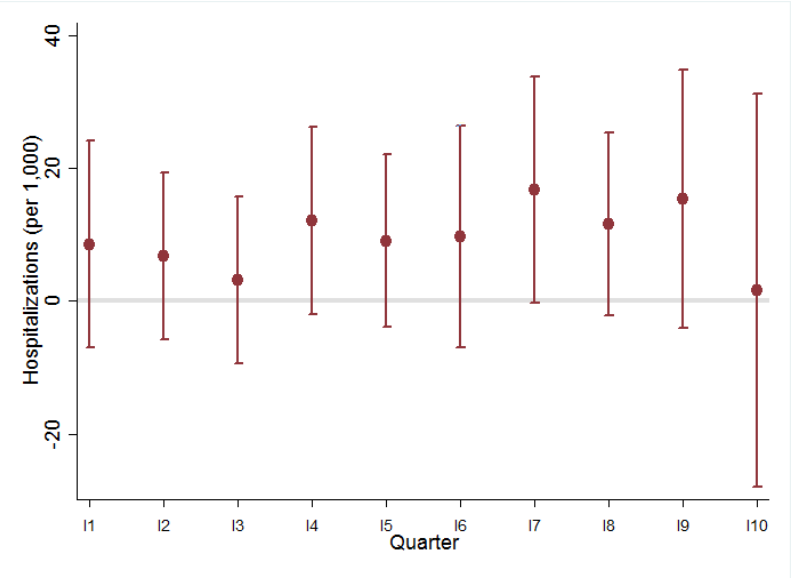
- We observed no significant results for all-cause hospitalizations or asthma-related hospitalizations in any post-intervention quarter. We observed a significant decrease in ED visits in quarter I8.

[78]Adjustment factors include age, gender, CDPS risk score, prior-year cost, prior-year utilization, and state of residence. We were unable to adjust for race or ethnicity due to missing data.

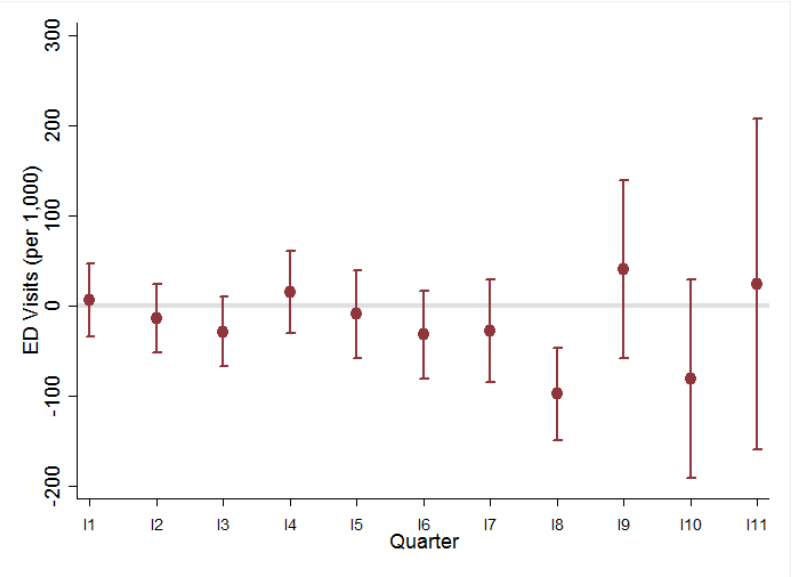
- We observed a significant increase in total cost of care relative to the comparison group in the first eight post-intervention quarters.

Exhibit S3.5: Adjusted Utilization Rates for Core Measures for HRiA by Quarter

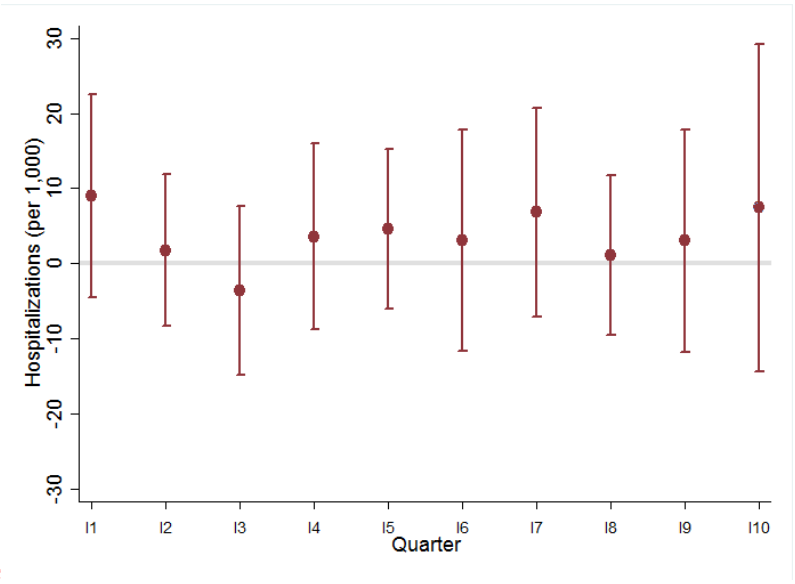
A. Children with Hospitalizations



B. Children with ED Visits

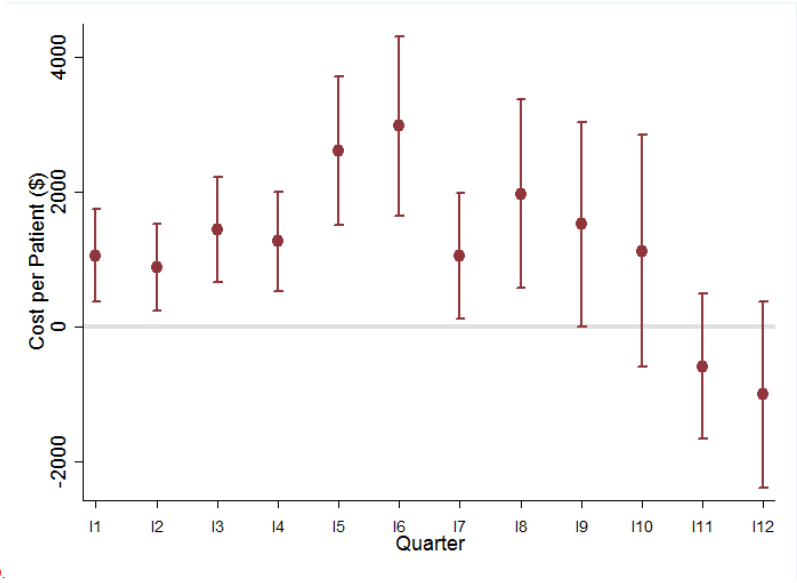


C. Children with Asthma-related Hospitalizations



C

D. Total Cost of Care



D.

Innovative Oncology Business Solutions, Inc.

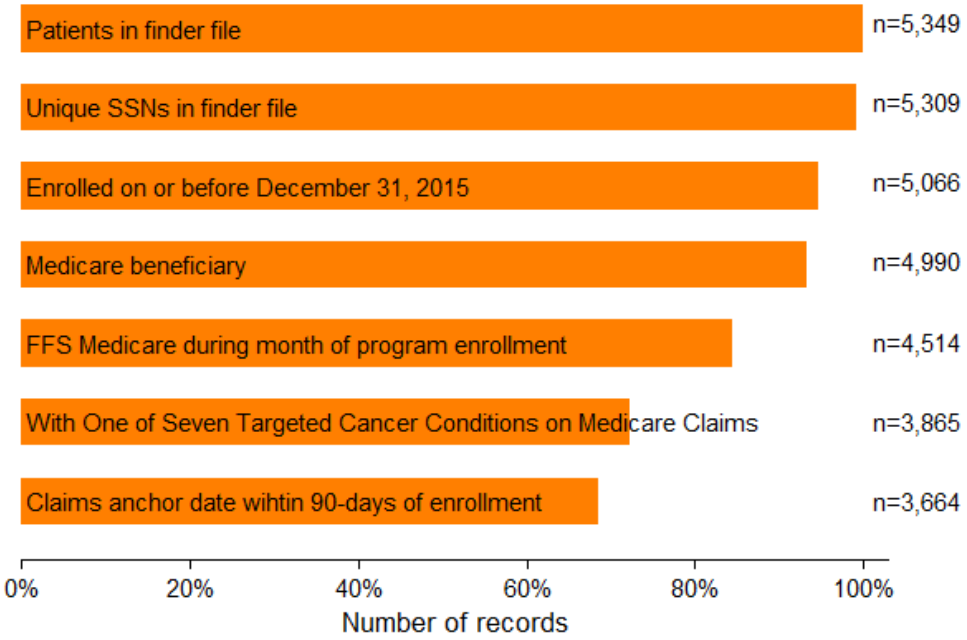
Treatment and Comparison Group Creation

- We worked with IOBS' finder file listing high-risk participants and their enrollment date to identify fee-for-service (FFS) Medicare claims for these participants (please see Exhibit S4.1). 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.[79]
- We restricted our treatment group to Medicare FFS participants who were enrolled in IOBS' for one or more quarters from October 2012 through June 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.[80]As with the treatment group, we defined enrollment date based on the claims and 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.

[79] We defined claims anchor date when we observe a diagnostic code for one of the selected cancers on inpatient, outpatient, or physician visit claims.

[80] 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 S4.1: Patients Identified through IOBS Finder File

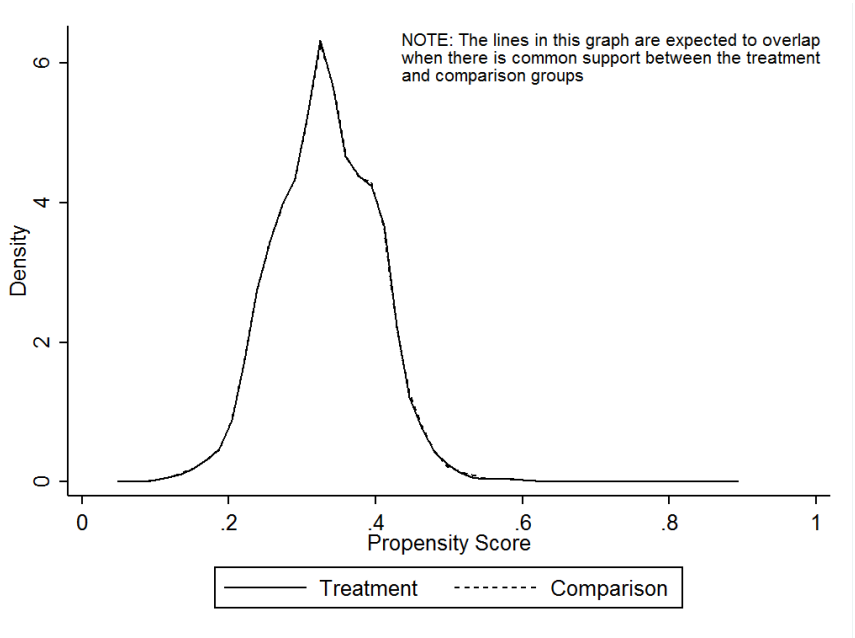


Comparison group selection. We used propensity score models to match intervention patients to comparison patients with respect to demographics, comorbidities, and prior utilization. Exhibit S4.2 summarizes the results from our propensity score matching. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B displays the distribution of covariates before and after matching:

- After matching, we observed that 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 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 utilization (hospitalization and ED visits) and 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 S4.2: Common Support & Covariate Balance for IOBS and Comparison Patients

A. Common Support



B. Covariate Balance

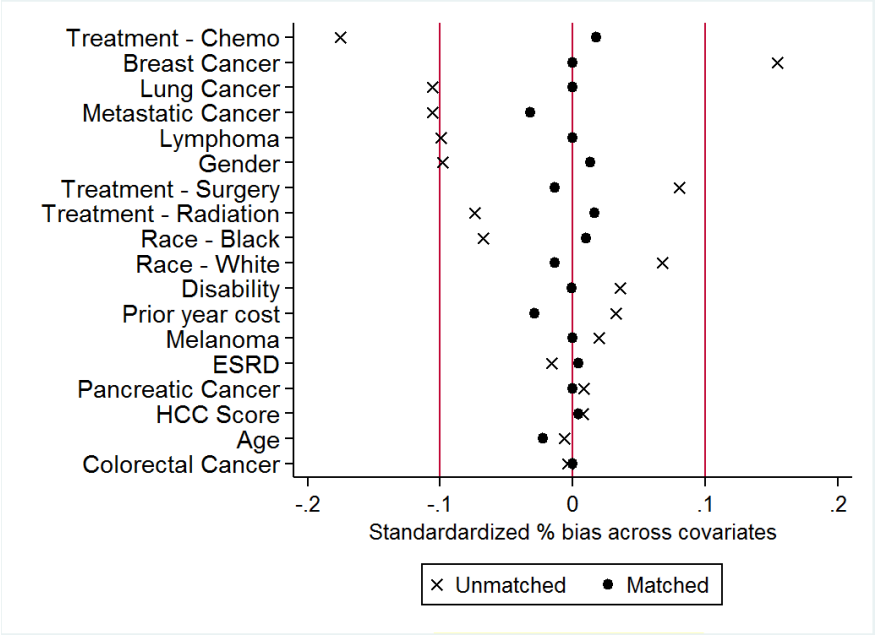


Exhibit S4.3 summarizes demographic and other basic information about the treatment and comparison patients included in our analysis of core outcome measures. Despite improvements in the comparison group after propensity score matching, we observed some differences between IOBS and the comparison group with respect to demographics and prior utilization. IOBS patients had significantly higher rates of ED use and significantly lower rates of hospitalization prior to enrollment. IOBS patients were also less

likely to be Hispanic. To minimize any residual confounding, these factors were all included as covariates in regressions models.

Exhibit S4.3: Descriptive Characteristics of IOBS and Matched Comparison Patients

Variable	IOBS	Comparison
	% (N)	% (N)
Number of Patients	3,664	3,664
Mean Number of Quarters Enrolled [Range]	6.0 [1-13]	6.0 [1-13]
Cancer Condition		
Breast	42.4% (1554)	42.4% (1554)
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	9.3% (340)	8.4% (309)
65–69 years old	25.1% (921)	26.2% (959)
70–74 years old	24.3% (889)	23.6% (865)
75–79 years old	19.0% (695)	18.5% (677)
80–84 years old	12.3% (450)	13.2% (485)
≥85 years old	10.1% (369)	10.1% (369)
Race/Ethnicity		
White	89.8% (3289)	90.2% (3305)
Black	6.0% (221)	5.8% (212)
Hispanic***	1.1% (39)	1.9% (71)
Other	3.1% (115)	2.1% (76)
Gender		
Female	69.4% (2541)	70.0% (2564)
Dual Status		
Dually eligible	15.7% (576)	13.4% (490)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$17,235 ($22,174)	$17,861 ($23,674)
Hospitalizations per 1,000 Patients (SD)**	523 (904)	607 (976)
ED Visits per 1,000 Patients (SD)***	850 (1853)	718 (1417)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-squared tests for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation.

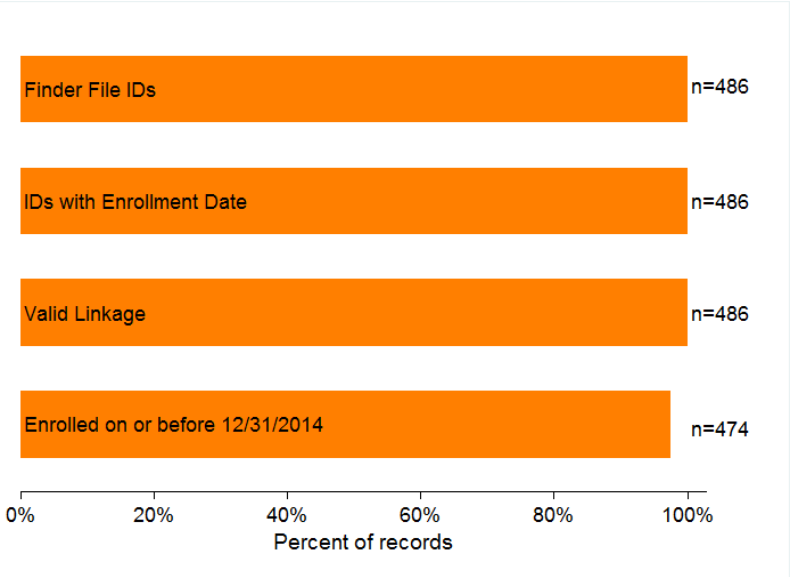
Le Bonheur Community Health and Well-Being

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.[81]
- 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 S5.1). Claims were available through December 2015.
- To identify a pool of comparison children with asthma, we used Tennessee's TennCare claims.[82] 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 S5.1: 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 above. Exhibit S5.2 summarizes the results from our propensity score matching. Panel A shows the similarities

[81]Tennessee's TennCare data were available through December 31, 2014.

[82]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 S5.2: Common Support and Covariate Balance for Le Bonheur and Comparison Patients

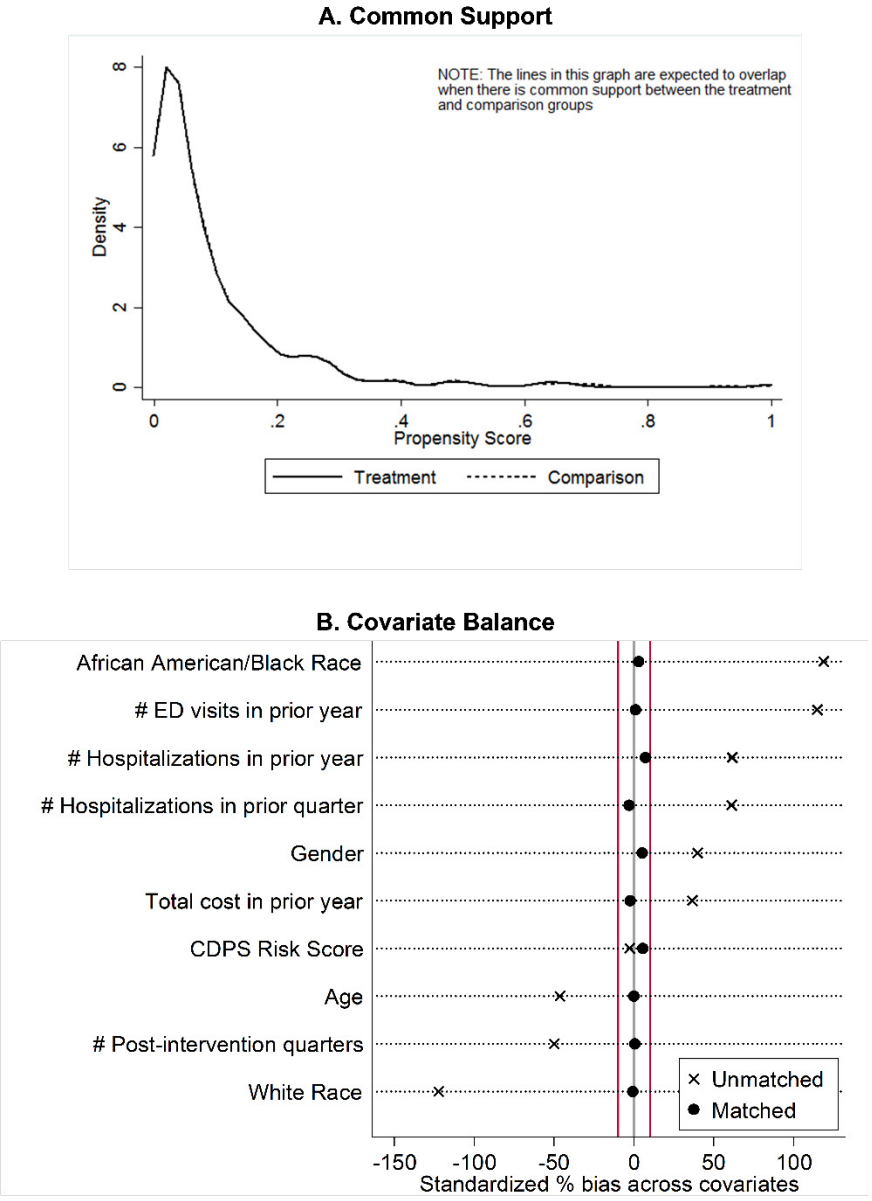


Exhibit S5.3 summarizes demographic and other basic information about the treatment and comparison patients included in our analysis of core outcome measures. After matching, the Le Bonheur participants were slightly younger ($p<0.1$), were more likely to live in an urban area ($p<0.01$), and had more asthma-related hospitalizations per 1,000 patients ($p<0.01$) compared with matched comparison patients.

Exhibit S5.3: Descriptive Characteristics of Le Bonheur and Matched Comparison Patients

Variable	Le Bonheur	Comparison
	% (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)

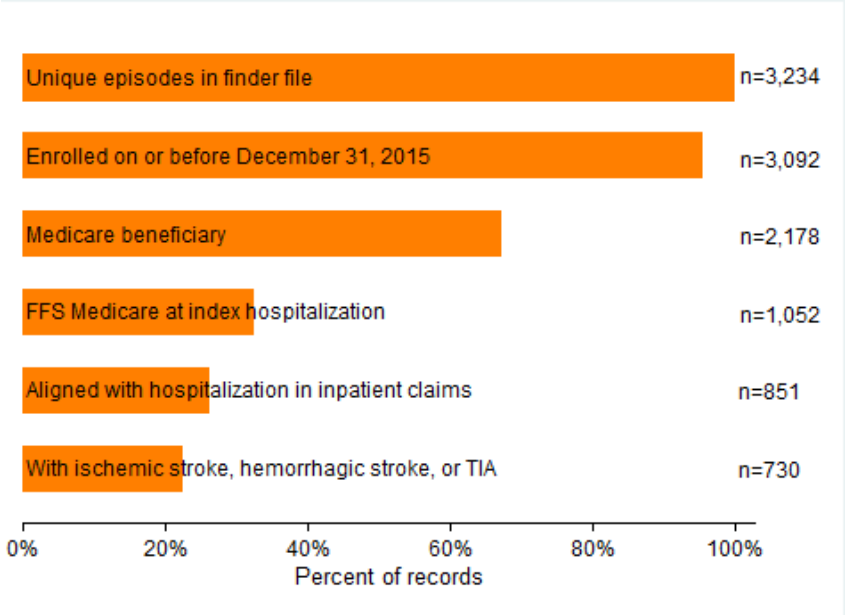
NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-square analysis for categorical variables and t-tests for continuous variables. CDPS, chronic disease and disability payment system (diagnostic classification system that Medicaid programs can use to make health-based capitated payments for certain Medicaid beneficiaries); ED, emergency department; SD, standard deviation.

Ochsner Clinic Foundation

Treatment and Comparison Group Creation

- We worked with Ochsner's finder file listing of Stroke Central participants to identify Medicare fee-for-service (FFS) patient-episodes for stroke in each post-intervention quarter from January 1, 2013, through December 31, 2015 (N = 730) (please see Exhibit S6.1). 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 S6.1: Patient-Episodes Identified through Ochsner Finder File[83]



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.[84,85] We ran propensity score models to produce standard mortality ratio (SMR) weights. We then incorporated the SMR weights

[83]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 NCE analysis.

[84]The comparison sites are United Regional Health Care System, TX, and Memorial Hermann Texas Medical Center, TX.

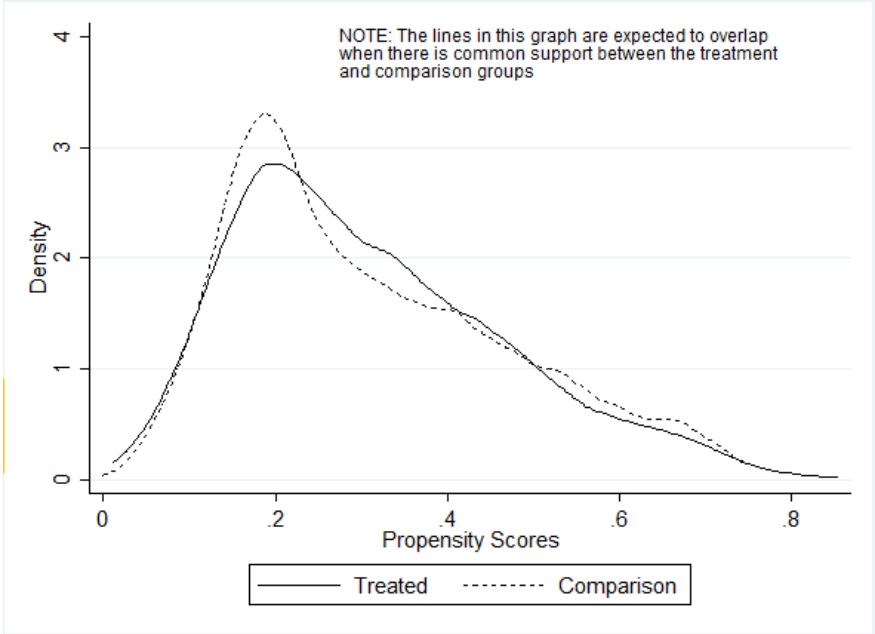
[85]We considered the following characteristics: geographic region, population density, teaching status, ownership type, number of beds, target diagnosis/procedure volume, demographics of hospital population, volume of inpatient stroke hospitalizations, and Stroke Center certifications.

into our analysis to minimize observed differences in covariates across Ochsner and comparison group patient-episodes included in our propensity score models. For more details on comparison group selection and SMR weighting, please see the Technical Appendix A in the third annual report.[86] Exhibit S6.2 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[87]

- 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 S6.2: Common Support and Covariate Balance for Ochsner and Comparison Patient-Episodes

A. Common Support



[86] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[87] 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).

B. Covariate Balance

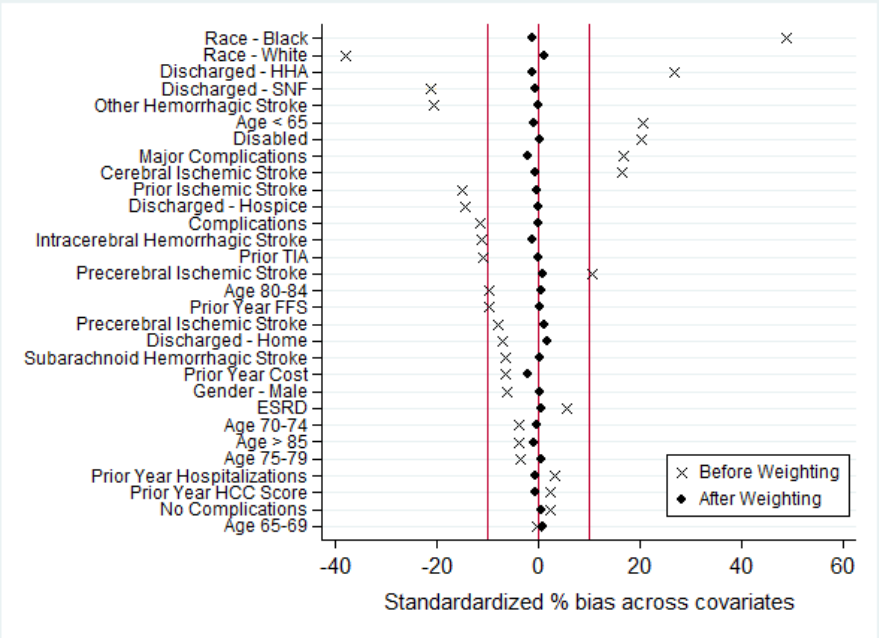


Exhibit S6.3 summarizes demographic and other basic information about the treatment and comparison patients with episodes included in our analysis of core outcome measures. Relative to Ochsner, comparison patients who had post-intervention stroke episodes were more likely to be older and White; have 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 S6.3: Descriptive Characteristics of Patients with Episodes in Ochsner and Comparison Groups[88]

Variable	Pre-intervention Ochsner	Pre-intervention Comparison	Post-intervention Ochsner	Post-intervention Comparison
	% (N)	% (N)	% (N)	% (N)
Number of Patient-Episodes	660	1,941	730	2759
Age Group* **				
<65 years old	19.7% (130)	12.6% (245)	23.0% (168)	14.3% (395)
65–69 years old	17.7% (117)	17.3% (336)	17.4% (127)	17.9% (494)
70–74 years old	17.4% (115)	17.9% (348)	16.2% (118)	18.4% (509)
75–79 years old	15.2% (100)	17.6% (341)	15.5% (113)	16.0% (441)
80–84 years old	14.7% (97)	16.7% (325)	11.5% (84)	16.4% (452)
≥85 years old	15.3% (101)	17.8% (346)	16.4% (120)	17.0% (468)

[88]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)
Race/Ethnicity* **				
White	58.0% (383)	77.9% (1513)	60.4% (441)	75.9% (2093)
Black	38.8% (256)	16.3% (316)	36.6% (267)	16.7% (462)
Hispanic	0.5% (3)	2.9% (56)	0.8% (6)	4.1% (112)
Other	2.7% (18)	2.9% (56)	2.2% (16)	3.3% (92)
Gender				
Female	55.5% (366)	52.7% (1022)	54.1% (395)	51.0% (1407)
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 (1.4)
Utilization Year Prior to Index Hospitalization				
No. Hospitalizations/Year	0.8 (1.4)	0.8 (1.4)	0.6 (1.2)	0.6 (1.1)
No. ED Visits/Year	1.4 (3.2)	1.1 (2.1)	1.3 (2.2)	1.2 (2.1)
Prior 1-year Cost**	$22,194 ($39,879)	$21,341 ($36,058)	$15,664 ($27,482)	$20,851 ($38,132)
Coverage Reason* **				
Age	70.2% (463)	78.0% (1514)	65.2% (476)	75.7% (2088)
Disability	27.3% (180)	20.4% (395)	32.5% (237)	22.7% (626)
ESRD	1.2% (8)	0.9% (17)	0.4% (3)	0.5% (14)
Disability and ESRD	1.4% (9)	0.8% (15)	1.9% (14)	1.1% (31)
Discharges* **				
Home	40.0% (264)	42.0% (816)	31.8% (232)	37.2% (1025)
SNF	10.0% (66)	17.8% (345)	12.7% (93)	19.9% (548)
HHA	22.3% (147)	12.3% (238)	23.0% (168)	12.7% (350)
Hospice	3.9% (26)	7.3% (142)	3.8% (28)	7.0% (194)
Other	23.8% (157)	20.6% (400)	28.6% (209)	23.3% (642)
Disease Composition* **				
Ischemic Stroke	67.0% (442)	65.3% (1267)	75.9% (554)	67.3% (1857)
Hemorrhagic Stroke	13.0% (86)	21.4% (416)	14.0% (102)	22.8% (628)
TIA	20.0% (132)	13.3% (258)	10.1% (74)	9.9% (274)

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 = 726, post-comparison = 2,745; ESRD, end-stage renal disease; HCC, hierarchical condition categories; HHA, home health aide; SNF, skilled nursing facility; TIA, transient ischemic attack.

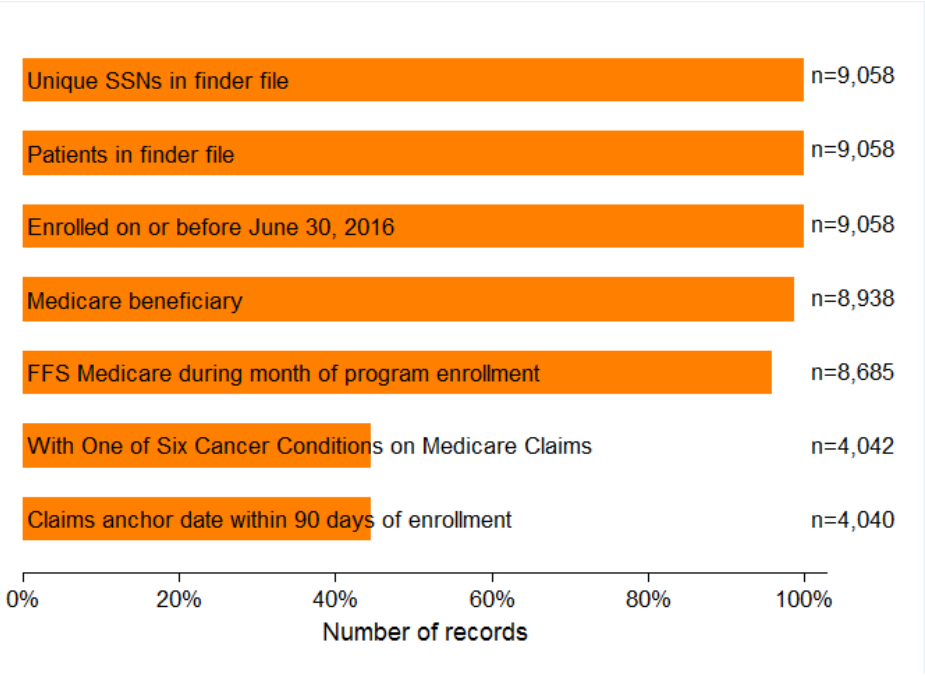
University of Alabama at Birmingham

Treatment and Comparison Group Creation

- We worked with UAB's finder file of participants and enrollment dates to identify fee-for-service (FFS) Medicare claims for individuals in our treatment group (please see Exhibit S7.1). 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, 2016, 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.[89] We defined enrollment date for the comparison pool patients using the same rules for claims anchor date as the treatment group. We first matched on whether a beneficiary was seen at a NCI CCC or an affiliated facility (i.e., every treatment beneficiary seen at a NCI CCC was matched to a comparator beneficiary who was also seen at a NCI CCC, and likewise for affiliated facilities); then, we used propensity score matching to match comparators to treatment beneficiaries.

[89]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.

Exhibit S7.1: Patients Identified through UAB Finder File

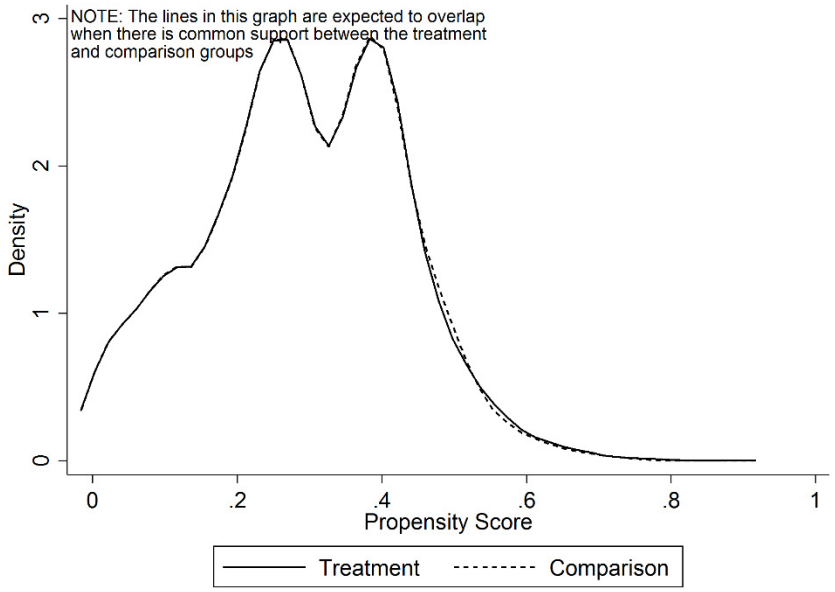


Comparison group selection. We used propensity score models to match intervention patients to comparison patients with respect to demographics, comorbidities, and prior utilization. Exhibit S7.2 summarizes the results from our propensity score matching. Panel A shows the similarities between the treatment and comparison groups after propensity score matching, and panel B displays the distribution of covariates before and after matching:

- After matching, we observed that 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 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 utilization (hospitalization and ED visits) and 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 & Covariate Balance for UAB and Comparison Patients

A. Common Support



B. Covariate Balance

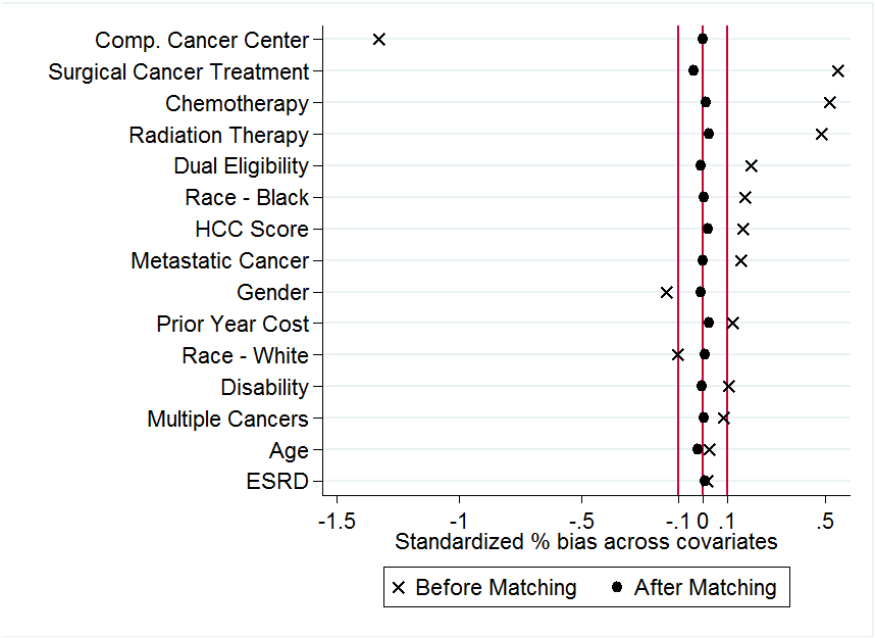


Exhibit S7.3 summarizes demographic and other basic information about the treatment and comparison patients included in our analysis of core outcome measures. After matching, we observe few differences between UAB participants and the comparison group with respect to demographic characteristics, clinical features, or prior utilization. UAB participants were slightly younger than comparison participants; to minimize any residual confounding, we included age as a covariate in the regression models.

Exhibit S7.3: Descriptive Characteristics of UAB and Matched Comparison Patients

Variable	UAB	Comparison
	% (N)	% (N)
Number of Beneficiaries	**4,040**	**4,040**
Mean No Quarters Enrolled [Range]	5.7 [1 - 15]	5.7 [1 - 15]
Cancer Condition		
Breast	29.2% (1179)	29.2% (1179)
Colorectal	14.8% (598)	14.8% (598)
Lung	28.0% (1130)	28.0% (1130)
Lymphoma	7.4% (300)	7.4% (300)
Female Genitourinary	16.2% (655)	16.2% (655)
Male Genitourinary	2.5% (102)	2.5% (102)
Head and Neck	1.9% (76)	1.9% (76)
Cancer Treatment		
Cancer Surgery	42.6% (1723)	44.4% (1794)
Cancer Radiation	37.8% (1526)	36.8% (1485)
Cancer Chemotherapy	66.5% (2685)	65.9% (2662)
Cancer Severity		
Metastatic Cancer	38.2% (1542)	38.3% (1546)
Cancer Hospital		
Comprehensive Cancer Center	7.9% (321)	7.9% (321)
Affiliate Hospital	92.1% (3719)	92.1% (3719)
Age **		
<65 years old	0.2% (10)	0.5% (19)
65-69 years old	31.3% (1266)	30.3% (1224)
70-74 years old	26.1% (1055)	27.9% (1126)
75-79 years old	22.3% (899)	20.6% (833)
80-84 years old	13.5% (546)	13.2% (532)
≥ 85 years old	6.5% (264)	7.6% (306)
Race/Ethnicity		
White	84.3% (3407)	84.1% (3397)
Black	14.0% (567)	14.0% (566)
Hispanic	0.2% (8)	0.1% (3)
Other	1.4% (58)	1.8% (74)
Gender		
Female	55.5% (2243)	55.0% (2221)
Dual Status		
Dually eligible	13.3% (537)	13.6% (551)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$22,965 ($26,972)	$22,306 ($28,248)
Hospitalizations per 1,000 (SD)	642 (1081)	634 (1104)
ED Visits per 1,000 (SD)	936 (2109)	933 (2185)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-squared tests for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation.

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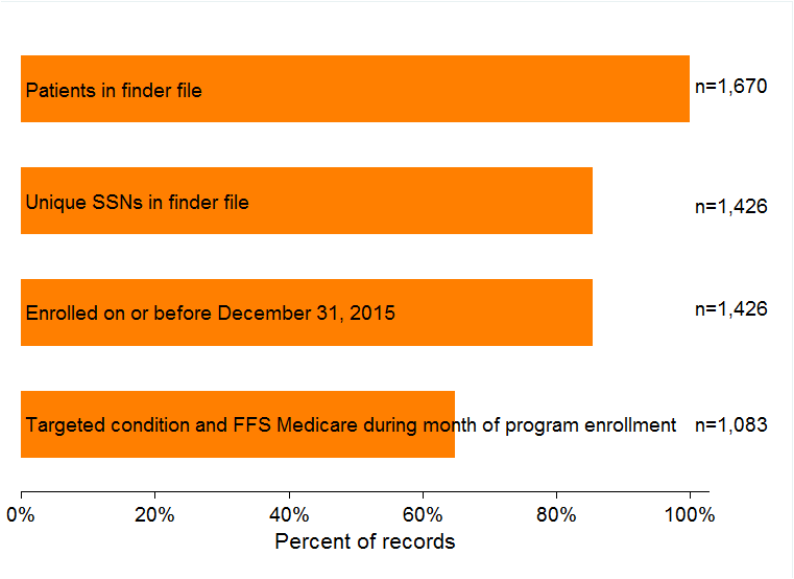
Treatment and Comparison Group Creation

- We worked with UCLA's finder file of participants and enrollment dates to identify Medicare fee-for-service (FFS) claims for individuals in our treatment group (please see Exhibit S8.1).
- 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, (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 the Technical Appendix of the third annual report.[90]

Exhibit S8.1: 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 the Technical Appendix in the third annual report.[91] Exhibit S8.2 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.

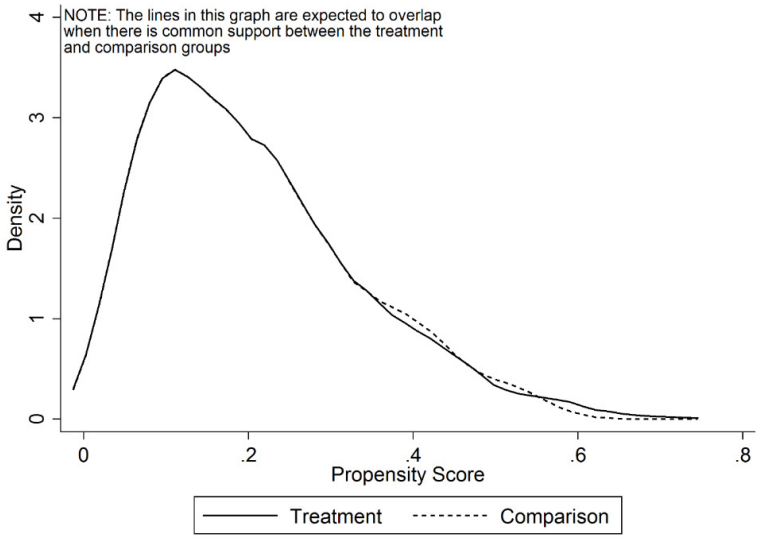
[90] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[91] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

- 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 S8.2: Common Support and Covariate Balance for UCLA and Comparison Participants

A. Common Support



B. Covariate Balance

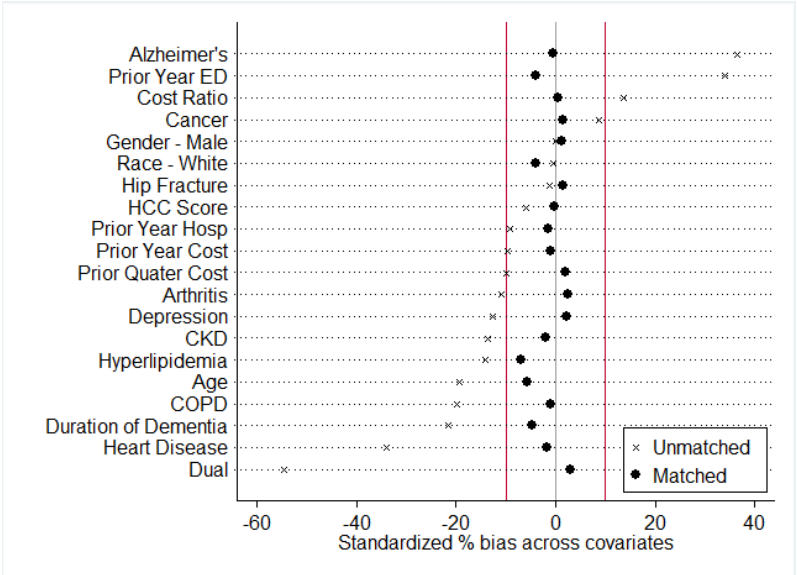


Exhibit S8.3 summarizes demographic and other basic information about treatment and comparison patients included in our analysis of core outcome measures. After matching, we observed significant differences between UCLA and comparison participants only in race and ethnicity: the comparison group has a higher percent of White participants and lower percent of Hispanic participants.

Exhibit S8.3: Descriptive Characteristics of UCLA and Comparison Patients

Variable	UCLA	Comparison
	% (N)	% (N)
Number of Persons	1083	1083
Mean Number of Quarters Enrolled [Range]	6.3 [1 - 15]	6.3 [1 - 15]
Alzheimer's Diagnosis		
Alzheimer's Diagnosis	68.7% (744)	68.9% (746)
Duration of Disease	1050.2 days (0, 5959)	1108.9 days (0, 5227)
Gender		
Female	64.7% (701)	65.3% (707)
Age Group		
54-64 years old	1.9% (21)	1.8% (20)
65-69 years old	5.2% (56)	5.9% (64)
70-74 years old	8.8% (95)	8.6% (93)
75-79 years old	19.6% (212)	16.1% (174)
80-84 years old	22.4% (243)	23.2% (251)
≥85 years old	42.1% (456)	44.4% (481)
Race/Ethnicity**		
White	71.6% (775)	73.3% (794)
Black	9.4% (102)	9.8% (106)
Hispanic	9.0% (98)	5.4% (58)
Asian	7.9% (86)	9.0% (98)
Other	2.0% (22)	2.5% (27)
Dual Eligibility		
Dual Enrolled	15.3% (166)	14.0% (152)
Not Dual Enrolled	84.7% (917)	86.0% (931)
Coverage Reason		
Old Age	94.1% (1019)	93.4% (1012)
Disability	5.7% (62)	6.5% (70)
ESRD	0.2% (2)	0.0% (0)
Hierarchical Condition Category (HCC)		
Mean HCC Score (SD)	1.8 (1.2)	1.8 (1.5)
Mean Count of HCCs (SD)	3.1 (2.4)	2.9 (2.8)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$17,260 ($27,526)	$17,514 ($33,692)
Hospitalizations per 1,000 (SD)	494 (1000)	507 (1023)
ED Visits per 1,000 (SD)	1082 (196)	969 (227)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-squared tests for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation.

Additional Analysis: Alternative Comparison Group

- In prior reports we have consistently found ULCA's ADC program lowered total cost of care relative to a comparison group. This reduction reached statistical significance in our third annual report,[92] where we found total cost of care was $605 (90% confidence interval $1090, $120) lower for ADC per participant per quarter. Analysis using the same methods in this report yielded a smaller estimate for reductions in cost ($365) that was not statistically significant (90% CI: -$861, $131).
- We hypothesized the analysis using a one-to-one matching scheme may not have not sufficient power to detect statistically significant findings of this size observed in this report (i.e., -$365). Thus, we conducted additional analysis using a two-to-one matching scheme.

Comparison Group Selection: In this analysis, each UCLA ADC participant was matched to two patients from the comparison pool. As with our other analysis, this matching was done without replacement and used a propensity score model 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 the Technical Appendix in the third annual report.[93] Exhibit S8.4 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. Matching each UCLA ADC participant to two comparison patients is a stepwise process, thus each panel has two sets of charts. The first set of charts represents the UCLA beneficiaries and their first beneficiary match; the second set of charts represents the UCLA beneficiaries and their second beneficiary match.

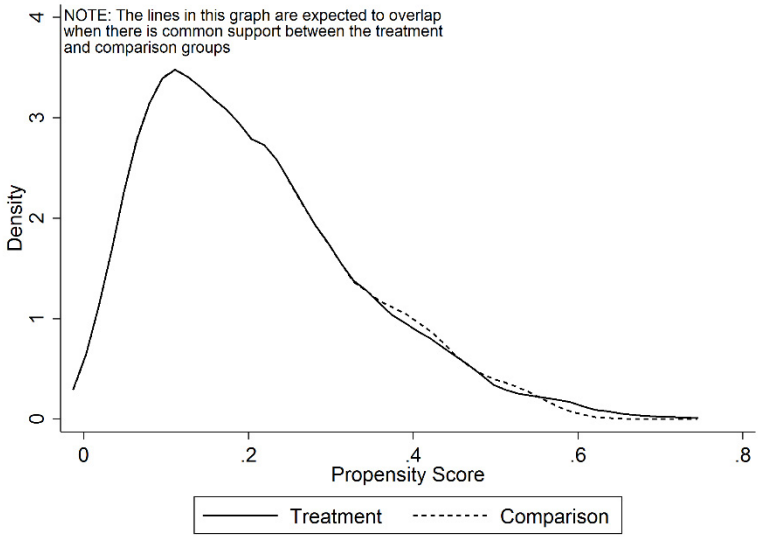
- After matching, the two groups had similar—although not perfectly overlapping—distributions of propensity scores. The distributions suggest a favorable match between these groups—at least with respect to the included factors.
- The balance charts shows that matching has achieved balance (i.e., reduced 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.

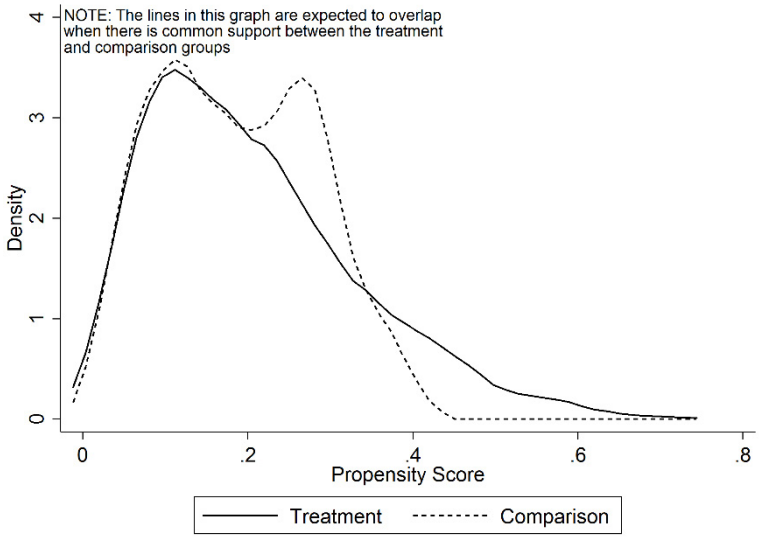
[92] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

[93] https://downloads.cms.gov/files/cmmi/hcia-diseasespecific-thirdannualrpt.pdf

Exhibit S8.4: Common Support and Covariate Balance for UCLA and Comparison Participants (2:1 Match)

A. Common Support





B. Covariate Balance

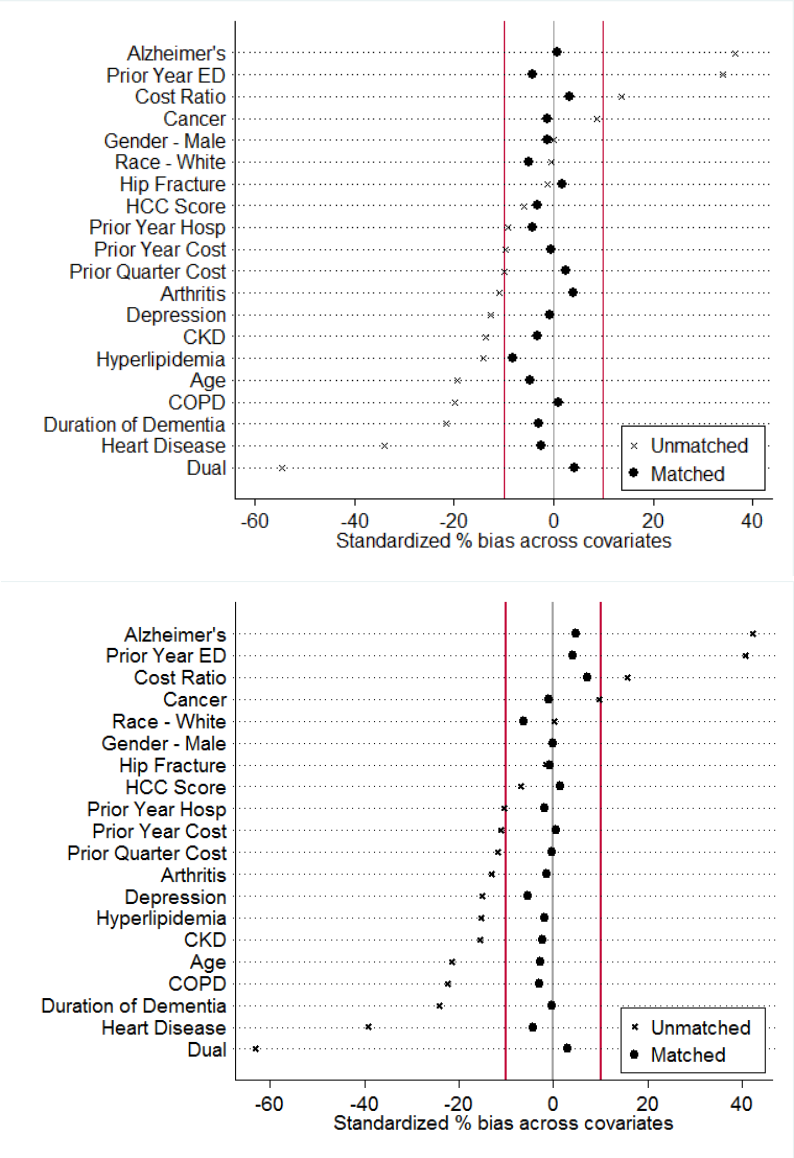


Exhibit S8.5 summarizes demographic and other basic information about treatment and comparison patients included in our analysis. For each UCLA ADC participant we selected two comparison patients, so the number of comparison patients is twice the number of UCLA ADC participants. After matching, we observed significant differences between UCLA and comparison participants only in race and ethnicity: the comparison group has a higher percent of White, Black, and Asian participants and lower percent of Hispanic participants relative to the UCLA ADC group.

Exhibit S8.5: Descriptive Characteristics of UCLA and Comparison Patients (2:1 Match)

Variable	UCLA	Comparison
	% (N)	% (N)
Number of Persons	1083	2166
Mean Number of Quarters Enrolled [Range]	7.4 [1 - 17]	10.1 [1 - 15]
Alzheimer's Diagnosis		
Alzheimer's Diagnosis	68.7% (744)	67.6% (1465)
Mean Duration of Disease [Range]	2.9 years (0, 16.3)	3.0 years (0,14.3)
Gender		
Female	64.7% (701)	65.0% (1407)
Age Group		
54-64 years old	1.9% (21)	1.8% (40)
65-69 years old	5.2% (56)	5.8% (125)
70-74 years old	8.8% (95)	9.5% (205)
75-79 years old	19.6% (212)	16.0% (347)
80-84 years old	22.4% (243)	22.0% (476)
≥85 years old	42.1% (456)	44.9% (973)
Race/Ethnicity**		
White	71.6% (775)	73.9% (1600)
Black	9.4% (102)	10.1% (218)
Hispanic	9.0% (98)	5.0% (109)
Asian	7.9% (86)	8.2% (178)
Other	2.0% (22)	2.8% (60)
Dual Eligibility		
Dual Enrolled	15.3% (166)	14.0% (304)
Coverage Reason		
Old Age	94.1% (1019)	94.0% (2035)
Disability	5.7% (62)	6.0% (129)
Hierarchical Condition Category (HCC)		
Mean HCC Score (SD)	1.8 (1.2)	1.8 (1.4)
Mean Count of HCCs (SD)	3.1 (2.4)	3.0 (2.7)
Mean Utilization and Cost in Year Prior to Program Enrollment		
Total Medicare Cost (SD)	$17,260 ($27,526)	$17,193 ($30,108)
Hospitalizations per 1,000 (SD)	494 (1000)	497 (992)
ED Visits per 1,000 (SD)	1082 (196)	929 (214)

NOTES: ***p<0.01, **p<0.05, *p<0.1. Statistical significance was assessed using Chi-squared tests for categorical variables and t-tests for continuous variables. ED, emergency department; SD, standard deviation.

Findings from our DID model where each UCLA ADC participant was matched to two comparison patients are shown in Exhibit S8.6. These models included adjustment for key demographic covariates, comorbidities, and other key factors.[94,95]

- There were no significant decreases in hospitalizations, ED visits, ACS hospitalizations, or readmissions for patients in the ADC program, relative to the comparison group.
- The ADC program showed significant decreases in total cost of care relative to the comparison group. Costs were $525 per patient per quarter lower for ADC participants.

Exhibit S8.6: Difference-in-Differences Estimates for Core Measures for UCLA (2:1 Match)

Average Quarterly Impact			
Outcome Measure (Patients per 1,000, unless noted)	**Adjusted Estimate**	**90% Confidence Interval**	**80% Confidence Interval**
Hospitalizations	5	-5, 15	-3,13
ED Visits	2	-10, 14	-7, 11
30-Day Readmissions	7	-29, 43	-21, 35
ACS Hospitalizations	-2	-6, 2	-5, 1
Total Cost of Care per Patient ($)	**-$525****	**-$901, -$149**	**-$818, -$232**

NOTES: ***p<0.01, **p<0.05, *p<0.1, †p<0.20. Disclaimer: Standard statistical practice is to use confidence intervals of 90% or higher. 80% confidence intervals are provided here for comparison purposes.

[94]We adjusted for age, gender, race (White), ethnicity, dual eligibility, disability status, end-stage renal disease, hierarchical condition categories (HCC) score, prior cancer diagnosis, heart disease, arthritis, hyperlipidemia, chronic kidney disease, hip fracture, depression, prior-year ED visits, prior-year year hospitalizations, prior-year HCC score, prior-quarter cost, prior-year cost ratio, prior-year cost, and time to dementia diagnosis.

[95]Findings are interpreted as significant where p<0.1.