Evaluation of the Medication Management (MM) Health Care Innovation Awardees

Third Annual Report

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EXECUTIVE SUMMARY

Acumen, LLC ("Acumen") and its partner, Westat, Inc., are contracted by the Centers for Medicare & Medicaid Services (CMS) to conduct a mixed-methods evaluation of the six medication management (MM) programs that received the Health Care Innovation Awards (HCIA). The MM awardees include Carilion New River Valley Medical Center's Improving Health for At-risk Rural Patients (IHARP), University of Southern California (USC), University of Pennsylvania's HeartStrong program (HeartStrong), Pharmacy Society of Wisconsin (PSW), the University of Tennessee's SafeMed program (SafeMed), and the University of Hawaii at Hilo's Pharm2Pharm program (Pharm2Pharm). This Third Annual Report presents summative evaluation findings from August 2013 through August 2016.

The MM awardees partnered with hospital pharmacists, community pharmacists, primary care physicians, and other health care staff to improve medication use and safety in patient populations that included Medicare, Medicaid and commercial insurance beneficiaries as well as uninsured beneficiaries. The programs seek to improve health conditions, reduce unnecessary hospitalizations, and reduce unnecessary emergency department use.

Analytic Approach

The mixed-methods evaluation of the MM programs focused on addressing the following research questions: (i) which innovative approaches reduced health care costs while improving or maintaining the standard of care, patient health, and quality of life? (ii) what implementation and contextual factors contributed to an intervention's successes or challenges? Quantitative analyses were performed to assess program effects on medication adherence, health and resource use outcomes for each awardee, primarily using intervention data provided by the awardee and Medicare claims data from CMS sources, including Medicare enrollment data, FFS claims and MA inpatient encounter data in the Common Working File (CWF). For the analysis of the PSW program, Acumen also used medication therapy management (MTM) encounter data and medical and drug claims data provided by Wisconsin Department of Health Services (DHS) for their health plan beneficiaries. For the analysis of intermediate clinical outcomes for the USC program, Acumen incorporated clinical data from electronic health records (EHR) provided by the awardee. Medication adherence to chronic medications was assessed using the proportion of days covered (PDC) metric based on prescription drug claims. Qualitative information from a variety of sources was used to understand each program's components and address questions regarding implementation factors, workforce issues, patient satisfaction, and factors affecting program sustainability. These sources included awardee program documents, interviews with HCIA awardee leadership, awardee progress reports provided by the Lewin Group, site visits, patient experience surveys, and workforce surveys.

For the analyses of program effects, single difference and differences-in-differences (DiD) methods were used to estimate the impact of each program on medication adherence, health, resource utilization, and expenditure outcomes. For the USC program, EHR-based clinical outcomes were also assessed using EHR data provided by USC's partner AltaMed. However, non-claims based clinical data were unavailable for other awardees, and thus any potential effects of the other awardees' programs on intermediate clinical outcomes could not be assessed. Results are presented with p-values indicating statistical significance at the 1%, 5%, and 10% levels.

Key Findings on Program Effects by Awardee

A brief description of the core innovation components and findings on program effects for each of the three MM awardees is provided below.

IHARP

The HCIA IHARP program focused on addressing the medication and chronic disease state management needs of patients residing in rural southwest Virginia and the Roanoke area. The innovation relied primarily on the primary care clinical pharmacist, a newly created workforce role that provided longitudinal care to IHARP patients that included comprehensive medication, prevention, and disease management services in the primary care setting. The program targeted individuals with two or more chronic conditions, including asthma, diabetes, and congestive heart failure, who took four or more medications and had a participating Carilion Clinic primary care provider. Eligible patients were identified during hospital admission and from participating Carilion primary care clinics.

The quantitative analysis of program effects on Medicare FFS beneficiaries identified statistically significant decreases in mortality and increases in some service use and expenditure measures following enrollment; however, the estimated effects are unlikely to accurately represent program effects due to selection bias. There were 33 fewer deaths per 1,000 beneficiaries (p-value: 0.092) among participants relative to controls in the first year of the intervention; however, this decrease was driven by a large spike in mortality among controls in the first intervention quarter. Consequently, the estimated decrease in mortality is unlikely to be caused by the intervention, and is more likely to be due to different pre-intervention health trajectories for treatment and control groups. Although Acumen incorporated an extensive set of predictive variables observable in claims data into the control group matching model to conduct robust analyses of program effects, participants may have been on a different health status trajectory than controls even in the absence of the intervention. Acumen's matching model could not capture all selection factors used in enrolling participants, as some relevant characteristics could not be assessed using information available from claims. For instance,

IHARP's enrolling pharmacists used their judgment in selecting patients with a life expectancy of six months or more. However, such selection factors cannot be observed in claims data, and thus there could be differences in mortality, treatment preferences, and health service use between the comparator groups which are otherwise well matched on variables available in claims data. The statistically significant cumulative increases of 372 inpatient admissions per 1,000 beneficiaries (p-value: 0.019), as well as cumulative increases of $1,639 per beneficiary (p-value: 0.037) in skilled nursing facility costs and $724 per beneficiary (p-value: 0.074) in physician and ancillary service costs for participants relative to controls were mostly concentrated in the first year of the intervention, and are also unlikely to be attributable to the program.

The analysis did not detect significant effects on medication adherence outcomes, other than a statistically significant decrease of 6.06 percent days covered by diabetes medications (p-value: 0.044) on diabetes medication adherence in the first year of the intervention. However, this estimated decrease may be attributable to unobserved differences between the treatment and control groups, or due to chance.

USC

The USC innovation leveraged novel clinical protocols to provide medication and disease management services at AltaMed safety net clinics in Los Angeles and Orange Counties; these services included comprehensive medication management, medication reconciliation, medication access assistance, patient counseling, drug education, provider education services, and preventive care. The intervention primarily targeted patients who had been diagnosed with four or more chronic conditions, were taking eight or more medications, or had at least one poorly controlled chronic condition.

Quantitative analyses of program effects were conducted for the combined cohort of Medicare FFS and MA beneficiaries participating in the program relative to matched controls on EHR-based clinical outcomes, as well as claims-based outcomes. Because the clinical indicators of interest were largely incomplete in the EHR data, multiple imputation models were developed for the analysis of EHR-based clinical outcomes.

The USC intervention was not associated with statistically significant changes cumulatively across the nine quarters following program enrollment in any claims-based outcomes, including mortality, health and resource use measures, expenditures, or medication adherence;[1] however, there were some notable changes in clinical indicators such as low-density

[1] In the analysis of yearly effects, the only finding that was statistically significant was a decrease in inpatient readmissions across the first year after enrollment, primarily driven by a decrease in the first quarter. However, this was inconsistent with significant readmission increases observed in later quarters.

lipoprotein (LDL) control and Hemoglobin A1c management. The intervention was associated with statistically significant improvements in LDL management, defined by the change in the rate of diabetes patients with LDL greater than 100 mg/dL. Specifically, the intervention was associated with a statistically significant decrease of 84 cases with uncontrolled LDL per 1,000 beneficiaries (p-value: 0.030) among participants relative to controls. Although the decrease in the overall rate of diabetic patients with poor management of Hemoglobin A1c (i.e., HbA1c greater than 8%) was not statistically significant cumulatively across the nine-quarter intervention period, positive effects were observed in multiple specific intervention quarters. However, given the limitations inherent in evaluating a non-randomized intervention using only claims-based measures and imputed clinical indicators, which were constructed from EHR records that were largely incomplete, neither the measured improvements in intermediate outcomes nor the lack of effect on other downstream outcomes can be conclusively attributed to the intervention.

HeartStrong

The HeartStrong program aimed to improve patient adherence to cardioprotective medication in the year after acute myocardial infarction (AMI) through a simple, low-resource innovation consisting of automated and person-based reminders, financial incentives, and follow-up from HeartStrong staff members who helped to address any adherence issues.

HeartStrong's intervention randomly assigned eligible individuals to intervention and control groups. However, a majority of the beneficiaries were enrolled in commercial payer insurance programs, and the low enrollment of Medicare beneficiaries precluded Acumen from conducting a quantitative analysis of the Medicare population using Medicare data alone. HeartStrong provided data on medical and prescription drug claims for program participants and non-participating controls enrolled in commercial payer programs in late July 2016. Thus, Acumen plans to conduct a quantitative analysis on the HeartStrong program to be included in the Report Addendum which will be submitted to CMS in early 2017.

PSW

The PSW HCIA innovation focused on spreading a standardized medication therapy management (MTM) model that existed prior to the HCIA award across Wisconsin. PSW built a network of pharmacies and pharmacy staff who provided an expanded set of services to help beneficiaries of partner insurers, including WI DHS, effectively manage their medications. To participate in the innovation, pharmacies registered, underwent a rigorous accreditation process, and agreed to train and certify at least one pharmacist to deliver MTM services.

Acumen conducted an analysis of program effects using MTM encounter data and WI DHS heath plan eligibility, enrollment and claims data on all WI DHS beneficiaries from January 1, 2011 to June 3, 2016. As one of the methods of patient selection, the PSW program intended to utilize claims-based targeting algorithms focused on four medical conditions (hypertension, diabetes, congestive heart failure, and geriatric syndromes), and have the Aprexis system automatically send the list of targeted WI DHS beneficiaries to participating pharmacies. However, due to Aprexis system implementation delays and challenges with implementing some of the claims-based targeting criteria, participating pharmacies relied more heavily on PSW's "pull" method that selected patients based on pharmacist discretion, clinician referral, or point-of-dispensing alerts (e.g., untimely refills) that did not necessarily focus on the four conditions but considered broader program criteria including health literacy and care coordination issues. Because these broader criteria are not observable in PSW program data or WI DHS claims data, an analysis that compares individuals who received the PSW MTM services (participants) to non-participants matched using available data would suffer from selection bias. Due to this limitation, and because training provided under the program to pharmacists in participating pharmacies may have had spillover effects on other beneficiaries receiving services from the pharmacies, Acumen developed a different analysis design than the one used for other MM awardee analyses. Acumen defined the intervention group as beneficiaries who filled their prescriptions at a pharmacy participating in the PSW intervention after the pharmacy received PSW program accreditation, but before the end of the HCIA award period. The comparison group was then defined as beneficiaries who filled their prescriptions at a matched, non-participating pharmacy in the month following a simulated, randomly selected "accreditation date". Participating pharmacies were matched with non-participating pharmacies based on characteristics such as pharmacy type, size of the population served, and geographic location. Beneficiary-level propensity score matching was performed to ensure that beneficiaries in the comparator groups had similar demographic and baseline health characteristics observable in claims data. Additionally, beneficiaries under the age of 18 were exactly matched on the presence of prescriptions for antiasthmatics, mental health prescriptions, and dermatological prescriptions, because a large proportion of younger intervention beneficiaries receiving services from participating pharmacies used prescription drugs of these types.

In the quantitative analysis of program effects, PSW was associated with a cumulative decrease in mortality and cumulative increases in readmissions and physician and ancillary expenditures, but these estimated effects cannot be credibly attributed to the intervention as they more likely reflect issues with the PSW program design. There were about two fewer deaths per 1,000 beneficiaries in the intervention group relative to controls (p-value: 0.100) cumulatively across the six intervention quarters. Cumulative increases in readmissions were estimated at around 74 beneficiaries with a readmission per 1,000 beneficiaries with an inpatient admission

(p-value: 0.032), and cumulative increases in physician and ancillary expenditures were estimated at about $64 per beneficiary (p-value: 0.088) across the six intervention quarters.

Program design and implementation factors, including the inconsistent implementation of beneficiary targeting criteria, required an analysis approach that defined the intervention cohort based on the accreditation status of a given pharmacy and the patient population served by the pharmacy after accreditation. This analysis was designed to capture all beneficiaries who may have received the PSW intervention. This methodology, however, remains subject to limitations as pharmacies participating in the program may differ systematically from control pharmacies on variables not observed in available data.

Pharm2Pharm

The Pharm2Pharm HCIA innovation implemented a formal hospital pharmacist to community pharmacist care coordination model designed to address medication management issues that occur during and after transitions of care. Pharm2Pharm targeted the elderly and other individuals who have been hospitalized and were at risk for subsequent medication-related hospitalizations and emergency department visits, regardless of insurance status. The program relied on specially trained hospital pharmacists and community pharmacists who incorporated additional medication management services into their daily practice. Although the Pharm2Pharm program had a standard set of patient targeting criteria, hospital pharmacists had the flexibility to override the criteria, in consultation with other clinicians, if they believed a patient could benefit from the program.

Acumen conducted analyses of program effects on a combined cohort of Medicare FFS and MA beneficiaries who were also enrolled in Medicare Part D; however, the findings from this analysis were largely inconclusive. Participation in the Pharm2Pharm program was associated with cumulative increases in certain service utilization outcomes, but these estimated effects cannot be credibly attributed to the intervention as they more likely reflect unobserved differences in pre-enrollment health trajectories between program participants and controls. Specifically, there were statistically significant increases of 700 inpatient admissions per 1,000 beneficiaries (p-value < 0.001) and 5,721 hospital days per 1,000 beneficiaries (p-value < 0.001) for the intervention group relative to controls cumulatively over the intervention period, primarily driven by increases in the first year of the intervention. This may be driven by a large spike in the death rate among controls in the first quarter after enrollment, likely resulting in more survivors in the participant group who could utilize health care services in Q1 and later quarters.

SafeMed

The SafeMed program provided medication and disease management support to patients during hospitalization and following discharge home. The innovation was intensive and targeted patients with high rates of health service utilization and costs. It also expanded the traditional roles of health care workers, particularly pharmacy technicians and licensed practical nurses, to include more outreach.

SafeMed provided Acumen with data on 374 participants enrolled in the program from February 5, 2013 through May 1, 2015, of which only 243 were enrolled in Medicare. Given this low enrollment, a credible quantitative analysis of program effects on health and resource use outcomes was not viable using Medicare claims data.

Key Findings on Implementation, Workforce, Patient Satisfaction, Context and Sustainability

Over the course of the three-year evaluation period, the evaluation team identified key findings for the HCIA MM awardees related to program implementation factors, workforce issues, patient satisfaction, context and factors affecting sustainability and scale-up. These findings were based on qualitative information obtained from interviews with HCIA awardee leadership, awardee progress reports provided by the Lewin Group, site visits, patient experience survey, workforce survey and additional materials provided directly by the awardees:

Cross-Awardee Qualitative Analysis Findings

- Using an "opt-out" enrollment approach, whereby all eligible patients are proactively scheduled for MM services or receive an automated medication reminder system, seems to be a promising patient engagement strategy compared to an "opt-in" approach where patients must actively enroll in the program to participate.
- Feedback from MM programs suggests that a "one size fits all" approach to delivering MM services was not always best for meeting patient needs and that there should be flexibility for MM workforce to use their clinical judgment to determine the need for and frequency of follow-up services, since some patients did not need all services while some patients needed more. Since the MM innovations were designed to interact with physicians and other prescribers, whether for patient referrals or to provide recommended modifications to patients' medication regimens, obtaining physician/prescriber buy-in to the MM programs was an important precursor for successful program implementation.
- MM awardees found that co-scheduling MM services, such as in-depth medication review visits, with other health care services, such as appointments with primary care providers, lab work, or medication pick-ups at pharmacies, increased patient willingness to participate in MM services.

- Two awardees used financial incentives to promote patient engagement in their MM programs – one found that incentives seemed to positively influence patient engagement and the other could not conclude whether the incentives impacted participation; however, the latter awardee supported not using incentives since it observed that those who participated only to receive the incentive did not fully engage with the program.
- Awardees encountered challenges with incorporating MM services into community pharmacy workflow and balancing the time needed to provide the services with existing dispensing responsibilities in the absence of broader changes in staffing models that would allow pharmacists dedicated time to providing MM services.
- MM awardees were largely unsuccessful in sustaining their HCIA models after grant funding ended and cited the lack of recognition for pharmacists as Medicare Part B health care providers as being one important factor impeding sustainability.
- MM awardees that considered charging participation fees for patients determined this was not a feasible sustainability approach due to lack of patient ability or willingness to pay for MM services.
- MM intervention participants who completed Patient Experience Surveys reported positive experiences regarding interactions with the pharmacists and health care providers and gave high ratings of program support and materials across all MM interventions.
- In the workforce survey, MM staff generally felt that their new roles in the HCIA program added value for patients and colleagues. Staff were also generally satisfied with their roles, including the training they received and the extent to which the roles used their professional skill sets. Patient care staff gave more favorable ratings than non-patient care staff, and those with more face-to-face interaction with patients were also more satisfied.

Qualitative Analysis Findings by Awardee

Additional findings for each of the individual HCIA MM programs are noted below:

- IHARP program leaders found that co-scheduling pharmacy visits with physician office visits was an effective strategy to increase important face-to-face interactions between patients and pharmacists.
- USC found that patients were most likely to enroll in the program when they were referred by a primary care provider.

- HeartStrong reported that patient adherence to medications was positively influenced by several program components, including the support of the partner organization, and the implementation of an automated medication reminder.
- Pharmacies that participated in the PSW innovation overwhelmingly emphasized the importance of specialized regional MM program implementation support provided by experienced pharmacists who helped pharmacies identify and solve problems within pharmacy workflows to efficiently deliver the MM services.
- Pharm2Pharm instituted minimum performance standards that community pharmacists had to meet before they received payment for MM services to address variation in community pharmacist performance. Program leaders cited this approach as being effective, but difficult to implement among some community pharmacists.
- SafeMed program leaders found that appropriate timing of comprehensive medication reviews (CMRs) significantly increased program participation. The CMR had to be scheduled to account for the importance of a patient seeing a primary care provider first. Additionally, program leaders found patients to be reluctant to accept medication changes made in the hospital without first having their usual, trusted care provider approve them. Thus, SafeMed focused on scheduling patients for following-up visits with a primary care provider before CMRs.

1 INTRODUCTION

Acumen, LLC ("Acumen") and its partner, Westat, Inc., are contracted by the Centers for Medicare & Medicaid Services (CMS) to conduct a mixed-methods evaluation of six programs implementing medication management (MM) innovations. The six programs are awardees of CMS's Health Care Innovation Awards (HCIA) Round One funding. CMS provided the awards to organizations with compelling new ideas for improving health, delivering better care, and reducing expenditures for individuals enrolled in Medicare, Medicaid, and the Children's Health Insurance Program (CHIP). Round One HCIA MM awardees began enrolling participants for the CMS project in 2012 and concluded HCIA implementation activities in 2015. Acumen is evaluating the effects of the six MM awardees' innovations on beneficiaries' health status, resource use, health care expenditures, and medication adherence among other outcomes. As part of the evaluation, Acumen is also identifying factors that have contributed to awardee implementation successes and challenges. This third annual report presents summative findings for the six awardees based on analyses conducted from August 2013 through August 2016. Section 1.1 below provides an overview of the awardees, while Section 1.2 describes our data sources and evaluation methods.

1.1 Overview of Awardees

The six MM HCIA awardees aim to improve patient health, reduce health care resource use, and lower health care expenditures through novel patient-level care interventions. MM programs conduct medication reviews, work to improve care coordination and transition, and communicate with patients, physicians, and other health care providers through a range of means, including phone, in-person meetings, and health information technology (HIT). The MM awardees are:

i. Carilion New River Valley Medical Center's Improving Health for At-risk Rural Patients (IHARP),
ii. University of Southern California (USC),
iii. The Trustees of the University of Pennsylvania's (UPenn) HeartStrong program,
iv. The Pharmacy Society of Wisconsin (PSW),
v. The University of Hawaii at Hilo's (UHawaii) Pharm2Pharm program, and
vi. The University of Tennessee Health Science Center's (UTHSC) SafeMed program.

1.1.1 Core Components of the Innovations

The IHARP program used hospital, community, and primary care-based pharmacists who are integrated into the medical teams of primary care and specialty clinics, to offer medication and disease management, care coordination, counseling, and education to high-risk patients to

improve care quality, reduce unnecessary hospitalizations and emergency department use, and prevent medication-related problems. The program is described in more detail in Section 2.

USC integrated pharmacy teams into safety net clinics, offering medication and disease management, counseling, and education to high-risk patients to improve care coordination and to reduce unnecessary hospitalizations and emergency department use. Section 3 provides additional details.

UPenn's HeartStrong program used GlowCap pill bottles, phone reminders, and incentives to monitor and improve patient adherence to cardioprotective medication in the year after acute myocardial infarction, as detailed in Section 4.

The PSW program, described in Section 5, accredited pharmacies and trained pharmacists to deliver comprehensive medication reviews and point-of-sale medication therapy management (MTM) services to patients with chronic conditions.

UHawaii's Pharm2Pharm program aimed to develop a formal "hospital-pharmacist-to-community-pharmacist" care coordination model designed to address medication management risks during transitions of care and for up to a year post-discharge. Program details are provided in Section 6.

Finally, the UTHSC's SafeMed program offered MTM care coordination services to post-discharge patients, focusing on intensive community-based outreach and follow-up calls and home visits, described in Section 7.

As a group, the MM programs vary substantially in patient enrollment, intervention components, and reach. However, there are similarities among some awardees. For example, SafeMed and Pharm2Pharm target post-discharge care coordination, ensuring that beneficiaries' drug therapies are optimized and not disrupted during this transition. Most awardees, with the exception of Pharm2Pharm, use health information technology (HIT) systems to target participants. HeartStrong, USC, and PSW rely heavily on HIT systems to optimize delivery of the interventions.

1.1.2 Enrollment

The MM awardees began enrolling patients in mid-2012. Table 1-1 lists each awardee's cumulative enrollment, as well as payer mix for participants. As the table shows, the programs vary widely in size. SafeMed, with fewer than 400 participants, is the smallest of the interventions, while PSW has over 33,000 participants. The counts in the table below are based on beneficiary-level program data provided by IHARP, USC, Pharm2Pharm, and SafeMed as well as enrollment counts provided directly by HeartStrong. Beneficiary-level data for PSW were provided by Wisconsin Department of Health Services (WI DHS).

Table 1-1: MM Program Enrollment and Payer Mix

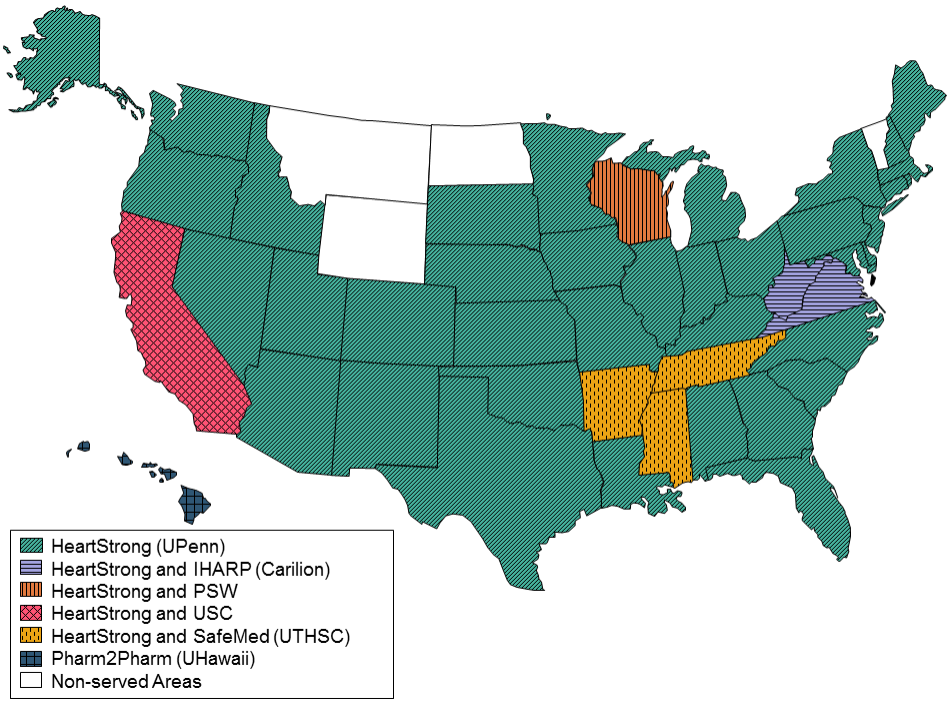
Awardee	Earliest Enrollment Date	Latest Enrollment Date	Medicare Parts A and B (FFS)		Medicare Advantage		Other Medicare Enrolled		Not Medicare-Enrolled/ Unknown		Total
IHARP	1/7/2013	12/31/2014	958	37%	500	19%	339	13%	809	31%	2,606*
USC	10/10/2012	6/30/2016	275	4%	902	13%	158	2%	5418	80%	6,753
HeartStrong	n/a	n/a	37**	2%	586	39%	20	1%	878	57%	1,501
PSW	10/26/2012	6/30/2015	1,838	6%	1,332	4%	5,228	16%	24,647	74%	33,105
Pharm2Pharm	3/12/2013	5/29/2015	505	24%	715	33%	404	19%	521	24%	2,145
SafeMed	2/5/2013	5/1/2015	121	32%	89	24%	37	10%	127	34%	374

Notes: "Medicare Parts A and B (FFS)" and "Medicare Advantage" may include dual-eligible beneficiaries and beneficiaries enrolled in Medicare Part D. Enrollment dates for HeartStrong are marked as "n/a" as payer mix provided by the awardee did not include this information. All PSW participants in this table, including those enrolled in Medicare FFS or Medicare Advantage, are enrolled in WI DHS health plans.
Most beneficiaries classified as "Other Medicare Enrolled" have Medicare Part A only, although other insurance statuses (e.g., Parts A and D) are rarely observed.
"Not Medicare-Enrolled/Unknown" includes beneficiaries who were not enrolled in Medicare on the day they entered the program or for whom the awardee did not provide sufficient personally identifiable information to link to Medicare claims.
*Data sent by IHARP for the report were missing some participants who are not included in the above table.
**HeartStrong counts under "Medicare Parts A and B (FFS)" include all beneficiaries enrolled in Medicare FFS, including those enrolled only in Medicare Part A.

1.1.3 Geographic Reach

The geographic reach of MM HCIA awardees is shown in Figure 1-1. SafeMed serves patients in Tennessee, Arkansas, and Mississippi; IHARP serves patients in Virginia and West Virginia; PSW serves pharmacies and patients in Wisconsin; the Pharm2Pharm program is available in Hawaii; and USC provides services in clinics in Southern California. HeartStrong initially operated only in Pennsylvania and New Jersey, but eventually expanded to a total of 45 states in an effort to increase enrollment.

Figure 1-1: Geographic Reach of MM Awardees



Source: Lewin Quarterly Awardee Progress Reports (January-March 2016) and quarterly awardee qualitative interviews

1.2 Data and Methods

The mixed methods evaluation of the MM programs will focus on addressing the following overarching research questions:

i. Which innovative approaches reduced health care costs while improving or maintaining the standard of care, patient health, and quality of life?

ii. Which contextual factors and mechanisms contributed to an intervention's success?

To comprehensively address these overarching research questions, Acumen is examining each awardee program across six evaluation categories: (i) innovation components, (ii) implementation effectiveness, (iii) program effectiveness, (iv) workforce issues, (v) context, and (vi) sustainability and spread. The first evaluation category, innovation components, provides a comprehensive description of the key components of the innovation, including the target population(s), theory of action, and theory of change driving the innovation. Implementation effectiveness focuses on identifying the factors associated with successful operation of the program and uptake by target populations, while program effectiveness examines the overall success of the intervention in improving patient health outcomes and quality of care and reducing resource use and medical expenditures. Workforce issues relate to the innovation's impact on workforce training, staff size, skills development, and provider satisfaction. Context assesses the

extent to which external policy and health system factors, and endogenous organizational factors influence program impacts. Finally, sustainability and spread refers to how successfully an innovation can be scaled and replicated in other settings. Table 1-2 details the key research questions that address each evaluation category.

Table 1-2: Evaluation Framework and Key Research Questions

Evaluation Category	Evaluation Dimension	Key Research Questions
Innovation Components	Target Complexity	• What are the key components of the innovation? • How is the innovation designed to reduce expenditures or improve care quality? • Who does the intervention target? Which priority population(s) does the intervention target? Does it target individuals, organizations, or both? • To what extent is the innovation viewed as a "plug in" versus a fundamental and major change within the implementing organization?
Implementation Effectiveness	Fidelity Reach Overall Effectiveness Implementation Process	• Was the intervention delivered as intended to the target population? • What were key successes in implementing the innovation as designed and factors associated with success? • What were the challenges in implementing the innovation as designed? • What changes were made to the innovation to increase enrollment, improve care, or reduce expenditures? • Did the innovation use internal evaluation findings to inform the implementation process, when necessary?
Program Effectiveness	Health Cost Resource Use Care Quality	• What are the effects of the innovation on participants' health outcomes? • What are effects of the innovation on healthcare expenditures and health service resource utilization? • What is the impact of the innovation on quality of care? • If the innovation has positive effects with respect to health, cost, resource use, or care quality, how long are these changes sustained? • If the innovation has positive effects, what are the innovation components that are driving the change?
Workforce Issues	Development and Training Deployment Satisfaction	• Did the innovation contribute in filling health care workforce gaps? • What type and level of workforce training does the innovation provide? • What type of support structure is available for staff? • What type of support structure is effective for staff deployment? • How does the innovation affect staff satisfaction? • Has the innovation experienced high staff turnaround? If so, what measures have been taken to remedy the problem?
Context	Leadership Engagement Team Characteristics Organization Capacity	• What endogenous (e.g., organizational) and exogenous (policy and environmental) factors affect implementation? • How is senior management structured, and how does it lead and communicate innovation changes to implementers? How does the innovation affect existing hospitals, medical practices, or other settings that provide health care to participants? • Are there unintended negative consequences of the innovation? If so, how can they be mitigated in similar models in the future? • To what extent does the innovation duplicate practices or programs that are already existent?
Sustainability/Spread	Sustainability Scalability	• How can successful innovation components be scaled and replicated in other settings?

Note: This evaluation framework is based on evaluation domains, dimensions, and research questions recommended in "CMS Innovation Center Health Care Center Innovation Awards: Evaluation Plan" (Rand, 2013) and CMS feedback during the evaluation process.

To address the research questions outlined above, Acumen synthesized findings from the qualitative and quantitative analyses described in the following sections to present a robust evaluation of each MM program.

1.2.1 Qualitative Analysis

The Acumen team reviewed awardee program materials, conducted phone interviews and site visits, and implemented participant experience and workforce surveys to collect qualitative information on each of the MM awardees for qualitative analysis. These data collection and analysis methods are described in turn below.

Review of Program Materials

The Acumen team reviewed existing awardee program materials and documentation to obtain a foundational understanding of the innovation program components, implementation processes, and workforce. The Acumen team requested copies of relevant program materials from awardees, which included, but were not limited to: marketing and outreach materials; training materials; job descriptions; staff and/or participant surveys and results; project schedules and work plans; implementation guides; and dissemination plans. The Acumen team also reviewed narrative reports, sustainability plans, and self-monitoring measurement dashboards prepared by each awardee and submitted to the Lewin Group, as well as quarterly progress reports on the implementation of awardees' programs developed by the Lewin Group.

Phone Interviews and Site Visits

The Acumen team conducted quarterly telephone interviews to collect qualitative information on the following evaluation categories: innovation components, implementation effectiveness, workforce, and implementation context. The team developed a comprehensive interview protocol that was used to collect the qualitative information. Given the short length of the interviews and broad scope of research interests, for each quarterly interview, the Acumen team identified a subset of priority interview questions from the full interview protocol, as well as awardee-specific questions to follow up on information provided in awardees' narrative and progress reports. Interviewees included program leaders, executive directors, and program managers. Interviews generally occurred on a quarterly basis and were approximately one hour in length.

During the second year of the contract, the Acumen team additionally conducted one- or two-day site visits with all six MM awardee programs. The site visits allowed the team to observe day-to-day implementation and management of the interventions. They entailed semi-structured interviews with program staff, observations of selected care processes related to the innovation, and when available, collection of supplemental program materials from the sites. When possible, the evaluation team spoke with physicians and other providers during the site

visits to gain insight into provider and physician acceptance of the MM interventions as well as the impact of the interventions on a wide range of health outcomes, including quality of care. Awardee leadership also provided valuable information on institutional support for the intervention and other factors that affected program sustainability and scalability.

Patient Experience Survey

The Acumen team evaluated patient experience with the MM HCIA interventions using a mixed-methods approach, including surveys and follow up telephone interviews to collect qualitative examples of patient experience with the interventions. The team developed a survey questionnaire to measure the specific aspects of health care appropriate to the HCIA interventions, with a focus on topics for which patients were the best or only source of information.

Survey questions were derived from several validated survey item sets, the Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys, the American short form Patient Activation Measure (PAM13) questionnaire, and the Purdue Pharmacy Directive Guidance Survey. Given the varying goals and intervention approaches, surveys were tailored for each of the MM awardees where applicable, but questions were kept largely consistent across the Patient Experience Surveys. The domains determined to be important in the evaluation of patient experience for MM awardees included: awareness of the intervention; intervention exposure[1]; communication[1]; experience with intervention[1, 2]; medication adherence[3]; views about healthcare[4]; and demographics[1].

Surveys and introductory letters were mailed to a sample of Medicare beneficiaries who participated in one of the HCIA interventions during the 4th quarter of 2014 or 1st quarter of 2015. This included patients newly enrolled in an HCIA intervention on or after October 1, 2014, as well as those who received active follow-up services on or after October 1, 2014. The sample of eligible patients was restricted to those for whom the program was able to provide a full name and mailing address. A census of eligible patients was drawn up to 1,800 per program. A total of 895 surveys were completed by MM program participants with an overall response rate of 40.5 percent. Table 1-3 provides sample sizes and response rates for each MM program. To further describe patient experience with the interventions, qualitative data were collected using open-ended survey questions and in-depth telephone interviews with up to five survey respondents.

[1] Adapted from the Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys.
[2] Partially adapted from the Purdue Pharmacy Directive Guidance Survey.
[3] Adapted from the Stanford Chronic Disease Self-Management Program (CDSMP-4).
[4] Adapted from the American short from Patient Activation Measure (PAM13).

Table 1-3: Patient Experience Survey Response Rates for MM Programs

Program Name	Number of Sampled Patients	Number of Completes	Response Rate
HeartStrong	82	42	51.2
IHARP	828	335	40.5
Pharm2Pharm	516	200	38.8
SafeMed	74	14	18.9
PSW	276	142	51.4
USC	433	162	37.4
Total	**2,209**	**895**	**40.5**

Patient Experience Survey results were analyzed by program to reflect the geographic, demographic, and health differences among the program populations, as well as the differences in intervention approaches. Limited comparisons are made across the interventions to reduce the possibility of highlighting variations that are due to population differences rather than differences in the outcomes of the interventions.

Workforce Survey

The Acumen team designed and administered a one-time survey of MM program staff. The workforce survey captured staff experience, perceptions, and level of satisfaction with the innovative care model. The survey was web-based with phone follow-up to non-respondents and was constructed using validated measures of job satisfaction and intent to leave or stay in the new role. Other survey items were adapted from staff surveys fielded by awardees or constructed specifically to answer key research questions. The survey contained core questions about staff experiences in the interventions as well as questions specific to MM awardees.

The survey was sent to all staff with a role in program implementation, regardless of whether the position was funded through the HCIA grant (as opposed to a sample of the staff, since many awardees have a small number of staff in the target population). Program leaders compiled and submitted names, email addresses, and phone numbers for all individuals in the target population, and the Acumen team worked with program leaders to ensure the staff lists were comprehensive and accurate. The Acumen team fielded the survey and solicited the support of program leaders in publicizing the survey and encouraging staff members to complete it.

Table 1-4 provides response rates for each program and the MM portfolio overall. A total of 255 workforce surveys were completed and an overall response rate of close to 76 percent was obtained. Workforce survey results are presented at the portfolio level in Section 8 because of the small staff sizes in most programs. Tests of statistical significance are not provided as the data constitute a census rather than a random sample of program staff.

Table 1-4: Workforce Survey Response Rates for MM Programs

Program Name	Number of Eligible Respondents[a]	Number of Trackable Completers[b]	Response Rate[c]	Total Number of Surveys Received
HeartStrong	26	19	73.1	19
IHARP	30	21	70.0	21
Pharm2Pharm	52	41	78.8	41
SafeMed	20	9	45.0	9
PSW	30	23	76.7	123
USC	47	42	89.4	42
Total	**205**	**155**	**75.6**	**255**

[a]Individuals determined to be ineligible for the survey (e.g., brand new hires, recent retirees were excluded from the count of eligible respondents).
[b]"Trackable completes" refers to individuals for whom the Acumen team had email addresses or names in advance of fielding. PSW also distributed a link to the survey to individuals for whom email addresses could not be shared. The 100 responses received through this channel could not be included in the calculation of response rate.
[c]Using the American Association for Public Opinion Research response rate equation #2.

1.2.2 Quantitative Analysis

This report presents quantitative analyses of program effects for the six MM programs through December 31, 2015. Acumen did not conduct a quantitative analysis for the HeartStrong or SafeMed programs, which did not have sufficient participant-level program data to conduct an analysis. Acumen conducted single difference and difference-in-differences (DiD) analyses of mortality, inpatient readmissions, resource use, medical expenditures, and medication adherence for Medicare beneficiaries targeted by awardee innovations relative to non-participating Medicare beneficiaries. The analyses primarily used intervention data and Medicare claims data with exceptions for the USC and PSW analyses, detailed in Sections 3.4 and 5.4, respectively. For the DiD analyses, Acumen relied on matched comparison groups for the analyses.

Acumen restricted MM intervention cohorts to beneficiaries enrolled in their respective interventions on September 30, 2015 or earlier. Acumen's analysis included only a Fee-for-Service cohort for IHARP, and a combined FFS and Medicare Advantage (MA) cohort for the USC and Pharm2Pharm analyses. Because the PSW intervention targeted Wisconsin Department of Health Services (WI DHS) beneficiaries, the PSW analysis exclusively analyzed WI DHS beneficiaries, some of whom were also enrolled in Medicare. The quantitative data sources, comparison group selection, study inclusion criteria, analytic method, and outcome measures for all evaluations except the USC analysis of intermediate clinical outcomes and the PSW analysis are further described below. The methodology for USC clinical outcomes and PSW analyses, which differ from the general evaluation approach, are described separately in Sections 3.4.4 and 5.4.1. However, the analysis of USC clinical outcomes and the PSW program also used a DiD framework to estimate program effects.

Data Sources

Acumen's quantitative analyses primarily relied on participant-level intervention data obtained directly from the awardees, as well as Medicare enrollment and claims data drawn from Acumen's CMS data holdings. The report relies on claims data with service dates through December 31, 2015. Acumen used enrollment data provided by awardees to obtain identifiers, intervention dates, and other intervention-related information for participating beneficiaries. Using identifiers including Social Security number, gender, name, and date of birth, Acumen then linked program participants to Medicare enrollment and claims data files for analysis.

The claims data sources differed slightly by analytic cohort. Acumen's Medicare claims data were obtained from CMS's common working files (CWF), and included data on diagnoses, health care service use, and expenditures across care settings for Medicare FFS beneficiaries. These data were used to create beneficiary-level longitudinal health profiles for analyses of the IHARP, USC and Pharm2Pharm FFS cohorts. Acumen also used Medicare enrollment and inpatient encounter data (i.e., no-pay inpatient claims submitted by hospitals) available in the CWF, and diagnosis data from the Risk Adjustment and Payment System (RAPS) for the analysis of MA beneficiaries in the USC and Pharm2Pharm interventions. MA data in the CWF does not include information on beneficiaries' service use, diagnosis and procedure information in non-inpatient settings or expenditures.[6]

Acumen used these Medicare claims data sources to identify and observe the outcomes of interest for intervention beneficiaries and control group beneficiaries selected by Acumen as described in the following sections. The additional data sources used in the USC and PSW analyses are detailed in Sections 3.4.4 and 5.4.1, respectively.

Outcome Measures

Acumen used CMS-recommended measures of health outcomes and quality-of-care indicators, health service use, and medical expenditures, and also constructed program-specific measures as relevant to evaluate program effects. For Medicare FFS beneficiaries in the IHARP, program, Acumen analyzed rates of mortality, 30-day readmissions (all-cause and unplanned), inpatient admissions (all-cause and unplanned), days spent in a hospital, emergency room (ER) visits, total Medicare expenditures, and categorical Medicare expenditures (inpatient, outpatient ER, outpatient non-ER, physician/ancillary services, skilled nursing facility, durable medical equipment, home health, and hospice). However, since Acumen's available MA data is primarily inpatient utilization data, outcomes for MA beneficiaries in the USC and

[6] Acumen also extracted MA encounter data across settings from the integrated data repository (IDR) to conduct a supplemental analysis on a Pharm2Pharm MA-only intervention cohort but found that the estimated effects on beneficiary outcomes were largely similar to those using data from the CWF (see Section 6.4). However, IDR MA data could not be used for analyses of MA beneficiaries in the USC cohort due to MA data completeness issues in the IDR for this cohort.

Pharm2Pharm programs include only mortality, 30-day readmissions, inpatient admissions, and number of hospital days, since these analyses combine Medicare FFS and MA beneficiaries into single cohorts. Acumen also reports program-specific measures for the USC FFS and MA cohort that focus on intermediate clinical outcomes, including uncontrolled blood pressure, uncontrolled low density lipoprotein, and poor hemoglobin A1c management, using awardee provided EHR data.

Program effects on medication adherence measures were also assessed for the MM interventions. The medication adherence measure utilized the Pharmacy Quality Alliance (PQA) proportion of days covered (PDC) metric assessing the proportion of days with prescription coverage for particular drug classes; this metric has been endorsed by the National Quality Forum (NQF). The average per-person PDC was measured for a single drug or multiple drugs within each of the five therapeutic classes listed below in the year after enrollment. The PDC threshold is established at 80 percent based on clinical study results as the level above which the medication has a reasonable likelihood of achieving the most health benefit. Effects were analyzed on average PDC, as well as adherence rates, which were assessed as the percentage of beneficiaries who met the 80 percent PDC threshold for each of these five therapeutic drug classes. To calculate the PDC, the number of days a patient was covered by at least one drug in the class, based on prescription fill dates and the days of supply, was divided by the number of days in the patient's measurement period (the index prescription date to the end of the measurement period). Patients were required to be continuously enrolled in a Medicaid or Medicare drug plan during the measurement period, and have at least two prescriptions filled in the drug category in the baseline period and two prescriptions filled in the same drug category in the intervention period. Adherence was measured for the following drug classes:

i. Renin Angiotensin System (RAS) Antagonists (ACEI/ARB/Direct Renin Inhibitors)
ii. Cholesterol Medications (HMG-CoA inhibitors – Statins)
iii. Diabetes Medications (biguanides, DPP-IV inhibitors, sulfonylureas, thiazolidinediones)
iv. Beta-Blockers
v. Calcium-Channel Blockers

Detailed definitions of all outcomes measures, including the meta-evaluation measures, are provided in Appendix A.

Comparison Groups

To conduct quantitative analyses, Acumen used matched comparison groups for all quantitative analyses of the MM programs. Acumen constructed comparison groups by matching beneficiaries participating in the intervention to beneficiaries who were not intervened upon, using a variety of observable characteristics derived from the datasets that were described

in the previous section. For this propensity score matching, Acumen matched each intervention group beneficiary to a control using scores constructed to reflect the beneficiaries' propensity to receive the awardee's intervention. These scores were generally based on predictive Medicare claims data variables including measures of sociodemographics, medical conditions, pre-enrollment health service use, prescription drug use, and medical expenditures and patterns. Acumen also leveraged program-specific information on intervention group characteristics and selection criteria to identify the appropriate set of variables to include in the propensity score matching model.

The matching model works by estimating the probability that a beneficiary will enroll in the intervention given observed covariates *X*. That is, if $D = 1$ for beneficiaries in the intervention group, and $D = 0$ for beneficiaries in the comparison group who do not receive an intervention, $\Pr(D_i=1 \mid X_i)$ is calculated using logistic regression, as per the following formula:

$$\Pr(D_i = 1|X_i) = \frac{e^{\lambda X_i}}{1+e^{\lambda X_i}}$$

where X_i represents binary and continuous terms of the X covariates, and λ represents a vector of estimation parameters (including a constant). Once the propensity score is calculated for both intervention group beneficiaries and potential controls, Acumen's approach is to match beneficiaries using both the propensity score and the values of X variables believed to be particularly important for predicting analysis outcomes. This ensures that covariate balance is achieved over a large variety of health-related covariates while also ensuring particularly close matches on critical covariates like age, baseline Medicare costs, and hospitalizations. The exact variables used varied based on intervention characteristics and data available, but the general process was as follows. Each intervention group beneficiary was first matched to a set of control group beneficiaries using exact matching on highly important categorical variables, especially important health utilization covariates like the presence of a recent hospitalization, and sociodemographic characteristics such as gender, race, dual eligibility and disability status. Among control beneficiaries who exactly matched on these variables, caliper matching was used to select control beneficiaries with propensity scores within 0.2 standard deviations of the propensity score from the intervention beneficiary as potential matches. Finally, a Mahalanobis-metric matching process was used to select for each intervention beneficiary the control beneficiary who was closest on a variety of key continuous variables, such as age and inpatient cost. Thus, each intervention beneficiary was matched to a control beneficiary who was highly similar on a variety of important prognostic characteristics. Intervention group beneficiaries without a matched comparison group member were excluded from the analysis.

Study Inclusion Criteria

Program participants and comparison groups were generally included in the quantitative portion of the analysis only if they have complete claims or encounter data beginning with a one-year pre-enrollment period (pre-enrollment period) through at least one intervention quarter after entering the program (post-enrollment period). As such, program participants and comparison groups are included in the analysis only if they are continuously enrolled in Medicare over this period. Pre-enrollment information that goes back in time, as included in complete claims or encounter data, is necessary for the construction of appropriate comparison groups. Beneficiaries who are continuously enrolled in Medicare but switch between FFS and MA are excluded from analyses that focus only on the FFS cohort (e.g., IHARP). For combined cohorts that include both FFS and MA beneficiaries (e.g., USC and Pharm2Pharm), Acumen uses the lowest common denominator of available data (inpatient utilization data for the MA population) to make sound comparisons over time. Additional exclusion criteria are applied as appropriate to each analysis as described in the Program Effectiveness section of each awardee chapter.

It is worth noting that not all beneficiaries are observed for the same length of time post-enrollment. For example, beneficiaries who enrolled in the program later are observed for fewer quarters post-intervention. In addition, there is sample attrition due to mortality.

Analytic Method

Acumen evaluated program effects using single difference and differences-in-differences (DiD) estimators, measuring changes in the intervention groups relative to controls from the pre-enrollment period to the quarter of interest in the post-enrollment period. Acumen generally conducted a single difference analysis of mortality and inpatient readmissions during the intervention period, and estimated the effect of the intervention on these outcomes using logistic models. Program effects on resource use, medical expenditures, and medication adherence were estimated using DiD methodology, and linear models were employed for this purpose. As awardees enrolled beneficiaries into their programs on a rolling basis since program launch, Acumen used each beneficiary's enrollment date as a reference for defining the pre- and post-enrollment periods.

For the DiD estimates, Acumen first calculated average changes in health outcomes, quality of care, health service use, and medical expenditures for intervention group beneficiaries in the period after program enrollment compared with the pre-enrollment period, and then calculated the corresponding changes for comparison groups over the same period. For each outcome measure, Acumen subtracted the average change in the comparison group from that in the intervention group to obtain the DiD estimate, and calculated heteroscedastic-robust standard errors for each estimate.

Acumen reports cumulative and yearly program effects for various outcomes of interest in the Program Effectiveness section for each awardee, while quarterly program effects are typically reported in the Appendix. Reported estimates of cumulative and quarterly effects are all based on the same DiD methodology, but they are calculated differently, so they are not directly comparable. In particular, the baseline (pre-enrollment) intervention and comparison groups used to compute changes in outcomes for cumulative (and yearly) estimates are different from those used for the calculation of quarterly estimates. Cumulative and yearly estimates of program effects, which are included in the main analysis, use baseline information for all beneficiaries ever included in the study, including those beneficiaries who were not observed in all post-intervention quarters. Quarterly program effects, included in the Appendix, compare outcomes for intervention and comparison groups in a given quarter to outcomes for those same individuals in the pre-enrollment period, omitting all other observations from the baseline sample. These quarterly estimates are referred to as "quarterly fixed effects" estimates.

Quarterly program effects are estimated independently in each quarter after program enrollment in a non-cumulative fashion. For example, the DiD estimate for Medicare expenditures in the first quarter after program enrollment (Q1) reflects the difference between the intervention group and the control group in Q1 compared with the difference in per-person Medicare expenditures between the intervention group and the control group during the entire pre-enrollment year, scaled to one quarter (divided by four). Similarly, the DiD estimate for the second quarter after enrollment (Q2) reflects the difference between the intervention and control groups observed in Q2 (who will generally be subsets of the groups observed in Q1) compared to the difference between the same groups in the pre-enrollment year, scaled to one quarter. For example, if the Q2 DiD estimate for total inpatient expenditures was -$100, this would indicate that enrollees who participated in the intervention and were observed in Q2 incurred, on average, $100 less in inpatient expenditures, compared to the baseline period, relative to those beneficiaries to whom they had been initially matched (based on pre-enrollment information). Thus, quarterly fixed effects estimates truly represent a longitudinal study, where the same individuals are tracked over time, and comparisons are made, for each quarter, between participants and non-participants. Each quarterly fixed effect estimate, however, is calculated based on a slightly different baseline sample. Quarterly fixed effects estimates for a given quarter are expressed in a per-beneficiary format for expenditure measures (by dividing by the total number of beneficiaries in that quarter) and in a per-1,000 beneficiaries format for all other measures (by dividing by the total number of beneficiaries in that quarter and multiplying by 1,000).

Cumulative program effects represent the effect of the program from the start of the intervention through the final quarter of available data. This cumulative estimate is generated by

producing a linear sum of the coefficients from a regression which includes indicator variables for each post-intervention quarter (interacted with participation indicators), where each coefficient is weighted by the number of participant beneficiaries in each quarter. A test of the statistical significance of this weighted sum is then conducted. Acumen calculates the cumulative estimates in accordance with methodologies specified by the team overseeing the HCIA meta-evaluation to ensure that the results are able to support the meta-evaluation. A statistically significant cumulative estimate for a given outcome would indicate that the intervention was associated with a change of that magnitude across all quarters of the intervention compared to the baseline period, relative to the comparison population. For example, if the cumulative DiD estimate for total inpatient expenditures was -$450,000, this would indicate that enrollees who participated in the intervention incurred $450,000 less in inpatient expenditures, compared to the baseline period, relative to the comparison population of the study.

In addition to cumulative program effects, Acumen calculates and reports annual program effects, so that the impact of the program in a particular year of the intervention can be observed. Annual estimates are calculated similarly to the cumulative estimates: they represent weighted sums of regression coefficients attached to quarterly indicator variables (interacted with participation indicators) corresponding to a specific post-intervention year (for example, Q1 through Q4 correspond to year 1). As described above, these estimates use the whole baseline population of intervention and comparison beneficiaries to calculate average changes in outcomes. For example, if the year 2 DiD estimate for total inpatient expenditures was -$400,000, this would indicate that participant enrollees observed in year 2 incurred, $400,000 less in inpatient expenditures in year 2, compared to the baseline period, relative to beneficiaries observed in year 2, who belong to the comparison group. The baseline period includes all participant and control beneficiaries who were part of the study at any point in time, regardless of whether they were observed in year 2.

In addition to reporting aggregate cumulative and yearly results, as described above, Acumen also normalizes coefficients to correspond to estimated effects per 1,000 beneficiaries, cumulatively and by year. These normalized estimates are included in the Appendix. To calculate these estimates, the cumulative (or yearly) estimate is first divided by the number of beneficiary-quarters[7] and then multiplied by the number of quarters (four quarters for a yearly normalized estimate, or all study quarters for a cumulative normalized estimate) and by 1,000.

[7] Beneficiary-quarters correspond to the total number of observations across all quarters. For example, if we observe five beneficiaries for two quarters and three beneficiaries for one quarter, these count as thirteen beneficiary-quarters.

Acumen assessed the statistical significance of estimated program effects on each outcome at the 10% ($p<0.10$) level, as well as the 5% ($p<0.05$) and 1% ($p<0.01$) levels. Cumulative results for each outcome are presented in tables that also show 90% confidence intervals (CI) and p-values for each point estimate. Quarterly key results are illustrated in figures showing plots of single difference or DiD estimates along with their 90% CI for each quarter after enrollment. In the figures showing quarterly differences and DiD estimates in this report, a statistically significant increase in an outcome is illustrated by a 90% CI that lies above the solid horizontal line representing null or zero effect, while a statistically significant decrease is depicted by a 90% CI that falls below this line. The estimated effect is represented by the midpoint of the 90% CI interval.

The remainder of this report is structured as follows. Sections 2 to 7 provide awardee-specific findings from Acumen's mixed-methods evaluation of the IHARP (Section 2)USC (Section 3) HeartStrong (Section 4), PSW (Section 5), Pharm2Pharm (Section 6), and SafeMed (Section 7) programs, respectively. Each of these sections includes a description of the program, evaluability issues, program effectiveness (with the exception of HeartStrong and SafeMed), implementation effectiveness, workforce issues, context as well as the program's sustainability and spread after the conclusion of the HCIA award. Section 8 then discusses some key cross-awardee findings for the evaluation categories of participant experience, workforce issues and factors affecting sustainability and spread of the MM programs, mostly based on the Patient Experience Survey, Workforce Survey, and other qualitative information received from awardees.

2 EVALUATION OF THE IHARP HEALTH CARE INNOVATION AWARD

This section provides summative evaluation findings for the Carilion New River Valley Medical Center's Improving Health for At-risk Rural Patients (or IHARP) innovation through August 2016. Section 2.1 summarizes the key evaluation findings which are detailed in the remainder of the chapter. Section 2.2 describes the IHARP program, while Section 2.3 discusses evaluability issues. Section 2.4 then presents findings from the quantitative analysis of program effects. Section 2.5 through Section 2.8 describe our qualitative analysis findings regarding program implementation effectiveness, workforce issues, contextual factors, and the program's potential for sustainability and scale-up, in turn.

2.1 Key Findings

The HCIA IHARP program focused on addressing the medication and chronic disease state management needs of patients residing in rural southwest Virginia and the Roanoke area. The innovation relied primarily on the primary care clinical pharmacist, a newly created workforce role that provided longitudinal care to IHARP patients that included comprehensive medication, prevention, and disease management services in the primary care setting.

The quantitative analysis of program effects identified statistically significant changes in some health and resource use measures among participants following enrollment relative to controls; however, the estimated effects are unlikely to represent program effects. The IHARP intervention was associated with a statistically significant decrease in mortality relative to controls in the first year of the intervention; however, this decrease was driven by a spike in mortality among controls in the first intervention quarter rather than any unusual changes among participants as discussed in more detail in Section 2.4.1 below. Consequently, the estimated decrease in mortality is unlikely to be attributable to the intervention, and is more likely to be due to different pre-intervention health trajectories for treatment and control groups.

Additionally, the intervention was associated with statistically significant increases in inpatient admissions and certain categories of expenditures (skilled nursing and physician/carrier costs). These estimated increases are driven by increased service use and costs for participants relative to controls in the first year after the intervention, and are also unlikely to be attributable to the intervention. More plausibly, the estimated increases in utilization and expenditures also reflect unobserved differences in underlying health status between treatment and control groups, as discussed in more detail in Section 2.4.1 and Section 2.4.2.

Qualitative evaluation of the IHARP program found that physician engagement in the IHARP program was critical to the program's implementation, and that the underlying patient centered medical home structure implemented throughout Carilion Clinic's primary care offices

was an important foundation to fostering collaboration between pharmacists and physicians. Additional key implementation learnings found that co-scheduling pharmacist visits with physician visits was an effective strategy to increase face-to-face interactions between patients and pharmacists and that allowing pharmacists to use clinical judgment in determining how to follow up with patients was a more effective and efficient model than requiring structured quarterly follow up. Between January and October 2015, IHARP continued to enroll and deliver services to new patients through the financial support of Carilion Clinic; however, in October 2015, Carilion Clinic administration decided to cease funding IHARP. Since November 1, 2015, IHARP has implemented aspects of the program in a significantly revised capacity; however, IHARP program leaders believe that CMS policy changes will enable Carilion to re-establish IHARP primary care clinical pharmacists in the primary care practices that participated in the IHARP program.

2.2 Program Description

The HCIA IHARP program was a patient-centered care model that provided medication and chronic disease state management services to targeted patients through pharmacists based in the hospital, primary care, and community-based settings. The IHARP program was designed to establish safe medication use, improve patients' medication-related clinical outcomes, and enhance patient and health care providers' satisfaction with care. For patients who were hospitalized, hospital-based pharmacists conducted patient recruitment and performed reviews of current patient medications as per hospital protocol for all hospitalized patients. They then transitioned patients to a primary care clinical pharmacist to receive IHARP medication management services in the primary care clinic setting. Patients received IHARP services from a primary care clinical pharmacist in participating Carilion primary care clinics. Patients had office visits with primary care clinical pharmacists every three months. During these visits, pharmacists provided comprehensive medication reviews, medication reconciliation, assistance with medication adherence, education on medication and disease management, as-needed referrals to medication assistance programs, and preventive care services. The initial visit would typically last between 45 and 60 minutes, depending on patient complexity, and subsequent visits averaged between 15 and 30 minutes. In some cases, participating community pharmacists would provide supplemental medication management services to patients.

The IHARP program focused on assisting patients residing in rural southwest Virginia and the Roanoke area with medication management. The program targeted individuals with two or more chronic conditions, including asthma, diabetes, and congestive heart failure, who took four or more medications and had a participating Carilion Clinic primary care provider. Eligible patients were identified during hospital admission and from participating Carilion primary care

clinics. For inpatient enrollment, hospital pharmacists used a daily list of patients produced by a targeting algorithm in the Epic electronic health record system to identify and recruit eligible patients. In the primary care setting, eligible patients were identified and enrolled primarily at participating clinic sites by clinic office staff and primary care clinical pharmacists who were familiar with IHARP's inclusion criteria. Pharmacists recruited patients in the program if they were perceived to have a life expectancy of more than six months; and program leaders described that this was based on the pharmacists' review of physician's notes in the EHR to get a sense of the prognosis. Patients in hospice, skilled nursing facility and long-term care facilities who were terminally ill, and those who were admitted from or returning to a nursing home were also excluded.

The HCIA IHARP program was an entirely new project that launched on January 7, 2013. In total, seven primary care clinical pharmacists provided clinical pharmacy services in 22 Carilion Clinic primary care offices. About 20 community pharmacies and two hospitals participated in IHARP. IHARP concluded participant enrollment under HCIA in early 2015, and IHARP's HCIA award concluded on March 31, 2016. Between January and October 2015, IHARP continued to enroll and deliver services to new patients and continued providing care to previously enrolled patients through the financial support of Carilion Clinic. During this period, all patients were enrolled at participating clinic sites, though hospital pharmacists were still able to make referrals.

Over the course of implementation, IHARP program leaders made some modifications to the program inclusion and exclusion criteria. They reduced the medication requirement inclusion criterion from six medications to four medications, not only to increase enrollment but also to include patients who could benefit from the program. Additionally, while program leaders had intended to exclude patients who received a medication therapy management (MTM) intervention through other programs within the past 12 months, they found this criterion was actually not operational because information on prior receipt of MTM could not be ascertained. Program leaders also expanded their recruitment activities. Initially, program leaders had planned to enroll patients only during hospital admission, but, starting in May 2013, enrollment was extended to eligible patients seen in a participating Carilion primary care clinic.

IHARP program leaders also modified some aspects of the innovation model. In summer 2014, IHARP implemented a simple telepharmacy program using a computer with a web cam that allowed one of the primary care clinical pharmacists to provide remote IHARP services to patients in one of the small, rural practices. Additionally, IHARP was not able to comprehensively implement the community pharmacist component of the innovation. Program leaders had envisioned that community pharmacists would provide supplemental medication management services in addition to the services provided by primary care clinical pharmacists.

Examples of these included assessing the patient's adherence (and providing adherence counseling as needed), providing an updated personal medication record when a new prescription was dispensed, monitoring and clarifying incomplete prescribed orders, counseling patients starting new medications, and providing preventive care. However, IHARP was unable to implement the community pharmacy component as initially intended due to difficulties partnering with chain and independent pharmacies in the region, described in greater detail in the Context section of this chapter.

2.3 Evaluability

This section summarizes the primary factors affecting the evaluability of IHARP, which includes program enrollment and payer mix, comparison group data availability and program implementation factors.

Table 2-1 provides detailed information on the program's enrollment and payer mix, based on participant-level program data provided by the awardee in October 2015. IHARP's data included 2,666 participants enrolled in the program from July 7, 2013 through December 31, 2014. After beneficiaries in the raw file were linked to Acumen's Medicare enrollment database, and duplicated records were removed from the file, 2,606 unique program participants remained, out of whom 958 were in Medicare FFS on their IHARP program enrollment date. The quantitative analysis of program effects relies on the availability of Medicare FFS claims and focuses on program participants enrolled continuously in Medicare FFS.

Table 2-1: Payer Mix of IHARP Program Enrollment by Calendar Quarter

Calendar Quarter	Medicare Parts A/B/D FFS		Medicare Advantage And Part D		Other Medicare Enrolled		Not Medicare-Enrolled/ Unknown		Total
Jan-Mar 2013	53	38%	30	22%	23	17%	33	24%	139
Apr-Jun 2013	55	39%	26	18%	20	14%	40	28%	141
Jul-Sep 2013	167	38%	75	17%	60	14%	136	31%	438
Oct-Dec 2013	165	38%	86	20%	58	13%	131	30%	440
Jan-Mar 2014	165	37%	78	18%	53	12%	148	33%	444
Apr-Jun 2014	170	37%	84	18%	59	13%	142	31%	455
Jul-Sep 2014	124	36%	69	20%	43	13%	108	31%	344
Oct-Dec 2014	59	29%	52	25%	23	11%	71	35%	205
Total	958	37%	500	19%	339	13%	809	31%	2,606

Source: Participant-level data provided by IHARP in October 2015.
Notes: Only beneficiaries in the "Medicare Parts A/B/D FFS" category are included in the quantitative analysis. "Not Medicare-Enrolled/Unknown" includes beneficiaries who were not enrolled in Medicare on the day they entered the IHARP program or for whom the awardee did not provide sufficient personally identifiable information to link to Medicare claims.
Most beneficiaries classified as "Other Medicare Enrolled" have Medicare Part A only, although other insurance statuses (e.g., Parts A and D) are rarely observed.

In May 2016, IHARP provided Acumen with a comparison group comprised of patients from Carilion primary care offices, who met the basic program eligibility criteria. However, because IHARP's control group was matched on a limited set of variables (age, gender, race, insurance status, and number of chronic conditions) and did not account for factors such as perceived life expectancy that IHARP used to select participants, Acumen continued to utilize a comparison group that it constructed using a more extensive set of predictive variables. Acumen's matching variables included multiple health status demographic and utilization variables, including a broad list of comorbidities and prescription drug use. To account for the geographic idiosyncrasies of the region in southwest Virginia where the IHARP program is delivered, the comparison group population is limited to the intervention region and states in the immediate surrounding area: Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. Additionally, to reflect the population size and density of the intervention region, Acumen selected individuals from counties with a population of less than 100,000 and population density of less than 500 people per square mile. Finally, Acumen accounted for region-specific socioeconomic characteristics by including the Area Deprivation Index (ADI), which uses 17 different markers of socioeconomic status based on census data to create an index of relative deprivation across geographic regions.[8] This control group is still subject to limitations of Medicare data to capture predictive variables to create well-matched comparison groups.

The core components of the awardee innovation remained relatively stable for the duration of the HCIA project. However, there were changes made to the target population and enrollment

[8] The ADI was used at the census block group-level for each beneficiary in the propensity-score matching model.

approaches in May 2013 to increase program participation. These included an expansion of the clinical criteria for participation eligibility, and the addition of the primary care setting for patient enrollment, to supplement efforts to enroll patients in the hospital setting.

2.4 Program Effectiveness

This section presents findings on the impact of the IHARP MM intervention on health and resource use outcomes for Medicare FFS beneficiaries. Outcomes were analyzed for eight quarters following IHARP program enrollment ("full intervention period"). In addition to the common cohort restrictions described in Section 1.2, the IHARP analytic cohort was further restricted to beneficiaries who were prescribed drugs for at least one of seven conditions targeted by the intervention: hypertension, diabetes, chronic obstructive pulmonary disease, asthma, heart failure, hyperlipidemia, or depression. These restrictions decreased the participant sample size available for analysis from 958 to 699 Medicare FFS beneficiaries. IHARP program participants were matched to a control group that Acumen constructed using the propensity score matching model described in Section 1.2. To increase comparability, the controls were selected from the state of Virginia (the location of the intervention) as well as the surrounding states of Kentucky, North Carolina, Tennessee, and West Virginia. Control beneficiaries were selected only from counties with levels of population density comparable to those found in the counties of the intervention cohort. Acumen also included the ADI in the matching model to account for socioeconomic characteristics.[9] As Appendix B.1 shows, the intervention and comparison groups in the analysis are well matched on observed demographic and health characteristics, as well as pre-enrollment resource use, expenditures, and Part D prescription drug event variables.

The remainder of this section highlights key quantitative findings for mortality, inpatient readmissions, health service utilization, medical expenditures, and medication adherence outcomes, in turn. Single difference or DiD estimates of program effects are reported at the cumulative level across the full intervention period, as well as for each specific year and each specific quarter after beneficiaries' enrollment in the IHARP program. Acumen provides complete results in Appendix B.

2.4.1 Mortality and Inpatient Readmissions

IHARP program participants had a lower mortality rate (22 fewer deaths for 699 beneficiaries) than controls in the first year of the intervention, which was marginally statistically significant (see Table 2-2 below). However, this finding was primarily driven by a large spike in mortality rate among controls during the first quarter of the intervention rather than any unusual changes in the intervention group (see Figure 2-1). There were 83 deaths per 1,000 beneficiaries

[9] Further detail on the area deprivation index (ADI) used can be found at http://www.hipxchange.org/ADI.

among controls in Q1, although mortality for this group dropped to only 8 total deaths per 1,000 beneficiaries in Q3. In comparison, mortality for the intervention group remained relatively stable at around 23 to 35 deaths per 1,000 beneficiaries per quarter from Q1 through Q5. This suggests that the mortality results are more likely to have been influenced by differences in baseline health status trends between participants and controls than to represent actual program effects.

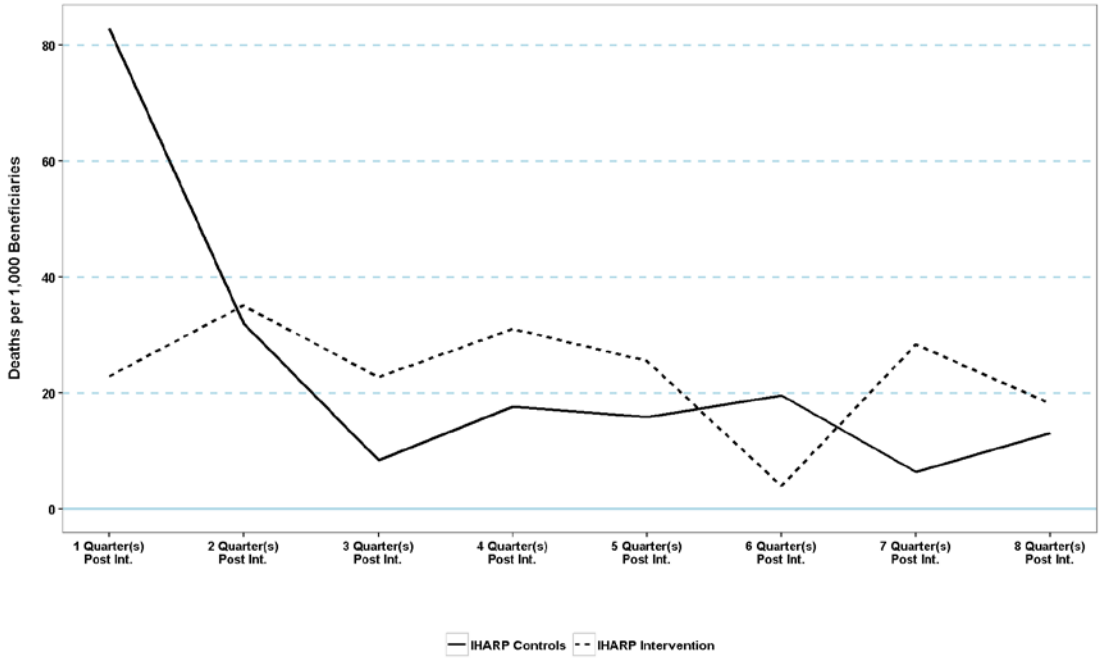
Although Acumen incorporated an extensive set of predictive variables observable in claims data into the control group matching model to conduct robust analyses of program effects, it is possible that participants were on a different health status trajectory than controls even in the absence of the intervention. Acumen did not have access to the same information that IHARP used in selecting program participants, so Acumen's matching model cannot possibly control for all selection factors used in enrolling participants. For instance, IHARP's enrolling pharmacists used their judgment in selecting patients with a life expectancy of six months or more. However, such selection factors cannot be observed in claims data, and thus there could be differences in mortality, treatment preferences, and health service use between the intervention and comparison groups, who are otherwise well matched on variables available in claims data.

Table 2-2: Aggregate Mortality: Cumulative and Yearly Differences after IHARP Enrollment, Medicare FFS Cohort

Measure	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	699	699	587
Mortality			
Difference[c]	-14.20	-21.88*	7.67
90% Confidence Interval	(-39.2 | 10.8)	(-43.2 | -0.5)	(-5.3 | 20.7)
P-Value	0.349	0.092	0.331

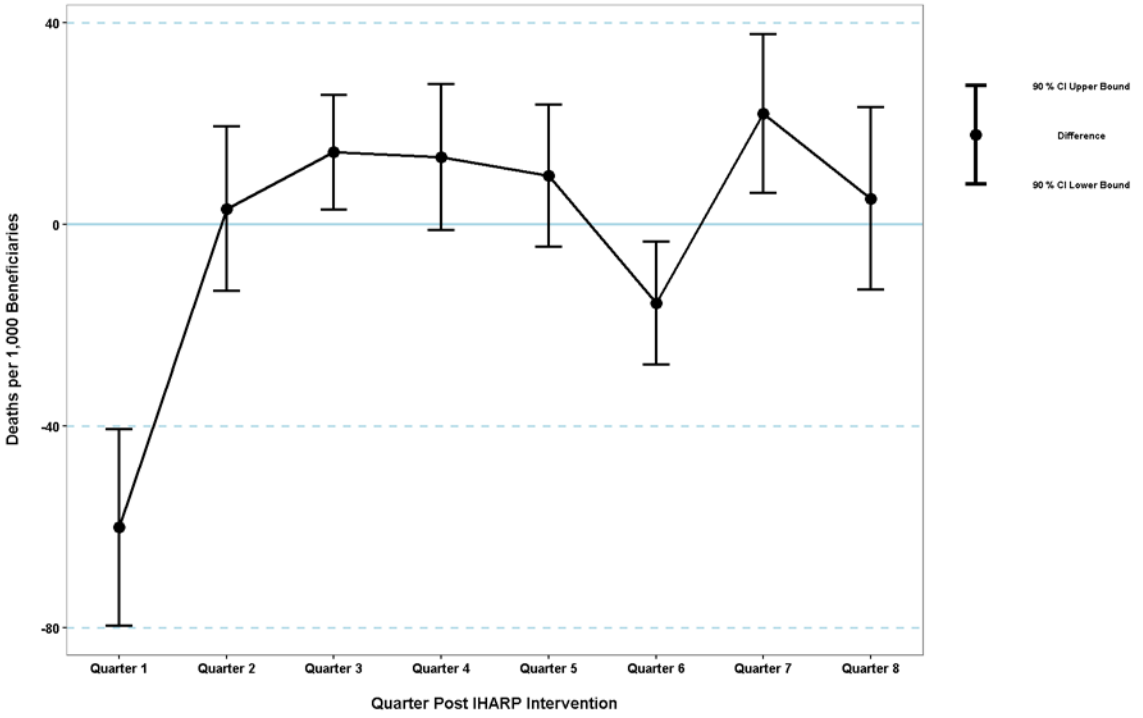
* Statistically significant at the ten percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.
[c]This estimate represents the difference in the number of deaths between the intervention and control groups during the relevant year in the intervention period.

Figure 2-1: Mortality per 1,000 Beneficiaries: Quarterly Trends for Participants and Controls, IHARP Medicare FFS Cohort



At the quarterly level, estimates of mortality effects varied in both direction and magnitude (see Figure 2-2). Detailed quarterly difference estimates are provided in Appendix Table B-3.

Figure 2-2: Mortality per 1,000 Beneficiaries: Quarterly Differences, IHARP Medicare FFS Cohort



In the analysis of hospital readmissions measures, statistically significant effects were not found at the cumulative or yearly level, and consistent patterns were not observed at the quarterly level. The magnitude and direction of DiD estimates also varied by quarter and year. Table 2-3 below shows the cumulative and yearly results while Appendix B presents quarterly results.

Table 2-3: Aggregate Inpatient Readmissions: Cumulative and Yearly Differences after IHARP Enrollment, Medicare FFS Cohort

Measure	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	699	699	587
30-Day Hospital Readmissions Following All Inpatient Admissions			
Difference[c]	0.90	-10.99	11.89
90% Confidence Interval	(-30.1 | 31.9)	(-36.7 | 14.7)	(-5.4 | 29.1)
P-Value	0.962	0.482	0.257
30-Day Hospital Unplanned Readmissions Following All Inpatient Admission			
Difference	-3.98	-15.30	11.32
90% Confidence Interval	(-34.4 | 26.4)	(-40.5 | 9.9)	(-5.7 | 28.4)
P-Value	0.830	0.317	0.275

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.
[c]This estimate represents the difference in the number of beneficiaries with an inpatient readmission among beneficiaries with at least one inpatient admission, as compared between the intervention and control groups during the intervention period.

2.4.2 Health Service Resource Use

Cumulatively across the eight quarters after program enrollment, the IHARP intervention was associated with a statistically significant increase in inpatient admissions primarily driven by a large increase observed in Q1. Table 2-4 shows a cumulative increase of 206 inpatient admissions among 699 participants relative to controls, which was significant at the 5% level.

Figure 2-4 shows a large increase in inpatient admissions in Q1 for participants relative to controls and relatively smaller increases in other quarters. In combination with the mortality results described in Section 2.4.1, one possible interpretation of these increases is that the results are influenced by selection bias. Because the death rate was much higher among controls than participants in Q1, there were significantly more remaining survivors in the participant group who could use hospital services in the first and subsequent quarters relative to controls. Thus, if the mortality finding in Q1 is due to unobserved pre-enrollment differences between comparator groups, estimates of increases in service use or cost measures may also reflect that selection bias, as there is no clear mechanism through which the program would be expected to increase inpatient admissions.

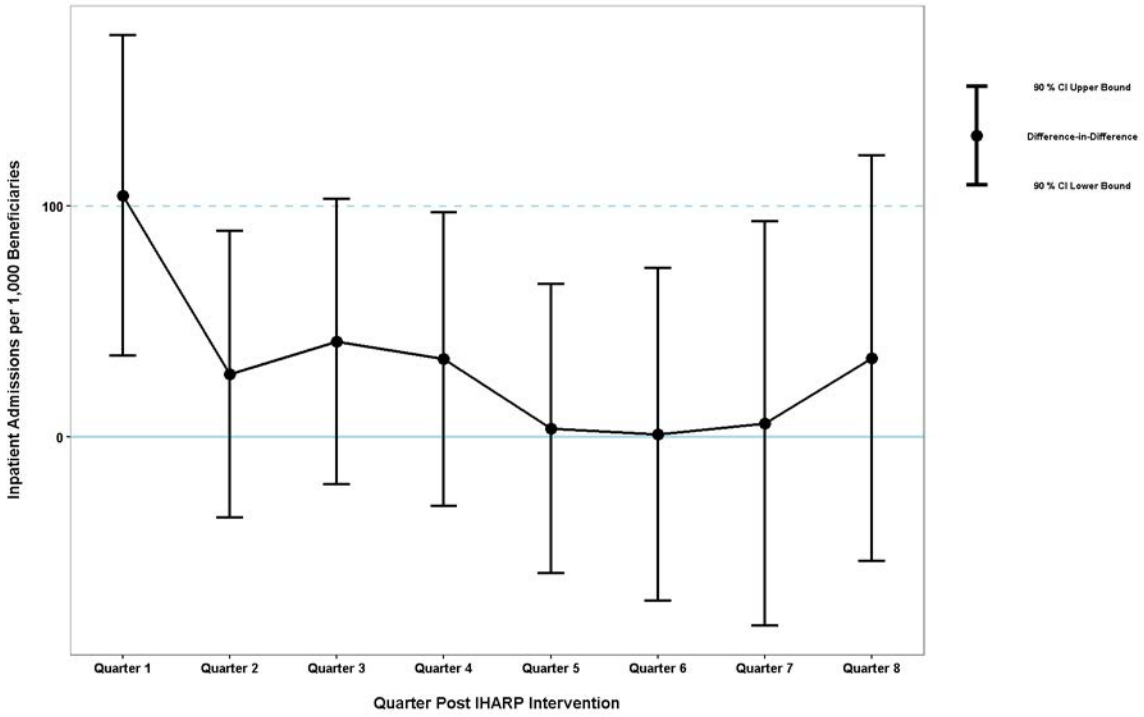
Table 2-4: Aggregate Resource Use: Cumulative and Yearly DiD Estimates, IHARP Medicare FFS Cohort

Measure	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	699	699	587
ER Visits			
Difference-in-Difference	185.59	95.21	90.38
90% Confidence Interval	(-13.1 | 384.2)	(-42.4 | 232.8)	(-10.8 | 191.6)
P-Value	0.124	0.255	0.142
Inpatient Admissions			
Difference-in-Difference	206.25**	165.26***	40.98
90% Confidence Interval	(61.1 | 351.4)	(64.5 | 266.0)	(-29.6 | 111.5)
P-Value	0.019	0.007	0.339
Unplanned Inpatient Admissions			
Difference-in-Difference	226.63***	167.02***	59.60
90% Confidence Interval	(87.8 | 365.5)	(71.2 | 262.8)	(-7.8 | 127.0)
P-Value	0.007	0.004	0.146
Hospital Days			

Measure	Full Intervention Period[a]	Year 1[b]	Year 2
Difference-in-Difference	428.72	510.28	-81.56
90% Confidence Interval	(-616.9 | 1,474.3)	(-261.5 | 1,282.1)	(-593.4 | 430.3)
P-Value	0.500	0.277	0.793

** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.

Figure 2-3: Inpatient Admissions per 1,000 Beneficiaries: Quarterly DiD Estimates, IHARP, Medicare FFS Cohort



There were no statistically significant cumulative or yearly effects on ER visits or hospital days (see Table 2-4). The quarterly estimates for these outcomes were also non-significant and did not show consistent increases or decreases.

2.4.3 Medical Expenditures

The IHARP program as not associated with statistically significant effects on total medical and drug costs; however, cumulative statistically significant increases were observed in the category of physician/ancillary service costs and skilled nursing facility (SNF) costs. Table 2-5 shows that the intervention was associated with a total cumulative increase of $401,615 in physician/carrier costs, and $908,845 in skilled nursing facility costs among 699 participants relative to controls, which were significant at the ten and five percent levels, respectively.

As discussed in Section 2.4.1 and Section 2.4.2, although the intervention and comparison groups are well-matched on variables that are observable in claims, these expenditure results are also likely attributable to differential baseline health trends in the comparator groups. The unusually high mortality rate among controls relative to participants in Q1, described in Section 2.4.1, likely led to more remaining survivors in the participant group who could use health services and incur costs in the first and subsequent quarters relative to controls. As the mortality differences were likely driven by unobserved differences, the expenditure increases likely reflect the same and may not represent true program effects. For example, Figure 2-4 shows that SNF costs were trending up in a steeper trajectory for participants relative to controls even prior to IHARP program enrollment, and thus the SNF cost peak observed in Q1 would likely be higher for participants than for controls even in the absence of the program.

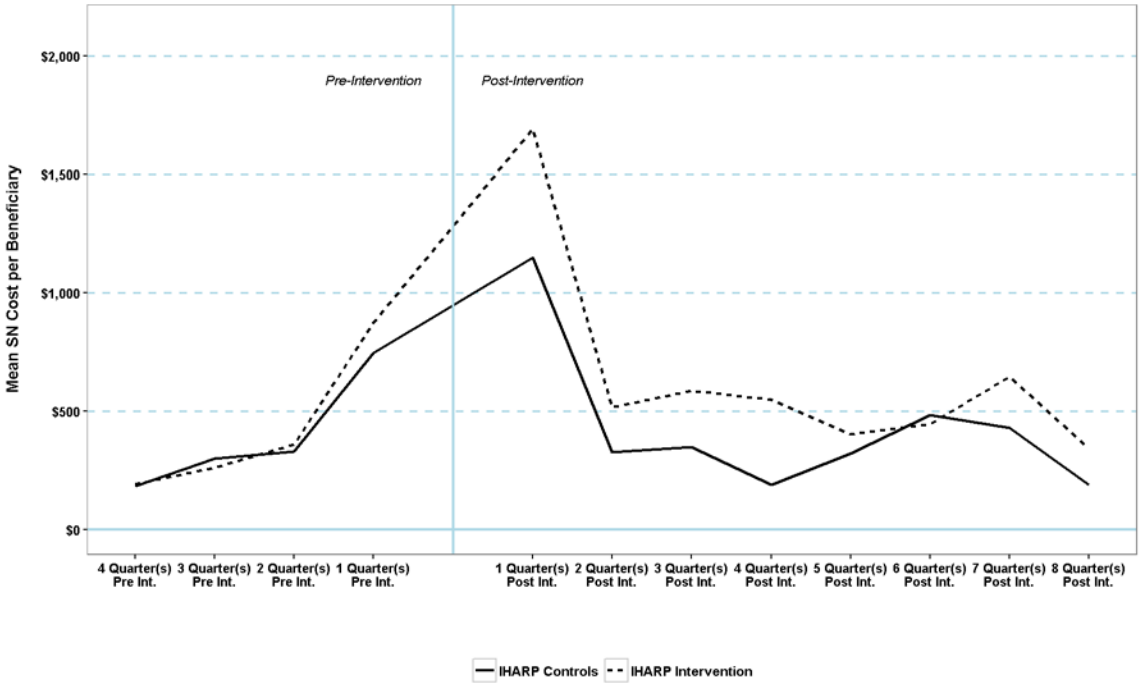
Table 2-5: Aggregate Expenditures: Cumulative and Yearly DiD Estimates, IHARP Medicare FFS Cohort

Measures (2011 USD per Beneficiary-Quarter)	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	699	699	587
Total Medicare Parts A, B, and D Expenditures[b]			
Difference-in-Difference	1,449,103	1,408,317	40,785
90% Confidence Interval	(-1,064,874.9 | 3,963,080)	(-471,887.5 | 3,288,522)	(-1,139,380.8 | 1,220,951)
P-Value	0.343	0.218	0.955
Total Medicare Parts A and B Expenditures			
Difference-in-Difference	1,755,105	1,703,388	51,717
90% Confidence Interval	(-658,972.1 | 4,169,181)	(-117,809.3 | 3,524,584)	(-1,062,983.4 | 1,166,418)
P-Value	0.232	0.124	0.939
Inpatient Expenditures			
Difference-in-Difference	226,508	454,744	-228,236
90% Confidence Interval	(-1,384,231.5 | 1,837,248.2)	(-814,799.9 | 1,724,288.2)	(-919,570.5 | 463,098.8)
P-Value	0.817	0.556	0.587
Outpatient ER Expenditures			
Difference-in-Difference	1,171	-12,524	13,696
90% Confidence Interval	(-167,721.1 | 170,063.9)	(-130,481.2 | 105,431.9)	(-63,565.6 | 90,957.6)
P-Value	0.991	0.861	0.771
Outpatient Non-ER Expenditures			

Measures (2011 USD per Beneficiary-Quarter)	Full Intervention Period[a]	Year 1[b]	Year 2
Difference-in-Difference	192,715	85,711	107,004
90% Confidence Interval	(-286,649.7 | 672,080.2)	(-250,404.8 | 421,826.9)	(-143,618.3 | 357,626.8)
P-Value	0.508	0.675	0.483
Physician and Ancillary Service Expenditures			
Difference-in-Difference	401,615*	336,693**	64,922
90% Confidence Interval	(31,656.9 | 771,572.3)	(62,979.5 | 610,406.1)	(-108,923.1 | 238,766.6)
P-Value	0.074	0.043	0.539
Skilled Nursing Facility Expenditures			
Difference-in-Difference	908,845**	810,334**	98,511
90% Confidence Interval	(192,568.7 | 1,625,121)	(282,640.5 | 1,338,027)	(-232,940.3 | 429,962)
P-Value	0.037	0.012	0.625
Durable Medical Equipment Expenditures			
Difference-in-Difference	42,778	-41,262	84,040
90% Confidence Interval	(-282,674.1 | 368,229.4)	(-270,751.1 | 188,226.3)	(-84,349.0 | 252,429.1)
P-Value	0.829	0.767	0.412
Home Health Expenditures			
Difference-in-Difference	16,650	134,820	-118,171
90% Confidence Interval	(-250,890.4 | 284,190.0)	(-59,546.9 | 329,187.8)	(-243,290.1 | 6,948.7)
P-Value	0.918	0.254	0.120
Hospice Expenditures			
Difference-in-Difference	-46,329	-74,070	27,740
90% Confidence Interval	(-171,142.2 | 78,483.8)	(-176,053.2 | 27,914.1)	(-39,867.1 | 95,347.9)
P-Value	0.541	0.232	0.500

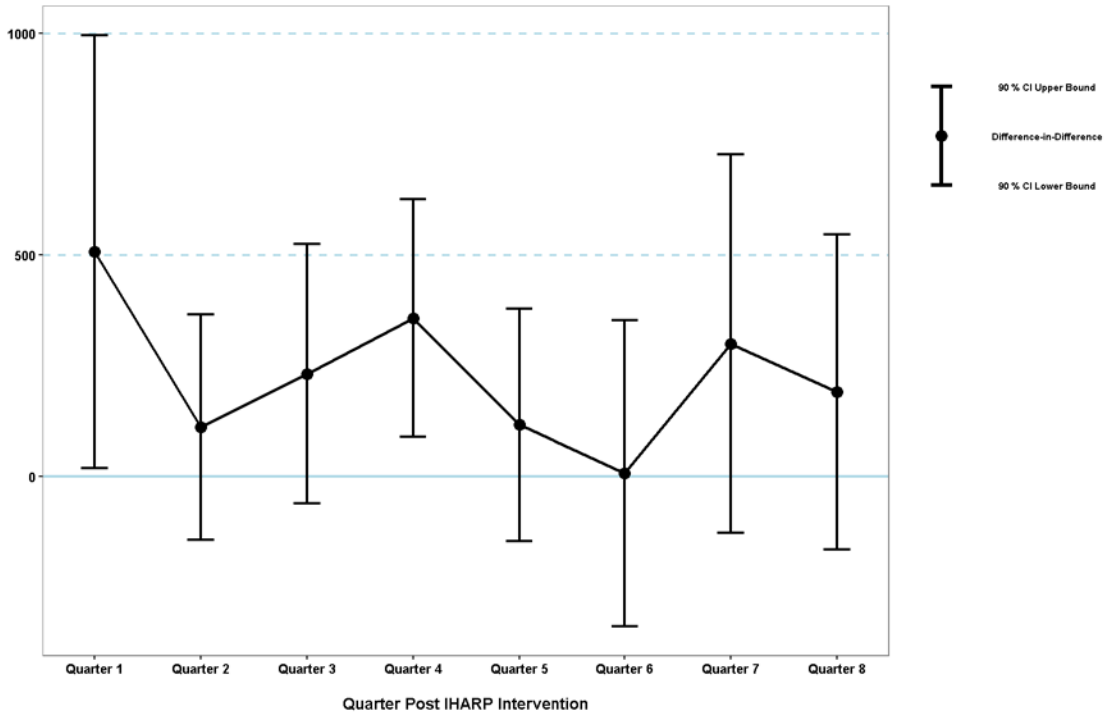
* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.

Figure 2-4: SNF Expenditures per Beneficiary: Quarterly Trends for Participants and Controls, IHARP Medicare FFS Cohort



At the quarterly level, there were increases observed for both physician and ancillary service costs and SNF costs in every quarter; however only the SNF cost increases in Q1 and Q4 were statistically significant (see Figure 2-5 for quarterly DiD estimates of SNF costs).

Figure 2-5: SNF Expenditures per Beneficiary: Quarterly DiD Estimates, IHARP Medicare FFS Cohort



2.4.4 Medication Adherence

There was a statistically significant decrease in diabetes medication adherence of 6.06 percent days covered in the first year of the intervention; however, this decrease is unlikely to reflect the true effect of the intervention. The estimated Year 1 decrease in diabetes medication adherence is more likely due to chance or to unobservable differences between treatment and control groups. Results for the other adherence measures were not significant in Year 1 or Year 2, and varied in direction by therapeutic drug class. Table 2-6 details these results.

The adherence DiD estimates should be interpreted in the context of the sample size, pre-enrollment adherence levels, as well as selection issues detailed in previous sections. Individuals eligible for measures of medication adherence represent only a small sample of program participants for a given therapeutic class, reducing the ability to detect an effect. Appendix B.5, which presents summary statistics on medication adherence, shows that IHARP participants were largely adherent to medications during the baseline period; the median baseline PDC was over 93 percent. This suggests that beneficiaries who chose to participate in the IHARP program may be individuals who were already likely to engage in healthy behaviors; thus, the potential margin of improvement in the intervention cohort's medication adherence may be minimal.

Table 2-6: Medication Adherence (Proportion of Days Covered) by Medication Type: Yearly DiD Estimates, IHARP Medicare FFS Cohort

Measures	Year 1[a]	Year 2
Beta Blockers		
Number of Participants	312	130
Difference-in-Difference	0.02	2.8
90% Confidence Interval	(-3,3)	(-3,8)
P-Value	0.992	0.401
Calcium Channel Blockers		
Number of Participants	157	54
Difference-in-Difference	1.41	4.88
90% Confidence Interval	(-3,6)	(-3,13)
P-Value	0.632	0.296
Diabetes Medication		
Number of Participants	114	44
Difference-in-Difference	-6.06*	-2.13
90% Confidence Interval	(-11,-1)	(-10,5)
P-Value	0.044	0.636
RAS Antagonists		
Number of Participants	314	116
Difference-in-Difference	-2.09	-2.31
90% Confidence Interval	(-6,1)	(-8,3)
P-Value	0.322	0.485
Statins		
Number of Participants	330	118
Difference-in-Difference	-1.92	0.47
90% Confidence Interval	(-5,1)	(-5,6)
P-Value	0.345	0.889

***** Statistically significant at the ten percent level.

[a]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.

2.5 Implementation Effectiveness

Program leaders found that physician engagement was a critical component of successful program implementation. Physician participation in, acceptance of, and referrals to the program increased the likelihood of patient participation by indicating endorsement of the program. IHARP's strategies for increasing physician engagement included (i) attending office staff meetings and having one-on-one meetings with physicians; (ii) being attuned to a physician's preferred method(s) for communication; (iii) highlighting IHARP's potential to save physicians

time and help them with quality measures, polypharmacy issues, and compliance requirements; and (iv) having physicians endorse IHARP to their peers.

Additionally, IHARP program leaders found that implementing certain patient communication strategies helped increase patient participation. These included (i) being respectful of a patient's condition (i.e., not approaching a patient who is acutely ill); (ii) using the medication review and reconciliation process to detect issues and demonstrate the value of a pharmacist's services; (iii) using talking points during enrollment to customize information based on patient needs and circumstances; and (iv) emphasizing that IHARP's aim is to enhance existing primary care services rather than be considered a separate program. Even with deploying these strategies, IHARP did experience difficulty following up with some patients who were enrolled in the hospital. Though these patients agreed to participate in IHARP during hospitalization, the primary care clinical pharmacists were unable to reach them post-discharge.

Program leaders and primary care clinical pharmacists also used scheduling strategies to increase participation. Specifically, scheduling primary care clinical pharmacist visits concurrently with physician visits was a useful strategy for encouraging patients to attend face-to-face meetings with pharmacists. Program leaders and primary care clinical pharmacists emphasized the importance of having an in-person initial visit, since it formed the foundation of the patient-pharmacist relationship.

Additionally, program leaders found that it was valuable to have a dedicated team member address medication access issues. IHARP program leaders estimated that for about 40 percent of the program's patients, the primary reason for medication non-adherence was cost. In winter 2015, an IHARP staff member began working with Carilion's medication assistance program (MAP) to ensure that IHARP patients completed their medication assistance-related paperwork. Carilion's MAP helps individuals who meet MAP's income requirements get their medications at little or no cost. According to program leaders, this process led to more patients receiving needed medication assistance.

One challenge that program leaders faced was low utilization of the telepharmacy version of the program. IHARP implemented a remote version of the program that used simple technology via web cam to allow telepharmacy consultations with Carilion's Galax practice, which serves few patients and was a significant commute for the primary care clinical pharmacists. The telepharmacy program at the Galax practice was not highly utilized largely because Galax physicians and office staff did not make many patient referrals. Thus, although it was available, utilization remained low for the duration of the HCIA-funded program.

Finally, program leaders noted the importance of allowing flexible implementation of some innovation components, and made modifications to the program accordingly. From January

through October 2015, when IHARP continued to enroll and serve patients with financial support from Carilion Clinic instead of HCIA funding, the program modified its approach to pharmacist follow ups for participants. Instead of requiring quarterly follow ups for all patients, program leaders allowed pharmacists to determine how often to follow up with IHARP patients and for how long this follow up should occur. This decision was prompted by primary care clinical pharmacist feedback that they struggled to find time to complete quarterly follow-up phone calls and that they felt they should have flexibility to use their clinical judgment to determine the frequency of follow-up services. Program leaders also considered relaxing the inclusion criteria for participants enrolled in the period following the HCIA grant; however, leaders found that the vast majority of those enrolled met the inclusion criteria used for the HCIA grant.

2.6 Workforce

Pharmacists reported that while the ADAPT training that was used to train intervention pharmacists was generally beneficial, a modified version of the training may be more suited for experienced pharmacists. During the early phase of implementation, all hospital and primary care clinical pharmacists received ADAPT training, a 19-week online continuing education course provided by the Canadian Pharmacist Association focused on primary care clinical pharmacy services. Primary care clinical pharmacists reported that the ADAPT training was useful but somewhat excessive or redundant for experienced pharmacists. They suggested having a modified version of the training for experienced pharmacists that allows customization of the training modules based on each pharmacist's personal background and experience.

Additionally, program leaders' experiences suggest that inclusion of a pharmacy technician role could be helpful for supporting clinical pharmacists in implementing a medication management program like IHARP. While the pharmacy technician role was not included in the IHARP model, primary care clinical pharmacists and IHARP program leaders reported that this role had great potential for increasing primary care clinical pharmacist capacity to provide IHARP services. Though this was not implemented for IHARP under the HCIA grant, program leaders developed a job description and sought Carilion budgetary approval for the position.

Finally, pharmacists reported that chronic disease state management guidelines were useful during the early implementation phase. IHARP developed evidence-based chronic disease state management guidelines that were integrated into Carilion's electronic health record (EHR) that helped guide primary care clinical pharmacists' medication management interventions to ensure the interventions were evidence-based. Primary care clinical pharmacists indicated that these guidelines were useful to them early in the project; however, pharmacists stopped using them as they became more familiar with the content of the guidelines.

2.7 Context

One important contributor to the acceptance of the IHARP program was the Patient-Centered Medical Home structure of the participating practices**.** A significant number of Carilion's primary care practices are National Committee for Quality Assurance (NCQA)-recognized patient centered medical homes (PCMHs). Since the PCMH model emphasizes team-based care, it has been an important foundation for the acceptance of IHARP's model and the promotion of teamwork between primary care clinical pharmacists and clinic physicians and staff members. All primary care clinical pharmacists interviewed during the site visit underscored the importance of the PCMH model in facilitating acceptance of IHARP.

IHARP staff and program leaders also reported on the importance of having a shared EHR between participating hospitals and primary care clinics to facilitate implementation of a medication management program like IHARP. Identifying and managing patients between settings would be both difficult and inefficient without a shared EHR. Thus, the EHR infrastructure was critical in facilitating the identification of eligible patients and tracking patients as they transitioned from hospital to clinic.

Collaborative practice agreements (CPAs) were perceived to have great potential in improving care coordination but could not be successfully implemented for the IHARP program. IHARP attempted to institute CPAs with Carilion physicians that would allow primary care clinical pharmacists to initiate or change drug therapies and refer patients for care instead of just providing recommendations to primary care providers. IHARP program leaders attempted to work with Carilion's Legal department to approve these agreements but were unable to successfully implement them. In the absence of CPAs, the primary care clinical pharmacists focused on developing strong working relationships with their patients' providers but those interviewed during the site visits overwhelmingly advocated for these agreements as important structures for efficiency and optimization of the program. Additionally, program leaders and clinical pharmacists revealed that trust between providers and pharmacists is a necessary precursor to CPAs and that this trust takes time to build.

There were organizational barriers that impeded community pharmacist participation in the IHARP model. CVS/Caremark, IHARP's planned community pharmacy partner, decided not participate in IHARP once IHARP program leaders clarified that the community pharmacists would need to have an active and involved role in delivering IHARP services, which included reviewing the EHR for patients who identified the pharmacy as their primary source of prescription medications, assessing their health status, and contacting patients starting a new medication within two weeks of the first dispense to assess the patient's response. IHARP then reached out to other chain and independent pharmacists in the region, establishing a network of

over 20 pharmacies; however, these pharmacies struggled to implement the program fully due to strained relationships with Carilion and other workflow barriers. A Carilion policy implemented in January 2014 required Carilion employees and their families to receive maintenance medications from Carilion pharmacies exclusively, reducing business for community pharmacies and harming the relationship between community pharmacies and IHARP. Community pharmacists' ability to provide IHARP's in-depth medication management services was limited by additional workflow barriers, including extensive time required for communication and documentation, inadequate staffing, and difficulty identifying patients enrolled in IHARP.

2.8 Sustainability and Spread

Starting in January 2015, IHARP continued to enroll and deliver services to new patients and continued providing care to previously enrolled patients through the financial support of Carilion Clinic. However, despite receiving favorable responses from Carilion Clinic administration leadership and initial financial support to sustain the IHARP program beyond the HCIA grant, the IHARP program as designed and tested under the HCIA grant concluded at the end of October 2015 following a decision by the administration to cease funding for the intervention. According to qualitative review of IHARP program reports, several key factors led to the Carilion Clinic administration's decision to stop funding the IHARP program. These included (i) an inability to generate revenue through incident-to-physician billing, (ii) an assessment of Carilion Clinic's financial documents that revealed a reduction in margin of over $500,000 as a result of the IHARP program (before factoring in the $700,000 in annual salary costs that would be necessary to continue the program), and (iii) an inability to transfer funding for IHARP primary care clinical pharmacists from the hospital cost center to the Carilion Community and Family Medical cost center (to avoid legal concerns related to a potential conflict of interest associated with having a hospital that receives referrals from Carilion physicians funding IHARP pharmacists).

Since November 1, 2015, following the cessation of funding for the intervention by Carilion Clinic administration, IHARP has implemented aspects of the program in a significantly revised capacity. One primary care clinical pharmacist continues to provide the full array of IHARP direct patient care services in one of the larger primary care practices in the Roanoke area. A second pharmacist works for Carilion Clinic medical group's Chronic Disease Management team and provides the core IHARP comprehensive medication management services to patients primarily via phone. This pharmacist also accepts remote consults for patients at various primary care practices throughout the system. A third primary care clinical pharmacist works with the three medication access program offices at Carilion Clinic, which are

expanding their reach throughout the Carilion systems based on IHARP's findings that medication affordability is a significant barrier for Carilion patients. As of June 30, 2016, these components of the IHARP integrated care practice model are still operational.

Carilion Clinic pharmacy leaders note that the revenue generation component for sustaining the model has recently become less relevant due to CMS changes in the payment structure for medical services away from Fee For Service following the implementation of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA). Pharmacy leadership is preparing a revised sustainability proposal for vetting through the Carilion Clinic 2016-2017 budget process, which will include financial data from the Medicare patients who received IHARP services along with an assessment of the impact of the emerging payment models from CMS on the viability of the new streamlined care model. Based on recent budgetary developments for 2016-2017, pharmacy leadership believes that Carilion will re-establish primary care clinical pharmacists in all of the practices that participated in IHARP between 2013 and October 2015. Should this occur, Carilion Clinic pharmacy leadership anticipates that the primary care clinical pharmacists will be able to implement the IHARP model more efficiently because of the modifications in the structured planned visits and reductions in documentation burden. Carilion Clinic pharmacy leadership anticipates that patient recruitment will be entirely primary care office-based since IHARP services will be available to all patients in the IHARP practices who meet the high risk criteria. Under this plan, primary care clinical pharmacists will share responsibility for calling patients within 72 hours of hospital discharge with care coordinators, and community pharmacy services will be focused primarily in Carilion Clinic community pharmacies.

3 EVALUATION OF THE UNIVERSITY OF SOUTHERN CALIFORNIA HEALTH CARE INNOVATION AWARD

This section provides summative evaluation findings for the University of Southern California innovation through August 2016. The USC innovation aimed to incorporate integrated pharmacy teams into AltaMed primary care clinics to provide comprehensive medication and disease management services to patients at high risk for poor medical outcomes. Section 3.1 summarizes the key evaluation findings for the USC program, detailed in the remainder of the chapter. Section 3.2 describes the USC program, while Section 3.3 discusses evaluability issues. Section 3.4 then presents findings from the quantitative analysis of program effects on the standard set of claims based outcomes as well as intermediate clinical outcomes derived from USC's Electronic Health Record (EHR). Finally, Sections 3.5 through 3.8 describe qualitative analysis findings related to program implementation effectiveness, workforce issues, contextual factors, and the program's potential for sustainability and scale-up, in turn.

3.1 Key Findings

Quantitative analysis of the USC intervention was unable to identify statistically significant cumulative effects on any claims-based outcomes, including mortality, health and resource use measures, expenditures, or medication adherence. At the yearly level, the only finding that was statistically significant was a decrease in inpatient readmissions in the first year after enrollment, primarily driven by a sharp decrease in readmissions in the first quarter of the intervention; however, this was followed by some significant increases in readmissions in later intervention quarters.

However, there were some measureable changes in clinical indicators such as LDL and Hemoglobin A1c. Specifically, the intervention was associated with statistically significant improvements in LDL management and control, defined by the change in the rate of patients with uncontrolled LDL (greater than 100 mg/ dL). Although the decrease in the overall rate of diabetic patients with poor management of Hemoglobin A1c (i.e., HbA1c greater than 8%) was not statistically significant cumulatively across the nine-quarter intervention period, positive effects were observed in multiple specific intervention quarters. However, given the limitations inherent in evaluating a non-randomized intervention using only claims-based measures and imputed clinical indicators, which were constructed from EHR records that were largely incomplete, neither the measured improvements in intermediate outcomes nor the lack of effects on most downstream outcomes can be conclusively attributed to the intervention. Section 3.4 provides further details.

With regards to program implementation, USC was successful in implementing flexible collaborative practice agreements that allowed pharmacy teams to provide MM services directly and independently to patients without prior physician approval, and the USC program learned patients were most likely to enroll in their program when they were referred by a primary care provider. During the third year of its HCIA grant and into its no-cost extension, the USC program implemented a telepharmacy-only version of the pharmacy team program at five AltaMed locations. According to information provided by program leaders, preliminary analyses suggest that providing clinical pharmacy services via video is as effective as in-person. Though both the in-person and telepharmacy services as designed and tested under the HCIA grant are no longer in operation at AltaMed clinics, USC continues to build on its activities and learnings from the HCIA grant to spread clinical pharmacy services. Additionally, AltaMed implemented a separate non-HCIA funded version of the program that resembles the original USC innovation before it switched to the telepharmacy-only model, but uses a modified workforce structure.

3.2 Program Description

The USC innovation leveraged novel clinical protocols to provide medication and disease management services at AltaMed safety net clinics in Los Angeles and Orange Counties; these services included comprehensive medication management, medication reconciliation, medication access assistance, patient counseling, drug education, provider education services, and preventive care. The goal of providing these services was to achieve cost savings through improved medication use and quality of patient care. Services were provided by teams of pharmacists, pharmacy residents, and pharmacy technicians who were integrated into each clinic with the aim of optimizing the impact and efficiency of clinical services. The clinical pharmacy teams used USC-developed clinical protocols that included clinical checklists, suggested interventions, patient counseling and education topics, preventive care screenings, dosage guidelines for targeted disease states (asthma, congestive heart failure, diabetes, hypertension, dyslipidemia, anticoagulation therapy), and medication management services (prescription refills and medication reconciliation). Pharmacy technicians conducted telephone follow-up for patients to assess their health and medication status, and they also conducted telephone follow-up after a patient's discharge from the program to determine if a patient was no longer meeting clinical goals and needed to re-enroll in the program.

The program targeted patients at high risk for poor medical outcomes who were identified by pharmacy technicians through daily hospital discharge reports (for managed care patients only), through a systematic electronic review of medical records utilizing novel algorithms, or by primary care providers during in-person office visits at AltaMed clinics. In the first two cases, pharmacy technicians made cold calls asking patients to schedule clinical pharmacy appointments and mailed appointment postcards to eligible patients. There were

several factors in determining whether a patient was "high risk," and the intervention primarily targeted patients who had been diagnosed with four or more chronic conditions, were taking eight or more medications, or had at least one poorly controlled chronic condition. Other factors considered were whether patients had poor adherence to drug therapy for a chronic disease, or whether they were taking warfarin, an anticoagulant medication used to prevent heart attacks, strokes, and blood clots in at-risk patients. Most commonly, physicians referred patients with diabetes, followed by patients with hypertension and patients on anti-coagulation therapy. Participating AltaMed clinics were located primarily in low income areas where the majority of patients served were Latinos.

USC launched its HCIA program on October 8, 2012. Though USC had been involved with other clinical pharmacy initiatives (such as the Health Resources and Service Administration's Patient Safety and Clinical Pharmacy Services Collaborative), the pharmacy team model in the AltaMed clinics was a new innovation. In fall 2014, USC began providing program services to the same target population served before, but through telehealth technology that enabled pharmacy team members to interact with patients in remote locations. The telehealth model included an in-person medical assistant at the AltaMed clinic who assisted the pharmacist locally (e.g. by situating the patient in the room, manipulating any needed equipment, handing paperwork to patients), while the clinical pharmacist, resident, or pharmacy technician served patients remotely through a telehealth video monitor on USC's campus. Identification and enrollment approaches were the same. The telepharmacy program was rolled out to two AltaMed clinics during the third year of USC's HCIA grant.

Beginning July 1, 2015, at the start of USC's no-cost extension period, USC transitioned to providing only remote services via video telehealth technology ("telepharmacy"). USC continued to provide telepharmacy services at the two original telepharmacy locations and prepared to expand the telepharmacy program to three additional AltaMed sites. USC stopped providing in-person pharmacy services to patients at all non-telepharmacy AltaMed locations by July 2015, and though USC had planned to stop providing in-person services at all telepharmacy locations during the no-cost extension period, in-person services at the three additional clinics where expansion of the telepharmacy program was planned were extended beyond the conclusion of the initial HCIA grant period to avoid gaps in care associated with delays in rolling out the telepharmacy program. By the end of October 2015, the telepharmacy program was operational at all five planned AltaMed clinic locations – El Modena; Hollywood; Santa Ana, Main; West Covina; and First Street Clinic – and all in-person services at these clinics had stopped. During the no-cost extension period telepharmacy services were still provided by teams of pharmacists and pharmacy technicians, but pharmacy residents were not included due to lower patient caseloads and the requirement that residents work "side-by-side" with a licensed

pharmacist. USC stopped providing telepharmacy services at the five AltaMed locations in mid-April 2016 and concluded its HCIA grant on June 30, 2016.

Besides the changes in the mode of delivering mediation management services as described above, USC did not make any significant changes to its innovation components or target population over the course of implementation. USC's inclusion criteria were consistent during implementation; however, program leaders did make adjustments to the trigger list (i.e., the electronic "flags" that were used to identify eligible patients according to the inclusion criteria) to better capture the intended target population. They found that having broad inclusion criteria was not as effective for identifying relevant patients (e.g., the "hit rate" was not high enough), so they made the trigger list more specific by adding clinical parameters.

3.3 Evaluability

This section summarizes the primary factors affecting the evaluability of the USC innovation, including program enrollment and payer mix, comparison group data availability, and program implementation factors.

Table 3-1 provides detailed information on the program's enrollment and payer mix, based on participant-level program data provided by the awardee. Acumen linked program data on intervention group beneficiaries to Medicare records to generate the payer mix. As Table 3-1 shows, there were 6,753 beneficiaries enrolled in the program through June 2016. Of these beneficiaries, only 17% were enrolled in Medicare Parts A, B, and D or MA and Part D on the day they entered the USC program. Because the quantitative analysis of program effects presented in Section 3.2 relies on the availability of Medicare claims data and focuses on the subset of USC beneficiaries enrolled in Medicare, the vast majority of participants could not be included in the analysis.

Table 3-1: Payer Mix of USC Program Enrollment by Calendar Quarter

Calendar Quarter	Medicare Parts A/B/D FFS		Medicare Advantage And Part D		Other Medicare Enrolled		Not Medicare-Enrolled/ Unknown		Total
Oct-Dec 2012	55	8%	69	11%	16	2%	515	79%	655
Jan-Mar 2013	28	4%	54	7%	23	3%	621	86%	726
Apr-Jun 2013	23	5%	13	3%	12	2%	438	90%	486
Jul-Sep 2013	24	4%	72	13%	20	4%	449	79%	565
Oct-Dec 2013	26	3%	187	25%	14	2%	527	70%	754
Jan-Mar 2014	43	6%	158	22%	20	3%	492	69%	713
Apr-Jun 2014	*	*	116	20%	*	*	429	75%	575
Jul-Sep 2014	15	3%	80	15%	10	2%	420	80%	525
Oct-Dec 2014	12	2%	63	13%	12	2%	414	83%	501
Jan-Mar 2015	*	*	44	9%	*	*	442	86%	516
Apr-Jun 2015	*	*	29	9%	*	*	273	87%	314
Jul-Sep 2015	*	*	*	*	*	*	129	91%	142

Calendar Quarter	Medicare Parts A/B/D FFS		Medicare Advantage And Part D		Other Medicare Enrolled		Not Medicare-Enrolled/ Unknown		Total
Oct-Dec 2015	*	*	*	*	*	*	101	89%	113
Jan-Mar 2016	*	*	*	*	*	*	122	100%	122
Apr-Jun 2016	*	*	*	*	*	*	46	100%	46
Total	275	4%	902	13%	158	2%	5,418	80%	6,753

Source: Participant-level data provided by USC in May 2016.
*All cell counts less than eleven have been suppressed to protect participant confidentiality
Notes: Beneficiaries in the "Medicare Parts A/B/D FFS" and the "Medicare Advantage and Part D" categories are included in the quantitative analysis in Section 3.4. "Not Medicare-Enrolled/Unknown" includes beneficiaries who were not enrolled in Medicare on the day they entered the USC program or for whom the awardee did not provide sufficient personally identifiable information to link to Medicare claims. Most beneficiaries classified as "Other Medicare Enrolled" have Medicare Part A only, although other insurance statuses (e.g., Parts A and D) are rarely observed.

Acumen investigated using Medi-Cal (Medicaid) claims data provided by the awardee to evaluate the USC program's effect on the Medi-Cal population. This data identified a large share of the non-Medicare enrolled USC participants as Medi-Cal beneficiaries. However, there were large discrepancies between the Medi-Cal claims data provided by AltaMed and claims from the Medicaid Statistical Information System (MSIS). Acumen was unable to use MSIS data alone to evaluate USC's Medi-Cal participant population because complete Medi-Cal claims data were only available from MSIS through March 31, 2013. Therefore, Acumen continued to focus its evaluation of the USC intervention on the Medicare FFS and MA populations.

To supplement the Medicare claims data analysis that focuses on health service use and medication adherence outcomes, Acumen used EHR data provided by the awardee. These EHR records included utilization data as well as variables derived from laboratory test results and other clinical indicators related to the diseases targeted by the USC intervention. Because the clinical tests reported in AltaMed's EHR data are not performed on a standardized schedule, they produce a data source that is largely incomplete, creating methodological challenges for evaluating these clinical outcomes. To address these challenges, Acumen developed a multiple imputation model, described in detail in Section 3.4.4, to impute the missing clinical values.

Although USC did not provide Acumen with a randomized control group, it did provide data on Medicare beneficiaries who received services at AltaMed clinics but were not enrolled in the HCIA MM intervention. Using a propensity score matching algorithm, Acumen constructed its comparison group from this pool of beneficiaires. The USC intervention remained relatively stable for the duration of the HCIA project. Though there were changes in the method of delivery of medication management services as described in the program description, there were no notable changes to the target population or innovation components that affected the program's evaluability.

3.4 Program Effectiveness

This section provides the findings on the impact of the USC MM intervention on mortality, inpatient readmissions, health service utilization, and medication adherence based on claims data analyses; and on intermediate clinical outcomes based on analyses of AltaMed's EHR data for Medicare beneficiaries. Using the cohort restrictions described in Section 1.2.2, and combining Medicare FFS and MA intervention beneficiaries to create a sufficient sample size, there were a total of 755 beneficiaries available for analysis in the combined intervention cohort. Applying the same restrictions, Acumen matched comparison groups to these beneficiaries using the propensity score matching model described in Section 1.2.2. Matching was performed separately for the Medicare FFS and MA intervention cohorts using Medicare claims data and awardee-provided EHR data. Appendix C.1 includes the demographic and baseline health characteristics for the intervention and matched comparison groups for both the Medicare FFS and MA cohorts and shows that the groups were well matched on all baseline traits used for matching. Since expenditure data and service use information for non-inpatient settings were not available for the MA beneficiaries, this report does not include an analysis of non-inpatient service use or medical expenditures for the combined intervention cohort.

The remainder of this section highlights key quantitative analysis findings. Single difference or DiD estimates of the program's effects are reported at the cumulative level across the full intervention period (i.e., across the nine quarters after USC program enrollment), as well as for each specific year and each specific quarter after beneficiaries' enrollment in the USC program. A detailed description of the analytic method is provided in Section 1.2.2, and definitions of outcome measures are included in Appendix A.

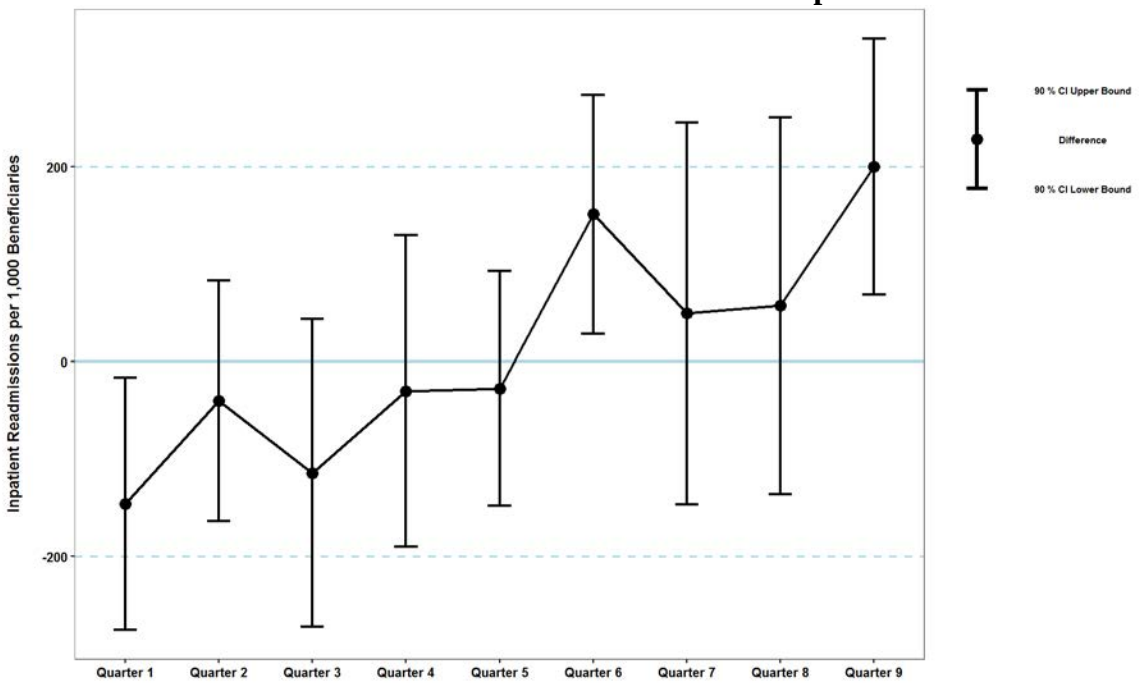
3.4.1 Mortality and Inpatient Readmissions

The USC intervention was not associated with any statistically significant changes in mortality cumulatively or in any year of the intervention (Table 3 2). The quarterly fixed effects estimates, shown in Appendix Table E 3, also do not follow a consistent pattern over time, showing insignificant increases and decreases across the intervention period, with only a statistically significant increase in the eighth quarter after enrollment.

Participation in the USC program was associated with statistically significant decreases in overall and unplanned 30-day hospital readmissions in the first year following enrollment but not cumulatively over the full examination period. (Table 3 2.) The quarterly fixed effects, detailed in Figure 3 1 suggest that the decrease in readmissions in the first year of the intervention is primarily driven by a sharp decrease in the first quarter of the intervention. However, there were estimated increases in later intervention quarters, including statistically significant readmission increases in Q6 and Q9, although the increase observed across the second

year of the intervention was not significant. Given the lack of a consistent pattern of effects, it is unlikely that the single significant Year 1 decrease reflects the true effect of the program.

Figure 3-1: Quarterly Trends in Hospital Readmissions per 1,000 Beneficiaries, USC Intervention and Control Groups



There is no evidence of a cumulative effect of the intervention on mortality or readmissions across the full examination period. However, because our analysis only includes the subset of USC participants enrolled in Medicare using available claims data, and a large portion of USC participants are actually enrolled in Medi-Cal, the findings on mortality and readmissions may not be applicable to the full USC population. Other limitations and program design factors that affect the interpretation of these results are further detailed in Section 3.4.5.

Table 3-2: Aggregate Mortality and Readmissions: Cumulative and Yearly Differences after USC Enrollment, Medicare FFS and MA Combined Cohort

Measure	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	755	755	623
Mortality			
Difference[c]	11.58	3.87	6.53
90% Confidence Interval	(-2.0 | 25.2)	(-5.7 | 13.5)	(-2.7 | 15.8)
P-Value	0.161	0.507	0.246

Measure	Full Intervention Period[a]	Year 1[b]	Year 2
30-Day Hospital Readmissions Following All Inpatient Admissions			
Difference[d]	-3.22	-15.43*	7.21
90% Confidence Interval	(-20.4 | 13.9)	(-28.6 | -2.3)	(-3.3 | 17.7)
P-Value	0.758	0.054	0.257
30-Day Hospital Unplanned Readmissions Following All Inpatient Admission			
Difference	-2.03	-15.30*	8.27
90% Confidence Interval	(-19.0 | 14.9)	(-28.3 | -2.3)	(-2.1 | 18.6)
P-Value	0.843	0.053	0.188

* Statistically significant at the ten percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.
[c]This estimate represents the difference in the number of deaths between the intervention and control groups during the relevant year in the intervention period.
[d]This estimate represents the difference in the number of beneficiaries with an inpatient readmission among beneficiaries with at least one inpatient admission, as compared between the intervention and control groups during the intervention period.

3.4.2 Health Service Resource Use

The USC intervention cohort was also not associated with any statistically significant decreases in measures of resource use, including inpatient admissions, unplanned inpatient admissions, or hospital days, compared to matched controls. The lack of statistical significance was consistent across the cumulative, yearly, and quarterly fixed effects estimates (shown in Appendix C.3).

Table 3-3: Aggregate Resource Use: Cumulative and Yearly DiD Estimates, USC Medicare FFS and MA Combined Cohort

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	755	755	623
Inpatient Admissions			
Difference-in-difference	67.55	9.38	31.12
90% Confidence Interval	(-22.2 | 157.3)	(-49.1 | 67.8)	(-14.0 | 76.3)
P-Value	0.216	0.792	0.257
Unplanned Inpatient Admissions			
Difference-in-difference	74.05	11.12	39.42
90% Confidence Interval	(-9.6 | 157.7)	(-43.6 | 65.9)	(-3.6 | 82.4)
P-Value	0.145	0.738	0.131

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
Hospital Days			
Difference-in-difference	249.53	-106.75	89.36
90% Confidence Interval	(-466.4 | 965.5)	(-531.0 | 317.5)	(-235.0 | 413.7)
P-Value	0.566	0.679	0.650

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.

3.4.3 Medication Adherence

There were no statistically significant effects of the intervention on medication adherence. Table 3-4 shows that there were small and insignificant increases in adherence for all therapeutic categories except for beta blockers. However, participants were already relatively adherent to their prescribed medications in the baseline period as shown in Appendix Table C-13, and thus the margin for observing significant improvements was limited. The DiD captures effects on mean adherence (PDC), and the mean PDC for beneficiaries already ranged from 82% to 88% prior to program enrollment depending on the therapeutic category (see Appendix Table C-13).While there were no significant effects on mean adherence, the possibility of program effects on subsets of patients with very low adherence cannot be ruled out. The small sample of participants eligible for inclusion in this analysis did not allow separate estimation for the low-adherence group, and also limited the statistical power to detect effects for the group as a whole.

Table 3-4: Medication Adherence (Proportion of Days Covered) by Medication Type, Yearly DiD Estimates, USC Medicare FFS and MA Combined Cohort

Measures	Year 1[a]	Year 2
Beta Blockers		
Number of Participants	262	113
Difference-in-Difference	-0.18	-0.17
90% Confidence Interval	(-4,4)	(-6,6)
P-Value	0.937	0.960
Calcium Channel Blockers		
Number of Participants	188	83
Difference-in-Difference	2.82	0.71
90% Confidence Interval	(-2,8)	(-7,8)
P-Value	0.350	0.875
Diabetes Medication		

Measures	Year 1[a]	Year 2
Number of Participants	178	75
Difference-in-Difference	3.26	2.98
90% Confidence Interval	(-1,7)	(-3,9)
P-Value	0.163	0.420
RAS Antagonists		
Number of Participants	457	208
Difference-in-Difference	0.22	-1.76
90% Confidence Interval	(-3,3)	(-6,2)
P-Value	0.897	0.500
Statins		
Number of Participants	441	204
Difference-in-Difference	2.06	0.46
90% Confidence Interval	(-1,5)	(-4,5)
P-Value	0.283	0.865

[a]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary.

3.4.4 Intermediate Clinical Outcomes

Given the possibility that the claims-based outcomes, evaluated in Sections 3.4.1-3.4.3, may not fully capture program effects, Acumen additionally assessed a selected set of EHR-based clinical measures, for which the program would be expected to have a more immediate impact. This section describes Acumen's approach to the analysis of intermediate clinical outcomes defined using USC's EHR data, and presents the findings from this analysis.

Outcomes

Table 3-5 below describes the measured clinical outcomes in detail, and the reason for their inclusion in the analysis. The outcomes were selected based on whether they yielded sufficient sample sizes for the analysis. Another consideration was whether the outcomes represented clinical measures that were part of USC's targeting criteria. For instance, the analysis requires a sufficient number of USC Medicare beneficiaries with hypertension, one of the program's targeted conditions, to evaluate the effect of the intervention on beneficiaries' blood pressure management.

Table 3-5: Description of Evaluated Intermediate Clinical Outcomes, USC Combined FFS and MA Cohort

Clinical Outcome	Measure Description	Reason for Inclusion
Uncontrolled Low Density Lipoprotein LDL	The rate of patients with diagnosis and treatment for disorder of the lipid metabolism with LDL greater than 100 mg/ dL	USC targets patients with uncontrolled LDL-cholesterol (LDL-C > 100 mg/ dL).
Poor Hemoglobin A1c Management	The rate of patients with diagnosis and treatment of diabetes whose Hemoglobin A1c is greater than 8.0%	USC targets patients with poor control of diabetes (hemoglobin A1c greater than 8%)
Uncontrolled Blood Pressure	The rate of patients with diagnosis and treatment for hypertension whose systolic blood pressure is greater than 140 mmHg or whose diastolic blood pressure is greater than 90 mmHg	USC targets patients with hypertension (blood pressure greater than 140/90)

Data Source

Acumen used EHR data derived from AltaMed's NextGen system provided by the awardee to evaluate intermediate clinical outcomes presented in the analysis; however, the lack of standardization in the data generation process presented significant challenges. Because the clinical tests reported in AltaMed's EHR data are not performed on a standardized schedule, they produce a data source that is largely incomplete, creating important methodological concerns. Test results are generated only if a beneficiary chooses to go to an AltaMed clinic and if a practitioner chooses to test and record the measurement. Consequently, these results are not available consistently over time for all beneficiaries. If unhealthy beneficiaries are more likely to visit clinics and be tested than healthy ones, then missing values in the data will be correlated with unobservable patient characteristics or outcomes, introducing bias in the empirical analysis.

As indicated in Table 3-6, the intervention groups generally had more measurements for the outcomes of interest, which suggests that participants have lower rates of missing data than controls, particularly for the blood pressure measure. This discrepancy may be due to more interest among program clinicians in outcomes for the treated population than for non-participants. The lack of standardization in the data generation process is problematic not only because it creates incomplete data but also because the missing values are not missing completely at random (MCAR), a term that is used to describe missing values that are uncorrelated with both observable variables in the data and with the unobservable outcome of

interest.[10] When data are not MCAR, the available data are not representative, and therefore a complete case method that relies on only the available measurements for each beneficiary is not credible. Acumen therefore developed a multiple imputation model, described in the "Analytic Approach" section below. Table 3-6 below shows the extent of non-random missing data by displaying differences in the number of values for each measure of interest between USC program participants and non-participants. The numbers in the table represent measurement counts for beneficiaries after the cohort restrictions described in the following section were applied.

Table 3-6: Average Number of Values in USC's EHR Data for Participants and Controls

Metric	LDL		Hemoglobin A1c		Blood Pressure	
	Intervention	Control	Intervention	Control	Intervention	Control
Sample Size	681	1,028	622	765	806	1,098
Average Number of Measures per Beneficiary (across the baseline and intervention period)	7.4	6.8	8.8	7.7	45.6	29.2
Average Number of Missing Quarters per Beneficiary (across the baseline and intervention period)	7.8	8.3	6.1	7.1	2.7	3.4

Analytic Approach

For all three intermediate clinical outcomes, Acumen first applied the same population restrictions that were applied to the analysis of USC's impact on the typical set of outcomes, described in Section 1.2.2. Additionally, Acumen restricted the participant and potential control populations to the relevant denominator cohort for each clinical measure. To evaluate uncontrolled LDL, the cohort was restricted to patients with a diagnosis code for a lipid metabolism disorder who were prescribed fibric acid derivatives or statins. This restriction enabled Acumen to capture the program's impact on measures of LDL through the use of cholesterol medications, since the program targeted patients with poor control of LDL-cholesterol. Since the program directly targeted patients with diabetes, the Hemoglobin A1c management measure was assessed for patients with a diabetes diagnosis who were receiving treatment for diabetes, including insulin, an insulin secretion agent, or other antidiabetics.

[10] Little, Roderick JA, and Donald B. Rubin. *Statistical analysis with missing data*. John Wiley & Sons, 2014.

Finally, for blood pressure control, Acumen limited the sample population to patients who had both a diagnosis code for a hypertensive event and who were receiving treatment for hypertension—another targeting criterion of the intervention. To adequately match beneficiaries to controls, participants and controls were also required to have at least one measurement of the relevant outcome in the baseline period.

After applying the cohort restriction criteria, Acumen identified a propensity score matched comparison group from the pool of AltaMed beneficiaries who received services from non-participating clinics. Acumen required that participants and controls were over the desired threshold for each of the three outcomes, based on USC's targeting criteria. The matching algorithm then used the Mahalanobis distance to identify the best matched intervention/control pairs using the relevant clinical measure in the baseline period. Beneficiaries were further matched on a comprehensive set of demographic and health characteristics, which can be found in Appendix C.

After identifying the set of matched controls, Acumen used a multiple imputation model to predict additional LDL, HbA1c, and blood pressure values in each quarter for intervention and control beneficiaries with missing quarters of data, based on their observed values and other demographic and health characteristics.[11] Mixed effects logistic regression was used on the imputed data sets to model the proportion of patients whose clinical measurement for cholesterol, HbA1c, or blood pressure was above the desired threshold in the baseline period and controlled in the intervention period.[12] The empirical strategy for measuring the effect of the intervention on each outcome replicates Acumen's standard analytical approach, using the propensity score matched comparison group to calculate quarterly difference estimates for each of the outcomes of interest. However, because the rates of beneficiaries who controlled their blood pressure, LDL, or HbA1c cannot be added across quarters, the "overall" estimates presented in the following section represent an average across quarters rather than a summation.

Results

There was a statistically significant overall decrease in the rate of patients with uncontrolled LDL and limited evidence of effects on Hemoglobin A1c control. However, the evidence on the program's effects on blood pressure was largely inconclusive. The overall and quarterly findings from the imputation model are presented in Table 3-7 below. Acumen also ran a complete case analysis to test the sensitivity of the results to an analysis that used only the

[11] Acumen used the R package "pan" to run the imputation model, which created several plausible imputated data sets, and the "mitools" function to aggregate the 10 regression models.
[12] The mixed effects logistic regression model adjusted for within patient correlation of observed data by adding a patient-level random intercept to the model.

existing data from the EHR and found parallel results to those presented in Table 3-7. The results of the complete case analysis can be found in Appendix C.5.

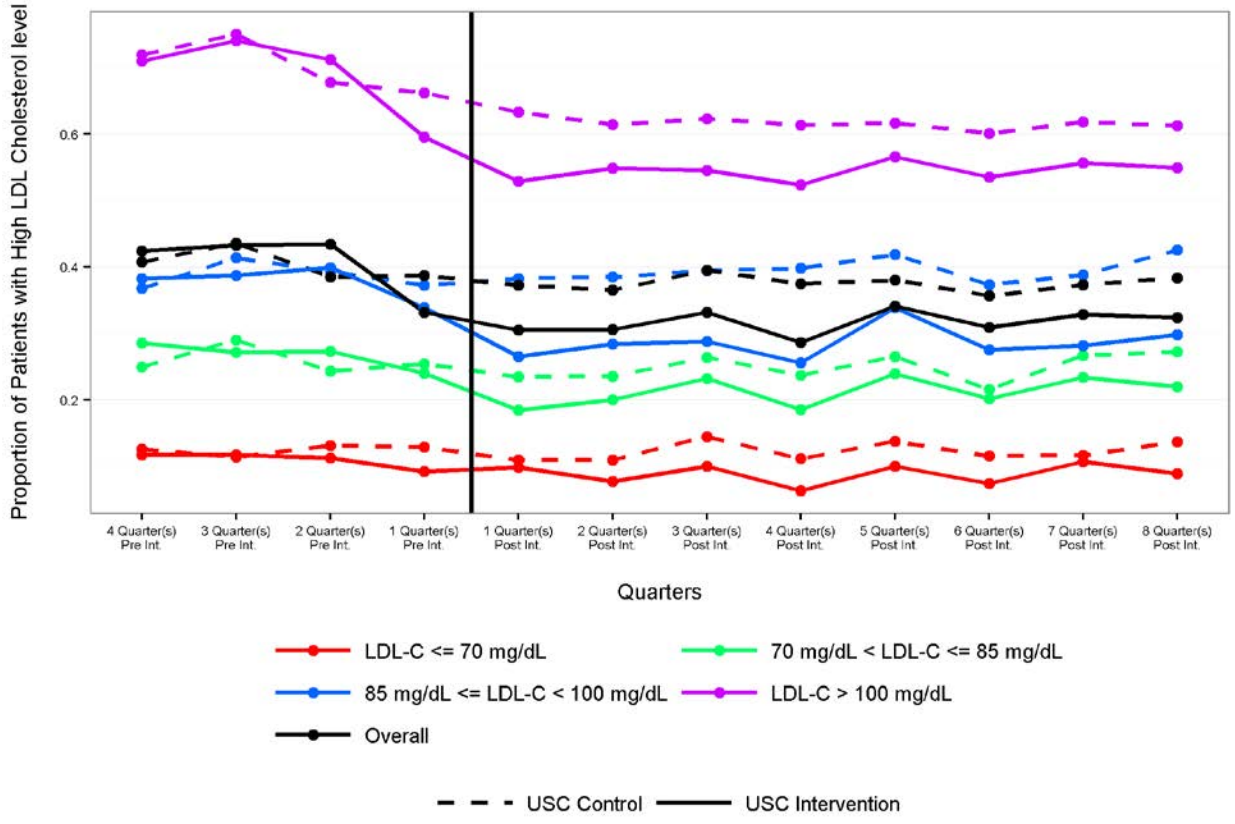
Table 3-7: Intermediate Clinical Outcomes, Quarterly Difference Estimates per 1,000 Beneficiaries, USC FFS and MA Combined Cohort

Measures	Overall[a]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Uncontrolled LDL										
Number of Participants	485	482	481	477	474	467	464	459	453	452
Difference	-83.76***	-79.09*	-106.32***	-97.24***	-70.96	-77.76***	-72.35***	-85.02***	-86.21***	-79.46**
90% Confidence Interval	(-129.78| -37.73)	(-146.54| -11.64)	(-173.84| -38.80)	(-151.70| -42.79)	(-153.25| 11.33)	(-127.16| -28.35)	(-115.35| -29.34)	(-130.52| -39.51)	(-136.91| -35.51)	(-143.66| -15.25)
P-Value	0.003	0.054	0.01	0.003	0.156	0.01	0.006	0.002	0.005	0.042
Poor Hemoglobin A1c Management										
Number of Participants	400	396	396	392	388	384	383	382	379	378
Difference	-53.03	-85.1	-93.00**	-87.54*	-79.4	-15.52	-63.06	8.74	-41.93	-10.73
90% Confidence Interval	(-123.26|17.20)	(-171.89|1.68)	(-158.10|- 27.91)	(-170.56|- 4.52)	(-166.71| 7.91)	(-121.66| 90.62)	(-139.78| 13.67)	(-101.63| 119.12)	(-120.48| 36.62)	(-129.13| 107.67)
P-Value	0.214	0.107	0.019	0.083	0.135	0.81	0.176	0.896	0.38	0.881
Uncontrolled Blood Pressure										
Number of Participants	613	608	607	605	599	592	589	586	577	573
Difference	-2	10.71	-58.50***	-35.27**	14.24	-12.74	-10.94	52.06	-2.65	38.75
90% Confidence Interval	(-27.85|23.86)	(-31.52|52.95)	(-70.14| -46.87)	(-58.93| -11.62)	(-28.34| 56.82)	(-47.36| 21.87)	(-46.17| 24.28)	(-7.01|111.13)	(-42.58| 37.28)	(-23.34| 100.84)
P-Value	0.899	0.677	<0.001	0.014	0.582	0.545	0.609	0.147	0.913	0.305

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.
[a]Results are averaged across all available quarters.

Of the intermediate clinical outcomes evaluated, the most consistent and quantitatively large decreases were observed for the uncontrolled LDL measure. On average, across the nine quarters of enrollment, the intervention was associated with a statistically significant decrease in the proportion of patients whose LDL was above the desired threshold of 100 mg/DL (uncontrolled LDL). Specifically, among the 485 patients included in the sample, there was an average overall decrease of 84 participants with uncontrolled LDL per 1,000 beneficiaries relative to controls. Figure 3-2 shows the proportion of intervention and comparison group beneficiaries with uncontrolled LDL cholesterol in the pre and post-intervention period, stratified by their baseline levels of LDL. As expected, it shows greater declines in the proportion of participants with uncontrolled LDL among the subgroups with high levels of LDL cholesterol in the baseline, relative to controls.

Figure 3-2: Rate of Patients with Uncontrolled LDL Cholesterol per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort

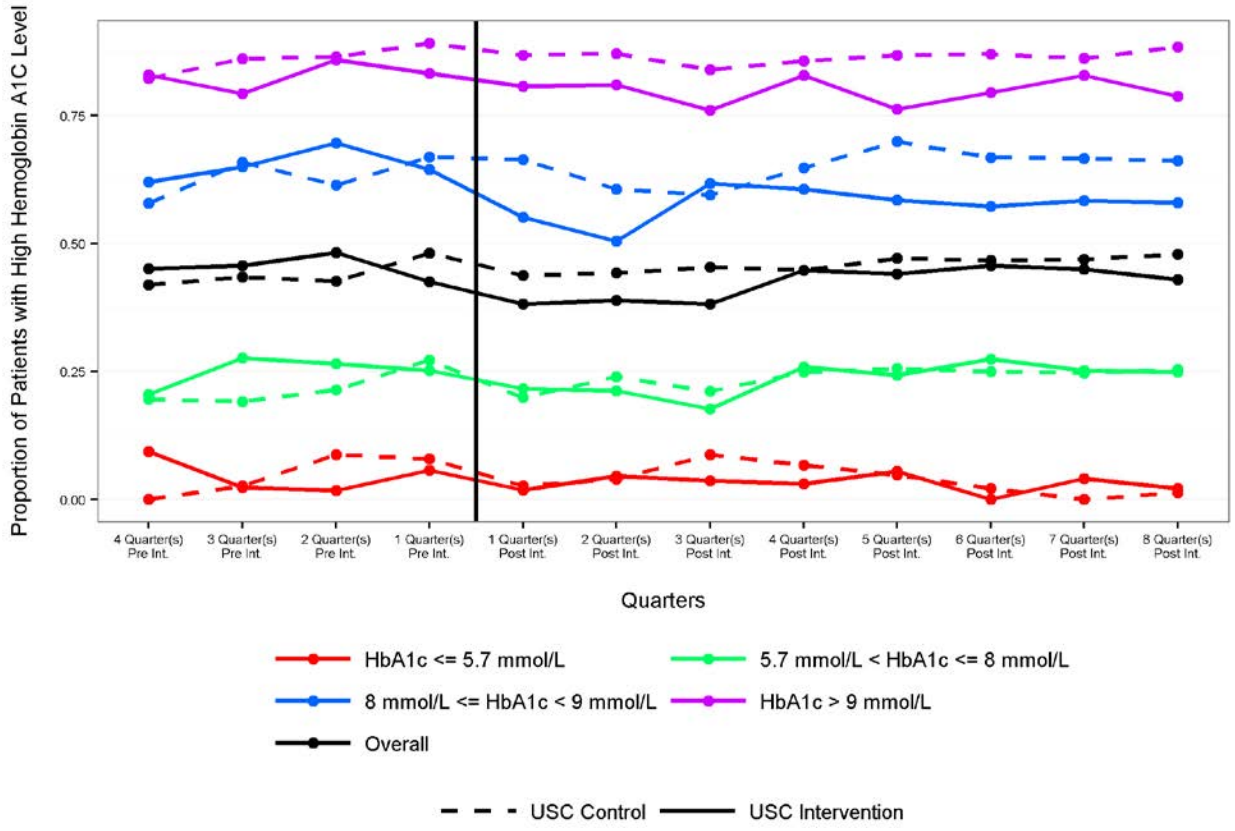


Among the diabetic patients included in the analysis, there was limited evidence of program effects on control of hemoglobin A1c. The average DiD estimate across the nine quarters of the post-intervention period was not statistically significant; however, the sample

consists of only 400 patients after cohort restrictions were applied. Quarterly point estimates do show a consistent trend of decreases in poor control among participants relative to controls. In both Q2 and Q3, there were significant decreases at the 5% and 10% level, respectively, of 93 and 87 beneficiaries with poorly controlled HbA1c per thousand.

Figure 3-3 compares the rate of beneficiaries with poorly controlled hemoglobin A1c among participants and controls in the pre and post-intervention period, stratified by baseline hemoglobin A1c levels. Particularly among the two cohorts with the highest baseline hemoglobin A1c (above 9 mmol/L and between 8 and 9 mmol/L), the proportion of patients with poor control decreased among the participant groups relative to controls in the post-intervention period.

Figure 3-3: Rate of Patients with Poorly Controlled Hemoglobin A1c per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort

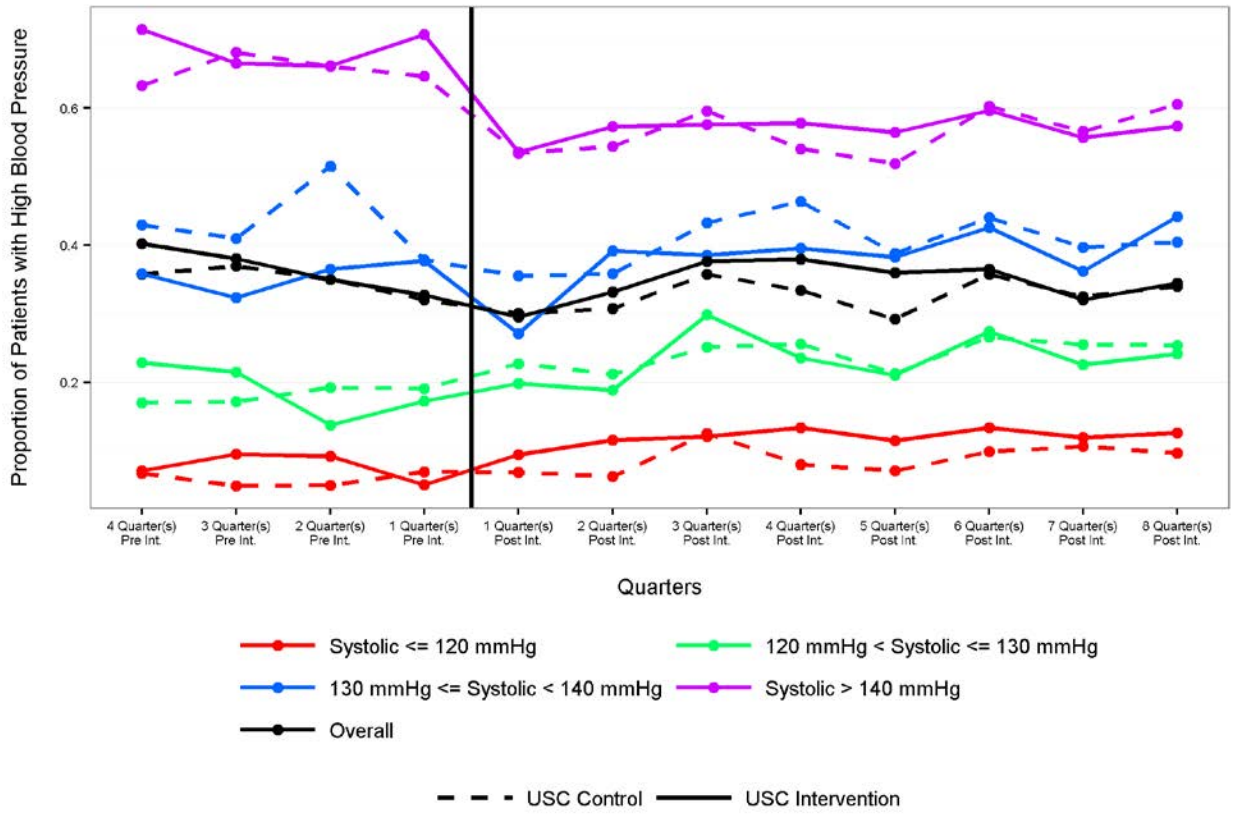


Finally, among the 613 beneficiaries with hypertension who met the cohort restrictions for the blood pressure measure, the intervention was not associated with a statistically significant average change in systolic or diastolic blood pressure relative to controls across the nine quarters following enrollment. There were statistically significant decreases in beneficiaries with

uncontrolled blood pressure in Q2 and Q3, amounting to 59 and 35 beneficiaries per thousand, respectively; however, Table 3-7 above shows that the magnitude and direction of effects varied by quarter across the examination period. Because most beneficiaries' diastolic blood pressure was below the threshold across the examination period, observed effects are likely driven by systolic blood pressure estimates.

Figure 3-4 Figure 3-4: Rate of Patients with Uncontrolled Blood Pressure per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort compares the proportion of participants and controls whose systolic blood pressure was above the desired threshold of 140 mmHg across the pre- and post-intervention period. While there is some evidence that the intervention may have affected blood pressure management among patients who had the highest systolic blood pressure during the baseline period, it is likely that these impacts were driven by a regression to the mean and baseline differences rather than program effects. Participants with hypertension, and particularly those with the highest blood pressure in the baseline period, tended to exhibit a spike in blood pressure in the quarter prior to enrollment in the intervention. Though Acumen's model accounted for this phenomenon by requiring beneficiaries to have a blood pressure measurement in that quarter and matching participants to controls based on that measurement, participants in the highest stratification still tended to have higher systolic blood pressure than controls in the highest stratification. Therefore, the observed effects can likely be attributed to baseline differences.

Figure 3-4: Rate of Patients with Uncontrolled Blood Pressure per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort



3.4.5 Discussion of Results

Although Acumen was largely unable to detect any conclusive findings on claims based outcomes, these findings must be interpreted in the context of the sample size, cohort characteristics and potential heterogeneity of effects that is not captured by our DiD estimates. First, the limited number of participants eligible for the analysis—755 for mortality and resource use outcomes and 457 or fewer for medication adherence outcomes—may not have been enough to detect statistical significance in the outcomes of interest. Second, the participants who were eligible for the analysis include only the subset of USC participants enrolled in Medicare, while the vast majority of participants were enrolled in Medi-Cal. Third, the analysis uses a combined cohort of FFS and MA beneficiaries that may have underlying differences in health trajectories and behaviors. As a result, the lack of significant findings may not be generalizable to the full USC population. It is also possible that the impacts of the intervention were concentrated in certain subpopulations at the tails of the measure distribution, whereas the DiD estimates of our evaluation only measure the effects of the population on the average. Finally, given the

significant findings observed on intermediate clinical outcomes in the analysis of EHR data, it's reasonable that downstream effects on mortality, health service use, and expenditure measures may not be detectable in the nine-quarter evaluation period.

Despite evidence suggesting that the USC program had some effect on intermediate clinical outcomes, and particularly LDL control, Acumen cannot rule out the possibility that these effects may be attributed to unobservable differences between participants and controls. Although Acumen incorporated an extensive set of predictive variables observable in claims and EHR data and matched on baseline levels of the outcome in question, it is possible that participants were on a different health trajectory than controls, regardless of the intervention. Given that beneficiaries were often selected into the intervention based on provider discretion, Acumen did not have access to the same information that USC used in selecting program participants. Therefore, Acumen's matching model cannot control for all selection factors used in enrolling participants. Consequently, the estimated decreases in these clinical intermediate outcomes may be due to differences in unobservable characteristics affecting health trajectories, rather than to program effects.

3.5 Implementation Effectiveness

To successfully implement the USC innovation, program leaders reported that provider acceptance of and engagement with the pharmacy teams was critical. USC found that patients were most likely to enroll in the program when they were referred by a primary care provider, so having primary care providers endorse the program through warm handoffs to the pharmacy team was critical for program implementation. USC reported that certain strategies were useful for increasing provider referrals and buy-in in the program, including (i) educating primary care providers about clinical pharmacy services in advance of program roll out, (ii) gaining provider buy-in on disease-specific protocols and listening to their recommendations, (iii) having pharmacists communicate with providers in person early in the clinical decision process to demonstrate competence and establish trust, (iv) using positive feedback from participating providers and patients to obtain buy-in from additional providers, (v) highlighting the potential of the pharmacy team to contribute to improvements on quality indicators, and (vi) emphasizing that the innovation increases primary care provider productivity, thus allowing providers to have larger patient caseloads.

Program leaders additionally reported that having bilingual pharmacy technicians was critical to successful implementation of the intervention. USC's clinical pharmacy technicians spoke both English and Spanish, which was reported as essential given that the majority of the patients served spoke Spanish as their first language. USC recruited only bilingual pharmacy

technicians since the technician role was designed to include enhanced patient care, communication, and navigation responsibilities.

Another key factor that affected program implementation was the volume of pharmacists' caseload, which tended to vary by the patient population served. Given the high demand for clinical pharmacy services, pharmacists reported some difficulty managing their patient caseloads, which often delayed patient visits (e.g., scheduling visits every three to four weeks instead of every two weeks as designed). Also, pharmacists reported that the high-risk elderly patients at the Program of All-Inclusive Care for the Elderly (PACE) program clinic sites (which were added in Year 2 of implementation) took more time and resources to educate and treat. Program leaders used floating pharmacy teams to alleviate the caseloads at some of the high-volume clinics, and pharmacists noted that they could increase productivity by seeing up to twice the number of patients when they had support from the full pharmacy team (a pharmacy technician, a pharmacy resident, and a medical assistant) as opposed to working independently. Program leaders noted that an average caseload of roughly 300 to 500 patients per site was sustainable for the in-person pharmacy team model, depending on the characteristics of the patient population. USC reported that it had smaller caseloads for the telepharmacy-only program due to smaller clinical staff and more visits per enrollee.

Program leaders found that technological challenges inhibited the intervention's transition to a telepharmacy-based model. Information technology problems delayed and disrupted the expansion of the telehealth program to additional clinic locations. USC attempted unsuccessfully to implement two established technology solutions – Cisco and Blue Jeans. The Cisco telehealth units experienced issues with configuration and overheating, and AltaMed experienced connectivity issues with Blue Jeans. After prolonged inability to resolve these issues, program leaders decided to eventually switch to a simpler technology involving a computer and web camera to deliver telepharmacy services. Despite these challenges, USC was able to implement the telepharmacy program at all five planned AltaMed locations, and according to program leaders, preliminary analyses suggest that providing clinical pharmacy services via video is as effective as in-person.

Finally, USC found that an automated appointment reminder through AltaMed plus a phone call from a pharmacy technician was the best approach to increasing patient attendance at appointments. USC tried different approaches for scheduling telepharmacy visits (e.g., scheduling single appointments every 30 minutes, double-booking patients for 45 minute time slots) and found that all resulted in the same efficiency and visit volume.

3.6 Workforce

One factor that was imperative to creating a sustainable workforce was the integration of clinical pharmacy skills into pharmacy and pharmacy technician training. USC emphasized the need to train pharmacy and pharmacy technician students to provide clinical pharmacy services. USC initiated "co-training" with three pharmacy technician schools, which was designed to prepare graduates for work in the clinical pharmacy team model. Clinical pharmacy residents indicated that training was instrumental in preparing them for the clinical pharmacist role and exposing them to different clinical settings.

Turnover of other health care team members, such as physicians, care coordinators, and medical assistants, at some AltaMed clinics was another factor that affected implementation of the innovation. According to program leaders, turnover within these positions is common in safety net clinics, particularly for medical assistants. AltaMed noted that there are shortages of well-qualified medical assistants, which is a general workforce issue external to AltaMed. Since medical assistants provided logistical support to the clinical pharmacy technicians, high rates of medical assistant turnover hindered implementation and team efficiency. Turnover among these health care team members also negatively impacted implementation of the pharmacy team model because these team members needed time to become familiar with the pharmacy team and build relationships. In some cases, AltaMed was able to assign existing clinic office administrative staff to provide temporary support to the pharmacy team, but program leaders noted that the high turnover continued to impact the continuity and effectiveness of the program.

3.7 Context

Program leaders reported that collaborative practice agreements between pharmacists and primary care providers were critical to implementation of the innovation. California law permits pharmacists to modify medication therapy according to institution-specific protocols (or collaborative practice agreements). As part of the HCIA grant, USC and AltaMed implemented these agreements, which allow pharmacists involved in the innovation to change patients' medications according to AltaMed clinical protocols without prior physician approval. According to program staff and primary care providers, the collaborative practice agreements in place between pharmacists and primary care providers were appropriate in scope, increased workforce productivity, and were critical to delivering program services efficiently.

Additionally, program leaders reported that AltaMed's existing patient-centered medical home team-based care model facilitated acceptance of USC's HCIA pharmacy team innovation. AltaMed clinics were concurrently implementing a broader team-based care model during the HCIA implementation period which helped foster acceptance of the USC pharmacy team innovation by other providers. This broader model promoted comprehensive, high quality care

through the patient-centered medical home concept. AltaMed leaders indicated that physician training in team-based care models and their influence on other physician peers may have facilitated physician buy-in of the program. Even with this foundational team-based model, trust between providers and the pharmacy team took time to build.

Finally, EHR infrastructure was an important component for communication and documentation for the pharmacy teams involved in the USC HCIA innovation. In addition to serving as a tool for identifying patients, AltaMed's system-wide EHR also served as a critical communication tool for the pharmacy teams. The pharmacy teams relied on the EHR system to communicate internally and with primary care providers and other staff in AltaMed clinics. For example, pharmacy team members would document the outcomes of outreach and clinical-focused telephone calls in the EHR. Pharmacists could also relay medication changes and the reasons for adjustments. The EHR also had built-in modules that were developed specifically for the innovation to help guide pharmacy team interactions with patients. The EHR enabled numerous process efficiencies that facilitated the overall implementation of the model.

3.8 Sustainability and Spread

Prior to the conclusion of the HCIA grant, USC worked with AltaMed program leaders to submit a budget proposal to AltaMed's Board of Directors to continue the HCIA innovation model using pharmacy teams consisting of only a pharmacist and technician. In April 2015, AltaMed's Board of Directors decided not to approve the budget for this model. Instead, the Board approved a budget for a substantially modified model that uses pharmacists and pharmacy technicians, along with mid-level providers, such as physician assistants and nurse practitioners. AltaMed opted to use more mid-level providers, who have the ability to autonomously bill insurance providers for their services, instead of pharmacists, who are not recognized as autonomous providers and cannot bill. This decision was largely driven by financial considerations associated with the predominant fee-for-service arrangements that AltaMed has with public and private payers. Program leaders speculated that budget approval would have been more likely in a capitated and/or value-based payment arrangement. The modified model targets the same disease states and uses almost identical clinical collaborative practice agreements and protocols as those used for the HCIA innovation.

As of June 2016, the modified model described above using mid-level providers along with pharmacists and pharmacy technicians was still in operation at AltaMed. AltaMed reported that all the sites that participated in the HCIA award continued some version of the program – either the modified AltaMed model or USC's telepharmacy program. Following the conclusion of USC's telepharmacy program in April 2016, AltaMed telepharmacy sites began transitioning to AltaMed's modified in-person model, but leadership reported that at least one of the sites will

use a Skype-enabled telepharmacy version of the program. AltaMed leaders report that the modified model is managing roughly the same number of patients as the pharmacy teams did under the HCIA grant. The mid-level providers involved in delivering services under the modified care model are billing for their services. As of June 2016, the AltaMed program was approaching a break-even point as revenues generated through billing for services began to offset labor and operation costs associated with the program. AltaMed leaders also decided to decrease staffing of the model by one mid-level provider to reduce costs. AltaMed leaders reported the primary factor contributing to the continued revenue shortfall was a patient no-show rate of 34 percent. AltaMed leaders did report that visit volume per provider was slowly increasing and that they may potentially expand staff and the number of sites once there are more improvements in visit volume and no-show rates across the program.

USC has undertaken other efforts to spread its innovation model. It developed an online training module to prepare pharmacists for providing clinical pharmacy services and worked with the Indian Pharmacists Association (IPA) to pilot test the training module among retail pharmacies. As of June 2016, USC was still collaborating with IPA and reported also partnering with the California Society of Health System Pharmacists to offer the training to members, as well as a clinical examination process that will confirm comprehension of essential medication management competencies. Additionally, USC is working with community pharmacists on pay-for-performance programs, planning a learning collaborative focused on best practices in delivery and sustainment of comprehensive medication management programs, creating a USC web portal with open access to tools and links that support successful clinical pharmacy practice, and submitting an AHRQ grant proposal to provide comprehensive medication management for patients receiving behavioral health services that are co-located with primary care clinics. Finally, USC reported that it is implementing a similar clinical pharmacy model in conjunction with Los Angeles County + USC Medical Center, using approaches to identify and track high-risk patients similar to those used for the HCIA grant.

Program leaders believe the USC program is scalable and customizable to many disease states and patient populations, but they, along with other program staff, reported that a key factor limiting scalability is that the federal government and many states do not recognize pharmacists as health care providers. These policies make it difficult for health plans/insurers to pay for clinical pharmacy services, since pharmacists cannot receive direct reimbursement for pharmacy services. Though California does recognize pharmacists as providers, it does not permit pharmacists to receive direct reimbursement for pharmacy services.

4 EVALUATION OF THE HEARTSTRONG HEALTH CARE INNOVATION AWARD

This section provides summative evaluation findings for the Trustees of the University of Pennsylvania's (UPenn) HeartStrong innovation, reflecting results through August 2016 unless noted otherwise. Section 4.1 provides a high-level overview of the key findings from the HeartStrong evaluation detailed in the remainder of the chapter. Section 4.2 describes the HeartStrong program, while Section 4.3 discusses the evaluability of the program focusing on sample size and payer mix issues. Sections 4.4, 4.5, 4.6, and 4.7 discuss, respectively, key findings on the evaluation categories of implementation effectiveness, workforce, context, factoring affecting the program's sustainability and spread. Acumen does not evaluate HeartStrong's program effectiveness in this report as Acumen did not have data on a sufficient number of participants for a credible quantitative analysis.

4.1 Key Findings

The HeartStrong program aimed to improve patient adherence to cardioprotective medication in the year after acute myocardial infarction (AMI) through a simple, low-resource innovation consisting of automated and person-based reminders, financial incentives, and follow up from HeartStrong staff members who helped to address any adherence issues. HeartStrong found adherence rates were positively influenced by medication reminders along with having an adherence partner (i.e., a friend or family member). Additional findings from HeartStrong suggest that using an "opt-out" enrollment approach can increase patient enrollment and that financial incentives have the potential to positively influence medication adherence. Though HeartStrong was a discrete, proof-of-concept study, the program has demonstrated its scalability on a national level, successfully expanding the program to 45 states.

4.2 Program Description

The HeartStrong innovation provided patients who had been recently hospitalized for AMI with automated and person-based medication reminder systems, as well as financial incentives to motivate medication adherence. The goal of the HeartStrong program was to improve patient adherence to cardioprotective medications with the aim of minimizing cardiovascular events and reducing unnecessary health care service utilization. Eligible participants, who were primarily commercial insurance and some Medicare beneficiaries, were identified via insurance partner claims data indicating patients that have been diagnosed with AMI and discharged from the hospital with a length of stay between one and 180 days. Eligible patients were then contacted through recruitment mailings sent weekly. The program targeted patients who were prescribed two or more of the following types of medications: aspirin, beta

blocker, platelet blocker, or statin. Insurers scanned discharge diagnosis codes and submitted the data to HeartStrong. HeartStrong staff members then reviewed and cleaned the claims data to identify eligible patients, and sent them invitations to participate in the program. Patients who chose to participate in the program would then receive Vitality GlowCap pill bottles for each of the four targeted medications/medication classes. Alternatively, patients also had the option to receive pill bottles organized by time of day (i.e., AM and PM) instead of receiving separate pill bottles for each of the four targeted medication classes. The bottles were programmed to provide an audio and visual alert to remind patients when to take their medications and send a signal back to HeartStrong's electronic portal whenever the patient opens them.

Patients who adhered to their medications by opening their GlowCap pill bottles were entered into a lottery to receive incentive payments. Patients had a 1-in-10 chance of winning $5 or a 1-in-100 chance of winning $50 for each day they were adherent. Patients who did not adhere to their medications received follow-up interventions that escalated as the number of non-adherent days increased. Interventions began with automated text, email or interactive voice response (IVR) alerts to patients and escalated to alerts to an identified friend/family member, followed by phone calls, mailed letters, and contact with the patient's physician if non-adherence persisted. Additionally, program advisors (research coordinators and social workers) followed up with patients who had not taken their medications within four days to help address adherence issues, including challenges related to care coordination, behavioral health, and cost of medications/copayments. Patients were referred for additional social work follow-up as needed.

HeartStrong was an entirely new project that launched on March 22, 2013. Participants who enrolled in the program received the services listed above for one year. At the end of the one-year period, participants were transitioned off the program and no longer received the automated or person-based alerts. The final participant completed involvement in the HeartStrong program on January 5, 2016, and HeartStrong's HCIA award concluded on June 30, 2016.

While the primary target population of the innovation remained consistent throughout the HCIA implementation period, the program expanded its geographic reach, extended the enrollment period for eligible patients, and implemented additional follow-up processes. Project leaders had initially proposed to limit participation to patients discharged from New Jersey hospitals or hospitals within the University of Pennsylvania Health System. Due to the regional and national presence of their insurance partners (and the remote monitoring features of the innovation), UPenn expanded the geographic reach of the innovation, enrolling patients in 45 different states where their insurance partners' beneficiaries resided. UPenn also increased the timeframe during which patients were enrolled after hospital discharge from 45 to 60 days, since

program leaders felt the time required to identify patients through insurance claims and submit this information to UPenn was causing them to omit some patients. Program advisors also implemented additional follow up interventions for patients who either stopped using their GlowCaps or initially agreed to enroll in the program but did not set up their GlowCap devices. This follow up consisted of a combination of phone calls and letters.

4.3 Evaluability

This section provides information on the primary factors affecting the evaluability of HeartStrong, including intervention group data availability, program enrollment size and payer mix, and comparison group data availability.

Table 4-1 presents detailed information on the program's enrollment and payer mix on the HeartStrong program provided directly by the awardee in April 2015. HeartStrong's intervention randomly assigned eligible individuals to intervention and control groups. Because the awardee combined beneficiaries in the two groups in the enrollment and payer mix data they provided to Acumen, the enrollment counts in the table represent beneficiaries in both the intervention and control groups. HeartStrong ended enrollment in December 2014, meeting its enrollment target of 1,500, including intervention and control beneficiaries. A majority of the beneficiaries were enrolled in commercial payer insurance programs, and the low enrollment of Medicare beneficiaries precluded Acumen from conducting a quantitative analysis of the Medicare population using Medicare data alone. HeartStrong provided data on medical and prescription drug claims for program participants and non-participating controls enrolled in commercial payer programs in late July 2016. Though these data were not received in time to conduct a quantitative analysis for this report, Acumen plans to conduct a quantitative analysis on the HeartStrong program to be included in the Report Addendum due to CMS in early 2017.

Table 4-1: Payer Mix of HeartStrong Program Enrollment (Intervention and Control Group Beneficiaries) by Calendar Quarter

Calendar Quarter	Program Enrollees								Total
	Medicare Parts A and B FFS		Medicare Advantage		Medicaid		Commercial		
Jan-Mar 2013	*	*	*	*	*	*	*	*	*
Apr-Jun 2013	*	*	*	*	*	*	20	56%	36
Jul-Sep 2013	*	*	*	*	*	*	89	67%	133
Oct-Dec 2013	*	*	*	*	*	*	151	80%	189
Jan-Mar 2014	*	*	*	*	*	*	157	68%	231
Apr-Jun 2014	*	*	*	*	*	*	134	51%	261
Jul-Sep 2014	*	*	146	48%	*	*	*	*	304

Calendar Quarter	Program Enrollees								Total
	Medicare Parts A and B FFS		Medicare Advantage		Medicaid		Commercial		
Oct-Dec 2014	*	*	169	49%	*	*	163	47%	346
Cumulative Total	37	2%	586	39%	20	1%	858	57%	1,501

Source: Enrollment and payer mix data provided by HeartStrong in April 2015.
*All cell counts less than eleven have been suppressed to protect participant confidentiality

4.4 Implementation Effectiveness

HeartStrong leaders reported that the rapidly changing technological landscape led to challenges in implementing the program. Though HeartStrong used the GlowCaps devices throughout its HCIA implementation period, these devices are now no longer available because the 2G network on which the devices operated was retired. UPenn's Center for Health Incentives and Behavioral Economics (CHIBE), which implemented the HeartStrong program, is currently testing alternative devices that could potentially be incorporated in future remote medication management programs. Program leaders reported that MedSignals, which was tested as part of HeartStrong's alternative device experiment, worked well when participants had landlines, but was more challenging to deploy on a cellular 3G network due to configuration and SIM card issues. Given ongoing issues with MedSignals' service and available inventory, UPenn does not think it is a feasible option and will not use it for future studies. UPenn is currently using CleverCap and AdhereTech electronic pill bottles in other CHIBE studies. These devices appear to be reliable, and CHIBE is currently conducting cost effectiveness analyses.

Program leaders found that incorporating adequate technology support is critical for an innovation that relies primarily on a technological component for implementation. An important success factor was having a dedicated, internal web developer, who understood the programming code and structure of the databases and websites used to manage HeartStrong, execute information technology system improvements. Program leaders noted that integrating the GlowCaps devices with HeartStrong's Way to Health platform (the system used to monitor adherence and run the patient lotteries) was an ongoing process that required substantial time and resources.

Program leaders found that using an opt-in enrollment approach presented a challenge to patient enrollment, and found that switching to an opt-out approach significantly improved enrollment rates**.** Under the HCIA grant intervention, patients were required to opt in to receive GlowCap bottles, which may have limited program participation. HeartStrong ran a separate experiment that involved directly mailing all eligible patients the GlowCap bottles, and requiring patients to opt out of the intervention. HeartStrong reported that enrollment rates were

significantly higher for participants in the opt-out program, and medication adherence rates were similar among participants in the opt-in and opt-out programs.

An experiment conducted by HeartStrong suggested that financial incentives have the potential to positively influence medication adherence. As another planned facet of the opt-out experiment, HeartStrong removed the daily lottery incentive for opt-out participants after three months of participation to evaluate the impact of the incentive on adherence rates. They found that adherence rates declined in the opt-out group following the elimination of the incentive. Program leaders thus suggested that financial incentives could have a positive effect on medication adherence.

Inaccurate or incomplete beneficiary contact information from insurers posed a challenge for patient enrollment into the HeartStrong program. HeartStrong had difficulty recruiting patients due to incomplete contact information, particularly phone numbers, for a substantial proportion of eligible participants. HeartStrong improved its process for finding patient contact information through the use of a fee-based web searching service, Intelius, to increase patient enrollment.

Ultimately, although HeartStrong successfully met its enrollment target, it struggled during the early phase of the implementation to recruit participants, and, program leaders reported that recruiting a sufficient number of participants required taking a multi-pronged approach. HeartStrong reported that the following strategies helped to boost program enrollment: using a tracking mechanism on recruitment mailings, which helps program advisors gauge when to time outreach calls; co-branding recruitment letters with insurer partners; having program advisors adjust their schedules to make patient recruitment calls during different times of the day, including evenings and weekends; designating one program advisor to monitor the patient recruitment call queue and assign calls to program advisors; and adding promotional materials (brochures, magnet pads, bracelets, and pens) to encourage eligible patients to open the mailed recruitment materials.

Program leaders identified cognitive function screening of eligible participants prior to enrollment as a potentially effective component of a remote medication management intervention like HeartStrong that serves many older adults. In early December 2014, the HeartStrong team implemented a screening tool for eligible patients over 75 to ensure that they had the cognitive function to understand the program and give informed consent to participate in the program; however, the tool was not widely used, since implementation coincided with the end of new patient recruitment in mid-December 2014. According to program leaders, the tool, which was administered to patients by program advisors via phone during the enrollment

process, was effective, and the program would have benefited from using the tool since the start of the program. Program leaders strongly recommended using this type of tool for future iterations of the program, especially since the interactions between program advisors and patients were primarily by phone, limiting the ability to assess cognitive deficits through in-person observation.

Finally, leaders reported that medication reminders along with "social influence" lead to high rates of medication adherence. HeartStrong conducted a "social influence" study to learn whether involving adherence partners (i.e., friends and family members) in the program is an effective way to improve adherence. The study involved a 4-arm analysis: Arm 1) Social support partner, Arm 2) Medication reminder, Arm 3) Social support partner and medication reminder, Arm 4) Usual care. Results show that participants with a social support partner and medication reminder (Arm 3) had the highest adherence of all 4 groups, followed by participants with a medication reminder only (Arm 2). The study also found that recruiting friends and family via automated methods (i.e., email) is not as effective as telephone outreach.

4.5 Workforce

In implementing the HeartStrong program, leaders found that it was important to have role clarity for new staff positions. The program advisor role, which was performed by both social workers and research coordinators, was created specifically for HeartStrong. While the program advisors who were research assistants reported that project leadership was effective with matching their skills to tasks and maximizing their strengths within the program advisor role, the program advisors who were social workers expressed some initial lack of clarity about their roles. They believe this stemmed from a general lack of understanding about the skills and expertise of social workers. Since these roles and responsibilities were not initially well defined, teamwork was hindered; however, teamwork improved over time as roles became clearer, which included social workers focusing more on addressing adherence issues and intervening with participants who were referred for additional social work follow up versus participant recruitment and monitoring. HeartStrong noted that using an organizational chart was helpful in clarifying roles and team structure.

Additionally, ongoing training specifically tailored to the program was very helpful to staff. Staff received initial one-time training on patient engagement techniques and specific medical issues, such as AMI, but program staff reported that ongoing training specific to the program was the most helpful. For example, the program conducted two in-house coaching sessions during which program advisors made mock calls, listened to recordings of the calls, and received feedback. Also, HeartStrong implemented weekly "social worker rounds" that provided

the program advisors with opportunities to discuss challenges or themes that arose from recruitment calls and participant case management.

4.6 Context

One of the challenges that the HeartStrong program leaders faced was incorporating insurer partnerships into the program. Although insurers were receptive to partnerships with HeartStrong, contractual agreements and data transfer requirements with the insurers required significant HeartStrong program staff time, and was ultimately a very time- and resource-intensive process. In some cases, HeartStrong leveraged the leadership of an advisory board consisting of University of Pennsylvania Health System and insurance partner senior leaders to help shepherd and expedite contractual agreements. While HeartStrong used GlowCaps pill bottles to provide automated reminders and track adherence through its HCIA implementation, these devices are no longer available as of January 2016. Beyond the HCIA grant, UPenn is currently testing alternative devices (CleverCap and AdhereTech) that could potentially be incorporated in future medication management programs.

4.7 Sustainability and Spread

The HeartStrong project was a discrete, proof-of-concept study, but program leaders designed the innovation with scalability in mind and made the innovation components simple, low-touch, and low-intensity, while leveraging existing technology. Further, HeartStrong demonstrated the ability to scale the program on a national level since it was able to successfully expand the program to 45 states. Program leaders indicated that the program may be easily scalable when implemented through a hospital (i.e., as part of the discharge plan) or insurance company with existing patient relationships, which would reduce the amount of effort required to recruit patients. UPenn's priority is to publish results from the innovation, and UPenn believes this approach will bring broad awareness of the innovation and contribute to its replication in other settings.

5 EVALUATION OF THE PHARMACY SOCIETY OF WISCONSIN HEALTH CARE INNOVATION AWARD

This section provides summative evaluation findings for the Pharmacy Society of Wisconsin (PSW) innovation, reflecting new analytic results through August 2016, unless noted otherwise. Section 5.1 provides an overview of the key findings detailed in the remainder of the chapter. Section 5.2 describes PSW's innovation components and Section 5.3 summarizes the primary factors affecting program evaluability. Section 5.4 summarizes new quantitative analytic methods and provides findings on program effects. Sections 5.5, 5.6, and 5.7 highlight, respectively, findings on implementation effectiveness, workforce, and context. Finally, Section 5.8 describes the sustainability and spread of the PSW program after the end of the HCIA project.

5.1 Key Findings

The PSW HCIA innovation focused on spreading a standardized medication therapy management (MTM) model that was successful on a regional basis prior to the HCIA award across the state of Wisconsin. PSW built a network of pharmacies and pharmacy staff who provided an expanded set of services to help beneficiaries of partner insurers effectively manage their medications. To participate in the innovation, pharmacies registered, underwent a rigorous accreditation process, and agreed to train and certify at least one pharmacist to deliver MTM services. The PSW innovation relied on staff members who were hired under HCIA to provide assistance to pharmacies with implementing the MTM model, and on a health information technology solution that supported the identification, documentation, reporting, and billing processes necessary to deliver MTM services. However, the program experienced significant hurdles with implementing the health technology solution, and as a result the targeting criteria initially set by PSW were not consistently implemented.

PSW found that fitting MTM services, particularly in-person comprehensive medication reviews, into pharmacist workflow was a common challenge among pharmacies that participated in the innovation. However, according to PSW, pharmacists who had dedicated time to deliver MTM services and who had adequate support from pharmacy technicians were better suited to overcome this challenge. PSW also learned that usual care providers are highly influential in beneficiary acceptance of MTM services and that a significant proportion of individuals declined MTM services due to lack of interest. Following the conclusion of the HCIA award, PSW continues to support the network of payers and pharmacies in delivering MTM services, though it has scaled back and discontinued a number of support structures that it developed under HCIA.

In the quantitative analysis of program effects, PSW was associated with a cumulative decrease in mortality and cumulative increases in readmissions and physician and ancillary

expenditures, but these estimated effects cannot be credibly attributed to the intervention as they more likely reflect issues specific to the PSW program design. The inconsistent implementation of beneficiary targeting criteria, described in Section 5.3, required an analysis approach that defined the intervention cohort based on the accreditation status of a given pharmacy and the patient population served by the pharmacy after accreditation. Details of this analysis, which was designed to capture all beneficiaries who may have received the PSW intervention, are presented in Section 5.4.1. This methodology, however, remains subject to limitations as pharmacies participating in the program may differ systematically from control pharmacies on variables not observed in available data.

5.2 Program Description

The implementation of the PSW Wisconsin Pharmacy Quality Collaborative (WPQC) innovation under the HCIA grant launched on March 27, 2013 and concluded on June 30, 2015. The WPQC program, which used a standardized MTM model, was launched as a pilot program in the south-central region of Wisconsin in 2008, and thus was in operation on a smaller scale prior to the HCIA award. The purpose of the WPQC program was to enable community pharmacists and pharmacy technicians to provide an expanded set of services to help beneficiaries effectively manage their medications. The WPQC program relied on a network of pharmacies and contracted health plans to help expand and standardize the MTM model. As part of the HCIA grant, PSW expanded the WPQC network of pharmacies and payers across the state of Wisconsin.

To participate in the WPQC program, pharmacies became WPQC members through a registration and accreditation process. This process involved meeting rigorous standards, including training and certification of at least one of the pharmacy's pharmacists, to deliver MTM services. PSW also allowed for certification of pharmacy technicians and students in the WPQC program to deliver services, though this was not a requirement for pharmacy participation. When a pharmacy registered to become an accredited WPQC member, it completed a good faith agreement stating that the pharmacy would be compliant with meeting and upholding the quality expectations of WPQC over the next six months, which involved demonstrating compliance with quality-based best practices and developing and maintaining policies and procedures that supported the provision of WPQC MTM services. Additionally, each pharmacy completed a quality assurance survey twice a year to ensure it was meeting WPQC best practice criteria as a condition of ongoing participation. When a pharmacist registered to participate, he/she was required to obtain certification by completing an 11-hour online training program that covered the programmatic details of WPQC; policy and procedures of the program; the quality assurance survey process; an overview of program criteria; clinical

content; and simulations and case studies for beneficiary assessment and health literacy. Pharmacy technicians received a modified 5-hour training that did not include clinical, assessment, and case study content. Pharmacy students at clerkship experiential sites received a one-hour training webinar covering the basic tenets of the WPQC program and completed a modified online training program. Continuing education credits were awarded for pharmacists and technicians.

Certified pharmacists, with support from technicians and students in some cases, delivered two levels of WPQC MTM services: Level 1 (L1) and Level 2 (L2). L1 (intervention-based) services were provided during medication dispensing (point-of-sale) and included: (i) review of cost effectiveness of medications and identification of opportunities to change the dose, dosage form, or duration of therapy; (ii) consultation and education to improve beneficiary adherence; (iii) consultation on any device associated with a medication; and (iv) review of opportunities to add or delete medications based on clinical guidelines, indication, or other reason as determined by the pharmacist. For WI DHS beneficiaries only, pharmacies could provide L1 services without being accredited. L2 services consisted of a more in-depth comprehensive medication review and assessment (CMR/A) provided on an appointment basis (typically lasting about 60 minutes) followed by up to three 30- to 45-minute pharmacist visits annually. L2 services included: (i) identification, resolution, and prevention of medication-related problems; (ii) assessment of beneficiary's health status; (iii) formulation of a medication treatment plan; (iv) in-depth education and training on adherence and appropriate medication use; (v) provision of a personal medical record and medication action plan following each encounter; and (vi) follow-up medication reviews to monitor and evaluate beneficiary response to therapy.

Delivery of L1 and L2 services was supported by a health information technology solution known as the Aprexis™ system, which was implemented as part of the HCIA grant. Certified pharmacists used the Aprexis system to identify eligible patients (discussed in-depth below), for decision support, to document MTM interventions, to generate reports to primary care providers/prescribers, and to bill participating payers for L1 and L2 services. Regional Implementation Specialists (RISs), pharmacists who were hired under HCIA to assist pharmacies with implementing the WPQC program, also supported accredited pharmacies. Finally, the WPQC program was guided by a steering committee comprised of health plan representatives; pharmacists representing chain, health system, and independent community pharmacies; the University of Wisconsin School of Pharmacy; PSW staff; and the Wisconsin Medical Society. The steering committee met monthly via phone and quarterly in person to discuss program utilization, challenges, and strategies, and to provide guidance for ongoing work.

For the HCIA project, the WPQC program aimed to use criteria developed by PSW to target Wisconsin Department of Health Services (WI DHS) and partnering commercial insurance plan beneficiaries who had at least one of the following conditions: diabetes, heart failure, asthma, and geriatric syndromes[13]. A representative from an accredited pharmacy (i.e., a pharmacist, pharmacy technician, or pharmacy student) contacted eligible beneficiaries to enroll them in the program. Beneficiaries could be eligible for multiple L1 services, L2 services, or both, since the program used separate sets of criteria to identify beneficiaries eligible for L1 and L2 services for each targeted condition.

Certified pharmacists relied on multiple approaches to identify beneficiaries who were eligible for the program. The first was through periodic review of lists of beneficiaries identified through an automatic "push" via the Aprexis system, which utilized claims-based targeting criteria developed by PSW. Though this Aprexis system push process was used for commercial insurer beneficiaries starting in spring 2013, it was unavailable for the WI DHS beneficiary population until November 2014. Before the Aprexis system was available for WI DHS beneficiaries, pharmacists conducted periodic reviews of a list of eligible beneficiaries provided by WI DHS to accredited pharmacies on a one-time basis in March 2013, which was not generated using the PSW targeting criteria. Eligible beneficiaries were also identified through additional methods, known as "pulls," which did not necessarily rely on the targeting criteria or use of the Aprexis system. These pull methods included (i) identification of eligible beneficiaries at the dispensing pharmacy or during United Way of Dane County community events based on pharmacists' clinical discretion and general WPQC program eligibility requirements; (ii) physician and health system referrals to the program; and (iii) point-of-dispensing alerts (e.g., formulary, refill too soon, and three-month supply) generated by WI DHS and sent by the pharmacy product dispensing system, which were separate from the Aprexis system and provided to pharmacies prior to the HCIA implementation.

During HCIA grant implementation, PSW did not make any significant changes to the core components of the MTM services delivered as part of the WPQC program or the training, certification, and accreditation process; however, as noted, during the HCIA grant period, PSW did implement the RIS role and the Aprexis system.

[13] Geriatric syndromes are related to medications that may be contraindicated for older beneficiaries (age 65 or older).

5.3 Evaluability

This section summarizes the primary factors affecting the evaluability of PSW's WPQC program, which include program enrollment and payer mix, program implementation factors, and comparison group data availability.

The enrollment and payer mix figures for beneficiaries of WI DHS health insurance plans who received PSW MTM services from October 2012 (HCIA program launch) through June 2015 are presented in Table 5-1. These figures were calculated using data provided by WI DHS linked to Acumen's in-house Medicare data and only include beneficiaries who had WI DHS claims containing procedure codes for MTM services rendered by a WPQC certified pharmacy or if the WI Provider Portal MTM data and Aprexis-based MTM data identified them as such. Table 5-1 shows that a majority of these beneficiaries were only enrolled in WI DHS health insurance plans while 26 percent were dually enrolled in WI DHS health insurance plans and Medicare, which is consistent with PSW's program description under the HCIA award. Thus, the quantitative analyses presented in this report primarily focuses on the WI DHS beneficiary population.

Table 5-1: Payer Mix of PSW Program Enrollment by Calendar Quarter

Calendar Quarter	Enrolled in WI DHS Health Benefit Plans Only		Enrolled in WI DHS Health Plans, and Medicare Parts A, B, and D		Enrolled in WI DHS Health Plans, and Medicare Advantage and Part D		Enrolled in WI DHS Health Plans and Other Medicare		Total
Oct-Dec 2012	308	68%	*	*	*	*	105	23%	451
Jan-Mar 2013	1,633	77%	*	*	*	*	322	15%	2,111
Apr-Jun 2013	2,143	78%	107	4%	92	3%	392	14%	2734
Jul-Sep 2013	1,841	71%	126	5%	92	4%	533	21%	2,592
Oct-Dec 2013	1,835	71%	113	4%	88	3%	554	21%	2,590
Jan-Mar 2014	2,309	69%	222	7%	144	4%	669	20%	3,344
Apr-Jun 2014	3,268	74%	192	4%	144	3%	793	18%	4,397
Jul-Sep 2014	3,175	76%	198	5%	150	4%	675	16%	4,198
Oct-Dec 2014	2,445	75%	188	6%	229	7%	384	12%	3,246
Jan-Mar 2015	2,927	79%	215	6%	157	4%	417	11%	3,716
Apr-Jun 2015	2,763	74%	337	9%	182	5%	444	12%	3,726
Total	24,647	74%	1,838	6%	1,332	4%	5,288	16%	33,105

Notes: "Enrolled in WI DHS Health Plans and Other Medicare" includes beneficiaries enrolled in Part A only, Part B only, and/or Part D only in addition to WI DHS Health Plans.
"Enrolled in WI DHS Health Benefit Plans Only" includes WI DHS health plan beneficiaries who were not enrolled in Medicare on the day they entered the PSW program or for whom the awardee did not provide sufficient personally identifiable information to link to Medicare claims.

The enrollment count includes WI DHS health plan beneficiaries who received PSW MTM services between October 2012 (HCIA launch) and June 30, 2015. Acumen used beneficiary-level WI DHS data linked to Acumen's in-house Medicare data to assess Medicare enrollment status.
*All cell counts less than eleven have been suppressed to protect participant confidentiality

Several program design issues may affect the analysis presented in this report. As one of the methods of patient selection, the PSW program intended to utilize claims-based targeting algorithms focused on four medical conditions (hypertension, diabetes, congestive heart failure, and geriatric syndromes), and have the Aprexis system automatically send the list of targeted WI DHS beneficiaries to participating pharmacies. Originally, Acumen planned to use these targeting criteria to match an appropriate control group. However, from self-monitoring reports and communications with program leaders, Acumen learned there was inconsistent implementation of these targeting criteria.[14] Due to Aprexis system implementation delays and challenges with implementing some of the claims-based targeting criteria, participating pharmacies relied more heavily on PSW's "pull" method that selected patients based on pharmacist discretion, clinician referral, or point-of-dispensing alerts (e.g., untimely refills) that did not necessarily focus on the four conditions but considered broader program targeting criteria including health literacy and care coordination issues. Because these broader criteria are not observable in PSW program data or WI DHS claims data, an analysis that compares individuals who received the PSW MTM services (participants) to non-participants matched using available data would suffer from selection bias. Due to this limitation, and because training provided under the program to pharmacists in participating pharmacies may have had spillover effects on other beneficiaries receiving services from the pharmacies, Acumen developed a different analysis design than the one used for other MM awardee analyses. Acumen did not rely on PSW's targeting criteria focused on the four conditions and instead defined the intervention cohort as beneficiaries who filled a prescription or "visited" an accredited pharmacy after the date of accreditation, regardless of whether they received an MTM service. Acumen constructed the control cohort from beneficiaries who visited non-accredited pharmacies. These beneficiaries were matched on beneficiary-level as well as pharmacy-level characteristics. Additional information on intervention and control group selection is detailed in Section 5.4.1.2.

This analytic design, however, remains subject to limitations. Specifically, the PSW program was not designed to randomize pharmacies for accreditation with WPQC. In addition, PSW program leaders were not able to provide characteristics of pharmacies who were accredited through WPQC to match to control pharmacies.

[14] PSW's self-monitoring reports and narrative progress reports, through June 30, 2015, available on the Lewin Group website

5.4 Program Effectiveness

This section describes the methods and data sources used for the evaluation of the PSW MM intervention and presents the findings on the impact of the PSW MM intervention on mortality, inpatient readmissions, health service utilization, medical expenditures, and medication adherence for WI DHS beneficiaries using cumulative, yearly and quarterly estimates.

5.4.1 Methods and Data Sources

As detailed in Section 5.2, the PSW program implemented a standardized MTM model across Wisconsin to provide eligible beneficiaries with a range of medication management services through accreditation of participating pharmacies, the training and certification of pharmacists, and the use of the Aprexis HIT system. The intended implementation of the program identified beneficiaries eligible for PSW interventions through a "push" via the Aprexis system, using the targeting criteria; beneficiaries could also be identified via a manual "pull" that does not necessarily rely on the targeting criteria or the use of the Aprexis system.

Acumen previously created an intervention cohort identifying individual beneficiaries of WI DHS health plans who received PSW MTM services from participating PSW pharmacies, using WI DHS MTM claims codes. Acumen then used a propensity score matching method to identify a comparison group of control beneficiaries who did not receive MTM services from PSW pharmacies. Because beneficiaries participating in the intervention are likely to be systematically different from non-participants, this original analysis aimed to match intervention beneficiaries to a comparison group of beneficiaries who met the targeting criteria outlined by PSW, among other demographic and baseline health characteristics. However, Acumen found that a substantial proportion of intervention group beneficiaries did not meet the PSW targeting criteria.

Based on self-monitoring reports submitted by PSW, and communications with program leaders, Acumen learned that delays in Aprexis system implementation and challenges in identifying WI DHS patients eligible for adherence services (due to lack of continuous health plan eligibility) hindered the identification of patients based on claims-based algorithms in the Aprexis system. This introduces unobservable confounders and creates significant challenges to conducting a credible evaluation under an analysis plan that utilizes claims-based program targeting criteria to identify the appropriate control beneficiaries. Since a significant portion of the participants were selected into the program based on criteria that are unobservable in available data, an analysis that compares participants to non-participants matched using claims data will suffer from selection bias. Acumen thus utilized an alternative analytic approach to evaluate PSW program effects, described in the following sections.

5.4.1.1. Data Sources

The Acumen team received WI DHS data files from WI DHS' contractor, Hewlett Packard (HP), on a quarterly basis. These files included MTM intervention data, as well as WI DHS heath plan eligibility, enrollment and claims data on all WI DHS beneficiaries from January 1, 2011 to June 3, 2016. For the duration of their HCIA award period, PSW program leaders also sent Acumen a monthly list of accredited pharmacies that were active with WPQC. This monthly list included pharmacies' national provider identification (NPI), accreditation and withdrawal dates.

5.4.1.2. Intervention Group and Comparison Group Selection

Beneficiary selection into the intervention group or control group for the analysis depended on the accreditation status of a given pharmacy and occurred in three steps. First, to be considered for the intervention group or potential control population, a beneficiary must have been enrolled in a WI DHS health plan with a prescription drug benefit ("WI DHS plan with Rx") during the relevant period. Second, non-accredited pharmacies were assigned a pseudo-accreditation date. Pseudo-accreditation dates were sampled randomly from the list of actual accreditation dates of accredited pharmacies that were of the same size and type.[15] Third, a beneficiary's first filled prescription after a given pharmacy's accreditation or pseudo-accreditation date defined the "index date" for that beneficiary. Index dates must occur within one month after the accreditation or pseudo-accreditation date. Furthermore, index dates should not occur after the HCIA program end date (June 30, 2015). Beneficiaries with an inpatient stay on their index date were excluded. For beneficiaries with multiple index dates, Acumen only considered the earliest index date for cohort assignment. If a beneficiary's earliest index date occurred for a fill at an accredited pharmacy after the pharmacy's accreditation date, the beneficiary was selected into the intervention group. If a beneficiary's earliest index date occurred for a fill at a non-accredited pharmacy after the pharmacy's pseudo-accreditation date, the beneficiary was selected into the potential control population. Subsequent pharmacy visits after a beneficiary's earliest index date may occur at accredited or non-accredited pharmacies.

Finally, WI DHS health plan enrollment restrictions were applied to both groups. Beneficiaries in both the intervention group and potential control population were required to be continuously enrolled in a WI DHS plan with Rx for at least one year prior to their index date through a given quarter of interest after the index date. This method for defining the intervention and control groups helps address the issue of selection bias, because beneficiaries' assignment to the intervention population is not determined based on pharmacists' discretion, but whether or

[15] Pharmacy size was based on the average monthly number of served beneficiaries on a WI DHS plan with Rx. Pharmacy type was based on the pharmacy's primary taxonomy code from the National Plan & Provider Enumeration System (NPPES).

not beneficiaries visited an accredited pharmacy. Furthermore, potential spillover effects of the intervention, which may occur due to pharmacists utilizing the training received from the WPQC certification process to address the needs of non-targeted WI DHS beneficiaries, are captured with this definition.

There were a total of 38,381 beneficiaries in the intervention group available for analysis after applying these restrictions. As shown in Appendix D.1, the intervention cohort largely consisted of beneficiaries who were younger than age 65 (98%).

The final control group was created by matching beneficiaries from the potential control population to the intervention group. A propensity score matching method, described in Section 1.2.2, incorporated beneficiary-level characteristics such as age, sex, race, and health status indicators and pharmacy-level characteristics such as pharmacy size and the quarterly rate of inpatient stays among WI DHS plan with Rx beneficiaries for a given pharmacy (see Appendix D.1).[16] Exact matching was performed on certain drug generic product identifiers (GPI) (e.g., antiasthmatic, mental health prescriptions, and dermatological prescriptions) for beneficiaries under 18 years of age because a large proportion of younger intervention beneficiaries used prescription drugs under these GPI categories. An exact matching was applied for pharmacy type (e.g., institutional pharmacy, long term care pharmacy), which was defined by the NPPES primary taxonomy code. As shown in Appendix D.1, the intervention and comparison groups were well matched on important predictive characteristics.

5.4.1.3. Analytic Method

Acumen calculated the usual set of outcomes produced for the evaluation of HCIA MM programs and compared the intervention and matched control cohorts using a single difference or differences-in-differences (DiD) approach. This approach is described in detail in Section 1.2.2.

The remainder of this section highlights key quantitative findings for PSW. Sections 5.4.2, 5.4.3, 5.4.4, and 5.4.5 highlight notable results for mortality and inpatient readmissions, resource use, medical expenditures, and medication adherence, respectively. Non-inpatient resource use data were not available for the WI DHS beneficiaries, and therefore, not presented in our findings. Single difference or DiD estimates are used to describe differences between the intervention and control groups, before and after the intervention at the cumulative level across the full intervention period, as well as for each specific year and each specific quarter after beneficiaries' index dates. Complete results of our analyses are provided in Appendix D.

[16] Acumen considered a matching process that matched on characteristics of the beneficiary population associated with accredited and non-accredited pharmacies, but determined that performing matching on specific beneficiaries visiting accredited and non-accredited pharmacies would lead to a broader population of controls available for the analysis.

5.4.2 Mortality and Inpatient Readmissions

As shown in Table 5-2, PSW was associated with a cumulative statistically significant decrease in mortality over the full intervention period (six quarters following index date). Among 38,381 intervention beneficiaries, there were 50 fewer deaths (1.46 fewer deaths per 1,000 beneficiaries) across the six quarters after program enrollment relative to controls, and this difference was statistically significant at the 10 percent level. In the quarterly fixed effects analysis, non-significant decreases were generally observed.

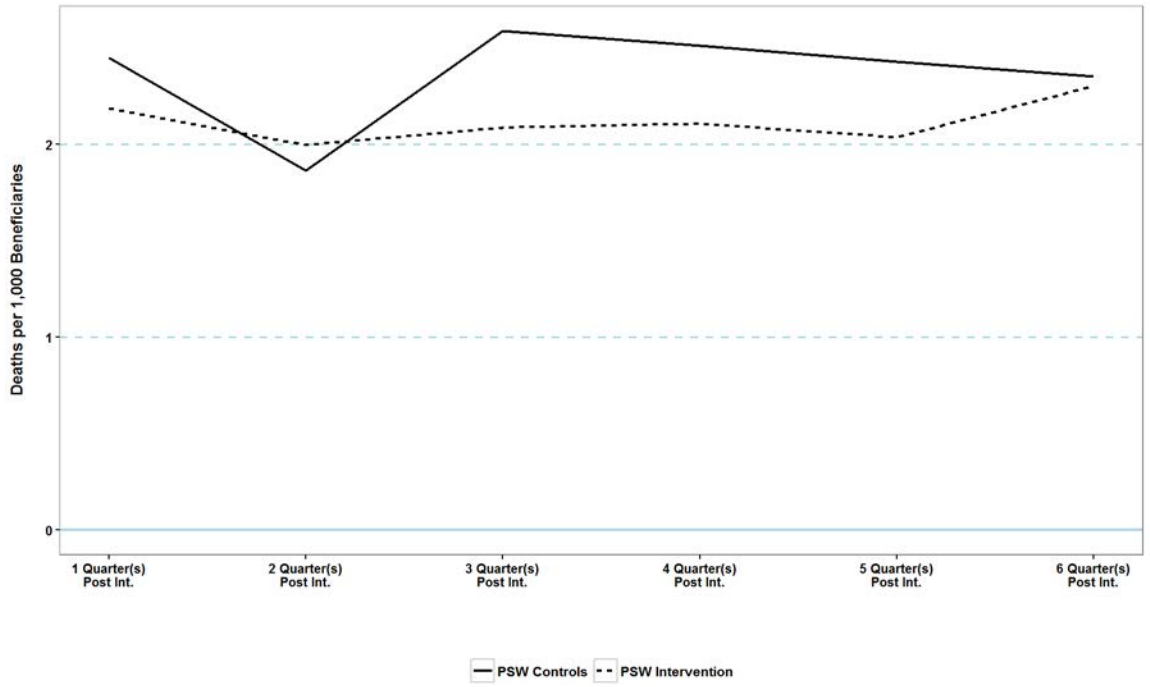
However, the observed decrease in mortality is unlikely to be due to the intervention, as it is not driven by a noticeable downward trend in death rates among the intervention group. As Figure 5-1 below shows, the control group has high mortality in Q1, which dips in Q2 and increases again in Q3. In contrast, the mortality rate for the intervention group is fairly stable over time. Thus, the estimated drop in mortality may be the result of unobserved pre-enrollment differences between the intervention and control groups that resulted in different health status trajectories between the two groups. Section 5.4.6 below describes in detail how program design issues limited the analysis design.

Table 5-2: Aggregate Mortality: Cumulative and Yearly Differences after PSW Enrollment, WI DHS Cohort

Measures	Full Intervention Period[a]	Year 1[b]
Number of Participants	38,381	38,381
Mortality		
Difference[c]	-49.66*	-35.88
90% Confidence Interval	(-99.3 | 0.0)	(-77.2 | 5.5)
P-Value	0.100	0.153

* Statistically significant at the ten percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program.
[c]This estimate represents difference in the number of deaths between participants and controls during the intervention period.

Figure 5-1: Quarterly Trends in Mortality Per 1,000 Beneficiaries, PSW Intervention and Control Groups



Increases in inpatient readmissions were statistically significant cumulatively over the full intervention period and in Year 1. As Table 5-3 shows, among the intervention population of 38,381 WI DHS beneficiaries, there were increases of 97 beneficiaries with an inpatient readmission (74 beneficiaries with an inpatient readmission per 1,000 beneficiaries with at least one admission) across the full intervention period. However, there is no reasonable mechanism through which the program is expected to increase readmissions. It is more plausible that these effects were related to unobserved pre-enrollment differences between the intervention and control groups, as discussed further in Section 5.4.6 below.

Table 5-3: Aggregate Inpatient Readmissions: Cumulative and Yearly Differences after PSW Enrollment, WI DHS Cohort

Measures	Full Intervention Period[a]	Year 1[b]
Number of Participants	38,381	38,381
30-Day Hospital Readmissions Following All Inpatient Admissions		
Difference[c]	96.58**	79.13**
90% Confidence Interval	(22.4 | 170.7)	(16.0 | 142.3)
P-Value	0.032	0.039
30-Day Hospital Unplanned Readmissions Following All Inpatient Admissions		

Measures	Full Intervention Period[a]	Year 1[b]
Difference	91.60**	71.51*
90% Confidence Interval	(19.4 | 163.8)	(9.8 | 133.2)
P-Value	0.037	0.057

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program.
[c]The estimate represents the difference in the number of beneficiaries with at least one readmission among beneficiaries who had an inpatient admission, as compared between the intervention and control groups during the relevant year in the intervention period.

5.4.3 Health Service Resource Use

Cumulative and yearly estimated effects of the PSW intervention on health service resource utilization in the inpatient setting were not statistically significant for WI DHS beneficiaries. Non-significant increases were observed cumulatively and in Year 1 after program enrollment. There were also generally non-significant increases observed in the quarterly analysis in the six quarters after enrollment.

Table 5-4: Aggregate Resource Use: Cumulative and Yearly DiD Estimates after PSW Enrollment, WI DHS Cohort

Measures	Full Intervention Period[a]	Year 1[b]
Number of Participants	38,381	38,381
Inpatient Admissions		
Difference-in-Difference	208.86	233.27
90% Confidence Interval	(-291.6 | 709.3)	(-151.9 | 618.4)
P-Value	0.492	0.319
Unplanned Inpatient Admissions		
Difference-in-Difference	128.90	203.44
90% Confidence Interval	(-347.0 | 604.8)	(-162.7 | 569.5)
P-Value	0.656	0.361
Hospital Days		
Difference-in-Difference	564.36	122.71
90% Confidence Interval	(-3,793.8 | 4,922.5)	(-3,258.5 | 3,503.9)
P-Value	0.831	0.952

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program.

5.4.4 Medical Expenditures

The PSW intervention was associated with a statistically significant cumulative increase in physician and ancillary service expenditures, and with no change in other medical expenditure categories (see Table 5-5). The quarterly fixed effects analysis did not find any significant increases, across any expenditure category, in the six quarters after enrollment.

Table 5-5: Aggregate Expenditures: Cumulative and Yearly DiD Estimates after PSW Enrollment, WI DHS Cohort

Measures (2011 USD per Beneficiary-Quarter)	Full Intervention Period	Year 1
Number of Participants	38,381	38,381
Total Medical and Drug Expenditures		
Difference-in-Difference	5,177,925	5,762,727
90% Confidence Interval	(-5,603,987 | 15,959,837)	(-2,718,245 | 14,243,699)
P-Value	0.430	0.264
Total Medical Expenditures		
Difference-in-Difference	6,471,426	7,020,699
90% Confidence Interval	(-2,548,449.0 | 15,491,302)	(-100,129.3 | 14,141,527)
P-Value	0.238	0.105
Inpatient Expenditures		
Difference-in-Difference	1,406,038	3,848,779
90% Confidence Interval	(-5,854,873 | 8,666,948)	(-1,958,475 | 9,656,032)
P-Value	0.750	0.276
Total Outpatient Expenditures		
Difference-in-Difference	683,634	600,831
90% Confidence Interval	(-696,003.1 | 2,063,271)	(-454,137.2 | 1,655,799)
P-Value	0.415	0.349
Physician and Ancillary Service Expenditures		
Difference-in-Difference	2,166,688*	1,329,278
90% Confidence Interval	(76,167.1 | 4,257,209)	(-272,049.3 | 2,930,605)
P-Value	0.088	0.172
Home Health Expenditures		
Difference-in-Difference	2,215,067	1,241,811
90% Confidence Interval	(-388,491.4 | 4,818,624)	(-744,377.7 | 3,228,001)
P-Value	0.162	0.304

* Statistically significant at the ten percent level.

[a]Results are cumulative across all available quarters.

[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program.

5.4.5 Medication Adherence

As shown in Table 5-6, the PSW intervention was not associated with cumulative statistically significant changes in medication adherence for any of the five selected therapeutic drug classes in the first year following program enrollment. There were small, non-significant decreases in medication adherence for all therapeutic classes except for statins, which showed a non-significant increase. However, the sample size available for analysis, ranging from 508 to 1,173 intervention beneficiaries depending on the therapeutic category, may not have been sufficient to detect these small effects.

Table 5-6: Medication Adherence (Proportion of Days Covered) by Medication Type: Yearly DiD Estimates after PSW Enrollment, WI DHS Cohort

Measures	Year 1[a]
Beta Blockers	
Number of Participants	799
Difference-in-Difference	-0.5
90% Confidence Interval	(-3,2)
P-Value	0.772
Calcium Channel Blockers	
Number of Participants	508
Difference-in-Difference	-0.64
90% Confidence Interval	(-4,3)
P-Value	0.759
Diabetes Medication	
Number of Participants	581
Difference-in-Difference	-0.49
90% Confidence Interval	(-4,3)
P-Value	0.815
RAS Antagonists	
Number of Participants	1,173
Difference-in-Difference	-0.87
90% Confidence Interval	(-3,1)
P-Value	0.529
Statins	
Number of Participants	1,004
Difference-in-Difference	0.16
90% Confidence Interval	(-2,3)
P-Value	0.915

[a]Year 1 refers to the one-year period after a beneficiary's enrollment in the program.

5.4.6 Discussion of Results

As discussed in Section 5.3, estimated effects of the PSW program on beneficiary outcomes, including decreases in mortality and increases in inpatient readmissions, are likely affected by the limitations of a nonrandomized program design. The inconsistent implementation of beneficiary targeting criteria and non-random selection of pharmacies into the PSW program created additional limitations to Acumen's study design, and renders estimated effects less credible than they would have been otherwise.

Pharmacies who participated in the PSW intervention and received training for their pharmacists to improve medication management services may be systematically different from non-participating pharmacies. Participating pharmacies likely have different patient population needs and characteristics, organizational characteristics, and internal resources for quality improvements than non-participating pharmacies. These differences may influence outcomes for their beneficiaries, but they are unobservable in the data used for the evaluation. It is possible, for example, that pharmacies with complex patient populations were more inclined to participate in the program to address their patients' needs while increasing the scope of their services, and these differences were not observed in the data. Because complex patients are already on a trajectory to receive increased health services over time, the analysis comparing patient populations served by participating pharmacies to those served by other pharmacies may have shown larger increases in certain health service use measures for the intervention population. The increase in readmissions observed for participants relative to controls also likely reflects this bias as there is no clear mechanism through which the program would be expected to increase readmissions.

Further, as described in Section 5.2, the PSW program existed prior to the HCIA award period, so the minimal changes made during HCIA implementation, including the intermittent implementation of the Aprexis system to identify eligible patients and deliver MM services, allows for minimal margin for potential improvements that can be captured by our analyses. As a result, actual effects are likely dwarfed by the influence of selection bias issues discussed above on the DiD estimates.

5.5 Implementation Effectiveness

Delays in implementation of automatic notifications of eligible beneficiaries by the Aprexis system led to a large proportion of beneficiaries being identified by pharmacists through the pull process. PSW was unable to implement automatic pushes of eligible WI DHS beneficiaries through the Aprexis system until November 2014 due to delays resulting from the WI DHS vendor approval process. Thus, MTM services were primarily delivered to WI DHS beneficiaries who were identified as eligible for the program by various methods defined in

Section 5.2. Even after automatic pushes through the Aprexis system were implemented, pharmacists only used pushes to identify eligible beneficiaries in a small number of cases during the HCIA implementation period. Specifically, adherence pushes for the targeted disease states were unable to be implemented given the lack of continuous enrollment of WI DHS beneficiaries.

Pharmacist review of pushed recommendations was a necessary process step. PSW found that pharmacists rejected about 30 percent of the L1 pushes that they reviewed. By far, the most common reason for rejection of an L1 push was that the beneficiary was "not in need of intervention." This finding suggested that having a process for a pharmacist to review the push was an important process step to ensure that MTM services were provided to appropriate individuals.

Pharmacies that delivered many MTM services relied on pulls more than pushes. Relative to low-volume pharmacies, PSW observed that a greater proportion of MTM interventions (particularly L2 services) completed by high-volume pharmacies were the products of pulls rather than pushes. According to PSW, these high-volume pharmacies are accustomed to providing significant numbers of MTM services and have fully-operationalized MTM workflows. High-volume pharmacies also view every beneficiary as a potential MTM opportunity and thus provide many services as pulls versus relying on pushes to identify which beneficiaries to target and what interventions to provide.

Accredited pharmacies benefited from specialized MTM program implementation support. According to PSW, pharmacies that want to provide MTM services may lack the understanding or experience to effectively implement an MTM program. To address this, PSW hired RISs under HCIA to provide tailored implementation support to accredited pharmacies. The RISs conducted site visits to each pharmacy in their region about twice per year and communicated regularly with each pharmacy via email, phone, or in person. RISs provided individualized pharmacy and pharmacy staff training as needed and helped to identify and solve problems within pharmacy workflows to efficiently deliver the WPQC program. All RISs were pharmacists who had previous pharmacy experience, which increased their credibility among certified pharmacists and helped them troubleshoot implementation challenges. Certified pharmacists and pharmacy staff overwhelmingly emphasized the importance of the RISs' support in helping them implement the program.

A significant proportion of eligible beneficiaries declined MTM services. PSW found that about 30 percent of the L1 pushes and roughly half of the L2 pushes that were approved by pharmacists were not ultimately accepted by eligible beneficiaries. The most common reason beneficiaries communicated for refusing these services was "not interested." Other common

reasons were "may consider in future" and "relies on primary provider for guidance." According to PSW, this suggests that additional beneficiary education about the value of MTM services and the pharmacist's role in providing them is needed. PSW reported the strategies that seemed to be effective for improving beneficiary uptake of MTM services include (i) dovetailing L2 services with medication pickups or, in the case of health system pharmacists, scheduling L2 visits immediately before or after a clinic visit or lab work; (ii) personalizing invitations to demonstrate care and understanding of the beneficiary's health opportunities; (iii) implementing home visits for L2 services, which was done by one pharmacy organization that serves a large WI DHS population in the Milwaukee area; (iv) using clear and jargon-free language with beneficiaries; and (v) using an "opt out" approach for scheduling L2 services, in which follow-up visits are scheduled for beneficiaries unless they explicitly decline. Additionally, focus groups conducted by PSW program leaders and WI DHS revealed that WI DHS beneficiaries who had strong relationships with pharmacists were more likely to accept L2 services.

Other healthcare providers were highly influential in beneficiary acceptance of MTM services. PSW found that if a beneficiary's usual care provider expresses support for or provides a referral to an MTM service, the beneficiary is more likely to accept the service. As a result, PSW pursued opportunities to develop stronger relationships with providers in an effort to increase beneficiary acceptance of MTM services. PSW collaborated with a local health system on a pilot program that coordinated the transition of care communications from an inpatient unit of a health system to the beneficiary's home pharmacy, which was well-received. PSW encouraged accredited pharmacies to contact local physicians or physician groups and educate them about the WPQC program, which resulted in one-on-one meetings with providers and academic detailing with practices. According to PSW, developing relationships with providers also increased the likelihood that they would accept medication changes recommended by pharmacists.

There was often a significant time delay between when an MTM service was pushed to a pharmacy and when it was completed. The provision of MTM services is a complex process and PSW noted that it took pharmacies longer than expected to complete the necessary steps. The MTM push workflow involved pharmacists reviewing Aprexis-suggested interventions in the Aprexis system, deciding whether the interventions were appropriate, and obtaining approval from beneficiaries and providers. The average time it took to complete a pushed L1 and pushed L2 service was roughly 47 days and 83 days, respectively. Due to documentation limitations of the Aprexis system, PSW was not able to determine the cause for these time delays, but suggested the delays may be due to the time necessary (i) to gain beneficiary approval, (ii) to schedule the L2 services, or (iii) to obtain approval from prescribers on the changes recommended by the pharmacist (for L1 interventions). PSW suggested that delays in

beneficiary approval might occur because pharmacists may wait until a beneficiary picks up their prescriptions at the pharmacy to approach them about MTM services. PSW leaders recommended that MTM software should have functionality to ensure that pharmacies act upon/deliver services that are pushed to them (e.g., assignment of deadlines or email notifications that pushed interventions remain unaddressed). These software functionalities would facilitate the management of pending opportunities and ultimately lead to increased revenue for pharmacies since pharmacists can bill participating insurers for completed L1 and L2 services.

5.6 Workforce

PSW leaders found that staffing models that utilized pharmacy technicians and support staff, and provided dedicated time for delivering MTM services supported the provision of MTM services. Fitting MTM services into pharmacist workflow, particularly L2 services, was an ongoing challenge for the WPQC program. According to PSW program leaders and pharmacists, some workforce-related strategies that helped to facilitate provision of MTM services included the use of staffing models that provided dedicated time for delivering MTM services and use of pharmacy technicians and support staff to assist with beneficiary identification, beneficiary enrollment, and MTM service provision. According to PSW, the ideal MTM staffing model would involve training all pharmacists, technicians, and students within a pharmacy in the WPQC model; however, very few pharmacies adopted this model. PSW suggested that the minimum ideal staffing model would have at least one certified technician who is actively involved in the delivery of MTM services in each pharmacy.

Learning communities, also known as workgroups, focused on L2 services and helped increase the provision of L2 services. During the HCIA implementation, PSW offered three ten-week statewide workgroups to accredited pharmacies to address low L2 completion rates. These workgroups offered guidance to pharmacists on topics such as administering L2 services, inviting beneficiaries to use the WPQC program, and helping pharmacies transition from a medication dispensing model to a service-based MTM model. According to PSW, these workgroups improved pharmacist understanding of how to identify, recruit, and retain eligible beneficiaries for L2 services, and doubled the number of L2 services provided by pharmacists who participated in the workgroups.

5.7 Context

The delivery of MTM services required a broad culture change within pharmacies. PSW program leaders highlighted the need for a systematic change in pharmacy practices, including changes in the organizational culture and workflow, to deliver MTM services for the innovation

to be maximally effective. Pharmacies struggled with "retrofitting" MTM services into the existing traditional dispensing workflow. Many pharmacies that signed up to participate in the WPQC program did not participate or minimally participated in the program because they were unable to adjust their workflow, systems, and staffing model to transition to an MTM service-centered model. Some pharmacies successfully adapted their environments to provide MTM services, and as a result, a significant proportion of the completed L1 and L2 services volume was concentrated in those locations. PSW's self-analysis suggested that defined MTM workflow was an attribute that correlated with both L1 and L2 service provision. L2 service provision additionally benefitted from availability of marketing services.

While there was variable use of collaborative practice agreements between primary care providers and certified pharmacists, there was consensus among pharmacists that these agreements were useful. Collaborative practice agreements allow pharmacists to make medication adjustments without physician pre-approval. Pharmacists interviewed during site visits indicated that these agreements would make providing MTM services more efficient and help facilitate the completion of these services. PSW developed a Collaborative Practice Agreement Toolkit to help WPQC pharmacists implement these agreements. Some pharmacists were successful in implementing collaborative practice agreements with physicians under the WPQC program, while others were not. Among pharmacists that were successful in implementing agreements with prescribers, PSW was not able to evaluate the impact of the agreements on MTM service delivery.

PSW noted that overlap with other MTM programs led to competing priorities. Some of the WPQC member pharmacies also participated in other MTM programs, often through MTM vendors such as Outcomes MTM or Mirixa. Pharmacies' limited time and resources were divided across multiple MTM programs and it was a challenge to convince pharmacies to prioritize the WPQC program. This was particularly influenced by differences in reimbursement rates and the fact that other MTM programs redirected MTM service opportunities to other MTM providers if a given pharmacy was not able to provide those services by a specified deadline.

5.8 Sustainability and Spread

While PSW's HCIA grant ended in June 2015, it continues to accredit pharmacies and certify pharmacists, technicians, and students and has not made any changes to the WPQC MTM services received by eligible beneficiaries of its private payer partners and WI DHS. However, the use of the Aprexis system with the WI DHS beneficiary population, which was originally supported by the HCIA grant, is no longer available to accredited pharmacies as PSW was unable to find alternative funding sources. Following the discontinuation of the Aprexis system for WI DHS beneficiaries, PSW worked with pharmacies to facilitate the transition of the billing

and clinical documentation of WPQC MTM services provided to this population back to the WI DHS proprietary portal.

As of October 1, 2015, PSW transitioned to a "basic" approach for supporting the WPQC program. Under this basic approach, PSW reduced staffing as well as the implementation support structures developed over the course of the HCIA grant (e.g., discontinuation of the RIS role, personalized support, and regularly-scheduled workgroups) that were available to accredited WPQC pharmacies. PSW also simplified its semi-annual quality assurance survey evaluation to focus only on WPQC's quality-based best practices for medication management. PSW continues to convene quarterly in-person WPQC Steering Committees to discuss strategic plans for the WPQC program.

Though changes to the WPQC program, processes, and support structures occurred after the HCIA grant ended, PSW believes that pharmacies that developed well-defined MTM workflows and had consistently executed these workflows will continue to successfully deliver high volumes of L1 and L2 MTM services to eligible beneficiaries as part of the WPQC program. While program leaders initially had concerns about the impact of the loss of the Aprexis system on ongoing pharmacy participation for WI DHS beneficiaries, high-performing pharmacies have generally become less dependent on Aprexis system pushes due to fully operationalized MTM workflows and proactive beneficiary identification skills.

Over the course of implementation, PSW program leaders discussed the importance of achieving positive returns on investment (ROI) for both participating payers and accredited pharmacies and the factors that affect ROI. PSW reported that ROI for accredited pharmacies could be calculated for L1 cost-effectiveness interventions, but not for L2 interventions. The time delays for completing MTM services, particularly L2 services, due to challenges in integrating these services with pharmacy workflows greatly influenced the ROI calculation. Moreover, PSW found that the reimbursement rate for L2 services was not cost-justified by community pharmacies with private payers. Sufficient volume of L1 and L2 services is another factor that influences ROI since sufficient volume is necessary to offset the time and resource investments made by pharmacies. As a result of this need, PSW added insurer partners and continues to pursue more insurer partnership opportunities to create adequate pools of beneficiaries who are eligible to receive MTM services. Health plans also require a sufficient volume of value-added MTM services delivered to their beneficiaries to achieve a positive ROI. At the conclusion of PSW's HCIA grant, PSW's payer partners had not yet seen a significant positive ROI and decided not to fund the PSW infrastructure and resource components that were built over the course of the HCIA grant. However, support for medication management pharmacy service compensation did continue. According to PSW, the payers will consider

providing financial support of infrastructure and resource components in future budget periods if program evaluation findings are positive and there is a sufficient increase in service volume that enables ROI calculations.

6 EVALUATION OF THE PHARM2PHARM HEALTH CARE INNOVATION AWARD

This section provides evaluation findings for the University of Hawaii at Hilo's "pharmacist-to-pharmacist" or "Pharm2Pharm" program reflecting analytic results through August 2016 unless noted otherwise. Section 6.1 provides a high-level overview of the key findings detailed in the remainder of the chapter. Section 6.2 describes the Pharm2Pharm program and Section 6.3 describes the primary factors affecting program evaluability. Section 6.4 provides quantitative analysis findings on program effects. Sections 6.5, 6.6, and 6.7 present findings on implementation effectiveness, workforce, and context, respectively. Finally, Section 6.8 describes the sustainability and spread of the Pharm2Pharm program after the end of the HCIA project.

6.1 Key Findings

The Pharm2Pharm HCIA innovation implemented a formal hospital pharmacist to community pharmacist care coordination model designed to address medication management issues that occur during transitions of care. The program relied on specially trained hospital pharmacists and community pharmacists who incorporated additional medication management services into their daily practice. Pharm2Pharm experienced challenges in patient engagement during transitions of care but found that use of hospital pharmacists to conduct follow ups with patients after discharge helped improve patient retention. Pharm2Pharm benefited from a state-wide health information exchange, and program leaders continued to explore opportunities for using the exchange to streamline the process for identifying patients who could benefit from medication management services. Pharm2Pharm also learned that a beneficiary out-of-pocket payment model was not a sustainable funding model for the program due to lack of patient interest in paying for outpatient medication management services. The Pharm2Pharm model, as designed and tested under HCIA, is no longer in operation; however, as part of its one-year no-cost extension, Pharm2Pharm launched sustainability pilot projects with four outpatient sites to test modified versions of the traditional Pharm2Pharm model, and three of the sites were still in operation at the time of this report.

Participation in the Pharm2Pharm program was associated with cumulative increases in certain service utilization outcomes, but these estimated effects cannot be credibly attributed to the intervention as they more likely reflect unobserved differences in pre-enrollment health trajectories between program participants and controls. Specifically, there were statistically significant increases in inpatient admissions and hospital days for intervention beneficiaries relative to controls cumulatively over the intervention period, primarily driven by increases in the first year of the intervention. This may be driven by a large spike in the death rate among

controls in Q1, likely resulting in more survivors in the participant group who could utilize health care services in Q1 and later quarters.

6.2 Program Description

The Pharm2Pharm HCIA innovation, launched on February 26, 2013, was a formal hospital pharmacist to community pharmacist care coordination model designed to reduce costs and address medication management risks that occur during transitions of care. Pharm2Pharm targeted the elderly and other individuals who have been hospitalized and were at risk for subsequent medication-related hospitalizations and emergency department visits, regardless of insurance status. Medication management and care coordination services were provided by hospital consulting pharmacists (HCPs) and community consulting pharmacists (CCPs). HCPs identified eligible patients during hospitalization and performed in-depth medication reconciliation for program participants prior to hospital discharge. Community physicians and hospital care providers also referred patients to Pharm2Pharm, and HCPs reviewed these referrals based on standard targeting criteria. Immediately after patient discharge or after a referral had been reviewed, HCPs followed up with patients to assess their medication status and arranged a visit with one of the program's CCPs. Once this communication occurred, HCPs transferred patient responsibility to CCPs, also known as a "hand-off," by transmitting care transition documents either by fax or secure electronic messaging. Post-hand-off, CCPs conducted initial face-to-face visits with patients (unless a telephonic meeting was requested) followed by as-needed follow-up visits (typically administered by telephone or in-person) over the course of the subsequent year with more frequent visits occurring immediately after hospital discharge. These visits focused on the patients' health status; recent acute care visits; progress toward personal health goals; medication reconciliation, appropriateness, effectiveness, safety, and adherence; and patient education. CCPs contacted prescribers on a quarterly basis to provide patient updates and to make recommendations to optimize medications as needed. These intervention components constituted what was known as the "traditional model" of the Pharm2Pharm program.

Program leaders modified patient identification approaches throughout the course of implementation of the traditional model. Through self-monitoring activities, Pharm2Pharm program leaders learned that approximately 20 to 40 percent of program participants were enrolled based on HCP's clinical judgment and not by standard patient targeting criteria. Thus, in 2014, Pharm2Pharm expanded the patient targeting criteria to capture additional patients who were typically enrolled based on HCPs' discretion. That same year, Pharm2Pharm also began accepting patient referrals from community providers and discontinued HCPs' enrollment of patients from the emergency room (ER). Program leaders found enrollment of patients from the ER was not cost-effective and had limited added value, since most ER patients who were eligible

for Pharm2Pharm were admitted to the hospital and could be identified by HCPs during hospitalization.

Some program components of the traditional model of the Pharm2Pharm program were also modified during the implementation period, including CCPs' responsibilities, length of patient enrollment in the program, and targeted geographic areas. Under the initial version of the traditional model, CCPs were responsible for conducting a call with the patient within one day of discharge and scheduling a more in-depth appointment within three days of discharge. However, CCPs struggled to meet these parameters, motivating program leaders to shift these responsibilities to HCPs. Beginning in September 2014, Pharm2Pharm implemented an "early graduation" process for patients who were determined to be progressing extremely well prior to the one-year mark after enrollment, which more efficiently used Pharm2Pharm resources. Finally, though Pharm2Pharm initially targeted only rural areas with severe physician shortages, program leaders decided to expand the program to Honolulu County, an urban setting, as health care providers perceived a strong need for Pharm2Pharm services there as well.

The Pharm2Pharm innovation was granted a one-year no-cost HCIA award extension from July 1, 2015 through June 30, 2016 to continue intervention activities and test sustainability pilots. The no-cost extension allowed Pharm2Pharm to continue providing the community pharmacy services component of the traditional model to existing beneficiaries; enrollment of new patients to the traditional model of the program concluded on June 30, 2015. Beginning in the summer of 2015, Pharm2Pharm launched sustainability pilot projects with several outpatient sites to test modified versions of the traditional Pharm2Pharm model. These sites included a rural health clinic, a federally-qualified health center (FQHC), and two independent physician practices.

6.3 Evaluability

This section summarizes the primary factors affecting the evaluability of Pharm2Pharm, which include program enrollment and payer mix; program implementation factors, such as the extent to which the innovation changed during the HCIA implementation period; and comparison group data availability.

Pharm2Pharm's data partner, Hawaii Health Information Corporation (HHIC), provided intervention data on 2,145 individuals enrolled in the program through May 29, 2015. These data include beneficiaries who were determined eligible for the Pharm2Pharm program by an HCP, consented to participate, and had their care transition documents sent to the CCP, regardless of whether or not they attended their first visit with the CCP. Table 6-1 provides the enrollment and payer mix figures for Pharm2Pharm's intervention group beneficiaries. Since

Pharm2Pharm does not document the start date for the HCP intervention, Acumen used beneficiaries' hospital discharge date as the proxy program enrollment date. The payer mix figures presented in Table 6-1 were determined by linking intervention group beneficiaries in the program data provided by HHIC to their Medicare records. Out of the 2,145 individuals enrolled in Pharm2Pharm through May 29, 2015, Table 6-1 shows that only 1,220 individuals were enrolled in Medicare Parts A and B or Medicare Advantage as well as Medicare Part D, and only these individuals were eligible for inclusion in this analysis. Additional cohort restrictions, which are explained in detail in Section 6.4, further reduces the sample available for the analysis and limits the power of the analysis to detect true effects of the Pharm2Pharm intervention.

Table 6-1: Payer Mix of Pharm2Pharm Program Enrollment by Calendar Quarter

Calendar Quarter	Medicare Parts A, B, and D		Medicare Advantage and Part D		Other Medicare Enrolled		Not Medicare-Enrolled/ Unknown		Total
Jan-Mar 2013	*	*	*	*	*	*	*	*	13
Apr-Jun 2013	*	*	43	35%	*	*	*	*	124
Jul-Sep 2013	51	22%	84	37%	41	18%	51	22%	227
Oct-Dec 2013	73	22%	125	37%	65	19%	76	22%	339
Jan-Mar 2014	75	24%	106	34%	61	19%	74	23%	316
Apr-Jun 2014	52	23%	70	31%	37	17%	64	29%	223
Jul-Sep 2014	62	25%	85	34%	43	17%	62	25%	252
Oct-Dec 2014	77	27%	93	32%	49	17%	68	24%	287
Jan-Mar 2015	53	23%	73	31%	47	20%	60	26%	233
Apr-May 29, 2015	*	*	*	*	37	28%	32	24%	131
Total	505	24%	715	33%	404	19%	521	24%	2,145

Notes: The enrollment counts include individuals who were determined to be eligible for the Pharm2Pharm program by a hospital consulting pharmacist (HCP), consented to participate, and had their care transition documents sent to the community consulting pharmacist (CCP), regardless of whether or not they attended their first visit with the CCP. Acumen used the discharge date from the hospital where beneficiaries were recruited for the intervention by the HCP as the proxy program enrollment date.
"Other Medicare Enrolled" may include dual-eligible beneficiaries and beneficiaries enrolled in Medicare Part A only, Part B only, and/or Part D only.
"Medicare Parts A, B, and D" and "Medicare Advantage and Part D" may include dual-eligible beneficiaries.
"Not Medicare-Enrolled/Unknown" includes beneficiaries who were not enrolled in Medicare on the day they entered the Pharm2Pharm program or for whom the awardee did not provide sufficient personally identifiable information to link to Medicare claims.
*All cell counts less than eleven have been suppressed to protect participant confidentiality

Since Pharm2Pharm did not randomize beneficiaries into intervention and control groups for receipt of the intervention, Acumen constructed a comparison group of Medicare beneficiaries drawn from CMS administrative files by matching Pharm2Pharm intervention group beneficiaries on important demographic and health characteristics. Although the Pharm2Pharm program has a standard set of patient targeting criteria, HCPs had the flexibility to override the criteria, in consultation with other clinicians, if they believed a patient could benefit

from the program. In 2014, Pharm2Pharm expanded its patient enrollment and identification criteria to include beneficiaries who were not captured under the previous criteria, but were nevertheless being enrolled in Pharm2Pharm based on HCP discretion. These changes in enrollment criteria over the course of the intervention and the lack of consistent application of the standard targeting criteria imply that a comparison group based on standard program targeting criteria may not adequately match the participant population.

Other program implementation factors that affect the evaluability of Pharm2Pharm include modifications to program components and workflow over the HCIA project period. In addition to the changes to patient enrollment and identification criteria, there were also procedural changes to the transfer of responsibility from HCP to CCP or patient hand-off. Previously, patient hand-off was defined as the transfer of care transition documents from the HCP to CCP. Over the course of the HCIA project period, Pharm2Pharm revised the patient hand-off definition, increasing the HCP's role so that HCPs were additionally responsible for scheduling a given patient's first visit with the CCP and also for engaging with the patient until the first visit with the CCP.

There is insufficient documentation of the HCP intervention start date so Acumen used beneficiaries' hospital discharge date as a proxy for intervention enrollment date for the differences-in-differences analysis of program effects. Since the discharge date may not represent the true start of participants' exposure to the program, this may limit the ability of the analysis to capture the true effects of the Pharm2Pharm intervention on beneficiary health, utilization, and medication adherence outcomes.

6.4 Program Effectiveness

This section describes the impact of the Pharm2Pharm MM intervention on health and resource use outcomes for Medicare beneficiaries for eight quarters following Pharm2Pharm program enrollment ("full intervention period"). In addition to the common cohort restrictions described in Section 1.2.2, the Medicare FFS and MA cohorts were further restricted to beneficiaries who had at least one hospital admission in the year prior to their Pharm2Pharm program enrollment and who generally met the targeting criteria set by the Pharm2Pharm program.[17] Acumen combined the Medicare FFS and MA intervention cohorts to create a sufficient sample size, which resulted in a total of 833 beneficiaries available for analysis ("combined intervention cohort"). Medicare FFS and MA claims data utilized in this report for

[17] Based on Pharm2Pharm targeting criteria, additional restrictions to the analytic cohort include at least one inpatient stay 365 days before program enrollment and any one of the following conditions: (i) have 15 or more different drug prescriptions; (ii) have 10 or more different drug prescriptions and at least one high-risk (i.e., narrow therapeutic index) drug prescription; or (iii) have two or more different drug prescriptions and a chronic condition.

the analysis of the combined intervention cohort were pulled from CWF. Applying the same restrictions, Acumen matched comparison groups to these beneficiaries using a propensity score matching model described in Section 1.2.2. Matching was performed separately for the Medicare FFS and MA intervention cohorts. Appendix E.1 shows that participants and controls in both the Medicare FFS and MA groups were well matched on demographic and baseline health characteristics.[18]

Given potential limitations of combining Medicare FFS and MA beneficiaries into one analytic cohort, Acumen conducted a supplemental analysis on an MA-only intervention cohort using MA data from the Integrated Data Repository (IDR). Because MA beneficiaries are generally healthier and utilize services at a different rate than Medicare FFS beneficiaries, analysis of the combined intervention cohort may not appropriately capture program effects (see Appendix Table E-1 and Appendix Table E-2 in Appendix E.1). The MA-only analysis used additional MA data elements available in the IDR to test how beneficiary outcomes would be affected if these data elements were included in Acumen's matching model. These additional MA IDR data elements include diagnostic and utilization information in non-inpatient settings, which are not available in the CWF MA data used for the combined cohort analysis. The estimated effects on beneficiary outcomes from this supplemental analysis were largely similar to those from the main analysis for the combined intervention cohort.

The remainder of this section highlights key quantitative findings for the Pharm2Pharm combined intervention cohort. Sections 6.4.1, 6.4.2, and 6.4.3 highlight notable results for mortality and inpatient readmissions, resource use, and medication adherence, respectively. Non-inpatient resource use and expenditure data were not available for the MA beneficiaries, and therefore, not presented in our findings. Single difference or DiD methodology is used to estimate the effect of the intervention at the cumulative level across the full intervention period, as well as for each specific year and each specific quarter after beneficiaries' enrollment in the Pharm2Pharm program. Complete results of our analyses are provided in Appendix E.

6.4.1 Mortality and Inpatient Readmissions

As shown in Table 6-2, Pharm2Pharm was not associated with cumulative or yearly statistically significant effects on mortality across the two years after program enrollment for the combined intervention cohort.

[18] However, race and ethnicity categories used for matching (e.g., white, black, other) may not have adequate granularity for Pharm2Pharm beneficiaries since the majority of Hawaiian residents are Asian or Native Hawaiian/Other Pacific Islanders. Thus, the control group created for this analysis may not be truly equivalent to the intervention group.

Table 6-2: Aggregate Mortality: Cumulative and Yearly Differences after Pharm2Pharm Enrollment, Medicare FFS and MA Combined Cohort

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	833	833	484
Mortality			
Difference[c]	0.81	-11.86	12.67
90% Confidence Interval	(-31.6 | 33.2)	(-40.7 | 17.0)	(-2.0 | 27.3)
P-Value	0.967	0.500	0.154

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year period.
[c]This estimate represents difference in the number of deaths between participants and controls during the intervention period.

The first-year mortality estimates are driven by a quantitatively large and statistically significant spike in mortality among controls in the first quarter post-intervention which was not observed for participants; this likely reflects unobserved differences between the comparator groups in pre-enrollment health status trends rather than program effects. The Q1 spike among controls in Figure 6-1 is unlikely to reflect the expected trend for the participant population in the absence of the intervention. The estimates thus more likely reflect pre-existing differences in health trajectories between participants and controls. There were a total of 106 deaths per 1,000 beneficiaries among controls in Q1, although the mortality for this group dropped to only 26 deaths per 1,000 beneficiaries in Q3 (see Appendix Table E-6 in Appendix E.2). In comparison, the mortality among participants remained relatively stable at around 45 to 56 deaths per 1,000 beneficiaries per quarter from Q1 through Q3. As mentioned in Section 6.3, these differences between intervention and control cohorts may be due to selection bias as a result of patient enrollment based on HCPs' discretion and changes to the standard patient targeting criteria over the course of the HCIA project. Additionally, although Acumen matched a robust comparison group based on an extensive set of variables observable in claims data, patients who chose to participate in the program are likely to be systematically different from controls in terms of their health-seeking behavior and other unobservable characteristics that influence mortality as well as other outcomes discussed in the remainder of the section.

Figure 6-1: Mortality per 1,000 Beneficiaries: Quarterly Trends for Participants and Controls, Pharm2Pharm Medicare FFS and MA Combined Cohort

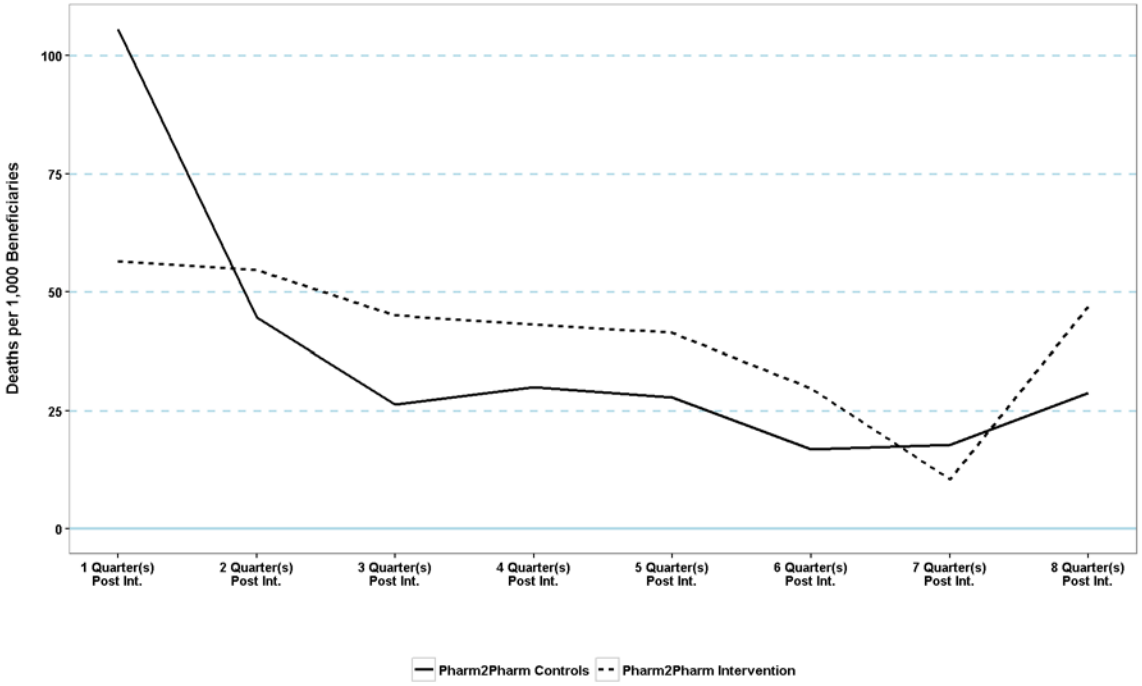


Table 6-3 shows that Pharm2Pharm was not associated with cumulative or yearly statistically significant effects on inpatient readmissions across the two years after program enrollment for the combined intervention cohort. There were no consistent patterns observed in quarterly estimates, which were non-significant across all eight quarters (see Appendix Table E-5). However, as mentioned above, differences in unobservable characteristics between comparator groups may have influenced estimates. Additionally, there were only 833 participants available for analysis, so there may not be adequate power to detect significant effects across all outcomes.

Table 6-3: Aggregate Inpatient Readmissions: Cumulative and Yearly Differences after Pharm2Pharm Enrollment, Medicare FFS and MA Combined Cohort

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	833	833	484
30-Day Hospital Readmissions Following All Inpatient Admissions			
Difference[c]	10.36	2.31	8.05
90% Confidence Interval	(-24.1 | 44.8)	(-28.3 | 32.9)	(-7.8 | 23.9)
P-Value	0.621	0.901	0.403
30-Day Hospital Unplanned Readmissions Following All Inpatient Admissions			

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
Difference	12.81	4.50	8.31
90% Confidence Interval	(-21.2 | 46.8)	(-25.8 | 34.8)	(-7.1 | 23.8)
P-Value	0.535	0.807	0.376

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year period.
[c]The estimate represents the difference in the number of beneficiaries with at least one readmission for every beneficiary who has an inpatient admission, as compared between the intervention and control groups during the relevant year in the intervention period.

6.4.2 Health Service Resource Use

Cumulatively and in the first year after program enrollment, the Pharm2Pharm intervention was associated with statistically significant increases in inpatient admissions, unplanned inpatient admissions, and hospital days for intervention beneficiaries relative to controls. As shown in Table 6-4 among the 833 beneficiaries who received the Pharm2Pharm intervention, there was a statistically significant increase of about 373 total inpatient admissions (700 inpatient admissions per 1,000 beneficiaries) cumulatively across the two years after enrollment for the intervention group relative to the control group. The Pharm2Pharm intervention was also associated with statistically significant increases in unplanned inpatient admissions and hospital days cumulatively over the two years after program enrollment among participants relative to controls. The cumulative effects were primarily driven by statistically significant effects in Year 1 (p-value<0.001). The quarterly fixed-effects analysis also found marginally significant increases in resource use outcome measures in the first few quarters after program enrollment, which were generally followed by non-significant increases in other quarters as shown in Figure 6-2 and Appendix E.3.

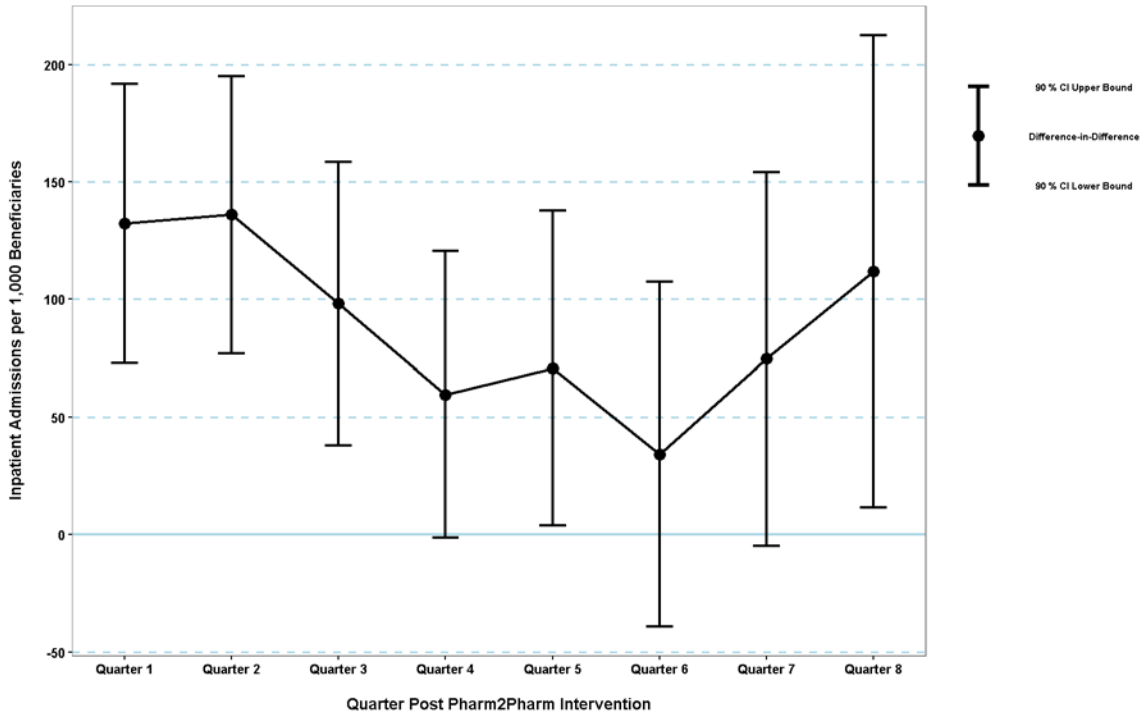
Table 6-4: Aggregate Resource Use: Cumulative and Yearly DiD Estimates after Pharm2Pharm Enrollment, Medicare FFS and MA Combined Cohort

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
Number of Participants	833	833	484
Inpatient Admissions			
Difference-in-Difference[c]	373.19***	320.75***	52.44*
90% Confidence Interval	(248.1 | 498.3)	(222.7 | 418.8)	(0.5 | 104.4)
P-Value	<0.001	<0.001	0.097
Unplanned Inpatient Admissions			
Difference-in-Difference	245.09***	226.15***	18.94

Measures	Full Intervention Period[a]	Year 1[b]	Year 2
90% Confidence Interval	(123.7 | 366.5)	(131.6 | 320.7)	(-31.9 | 69.8)
P-Value	<0.001	<0.001	0.540
Hospital Days			
Difference-in-Difference	3,049.05***	2,399.98***	649.07*
90% Confidence Interval	(1,691.2 | 4,406.9)	(1,372.8 | 3,427.1)	(20.2 | 1,277.9)
P-Value	<0.001	<0.001	0.090

* Statistically significant at the ten percent level.
*** Statistically significant at the one percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year period.

Figure 6-2: Inpatient Admissions per 1,000 Beneficiaries: Quarterly DiD Estimates, Pharm2Pharm, Medicare FFS and MA Combined Cohort



These findings on resource use measures should be interpreted with caution as they are unlikely to reflect program effects. As discussed in Section 6.4.1, controls had a significantly higher death rate in Q1 than participants; thus, there were many more survivors in the participant group who could utilize health care services in Q1 and later quarters compared with the control group. Both the estimated effects on mortality and on inpatient service use outcomes may be the result of unobservable differences between the non-randomized intervention and matched

comparison groups; there is no causal mechanism through which the Pharm2Pharm program is likely to have increased utilization.

6.4.3 Medication Adherence

As shown in Table 6-5, the Pharm2Pharm intervention was not associated with cumulative statistically significant changes in medication adherence for any of the five selected therapeutic drug classes in the first or second year following program enrollment. The magnitude and direction of non-significant estimates also varied by therapeutic category.

However, the adherence DiD estimates should be interpreted in the context of the sample size and pre-enrollment adherence levels in addition to the selection issues detailed in previous sections. Individuals eligible for measures of medication adherence for each of the therapeutic classes represent only a small sample of program participants for a given therapeutic class, reducing the ability to detect an effect of the Pharm2Pharm intervention. Appendix E.4, which presents summary statistics on medication adherence, shows that the Pharm2Pharm intervention cohort was largely adherent to medications during the baseline period; the median baseline PDC was over 89 percent for the intervention cohort. This suggests that beneficiaries who consented to participate in the Pharm2Pharm program may be individuals who were already likely to engage in healthy behaviors; thus, the potential margin of improvement in the intervention cohort's medication adherence may be minimal.

Table 6-5: Medication Adherence (Proportion of Days Covered) by Medication Type: Yearly DiD Estimates after Pharm2Pharm Enrollment, Medicare FFS and MA Combined Cohort

Measures	Year 1[a]	Year 2
Beta Blockers		
Number of Participants	300	89
Difference-in-Difference	0.44	1.55
90% Confidence Interval	(-4,5)	(-6,9)
P-Value	0.864	0.727
Calcium Channel Blockers		
Number of Participants	174	58
Difference-in-Difference	-1.89	-4.02
90% Confidence Interval	(-8,4)	(-12,4)
P-Value	0.586	0.435
Diabetes Medication		
Number of Participants	102	37
Difference-in-Difference	0.7	-3.65

Measures	Year 1[a]	Year 2
90% Confidence Interval	(-6,7)	(-14,7)
P-Value	0.866	0.563
RAS Antagonists		
Number of Participants	290	85
Difference-in-Difference	-0.38	-2.19
90% Confidence Interval	(-4,4)	(-9,5)
P-Value	0.879	0.591
Statins		
Number of Participants	347	111
Difference-in-Difference	0.43	-4.41
90% Confidence Interval	(-3,4)	(-11,2)
P-Value	0.849	0.267

[a]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year period.

6.5 Implementation Effectiveness

Demonstrating the value of medication management services to patients was a useful patient education and recruitment strategy. HCPs initially encountered challenges obtaining patient acceptance of Pharm2Pharm services, largely due to patient perception that primary care providers were already monitoring their medications effectively and lack of understanding about the value of medication management and the role of pharmacists. Pharm2Pharm reported that it improved patient recruitment by directing HCPs to demonstrate the value of the program to patients and provide examples of medication management services before asking patients to enroll. For example, HCPs used an initial review and discussion of patients' medication as a strategy to introduce and educate them about the program, which led to increased acceptance of services.

Pharm2Pharm experienced challenges in keeping patients engaged in the intervention during transitions of care and experimented with different approaches to boost engagement. Pharm2Pharm found that hospitalized patients agreed to enroll in Pharm2Pharm, but did not participate in the program following discharge (i.e., patients did not attend follow-up appointments with CCPs). The shift of the post-discharge call and CCP appointment scheduling responsibilities from CCPs to HCPs, which were discussed earlier in Section 6.2, improved patient retention. Pharm2Pham also reported that use of an "opt-out" approach consisting of letters with CCP appointment times mailed to non-responsive patients and follow-up methods, such as varying the time of day for patient outreach, helped to increase patient retention.

There were barriers and challenges associated with engaging physicians in the Pharm2Pharm program due to lack of awareness and limited physician bandwidth. Pharm2Pharm had relatively low rates of physician acceptance of pharmacist recommendations compared to pharmacists who are embedded in the physician's practice. According to surveys conducted by Pharm2Pharm, low physician acceptance rates were attributable to lack of physician awareness of both the program and that their patients were enrolled in the program, as well as loss of CCP communications among large volumes of faxed information. In addition, while physician referrals to Pharm2Pharm were introduced as a component of the innovation, such referrals were rarely made. According to program leaders, physicians were challenged by workflow issues related to quality measures, new payment initiatives, and changes in the healthcare delivery climate, which distracted them from actively referring patients to Pharm2Pharm.

Pharm2Pharm made efforts to improve relationships with and referrals from physicians, including (i) use of electronic communication instead of fax-based communication; (ii) development of a referral guide to provide to physicians who had high volumes of patients participating in the Pharm2Pharm program; (iii) use of focus groups and meetings to identify ideal communication methods; and (iv) monthly workgroups of CCPs with high patient volumes to discuss methods of increasing both physician and patient engagement. In Pharm2Pharm's sustainability pilot projects in outpatient settings, physician acceptance of pharmacist recommendations was higher relative to the traditional Pharm2Pharm model (45 percent vs. 27 percent). Physicians' ratings of pharmacist services and likelihood to "definitely" recommend the pharmacist were also higher in the pilots. Program leaders attribute these trends to pharmacists' ability to build closer partnerships with physicians in the pilots because the pharmacists were based in the outpatient setting. This is in contrast to the traditional Pharm2Pharm model where CCPs were based in community pharmacy settings.

6.6 Workforce

Pharmacy staffing models affected the provision of community-based Pharm2Pharm services. According to program leaders, community pharmacies that were successful with implementing Pharm2Pharm services largely used staffing models that allowed pharmacists to conduct medication management services in addition to dispensing services. This finding was supported by observations from Acumen's site visit, which found that pharmacists with time dedicated to Pharm2Pharm activities were able to manage the Pharm2Pharm workload more effectively.

Motivational interviewing was an important training competency for community pharmacists. Pharm2Pharm's self-evaluation found that medication non-adherence due to

patient choice (e.g., patients deciding not to take medications that are prescribed to them due to regimen complexity, health literacy barriers, cultural/personal beliefs, etc.) was the largest contributor to potentially preventable medication-related readmissions among Pharm2Pharm patients. According to program leaders, this finding supported the need for pharmacists to be competent in motivational interviewing to help patients with implementing health-related behavior change. Pharm2Pharm thus offered additional training on motivational techniques to HCPs and CCPs.

To create a sustainable pharmacy workforce that is prepared to deliver transitional care pharmacy services, Pharm2Pharm developed and implemented a specialized care transition rotation that was well received by pharmacy students and could potentially serve as a useful training model for other pharmacy schools. As part of its no-cost extension, Pharm2Pharm implemented a multi-site student rotation pilot for fourth-year pharmacy students on care transitions. The purpose of the rotation was to develop a pharmacy workforce prepared to deliver pharmacy services across care transitions (such as the services developed and deployed by Pharm2Pharm). In addition to a traditional onsite preceptor, the pilot employed an experienced HCP who functioned as a subject matter expert (SME) across all three rotation sites. Feedback from pharmacy students who completed the rotation was positive and students appreciated the opportunity to participate in the care transition model. Additionally, program leaders noted that use of an SME in addition to a traditional preceptor was a useful approach to ensure pharmacy students received training in the skills necessary to provide MM services. The University of Hawaii College of Pharmacy is considering how to broadly leverage findings from this pilot across its program, and program leaders believe other universities should consider this approach for their own student rotations.

Pharm2Pharm's interactive web-based training aimed to ensure standardization and scalability of program components. Community pharmacist trainings included information on the goals and objectives of the Pharm2Pharm model, specific processes and procedures involved in the model, high risk medication, and continuous quality improvement. Over the course of program implementation, program leaders iteratively refined how this training was provided to HCPs and CCPs. The original eight-hour live training session was modified into a two-hour home-based (electronic) review of Pharm2Pharm's Standard Operating Procedures followed by a six-hour live training that focused on case-based learning. Program leaders eventually converted the training to an entirely web-based, interactive format to ensure standardization and efficiency. Pharm2Pharm used the training (available at http://pharmacy.uhh.hawaii.edu/ce/irdtp.php) with fourth-year pharmacy students and select pharmacists. As of the end of the HCIA implementation period, Pharm2Pharm planned to disseminate the module more broadly through

state contacts and national pharmacy groups with hopes that it will lead to broader adoption of the Pharm2Pharm model.

6.7 Context

Over the course of the HCIA project, Pharm2Pharm was able to use the Hawaii Health Information Exchange (HHIE) to support key communication processes of Pharm2Pharm that facilitated implementation. Data sharing agreements through the HHIE enabled electronic communication and transfer of patient care documents between HCPs and CCPs and also gave CCPs access to patient prescription histories. A number of physicians also signed separate agreements authorizing CCPs to access patient lab tests via the HHIE, which provided CCPs with useful clinical information. In spring 2015, a new regulatory framework interpretation further facilitated data sharing as it allowed patients to authorize CCPs access to their lab data through the HHIE.

Under the HCIA grant, Pharm2Pharm instituted a payment structure for reimbursing CCPs for Pharm2Pharm medication management services but found that implementing a payment structure without associated performance requirements led to variations in MM service delivery. Under Pharm2Pharm's original payment model, CCPs received $695 per patient per year, which was not tied to performance standards. To address variation in CCP performance and ensure program fidelity and standardization, Pharm2Pharm implemented minimum standards CCPs had to meet to receive payment. CCPs were required to complete patient visits at least once every two months on average across patients, reconcile medications within 30 days post-discharge for at least 80 percent of new patients, and contact primary care providers at least quarterly for 80 percent of patients. Additionally, at least 50 percent of new patients must have had their first CCP visit within three days of discharge. Program leaders reported that using this "pay for performance" approach was effective in reducing practice variation; however, during Acumen's site visit, some CCPs reported difficulty with implementing these standards. Some CCPs perceived that the standards were set too high and certain standards did not reflect performance since they were out of CCPs' control (e.g., patients failing to attend their initial CCP appointments). Community pharmacies with low patient volumes especially struggled with the standards as one or two missed patient appointments could result in a failure to meet percentage-based standards. Program leaders noted, however, that they granted exceptions for such circumstances to prevent penalty to CCPs for performance issues outside of their control or due to low volume.

Given the aforementioned challenges with engaging physicians in the Pharm2Pharm model, Pharm2Pharm found that collaborative practice agreements were also difficult to implement as they required strong working relationships and trust between pharmacists and

physicians. Throughout implementation, Pharm2Pharm program leaders supported the use of collaborative practice agreements and provided resources and templates to help pharmacists establish these agreements. However, few pharmacists were successful in executing these agreements. Program leaders recognized the importance of developing strong pharmacist-physician working relationships prior to pursuing such agreements.

6.8 Sustainability and Spread

Pharm2Pharm stopped enrolling patients in June 2015 under the "traditional" model of the program, as designed and tested under the three-year HCIA grant. As part of its one-year no-cost extension, CCPs continued to provide the community pharmacy services component of the traditional program through December 2015. Beginning in the summer of 2015, Pharm2Pharm launched sustainability pilot projects with several outpatient sites to test modified versions of the traditional Pharm2Pharm model. These sites included a rural health clinic, a FQHC, and two independent physician practices. Program leaders reported variability across the four sites in the services the pharmacists provided, the patient eligibility criteria, and the patient identification process. At the time of this report, these pilots were still in operation at all but one of the sites and program leaders planned to stay in touch with all pilot sites to see how the models evolve at their respective locations.

Pharm2Pharm pursued both "incident to physician" billing (a way to bill for outpatient services provided by a non-physician provider) and beneficiary out-of-pocket payment as sustainable funding models for the program. Efforts to implement incident to physician billing in the outpatient setting under the traditional Pharm2Pharm model were unsuccessful. Pharm2Pharm's discussions with physicians through May 2015 indicated lack of support for this option because physicians did not have the capacity or infrastructure to adapt workflow and resources to accommodate pharmacists' use of existing or new billing codes. Pharm2Pharm also attempted to implement incident to physician billing at the sustainability pilot sites. At the time of the report, Pharm2Pharm was still evaluating the use of incident to physician billing at these sites and could not confirm whether this billing approach had been established. Pharm2Pharm also pilot-tested a beneficiary out-of-pocket payment model for CCP services at two of its partner hospitals during the early portion of its no-cost extension period. Under this pilot, HCPs presented patients with the option to receive outpatient CCP services for an out-of-pocket fee, ranging from roughly $10 to $50 per visit. Program leaders abandoned the out-of-pocket payment model as a potential sustainability option since patients were not willing to pay for CCP services. Program leaders noted that the out-of-pocket payment model may thrive in areas with high prevalence of consumer-driven, high-deductible health plans, which are rare in Hawaii.

Though the traditional model was not sustained, four of the hospitals that participated in the traditional model of the program hired their HCPs to provide some version of the transitional care pharmacy services implemented as part of Pharm2Pharm. One of the hospitals participating in Hawaii Health Partners' accountable care organization (ACO) has redeployed its HCP to provide MM services to the ACO's "complex care" patients (e.g., those with multiple chronic conditions, limited functional status, and/or psychosocial needs). Another hospital has specifically created a "transitional care pharmacist" position for its HCP.

Finally, because there is no existing payment mechanism to provide reimbursement for inpatient pharmacy services, Pharm2Pharm recently undertook efforts to streamline the process for identifying patients who need MM services using the HHIE and found that, at least for simple cases, this was feasible. As noted, in the traditional Pharm2Pharm model the HCPs conducted medical chart review to identify eligible patients. This was an effective but resource-intensive approach for identifying patients. In order to improve efficiency, Pharm2Pharm recently undertook efforts to evaluate whether the HHIE Community Health Record (CHR) coupled with a medical fill history could automatically identify a subset of hospitalized patients who have "flags" for potentially sub-optimized medications according to national evidence-based treatment guidelines. The HHIE CHR gives pharmacists access to clinical information and laboratory test results that help them to identify and monitor patients who need medication management services. Pharm2Pharm used two scenarios to test this functionality. The first scenario aimed to find hospitalized patients with a diagnosis of diabetes who are not on a statin, which consists of a simple and straightforward algorithm. The second scenario aimed to find heart failure patients with suboptimized medications, which consists of a complex algorithm that factors in lab values, race, and several types of medications. In the diabetes test case, Pharm2Pharm found that the CHR could effectively find patients with suspected sub-optimized medications. The results of the heart failure test case were still pending at the time of the report. Program leaders noted these test efforts suggest that health information exchanges could potentially be used to support broader MM service delivery.

7 EVALUATION OF THE SAFEMED HEALTH CARE INNOVATION AWARD

This section provides summative evaluation findings for the University of Tennessee Health Science Center's SafeMed innovation, reflecting results through August 2016 unless noted otherwise. Section 7.1 summarizes the key evaluation findings which are detailed in the remainder of the chapter. Section 7.2 describes the SafeMed program, while Section 7.3 discusses evaluability, focusing on the small sample size that precluded an analysis of program effects. Section 7.4 through Section 7.7 describe our qualitative analysis findings regarding program implementation effectiveness, workforce issues, contextual factors, and the program's potential for sustainability and scale-up, in turn.

7.1 Key Findings

The SafeMed program provided medication and disease management support to patients during hospitalization and following discharge home. The innovation was intensive and targeted patients with high rates of health service use and costs. It also expanded the traditional roles of health care workers, particularly pharmacy technicians and licensed practical nurses, who acted as outreach workers. SafeMed learned that intervening with complex patients requires substantial time and resources, tailored approaches to patient engagement, formation of strong relationships with patients, and use of specialized motivational interviewing skills to help prompt patient behavior change. SafeMed also noted the importance of having a comprehensive care transition infrastructure or program in place to intervene effectively with these complex patients following hospitalization.

SafeMed program leaders largely attributed failure to sustain the program following the end of the HCIA award period to the defeat of Medicaid expansion in Tennessee. Thus following the end of the program, leaders undertook efforts to spread some of the promising intervention components, and released a module for the American Medical Association - Medical Group Management Association that teaches primary care physicians and staff how to build a SafeMed practice-based care transitions team and implement the model.

The following sections provide additional details on these findings.

7.2 Program Description

The HCIA SafeMed project was designed to offer a patient-centered approach to comprehensive medication and disease management through expanded access to inpatient, community-based, and home-based services delivered by a consistent interdisciplinary team. The project aimed to reduce readmissions, emergency room visits, and health care expenditures. SafeMed's interdisciplinary team comprised a community health pharmacist, community health

pharmacist technician, licensed practical nurse, advanced practice nurse, registered nurse, and social worker. The program targeted hospitalized Medicaid and Medicare beneficiaries with chronic physical and mental health conditions, high rates of inpatient utilization, and high costs. Specifically, the program focused on individuals who had been diagnosed with at least one of the targeted medical health conditions, which include congestive heart failure, coronary artery disease, diabetes, hypertension, and chronic lung disease. Additionally, enrolled patients must have had two or more hospital admissions, or one hospital admission and two or more emergency room visits within the past six months. However, the SafeMed program excluded homeless patients and patients with severe mental illness.

A registered nurse or advance practice nurse identified potential participants for the SafeMed intervention by reviewing daily eligibility reports pulled from the electronic health record (EHR) system during a patients' hospital admission at one of the participating hospitals in Methodist LeBonheur Healthcare system. Nurses would then perform supplementary screening by reviewing patients' medical records to confirm eligibility of the selected patients before proceeding with patient recruitment.

Patients enrolled for an initial 45-day period and then could opt to continue receiving services for an additional three months. Once enrolled, a community health pharmacist provided medication management services, including a comprehensive medication review, while the patient was still in the hospital, and a social worker, along with a registered nurse or advance practice nurse, provided education, case management, and discharge planning and support. After patient discharge, an outreach team consisting of a licensed practical nurse and community health pharmacist technician conducted a home visit within 72 hours of discharge. This visit typically lasted between one and two hours and was designed to review and reinforce the discharge plan. During this visit, the licensed practical nurse performed a brief, condition-specific assessment, and the community health pharmacist technician reviewed medications, discussed medication side effects, and oversaw the disposal of unnecessary or expired medications. The outreach team also conducted a second home visit (usually lasting about 30 minutes) and continued to periodically call the patient to assess medication problems, symptom exacerbations, and psychosocial issues and makes referrals to the advance practice nurse, registered nurse, social worker, or community health pharmacist as necessary. In addition to the home visits and as-needed referrals, patients could receive more extensive ongoing medication therapy management services at the discretion of the outreach team, including a post-discharge comprehensive medication review. Finally, patients had the option of attending group support sessions where they shared experiences and challenges related to managing their diseases and medications.

The SafeMed HCIA intervention was an entirely new program that was launched on February 4, 2013. SafeMed enrolled its last patient on May 1, 2015 and stopped providing services to patients in July 2015. SafeMed's HCIA award concluded on June 30, 2016.

Over the course of implementation, SafeMed program leaders made a few notable changes to the innovation. The program was initially nine months long; however, program leaders found that patients were hesitant to commit to a nine-month program, leading to low enrollment. Thus, in June 2013, SafeMed was redesigned as a two-phase program. Enrolled patients initially agreed to participate in a 45-day care transition program (Phase 1) and then had the option to participate in a three-month extension for continued outreach and follow up (Phase 2). This redesigned model was better received by participants and boosted enrollment. SafeMed also made changes to its program inclusion criteria over time (e.g., targeting patients with only one major chronic condition instead of two, including uninsured patients), though these changes did not produce significant differences in its enrolled patient population or number of enrollees. Program leaders noted that overall SafeMed had to incorporate more care transition services into the program than initially proposed in order to improve care quality and coordination among health providers.

7.3 Evaluability

This section summarizes the primary factor affecting the evaluability of the SafeMed program that precluded a quantitative analysis of program effects based on available Medicare enrollment and claims data.

Table 7-1 provides detailed information on the program's enrollment and payer mix based on participant-level program data provided by the awardee linked to Medicare records. SafeMed provided Acumen with data on 374 participants enrolled in the program from February 5, 2013 through May 1, 2015, of which 243 were enrolled in Medicare on the day they entered the SafeMed program. Given this low enrollment, a credible quantitative analysis of program effects on health and resource use outcomes was not viable using Medicare claims data.

Table 7-1: Payer Mix of SafeMed Program Enrollment by Calendar Quarter

Calendar Quarter	Medicare Parts A/B/D FFS		Medicare Advantage And Part D		Other Medicare Enrolled		Not Medicare-Enrolled/		Total
Jan-Mar 2013	*	*	*	*	*	*	*	*	23
Apr-Jun 2013	*	*	*	*	*	*	*	*	27
Jul-Sep 2013	16	53%	*	*	*	*	*	*	30
Oct-Dec 2013	11	37%	*	*	*	*	*	*	30
Jan-Mar 2014	14	33%	*	*	*	*	14	33%	42
Apr-Jun 2014	20	34%	18	31%	*	*	*	*	59
Jul-Sep 2014	18	33%	*	*	*	*	22	40%	55
Oct-Dec 2014	*	*	12	24%	*	*	20	40%	50
Jan-Mar 2015	14	30%	*	*	*	*	21	46%	46
Apr-Jun 2015	*	*	*	*	*	*	*	*	12
Total	121	32%	89	24%	37	10%	127	34%	374

Source: Program data provided by SafeMed in November 2015.
Notes: "Not Medicare-Enrolled/Unknown" includes beneficiaries who were not enrolled in Medicare on the day they entered the SafeMed program or for whom the awardee did not provide sufficient personally identifiable information to link to Medicare claims.
*All cell counts less than eleven have been suppressed to protect participant confidentiality

7.4 Implementation Effectiveness

Program leaders found that intervening with complex patients required substantial time and resources, as well as tailored approaches. SafeMed served patients with limited education, limited financial means, and few social supports. These patients had difficulty following through with medication plans and lifestyle changes, and missed follow-up appointments regularly. As a result, SafeMed staff spent a substantial amount of time tracking down patients, facilitating their follow-up appointments outside of the program, and navigating the complex health care and insurance systems on their behalf. Moreover, SafeMed staff noted that, given these complex patient factors, using a "one size fits all" approach did not meet patient needs. Though SafeMed focused on maintaining implementation fidelity to its program components for evaluation purposes, program staff and leaders reported that tailoring the program for each participant based on how ready they were to self-manage their health conditions would have made the program more effective.

Additionally, program leaders reported that simply increasing touch points with patients did not increase participant engagement. Some SafeMed enrollees did not fully engage in the program, and SafeMed found that increasing the number of pre- and post-discharge interactions with these individuals did not have any impact on patient engagement (e.g., likelihood to schedule follow-up visits, attend support sessions, and attend outpatient medication reviews). SafeMed leaders indicated that this finding demonstrates a need to form more meaningful relationships with these patients. Successful patient engagement strategies highlighted by

SafeMed include 1) reducing the screening burden and simplifying the intake process by minimizing the information collected from patients during enrollment, and 2) using patient-centered recruitment approaches. For example, SafeMed staff framed eligibility for participation in the program to patients as being "selected" to participate and tailored marketing of the program to focus on patients' individual needs. SafeMed leaders noted that the outreach worker role was particularly important for establishing connections and building strong relationships with patients, since outreach workers serve as liaisons for patients during the transition from hospital to home.

The impact of offering financial incentives to participants on their engagement in the program was unclear. SafeMed initially offered a $25 payment incentive to patients to attend group support sessions and comprehensive medication reviews (CMRs) but decided to eliminate the incentive. Program leaders reported that attendance dropped once they removed the financial incentive, although attendance may have simultaneously been impacted by other factors, such as poor weather. Though results were inconclusive, SafeMed team members strongly supported removing the incentive because they felt those who attended the sessions only to receive the incentive did not fully participate.

Increased collaboration with primary care providers was helpful in facilitating program implementation. For example, primary care providers with stronger relationships with SafeMed were more likely to accept community health pharmacist recommendations. As a result, the program deployed efforts to coordinate care with primary care providers, including discussing patient care with primary care offices, especially after patient discharge, and having patients attend appointments with SafeMed nurses when appropriate. SafeMed also relied on partnerships with the regional Medicare Quality Improvement Organization and the Memphis Medical Society to build awareness about the program among primary care providers.

SafeMed program leaders addressed low post-discharge CMR rates by focusing on timing the CMRs appropriately. Specifically, leaders attributed the low rates largely to patient reluctance to receive the medication reviews and difficulty timing the reviews after the post-discharge primary care provider visits. One factor in this was that patients were reluctant to accept medication changes made in the hospital without first having their usual, trusted care provider approve them. SafeMed also found that the CMR is not helpful unless the patient has seen a primary care provider first. In response to this finding, project staff focused on ensuring that the patient had a follow-up visit with a primary care provider scheduled either prior to hospital discharge or during subsequent interactions (the initial home visit or follow-up calls). SafeMed also attempted to schedule CMRs during group support session since patients were already onsite at the hospital.

Finally, program leaders reported implementation challenges due to inaccuracies in the EHR-based algorithm used to identify eligible beneficiaries. As noted in Section 7.2, SafeMed identified eligible patients using daily EHR-generated patient eligibility reports, which were then reviewed by SafeMed staff, who performed additional screening to determine true patient eligibility. SafeMed worked with information technology staff to continually refine the algorithm over the course of implementation but found that the algorithm generally did not reliably identify eligible patients. For the EHR-identification approach to work efficiently, the underlying algorithms need to accurately identify eligible participants.

7.5 Workforce

SafeMed program leaders' experiences suggests that hiring flexible pharmacy technicians is helpful for implementing medication management programs like SafeMed that rely on pharmacy technicians in an expanded patient outreach and care coordination role. SafeMed's pharmacy technicians served as outreach workers with an expanded patient care role, and program leaders noted that the ability for a pharmacy technician to successfully function in this expanded role varied by individual. Program leaders attributed the variation to personality, with some technicians being more comfortable with the lack of structure inherent in being an outreach worker. SafeMed did experience some turnover among staff members who were not comfortable in the new role. Additionally, SafeMed had to work with the state pharmacy board to define the pharmacy technician role and ensure it was within the appropriate scope of practice.

Additionally, motivational interviewing skills are important to hone for an intervention targeting complex patients. About one year into its implementation, SafeMed learned that its staff needed additional training to effectively intervene with the program's complex target population. SafeMed program leaders identified motivational interviewing as an important skill for staff members to hone, but also learned that applying motivational interviewing techniques was not easy for staff members. The program adopted the OARS (open questions, affirming, reflection, and summarizing) model, which focuses on the beginning level skills of motivational interviewing, and provided OARS training between July and September 2014. SafeMed reported that this additional training and the use of a consultant, who assessed staff skills and provided individualized coaching, improved the motivational interviewing skills of SafeMed staff.

7.6 Context

The patient population targeted by the SafeMed program struggled with medication access due to issues with cost and affordability of medications, as well as other access barriers, such as the timing required for preauthorization of certain medications through Medicaid and Medicare and challenges finding transportation to the pharmacy. Though the program prioritized

increasing access to medications for the patient population, it encountered barriers. SafeMed attempted to leverage available medication access assistance programs but found that most of these programs were geared toward the uninsured, which was not SafeMed's target population. Additionally, SafeMed's pharmacists struggled to assist Medicaid patients in obtaining needed medications under the TennCare program. With some exceptions, TennCare's pharmacy benefit covers only five prescriptions per month, only two of which can be brand name drugs. As a result, pharmacists assisted patients in prioritizing the more expensive medications for TennCare reimbursement, but medication access remained an issue.

One formidable implementation challenge was the lack of an existing care transition infrastructure within the Methodist systems. SafeMed program leaders noted that the Methodist system did not have an evidence-based care transitions program in place prior to SafeMed, which affected the scope and ease of implementation of the program. As noted, program leaders therefore had to design and incorporate care transition elements into the program.

7.7 Sustainability and Spread

Despite actively pursuing multiple approaches to sustaining and expanding the program after the conclusion of the HCIA grant, the SafeMed program ended in July 2015. SafeMed's primary sustainability strategy was to have SafeMed staff become part of individual hospital-based readmission reduction teams. Though this approach had the support of Methodist leadership, the individual hospitals did not proceed with hiring SafeMed team members. Program leaders believe that the failed push for Medicaid expansion in Tennessee and the associated budget implications for Methodist LeBonheur Healthcare system, as the largest provider of uninsured care in the state, largely contributed to this lack of action. During site visit interviews, some program staff suggested that an outpatient clinic, as originally envisioned for the program but never implemented, had the potential of contributing to the sustainability of the program by increasing the program's return on investment. If implemented, the clinic may have reduced the amount of time staff spent scheduling outpatient appointments, and provided a resource for patients who would otherwise have visited the emergency department, thus potentially avoiding preventable readmissions.

Though SafeMed's efforts to sustain the program were unsuccessful, program leaders undertook efforts to spread some of the promising program components. Notably, SafeMed program leaders developed a Practice Improvement Module for the American Medical Association - Medical Group Management Association (AMA-MGMA) Innovation Challenge about the SafeMed model, which was selected as one of five Practice Innovation Challenge winners. The module uses a pared-down version of the SafeMed program and teaches primary care physicians and staff who practice medicine in an integrated medical system how to build a

SafeMed practice-based care transitions team and implement the model overall. The module is available at https://www.stepsforward.org/modules/safemed-transition-care.

8 CROSS-AWARDEE EVALUATION FINDINGS

This section provides an overview of group-level findings for the MM HCIA awardees for the categories of participant experience, workforce issues, implementation successes and challenges, and factors affecting program sustainability and scale-up, through August 2016, unless noted otherwise.

8.1 Participant Experience

The majority of HCIA MM intervention participants who completed the Patient Experience Survey, described in Section 1.2.1, reported positive experiences regarding interactions with pharmacists and health care providers. They also reported favorably on the written materials and other support received to help understand their medication regimens. Survey findings indicated that participants had varied degrees of awareness that they were receiving additional services for MM beyond their usual health care delivery services. Awareness of the MM intervention varied greatly from program to program, ranging from 40 percent of PSW survey respondents reporting awareness that they were included in a program to help support them with their medications to 65 percent for USC survey respondents.

Despite the varied awareness that they were receiving additional services, those who said they were aware that they were part of a program to help them take their medicines, felt more confident that they knew how to take their medicines. Of those who were aware they were part of a program, 57 percent said they strongly agreed that they knew how to take medicines compared to 45 percent that were not aware they were part of a program.

Ratings of program support and materials were high across all MM interventions. On a scale from zero to ten, ratings for the support provided by pharmacists and health care team members ranged from 8.2 for IHARP survey respondents to 9.3 for respondents from the PSW intervention. Ratings for hard copy materials were also high, but slightly lower, ranging from 8.3 for IHARP survey participants to 8.8 for PSW and USC.

8.2 Workforce Issues

This section reports highlights from a survey of MM staff and other key cross-awardee findings related to workforce based on qualitative information obtained from interviews with HCIA awardee leadership, awardee progress reports provided by the Lewin Group, site visits, and additional materials provided directly by awardees. Workforce survey results are presented at the aggregate level because of the small staff sizes in most programs. In particular, results are focused on the impact of respondents' roles (leadership, patient care, or non-patient care staff) on their experiences across MM programs. Job titles of program staff were used to characterize the role of each staff member. Survey methods and response rates are reported in Section 1.2.1.

MM staff generally felt that their roles in the HCIA program added value for patients and colleagues. More than 80 percent strongly agreed that their roles improved patient care, and more than 60 percent strongly agreed that their roles were cost effective, increased patient satisfaction, helped patients make decisions, increased patient safety, and added value to the organization (Table 8-1). MM respondents were less certain that their roles were appreciated by other health professionals or that their role fits well within the flow of patient care. Of professionals surveyed, patient care staff reported the most positive impacts of their HCIA intervention related role. MM leadership was less likely to strongly agree that their roles reduced the workload of other health professionals, that other professionals appreciated their role, and that their role fit well within the flow of patient care. Non-patient care staff were generally less likely to perceive an impact of their role on patients, although they were the most likely to report that their role fit well within the flow of patient care. Among respondents who agreed that their role reduced the workload of other health care professionals, MM staff members were most likely to report that their role reduced the workload of physicians (92.1%), Advanced Practice Registered Nurses (62.6%), and pharmacists (44.2%).

Table 8-1: Program Staff's Perceived Impact of Role in MM Interventions

Survey Response	Percent of Respondents who Indicated "Strongly Agree" by Role			
	Leadership	Patient Care	Non-Patient Care	All Roles
Role in MM program (N=251)	19.5	70.5	10.0	100.0
Role is improving patient care (N=235)	78.6	83.5	52.9	80.4
Role is cost effective (N=227)	64.9	63.4	38.9	61.7
Role is increasing patient satisfaction (N=232)	61.0	69.7	43.8	66.4
Role is reducing HCP workload (N=224)	35.0	47.1	33.3	44.2
Other HCPs appreciate role (N=231)	37.5	42.3	37.5	41.1
Role fits in patient care flow (N=217)	43.3	44.6	58.3	45.2
Role is helping patients make decisions (N=225)	58.8	65.9	40.0	63.1
Role is increasing patient safety (N=228)	59.0	79.4	35.7	73.2
Role adds value to organization (N=246)	72.3	75.0	65.2	73.6

Note: Missing data are not included in the percentages reported. Valid N for each variable is reported in row labels. "Not applicable" responses to each item have been coded as missing.

Overall, respondents were very satisfied with their roles and the training they received. More than half strongly agreed that they received the training they needed and that their role fully utilized their skills (Table 8-2). On a scale of 1-7, respondents' average rating of their job satisfaction was high at 5.9, and more than 80 percent reported that they "definitely" or "probably" would not leave if they had the opportunity to remain with the program. Patient care staff had somewhat higher levels of satisfaction compared with other roles; more than 60 percent strongly agreed that their role fully utilized their skills, and a higher percentage of staff reported that they definitely would not leave their role.

Table 8-2: Program Staff's Perceptions of Role Fit, Training, and Job Satisfaction in MM Interventions

Survey Response	Percent of Respondents by Role			
	Leadership	Patient Care	Non-Patient Care	All Roles
Role in MM program (N=251)	19.5	70.5	10.0	100.0
"Strongly Agree" that s/he received needed training (N=233)	48.8	59.8	55.6	57.5
"Strongly Agree" that role fully utilizes skills (N=228)	40.5	63.1	33.3	57.5
Average Satisfaction Score* (N = 248)	5.8	5.9	6.2	5.9
Intention to leave role after end of HCIA funding (N=247)				
Definitely would not leave	50.0	61.7	37.5	57.1
Probably would not leave	33.3	24.6	41.7	27.9
Uncertain	12.5	9.7	12.5	10.5
Probably would leave	0.0	2.3	8.3	2.4
Definitely would leave	4.2	1.7	0.0	2.0

*Respondents rated their satisfaction on a scale of 1=Extremely Dissatisfied to 7=Extremely Satisfied.
Note: Missing data are not included in the percentages reported. Valid N for each variable is reported in row labels.

There was a strong relationship between MM staff respondents' satisfaction with the program and their assessment of the performance of other program staff. Around half of the respondents with high job satisfaction, compared to only a quarter of the respondents with low job satisfaction, rated their colleagues very positively in terms of communication with patients. Patient care staff with high job satisfaction were more likely to report that face-to-face interactions was their primary method of communication, and they also interacted with patients more frequently and for a longer duration during each interaction.

Additionally, program leaders found that the incorporation of pharmacy technicians into the implementation of MM programs was a strong factor in program success. Pharmacy technicians could support the program by serving in patient outreach and patient navigation roles, thereby allowing clinically-trained or other professional staff to focus on delivering MM and other health care services. Both the USC and SafeMed programs relied on expanded roles for pharmacy technicians, and program leaders indicated that these roles were integral to the implementation of their overall models. Similarly, PSW relied on pharmacy technicians in its certification process, and provided them with training to support pharmacists. Technicians were trained to identify eligible participants and provide an expanded set of medication management services, such as flagging the need for medication management services for pharmacists to review. Though the pharmacy technician role was not included in the IHARP model, primary care clinical pharmacists and IHARP program leaders reported that incorporating this role could have great potential for increasing primary care clinical pharmacist capacity to provide IHARP services.

Finally, program leaders emphasized the importance of motivational interviewing training in developing an MM workforce. Specifically, program leaders from Pharm2Pharm, SafeMed, and IHARP reported that providing motivational interviewing training to MM workforce members helped staff develop the skills necessary to assist patients with making behavioral and lifestyle changes.

8.3 Implementation Successes and Challenges

Across awardees, program leaders reported the benefits of using an "opt-out" strategy to increase patient engagement in the program. As a supplement to its standard "opt-in" model, HeartStrong conducted an "opt-out" experiment in which all eligible patients received their electronic pill bottles (GlowCaps) upfront by mail along with a full package of information. HeartStrong reported that enrollment rates were significantly higher for the opt-out participants, while medication adherence rates were similar among patients enrolled via either strategy. This finding aligns with feedback from other MM awardees that opt-out approaches improved patient acceptance of services. PSW reported that automatically scheduling beneficiaries for visits for in-depth medication management services unless they explicitly declined was an effective strategy, and Pharm2Pharm reported that sending letters to non-responsive patients with a scheduled an appointment with the community pharmacist helped to re-engage patients who stopped participating in the program after hospital discharge.

However, awardees had mixed feedback about the use of financial incentives to promote patient engagement. HeartStrong and SafeMed both used financial incentives to promote patient participation in their respective programs. HeartStrong indicated that providing participants a $25 incentive first for enrollment and again upon setting up the GlowCaps was an effective engagement strategy. Additionally, HeartStrong removed its daily lottery incentive for opt-out participants after three months of participation and found that adherence rates declined in the opt-out group following the elimination of the incentive. Similarly, SafeMed initially provided a $50 incentive to participants to attend group support sessions and comprehensive medication reviews but found a drop in attendance following the removal of the financial incentive. However, SafeMed leaders continued to support the removal of the incentive because they felt those who attended the sessions only to receive the incentive did not fully engage with the program. Additionally, SafeMed team members believed that the decrease in attendance may have been attributable to other factors, such as inclement weather.

Integrating MM programs into existing dispensing workflows of community pharmacies was a challenge across awardees. MM awardees with a community pharmacy component (IHARP, PSW, and Pharm2Pharm) all reported encountering difficulty with implementing MM services, particularly in-depth or comprehensive medication reviews, in the community setting.

Community pharmacists had difficulty incorporating these services into their workflow and balancing the time needed to provide the services with their existing dispensing responsibilities. Feedback from awardees indicated that successful provision of these services would require culture change and staffing models that allow pharmacists time dedicated to provide MM services. Using pharmacy technicians and other staff to support pharmacists in the delivery of these services was a useful strategy to address these challenges.

Additionally, MM awardees found it effective to link MM services to existing health care service touchpoints to help ongoing patient engagement. MM awardees generally emphasized the importance of having face-to-face interactions with patients, particularly for initial visits that involve in-depth medication reviews. However, patients sometimes struggled to attend these visits, especially when challenged by multiple medical appointments or transportation barriers. Awardees reported that co-scheduling in-depth medication review visits with other health care services, such as appointments with primary care providers, lab work, or medication pick-ups at pharmacies, increased patient willingness to attend in-depth medication reviews.

Physician/prescriber engagement was also an important factor in MM program implementation, and awardees used multiple approaches to increase support of these individuals. Staff of the MM programs interacted with physicians and other prescribers as part of the innovations, whether for patient referrals or to provide recommended modifications to patients' medication regimens. Obtaining physician/prescriber buy-in to the program underpinned these activities and was an important precursor for successful program implementation. Awardees reported several strategies for securing physician/prescriber support for the programs including highlighting potential time savings and improvements on quality measures, proactively seeking physician input, and convening one-on-one meetings with providers. Awardees reported that having physician champions endorse the program to their peers was another effective way to get broader buy-in. Awardees emphasized that obtaining physician buy-in and building their trust in the MM program, particularly in the ability of pharmacists to deliver MM services, takes time but can be an important factor for optimizing MM program implementation.

Program leaders emphasized the importance of flexibility in implementation of the MM program, as many awardees experienced tension between ensuring fidelity to the model while still tailoring the model to address patients' needs. Program staff directly involved in implementing the intervention for several programs voiced concerns about the challenge of balancing a need to provide standardized services while effectively managing and addressing diverse patient needs. According to these staff, a "one size fits all" approach was not always best for meeting patient needs; some program staff indicated that having flexibility to use their clinical judgment to determine the need for and frequency of follow-up services would have been ideal, since some patients did not need all services while some patients needed more. At the

same time, staff members also recognized the need for standardized services for evaluation purposes.

A patient-centered medical home structure was an important factor for acceptance of MM innovations in primary care. Both USC and IHARP, the two MM awardees mainly based in the primary care setting, implemented programs in primary care practices with an underlying patient-centered medical home model. Both awardees indicated this model, which emphasizes team-based care, was an important foundation for the acceptance of the MM innovations and fostered teamwork between pharmacists/pharmacy team members and clinic physicians and staff members.

Collaborative practice agreements between physicians and pharmacists were perceived to have great potential in improving care coordination for MM intervention beneficiaries. However, program leaders reported challenges in implementing the agreements, and noted that coordination required trust between physicians and pharmacists. These agreements, which can allow pharmacists to act upon observations and recommendations in real time and modify drug therapies without physician approval, were viewed as having great potential to improve pharmacist efficiency and productivity and optimize MM program implementation. Awardees underscored that these agreements required a high level of trust between physicians and pharmacists and that programs must be sufficiently mature to establish this foundational trust, which takes time and effort to build. USC was the only MM awardee to implement formal, written collaborative practice agreements with physicians. PSW developed a collaborative practice agreement toolkit to support its participating pharmacies in implementing these agreements. IHARP program leaders attempted to pursue these agreements but were unable to do so due to delays associated with Carilion's Legal Department's approval, and Pharm2Pharm focused on improving relationships with high-volume physicians who serve its participants as a precursor for building collaborative practice agreements.

8.4 Factors Affecting Sustainability and Scale Up

MM awardees that partnered with health systems to implement their programs faced challenges when pursuing health system funding as a primary sustainability strategy following the end of the HCIA award, and this funding did not fully materialize for all awardees. IHARP, USC, and SafeMed all pursued financial support from their partnering health systems to fund the innovations following the end of the HCIA grant. All three partnering health systems offered some preliminary commitment to provide ongoing financial support. Carilion Clinic funded the IHARP program temporarily starting in January 2015, but Carilion's administration ultimately decided to withdraw funding due to legal and financial reasons, thus effectively ending the IHARP program in October 2015. IHARP program leaders noted, however, that based on recent

Carilion Clinic budgetary developments for 2016-2017, it seems likely that Carilion will reestablish primary care clinical pharmacists in all of the practices that participated in IHARP between 2013 and October 2015. Though hospitals within SafeMed's partnering health system, Methodist LeBonheur Healthcare, expressed interest in integrating SafeMed staff into existing hospital-based readmission reduction teams, these efforts did not come to fruition. As a result, the SafeMed innovation is no longer in operation. USC's partnering health system, AltaMed, approved a modified version of the program that included providers that could autonomously bill (e.g., physician assistants and nurse practitioners), since pharmacists do not have federal recognition as Medicare Part B health care providers. However, the program is drastically modified from the version implemented and tested under the HCIA award.

In exploring sustainability options, some MM awardees considered out-of-pocket fees as a source of program funding but found that this was unlikely to be a viable option. Pharm2Pharm pilot tested an out-of-pocket payment model for community pharmacy services as part of its no-cost extension period. Hospitalized patients who received inpatient Pharm2Pharm services were given the option to receive outpatient Pharm2Pharm services from a community pharmacist for an out-of-pocket fee, ranging from roughly $10 to $50 per visit. Since no patients chose to pay out of pocket for community pharmacy services, Pharm2Pharm program leaders decided to abandon this strategy as a potential sustainability option. IHARP program leaders included revenue generation through billing and co-payment collection in the program's sustainability plan but decided that requiring patients to pay for IHARP services was an unlikely model for sustaining or scaling the program despite high patient satisfaction with the program, since IHARP's patient population struggled with office visit co-payments. IHARP program leaders believed introducing additional fees may deter patients from seeking care and investing in pharmacy services even among patients who could afford co-payments.

Finally, MM awardees reported that the lack of recognition for pharmacists as health care providers adversely impacted the potential for sustainability and scalability of their innovations. Many MM program leaders and staff indicated that federal policies that do not recognize pharmacists as Medicare Part B health care providers able to bill Medicare for their consultation services restricted the possibility of scaling and sustaining innovations that largely represent pharmacy services-centered models.

APPENDIX A: OUTCOME MEASURE SPECIFICATIONS BY AWARDEE

The tables below define the outcome measures presented for the IHARP, PSW, USC, and Pharm2Pharm programs. Appendix Table A-1 provides definitions of key terms used in the outcome measure definitions, and Appendix Table A-2 provides definitions of the outcome measures themselves.

Appendix Table A-1: Definitions of Terms Used in Outcome Measure Definitions

Term	Definition	Relevant Awardees
Expenditure	All expenditure measures represent Medicare payments. Cost data are payment standardized using the CMS payment standardization methodology to remove differences due to geographic variation in Medicare payment rates and variation among classes of providers. All costs are adjusted monthly for inflation from a 2011 base year using the Bureau of labor Statistics Consumer Price Index for medical care services. Cost data are not risk adjusted.	IHARP
Beneficiary	Beneficiaries must be continuously enrolled in Medicare Parts A and B (Fee For Service, FFS) or C (Medicare Advantage, MA) for one year prior to the program's intervention date through the intervention quarter of interest. For USC and IHARP, beneficiaries must also be continuously enrolled in Medicare Part D for one year prior to the program's intervention date through the intervention quarter of interest. Beneficiaries who switch between FFS and MA are included in the MA analysis. If a beneficiary dies, the beneficiary will be included in the quarter in which he or she died and not in any subsequent quarters.	USC, Pharm2Pharm

Appendix Table A-2: Definitions of Outcome Measures

Measure	Relevant Population	Definition	Relevant Awardees
All-Cause Mortality per 1,000 Beneficiaries	FFS and MA	Numerator: Number of deaths * 1,000 Denominator: Total number of beneficiaries.	IHARP, USC, Pharm2Pharm
Total Medicare Expenditures Per Beneficiary (1 of 4 core meta-evaluation measures)	FFS	Numerator: Total Medicare Parts A and B claim costs. Part D costs are not included. Denominator: Total number of beneficiaries.	IHARP
Total Medicare Parts A, B, and D Expenditures Per Beneficiary	FFS	Numerator: Total Medicare Parts A, B, and D[a] claim costs. Denominator: Total number of beneficiaries.	IHARP
Inpatient Expenditures Per Beneficiary	FFS	Numerator: Total inpatient stay costs. Denominator: Total number of beneficiaries.	IHARP
Outpatient ER Expenditures Per Beneficiary	FFS	Numerator: Total emergency room (ER)-only outpatient claim costs. Denominator: Total number of beneficiaries.	IHARP

Measure	Relevant Population	Definition	Relevant Awardees
Outpatient Non-ER Expenditures Per Beneficiary	FFS	Numerator: Total non-ER outpatient claim costs. Denominator: Total number of beneficiaries.	IHARP
Physician and Ancillary Service Expenditures Per Beneficiary	FFS	Numerator: Total physician/carrier claim costs. Denominator: Total number of beneficiaries.	IHARP
Skilled Nursing Facility Expenditures Per Beneficiary	FFS	Numerator: Total skilled nursing facility claim costs. Denominator: Total number of beneficiaries.	IHARP
Home Health Expenditures Per Beneficiary	FFS	Numerator: Total home health claim costs. Denominator: Total number of beneficiaries.	IHARP
Hospice Expenditures Per Beneficiary	FFS	Numerator: Total hospice claim costs. Denominator: Total number of beneficiaries.	IHARP
Number of ER Visits Per 1,000 Beneficiaries (1 of 4 core meta-evaluation measures)	FFS	Numerator: Number of beneficiaries with at least one outpatient ER claim with no inpatient admission on the same day * 1,000. Denominator: Total number of beneficiaries.	IHARP
Number of ER Visits Per 1,000 Beneficiaries	FFS	Numerator: Number of days with an ER claim for beneficiaries with no inpatient admission on the same day * 1,000. Denominator: Total number of beneficiaries.	IHARP
Number of Inpatient Admissions Per 1,000 Beneficiaries (1 of 4 core meta-evaluation measures)	FFS and MA	Numerator: Number of beneficiaries with at least one inpatient stay * 1,000. Denominator: Total number of beneficiaries.	IHARP, USC, Pharm2Pharm
Number of Inpatient Admissions Per 1,000 Beneficiaries	FFS and MA	Numerator: Number of inpatient stays * 1,000. Denominator: Total number of beneficiaries.	IHARP, USC, Pharm2Pharm
Unplanned Inpatient Admission Rate Per 1,000 Beneficiaries	FFS and MA	Numerator: Number of beneficiaries with at least one unplanned inpatient stay * 1,000. Denominator: Total number of beneficiaries.	IHARP, USC, Pharm2Pharm
Unplanned Inpatient Admissions Per 1,000 Beneficiaries	FFS and MA	Numerator: Number of unplanned inpatient stays * 1,000. Denominator: Total number of beneficiaries.	IHARP, USC, Pharm2Pharm
30-Day Hospital Readmissions Per 1,000 Beneficiaries	FFS and MA	Numerator: Number of beneficiaries with an inpatient stay admission within 30 days of discharge from a previous inpatient stay * 1,000. Denominator: Number of beneficiaries with an inpatient stay.	IHARP, USC, Pharm2Pharm
30-Day Hospital Unplanned Readmissions Per 1,000 Beneficiaries (1 of 4 core meta-evaluation measures)	FFS and MA	Numerator: Number of beneficiaries with an unplanned inpatient stay admission within 30 days of discharge from a previous inpatient stay * 1,000 Denominator: Number of beneficiaries with an inpatient stay.	IHARP, USC, Pharm2Pharm

Measure	Relevant Population	Definition	Relevant Awardees
Number of Hospital Days Per 1,000 Beneficiaries	FFS and MA	Numerator: Total number of inpatient days * 1,000. Denominator: Total number of beneficiaries.	IHARP, USC, Pharm2Pharm
Proportion of Days Covered (PDC) measure for adherence to diabetes medications	FFS and MA	Numerator: Number of days the patient was covered by at least one drug in the class based on prescription fill dates and days of supply * 100. Denominator: Number of days in patient's measurement period (index prescription date to the end of calendar year, disenrollment, or death).	USC, IHARP, Pharm2Pharm
PDC measure for adherence to RAS antagonists	FFS and MA,	Numerator: Number of days the patient was covered by at least one drug in the class based on prescription fill dates and days of supply * 100. Denominator: Number of days in patient's measurement period (index prescription date to the end of calendar year, disenrollment, or death).	USC, IHARP, Pharm2Pharm
PDC measure for adherence to Beta Blockers	FFS and MA,	Numerator: Number of days the patient was covered by at least one drug in the class based on prescription fill dates and days of supply * 100. Denominator: Number of days in patient's measurement period (index prescription date to the end of calendar year, disenrollment, or death).	USC, IHARP, Pharm2Pharm
PDC measure for adherence to Calcium Channel Blockers	FFS and MA,	Numerator: Number of days the patient was covered by at least one drug in the class based on prescription fill dates and days of supply * 100. Denominator: Number of days in patient's measurement period (index prescription date to the end of calendar year, disenrollment, or death).	USC, IHARP, Pharm2Pharm
PDC Measure of adherence to statins	FFS and MA,	Numerator: Number of days the patient was covered by at least one drug in the class based on prescription fill dates and days of supply * 100. Denominator: Number of days in patient's measurement period (index prescription date to the end of calendar year, disenrollment, or death).	USC, IHARP, Pharm2Pharm
Change in the rate of patients with blood pressure greater than 140/90	FFS and MA	Numerator: Diabetes patients with HbA1c > 8%. Denominator: Total patients with diabetes diagnosis	USC
Change in the rate of patients with diabetes who had Hemoglobin A1c greater than 8.0%	FFS and MA	Numerator: Hypertension Patients with blood pressure > 140/90 Denominator: Total hypertension patients	USC
Change in the rate of patients with LDL greater than 100 gm/ dL	FFS and MA	Numerator: Diabetes patients with LDL > 100 Denominator: Total diabetes patients	USC

APPENDIX B: RESULTS FOR IHARP

The following tables provide the baseline demographic and health characteristics, mortality and readmission rates, health service utilization, medical costs, and medication adherence rates results for intervention and comparison group beneficiaries in the IHARP FFS cohort.

B.1 Demographic and Health Characteristics

Appendix Table B-1: IHARP Baseline Demographic and Health Characteristics, Medicare FFS Cohort

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Number of Beneficiaries	700	700		
Average Age (Years)[+]	70.69	70.88	-0.19	0.02
Age under 65[+]	21%	21%	0%	0.00
Gender				
Male[+]	37%	37%	0%	0.00
Female	63%	63%	0%	0.00
Race				
White[+]	91%	91%	0%	0.00
Black or Other	9%	9%	0%	0.00
Dual Eligible[+]	24%	24%	0%	0.00
Medicare Eligibility				
Disabled[+]	41%	41%	0%	0.00
Aged	59%	59%	0%	0.00
Area Deprivation Index (ADI)[+]	105.21	104.87	0.34	0.03
Evaluation and Management (E&M) Visits				
E&M Visits: 0	0%	0%	0%	0%
E&M Visits: 1-5[+]	15%	13%	2%	0.06
E&M Visits: 6-10[+]	27%	25%	3%	0.06
E&M Visits: 11-15[+]	23%	24%	-1%	0.02
E&M Visits: 16+[+]	34%	38%	-4%	0.08
Resource Use per Beneficiary (Pre-Enrollment Year)				
0 SNF Stays (Prior Year)	89%	89%	0%	0.00
1 SNF Stay (Prior Year)[+]	8%	8%	0%	0.00
2+ SNF Stays (Prior Year)[+]	4%	4%	0%	0.00
IP Stay before study enrollment	50%	50%	0%	0.00
0 IP Stays (1Q Prior)	41%	41%	0%	0.00
1 IP Stay (Prior Year)[+]	46%	46%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
2+ IP Stays (Prior Year)+	13%	13%	0%	0.00
0 IP Stays (Prior Year)	30%	31%	-1%	0.02
1 IP Stay (Prior Year)+	39%	40%	-1%	0.02
2+ IP Stays (Prior Year)	31%	29%	2%	0.05
ER Visits (Pre-Enrollment Quarter)				
ER Visits: 0	66%	67%	-1%	0.02
ER Visits: 1+	26%	26%	-1%	0.02
ER Visits: 2++	9%	7%	2%	0.07
Medical Cost per Beneficiary				
Cost (4Q Prior)+	$3,047	$3,214	-166	0.03
Cost (3Q Prior)+	$3,489	$3,454	35	0.00
Cost (2Q Prior)+	$3,810	$3,604	206	0.03
Cost (1Q Prior)+	$9,524	$9,129	395	0.03
IP Cost (Prior Year)	$8,896	$8,204	692	0.06
IP Cost (1Q Prior)+	$5,246	$5,015	231	0.03
Frailty Measures				
Home Oxygen+	25%	24%	0%	0.01
Charlson Score+	2.03	2.00	0.04	0.01
Drug History (Pre-Enrollment Year)				
Antidiabetics+	37%	37%	0%	0.01
Insulin+	29%	29%	0%	0.01
SSRIs and SNRIs+	43%	44%	-1%	0.03
Other Antidepressants+	30%	29%	1%	0.02
Statins+	71%	70%	0%	0.01
Thiazide+	41%	41%	0%	0.00
Calcium channel blockers+	47%	46%	1%	0.01
Beta blockers+	70%	72%	-2%	0.05
ACE inhibitors+	56%	55%	2%	0.03
ARBs+	25%	25%	0%	0.01
Antihypertensives+	20%	22%	-2%	0.06
Antineoplastics+	6%	8%	-1%	0.06
Corticosteroids+	42%	44%	-3%	0.05
Cardiotonics+	7%	8%	-1%	0.05
Antiarrhythmics+	8%	10%	-2%	0.06
Vasopressors+	3%	3%	0%	0.00
Antiasthmatics+	44%	43%	1%	0.01
Antianxiety Agents+	34%	35%	-1%	0.02
Antipsychotics+	11%	9%	1%	0.05

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Anticoagulants[+]	26%	30%	-4%	0.09
Insulin[+]	29%	29%	0%	0.01
Nitrates[+]	35%	37%	-2%	0.04
Loop diuretics[+]	52%	49%	3%	0.06
Potassium sparing diuretics[+]	14%	14%	-1%	0.02
Fibric acid derivatives[+]	15%	13%	1%	0.04
Platelet aggregation inhibitors[+]	22%	22%	0%	0.01
Initial Hospitalization Major Diagnosis Category				
Diseases & Disorders Of The Nervous System[+]	3%	4%	-1%	0.04
Diseases & Disorders Of The Respiratory System[+]	10%	9%	1%	0.03
Diseases & Disorders Of The Circulatory System[+]	14%	14%	0%	0.01
Diseases & Disorders Of The Musculoskeletal System & Conn Tissue[+]	4%	4%	1%	0.04
Healthcare Cost and Utilization Project (HCUP) Diagnosis Categories (Pre-Enrollment Year)				
Acute cerebrovascular disease (IP)	2%	3%	0%	0.02
Acute cerebrovascular disease (IP, 30 days prior)	1%	2%	-1%	0.06
AMI (IP)	3%	4%	-1%	0.03
AMI (IP, 30 days prior)	2%	2%	0%	0.00
Cerebrovascular disease[+]	28%	27%	1%	0.01
Parkinson's disease and multiple sclerosis	2%	2%	0%	0.03
Asthma	49%	47%	2%	0.04
Coagulation and hemorrhagic disorders[+]	11%	11%	0%	0.00
Congestive heart failure (All Settings)[+]	42%	41%	1%	0.02
Congestive heart failure (IP)	9%	8%	1%	0.04
Coronary atherosclerosis[+]	53%	55%	-2%	0.03
Dementia[+]	10%	9%	1%	0.03
Diabetes mellitus without complication[+]	67%	68%	-1%	0.02
Diabetes mellitus with complications[+]	42%	40%	2%	0.03
Cardiac dysrhythmias, arrest and ventricular fibrillation[+]	67%	68%	-1%	0.02
Fluid and electrolyte disorders[+]	44%	43%	1%	0.03
Gastrointestinal hemorrhage (All Settings)[+]	10%	8%	2%	0.06
Gastrointestinal hemorrhage (IP)	2%	3%	0%	0.01
Other heart disease[+]	86%	88%	-2%	0.07
Heart valve disorders[+]	46%	46%	0%	0.00
Hepatitis[+]	2%	2%	-1%	0.04
Hypertension with complications[+]	30%	30%	1%	0.01
Stomach, pancreas and lung cancer[+]	1%	2%	-1%	0.06
Peri- endo- and myocarditis[+]	15%	14%	1%	0.03

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Disorders of nervous system+	27%	28%	-2%	0.04
Other cancers	18%	20%	-1%	0.03
Paralysis+	3%	3%	0%	0.00
Pneumonia+	32%	29%	2%	0.05
Pneumonia (IP, 30 days prior)	4%	4%	0%	0.02
Pulmonary heart disease+	16%	15%	1%	0.04
Renal failure	37%	38%	-1%	0.01
Respiratory failure (IP)+	3%	2%	1%	0.06
Respiratory failure (IP, 30 days prior)	2%	1%	0%	0.04
Rheumatoid arthritis and related disease+	5%	7%	-2%	0.08
Septicemia+	10%	10%	1%	0.02
Shock+	3%	3%	0%	0.03
Tuberculosis+	0%	0%	0%	0.05
Procedures (Pre-Enrollment Year)				
Bypass and PTCA (IP)+	4%	3%	0%	0.02
Heart valve procedures (IP)+	2%	2%	0%	0.02
Hemodialysis+	5%	4%	1%	0.05
Peritoneal dialysis	3%	3%	1%	0.04
Procedures on vessels of head and neck (IP)+	13%	13%	0%	0.00
Radiology and chemotherapy+	2%	2%	0%	0.02
Respiratory intubation and mechanical ventilation+	12%	10%	2%	0.06
Blood transfusion+	11%	10%	1%	0.03
Blood transfusion (IP)+	10%	9%	1%	0.04
Transportation	42%	38%	4%	0.08
HCC Risk Score	2.69	2.61	8%	0.04
Comorbidity Categories (Pre-Enrollment Quarter)				
Depression	10%	9%	0%	0.01
AIDS HIV	0%	0%	0%	0.00
Alcohol Abuse	3%	3%	0%	0.02
Cardiac Arrhythmias	53%	50%	4%	0.07
Congestive Heart Failure	37%	37%	1%	0.02
Chronic Pulmonary Disease	46%	41%	5%	0.11
Coagulopathy	6%	7%	-1%	0.02
Deficiency Anemia	11%	13%	-2%	0.05
Diabetes Complicated	25%	21%	4%	0.10
Diabetes Uncomplicated	56%	55%	1%	0.02
Dementia	1%	2%	-1%	0.08
Drug Abuse	2%	3%	-2%	0.10

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Fluid and Electrolyte Disorders	34%	29%	5%	0.10
Hypothyroidism	27%	21%	5%	0.12
Hypertension Complicated	17%	17%	-1%	0.02
Hypertension Uncomplicated	83%	85%	-2%	0.05
Liver Disease	8%	7%	0%	0.02
Lymphoma	1%	1%	0%	0.00
Metastatic Cancer	1%	3%	-2%	0.13
Myocardial Infarction	17%	17%	1%	0.02
Obesity	25%	19%	7%	0.17
Other Neurological Disorders	10%	12%	-2%	0.06
Paralysis	1%	2%	-1%	0.04
Peptic Ulcer Disease Excluding Bleeding	1%	2%	0%	0.02
Peripheral Vascular Disorders	17%	16%	1%	0.03
Psychosis	5%	5%	0%	0.00
Pulmonary Circulation Disorders	4%	3%	1%	0.08
Renal Failure	24%	25%	-1%	0.03
Rheumatoid Arthritis Collagen Vascular Disease	7%	9%	-2%	0.08
Solid Tumor Without Metastasis	7%	10%	-4%	0.13
Valvular Disease	30%	30%	0%	0.01
Weight Loss	6%	6%	0%	0.00

[+]Denotes characteristic used for matching.

[a]Standardized mean difference is an effect size measure used in the above table to identify substantial differences between the intervention and control groups; a standardized mean difference of 0.1 or greater is treated as an indicator of a substantial difference between the two groups.

B.2 Mortality and Readmissions

Appendix Table B-2: Cumulative and Yearly Mortality and Readmissions per 1,000 Beneficiaries, Differences after IHARP Enrollment, Medicare FFS Cohort

Measures	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participants	699	699	587
Mortality			
Difference[c]	-25.62	-32.59*	17.52
90% Confidence Interval	(-70.6 | 19.4)	(-64.4 | -0.8)	(-12.1 | 47.2)
P-Value	0.349	0.092	0.331
30-Day Hospital Readmissions Following All Inpatient Admissions			
Difference	9.43	-92.15	164.59
90% Confidence Interval	(-313.8 | 332.7)	(-307.7 | 123.4)	(-74.1 | 403.3)
P-Value	0.962	0.482	0.257
30-Day Hospital Unplanned Readmissions Following All Inpatient Admission			
Difference	-41.56	-128.32	156.71
90% Confidence Interval	(-359.1 | 276.0)	(-339.4 | 82.8)	(-79.3 | 392.7)
P-Value	0.830	0.317	0.275

* Statistically significant at the ten percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.
[c]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries or the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Table B-3: Quarterly Difference in Mortality per 1,000 Beneficiaries after IHARP Enrollment, Medicare FFS Cohort

Measures	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Medicare FFS								
Number of Participant Beneficiaries	699	683	659	644	587	502	387	275
Difference[a]	-60.09***	3.09	14.32**	13.33	9.62	-15.67**	21.95**	5.08
90% Confidence Interval	(-79.6 | -40.6)	(-13.3 | 19.5)	(2.9 | 25.7)	(-1.2 | 27.8)	(-4.5 | 23.7)	(-27.9 | -3.4)	(6.2 | 37.7)	(-13.0 | 23.2)
P-Value	<0.001	0.757	0.039	0.130	0.262	0.035	0.022	0.645

** Statistically significant at the five percent level.

*** Statistically significant at the one percent level.

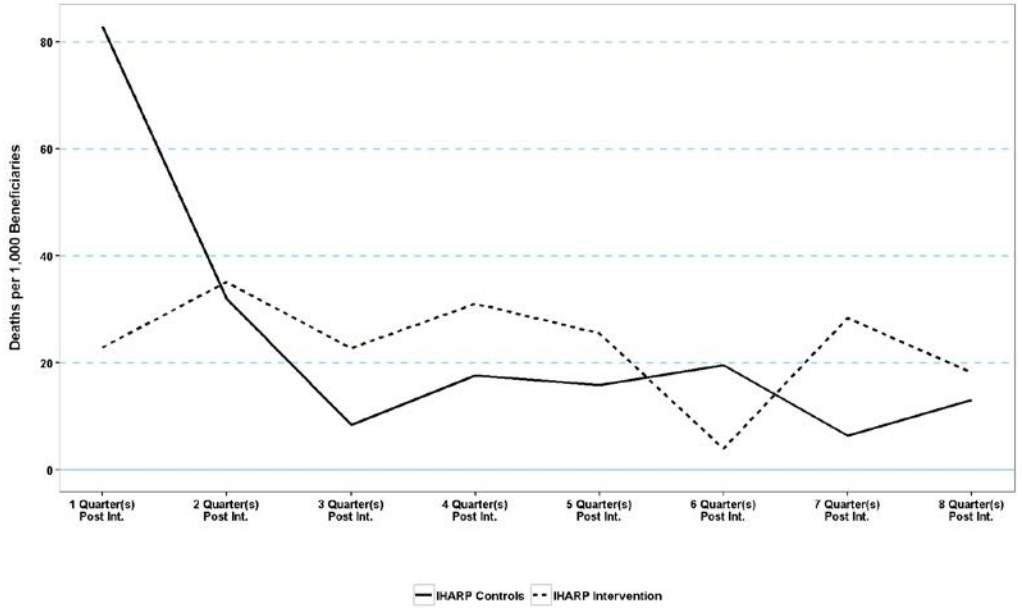
[a]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries between the intervention group and control group in the relevant quarter of the intervention period. There were no deaths in the intervention or control groups prior to program enrollment as beneficiaries were required to be alive on program start date to be included in the study.

Appendix Table B-4: Quarterly Difference in Readmissions per 1,000 IP Admissions after IHARP Enrollment, Medicare FFS Cohort

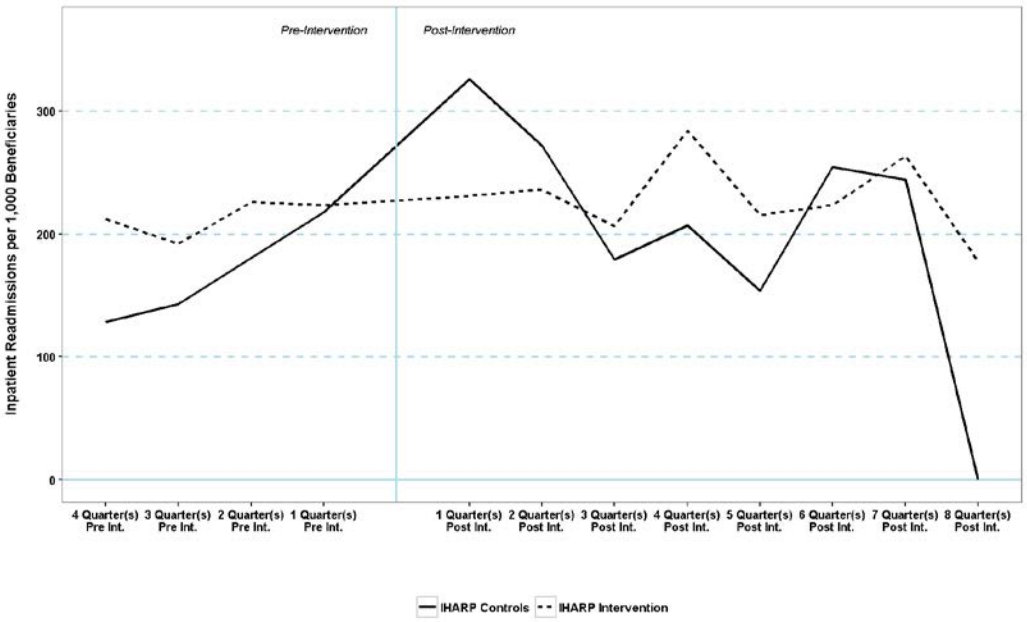
Measures	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Number of Participant Beneficiaries	699	683	659	644	587	502	387	275
30-Day Hospital Readmissions per 1,000 Beneficiaries Following all Inpatient Admissions	169	123	97	88	93	94	57	45
Difference[a]	-94.81	-35.66	27.08	77.19	61.21	-30.83	19.26	177.78***
90% Confidence Interval	(-193.6 | 3.9)	(-143.4 | 72.1)	(-75.4 | 129.6)	(-40.7 | 195.1)	(-40.4 | 162.8)	(-147.8 | 86.2)	(-126.9 | 165.5)	(84.0 | 271.5)
P-Value	0.114	0.586	0.664	0.282	0.322	0.665	0.828	0.002
30-Day Hospital Unplanned Readmissions per 1,000 Beneficiaries Following any Inpatient Admission	169	123	97	88	93	94	57	45
Difference	-107.06*	-21.37	6.46	54.47	76.59	-41.47	1.71	177.78***
90% Confidence Interval	(-202.7 | -11.4)	(-127.9 | 85.1)	(-94.3 | 107.2)	(-62.1 | 171.0)	(-22.8 | 176.0)	(-157.7 | 74.8)	(-143.1 | 146.5)	(84.0 | 271.5)
P-Value	0.066	0.741	0.916	0.442	0.205	0.557	0.984	0.002

* Statistically significant at the ten percent level.
*** Statistically significant at the one percent level.
[a]The "difference" estimate represents the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Figure B-1: IHARP Mortality per 1,000 Beneficiaries by Quarter Following Enrollment, Medicare FFS Cohort



Appendix Figure B-2: IHARP Readmissions per 1,000 Beneficiaries by Quarter, Medicare FFS Cohort



Appendix Table B-5: Quarterly Mortality and Readmission per 1,000 Beneficiaries for Participants and Controls, IHARP Medicare FFS Cohort, Q1 to Q4

Measures	Q1		Q2		Q3		Q4	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	699	699	683	624	659	592	644	564
All-Cause Mortality per 1,000 Beneficiaries	22.9	83.0	35.1	32.1	22.8	8.4	31.1	17.7
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	230.8	325.6	235.8	271.4	206.2	179.1	284.1	206.9
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	195.3	302.3	235.8	257.1	185.6	179.1	261.4	206.9

Appendix Table B-6: Quarterly Mortality and Readmission per 1,000 Beneficiaries for Participants and Controls, IHARP Medicare FFS Cohort, Q5 to Q8

Measures	Q5		Q6		Q7		Q8	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	587	502	502	407	387	309	275	229
All-Cause Mortality per 1,000 Beneficiaries	25.6	15.9	4.0	19.7	28.4	6.5	18.2	13.1
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	215.1	153.8	223.4	254.2	263.2	243.9	177.8	0.0
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	215.1	138.5	212.8	254.2	245.6	243.9	177.8	0

B.3 Health Service Resource Use

Appendix Table B-7: Cumulative and Yearly DiD Estimates of Resource Use per 1,000 Beneficiaries, IHARP Medicare FFS Cohort

Measures (Number of Events or Days)	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participant Beneficiaries	699	699	587
ER Visits	334.69	141.84	206.46
90% Confidence Interval	(-23.6 | 693.0)	(-63.2 | 346.8)	(-24.7 | 437.6)
P-Value	0.124	0.255	0.142
Inpatient Admissions	371.95**	246.20**	93.62
90% Confidence Interval	(110.1 | 633.8)	(96.1 | 396.3)	(-67.6 | 254.8)
P-Value	0.019	0.007	0.339
Unplanned Inpatient Admissions	408.70**	248.82**	136.16
90% Confidence Interval	(158.3 | 659.1)	(106.1 | 391.5)	(-17.7 | 290.0)
P-Value	0.007	0.004	0.146
Hospital Days	773.16	760.19	-186.32
90% Confidence Interval	(-1,112.5 | 2,658.8)	(-389.6 | 1,910.0)	(-1,355.6 | 983.0)
P-Value	0.500	0.277	0.793

** Statistically significant at the five percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.

Appendix Table B-8: Quarterly DiD Estimates of Resource Use (Number of Events or Days per 1,000 Beneficiaries), IHARP Medicare FFS Cohort

Measures (Number of Events or Days per 1,000 Beneficiaries)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Number of Participant Beneficiaries	699	683	659	644	587	502	387	275
ER Visits	17.53	-6.74	69.91	85.36	78.03	35.28	-6.80	-44.90
90% Confidence Interval	(-71,106)	(-93,79)	(-33,173)	(-1,172)	(-20,176)	(-80,150)	(-124, 110)	(-180,90)
P-Value	0.745	0.898	0.266	0.106	0.188	0.613	0.924	0.584
Inpatient Admissions	104.43**	27.15	41.20	33.72	3.72	1.18	6.00	34.13
90% Confidence Interval	(35,174)	(-35,89)	(-20,102)	(-29,96)	(-58,66)	(-70,72)	(-79,91)	(-51,119)
P-Value	0.013	0.469	0.265	0.374	0.921	0.978	0.908	0.511
Unplanned Inpatient Admissions	106.94***	24.89	41.05	33.17	6.95	4.69	6.78	30.48
90% Confidence Interval	(43,171)	(-34,84)	(-16,99)	(-27,93)	(-52,66)	(-64,73)	(-75,88)	(-49,110)
P-Value	0.006	0.488	0.240	0.363	0.847	0.910	0.891	0.527
Hospital Days	-107.30	252.75	456.02	-6.64	129.58	-95.12	-359.59	175.56
90% Confidence Interval	(-711,497)	(-216, 722)	(-84,996)	(-416, 402)	(-344, 603)	(-486, 296)	(-1122, 403)	(-327, 678)
P-Value	0.770	0.375	0.165	0.979	0.653	0.689	0.438	0.565

** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.

Appendix Table B-9: Quarterly Resource Use Rate (Number of Beneficiaries with Events per 1,000 Beneficiaries) for Participants and Controls, IHARP Medicare FFS Cohort, Q1 to Q4

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	699	699	699	699	683	624	659	592	644	564
Health Service Use Rate per 1,000 Beneficiaries										
ER Visits	519.3	492.1	211.7	176.0	194.7	190.7	188.2	162.2	212.7	166.7
All Inpatient Admissions	699.6	683.8	248.9	135.9	188.9	118.6	162.4	113.2	149.1	104.6
Unplanned Inpatient Admissions	656.7	628.0	227.5	124.5	174.2	109.0	151.7	101.4	132.0	95.7

Appendix Table B-10: Quarterly Resource Use Rate (Number of Beneficiaries with Events per 1,000 Beneficiaries) for Participants and Controls, IHARP Medicare FFS Cohort, Q5 to Q8

Measures	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	587	502	502	407	387	309	275	229
Health Service Use Rate per 1,000 Beneficiaries								
ER Visits	197.6	167.3	191.2	169.5	209.3	213.6	225.5	209.6
All Inpatient Admissions	163.5	129.5	189.2	145.0	160.2	132.7	170.9	78.6
Unplanned Inpatient Admissions	153.3	119.5	175.3	132.7	149.9	123.0	160.0	69.9

Appendix Table B-11: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, IHARP Medicare FFS Cohort, Q1 to Q4

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	699	699	699	699	683	624	659	592	644	564
Mean Number of Events per 1,000 Beneficiaries										
ER Visits	1,217.5	1,093.0	341.9	293.3	307.5	282.1	329.3	234.8	324.5	223.4
All Inpatient Admissions	1,316.2	1,173.1	359.1	218.9	254.8	176.3	238.2	148.6	220.5	141.8
Unplanned Inpatient Admissions	1,196.0	1,074.4	323.3	186.0	231.3	160.3	217.0	131.8	200.3	125.9
Hospital Days	6,034.3	5,284.7	1,871.2	1,791.1	1,578.3	1,059.3	1,490.1	785.5	1,020.2	805.0

Appendix Table B-12: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, IHARP Medicare FFS Cohort, Q5 to Q8

Measures	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	587	502	502	407	387	309	275	229
Mean Number of Events per 1,000 Beneficiaries								
ER Visits	328.8	237.1	326.7	245.7	346.3	258.9	330.9	270.7
All Inpatient Admissions	216.4	167.3	249.0	199.0	237.7	187.7	210.9	100.4
Unplanned Inpatient Admissions	201.0	151.4	231.1	176.9	224.8	165.0	200.0	78.6
Hospital Days	1,182.3	870.5	1,099.6	1,004.9	1,268.7	1,521.0	941.8	528.4

B.4 Medical Expenditures

Appendix Table B-13: Cumulative and Yearly DiD Estimates of Expenditures per 1,000 Beneficiaries, IHARP Medicare FFS Cohort

Measures (2011 USD)	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participant Beneficiaries	699	699	587
Total Medicare Parts A, B, and D Expenditures[c]	2,613,350.03	2,098,051.91	93,170.18
90% Confidence Interval	(-1,920,423.6 | 7,147,124)	(-702,998.1 | 4,899,102)	(-2,602,811.6 | 2,789,152)
P-Value	0.343	0.218	0.955
Total Medicare Parts A and B Expenditures	3,165,202.2	2,537,635.1	118,142.9
90% Confidence Interval	(-1,188,407.7 | 7,518,812)	(-175,507.3 | 5,250,778)	(-2,428,288.8 | 2,664,575)
P-Value	0.232	0.124	0.939
Inpatient Expenditures	408,491.2	677,458.7	-521,383.9
90% Confidence Interval	(-2,496,360 | 3,313,342)	(-1,213,855 | 2,568,772)	(-2,100,675 | 1,057,907)
P-Value	0.817	0.556	0.587
Outpatient ER Expenditures	2,112.55	-18,658.65	31,287.33
90% Confidence Interval	(-302,472.7 | 306,697.8)	(-194,385.3 | 157,068.0)	(-145,209.8 | 207,784.4)
P-Value	0.991	0.861	0.771
Outpatient Non-ER Expenditures	347,547.8	127,688.7	244,441.4
90% Confidence Interval	(-516,951.6 | 1,212,047.3)	(-373,042.5 | 628,420.0)	(-328,083.0 | 816,965.8)
P-Value	0.508	0.675	0.483
Physician and Ancillary Service Expenditures	724,282.4*	501,590.8**	148,307.9
90% Confidence Interval	(57,090.9 | 1,391,473.9)	(93,824.3 | 909,357.3)	(-248,824.9 | 545,440.6)
P-Value	0.074	0.043	0.539
Skilled Nursing Facility Expenditures	1,639,034**	1,207,201**	225,039
90% Confidence Interval	(347,283.5 | 2,930,785.5)	(421,065.9 | 1,993,336.4)	(-532,131.0 | 982,209.1)
P-Value	0.037	0.012	0.625
Durable Medical Equipment Expenditures	77,146.36	-61,471.00	191,981.88
90% Confidence Interval	(-509,782.0 | 664,074.7)	(-403,353.7 | 280,411.7)	(-192,687.5 | 576,651.3)
P-Value	0.829	0.767	0.412
Home Health Expenditures	30,026.67	200,849.87	-269,950.17

Measures (2011 USD)	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
90% Confidence Interval	(-452,462.4 | 512,515.8)	(-88,710.4 | 490,410.2)	(-555,774.0 | 15,873.6)
P-Value	0.918	0.254	0.120
Hospice Expenditures	-83,551.34	-110,345.75	63,370.35
90% Confidence Interval	(-308,642.4 | 141,539.7)	(-262,276.7 | 41,585.2)	(-91,072.8 | 217,813.5)
P-Value	0.541	0.232	0.500

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.
[c]Denominator is subset to beneficiaries enrolled in Medicare Part D.

Appendix Table B-14: Quarterly DiD Estimates of Expenditures per Beneficiary, IHARP Medicare FFS Cohort

Measures (2011 USD per Person)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Number of Participant Beneficiaries	699	683	659	644	587	502	387	275
Total Medicare Parts A, B, and D Expenditures[a]	528.11	191.26	974.17	117.79	-73.35	39.48	-230.92	871.56
90% Confidence Interval	(-922,1979)	(-994,1377)	(-281,2229)	(-1082, 1317)	(-1148, 1001)	(-1072, 1151)	(-1889, 1427)	(-497,2240)
P-Value	0.549	0.791	0.202	0.872	0.911	0.953	0.819	0.295
Total Medicare Parts A and B Expenditures	521.02	332.32	1,012.61	336.69	57.10	-67.73	-191.85	789.27
90% Confidence Interval	(-906,1948)	(-795,1460)	(-190,2216)	(-799,1472)	(-928,1042)	(-1103,968)	(-1756, 1373)	(-451,2029)
P-Value	0.548	0.628	0.166	0.626	0.924	0.914	0.840	0.295
Inpatient Expenditures	-281.33	102.52	823.79	-151.70	-3.61	-198.78	-548.11	491.02
90% Confidence Interval	(-1277,715)	(-701,906)	(-42,1690)	(-919,616)	(-558,551)	(-766,369)	(-1618,522)	(-219,1201)
P-Value	0.642	0.834	0.118	0.745	0.991	0.565	0.400	0.256
Outpatient ER Expenditures	-23.71	-57.69	10.16	55.45	6.63	-24.03	-66.74	-12.68
90% Confidence Interval	(-89,41)	(-139,24)	(-49,69)	(-24,135)	(-52,65)	(-92,43)	(-148,15)	(-111,86)
P-Value	0.547	0.244	0.778	0.252	0.852	0.558	0.178	0.832
Outpatient Non-ER Expenditures	19.64	105.66	-49.80	7.59	14.58	156.86	32.11	2.40
90% Confidence Interval	(-203,242)	(-104,315)	(-300,201)	(-210,225)	(-250,279)	(-87,401)	(-211,275)	(-333,338)
P-Value	0.885	0.407	0.744	0.954	0.928	0.290	0.828	0.991
Physician and Ancillary Service Expenditures	162.57	75.30	79.10	174.73	25.63	26.02	116.08	196.41
90% Confidence Interval	(-22,347)	(-94,244)	(-110,268)	(-35,384)	(-141,192)	(-157,209)	(-100,332)	(-16,409)
P-Value	0.148	0.463	0.492	0.170	0.800	0.815	0.376	0.128
Skilled Nursing Facility Expenditures	507.26*	111.56	232.04	357.71**	117.49	8.50	300.24	190.67

Measures (2011 USD per Person)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
90% Confidence Interval	(19,995)	(-140,363)	(-59,524)	(100,615)	(-144,379)	(-340,357)	(-115,716)	(-159,540)
P-Value	0.087	0.466	0.190	0.022	0.459	0.968	0.235	0.370
Durable Medical Equipment Expenditures	-5.40	22.86	-33.18	-120.81	-57.80	-48.30	20.36	119.18
90% Confidence Interval	(-141,131)	(-124,170)	(-179,112)	(-337,95)	(-264,149)	(-154,57)	(-87,128)	(-110,348)
P-Value	0.948	0.798	0.708	0.358	0.645	0.452	0.756	0.393
Home Health Expenditures	182.54*	18.40	-12.68	-3.20	-80.25	6.01	-41.62	-190.91*
90% Confidence Interval	(29,337)	(-108,145)	(-129,104)	(-117,110)	(-192,31)	(-122,134)	(-195,112)	(-367,-14)
P-Value	0.051	0.811	0.858	0.963	0.236	0.939	0.655	0.075
Hospice Expenditures	-45.92	-53.57	-28.07	11.13	34.08	12.58	8.78	6.03
90% Confidence Interval	(-119,27)	(-130,23)	(-121,65)	(-38,60)	(-48,116)	(-29,54)	(-76,94)	(-78,90)
P-Value	0.301	0.249	0.619	0.710	0.496	0.619	0.865	0.905

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
[a]Denominator is subset to beneficiaries enrolled in Medicare Part D

Appendix Table B-15: IHARP Total Medicare Expenditures in the Baseline Period and by Quarter Following Enrollment, Medicare FFS Cohort, Q1 to Q4

Measures (2011 USD)	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	699	699	699	699	683	624	659	592	644	564
Total Medicare Parts A, B, and D Expenditures[a]										
Mean	$23,597	$21,646	$8,999	$7,983	$6,514	$5,611	$6,481	$4,964	$5,835	$5,228
Median	$15,360	$14,352	$3,841	$2,506	$1,963	$1,900	$1,891	$1,944	$1,819	$1,854
90th percentile	$57,038	$48,420	$24,424	$19,792	$18,644	$12,720	$16,185	$12,673	$15,401	$12,250
99th percentile	$117,518	$107,940	$66,539	$75,515	$53,490	$52,401	$68,542	$40,873	$53,223	$48,498
Total Medicare Parts A and B Expenditures										
Mean	$19,843	$17,600	$8,045	$6,963	$5,549	$4,407	$5,450	$3,806	$4,869	$3,954
Median	$11,653	$10,752	$2,255	$1,643	$1,086	$1,032	$1,078	$1,003	$938	$880
90th percentile	$47,287	$43,405	$23,275	$17,568	$17,298	$11,016	$13,843	$10,656	$12,971	$9,098
99th percentile	$106,878	$89,719	$66,217	$75,244	$51,775	$47,919	$63,487	$38,067	$50,732	$47,747

[a]Denominator is subset to beneficiaries enrolled in Medicare Part D.

Appendix Table B-16: IHARP Total Medicare Expenditures by Quarter Following Enrollment, Medicare FFS Cohort, Q5 to Q8

Measures (2011 USD)	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	587	502	502	407	387	309	275	229
Total Medicare Parts A, B, and D Expenditures[a]								
Mean	$5,452	$5,084	$5,681	$5,195	$6,005	$5,892	$5,571	$4,150
Median	$1,773	$1,779	$2,183	$1,982	$2,123	$1,781	$1,927	$1,588
90th percentile	$14,955	$12,230	$16,890	$13,173	$17,558	$13,104	$16,839	$10,762
99th percentile	$45,160	$50,140	$38,875	$43,745	$49,359	$47,216	$35,533	$34,323
Total Medicare Parts A and B Expenditures								
Mean	$4,358	$3,764	$4,509	$4,068	$4,725	$4,548	$4,402	$2,964
Median	$1,084	$924	$1,096	$926	$1,079	$930	$1,168	$824
90th percentile	$13,137	$9,127	$13,527	$10,298	$14,559	$10,985	$13,030	$7,819
99th percentile	$39,808	$42,201	$37,111	$39,236	$42,908	$46,366	$34,723	$30,661

[a]Denominator is subset to beneficiaries enrolled in Medicare Part D.

Appendix Table B-17: IHARP Inpatient and Outpatient Expenditures in the Baseline Period and by Quarter Following Enrollment, Medicare FFS Cohort, Q1 to Q4

Measures (2011 USD)	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	699	699	699	699	683	624	659	592	644	564
Inpatient Expenditures										
Mean	$8,885	$7,530	$2,781	$2,724	$2,249	$1,682	$2,308	$1,083	$1,715	$1,514
Median	$4,521	$4,154	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$23,298	$18,429	$9,115	$5,876	$6,764	$3,857	$5,406	$2,873	$4,964	$2,404
99th percentile	$60,404	$50,804	$40,568	$63,832	$34,470	$29,710	$38,912	$18,885	$29,227	$25,995
Outpatient ER Expenditures										
Mean	$586	$645	$151	$189	$130	$197	$127	$131	$172	$137
Median	$102	$0	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$1,741	$1,816	$507	$407	$417	$456	$401	$367	$438	$365
99th percentile	$3,930	$6,221	$1,977	$3,067	$1,777	$2,723	$2,073	$2,154	$2,677	$1,950
Outpatient Non-ER Expenditures										
Mean	$2,341	$2,059	$830	$740	$765	$570	$705	$666	$729	$647
Median	$622	$654	$105	$64	$66	$69	$66	$61	$66	$69
90th percentile	$5,251	$4,840	$2,145	$1,484	$1,722	$1,294	$1,524	$1,315	$1,556	$1,301
99th percentile	$27,281	$25,173	$11,171	$10,075	$10,435	$8,585	$9,623	$9,048	$10,457	$10,438

Appendix Table B-18: IHARP Inpatient and Outpatient Expenditures by Quarter Following Enrollment, Medicare FFS Cohort, Q5 to Q8

Measures (2011 USD)	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	587	502	502	407	387	309	275	229
Inpatient Expenditures								
Mean	$1,449	$1,133	$1,512	$1,345	$1,601	$1,973	$1,549	$679
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$4,608	$3,242	$5,132	$4,133	$6,668	$3,480	$6,614	$0
99th percentile	$18,641	$20,562	$20,485	$24,447	$23,241	$26,042	$26,241	$13,144
Outpatient ER Expenditures								
Mean	$138	$134	$142	$155	$139	$174	$173	$151
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$435	$293	$412	$388	$461	$393	$528	$419
99th percentile	$2,283	$2,456	$2,287	$2,142	$1,991	$2,157	$2,075	$2,630
Outpatient Non-ER Expenditures								
Mean	$794	$692	$798	$601	$687	$556	$728	$653
Median	$81	$69	$65	$66	$60	$66	$66	$59
90th percentile	$1,597	$1,221	$2,062	$1,302	$1,485	$1,343	$1,537	$1,309
99th percentile	$10,137	$11,035	$10,600	$7,563	$8,629	$7,460	$8,036	$9,417

Appendix Table B-19: IHARP Expenditures for Other Settings in the Baseline Period and by Quarter Following Enrollment, Medicare FFS Cohort, Q1 to Q4

Measures (2011 USD)	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	699	699	699	699	683	624	659	592	644	564
Physician and Ancillary Service Expenditures										
Mean	$4,179	$3,942	$1,447	$1,225	$1,110	$951	$1,091	$951	$1,100	$883
Median	$2,898	$3,089	$829	$653	$496	$481	$467	$438	$464	$446
90th percentile	$9,224	$7,620	$3,288	$2,790	$2,746	$2,224	$2,581	$2,292	$2,632	$2,009
99th percentile	$21,247	$16,827	$8,665	$9,403	$9,256	$7,590	$10,414	$6,446	$9,068	$6,557
Skilled Nursing Facility Expenditures										
Mean	$1,680	$1,554	$1,689	$1,150	$516	$325	$587	$349	$547	$188
Median	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$3,403	$4,437	$5,153	$0	$0	$0	$0	$0	$0	$0
99th percentile	$31,460	$27,771	$27,345	$27,446	$14,040	$11,000	$17,833	$14,099	$17,953	$7,409
Durable Medical Equipment Expenditures										
Mean	$853	$930	$244	$269	$253	$244	$208	$254	$232	$312
Median	$163	$140	$29	$0	$15	$0	$16	$0	$18	$0
90th percentile	$2,041	$2,113	$553	$553	$536	$507	$504	$543	$504	$489
99th percentile	$5,496	$6,983	$2,028	$3,747	$2,404	$3,299	$1,325	$4,156	$1,712	$3,328
Home Health Expenditures										
Mean	$1,164	$849	$795	$534	$446	$333	$327	$259	$302	$237
Median	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$4,295	$3,065	$3,393	$2,467	$2,198	$0	$1,079	$0	$0	$0
99th percentile	$14,224	$14,100	$7,347	$6,522	$5,664	$5,380	$4,852	$5,279	$5,262	$4,743
Hospice Expenditures										
Mean	$19	$11	$70	$114	$49	$97	$73	$96	$47	$30
Median	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
99th percentile	$0	$0	$886	$4,651	$830	$2,124	$116	$705	$237	$0

Appendix Table B-20: IHARP Expenditures for Other Settings by Quarter Following Enrollment, Medicare FFS Cohort, Q5 to Q8

Measures (2011 USD)	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	587	502	502	407	387	309	275	229
Physician and Ancillary Service Expenditures								
Mean	$989	$924	$1,029	$982	$1,072	$952	$1,007	$789
Median	$503	$492	$531	$478	$563	$457	$536	$434
90th percentile	$2,342	$2,077	$2,531	$2,417	$2,508	$2,621	$2,351	$1,975
99th percentile	$7,310	$6,457	$5,411	$5,622	$7,310	$6,230	$6,556	$3,927
Skilled Nursing Facility Expenditures								
Mean	$401	$320	$445	$483	$644	$429	$343	$189
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0	$0	$0
99th percentile	$12,094	$13,302	$13,894	$17,849	$15,654	$14,298	$11,697	$3,946
Durable Medical Equipment Expenditures								
Mean	$243	$250	$200	$229	$223	$162	$322	$155
Median	$15	$0	$5	$0	$16	$0	$28	$0
90th percentile	$468	$462	$482	$487	$481	$468	$518	$460
99th percentile	$2,411	$2,040	$1,528	$3,353	$1,844	$1,369	$2,098	$1,379
Home Health Expenditures								
Mean	$246	$263	$315	$231	$286	$250	$219	$313
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$551	$0	$100	$0	$0	$108
99th percentile	$4,023	$4,301	$4,778	$4,451	$4,793	$5,930	$4,695	$4,769
Hospice Expenditures								
Mean	$75	$41	$38	$26	$56	$47	$41	$35
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0	$0	$0
99th percentile	$2,425	$0	$0	$821	$298	$0	$0	$0

B.5 Medication Adherence

Appendix Table B-21: Average Proportion of Days Covered (PDC) by Medication Type

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)		Baseline Period (for 2nd Year Post Enrollment)		Intervention Period (2nd Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Beta Blockers								
Number of Eligible Beneficiaries	312	288	312	288	130	114	130	114
Mean	86.74	88.36	84.02	85.62	84.34	86.44	84.80	84.10
Median	93.14	94.43	91.37	93.04	92.82	92.20	92.13	95.21
25th percentile	81.65	83.54	73.77	79.91	73.33	82.44	76.27	69.73
75th percentile	98.95	99.11	98.27	98.52	98.92	98.00	98.21	99.71
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calcium Channel Blockers								
Number of Eligible Beneficiaries	157	157	157	157	54	59	54	59
Mean	87.47	89.30	86.84	87.26	89.52	89.22	89.84	84.67
Median	96.18	95.68	95.78	95.33	96.56	95.19	97.15	95.59
25th percentile	87.19	86.40	84.76	83.68	87.25	83.80	87.46	73.54
75th percentile	99.17	98.90	99.28	98.86	99.34	99.14	99.71	99.70
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Diabetes Medication		157						
Number of Eligible Beneficiaries	114	117	114	117	44	57	44	57
Mean	90.35	89.08	84.75	89.55	90.03	88.69	89.79	90.58
Median	96.16	95.73	93.39	96.19	96.95	94.35	96.46	98.06
25th percentile	88.66	82.92	76.35	85.71	87.52	81.66	87.30	90.86
75th percentile	100.00	100.00	99.59	100.00	100.00	99.44	100.00	100.00
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
RAS Antagonists								
Number of Eligible Beneficiaries	314	291	314	291	116	104	116	104
Mean	88.07	86.29	85.20	85.51	88.44	82.53	89.53	85.92
Median	95.44	94.01	94.48	93.99	96.23	92.32	95.43	94.57
25th percentile	85.03	80.12	80.17	77.81	84.44	73.74	84.21	76.38
75th percentile	99.02	99.14	98.61	98.71	99.71	98.25	99.22	99.14
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)		Baseline Period (for 2nd Year Post Enrollment)		Intervention Period (2nd Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Statins								
Number of Eligible Beneficiaries	330	303	330	303	118	116	118	116
Mean	85.11	84.11	85.38	86.30	83.78	83.19	87.52	86.47
Median	93.35	90.94	92.54	92.77	92.92	91.09	93.23	93.74
25th percentile	78.72	76.38	78.55	82.20	75.00	70.39	81.82	83.86
75th percentile	98.24	98.04	97.67	98.34	97.90	98.09	98.58	98.72
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

APPENDIX C: RESULTS FOR USC

The following tables provide the baseline demographic and health characteristics; mortality and readmission rates; health service utilization and medication adherences rates results for intervention and comparison group beneficiaries in the USC FFS and MA cohort.

C.1 Demographic and Health Characteristics

Appendix Table C-1: USC Baseline Demographic and Health Characteristics, FFS and MA Cohorts

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Number of Beneficiaries	755	755		
Average Age (Years)[+]	71.90	72.12	-0.21	0.02
Age under 65[+]	17%	17%	0%	0.00
Gender				
Male[+]	41%	42%	-1%	0.01
Female	59%	58%	1%	0.01
Race				
White[+]	43%	43%	1%	0.01
Black or Other	57%	57%	-1%	0.01
Dual Eligible[+]	86%	87%	-1%	0.03
Medicare Eligibility				
Disabled[+]	28%	26%	1%	0.03
ESRD	1%	0%	1%	0.07
Aged[+]	72%	74%	-2%	0.04
Area Deprivation Index (ADI)[+]	97.53	97.58	-0.05	0.00
Evaluation and Management (E&M) Visits				
E&M Visits: 0	1%	1%	0%	0.02
E&M Visits: 1-5[+]	14%	13%	1%	0.03
E&M Visits: 6-10[+]	21%	20%	1%	0.02
E&M Visits: 11-15[+]	16%	18%	-3%	0.07
E&M Visits: 16+[+]	49%	48%	1%	0.02
Resource Use per Beneficiary (Pre-Enrollment Year)				
0 IP Stays (1Q Prior)	91%	92%	-1%	0.05
1 IP Stay (Prior Year)[+]	8%	7%	1%	0.05
2+ IP Stays (Prior Year)[+]	1%	1%	0%	0.00
0 IP Stays (Prior Year)	80%	82%	-1%	0.04
1 IP Stay (Prior Year)[+]	14%	12%	2%	0.05
2+ IP Stays (Prior Year)[+]	6%	6%	0%	0.01

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Charlson Score+	0.27	0.23	0.05	0.05
Drug History (Pre-Enrollment Year)				
Antidiabetics+	56%	56%	0%	0.00
Insulin+	45%	43%	2%	0.03
SSRIs and SNRIs+	34%	34%	1%	0.02
Other Antidepressants+	21%	20%	1%	0.02
Statins+	84%	85%	-1%	0.04
Thiazide+	42%	41%	1%	0.02
Calcium channel blockers+	47%	47%	0%	0.01
Beta blockers+	55%	54%	0%	0.01
ACE inhibitors+	68%	69%	-1%	0.01
ARBs+	35%	37%	-1%	0.03
Antihypertensives+	20%	18%	2%	0.05
Antineoplastics+	7%	7%	0%	0.02
Corticosteroids+	25%	24%	0%	0.01
Cardiotonics+	4%	3%	1%	0.04
Antiarrhythmics+	3%	2%	0%	0.01
Vasopressors	1%	1%	0%	0.00
Antiasthmatics+	38%	39%	-1%	0.03
Antianxiety Agents+	23%	24%	-1%	0.02
Antipsychotics+	11%	10%	0%	0.00
Anticoagulants+	10%	9%	1%	0.04
Insulin+	28%	26%	3%	0.06
Nitrates+	20%	20%	0%	0.01
Loop diuretics+	25%	25%	0%	0.01
Potassium sparing diuretics+	4%	5%	0%	0.01
Fibric acid derivatives+	16%	15%	1%	0.04
Platelet aggregation inhibitors+	17%	17%	0%	0.01
Healthcare Cost and Utilization Project (HCUP) Diagnosis Categories (Pre-Enrollment Year)				
Acute cerebrovascular disease (IP)+	1%	1%	1%	0.06
Acute cerebrovascular disease (IP, 30 days prior)	0%	0%	0%	0.03
AMI (IP)	1%	1%	0%	0.02
AMI (IP, 30 days prior)	0%	0%	0%	0.05
Cerebrovascular disease+	17%	18%	-1%	0.02
Parkinson's disease and multiple sclerosis	2%	2%	0%	0.01
Asthma	26%	27%	-1%	0.03
Coagulation and hemorrhagic disorders+	6%	5%	0%	0.01

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Congestive heart failure (All Settings)[+]	19%	19%	0%	0.01
Congestive heart failure (IP)	1%	1%	0%	0.02
Coronary atherosclerosis[+]	25%	26%	-1%	0.01
Dementia[+]	17%	19%	-1%	0.04
Diabetes mellitus without complication[+]	60%	59%	1%	0.03
Diabetes mellitus with complications[+]	56%	55%	1%	0.01
Cardiac dysrhythmias, arrest and ventricular fibrillation[+]	25%	23%	1%	0.03
Fluid and electrolyte disorders[+]	13%	13%	0%	0.01
Gastrointestinal hemorrhage (All Settings)[+]	5%	6%	0%	0.01
Gastrointestinal hemorrhage (IP)	0%	1%	0%	0.06
Other heart disease[+]	46%	45%	1%	0.03
Heart valve disorders[+]	10%	11%	-1%	0.02
Hepatitis[+]	3%	3%	0%	0.00
Hypertension with complications[+]	14%	14%	0%	0.00
Stomach, pancreas and lung cancer[+]	1%	1%	0%	0.02
Peri- endo- and myocarditis[+]	5%	5%	0%	0.00
Disorders of nervous system[+]	15%	15%	0%	0.01
Other cancers	8%	8%	0%	0.01
Paralysis[+]	3%	3%	0%	0.00
Pneumonia[+]	10%	10%	1%	0.02
Pneumonia (IP, 30 days prior)	0%	0%	0%	0.03
Pulmonary heart disease[+]	1%	1%	0%	0.00
Renal failure	34%	34%	0%	0.00
Respiratory failure (IP)	0%	0%	0%	0.02
Respiratory failure (IP, 30 days prior)	0%	0%	0%	0.05
Rheumatoid arthritis and related disease[+]	3%	4%	-1%	0.03
Septicemia[+]	3%	3%	0%	0.01
Shock	1%	0%	0%	0.07
Tuberculosis	0%	0%	0%	0.03
Procedures (Pre-Enrollment Year)				
Bypass and PTCA (IP)	1%	1%	1%	0.06
Heart valve procedures (IP)	0%	0%	0%	0.09
Hemodialysis	0%	1%	0%	0.04
Peritoneal dialysis	1%	1%	0%	0.03
Procedures on vessels of head and neck (IP)	3%	2%	1%	0.04
Radiology and chemotherapy	1%	1%	0%	0.04
Respiratory intubation and mechanical ventilation	1%	1%	0%	0.00
Blood transfusion[+]	3%	3%	0%	0.00
Blood transfusion (IP)[+]	2%	2%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Transportation	13%	12%	1%	0.03
HCC Risk Score	1.96	1.97	-2%	0.01
Comorbidity Categories (Pre-Enrollment Quarter)				
Depression[+]	18%	18%	0%	0.00
AIDS HIV	0%	0%	0%	0.00
Alcohol Abuse[+]	2%	2%	0%	0.03
Cardiac Arrhythmias	14%	12%	2%	0.06
Congestive Heart Failure	13%	13%	1%	0.02
Chronic Pulmonary Disease[+]	14%	15%	-1%	0.04
Coagulopathy	2%	3%	-1%	0.08
Deficiency Anemia[+]	2%	3%	0%	0.03
Diabetes Complicated	40%	39%	2%	0.03
Diabetes Uncomplicated	46%	48%	-1%	0.02
Dementia	7%	6%	1%	0.03
Drug Abuse	1%	1%	0%	0.00
Fluid and Electrolyte Disorders[+]	5%	5%	1%	0.04
Hypothyroidism	10%	10%	0%	0.00
Hypertension Complicated[+]	4%	4%	1%	0.03
Hypertension Uncomplicated	72%	74%	-1%	0.03
Liver Disease	4%	4%	0%	0.01
Lymphoma	0%	0%	0%	0.03
Metastatic Cancer	1%	0%	0%	0.04
Myocardial Infarction	3%	3%	0%	0.00
Obesity[+]	68%	69%	-1%	0.02
Other Neurological Disorders	6%	3%	3%	0.12
Paralysis	2%	2%	0%	0.02
Peptic Ulcer Disease Excluding Bleeding	1%	0%	0%	0.05
Peripheral Vascular Disorders	17%	18%	-1%	0.02
Psychosis[+]	3%	2%	1%	0.06
Pulmonary Circulation Disorders	1%	0%	0%	0.06
Renal Failure	22%	22%	1%	0.02
Rheumatoid Arthritis Collagen Vascular Disease	3%	3%	-1%	0.05
Solid Tumor Without Metastasis	5%	4%	1%	0.05
Valvular Disease[+]	3%	4%	0%	0.02
Weight Loss[+]	3%	3%	0%	0.01

[+]Denotes characteristic used for matching.

[a]Standardized mean difference is an effect size measure used in the above table to identify substantial differences between the intervention and control groups; a standardized mean difference of 0.1 or greater is treated as an indicator of a substantial difference between the two groups.

C.2 Mortality and Readmissions

Appendix Table C-2: Cumulative and Yearly Mortality and Readmissions per 1,000 Beneficiaries, Differences after USC Enrollment, FFS and MA Cohorts

Measures	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participants	755	755	623
Mortality			
Difference[c]	20.64	5.35	13.30
90% Confidence Interval	(-3.6 | 44.9)	(-7.9 | 18.6)	(-5.5 | 32.1)
P-Value	0.161	0.507	0.246
30-Day Hospital Readmissions Following All Inpatient Admissions			
Difference	-83.40	-337.26*	207.60
90% Confidence Interval	(-528.1 | 361.3)	(-625.2 | -49.4)	(-93.8 | 509.0)
P-Value	0.758	0.054	0.257
30-Day Hospital Unplanned Readmissions Following All Inpatient Admission			
Difference	-52.74	-334.46*	237.93
90% Confidence Interval	(-492.1 | 386.6)	(-618.7 | -50.2)	(-59.7 | 535.5)
P-Value	0.843	0.053	0.188

* Statistically significant at the ten percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.
[c]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries or the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Table C-3: Quarterly Difference in Mortality per 1,000 Beneficiaries after USC Enrollment, FFS and MA Cohorts

Measures	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Medicare FFS									
Number of Participant Beneficiaries	755	745	719	669	623	562	460	318	199
Difference[a]	2.65	-2.68	-1.46	7.34	-5.39	7.01	4.23	12.58**	5.97
90% Confidence Interval	(-3.5 | 8.8)	(-7.1 | 1.7)	(-9.1 | 6.1)	(-0.8 | 15.5)	(-15.8 | 5.0)	(-0.2 | 14.2)	(-4.6 | 13.0)	(2.3 | 22.9)	(-7.5 | 19.4)
P-Value	0.478	0.317	0.752	0.140	0.394	0.110	0.429	0.044	0.465

** Statistically significant at the five percent level.

[a]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries between the intervention group and control group in the relevant quarter of the intervention period. There were no deaths in the intervention or control groups prior to program enrollment as beneficiaries were required to be alive on program start date to be included in the study.

Appendix Table C-4: Quarterly Difference in Readmissions per 1,000 IP Admissions after USC Enrollment, FFS and MA Cohorts

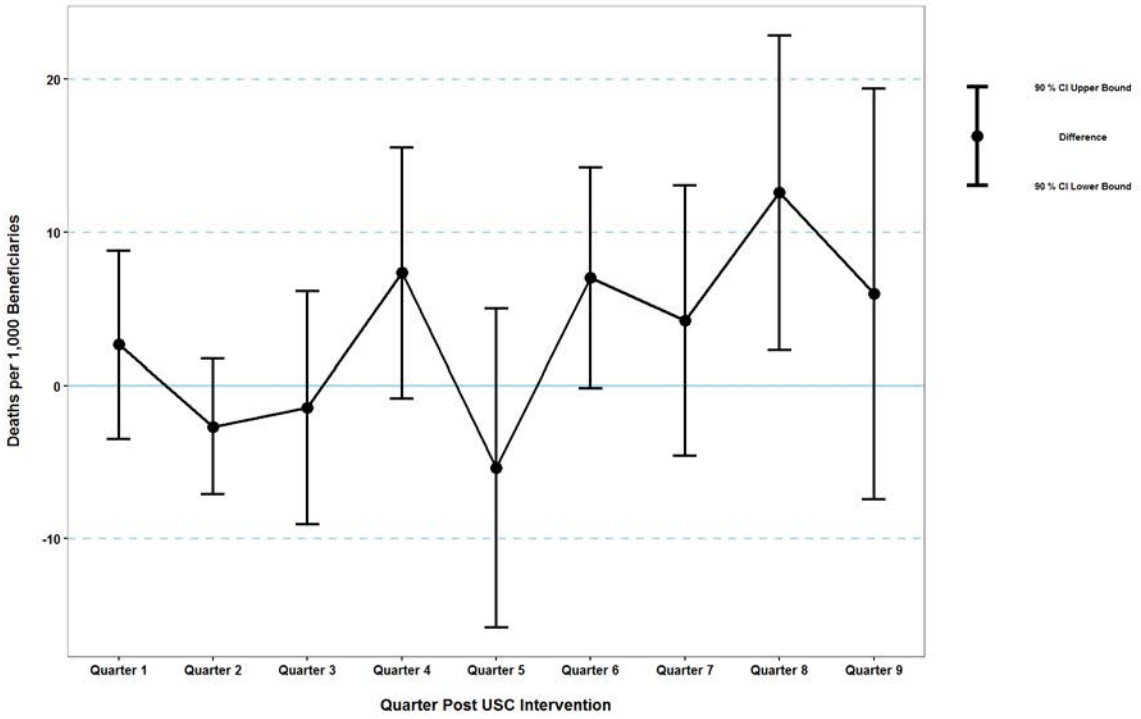
Measures	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Number of Participant Beneficiaries	755	745	719	669	623	562	460	318	199
30-Day Hospital Readmissions per 1,000 Beneficiaries Following all Inpatient Admissions	47	44	48	44	49	39	31	20	25
Differencea	-145.66*	-40.21	-114.58	-29.87	-27.55	151.07**	49.34	57.14	200.00**
90% Confidence Interval	(-275.3 | -16.1)	(-163.6 | 83.2)	(-272.4 | 43.3)	(-189.8 | 130.0)	(-148.2 | 93.1)	(28.4 | 273.8)	(-146.6 | 245.3)	(-136.3 | 250.6)	(68.4 | 331.6)
P-Value	0.065	0.592	0.233	0.759	0.707	0.043	0.679	0.627	0.012
30-Day Hospital Unplanned Readmissions per 1,000 Beneficiaries Following any Inpatient Admission	47	44	48	44	49	39	31	20	25
Difference	-145.66*	-14.57	-135.42	-29.87	-27.55	178.10**	49.34	57.14	200.00**
90% Confidence Interval	(-275.3 | -16.1)	(-132.7 | 103.5)	(-290.7 | 19.9)	(-189.8 | 130.0)	(-148.2 | 93.1)	(63.1 | 293.1)	(-146.6 | 245.3)	(-136.3 | 250.6)	(68.4 | 331.6)
P-Value	0.065	0.839	0.151	0.759	0.707	0.011	0.679	0.627	0.012

* Statistically significant at the ten percent level.

** Statistically significant at the five percent level.

[a]The "difference" estimate represents the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Figure C-1: Quarterly Differences in Mortality per 1,000 beneficiaries, USC Intervention and Control Groups



Appendix Table C-5: Quarterly Mortality and Readmissions per 1,000 Beneficiaries for Participants and Controls, USC FFS and MA Cohorts, Q1 to Q5

Measures	Q1		Q2		Q3		Q4		Q5	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	755	755	745	746	719	713	669	650	623	599
All-Cause Mortality per 1,000 Beneficiaries	6.6	4.0	1.3	4.0	7.0	8.4	12.0	4.6	9.6	15.0
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	85.1	230.8	113.6	153.8	166.7	281.2	227.3	257.1	122.4	150.0
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	85.1	230.8	113.6	128.2	145.8	281.2	227.3	257.1	122.4	150.0

Appendix Table C-6: Quarterly Mortality and Readmissions per 1,000 Beneficiaries for Participants and Controls, USC FFS and MA Cohorts, Q6 to Q9

Measures	Q6		Q7		Q8		Q9	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	562	531	460	448	318	365	199	245
All-Cause Mortality per 1,000 Beneficiaries	8.9	1.9	8.7	4.5	12.6	0.0	10.1	4.1
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	205.1	54.1	225.8	176.5	200.0	142.9	200.0	0.0
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	205.1	27	225.8	176.5	200.0	142.9	200.0	0.0

C.3 Health Service Resource Use

Appendix Table C-7: Cumulative and Yearly DiD Estimates of Resource Use per 1,000 Beneficiaries, USC FFS and MA Cohorts

Measures (Number of Events or Days)	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participant Beneficiaries	755	755	623
Inpatient Admissions	120.38	12.99	63.42
90% Confidence Interval	(-39.6 | 280.4)	(-68.0 | 94.0)	(-28.6 | 155.5)
P-Value	0.216	0.792	0.257
Unplanned Inpatient Admissions	131.96	15.40	80.33
90% Confidence Interval	(-17.1 | 281.0)	(-60.4 | 91.2)	(-7.2 | 167.9)
P-Value	0.145	0.738	0.131
Hospital Days	444.71	-147.85	182.09
90% Confidence Interval	(-831.2 | 1,720.7)	(-735.5 | 439.8)	(-478.8 | 842.9)
P-Value	0.566	0.679	0.650

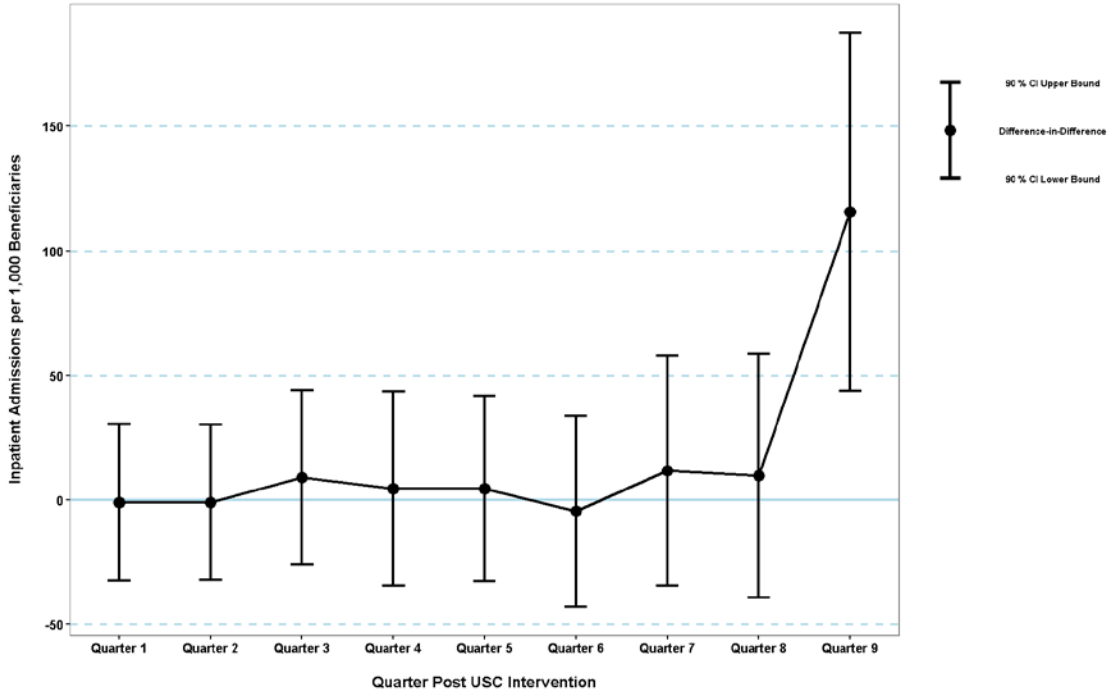
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.

Appendix Table C-8: Quarterly DiD Estimates of Resource Use (Number of Events or Days Per 1,000 Beneficiaries), USC FFS and MA Cohorts

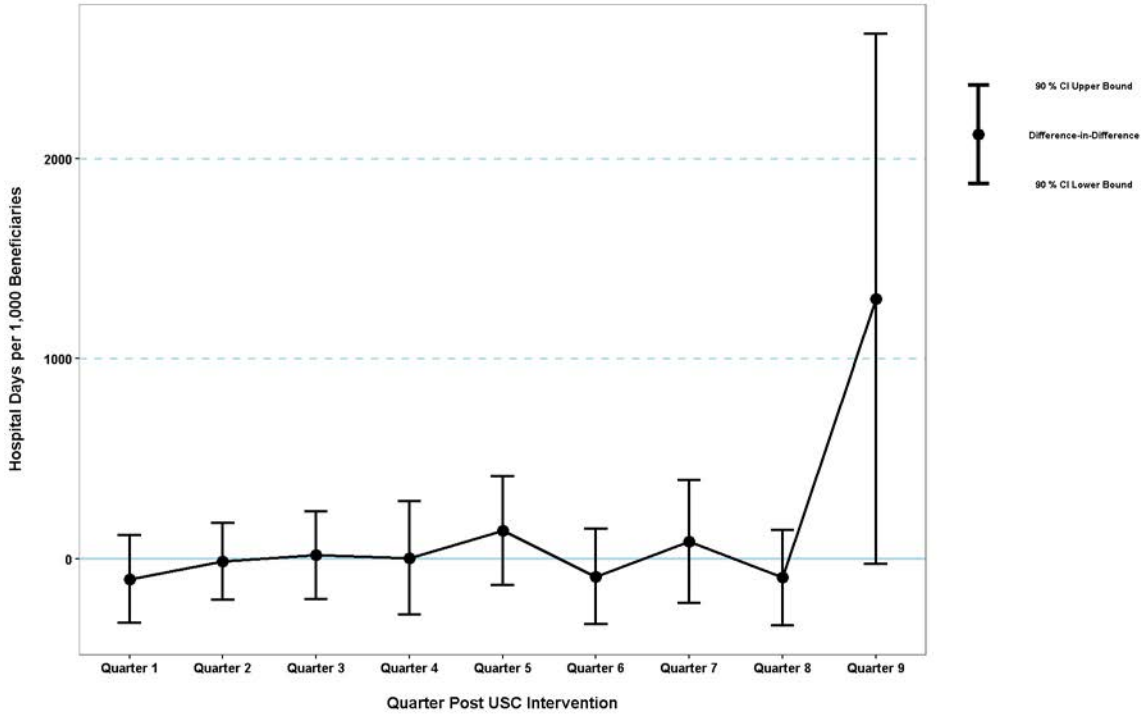
Measures (Number of Events or Days per 1,000 Beneficiaries)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Number of Participant Beneficiaries	755	745	719	669	623	562	460	318	199
Inpatient Admissions	-0.99	-1.01	9.01	4.52	4.46	-4.55	11.87	9.79	115.65***
90% Confidence Interval	(-33,31)	(-32,30)	(-26,44)	(-35,44)	(-33,42)	(-43,34)	(-34,58)	(-39,59)	(44,188)
P-Value	0.959	0.958	0.673	0.849	0.844	0.845	0.672	0.742	0.008
Unplanned Inpatient Admissions	0.00	7.72	6.19	-0.56	4.19	-0.78	21.70	25.69	100.73**
90% Confidence Interval	(-30,30)	(-21,37)	(-27,40)	(-38,37)	(-32,40)	(-37,36)	(-23,66)	(-22,73)	(31,170)
P-Value	1.000	0.664	0.760	0.980	0.849	0.972	0.420	0.372	0.017
Hospital Days	-103.31	-15.16	17.15	2.83	138.72	-90.53	85.95	-95.52	1,297.82
90% Confidence Interval	(-323, 117)	(-208, 178)	(-202, 236)	(-281, 287)	(-133, 411)	(-329, 148)	(-222, 394)	(-334, 143)	(-29,2624)
P-Value	0.440	0.897	0.898	0.987	0.402	0.533	0.646	0.510	0.108

** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.

Appendix Figure C-2: Quarterly Differences in Inpatient Admissions per 1,000 beneficiaries, USC Intervention and Control Groups



Appendix Figure C-3: Quarterly Differences in Hospital Days per 1,000 beneficiaries, USC Intervention and Control Groups



Appendix Table C-9: Quarterly Resource Use Rate (Number of Beneficiaries with Event per 1,000 Beneficiaries) for Participants and Controls, USC FFS and MA Cohorts, Q1 to Q4

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	755	755	755	755	745	746	719	713	669	650
Health Service Use Rate per 1,000 Beneficiaries										
All Inpatient Admissions	198.7	184.1	62.3	53.0	59.1	53.6	69.5	47.7	67.3	60.0
Unplanned Inpatient Admissions	174.8	169.5	57.0	47.7	57.7	48.3	62.6	43.5	62.8	58.5

Appendix Table C-10: Quarterly Resource Use Rate (Number of Beneficiaries with Event per 1,000 Beneficiaries) for Participants and Controls, USC FFS and MA Cohorts, Q5 to Q9

Measures	Q5		Q6		Q7		Q8		Q9	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	623	599	562	531	460	448	318	365	199	245
Health Service Use Rate per 1,000 Beneficiaries										
All Inpatient Admissions	85.1	70.1	73.0	71.6	69.6	37.9	75.5	57.5	130.7	28.6
Unplanned Inpatient Admissions	80.3	68.4	69.4	71.6	65.2	31.2	75.5	46.6	110.6	28.6

Appendix Table C-11: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, USC FFS and MA Cohort, Q1 to Q4

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	755	755	755	755	745	746	719	713	669	650
Mean Number of Events per 1,000 Beneficiaries										
All Inpatient Admissions	294.0	284.8	72.8	71.5	71.1	69.7	84.8	74.3	91.2	81.5
Unplanned Inpatient Admissions	249.0	249.0	66.2	66.2	68.5	60.3	75.1	70.1	82.2	80.0
Hospital Days	1,446.4	1,239.7	287.4	339.1	295.3	246.6	395.0	359.0	432.0	403.1

Appendix Table C-12: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, USC FFS and MA Cohort, Q5 to Q9

Measures	Q5		Q6		Q7		Q8		Q9	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	623	599	562	531	460	448	318	365	199	245
Mean Number of Events per 1,000 Beneficiaries										
All Inpatient Admissions	97.9	88.5	89.0	82.9	93.5	60.3	100.6	65.8	170.9	32.7
Unplanned Inpatient Admissions	93.1	86.8	85.4	79.1	89.1	51.3	100.6	54.8	150.8	32.7
Hospital Days	573.0	407.3	368.3	408.7	539.1	319.2	327.0	298.6	1,593.0	200.0

C.4 Medication Adherence

Appendix Table C-13: Average Proportion of Days Covered (PDC) by Medication Type

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)		Baseline Period (for 2nd Year Post Enrollment)		Intervention Period (2nd Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Beta Blockers								
Number of Eligible Beneficiaries	262	237	262	237	113	131	113	131
Mean	88.31	86.59	87.61	86.07	86.44	85.95	87.44	87.13
Median	95.90	95.98	96.89	95.34	94.33	96.26	97.20	96.22
25th percentile	82.95	80.00	81.82	83.57	79.40	78.49	85.16	83.07
75th percentile	100.00	100.00	100.00	100.00	98.90	100.00	100.00	100.00
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calcium Channel Blockers								
Number of Eligible Beneficiaries	188	178	188	178	83	87	83	87
Mean	86.38	87.99	86.41	85.20	83.29	86.41	86.29	88.70
Median	95.39	96.61	96.76	96.99	93.62	95.64	96.25	97.41
25th percentile	82.94	86.20	80.07	80.54	71.26	84.85	83.71	82.50
75th percentile	100.00	99.71	100.00	100.00	100.00	99.63	100.00	100.00
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Diabetes Medication								
Number of Eligible Beneficiaries	178	208	178	208	75	118	75	118
Mean	87.61	91.47	89.70	90.31	86.89	92.73	87.75	90.62
Median	95.70	98.35	100.00	97.92	95.31	98.65	98.55	98.91
25th percentile	79.55	88.62	85.29	86.17	79.40	90.65	85.71	87.32
75th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
RAS Antagonists								
Number of Eligible Beneficiaries	457	466	457	466	208	261	208	261
Mean	86.63	87.16	88.13	88.44	85.52	86.15	86.84	89.24
Median	96.35	95.53	97.43	96.96	95.19	94.94	97.67	98.32
25th percentile	81.74	81.95	82.42	83.43	79.22	80.22	85.27	85.37
75th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Statins								
Number of Eligible Beneficiaries	441	423	441	423	204	242	204	242

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)		Baseline Period (for 2nd Year Post Enrollment)		Intervention Period (2nd Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Mean	82.79	82.47	87.39	85.01	83.30	82.33	86.65	85.23
Median	92.82	90.54	96.13	93.07	92.41	90.35	95.48	95.07
25th percentile	73.14	73.17	79.94	77.14	73.54	72.58	79.52	77.51
75th percentile	99.29	98.88	100.00	99.71	98.86	98.84	100.00	99.71
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

C.5 Intermediate Clinical Outcomes

Measures	Overall	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Uncontrolled LDL										
Number of Participants	485	482	481	477	474	467	464	459	453	452
Difference	-78.54**	-60.31	-124.83***	-90.66**	-21.54	-74.19*	-82.37*	-95.11**	-91.12*	-38.39
90% Confidence Interval	(-131.21|-25.88)	(-129.34|8.71)	(-189.61|-60.06)	(-158.20|-23.13)	(-101.70|58.62)	(-147.42|-0.96)	(-156.68|-8.06)	(-170.14|-20.08)	(-168.45|-13.79)	(-134.28|57.50)
P-Value	0.014	0.151	0.002	0.027	0.658	0.096	0.068	0.037	0.053	0.510
Poor Hemoglobin A1c Management										
Number of Participants	400	396	396	392	388	384	383	382	379	378
Difference	-32.67	-36.88	-32.14	-77.53*	-45.51	49.21	-76.31	9.18	-64.04	15.34
90% Confidence Interval	(-87.32|21.97)	(-109.84|36.07)	(-108.32|44.03)	(-150.27|-4.79)	(-121.57|30.55)	(-37.13|135.54)	(-154.52|1.90)	(-81.05|99.41)	(-149.95|21.88)	(-83.95|114.63)
P-Value	0.325	0.406	0.488	0.080	0.325	0.349	0.108	0.867	0.220	0.799
Uncontrolled Blood Pressure										
Number of Participants	613	608	607	605	599	592	589	586	577	573
Difference	-5.08	18.77	-54.36**	-29.56	15.46	-21.76	-15.44	60.76**	-17.24	36.15
90% Confidence Interval	(-33.44|23.28)	(-21.39|58.94)	(-90.51|-18.21)	(-67.83|8.71)	(-26.11|57.04)	(-61.34|17.82)	(-56.92|26.05)	(12.99|108.52)	(-61.05|26.58)	(-15.78|88.08)
P-Value	0.768	0.442	0.013	0.204	0.541	0.366	0.541	0.036	0.518	0.252

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.

APPENDIX D: RESULTS FOR PSW

The following tables provide the baseline demographic and health characteristics; mortality and readmission rates; health service utilization, expenditure, and medication adherences rates results for intervention and comparison group beneficiaries in the PSW cohort.

D.1 Demographic and Health Characteristics

Appendix Table D-1: PSW Baseline Demographic and Health Characteristics, WI DHS Cohort

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Number of Beneficiaries	38,381	38,381		
Average Age (Years)[+]	27.57	27.80	-0.23	0.01
Age under 65[+]	98%	98%	0%	0.03
Gender				
Male[+]	39%	39%	0%	0.00
Female	61%	61%	0%	0.00
Race				
White[+]	57%	58%	-2%	0.03
Black[+]	13%	13%	0%	0.01
Other	30%	29%	1%	0.02
Evaluation and Management (E&M) Visits				
E&M Visits: 0	4%	5%	-1%	0.03
E&M Visits: 1-5	45%	46%	-1%	0.01
E&M Visits: 6-10	27%	27%	0%	0.01
E&M Visits: 11-15	12%	12%	0%	0.01
E&M Visits: 16+[+]	11%	11%	0%	0.01
Resource Use per Beneficiary (Pre-Enrollment Year)				
IP Stay before study enrollment				
0 IP Stays (1Q Prior)	95%	95%	0%	0.02
1 IP Stay (1Q Prior)[+]	4%	3%	0%	0.02
2+ IP Stays (1Q Prior)[+]	1%	1%	0%	0.01
0 IP Stays (Prior Year)	87%	88%	0%	0.01
1 IP Stay (Prior Year)[+]	8%	8%	0%	0.00
2+ IP Stays (Prior Year)[+]	5%	4%	0%	0.02
Drug History (Pre-Enrollment Year)				
Antidiabetics[+]	9%	8%	0%	0.00
Insulin[+]	4%	4%	0%	0.01

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
SSRIs and SNRIs+	37%	36%	0%	0.00
Other Antidepressants+	26%	26%	0%	0.00
Statins+	13%	13%	0%	0.00
Thiazids+	10%	10%	0%	0.00
Calcium channel blockers+	8%	7%	0%	0.00
Beta blockers+	13%	13%	0%	0.00
ACE inhibitors+	12%	12%	0%	0.00
ARBs+	4%	4%	0%	0.00
Antihypertensives+	12%	12%	0%	0.01
Antineoplastics+	2%	2%	0%	0.00
Corticosteroids+	35%	35%	0%	0.00
Cardiotonics+	0%	0%	0%	0.00
Antiarrhythmics+	0%	0%	0%	0.00
Vasopressors+	4%	4%	0%	0.00
Antiasthmatics+	42%	42%	0%	0.00
Antianxiety Agents+	31%	31%	0%	0.00
Antipsychotics+	20%	19%	1%	0.02
Anticoagulants+	4%	4%	0%	0.01
Insulin+	5%	5%	0%	0.00
Nitrates+	2%	2%	0%	0.01
Loop diuretics+	5%	5%	0%	0.00
Potassium sparing diuretics+	2%	2%	0%	0.00
Fibric acid derivatives+	3%	3%	0%	0.00
Platelet aggregation inhibitors+	2%	2%	0%	0.01
Healthcare Cost and Utilization Project (HCUP) Diagnosis Categories (Pre-Enrollment Year)				
Acute cerebrovascular disease (IP)	0%	0%	0%	0.00
Acute cerebrovascular disease (IP, 30 days prior)	0%	0%	0%	0.00
AMI (IP)	0%	0%	0%	0.00
AMI (IP, 30 days prior)	0%	0%	0%	0.00
Cerebrovascular disease+	2%	2%	0%	0.01
Parkinson's disease and multiple sclerosis+	1%	1%	0%	0.00
Asthma+	25%	25%	0%	0.00
Coagulation and hemorrhagic disorders+	2%	2%	0%	0.00
Congestive heart failure (All Settings) +	2%	2%	0%	0.00
Congestive heart failure (IP) +	0%	0%	0%	0.00
Coronary atherosclerosis+	3%	3%	0%	0.01
Dementia+	2%	2%	0%	0.01
Diabetes mellitus without complication+	13%	13%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Diabetes mellitus with complications+	5%	5%	0%	0.00
Cardiac dysrhythmias, arrest and ventricular fibrillation+	8%	8%	0%	0.01
Fluid and electrolyte disorders+	7%	7%	0%	0.00
Gastrointestinal hemorrhage (All Settings) +	3%	3%	0%	0.01
Gastrointestinal hemorrhage (IP)	0%	0%	0%	0.00
Other heart disease+	18%	18%	0%	0.01
Heart valve disorders+	3%	3%	0%	0.00
Hepatitis+	2%	2%	0%	0.01
HIV infection	1%	0%	1%	0.10
Hypertension with complications+	2%	2%	0%	0.00
Stomach, pancreas and lung cancer+	0%	0%	0%	0.00
Peri- endo- and myocarditis+	1%	1%	0%	0.00
Disorders of nervous system+	10%	10%	0%	0.01
Other cancers+	4%	4%	0%	0.00
Paralysis+	2%	2%	0%	0.01
Pneumonia+	6%	6%	0%	0.01
Pneumonia (IP, 30 days prior)	0%	0%	0%	0.01
Pulmonary heart disease+	1%	1%	0%	0.00
Renal failure+	3%	3%	0%	0.00
Respiratory failure (IP) +	0%	0%	0%	0.00
Respiratory failure (IP, 30 days prior)	0%	0%	0%	0.00
Rheumatoid arthritis and related disease+	1%	1%	0%	0.00
Septicemia+	1%	1%	0%	0.01
Shock	0%	0%	0%	0.01
Tuberculosis	0%	0%	0%	0.01
Procedures (Pre-Enrollment Year)				
Bypass and PTCA (IP)	2%	2%	0%	0.02
Heart valve procedures (IP)	1%	1%	0%	0.00
Hemodialysis+	0%	0%	0%	0.01
Peritoneal dialysis+	0%	0%	0%	0.01
Procedures on vessels of head and neck (IP) +	15%	14%	1%	0.02
Radiology and chemotherapy+	1%	1%	0%	0.00
Respiratory intubation and mechanical ventilation+	1%	1%	0%	0.01
Blood transfusion+	1%	1%	0%	0.01
Blood transfusion (IP) +	5%	5%	0%	0.01
Transportation+	12%	12%	0%	0.00
Comorbidity Categories (Pre-Enrollment Quarter)				
Depression	11%	11%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
AIDS HIV	0%	0%	0%	0.00
Alcohol Abuse	2%	2%	0%	0.00
Cardiac Arrhythmias	3%	3%	0%	0.01
Congestive Heart Failure	1%	1%	0%	0.00
Chronic Pulmonary Disease	13%	13%	0%	0.01
Coagulopathy	1%	1%	0%	0.00
Deficiency Anemia	1%	1%	0%	0.01
Diabetes Complicated	2%	2%	0%	0.00
Diabetes Uncomplicated	8%	7%	0%	0.01
Dementia	0%	0%	0%	0.02
Drug Abuse	4%	4%	0%	0.00
Fluid and Electrolyte Disorders	3%	3%	0%	0.00
Hypothyroidism	4%	4%	0%	0.00
Hypertension Complicated	1%	1%	0%	0.01
Hypertension Uncomplicated	12%	11%	0%	0.01
Liver Disease	1%	1%	0%	0.01
Lymphoma	0%	0%	0%	0.01
Metastatic Cancer	0%	0%	0%	0.01
Myocardial Infarction	0%	0%	0%	0.00
Obesity	7%	6%	0%	0.01
Other Neurological Disorders	4%	3%	0%	0.01
Paralysis	1%	1%	0%	0.01
Peptic Ulcer Disease Excluding Bleeding	0%	0%	0%	0.00
Peripheral Vascular Disorders	1%	1%	0%	0.03
Psychosis	3%	3%	0%	0.01
Pulmonary Circulation Disorders	0%	0%	0%	0.02
Renal Failure	1%	1%	0%	0.00
Rheumatoid Arthritis Collagen Vascular Disease	2%	2%	0%	0.00
Solid Tumor Without Metastasis	1%	1%	0%	0.00
Valvular Disease	1%	1%	0%	0.01
Weight Loss	1%	1%	0%	0.01
Antiasthmatics prescriptions (Age <18) [+]	3%	3%	0%	0.00
Mental health prescriptions (Age <18) [+]	13%	13%	0%	0.00
Dermatologicals prescription (Age <18) [+]	4%	4%	0%	0.00
Other prescriptions (Age <18) [+]	20%	20%	0%	0.00
All prescriptions (Age>=18) [+]	60%	60%	0%	0.00
No. of RX on index date[+]	3.63	3.63	0.00	0.00
Bene visits to pharmacies in the baseline period[+]	13.08	12.90	0.18	0.02

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
ADI+	100.27	99.68	0.60	0.07
Pharmacy- level Characteristics				
Institutional Pharmacy+	0%	0%	0%	0.00
Long Term Care Pharmacy+	2%	2%	0%	0.00
Other Pharmacy+	98%	98%	0%	0.00
Pharmacy size - No. of beneficiaries visited in the prior quarter				
Pharmacy size - 0 - 500	66%	67%	-1%	0.02
Pharmacy size - 500 - 1000+	25%	25%	0%	0.00
Pharmacy size - 1000 - 2500+	9%	7%	2%	0.07
Pharmacy size - 2500 - 5000+	1%	2%	-1%	0.10
Pharmacy IP rates in the baseline period				
Quarterly IP rate - <0.15	38%	37%	0%	0.01
Quarterly IP rate - 0.15 to 0.2+	11%	11%	-1%	0.02
Quarterly IP rate - 0.2 to 0.25+	7%	8%	-1%	0.04
Quarterly IP rate - > 0.25+	45%	44%	1%	0.03
Pharmacies with a hospital in the same zip code+	49%	51%	-2%	0.04

+Denotes characteristic used for matching.

[a]Standardized mean difference is an effect size measure used in the above table to identify substantial differences between the intervention and control groups; a standardized mean difference of 0.1 or greater is treated as an indicator of a substantial difference between the two groups.

D.2 Mortality and Readmissions

Appendix Table D-2: Cumulative and Yearly Mortality and Readmissions per 1,000 Beneficiaries, Differences after PSW Enrollment, WI DHS Cohort

Measures	Full Intervention Period[a]	Total Year 1[b]
Number of Participants	38,381	38,381
Mortality		
Difference[c]	-1.46*	-1.01
90% Confidence Interval	(-2.9 | 0.0)	(-2.2 | 0.2)
P-Value	0.100	0.153
30-Day Hospital Readmissions Following All Inpatient Admissions		
Difference	73.84**	55.92**
90% Confidence Interval	(17.1 | 130.5)	(11.3 | 100.5)
P-Value	0.032	0.039
30-Day Hospital Unplanned Readmissions Following All Inpatient Admission		
Difference	70.03**	50.54*
90% Confidence Interval	(14.8 | 125.3)	(6.9 | 94.1)
P-Value	0.037	0.057

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.
[c]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries or the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Table D-3: Quarterly Difference in Mortality per 1,000 Beneficiaries after PSW Enrollment, WI DHS Cohort

Measures	Q1	Q2	Q3	Q4	Q5	Q6
Number of Participant Beneficiaries	38,381	36,565	34,518	32,740	31,393	29,948
Difference[a]	-0.26	0.13	-0.50	-0.40	-0.39	-0.05
90% Confidence Interval	(-0.8 | 0.3)	(-0.4 | 0.7)	(-1.1 | 0.1)	(-1.0 | 0.2)	(-1.0 | 0.2)	(-0.7 | 0.6)
P-Value	0.453	0.688	0.170	0.282	0.300	0.899

[a]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries between the intervention group and control group in the relevant quarter of the intervention period. There were no deaths in the intervention or control groups prior to program enrollment as beneficiaries were required to be alive on program start date to be included in the study.

Appendix Table D-4: Quarterly Difference in Readmissions per 1,000 IP Admissions after PSW Enrollment, WI DHS Cohort

Measures	Q1	Q2	Q3	Q4	Q5	Q6
Number of Participant Beneficiaries	38,381	36,565	34,518	32,740	31,393	29,948
30-Day Hospital Readmissions per 1,000 Beneficiaries Following all Inpatient Admissions	1642	1456	1334	1228	1150	1038
Difference[a]	19.92	10.82	1.74	23.08	13.20	2.19
90% Confidence Interval	(-1.4 | 41.2)	(-10.1 | 31.7)	(-21.2 | 24.7)	(-1.3 | 47.5)	(-11.2 | 37.6)	(-23.8 | 28.1)
P-Value	0.124	0.394	0.901	0.120	0.373	0.890
30-Day Hospital Unplanned Readmissions per 1,000 Beneficiaries Following any Inpatient Admission	1642	1456	1334	1228	1150	1038
Difference	16.65	8.70	3.35	22.01	11.17	6.97
90% Confidence Interval	(-4.2 | 37.5)	(-11.7 | 29.1)	(-19.0 | 25.7)	(-1.9 | 45.9)	(-12.5 | 34.8)	(-18.1 | 32.0)
P-Value	0.189	0.483	0.805	0.130	0.437	0.647

[a] The "difference" estimate represents the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Table D-5: Quarterly Mortality and Readmission per 1,000 Beneficiaries for Participants and Controls, PSW WI DHS Cohort, Q1 to Q3

Measures	Q1		Q2		Q3	
	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	38,381	38,381	36,565	36,440	34,518	34,353
All-Cause Mortality per 1,000 Beneficiaries	2.2	2.4	2.0	1.9	2.1	2.6
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	168.1	148.2	133.2	122.4	146.9	145.2
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	159.0	142.3	125.0	116.3	137.9	134.6

Appendix Table D-6: Quarterly Mortality and Readmission per 1,000 Beneficiaries for Participants and Controls, PSW WI DHS Cohort, Q4 to Q6

Measures	Q4		Q5		Q6	
	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	32,740	32,654	31,393	31,278	29,948	29,733
All-Cause Mortality per 1,000 Beneficiaries	2.1	2.5	2.0	2.4	2.3	2.4
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	165.3	142.2	149.6	136.4	147.4	145.2
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	157.2	135.2	138.3	127.1	137.8	130.8

D.3 Health Service Resource Use

Appendix Table D-7: Cumulative and Yearly DiD Estimates of Resource Use per 1,000 Beneficiaries, PSW WI DHS Cohort

Measures (Number of Events or Days)	Full Intervention Period[a]	Total Year 1[b]
Number of Participant Beneficiaries	38,381	38,381
Inpatient Admissions	6.16	6.56
90% Confidence Interval	(-8.6 | 20.9)	(-4.3 | 17.4)
P-Value	0.492	0.319
Unplanned Inpatient Admissions	3.80	5.72
90% Confidence Interval	(-10.2 | 17.8)	(-4.6 | 16.0)
P-Value	0.656	0.361
Hospital Days	16.64	3.45
90% Confidence Interval	(-111.8 | 145.1)	(-91.7 | 98.6)
P-Value	0.831	0.952

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.

Appendix Table D-8: Quarterly DiD Estimates of Resource Use (Number of Events or Days per 1,000 Beneficiaries), PSW WI DHS Cohort

Measures (Number of Events or Days per 1,000 Beneficiaries)	Q1	Q2	Q3	Q4	Q5	Q6
Number of Participant Beneficiaries	38,381	36,565	34,518	32,740	31,393	29,948
Inpatient Admissions	1.78	1.58	1.50	2.37	0.60	-0.01
90% Confidence Interval	(-3,6)	(-3,6)	(-3,6)	(-2,7)	(-4,5)	(-5,5)
P-Value	0.531	0.566	0.600	0.413	0.834	0.997
Unplanned Inpatient Admissions	1.97	0.73	2.13	1.71	-0.47	-0.36
90% Confidence Interval	(-2,6)	(-4,5)	(-2,7)	(-3,6)	(-5,4)	(-5,4)
P-Value	0.465	0.780	0.434	0.536	0.865	0.898
Hospital Days	17.98	-10.24	-15.18	11.40	29.76	-2.26
90% Confidence Interval	(-21,57)	(-52,31)	(-58,28)	(-29,52)	(-12,72)	(-44,40)
P-Value	0.448	0.685	0.562	0.641	0.242	0.929

Appendix Table D-9: Quarterly Resource Use Rate (Number of Beneficiaries with Events per 1,000 Beneficiaries) for Participants and Controls, WI DHS Cohort, Q1 to Q3

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	38,381	38,381	38,381	38,381	36,565	36,440	34,518	34,353
Health Service Use Rate per 1,000 Beneficiaries								
All Inpatient Admissions	129.0	124.4	43.4	40.4	40.6	36.7	39.2	36.2
Unplanned Inpatient Admissions	121.2	115.9	40.7	37.7	37.5	34.2	37.1	34.0

Appendix Table D-10: Quarterly Resource Use Rate (Number of Beneficiaries with Events per 1,000 Beneficiaries) for Participants and Controls, WI DHS Cohort, Q4 to Q6

Measures	Q4		Q5		Q6	
	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	32,740	32,654	31,393	31,278	29,948	29,733
Health Service Use Rate per 1,000 Beneficiaries						
All Inpatient Admissions	38.1	35.2	37.2	34.9	35.3	33.4
Unplanned Inpatient Admissions	35.6	32.9	34.8	33.1	33.0	31.4

Appendix Table D-11: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, PSW WI DHS Cohort, Q1 to Q3

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	38,381	38,381	38,381	38,381	36,565	36,440	34,518	34,353
Mean Number of Events per 1,000 Beneficiaries								
All Inpatient Admissions	227.6	214.5	62.6	57.5	56.0	51.1	54.9	50.2
Unplanned Inpatient Admissions	210.5	196.8	58.2	52.8	51.1	47.0	51.6	46.2
Hospital Days	1,061.6	997.1	313.1	279.0	268.1	261.6	269.4	267.4

Appendix Table D-12: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, PSW WI DHS Cohort, Q4 to Q6

Measures	Q4		Q5		Q6	
	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	32,740	32,654	31,393	31,278	29,948	29,733
Mean Number of Events per 1,000 Beneficiaries						
All Inpatient Admissions	53.2	48.1	50.8	47.6	48.9	46.3
Unplanned Inpatient Admissions	49.2	44.7	46.9	44.8	45.2	42.9
Hospital Days	269.0	244.5	264.0	224.6	249.4	242.9

D.4 Medical Expenditures

Appendix Table D-13: Cumulative and Yearly DiD Estimates of Expenditures per 1,000 Beneficiaries, PSW WI DHS Cohort

Measures (2011 USD)	Full Intervention Period[a]	Total Year 1[b]
Number of Participant Beneficiaries	38,381	38,381
Total Medical and Drug Expenditures	152,632.3	162,097.5
90% Confidence Interval	(-165,191.6 | 470,456.3)	(-76,460.4 | 400,655.4)
P-Value	0.430	0.264
Total Medical Expenditures	190,761.5	197,482.5
90% Confidence Interval	(-75,121.9 | 456,645.0)	(-2,816.5 | 397,781.4)
P-Value	0.238	0.105
Inpatient Expenditures	41,446.49	108,260.77
90% Confidence Interval	(-172,587.1 | 255,480.1)	(-55,089.2 | 271,610.7)
P-Value	0.750	0.276
Total Outpatient Expenditures	20,151.83	16,900.54
90% Confidence Interval	(-20,516.4 | 60,820.1)	(-12,774.2 | 46,575.3)
P-Value	0.415	0.349
Physician and Ancillary Service Expenditures	63,868.57*	37,390.73
90% Confidence Interval	(2,245.2 | 125,491.9)	(-7,652.4 | 82,433.8)
P-Value	0.088	0.172
Home Health Expenditures	65,294.65	34,930.42
90% Confidence Interval	(-11,451.8 | 142,041.1)	(-20,938.3 | 90,799.2)
P-Value	0.162	0.304

* Statistically significant at the ten percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.

Appendix Table D-14: Quarterly DiD Estimates of Expenditures per Beneficiary, PSW WI DHS Cohort

Measures (2011 USD per Person)	Q1	Q2	Q3	Q4	Q5	Q6
Number of Participant Beneficiaries	38,381	36,565	34,518	32,740	31,393	29,948
Total Medical and Drug Expenditures[a]	55.86	37.19	10.55	37.99	-37.45	9.10
90% Confidence Interval	(-56,168)	(-58,133)	(-96,117)	(-93,169)	(-146,71)	(-109,127)
P-Value	0.411	0.521	0.871	0.633	0.572	0.899
Total Medical Expenditures	61.32	6.20	64.48	55.54	-10.11	-8.71
90% Confidence Interval	(-36,158)	(-73,85)	(-25,154)	(-46,157)	(-96,75)	(-108,90)
P-Value	0.298	0.897	0.237	0.369	0.846	0.885
Inpatient Expenditures	48.03	-25.22	45.89	42.90	-26.53	-44.72
90% Confidence Interval	(-32,128)	(-82,32)	(-23,115)	(-39,125)	(-88,35)	(-121,32)
P-Value	0.321	0.467	0.276	0.392	0.477	0.336
Total Outpatient Expenditures	1.56	7.26	6.51	-4.58	-5.07	2.45
90% Confidence Interval	(-11,14)	(-7,21)	(-8,21)	(-20,11)	(-21,11)	(-14,19)
P-Value	0.841	0.389	0.473	0.623	0.602	0.804
Physician and Ancillary Service Expenditures	10.83	16.70	4.34	6.23	11.18	13.56
90% Confidence Interval	(-9,31)	(-3,37)	(-17,25)	(-16,28)	(-11,33)	(-9,36)
P-Value	0.378	0.173	0.735	0.640	0.404	0.324
Home Health Expenditures	0.90	7.45	7.74	11.00	10.31	20.00
90% Confidence Interval	(-26,28)	(-21,35)	(-22,37)	(-20,42)	(-21,42)	(-13,53)
P-Value	0.956	0.661	0.666	0.559	0.589	0.316

[a]Denominator is subset to beneficiaries enrolled in Medicare Part D.

Appendix Table D-15: PSW Total Medical Expenditures in the Baseline Period and by Quarter Following Enrollment, WI DHS Cohort, Q1 to Q3

Measures (2011 USD)	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	38,381	38,381	38,381	38,381	36,565	36,440	34,518	34,353
Total Medical and Drug Expenditures[a]								
Mean	$7,565	$7,170	$2,123	$1,969	$2,052	$1,910	$2,099	$1,984
Median	$2,848	$2,808	$590	$588	$557	$547	$567	$584
90th percentile	$17,417	$16,756	$4,622	$4,395	$4,695	$4,299	$4,669	$4,530
99th percentile	$69,793	$64,785	$23,288	$21,027	$23,707	$20,908	$23,391	$22,319
Total Medical Expenditures								
Mean	$5,018	$4,851	$1,462	$1,359	$1,351	$1,299	$1,410	$1,299
Median	$1,429	$1,472	$284	$288	$241	$247	$248	$258
90th percentile	$10,982	$10,897	$2,829	$2,809	$2,782	$2,697	$2,802	$2,763
99th percentile	$53,675	$50,602	$18,163	$17,284	$18,235	$15,963	$18,316	$16,762

[a]Denominator is subset to beneficiaries enrolled in Medicare Part D.

Appendix Table D-16: PSW Total Medical Expenditures by Quarter Following Enrollment, WI DHS Cohort, Q4 to Q6

Measures (2011 USD)	Q4		Q5		Q6	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	32,740	32,654	31,393	31,278	29,948	29,733
Total Medical and Drug Expenditures[a]						
Mean	$2,168	$2,025	$2,042	$1,978	$2,035	$1,920
Median	$554	$559	$523	$518	$458	$442
90th percentile	$4,943	$4,688	$4,740	$4,603	$4,798	$4,530
99th percentile	$24,217	$22,627	$23,243	$21,885	$22,703	$20,902
Total Medical Expenditures						
Mean	$1,412	$1,312	$1,291	$1,261	$1,297	$1,261
Median	$225	$236	$203	$206	$172	$168
90th percentile	$2,819	$2,797	$2,716	$2,695	$2,713	$2,628
99th percentile	$18,752	$16,980	$17,371	$16,512	$16,611	$15,876

[a]Denominator is subset to beneficiaries enrolled in Medicare Part D.

Appendix Table D-17: PSW Inpatient and Outpatient Expenditures in the Baseline Period and by Quarter Following Enrollment, WI DHS Cohort, Q1 to Q3

Measures (2011 USD)	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	38,381	38,381	38,381	38,381	36,565	36,440	34,518	34,353
Inpatient Expenditures								
Mean	$1,341	$1,221	$441	$363	$348	$342	$389	$313
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$1,573	$1,436	$0	$0	$0	$0	$0	$0
99th percentile	$26,580	$24,747	$10,052	$9,395	$9,501	$8,220	$9,011	$8,352
Total Outpatient Expenditures								
Mean	$928	$932	$255	$255	$255	$249	$266	$258
Median	$258	$283	$0	$0	$0	$0	$0	$0
90th percentile	$2,235	$2,269	$651	$682	$633	$635	$644	$681
99th percentile	$9,957	$9,788	$3,449	$3,478	$3,729	$3,487	$3,995	$3,824

Appendix Table D-18: PSW Inpatient and Outpatient Expenditures by Quarter Following Enrollment, WI DHS Cohort, Q4 to Q6

Measures (2011 USD)	Q4		Q5		Q6	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	32,740	32,654	31,393	31,278	29,948	29,733
Inpatient Expenditures						
Mean	$398	$330	$313	$316	$341	$358
Median	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0
99th percentile	$9,392	$8,885	$8,314	$8,201	$8,670	$8,504
Total Outpatient Expenditures						
Mean	$262	$264	$246	$250	$249	$244
Median	$0	$0	$0	$0	$0	$0
90th percentile	$675	$669	$627	$613	$587	$584
99th percentile	$3,891	$4,005	$3,739	$3,759	$3,950	$3,680

Appendix Table D-19: PSW Expenditures for Other Settings in the Baseline Period and by Quarter Following Enrollment, WI DHS Cohort, Q1 to Q3

Measures (2011 USD)	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	38,381	38,381	38,381	38,381	36,565	36,440	34,518	34,353
Physician and Ancillary Service Expenditures								
Mean	$2,111	$2,102	$592	$579	$562	$543	$560	$554
Median	$914	$920	$195	$196	$172	$170	$174	$177
90th percentile	$5,002	$4,998	$1,465	$1,445	$1,407	$1,358	$1,408	$1,385
99th percentile	$17,708	$17,485	$6,077	$5,889	$5,840	$5,601	$5,927	$5,742
Home Health Expenditures								
Mean	$638	$596	$174	$162	$185	$165	$196	$175
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0	$0	$0
99th percentile	$20,940	$20,840	$5,805	$5,895	$6,093	$5,925	$6,455	$6,074
Hospice Expenditures								
Mean	$0	$0	$0	$0	$0	$0	$0	$0
Median	$0	$0	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0	$0	$0
99th percentile	$0	$0	$0	$0	$0	$0	$0	$0

Appendix Table D-20: PSW Expenditures for Other Settings by Quarter Following Enrollment, WI DHS Cohort, Q4 to Q6

Measures (2011 USD)	Q4		Q5		Q6	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	32,740	32,654	31,393	31,278	29,948	29,733
Physician and Ancillary Service Expenditures						
Mean	$547	$539	$528	$514	$500	$483
Median	$159	$162	$144	$147	$122	$118
90th percentile	$1,362	$1,368	$1,303	$1,319	$1,251	$1,222
99th percentile	$5,738	$5,712	$5,953	$5,579	$5,663	$5,536
Home Health Expenditures						
Mean	$205	$179	$204	$182	$207	$176
Median	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0
99th percentile	$6,452	$6,163	$6,499	$6,191	$6,321	$5,937
Hospice Expenditures						
Mean	$0	$0	$0	$0	$0	$0
Median	$0	$0	$0	$0	$0	$0
90th percentile	$0	$0	$0	$0	$0	$0
99th percentile	$0	$0	$0	$0	$0	$0

D.5 Medication Adherence

Appendix Table D-21: Average Proportion of Days Covered (PDC) by Medication Type

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls
Beta Blockers				
Number of Eligible Beneficiaries	799	831	799	831
Mean	63.36	61.97	64.80	63.91
Median	62.12	61.64	63.64	62.50
25th percentile	44.76	42.17	47.78	47.24
75th percentile	84.13	82.19	85.71	85.71
90th percentile	99.45	99.28	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00
Calcium Channel Blockers				
Number of Eligible Beneficiaries	508	557	508	557
Mean	62.25	62.07	66.72	67.18
Median	61.62	61.64	67.42	66.67
25th percentile	46.12	44.26	50.27	50.00
75th percentile	80.69	81.57	86.59	89.40
90th percentile	96.55	96.90	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00
Diabetes Medication				
Number of Eligible Beneficiaries	581	543	581	543
Mean	64.24	65.63	65.55	67.43
Median	63.83	65.70	66.67	67.40
25th percentile	45.86	47.08	46.10	48.74
75th percentile	85.19	89.64	86.71	90.36
90th percentile	99.39	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00
RAS Antagonists				
Number of Eligible Beneficiaries	1173	1213	1173	1213
Mean	63.42	63.16	66.72	67.32
Median	63.07	62.20	65.88	67.23
25th percentile	46.59	46.53	50.14	50.21
75th percentile	82.57	83.03	88.92	88.89
90th percentile	99.27	98.86	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00
Statins				
Number of Eligible Beneficiaries	1004	1016	1004	1016
Mean	57.87	58.41	62.64	63.01

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls
Median	57.97	57.42	61.59	62.70
25th percentile	38.09	39.34	44.61	45.56
75th percentile	76.63	76.32	81.60	83.21
90th percentile	94.74	96.95	99.70	99.24
99th percentile	100.00	100.00	100.00	100.00

APPENDIX E: RESULTS FOR PHARM2PHARM

The following tables provide the baseline demographic and health characteristics; mortality and readmission rates; health service utilization; and medication adherence rates results for the intervention group and comparison group beneficiaries in the Pharm2Pharm cohort who were enrolled in Medicare Parts A, B, and D (Medicare FFS) or Medicare Advantage and Part D (MA).

E.1 Demographic and Health Characteristics

Appendix Table E-1: Pharm2Pharm Baseline Demographic and Health Characteristics, Medicare FFS Cohort

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Number of Beneficiaries	311	311		
Average Age (Years)[+]	74.31	74.41	-0.10	0.01
Age under 65[+]	12%	12%	0%	0.00
Gender				
Male[+]	46%	46%	0%	0.00
Female	54%	54%	0%	0.00
Race				
White[+]	35%	38%	-4%	0.07
Black or Other	65%	62%	4%	0.07
Dual Eligible[+]	16%	13%	4%	0.10
Medicare Eligibility				
Disabled[+]	20%	18%	1%	0.03
ESRD	4%	2%	2%	0.12
Aged[+]	77%	80%	-3%	0.08
Area Deprivation Index (ADI)[+]	100.96	101.39	-0.42	0.04
Evaluation and Management (E&M) Visits				
E&M Visits: 0	2%	3%	-1%	0.06
E&M Visits: 1-5[+]	14%	18%	-4%	0.11
E&M Visits: 6-10[+]	19%	16%	3%	0.08
E&M Visits: 11-15[+]	27%	26%	2%	0.04
E&M Visits: 16+[+]	38%	38%	0%	0.01
Resource Use per Beneficiary (Pre-Enrollment Year)				
0 SNF Stays (Prior Year)	89%	87%	2%	0.06
1 SNF Stay (Prior Year)[+]	8%	9%	-1%	0.03
2+ SNF Stays (Prior Year)[+]	3%	4%	-1%	0.05
0 IP Stays (1Q Prior)	0%	0%	0%	0.00
1 IP Stay (Prior Year)[+]	74%	74%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
2+ IP Stays (Prior Year)+	26%	26%	0%	0.00
0 IP Stays (Prior Year)	0%	0%	0%	0.00
1 IP Stay (Prior Year)+	52%	52%	0%	0.00
2+ IP Stays (Prior Year)+	48%	48%	0%	0.00
ER Visits (Pre-Enrollment Quarter)				
ER Visits: 0	68%	73%	-5%	0.10
ER Visits: 1+	20%	17%	3%	0.07
ER Visits: 2++	11%	10%	2%	0.05
Medical Cost per Beneficiary				
Cost (4Q Prior)+	$3,756	$3,540	216	0.03
Cost (3Q Prior)+	$4,546	$4,219	327	0.03
Cost (2Q Prior)+	$4,683	$4,502	181	0.02
Cost (1Q Prior)+	$15,501	$15,319	182	0.01
IP Cost (Prior Year)	$14,821	$13,850	971	0.06
IP Cost (1Q Prior)+	$10,346	$9,786	560	0.04
Frailty Measures				
Home Oxygen+	13%	13%	1%	0.02
Urinary Catheter	4%	3%	1%	0.04
Wheelchair Use	1%	1%	0%	0.03
Walker Use	4%	5%	-2%	0.08
Charlson Score	3.32	3.13	0.19	0.08
Drug History (Pre-Enrollment Year)				
Antidiabetics+	28%	32%	-4%	0.08
Insulin+	26%	27%	-1%	0.01
SSRIs and SNRIs+	21%	23%	-2%	0.05
Other Antidepressants+	13%	15%	-3%	0.07
Statins+	79%	77%	2%	0.05
Thiazide+	30%	31%	-1%	0.02
Calcium channel blockers+	51%	45%	5%	0.11
Beta blockers+	73%	72%	1%	0.01
ACE inhibitors+	46%	49%	-2%	0.05
ARBs+	43%	38%	5%	0.10
Antihypertensives+	20%	19%	1%	0.03
Antineoplastics+	9%	9%	0%	0.00
Corticosteroids+	47%	50%	-3%	0.06
Cardiotonics+	12%	14%	-3%	0.09
Antiarrhythmics+	12%	11%	2%	0.05
Vasopressors+	3%	4%	-1%	0.07

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Antiasthmatics+	44%	44%	0%	0.00
Antianxiety Agents+	21%	23%	-2%	0.04
Antipsychotics+	6%	6%	0%	0.01
Anticoagulants+	31%	36%	-5%	0.11
Insulin+	25%	25%	0%	0.00
Nitrates+	24%	22%	3%	0.06
Loop diuretics+	45%	43%	2%	0.05
Potassium sparing diuretics+	6%	7%	-1%	0.03
Fibric acid derivatives+	6%	7%	-1%	0.04
Platelet aggregation inhibitors+	26%	25%	1%	0.03
Healthcare Cost and Utilization Project (HCUP) Diagnosis Categories (Pre-Enrollment Year)				
Acute cerebrovascular disease (IP)	5%	5%	0%	0.01
Acute cerebrovascular disease (IP, 30 days prior)	4%	4%	-1%	0.03
AMI (IP)	13%	11%	2%	0.06
AMI (IP, 30 days prior)	9%	9%	0%	0.00
Cerebrovascular disease+	39%	37%	2%	0.04
Parkinson's disease and multiple sclerosis	2%	2%	0%	0.00
Asthma	53%	52%	1%	0.01
Coagulation and hemorrhagic disorders+	19%	19%	0%	0.01
Congestive heart failure (All Settings)+	49%	45%	4%	0.08
Congestive heart failure (IP)	13%	12%	1%	0.02
Coronary atherosclerosis+	65%	63%	3%	0.05
Dementia+	12%	12%	0%	0.00
Diabetes mellitus without complication+	74%	75%	-1%	0.01
Diabetes mellitus with complications+	50%	50%	-1%	0.01
Cardiac dysrhythmias, arrest and ventricular fibrillation+	74%	74%	0%	0.00
Fluid and electrolyte disorders+	60%	58%	2%	0.05
Gastrointestinal hemorrhage (All Settings)+	17%	20%	-3%	0.07
Gastrointestinal hemorrhage (IP)	5%	5%	0%	0.01
Other heart disease+	93%	94%	-1%	0.04
Heart valve disorder+	45%	44%	2%	0.03
Hepatitis+	5%	5%	0%	0.01
Hypertension with complications+	61%	56%	6%	0.12
Stomach, pancreas and lung cancer+	4%	3%	0%	0.02
Peri- endo- and myocarditis+	30%	24%	6%	0.14
Disorders of nervous system+	26%	21%	5%	0.11
Other cancers+	21%	17%	5%	0.11
Paralysis+	5%	5%	1%	0.03

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Pneumonia+	53%	45%	8%	0.16
Pneumonia (IP, 30 days prior)	5%	5%	0%	0.00
Pulmonary heart disease	25%	22%	3%	0.07
Renal failure	58%	53%	5%	0.10
Respiratory failure (IP)+	3%	2%	1%	0.09
Respiratory failure (IP, 30 days prior)	3%	2%	1%	0.09
Rheumatoid arthritis and related disease+	3%	2%	1%	0.06
Septicemia+	18%	17%	1%	0.03
Shock+	5%	5%	0%	0.02
Tuberculosis+	0%	0%	0%	0.00
Procedures (Pre-Enrollment Year)				
Bypass and PTCA (IP)+	9%	6%	4%	0.13
Heart valve procedures (IP)+	3%	3%	0%	0.02
Hemodialysis+	15%	11%	4%	0.11
Peritoneal dialysis+	16%	12%	4%	0.10
Procedures on vessels of head and neck (IP)	20%	20%	1%	0.02
Radiology and chemotherapy	4%	4%	0%	0.02
Respiratory intubation and mechanical ventilation+	12%	12%	1%	0.02
Blood transfusion+	14%	14%	0%	0.00
Blood transfusion (IP)+	11%	10%	0%	0.01
Transportation+	55%	57%	-3%	0.05
HCC Risk Score	3.34	3.07	27%	0.16
Comorbidity Categories (Pre-Enrollment Quarter)				
Depression	7%	8%	-1%	0.05
AIDS HIV	0%	0%	0%	0.00
Alcohol Abuse	3%	3%	0%	0.00
Cardiac Arrhythmias	62%	63%	-1%	0.02
Congestive Heart Failure	48%	45%	3%	0.06
Chronic Pulmonary Disease	53%	50%	3%	0.06
Coagulopathy	12%	12%	0%	0.01
Deficiency Anemia	22%	19%	3%	0.08
Diabetes Complicated	35%	32%	3%	0.07
Diabetes Uncomplicated	59%	57%	1%	0.03
Dementia	5%	5%	0%	0.02
Drug Abuse	4%	3%	2%	0.09
Fluid and Electrolyte Disorders	49%	49%	0%	0.00
Hypothyroidism	18%	18%	0%	0.00
Hypertension Complicated	38%	34%	3%	0.07

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Hypertension Uncomplicated	86%	91%	-5%	0.14
Liver Disease	10%	8%	2%	0.06
Lymphoma	1%	2%	-1%	0.10
Metastatic Cancer	1%	3%	-2%	0.16
Myocardial Infarction	32%	30%	2%	0.04
Obesity	22%	17%	4%	0.11
Other Neurological Disorders	14%	13%	1%	0.04
Paralysis	4%	3%	1%	0.05
Peptic Ulcer Disease Excluding Bleeding	4%	3%	2%	0.09
Peripheral Vascular Disorders	28%	26%	2%	0.04
Psychosis	3%	4%	0%	0.02
Pulmonary Circulation Disorders	4%	5%	-2%	0.08
Renal Failure	48%	44%	4%	0.08
Rheumatoid Arthritis Collagen Vascular Disease	7%	4%	3%	0.13
Solid Tumor Without Metastasis	13%	10%	3%	0.10
Valvular Disease	34%	31%	4%	0.08
Weight Loss	6%	7%	-2%	0.06

[+]Denotes characteristic used for matching.

[a]Standardized mean difference is an effect size measure used in the above table to identify substantial differences between the intervention and control groups; a standardized mean difference of 0.1 or greater is treated as an indicator of a substantial difference between the two groups.

Appendix Table E-2: Pharm2Pharm Baseline Demographic and Health Characteristics, MA Cohort

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Number of Beneficiaries	522	522		
Average Age (Years)[+]	73.31	73.35	-0.04	0.00
Age under 65[+]	15%	15%	0%	0.00
Gender				
Male[+]	42%	42%	0%	0.00
Female	58%	58%	0%	0.00
Race				
White[+]	34%	35%	-1%	0.02
Black or Other	66%	65%	1%	0.02
Dual Eligible	37%	34%	3%	0.07
Medicare Eligibility				
Disabled[+]	29%	29%	0%	0.00
ESRD	1%	1%	1%	0.06
Aged[+]	70%	71%	-1%	0.02
Area Deprivation Index (ADI)[+]	100.71	100.59	0.12	0.01
Resource Use per Beneficiary (Pre-Enrollment Year)				
0 IP Stays (1Q Prior)	0%	0%	0%	0.00
1 IP Stay (Prior Year)	76%	80%	-4%	0.10
2+ IP Stays (Prior Year)[+]	24%	20%	4%	0.10
0 IP Stays (Prior Year)	0%	0%	0%	0.00
1 IP Stay (Prior Year)	55%	59%	-4%	0.09
2+ IP Stays (Prior Year)[+]	45%	41%	4%	0.09
Drug History (Pre-Enrollment Year)				
Antidiabetics	30%	31%	0%	0.00
Insulin[+]	33%	34%	-2%	0.03
SSRIs and SNRIs[+]	20%	22%	-2%	0.06
Other Antidepressants[+]	18%	15%	2%	0.07
Statins[+]	77%	79%	-2%	0.05
Thiazide[+]	35%	37%	-2%	0.04
Calcium channel blockers[+]	51%	52%	-1%	0.02
Beta blockers[+]	73%	74%	-1%	0.02
ACE inhibitors[+]	54%	52%	2%	0.04
ARBs[+]	38%	43%	-5%	0.11
Antihypertensives[+]	21%	21%	0%	0.00
Antineoplastics[+]	7%	8%	-1%	0.04
Corticosteroids[+]	48%	50%	-2%	0.04
Cardiotonics[+]	17%	16%	1%	0.03
Antiarrhythmics[+]	11%	11%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
Vasopressors+	1%	1%	0%	0.04
Antiasthmatics	50%	50%	1%	0.01
Antianxiety Agents+	20%	21%	0%	0.00
Antipsychotics+	6%	6%	0%	0.02
Anticoagulants+	32%	31%	1%	0.03
Insulin+	24%	23%	1%	0.03
Nitrates+	30%	29%	0%	0.01
Loop diuretics+	54%	53%	1%	0.02
Potassium sparing diuretics+	10%	9%	1%	0.03
Fibric acid derivatives+	6%	7%	-1%	0.04
Platelet aggregation inhibitors+	29%	29%	1%	0.01
Risk Adjustment Processing System (RAPS) V21 Hierarchical Condition Categories				
HCC1 HIV/AIDS	0%	0%	0%	0.06
HCC2 SEPTICEMIA, SEPSIS, SYSTEMIC INFLAM RESPONSE SYNDROME/SHOCK+	5%	4%	1%	0.03
HCC6 OPPORTUNISTIC INFECTIONS	0%	1%	0%	0.05
HCC8 METASTATIC CANCER AND ACUTE+ LEUKEMIA	0%	0%	0%	0.04
HCC9 LUNG AND OTHER SEVERE CANCERS+	1%	1%	0%	0.04
HCC10 LYMPHOMA AND OTHER CANCERS	1%	1%	0%	0.02
HCC11 COLORECTAL, BLADDER, AND OTHER CANCERS+	1%	1%	0%	0.04
HCC12 BREAST, PROSTATE, AND OTHER CANCERS AND TUMORS+	3%	2%	1%	0.05
HCC17 DIABETES WITH ACUTE COMPLICATIONS+	2%	1%	0%	0.03
HCC18 DIABETES WITH CHRONIC COMPLICATIONS+	30%	31%	0%	0.00
HCC19 DIABETES WITHOUT COMPLICATION+	24%	24%	0%	0.00
HCC21 PROTEIN-CALORIE MALNUTRITION+	0%	0%	0%	0.04
HCC22 MORBID OBESITY+	7%	9%	-2%	0.06
HCC23 OTHER SIGNIFICANT ENDOCRINE AND METABOLIC DISORDERS	5%	5%	0%	0.01
HCC27 END-STAGE LIVER DISEASE	1%	0%	1%	0.08
HCC28 CIRRHOSIS OF LIVER	1%	1%	0%	0.00
HCC29 CHRONIC HEPATITIS+	1%	1%	0%	0.00
HCC33 INTESTINAL OBSTRUCTION/PERFORATION	2%	2%	0%	0.02
HCC34 CHRONIC PANCREATITIS	1%	0%	0%	0.03
HCC35 INFLAMMATORY BOWEL DISEASE	1%	1%	0%	0.00

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
HCC39 BONE/JOINT/MUSCLE INFECTIONS/NECROSIS	1%	2%	-1%	0.05
HCC40 RHEUMATOID ARTHRITIS AND INFLAM CONNECTIVE TISSUE DISEASE	6%	9%	-3%	0.10
HCC46 SEVERE HEMATOLOGICAL DISORDERS	1%	1%	0%	0.02
HCC47 DISORDERS OF IMMUNITY	2%	1%	1%	0.08
HCC48 COAGULATION DEFECTS & OTH SPECIFIED HEMATOLOGICAL DISORDRS+	5%	6%	0%	0.02
HCC51 DEMENTIA WITH COMPLICATIONS+	0%	0%	0%	0.06
HCC52 DEMENTIA WITHOUT COMPLICATION+	3%	2%	1%	0.09
HCC54 DRUG/ALCOHOL PSYCHOSIS	1%	0%	0%	0.03
HCC55 DRUG/ALCOHOL DEPENDENCE	2%	2%	0%	0.00
HCC57 SCHIZOPHRENIA	2%	1%	1%	0.05
HCC58 MAJOR DEPRESSIVE, BIPOLAR, AND PARANOID DISORDERS+	5%	4%	0%	0.02
HCC70 QUADRIPLEGIA	0%	0%	0%	0.09
HCC71 PARAPLEGIA	0%	0%	0%	0.04
HCC72 SPINAL CORD DISORDERS/INJURIES	0%	1%	0%	0.03
HCC73 AMYOTROPHIC LATERAL SCLEROSIS & OTH MOTOR NEURON DISEASE	0%	0%	0%	0.06
HCC74 CEREBRAL PALSY	0%	0%	0%	0.00
HCC75 POLYNEUROPATHY	11%	15%	-4%	0.12
HCC76 MUSCULAR DYSTROPHY	0%	0%	0%	0.00
HCC77 MULTIPLE SCLEROSIS+	0%	1%	0%	0.03
HCC78 PARKINSONS AND HUNTINGTONS DISEASES+	1%	0%	0%	0.05
HCC79 SEIZURE DISORDERS AND CONVULSIONS+	3%	4%	-1%	0.05
HCC80 COMA, BRAIN COMPRESSION/ANOXIC DAMAGE	0%	0%	0%	0.00
HCC82 RESPIRATOR DEPENDENCE/TRACHEOSTOMY STATUS	0%	0%	0%	0.04
HCC83 RESPIRATORY ARREST	0%	0%	0%	0.06
HCC84 CARDIO-RESPIRATORY FAILURE AND SHOCK+	6%	6%	0%	0.01
HCC85 CONGESTIVE HEART FAILURE+	36%	36%	0%	0.00
HCC86 ACUTE MYOCARDIAL INFARCTION	6%	5%	0%	0.02
HCC87 UNSTABLE ANGINA & OTH ACUTE ISCHEMIC HEART DISEASE+	4%	4%	0%	0.01
HCC88 ANGINA PECTORIS+	5%	5%	0%	0.00
HCC96 SPECIFIED HEART ARRHYTHMIAS+	30%	29%	1%	0.03

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
HCC99 CEREBRAL HEMORRHAGE+	1%	1%	0%	0.02
HCC100 ISCHEMIC OR UNSPECIFIED STROKE	7%	6%	1%	0.02
HCC103 HEMIPLEGIA/HEMIPARESIS	4%	3%	0%	0.02
HCC104 MONOPLEGIA, OTHER PARALYTIC SYNDROMES	0%	0%	0%	0.00
HCC106 ATHEROSCLEROSIS OF EXTREMITIES W/ULCERATION OR GANGRENE	1%	1%	0%	0.00
HCC107 VASCULAR DISEASE WITH COMPLICATIONS	3%	3%	0%	0.01
HCC108 VASCULAR DISEASE	17%	22%	-5%	0.12
HCC110 CYSTIC FIBROSIS	0%	0%	0%	0.00
HCC111 CHRONIC OBSTRUCTIVE PULMONARY DISEASE+	26%	24%	2%	0.04
HCC112 FIBROSIS OF LUNG AND OTHER CHRONIC LUNG DISORDERS	2%	1%	0%	0.03
HCC114 ASPIRATION AND SPECIFIED BACTERIAL PNEUMONIAS+	2%	3%	-1%	0.05
HCC115 PNEUMOCOCCAL PNEUMONIA, EMPYEMA, LUNG ABSCESS	1%	1%	0%	0.02
HCC122 PROLIFERATIVE DIABTIC RETINOPATHY & VITREOUS HEMORR	3%	2%	1%	0.05
HCC124 EXUDATIVE MACULAR DEGENERATION	2%	1%	0%	0.03
HCC134 DIALYSIS STATUS+	4%	3%	0%	0.01
HCC135 ACUTE RENAL FAILURE+	9%	7%	2%	0.09
HCC136 CHRONIC KIDNEY DISEASE, STAGE 5+	2%	0%	2%	0.14
HCC137 CHRONIC KIDNEY DISEASE, SEVERE (STAGE 4)+	3%	3%	0%	0.00
HCC138 CHRONIC KIDNEY DISEASE, MODERATE (STAGE 3)+	12%	13%	-1%	0.03
HCC139 CHRONIC KIDNEY DIS, MILD OR UNSPEC (STG 1-2 OR UNSPEC)	7%	6%	1%	0.05
HCC140 UNSPECIFIED RENAL FAILURE	1%	0%	1%	0.12
HCC141 NEPHRITIS	0%	1%	-1%	0.10
HCC157 PRESS ULCER OF SKN W/NECROSIS THR TO MUSCLE,TENDON, BONE	0%	0%	0%	0.00
HCC158 PRESSURE ULCER OF SKIN WITH FULL THICKNESS SKIN LOSS	0%	0%	0%	0.00
HCC159 PRESSURE ULCER OF SKIN WITH PARTIAL THICKNESS SKIN LOSS	0%	0%	0%	0.06
HCC160 PRESSURE PRE-ULCER SKIN CHANGES OR UNSPECIFIED STAGE	0%	0%	0%	0.04

Characteristics	Intervention Group	Control Group	Percent Difference	Standardized Mean Difference[a]
HCC161 CHRONIC ULCER OF SKIN, EXCEPT PRESSURE	3%	7%	-4%	0.17
HCC162 SEVERE SKIN BURN OR CONDITION	0%	0%	0%	0.06
HCC166 SEVERE HEAD INJURY	0%	0%	0%	0.06
HCC167 MAJOR HEAD INJURY	1%	1%	0%	0.04
HCC169 VERTEBRAL FRACTURES WITHOUT SPINAL CORD INJURY	2%	2%	0%	0.00
HCC170 HIP FRACTURE/DISLOCATION	1%	1%	0%	0.04
HCC173 TRAUMATIC AMPUTATIONS AND COMPLICATIONS	1%	1%	0%	0.02
HCC176 COMPLICATIONS OF SPECIFIED IMPLANTED DEVICE OR GRAFT	3%	3%	0%	0.02
HCC186 MAJOR ORGAN TRANSPLANT OR REPLACEMENT STATUS	0%	0%	0%	0.04
HCC188 ARTIFICIAL OPENINGS FOR FEEDING OR ELIMINATION	1%	0%	1%	0.12
HCC189 AMPUTATION STATUS, LOWER LIMB/AMPUTATION COMPLICATIONS	2%	2%	0%	0.00

[+]Denotes characteristic used for matching.

[a]Standardized mean difference is an effect size measure used in the above table to identify substantial differences between the intervention and control groups; a standardized mean difference of 0.1 or greater is treated as an indicator of a substantial difference between the two groups.

E.2 Mortality and Readmissions

Appendix Table E-3: Cumulative and Yearly Mortality and Readmissions per 1,000 Beneficiaries, Differences after Pharm2Pharm Enrollment, Medicare FFS and MA Cohorts

Measures	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participants	833	833	484
Mortality			
Difference[c]	1.52	-16.17	38.04
90% Confidence Interval	(-59.2 | 62.3)	(-55.6 | 23.2)	(-5.9 | 81.9)
P-Value	0.967	0.500	0.154
30-Day Hospital Readmissions Following All Inpatient Admissions			
Difference	100.71	15.06	153.38
90% Confidence Interval	(-234.2 | 435.6)	(-184.6 | 214.8)	(-148.1 | 454.9)
P-Value	0.621	0.901	0.403
30-Day Hospital Unplanned Readmissions Following All Inpatient Admission			
Difference	124.51	29.36	158.28
90% Confidence Interval	(-205.8 | 454.9)	(-168.2 | 226.9)	(-136.0 | 452.5)
P-Value	0.535	0.807	0.376

[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.
[c]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries or the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Table E-4: Quarterly Difference in Mortality per 1,000 Beneficiaries after Pharm2Pharm Enrollment, Medicare FFS and MA Cohorts

Measures	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Number of Participant Beneficiaries	833	786	710	603	484	371	285	192
Difference[a]	-49.22***	10.09	18.75*	13.09	13.47	12.76	-7.25	18.14
90% Confidence Interval	(-71.1 | -27.3)	(-8.8 | 28.9)	(1.6 | 35.9)	(-6.1 | 32.3)	(-7.2 | 34.1)	(-6.3 | 31.8)	(-24.8 | 10.3)	(-14.5 | 50.8)
P-Value	<0.001	0.379	0.072	0.261	0.283	0.270	0.497	0.360

* Statistically significant at the ten percent level.

*** Statistically significant at the one percent level.

[a]The "difference" estimate represents the difference in the number of deaths per 1,000 beneficiaries between the intervention group and control group in the relevant quarter of the intervention period. There were no deaths in the intervention or control groups prior to program enrollment as beneficiaries were required to be alive on program start date to be included in the study.

Appendix Table E-5: Quarterly Difference in Readmissions per 1,000 IP Admissions after Pharm2Pharm Enrollment, Medicare FFS and MA Cohorts

Measures	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Number of Participant Beneficiaries	833	786	710	603	484	371	285	192
30-Day Hospital Readmissions per 1,000 Beneficiaries Following all Inpatient Admissions	225	147	140	101	79	55	47	29
Difference[a]	40.00	31.70	-98.05	23.51	40.51	-25.55	31.49	164.75
90% Confidence Interval	(-36.1 | 116.1)	(-81.2 | 144.6)	(-212.7 | 16.6)	(-80.3 | 127.4)	(-96.0 | 177.0)	(-159.5 | 108.4)	(-121.7 | 184.6)	(-18.2 | 347.7)
P-Value	0.387	0.644	0.160	0.710	0.625	0.754	0.735	0.139
30-Day Hospital Unplanned Readmissions per 1,000 Beneficiaries Following any Inpatient Admission	225	147	140	101	79	55	47	29
Difference	42.96	24.90	-98.05	48.51	69.08	-43.73	31.49	130.27
90% Confidence Interval	(-32.4 | 118.3)	(-87.7 | 137.5)	(-212.7 | 16.6)	(-48.8 | 145.8)	(-62.2 | 200.4)	(-175.4 | 87.9)	(-121.7 | 184.6)	(-48.4 | 309.0)
P-Value	0.348	0.716	0.160	0.412	0.387	0.585	0.735	0.230

[a] The "difference" estimate represents the difference in the number of beneficiaries with at least one readmission for every 1,000 beneficiaries who have at least one inpatient admission, as compared between the intervention and control groups during the relevant quarter in the intervention period.

Appendix Table E-6: Quarterly Mortality and Readmissions per 1,000 Beneficiaries for Participants and Controls, Pharm2Pharm Medicare FFS and MA Cohorts, Q1 to Q4

Measures	Q1		Q2		Q3		Q4	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	833	833	786	650	710	532	603	433
All-Cause Mortality per 1,000 Beneficiaries	56.4	105.6	54.7	44.6	45.1	26.3	43.1	30.0
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	262.2	222.2	251.7	220.0	192.9	290.9	148.5	125.0
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	257.8	214.8	244.9	220.0	192.9	290.9	148.5	100

Appendix Table E-7: Quarterly Mortality and Readmissions per 1,000 Beneficiaries for Participants and Controls, Pharm2Pharm Medicare FFS and MA Cohorts, Q5 to Q8

Measures	Q5		Q6		Q7		Q8	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Number of Beneficiaries	484	359	371	296	285	225	192	174
All-Cause Mortality per 1,000 Beneficiaries	41.3	27.9	29.6	16.9	10.5	17.8	46.9	28.7
30-Day Hospital Readmission per 1,000 Beneficiaries Following any Inpatient Admissions	240.5	200.0	163.6	189.2	191.5	160.0	275.9	111.1
30-day Hospital Unplanned Readmission per 1,000 Beneficiaries, Following any Inpatient Admission	240.5	171.4	145.5	189.2	191.5	160	241.4	111.1

E.3 Health Service Resource Use

Appendix Table E-8: Cumulative and Yearly DiD Estimates of Resource Use per 1,000 Beneficiaries, Pharm2Pharm Medicare FFS and MA Cohorts

Measures (Number of Events or Days)	Full Intervention Period[a]	Total Year 1[b]	Total Year 2
Number of Participant Beneficiaries	833	833	484
Inpatient Admissions	700.17***	437.59***	157.47*
90% Confidence Interval	(465.5 | 934.9)	(303.9 | 571.3)	(1.4 | 313.6)
P-Value	<0.001	<0.001	0.097
Unplanned Inpatient Admissions	459.83***	308.52***	56.88
90% Confidence Interval	(232.1 | 687.6)	(179.5 | 437.6)	(-95.7 | 209.5)
P-Value	<0.001	<0.001	0.540
Hospital Days	5,720.54***	3,274.19***	1,949.16*
90% Confidence Interval	(3,173.1 | 8,268.0)	(1,872.9 | 4,675.5)	(60.8 | 3,837.5)
P-Value	<0.001	<0.001	0.090

* Statistically significant at the ten percent level.
*** Statistically significant at the one percent level.
[a]Results are cumulative across all available quarters.
[b]Year 1 refers to the one-year period after a beneficiary's enrollment in the program, Year 2 refers to the subsequent one-year periods for a given beneficiary. Since beneficiaries enroll in the MM programs on a rolling basis, the intervention period is defined at the beneficiary-level and not based on calendar quarters or years.

Appendix Table E-9: Quarterly DiD Estimates of Resource Use (Number of Events or Days Per 1,000 Beneficiaries), Pharm2Pharm Medicare FFS and MA Cohorts

Measures (Number of Events or Days per 1,000 Beneficiaries)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Number of Participant Beneficiaries	833	786	710	603	484	371	285	192
Inpatient Admissions	132.35***	136.06***	98.26***	59.61	70.75*	34.20	74.68	111.98*
90% Confidence Interval	(73,192)	(79,193)	(40,156)	(-1,120)	(7,135)	(-38,107)	(-3,152)	(13,211)
P-Value	<0.001	<0.001	0.005	0.103	0.069	0.437	0.114	0.063
Unplanned Inpatient Admissions	90.34***	100.65***	65.47*	26.45	36.42	-2.84	42.05	68.83
90% Confidence Interval	(32,148)	(47,155)	(9,122)	(-32,84)	(-27,100)	(-73,68)	(-34,118)	(-28,166)
P-Value	0.010	0.002	0.057	0.453	0.344	0.947	0.365	0.244
Hospital Days	814.83**	912.45**	658.48**	544.72*	225.31	223.19	383.98	653.69
90% Confidence Interval	(269,1361)	(177,1648)	(113,1204)	(65,1025)	(-371,822)	(-768,1214)	(-742,1510)	(-257,1564)
P-Value	0.014	0.041	0.047	0.062	0.534	0.711	0.575	0.238

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.

Appendix Table E-10: Quarterly Resource Use Rate (Number of Beneficiaries with Event per 1,000 Beneficiaries) for Participants and Controls, Pharm2Pharm Medicare FFS and MA Cohorts, Q1 to Q4

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	833	833	833	833	786	650	710	532	603	433
Health Service Use Rate per 1,000 Beneficiaries										
All Inpatient Admissions	1,000.0	1,000.0	286.9	178.9	198.5	89.2	209.9	110.9	175.8	103.9
Unplanned Inpatient Admissions	983.2	917.2	264.1	175.3	189.6	80.0	201.4	105.3	172.5	97.0

Appendix Table E-11: Quarterly Resource Use Rate (Number of Beneficiaries with Event per 1,000 Beneficiaries) for Participants and Controls, Pharm2Pharm Medicare FFS and MA Cohorts, Q5 to Q8

Measures	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	484	359	371	296	285	225	192	174
Health Service Use Rate per 1,000 Beneficiaries								
All Inpatient Admissions	169.4	111.4	167.1	128.4	164.9	120.0	156.2	109.2
Unplanned Inpatient Admissions	163.2	105.8	161.7	125.0	157.9	115.6	156.2	109.2

Appendix Table E-12: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, Pharm2Pharm Medicare FFS and MA Cohorts, Q1 to Q4

Measures	Baseline Period (Year Prior to Enrollment)		Q1		Q2		Q3		Q4	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	833	833	833	833	786	650	710	532	603	433
Mean Number of Events per 1,000 Beneficiaries										
All Inpatient Admissions	1,854.7	1,726.3	402.2	237.7	293.9	124.6	278.9	150.4	220.6	131.6
Unplanned Inpatient Admissions	1,759.9	1,530.6	374.5	226.9	273.5	112.3	266.2	141.0	212.3	120.1
Hospital Days	10,595.4	10,608.6	2,612.2	1,800.7	2,141.2	1,118.5	1,767.6	1,054.5	1,393.0	722.9

Appendix Table E-13: Quarterly Resource Use (Number of Events per 1,000 Beneficiaries) for Participants and Controls, Pharm2Pharm Medicare FFS and MA Cohorts, Q5 to Q8

Measures	Q5		Q6		Q7		Q8	
	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls	Intervent.	Controls
Number of Beneficiaries	484	359	371	296	285	225	192	174
Mean Number of Events per 1,000 Beneficiaries								
All Inpatient Admissions	229.3	133.7	202.2	162.2	203.5	142.2	218.8	132.2
Unplanned Inpatient Admissions	223.1	125.3	194.1	155.4	196.5	133.3	213.5	132.2
Hospital Days	1,398.8	941.5	1,517.5	1,023.6	1,663.2	1,182.2	1,588.5	1,051.7

E.4 Medication Adherence

Appendix Table E-14: Average Proportion of Days Covered (PDC) by Medication Type

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)		Baseline Period (for 2nd Year Post Enrollment)		Intervention Period (2nd Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Beta Blockers								
Number of Eligible Beneficiaries	300	202	300	202	89	78	89	78
Mean	82.89	83.84	82.24	82.74	81.76	82.24	83.08	82.01
Median	90.67	93.41	90.21	92.95	89.05	93.36	91.15	92.25
25th percentile	72.44	75.00	71.96	68.23	71.64	65.69	71.22	66.48
75th percentile	98.00	98.68	97.59	98.31	97.18	98.35	97.23	98.23
90th percentile	100.00	100.00	100.00	100.00	99.72	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calcium Channel Blockers								
Number of Eligible Beneficiaries	174	96	174	96	58	39	58	39
Mean	84.73	87.29	80.41	84.85	86.28	88.61	83.22	89.57
Median	93.46	94.26	89.52	92.36	95.45	96.47	90.46	94.75
25th percentile	78.26	83.45	71.35	80.19	84.69	84.08	75.97	86.73
75th percentile	98.55	99.01	97.21	99.20	99.40	99.71	98.62	98.85
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Diabetes Medication								
Number of Eligible Beneficiaries	102	82	102	82	37	35	37	35
Mean	86.74	86.55	86.59	85.70	90.93	83.13	90.13	85.98
Median	94.11	96.07	94.74	94.29	97.27	96.00	98.06	93.04
25th percentile	79.86	88.17	81.08	80.08	89.29	82.11	81.67	78.67
75th percentile	99.39	100.00	100.00	99.72	99.72	99.71	100.00	100.00
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
RAS Antagonists								
Number of Eligible Beneficiaries	290	203	290	203	85	87	85	87
Mean	84.78	86.80	83.18	85.57	84.99	88.02	83.09	88.31
Median	93.58	93.68	91.21	94.35	93.77	94.10	93.22	96.17
25th percentile	78.37	83.19	76.60	81.19	80.12	83.53	73.43	85.43
75th percentile	98.34	98.34	98.27	99.19	98.03	99.03	99.34	99.15
90th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Statins								
Number of Eligible Beneficiaries	347	244	347	244	111	91	111	91

Measures	Baseline Period (Year Prior to Enrollment)		Intervention Period (1st Year Post Enrollment)		Baseline Period (for 2nd Year Post Enrollment)		Intervention Period (2nd Year Post Enrollment)	
	Intervention	Controls	Intervention	Controls	Intervention	Controls	Intervention	Controls
Mean	84.12	83.45	84.37	83.27	84.52	83.44	82.79	86.12
Median	91.57	91.88	91.01	90.91	91.86	92.86	91.62	94.99
25th percentile	76.99	73.50	76.92	74.30	76.06	72.43	75.21	81.08
75th percentile	97.20	98.43	97.73	97.47	97.40	99.17	97.41	99.65
90th percentile	99.71	100.00	100.00	100.00	99.41	100.00	100.00	100.00
99th percentile	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

APPENDIX F: META-EVALUATION MEASURES

F.1 Quarterly Baseline and Intervention Period Trends

Appendix Table F-1: Baseline and Intervention Meta-Evaluation Measure Trends: Total Medical Expenditures per Patient

Description	Baseline Period (Year Prior to Enrollment)				Intervention Period							
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Intervention Group												
IHARP FFS (1C1CMS331010)												
Spending Rate[a]	$3,902	$4,330	$4,781	$10,585	$8,999	$6,514	$6,481	$5,835	$5,452	$5,681	$6,005	$5,571
Standard Deviation	$6,657	$8,270	$8,541	$12,764	$13,473	$11,663	$15,592	$11,429	$9,254	$8,715	$10,195	$8,061
Unique Patients	699	699	699	699	699	683	659	644	587	502	387	275
PSW WI DHS (1C1CMS331073)												
Spending Rate[a]	$1,767	$1,777	$1,812	$2,209	$2,123	$2,052	$2,099	$2,168	$2,042	$2,035		
Standard Deviation	$7,643	$5,729	$5,668	$6,444	$9,518	$6,028	$7,935	$10,634	$6,189	$6,905		
Unique Patients	38,381	38,381	38,381	38,381	38,381	36,565	34,518	32,740	31,393	29,948		
Control Group												
IHARP FFS (1C1CMS331010)												
Spending Rate	$3,673	$3,803	$4,309	$9,861	$7,983	$5,611	$4,964	$5,228	$5,084	$5,195	$5,892	$4,150
Standard Deviation	$5,754	$6,939	$7,539	$11,191	$17,114	$11,710	$8,067	$11,250	$9,105	$8,436	$13,187	$6,883
Unique Patients	699	699	699	699	699	624	592	564	502	407	309	229
PSW WI DHS (1C1CMS331073)												
Spending Rate[a]	$1,706	$1,674	$1,764	$2,027	$1,969	$1,910	$1,984	$2,025	$1,978	$1,920		
Standard Deviation	$5,645	$5,158	$6,861	$5,958	$6,531	$6,394	$5,907	$6,718	$7,002	$7,377		
Unique Patients	38,381	38,381	38,381	38,381	38,381	36,440	34,353	32,654	31,278	29,733		

Note: Measures with 10 or fewer beneficiaries in the numerator are suppressed.
[a]Spending Rate: Total payments/Number of unique patients.

Appendix Table F-2: Baseline & Intervention Meta-Evaluation Measure Trends: Inpatient Admissions per 1,000 Beneficiaries

Description	Baseline Period (Year Prior to Enrollment)				Intervention Period								
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Intervention Group													
IHARP FFS (1C1CMS331010)													
Admit Rate[a]	123.0	143.1	150.2	595.1	248.9	188.9	162.4	149.1	163.5	189.2	160.2	170.9	
Standard Deviation	12.4	13.2	13.5	18.6	16.4	15.0	14.4	14.0	15.3	17.5	18.6	22.7	
Unique Patients	699	699	699	699	699	683	659	644	587	502	387	275	
PSW WI DHS (1C1CMS331073)													
Admit Rate	38.0	38.2	38.4	51.1	43.4	40.6	39.2	38.1	37.2	35.3			
Standard Deviation	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.1	1.1			
Unique Patients	38,381	38,381	38,381	38,381	38,381	36,565	34,518	32,740	31,393	29,948			
Pharm2Pharm FFS & MA (1C1CMS331061)													
Admit Rate	123.6	134.5	160.9	1000.0	286.9	198.5	209.9	175.8	169.4	167.1	164.9	156.2	
Standard Deviation	11.4	11.8	12.7	0.0	15.7	14.2	15.3	15.5	17.1	19.4	22.0	26.2	
Unique Patients	833	833	833	833	833	786	710	603	484	371	285	192	
USC FFS & MA (1C1CMS331040)													
Admit Rate	62.3	43.4	46.1	92.1	59.6	60.4	72.5	63.6	80.5	74.5	64.3	70.1	113.4
Standard Deviation	8.9	7.5	7.7	10.6	8.7	8.8	9.8	9.5	11.0	11.2	11.6	14.4	22.8
Unique Patients	738	738	738	738	738	729	703	660	609	550	451	314	194
Control Group													
IHARP FFS (1C1CMS331010)													
Admit Rate	111.6	100.1	103.0	595.1	135.9	118.6	113.2	104.6	129.5	145.0	132.7	78.6	
Standard Deviation	11.9	11.4	11.5	18.6	13.0	12.9	13.0	12.9	15.0	17.5	19.3	17.8	
Unique Patients	699	699	699	699	699	624	592	564	502	407	309	229	

Description	Baseline Period (Year Prior to Enrollment)				Intervention Period								
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
PSW WI DHS (1C1CMS331073)													
Admit Rate	39.4	36.1	34.9	46.6	40.4	36.7	36.2	35.2	34.9	33.4			
Standard Deviation	1.0	1.0	0.9	1.1	1.0	1.0	1.0	1.0	1.0	1.0			
Unique Patients	38,381	38,381	38,381	38,381	38,381	36,440	34,353	32,654	31,278	29,733			
Pharm2Pharm FFS & MA (1C1CMS331061)													
Admit Rate	116.4	110.4	135.7	1000.0	178.9	89.2	110.9	103.9	111.4	128.4	120.0	109.2	
Standard Deviation	11.1	10.9	11.9	0.0	13.3	11.2	13.6	14.7	16.6	19.4	21.7	23.6	
Unique Patients	833	833	833	833	833	650	532	433	359	296	225	174	
USC FFS & MA (1C1CMS331040)													
Admit Rate	50.1	47.4	46.1	81.3	55.6	56.0	48.8	59.7	65.6	70.0	39.5	49.9	35.4
Standard Deviation	8.0	7.8	7.7	10.1	8.4	8.5	8.2	9.4	10.3	11.3	9.4	11.8	12.3
Unique Patients	738	738	738	738	738	732	697	637	579	514	430	341	226

Note: Measures with 10 or fewer beneficiaries in the numerator are suppressed.

[a]Admit Rate: (Total admissions/Number of unique patients)*1,000.

Appendix Table F-3: Baseline & Intervention Meta-Evaluation Measure Trends: 30-Day Hospital Readmissions per 1,000 Admissions

Description	Baseline Period (Year Prior to Enrollment)				Intervention Period								
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Intervention Group													
IHARP FFS (1C1CMS331010)													
Readmit Rate[a]	211.8	191.9	225.5	223.0	230.8	235.8	206.2	284.1	215.1	223.4	263.2	177.8	
Standard Deviation	44.3	39.6	41.4	20.6	32.4	38.3	41.1	48.1	42.6	43.0	58.3	57.0	
Unique Patients	85	99	102	408	169	123	97	88	93	94	57	45	
PSW WI DHS (1C1CMS331073)													
Readmit Rate[a]	141.5	127.2	141.3	158.0	168.1	133.2	146.9	165.3	149.6	147.4			
Standard Deviation	9.2	8.7	9.1	8.3	9.2	8.9	9.7	10.6	10.5	11.0			
Unique Patients	1,449	1,454	1,465	1,943	1,642	1,456	1,334	1,228	1,150	1,038			
Pharm2Pharm FFS & MA (1C1CMS331061)													
Readmit Rate	178.2	187.5	150.4	249.7	262.2	251.7	192.9	148.5	240.5	163.6	191.5	275.9	
Standard Deviation	38.1	36.9	31.0	15.0	29.3	35.8	33.3	35.4	48.1	49.9	57.4	83.0	
Unique Patients	101	112	133	829	225	147	140	101	79	55	47	29	
USC FFS & MA (1C1CMS331040)													
Readmit Rate	108.7	250.0	117.6	134.3	136.4	113.6	183.7	250.0	159.1	230.8	285.7	105.3	190.5
Standard Deviation	45.9	76.5	55.3	41.7	51.7	47.8	55.3	68.5	55.1	67.5	85.4	70.4	85.7
Unique Patients	46	32	34	67	44	44	49	40	44	39	28	19	21
Control Group													
IHARP FFS (1C1CMS331010)													
Readmit Rate	128.2	142.9	180.6	217.8	325.6	271.4	179.1	206.9	153.8	254.2	243.9	0.0	
Standard Deviation	37.9	41.8	45.3	20.5	50.5	53.2	46.8	53.2	44.8	56.7	67.1	0.0	

Description	Baseline Period (Year Prior to Enrollment)				Intervention Period								
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Unique Patients	78	70	72	404	86	70	67	58	65	59	41	17	
PSW WI DHS (1C1CMS331073)													
Readmit Rate	141.1	135.9	148.3	144.6	148.2	122.4	145.2	142.2	136.4	145.2			
Standard Deviation	9.0	9.2	9.8	8.3	9.1	9.1	10.1	10.4	10.5	11.3			
Unique Patients	1,495	1,376	1,328	1,777	1,532	1,307	1,226	1,132	1,078	971			
Pharm2Pharm FFS & MA (1C1CMS331061)													
Readmit Rate	92.8	230.8	221.2	188.7	222.2	220.0	290.9	125.0	200.0	189.2	160.0	111.1	
Standard Deviation	29.5	44.2	39.0	13.6	35.8	58.6	61.2	52.3	67.6	64.4	73.3	74.1	
Unique Patients	97	91	113	832	135	50	55	40	35	37	25	18	
USC FFS & MA (1C1CMS331040)													
Readmit Rate	162.2	235.3	117.6	140.4	225.0	175.0	322.6	176.5	138.9	114.3	235.3	117.6	250.0
Standard Deviation	60.6	72.7	55.3	46.0	66.0	60.1	84.0	65.4	57.6	53.8	102.9	78.1	153.1
Unique Patients	37	34	34	57	40	40	31	34	36	35	17	17	8

Note: Measures with 10 or fewer beneficiaries in the numerator are suppressed.

[a]Readmit Rate: (Total admissions/Number of unique patients with an IP admission)*1,000.

Appendix Table F-4: Baseline & Intervention Meta-Evaluation Measure Trends: ER Visits per 1,000 Beneficiaries

Description	Baseline Period (Year Prior to Enrollment)				Intervention Period							
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Intervention Group												
IHARP FFS (1C1CMS331010)												
ER Rate[a]	157.4	155.9	160.2	341.9	211.7	194.7	188.2	212.7	197.6	191.2	209.3	225.5
Standard Deviation	13.8	13.7	13.9	17.9	15.5	15.2	15.2	16.1	16.4	17.6	20.7	25.2
Unique Patients	699	699	699	699	699	683	659	644	587	502	387	275
Control Group												
IHARP FFS (1C1CMS331010)												
ER Rate	154.5	154.5	158.8	301.9	176.0	190.7	162.2	166.7	167.3	169.5	213.6	209.6
Standard Deviation	13.7	13.7	13.8	17.4	14.4	15.7	15.1	15.7	16.7	18.6	23.3	26.9
Unique Patients	699	699	699	699	699	624	592	564	502	407	309	229

Note: Measures with 10 or fewer beneficiaries in the numerator are suppressed.

[a]ER Visit Rate: (Total ER visits and observation stays/Number of unique patients)*1,000.

F.2 Difference-in-Difference Estimates

F.2.1 Quarterly Results

Appendix Table F-5: DiD Meta-Evaluation Measure Estimates: Effects on Total Medical Expenditures

Description	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Intervention Group								
IHARP FFS (1C1CMS331010)	528.11	191.26	974.17	117.79	-73.35	39.48	-230.92	871.56
90% Confidence Interval	(-922,1979)	(-994,1377)	(-281,2229)	(-1082,1317)	(-1148,1001)	(-1072,1151)	(-1889,1427)	(-497,2240)
P-Value	0.549	0.791	0.202	0.872	0.911	0.953	0.819	0.295
PSW WI DHS (1C1CMS331073)	55.86	37.19	10.55	37.99	-37.45	9.10		
90% Confidence Interval	(-56,168)	(-58,133)	(-96,117)	(-93,169)	(-146,71)	(-109,127)		
P-Value	0.411	0.521	0.871	0.633	0.572	0.899		

Appendix Table F-6: DiD Meta-Evaluation Measure Estimates: Inpatient Admissions per 1,000 Beneficiaries

Description	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Intervention Group									
IHARP FFS (1C1CMS331010)	104.43**	27.15	41.20	33.72	3.72	1.18	6.00	34.13	
90% Confidence Interval	(35,174)	(-35,89)	(-20,102)	(-29,96)	(-58,66)	(-70,72)	(-79,91)	(-51,119)	
P-Value	0.013	0.469	0.265	0.374	0.921	0.978	0.908	0.511	
PSW WI DHS (1C1CMS331073)	1.78	1.58	1.50	2.37	0.60	-0.01			
90% Confidence Interval	(-3,6)	(-3,6)	(-3,6)	(-2,7)	(-4,5)	(-5,5)			
P-Value	0.531	0.566	0.600	0.413	0.834	0.997			
Pharm2Pharm FFS & MA (1C1CMS331061)	132.35***	136.06***	98.26***	59.61	70.75*	34.20	74.68	111.98*	
90% Confidence Interval	(73,192)	(79,193)	(40,156)	(-1,120)	(7,135)	(-38,107)	(-3,152)	(13,211)	
P-Value	<0.001	<0.001	0.005	0.103	0.069	0.437	0.114	0.063	

Description	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
USC FFS & MA (1C1CMS331040)	-0.99	-1.01	9.01	4.52	4.46	-4.55	11.87	9.79	115.65***
90% Confidence Interval	(-33,31)	(-32,30)	(-26,44)	(-35,44)	(-33,42)	(-43,34)	(-34,58)	(-39,59)	(44,188)
P-Value	0.959	0.958	0.673	0.849	0.844	0.845	0.672	0.742	0.008

* Statistically significant at the ten percent level.
** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.

Appendix Table F-7: DiD Meta-Evaluation Measure Estimates: 30-Day Hospital Readmissions per 1,000 Admissions

Description	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Intervention Group									
IHARP FFS (1C1CMS331010)	-94.81	-35.66	27.08	77.19	61.21	-30.83	19.26	177.78***	
90% Confidence Interval	(-193.6 | 3.9)	(-143.4 | 72.1)	(-75.4 | 129.6)	(-40.7 | 195.1)	(-40.4 | 162.8)	(-147.8 | 86.2)	(-126.9 | 165.5)	(84.0 | 271.5)	
P-Value	0.114	0.586	0.664	0.282	0.322	0.665	0.828	0.002	
PSW WI DHS (1C1CMS331073)	19.92	10.82	1.74	23.08	13.20	2.19			
90% Confidence Interval	(-1.4 | 41.2)	(-10.1 | 31.7)	(-21.2 | 24.7)	(-1.3 | 47.5)	(-11.2 | 37.6)	(-23.8 | 28.1)			
P-Value	0.124	0.394	0.901	0.120	0.373	0.890			
Pharm2Pharm FFA & MA (1C1CMS331061)	40.00	31.70	-98.05	23.51	40.51	-25.55	31.49	164.75	
90% Confidence Interval	(-36.1 | 116.1)	(-81.2 | 144.6)	(-212.7 | 16.6)	(-80.3 | 127.4)	(-96.0 | 177.0)	(-159.5 | 108.4)	(-121.7 | 184.6)	(-18.2 | 347.7)	
P-Value	0.387	0.644	0.160	0.710	0.625	0.754	0.735	0.139	
USC FFS & MA (1C1CMS331040)	-145.66*	-40.21	-114.58	-29.87	-27.55	151.07**	49.34	57.14	200.00**
90% Confidence Interval	(-275.3 | -16.1)	(-163.6 | 83.2)	(-272.4 | 43.3)	(-189.8 | 130.0)	(-148.2 | 93.1)	(28.4 | 273.8)	(-146.6 | 245.3)	(-136.3 | 250.6)	(68.4 | 331.6)
P-Value	0.065	0.592	0.233	0.759	0.707	0.043	0.679	0.627	0.012

** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.

Appendix Table F-8: DiD Meta-Evaluation Measure Estimates: ER Visits per 1,000 Beneficiaries

Description	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Intervention Group								
IHARP FFS (1C1CMS331010)	17.53	-6.74	69.91	85.36	78.03	35.28	-6.80	-44.90
90% Confidence Interval	(-71,106)	(-93,79)	(-33,173)	(-1,172)	(-20,176)	(-80,150)	(-124,110)	(-180,90)
P-Value	0.745	0.898	0.266	0.106	0.188	0.613	0.924	0.584

F.2.2 Cumulative Results

Appendix Table F-9: Meta-Measures: Summative Effect Sizes

ID	Awardee	Measure	Effect Size	90% Confidence Interval	Number of Baseline Quarters	Number of Intervention Quarters	Unique Intervention Group Benes	Unique Comparison Group Benes	Estimation Method[a]	Calendar or Program Exposure Based Quarter?[b]
1C1CMS331010	Carilion New River Valley Medical Center, FFS	Total Medical Costs (Per 1,000 Beneficiaries)	$2,613,350.03	(-1,920,423.6 | 7,147,124)	4	8	699	699	DiD (matched controls)	Program Exposure-Based
		IP Admissions (Per 1,000 Beneficiaries)	371.95**	(110.1 | 633.8)	4	8	699	699		
		IP Readmissions (Per 1,000 Beneficiaries)	9.43	(-313.8 | 332.7)	4	8	699	699		
		ER Visits (Per 1,000 Beneficiaries)	334.69	(-23.6 | 693.0)	4	8	699	699		
1C1CMS331073	Pharmacy Society of Wisconsin, Medicaid[c]	Total Medical Costs (Per 1,000 Beneficiaries)	$152,632.30	(-165,191.6 | 470,456.3)	4	6	38,381	38,381	DiD (matched controls)	Program Exposure-Based
		IP Admissions (Per 1,000 Beneficiaries)	6.16	(-8.6 | 20.9)	4	6	38,381	38,381		
		IP Readmissions (Per 1,000 Beneficiaries)	73.84**	(17.1 | 130.5)	4	6	38,381	38,381		
1C1CMS331061	University of Hawaii, Combined FFS and MA	IP Admissions (Per 1,000 Beneficiaries)	700.17***	(465.5 | 934.9)	4	8	833	833	DiD (matched controls)	Program Exposure-Based
		IP Readmissions (Per 1,000 Beneficiaries)	100.71	(-234.2 | 435.6)	4	8	833	833		
1C1CMS331040	University of Southern California, Combined FFS and MA	IP Admissions (Per 1,000 Beneficiaries)	120.38	(-39.6 | 280.4)	4	9	755	755	DiD (matched controls)	Program Exposure-Based
		IP Readmissions (Per 1,000 Beneficiaries)	-83.40	(-528.1 | 361.3)	4	9	755	755		

** Statistically significant at the five percent level.
*** Statistically significant at the one percent level.
[a] Acumen first calculated average changes in outcomes for intervention group beneficiaries in the period after program enrollment compared with the pre-enrollment period, and then calculated the corresponding changes for comparison groups over the same period. For each outcome measure, Acumen subtracted the average change in the comparison group from that in the intervention group to obtain the DiD estimate.

[b] This column denotes whether the quarterly results were compiled using calendar time, where all patients were present during the same chronological period, or a program exposure-based time, where program exposure begins when a patient first becomes eligible for care or enrolls.
[c] The PSW intervention group was defined as beneficiaries who visited participating pharmacies, and compared to a matched comparison group consisting of beneficiaries who visited non-participating pharmacies.

APPENDIX G: 508-COMPLIANT TABLES CORRESPONDING TO COLORED PLOTS FOR USC

Appendix Table G-1: Rate of Patients with Uncontrolled LDL Cholesterol per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort

Cohort	Baseline LDL Category	Quarter Before HCIA Program Launch				Quarter After HCIA Program Launch							
		Q4	Q3	Q2	Q1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
USC Control	LDL-C <= 70 mg/dL	0.12	0.11	0.13	0.13	0.12	0.09	0.14	0.12	0.13	0.12	0.12	0.12
USC Intervention	LDL-C <= 70 mg/dL	0.11	0.12	0.13	0.10	0.10	0.08	0.08	0.08	0.09	0.08	0.11	0.09
USC Control	70 mg/dL < LDL-C <= 85 mg/dL	0.30	0.27	0.26	0.26	0.26	0.27	0.28	0.26	0.24	0.28	0.29	0.26
USC Intervention	70 mg/dL < LDL-C <= 85 mg/dL	0.29	0.27	0.30	0.24	0.18	0.19	0.21	0.21	0.23	0.22	0.24	0.21
USC Control	85 mg/dL <= LDL-C < 100 mg/dL	0.39	0.41	0.39	0.40	0.37	0.36	0.40	0.39	0.43	0.37	0.42	0.41
USC Intervention	85 mg/dL <= LDL-C < 100 mg/dL	0.40	0.41	0.35	0.32	0.31	0.31	0.29	0.30	0.31	0.30	0.27	0.29
USC Control	LDL-C > 100 mg/dL	0.74	0.73	0.71	0.64	0.62	0.62	0.60	0.58	0.61	0.60	0.60	0.61
USC Intervention	LDL-C > 100 mg/dL	0.71	0.71	0.72	0.61	0.54	0.52	0.54	0.54	0.57	0.54	0.54	0.53
USC Control	Overall	0.43	0.42	0.40	0.39	0.37	0.36	0.39	0.37	0.38	0.37	0.38	0.37
USC Intervention	Overall	0.43	0.43	0.43	0.33	0.31	0.30	0.32	0.31	0.34	0.32	0.32	0.31

Appendix Table G-2: Rate of Patients with Poorly Controlled Hemoglobin A1c per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort

Cohort	Baseline HGB Category	Quarter Before HCIA Program Launch				Quarter After HCIA Program Launch							
		Q4	Q3	Q2	Q1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
USC Control	HbA1c <= 5.7 mmol/L	0.04	0.03	0.02	0.08	0.05	0.04	0.04	0.03	0.05	0.02	0.00	0.03
USC Intervention	HbA1c <= 5.7 mmol/L	0.05	0.11	0.11	0.08	0.09	0.02	0.04	0.06	0.04	0.07	0.03	0.07
USC Control	5.7 mmol/L < HbA1c <= 8 mmol/L	0.21	0.21	0.22	0.25	0.22	0.23	0.23	0.23	0.25	0.25	0.24	0.27
USC Intervention	5.7 mmol/L < HbA1c <= 8 mmol/L	0.22	0.25	0.25	0.25	0.22	0.21	0.22	0.26	0.24	0.28	0.25	0.27
USC Control	8 mmol/L <= HbA1c < 9 mmol/L	0.53	0.69	0.64	0.69	0.59	0.59	0.60	0.63	0.63	0.66	0.65	0.67
USC Intervention	8 mmol/L <= HbA1c < 9 mmol/L	0.55	0.63	0.64	0.65	0.56	0.58	0.59	0.57	0.56	0.61	0.61	0.59
USC Control	HbA1c > 9 mmol/L	0.83	0.85	0.90	0.87	0.84	0.87	0.85	0.81	0.86	0.87	0.89	0.85
USC Intervention	HbA1c > 9 mmol/L	0.79	0.81	0.83	0.84	0.81	0.82	0.78	0.84	0.78	0.80	0.79	0.79
USC Control	Overall	0.42	0.45	0.44	0.47	0.43	0.43	0.47	0.43	0.45	0.46	0.47	0.48
USC Intervention	Overall	0.43	0.45	0.46	0.43	0.39	0.40	0.40	0.44	0.44	0.47	0.45	0.44

Appendix Table G-3: Rate of Patients with Uncontrolled Blood Pressure per 1,000 Beneficiaries, Quarterly Trends for Participants and Controls, USC FFS and MA Combined Cohort

Cohort	Baseline Systolic Category	Quarter Before HCIA Program Launch				Quarter After HCIA Program Launch							
		Q4	Q3	Q2	Q1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
USC Control	Systolic <= 120 mmHg	0.07	0.05	0.05	0.07	0.07	0.06	0.13	0.08	0.07	0.10	0.11	0.10
USC Intervention	Systolic <= 120 mmHg	0.07	0.09	0.09	0.05	0.09	0.12	0.12	0.13	0.11	0.13	0.12	0.13
USC Control	120 mmHg < Systolic <= 130 mmHg	0.17	0.17	0.19	0.19	0.23	0.21	0.25	0.26	0.21	0.27	0.26	0.25
USC Intervention	120 mmHg < Systolic <= 130 mmHg	0.23	0.21	0.14	0.17	0.20	0.19	0.30	0.24	0.21	0.27	0.23	0.24
USC Control	130 mmHg <= Systolic < 140 mmHg	0.43	0.41	0.52	0.38	0.35	0.36	0.43	0.46	0.39	0.44	0.40	0.40
USC Intervention	130 mmHg <= Systolic < 140 mmHg	0.36	0.32	0.37	0.38	0.27	0.39	0.39	0.40	0.38	0.43	0.36	0.44
USC Control	Systolic > 140 mmHg	0.63	0.68	0.66	0.65	0.53	0.54	0.60	0.54	0.52	0.60	0.57	0.61
USC Intervention	Systolic > 140 mmHg	0.71	0.67	0.66	0.71	0.54	0.57	0.58	0.58	0.56	0.60	0.56	0.57
USC Control	Overall	0.36	0.37	0.35	0.32	0.30	0.31	0.36	0.33	0.29	0.36	0.33	0.34
USC Intervention	Overall	0.40	0.38	0.35	0.33	0.30	0.33	0.38	0.38	0.36	0.36	0.32	0.34