

**EVALUATING PROVIDER AND ORGANIZATIONAL RESPONSE IN SELECT  
POPULATION HEALTH MANAGEMENT INITIATIVES**

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**ABSTRACT**

Research has yielded mixed results as to the overall impact and sustainability of population health management initiatives. However, some organizations have been better able to alter care processes and provider behavior to achieve population cost and quality goals. To ensure the maximal impact of these initiatives and provide evidence-based guidance to healthcare organizations across the country, it is imperative to examine the contextual factors that drive change and performance. This dissertation will evaluate provider and organizational response to population health models aimed at the provision of home, community, and outpatient care.

Chapter 1 provides the purpose, summary of research and findings, and implications of the dissertation.

Chapter 2 is a qualitative study of the Caregiver Advise, Record, Enable (CARE) Act implementation within three purposively-selected UPMC medical-surgical units. Observations, interviews, and document review are triangulated to understand organizational processes, structures, and performance related to lay-caregiver education and preparation for patient discharge, in accordance with the legislation.

Chapter 3 evaluates the association between the structure of Medicare Shared Savings Program (MSSP) ACOs' contracted-provider network and the retention of attributed Medicare

fee-for-service beneficiaries. We use Medicare administrative claims data from 2013 to 2014. Results of the adjusted logistic regression indicate that ACO provider network comprehensiveness increases the odds of a beneficiary remaining attributed to the same ACO year-to-year. This finding could inform structural and organizational formation of future iterations of ACOs.

Finally, Chapter 4 measures provider-level changes resulting from a 2012 Pennsylvania fee standardization. We test two hypotheses using generalized linear models for the following outcomes: change in providers operating in a county and change in volume of units billed per beneficiary. Based upon the evidence, we summarize provider response to an exogenous rate change.

**Public Health Significance:**

This dissertation contributes to the literature by focusing on the supply-side structural and procedural changes that occur when new policy and payment mechanisms are put into place. Results from this dissertation can be used to establish best practices and inform future policy, rate-setting, and implementation decisions that enhance the success of these population health management initiatives.

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To my Dad, who would always beam with pride at my accomplishments.

## 1.0 INTRODUCTION

In 2008, Berwick proposed a transformation of the healthcare system to achieve three primary goals: improve health of populations, improve patient experience, and reduce costs.<sup>1</sup> These goals have become known commonly as “The Triple Aim.” The traditional structure and fee-for-service financing model of healthcare has not incentivized or even required cross-setting collaboration and proactive patient care. Pockets of innovative payment and program design have emerged to overcome these barriers and work towards achievement of The Triple Aim, such as pay-for-performance models, transitions of care programs, and patient-centered medical homes. Population health management strategies are often at the foundation of these initiatives.

Population health management can be defined as a “system of coordinated health care interventions and communications for at-risk and chronically ill populations. [It] supports care coordination by facilitating/supporting integration across providers or care settings to link chronically ill individuals and their families with health education and appropriate services and resources.”<sup>2</sup> The population health management approach places emphasis on cost-effective, preventive and appropriate care in the home, community, and outpatient settings.<sup>3</sup> When successful, it reduces high-cost events, such as hospitalizations or nursing facility admissions. Despite the growing popularity of population health management, reimbursement models and policies do not universally support these types of clinical activities.

Institutional theory states that organizational structure is determined by normative, cultural-cognitive, and regulative elements.<sup>4,5</sup> Normative and cultural-cognitive elements are often internal to the organization, align with moral imperatives and shared culture, and are harder to influence.<sup>6</sup> Because of this, regulation is often used to incentivize organizational change. Organizations respond to regulation, such as new policy or payment mechanisms, by modifying behavior to comply. These changes are done in an attempt to avoid punishment and maintain financial margins. External pressures to comply with regulation can result in modified structure and roles, beginning the internalization of the legislative objectives.<sup>7</sup> Without a legislative or financial catalyst, established normative and cultural-cognitive elements would most likely continue to drive organizational decisions and result in minimal transformation across the industry.

Organizations will behave in different ways to comply with regulative requirements. In this dissertation, we utilize three different policy and payment models to evaluate supply-side response. We define the supply-side response to be decisions regarding organizational structure, practices, and processes. The selected policy and payment models either encourage greater population management or alter previously established programs that provide care in the home or community. Our level of analysis varies in each study, but all strive to build evidence around effective implementation strategies and the mechanisms of change.

## **1.1 A MULTI-SITE CASE STUDY OF CARE ACT IMPLEMENTATION**

Recognizing the growing network of 43.5 million family caregivers in the United States, the barriers to integration, and the evidence of caregiver impact on patient and system outcomes,

the Commonwealth of Pennsylvania passed the Caregiver Advise, Record, Enable (CARE) Act on April 20, 2016. We designed a study to explore early implementation at a large, integrated delivery financing system. Our goal was to assess the effects of system-level decisions on unit implementation and the incorporation of the CARE Act's three components into routine care delivery.

We conducted a multi-site, ethnographic case study at three different hospitals' medical-surgical units. We conducted observations and semi-structured interviews to understand the implementation process and the approach to caregiver identification, notification, and education. We used deductive, thematic analysis to code interview and observations and linked findings to the Promoting Action on Research Implementation in Health Services (PARIHS) framework.

Organizational context and EHR capability were instrumental to CARE Act implementation and integration into workflow. The implementation team utilized a decentralized strategy and a variety of communication modes, relying on local hospital units to train staff and make the changes. We found that the system facilitated CARE Act implementation by placing emphasis on documentation and charting to demonstrate compliance with the legal requirements. There were no changes instituted to address the instruction requirement of the CARE Act.

General acute hospitals will be making or have made similar decisions on how to operationalize the regulatory components and demonstrate compliance with the CARE Act. This study can help to inform others as they design and improve their compliance and implementation strategies. I acknowledge publication of this article in *The Gerontologist*.<sup>8</sup>

## **1.2 MEDICARE SHARED SAVINGS PROGRAM ACO NETWORK COMPREHENSIVENESS AND PATIENT PANEL STABILITY**

To participate in the Medicare Shared Savings Program (MSSP), hospitals and health providers form a network, called an Accountable Care Organization (ACO). The ACO assumes responsibility for the cost and quality of care of assigned Medicare fee-for-service (FFS) beneficiaries. The current assignment method uses prospective assignment with retrospective reconciliation. This creates unpredictability for ACOs developing and deploying strategic initiatives aimed at improving value. The goal of this study is to determine if ACO network comprehensiveness is associated with the stability of assigned Medicare beneficiaries from 2013 to 2014.

Medicare FFS beneficiaries were identified for the MSSP ACOs participating in 2013 and 2014. The 2013 patient panel for each ACO was compared with final assignment in 2014. We created a measure of 2013 ACO contracted provider network comprehensiveness using the Medicare Advantage network adequacy specification for the minimum number of in-network providers. We utilized a logistic regression model, in which we adjusted for other organizational characteristics, market influences, and patient care seeking behavior covariates. Overall beneficiary attribution to the same MSSP ACO year-to-year was 84.38%, and network comprehensiveness was 25.78% (SD = 19.67). We found that a 0.10 increase in network comprehensiveness score significantly increased the odds of an individual remaining in the same ACO by 3.8% (P = 0.001). Patient panel stability was significantly associated with improved diabetes (P = 0.003) and hypertension (P = 0.014) control, timely access to care (P = 0.002), and delivery of health education (P = 0.03).

The comprehensiveness of a MSSP ACO's contracted provider network is associated with stable patient assignment year-to-year. Patient panel stability was significantly associated with improved diabetes and hypertension control. This indicates that patient panel stability may aid in the longitudinal management of some conditions. Additionally, the high-level of stability year-to-year indicates that prospective assignment alone may be a sufficient means of attribution.

### **1.3 HOME- AND COMMUNITY-BASED SERVICE PROVIDER RESPONSE TO RATE STANDARDIZATION**

Changes in reimbursement can impact the decisions providers make about regional scope of practice and how populations are served. In this study, we examine HCBS provider behavior and response to this exogenous rate standardization. We used Pennsylvania Medicaid claims data from 2011 to 2013 to analyze services provided by HCBS providers in the Aging waiver, which serves nursing-facility eligible adults over the age of 60. We focused on high volume provider categories: adult day care (ADC), agency personal assistant services (PAS), and home delivered meals for analysis purposes. We are interested in building understanding about the Pennsylvanian Aging Network's response and ability to adapt to new payment models. To evaluate the impact of the rate change, we determine how the rate change affected HCBS providers' market entry and exit and measure changes in service volumes prior to and after the rate change.

We used a logistic regression with a 6-month lag to evaluate HBCS providers' exit, a linear regression with 6-month lag to evaluate entry of new providers, and a generalized estimating model with a Poisson distribution to measure volume changes. The rate change did

not significantly affect exit for PAS ( $p=0.88$ ) or ADC providers ( $p=0.32$ ). Meal providers were 6.41 times more likely to continue services in counties when the rate increased by \$0.10 ( $p=0.01$ ). Rate changes did not significantly affect provider entry for any service line.

There is evidence that rate changes and market conditions affect volume. PAS providers decreased the number of units billed monthly by 3.1% when the rate increased by one dollar. ADC providers also had a significant 1.9% reduction in monthly volume when rates increased ( $p<0.001$ ). Contrastingly, an increase in the rate was associated with a 3.7% increase in meals delivered per month.

We identified variation in response by type of service. Meal providers were sensitive on both the extensive and intensive margin, while ADC and PAS providers only showed a response on the intensive margin, or the volume of service units billed. This indicates that HCBS providers are making strategic operational and production decisions based upon their organizational structure and operating expenses. Future policymakers should consider volume and potential affects to the market when adjusting reimbursement models.

## **1.4 IMPLICATIONS**

To determine achievement of regulatory objectives, it is necessary to understand provider response and behavior. This dissertation will provide important information to future iterations of population health management initiatives, inform replication, and establish implementation and translational evidence.

## **2.0 A MULTI-SITE CASE STUDY OF CARE ACT IMPLEMENTATION**

### **2.1 ABSTRACT**

**Background and Objectives:** The Commonwealth of Pennsylvania passed the Caregiver Advise, Record, Enable (CARE) Act on April 20, 2016. We designed a study to explore early implementation at a large, integrated delivery financing system. Our goal was to assess the effects of system-level decisions on unit implementation and the incorporation of the CARE Act's three components into routine care delivery.

**Research Design and Methods:** We conducted a multi-site, ethnographic case study at three different hospitals' medical-surgical units. We conducted observations and semi-structured interview to understand the implementation process and the approach to caregiver identification, notification, and education. We used thematic analysis to code interview and observations and linked findings to the Promoting Action on Research Implementation in Health Services (PARIHS) framework.

**Results:** Organizational context and EHR capability were instrumental to CARE Act implementation and integration into workflow. The implementation team utilized a decentralized strategy and a variety of communication modes, relying on local hospital units to train staff and make the changes. We found that the system facilitated CARE Act

implementation by placing emphasis on the documentation and charting to demonstrate compliance with the legal requirements.

**Discussion and Implications:** General acute hospitals will be making or have made similar decisions on how to operationalize the regulatory components and demonstrate compliance with the CARE Act. This study can help to inform others as they design and improve their compliance and implementation strategies.

**Key Words:** caregiver, discharge planning, health policy, organizational behavior

**Acknowledgements:** We acknowledge *The Gerontologist* for its publication and peer review of this article.<sup>8</sup>

## 2.2 INTRODUCTION

Clinicians and researchers recognize that the transitional period from hospital to home is a potential minefield of adverse events, such as harmful drug interactions, falls, and readmissions.<sup>9</sup> Of the 15.2% older adults who experience a hospitalization each year, 20% will have an adverse event in the three weeks after discharge.<sup>10,11</sup> Evidence-based transitions of care models have emerged to reduce adverse events and ensure a safe return to the home.<sup>12-15</sup> “The patient and caregiver are the only common thread between [hospital and home],”<sup>16</sup> and consequently many of these models require active caregiver participation on the care team and promote caregiver skill development.

Effective caregiver inclusion is an iterative process that requires collaboration starting early in the inpatient stay.<sup>17</sup> Despite the proliferation of evidence-based transitions of care models that tout the importance of caregiver involvement, hospitals and clinicians face

significant systemic and procedural barriers that limit caregiver inclusion in discharge planning.<sup>18</sup> In particular, there are high demands on clinicians' time. Clinicians' time is necessary to resolve nearly all of the commonly cited barriers to caregiver engagement: assessment of health literacy, communication and support to other health and social service providers, clinician-family relationships, and timely provision of detailed information.<sup>17,19</sup>

When done, the integration of caregivers into the discharge process has yielded positive individual and system-level outcomes, decreasing the odds of post-discharge adverse events. Previous studies demonstrate that greater levels of caregiver involvement during the discharge process resulted in caregivers reporting higher levels of care experience satisfaction, greater preparation to provide care, and greater perceived care continuity.<sup>20-22</sup> Better clinician-caregiver coordination was also associated with positive patient health outcomes, including greater pain control, higher functional status, and improved mental health.<sup>21</sup> From a system-level perspective, the inclusion of caregivers in the discharge planning process reduces the risk of 90-day readmissions by 25% and enhances the effect of transitions of care interventions in reducing 30-day readmissions.<sup>23-25</sup>

Recognizing the growing network of 43.5 million family caregivers in the United States, the barriers to integration, and the evidence of caregiver impact on patient and system outcomes, the Caregiver Advise, Record, Enable (CARE) Act was introduced in many state legislatures.<sup>26</sup> It requires hospitals to: 1) provide patients the opportunity to identify and record the name of a caregiver; 2) inform the caregiver when discharge is to occur; and 3) provide the caregiver with instruction of medical tasks to be performed in the home.<sup>27</sup> The Commonwealth of Pennsylvania passed the CARE Act on April 20, 2016, taking effect in 2017 and joining 35 other states where the CARE Act is law.<sup>27,28</sup> The Pennsylvania version states, "The hospital shall provide each

patient an opportunity...to designate at least one lay caregiver following the patient's entry to a hospital." Hospital staff must then document the choice in the patient's medical record, consult with the lay caregiver and issue a care plan prior to discharge, and "provide the lay caregiver with instructions in all after-care tasks." The law states that general acute hospitals are responsible for implementing and demonstrating compliance. Currently, there are no enforcement provisions or penalties associated with non-compliance nor any additional resources available to hospitals to aid implementation in Pennsylvania.<sup>28</sup>

To date, no evaluation has been conducted to examine CARE Act implementation and its success in addressing the systemic and procedural barriers that limit caregiver involvement. We designed a study to explore early implementation at University of Pittsburgh Medical Center (UPMC), a large, integrated delivery financing system in Pennsylvania. Our goal was to assess the effects of system-level decisions on unit implementation and the incorporation of the Act's three components into routine care delivery through application of the Promoting Action on Research Implementation in Health Services (PARIHS) framework.<sup>29,30</sup> Widely used as an implementation framework in health services research, PARIHS has three dynamic and interacting components used to determine success of implementation: context, facilitation, and evidence. Context describes the setting in which the change occurs, while facilitation describes the support and actions needed to change behavior. Evidence is the existing research, experience, and ongoing evaluation that informs the implementation process. These elements are scored from low to high and allow for a structured analysis and recommendations for future improvement.

## 2.3 METHODS

### 2.3.1 Design

From July 2017 to December 2017, we convened an interprofessional research team, composed of public health, occupational therapy, and nursing experts, to conduct a multi-site, ethnographic case study at three UPMC hospitals: a 49-bed rural, a 437-bed suburban, and a 489-bed urban hospital. Our use of an ethnographic case study design allowed to explore practitioner response to and interactions around the policy change in various subgroups and cultural units within the larger organization.

With the help of the system's Patient Education team, we performed a purposive selection of units. Medical-surgical units were targeted due to the heterogeneity of the patient conditions and the acute nature of hospitalizations, providing the greatest exposure to various patient and caregiver educational needs. We selected three units within hospitals of different sizes, populations, and rural/urban status for inclusion to maximize environmental and organizational variance. Researchers and the hospital's patient education representative worked to coordinate schedules for observation and interviews. UPMC's Quality Improvement Review Board approved this project.

First, the research team reviewed planning and training documents and met with UPMC leaders responsible for communicating and implementing changes associated with the Act. Based upon these conversations, we developed observational and semi-structured interview guides aligned with the three requirements of the Act. We included additional questions to understand the implementation process and the approach to caregiver identification, notification, and education. We programmed the structured, observational guide using Coda/iCoda 2 software 23 on iPads to consistently capture information on care point during inpatient stay, notification

and education methods and documentation, and caregiver interactions for each unique observation. We recorded the semi-structured interviews on the iPad after describing the purpose of the interview, ensuring confidentiality, and obtaining verbal consent. We securely stored the interviewee's first name, position, date, and questions asked on a shared document to avoid duplication and to track comprehensiveness of interviews.

All five researchers conducting interviews and observations received training on the use of the software prior to data collection. We provided printed instructions, screenshots, and guides of the tools as resources. In addition, at our first site, researchers familiar with both software programs were present to help in the case of technical difficulties and to ensure standard practices.

### **2.3.2 Data Collection**

We spent three days at the smaller hospital and four days at the larger hospitals. In most of our scheduled visits, we had two people on the unit to provide a more complete and comprehensive picture of caregiver identification, notification, and education. Each day on the unit consisted of multiple three-hour blocks of work, with two hours devoted to observation and the other hour spent in interviews and/or partner debriefs. Our research team designed the shift schedule to include observational periods during the morning, afternoon, and evening to maximize our understanding of the care process and to capture different times of day. In total, we collected 106 hours of observation data and conducted 27 semi-structured interviews with frontline clinical staff. Due to workflow constraints, the interviews ranged in length from 10 to 30 minutes. We attempted to interview a diverse set of health professionals, but did not limit ourselves to quotas. Interviews and observations continued until we had achieved thematic

saturation. Each team member also wrote daily reflections to summarize their experience. Data collection at each site is summarized in *Table 1*.

### **2.3.3 Data Analysis**

The data were summarized to count the types and frequency of caregiver identification, notification, and education. To share observational experiences, the team conducted debrief discussions after each site visit. Each team member presented the highlights of their daily reflections and shared impactful moments. The group discussed the reflections and stories until full consensus was reached about meaning and importance to the research aim.

Interviews were transcribed verbatim, removing any potentially identifying information. A qualitative, deductive thematic analysis approach was conducted using NVivo 11.<sup>31-33</sup> We structured and defined our codes a priori to capture implementation decisions, unit context, and caregiver involvement (*Table 2*). We used a deductive approach to ensure that our core research questions were answered.<sup>33,34</sup> The use of pre-defined codes guided data exploration by helping to focus the thematic analysis on relevant and revealing passages.<sup>35</sup> Two team members (BEF and CLL) conducted inter-coder reliability analyses and achieved kappa coefficient values of 0.75 for seven randomly selected interviews (26%). We categorized each code into the CARE Act's components and/or the PARIHS framework's three implementation elements: context, facilitation, and evidence.<sup>29,30</sup> We further reviewed each coded passage and placed it into the appropriate sub-element within each PARIHS category to allow for a more dimensional and detailed analysis of implementation success. We applied the PARIHS framework after the initial coding process, so that we were able to fully explore implementation decisions before assessing performance. Our inferences and conclusions are based upon saturated sub-elements relevant to the CARE Act implementation.

## **2.4 RESULTS**

The triangulation of interviews, observations, document review, and meetings with the implementation team revealed system-level decisions instrumental to unit CARE ACT performance. We summarize caregiver identification, notification, and education strategies. We then link these findings to the PARIHS framework to present key criteria under each element and describe the implementation process. Themes were highly consistent across units.

### **2.4.1 Summary of Changes**

UPMC altered the system's electronic health record (EHR) and documentation processes to fulfill CARE Act requirements. Structured fields were added to denote caregiver identification and notification, and a text box was added to document education delivered to the caregiver. We did not observe changes in care delivery processes around caregiver notification or education.

### **2.4.2 Context: Sub-elements of Organizational Structure, Leadership, and Professional Networks**

Context is defined as the environment in which implementation occurs in the PARIHS framework. At the system-level, clinical leaders and experts in operations, patient education, and informatics designed the implementation strategy. This implementation team was responsible for identifying the necessary changes to workflow and operations to achieve compliance. They attempted to create one systematic process throughout UPMC. Due to its size and heterogeneity, the implementation team utilized a decentralized strategy and a variety of communication modes, relying on local hospital units to train staff and make the changes. We

found that organizational structure, leadership, and professional networks influenced the context of CARE Act implementation at UPMC.

CARE Act information was passed along to all the system's hospitals through newsletters, listserv emails, screensavers, in-services, and meetings with various clinician groups. The implementation team provided training to the local Clinical and Operational Informatics and Patient Education Committee representatives at each hospital. The Patient Education Committee is mostly composed of individuals with a background in nursing. From this group, information flowed to unit leads or lead clinicians, who have nursing backgrounds and are responsible for the nursing practice on the unit. The unit leads then shared the information with their direct reports: staff nurses.

Not only did the communication strategy leverage the nursing professional network, nurses were also charged to complete the two main documentation requirements of the legislation. The training materials specify that the "Nurse is responsible to ensure [Home] Caregiver is identified and notified, but other clinicians can provide teaching." These two actions provided a uniquely nursing-centric approach to the implementation strategy. Nearly all non-nursing professionals (hospitalists, unit coordinators, care managers, physical therapists, and occupational therapists) indicated during interviews (n=6/7) and informal conversations that they had not previously heard of the CARE Act. For comparison, only a quarter of the nurses (n=4/18) interviewed indicated that they did not know much about the Act—some of which were float staff without a primary unit.

Across all three sites, interviewees mentioned that there had been initial training prior to implementation and minimal conversations thereafter. Some even indicated that they received an additional review of the CARE Act prior to the research team's arrival, stating "I just learned

about it a couple days ago, actually. I think for the first time” (M5). When asked about the training, a unit leader responded, “I would say there probably wasn’t a whole lot of training to the bedside nurses. I know it was presented at the Practice Council, and we have posted things on the unit.” In fact, many frontline clinical interviewees struggled to recall the Act until the researcher described the three requirements of the legislation. Researchers observed that the legislation’s goal to better prepare caregivers for post-acute care tasks was only one of the many ongoing quality improvement initiatives on the units.

While the health system used a multitude of methods to help support and facilitate communication about local implementation of the CARE Act, the reliance on unit nursing leadership to distribute and teach the information from these resources resulted in disparate levels of knowledge and learning for frontline staff. Within all three units, knowledge level varied tremendously, particularly by profession and role.

### **2.4.3 Facilitation: Sub-elements of Task Orientation and Skills/Attributes**

In the PARIHS framework, facilitation are the factors that make implementation easier. We found that UPMC placed emphasis on the documentation and charting to demonstrate compliance with the legal requirements, using task orientation and management to expedite implementation. Several structural changes were made to ensure systematic and universal data collection. The implementation team worked with the EHR team members to build a caregiver identifier section into the admission consent form. It is a structured field to indicate if the patient has identified, declined, or is unable to identify a caregiver. If a caregiver is identified, the clinician must enter the individual’s contact information. On the contact page, there is an area to indicate if the caregiver has been contacted for education at discharge.

Correspondingly, the implementation team chose to update the education section of the EHR to include a caregiver option in the “Individuals Taught” tab. This add-on provided a specific location for documentation of education provided to the caregiver. In this education section, the implementation team also created a “Caregiver Notified” indicator, which can be checked off after the discharge information is communicated. The training materials created by the system’s implementation team outlined these EHR changes, explicitly tying the CARE Act to documentation requirements.

Half of interviewees (n=14) indicated that the Act had most affected the documentation and charting process. M7 stated, “We can see under discharge planning that a responsible caregiver has been identified and documented. I do notice that information in the charts more than it was before.” Overall, interviewees expressed ease in documenting. When describing the new section of the admission assessment, M4 said “it’s cut and dry, it’s black and white, do you want somebody involved in your care. If not, they decline, that’s the radio button we hit.” Interviewees had a variety of responses to the increased charting requirements. Some proclaimed themselves as “detail-oriented documenter(s)” (B2) prior to the CARE Act, while others indicated new difficulties in remaining patient-centric due to increased documentation demands (B7, M5). The uptake and knowledge about the documentation requirements seemed universal, with M6 summarizing that “if you don’t chart it, it never happened.” Clinicians expressed they were now documenting patient and caregiver education more thoroughly and routinely.

Interviewees did highlight one specific difficulty in documenting and using the information to modify caregiver interactions. P2 mentioned, “I know it [prompts you] when they are admitted to fill out all of that patient information, things like who their caregiver is, but it’s kind of hard to find afterwards.” This gap was more explicitly stated by M7, who said: “I don’t

think anybody looks back in there [the EHR caregiver identification section] to make sure that they are educating the right person.” In the education section of the EHR, where charting occurs, the information about the designated caregiver does not populate. Clinicians must go to the contact information page to ensure that she/he notifies and educates the right person.

Contrasting the approach taken to documentation, the implementation team did not institute changes to address the instruction requirement of the CARE Act. There was a system- and unit-level perception that caregivers were already receiving education over the course of the patient’s stay and that existing educational resources were robust and sufficient. Rather, UPMC’s implementation team viewed the legislation as simply formalizing caregiver inclusion in care delivery. This strategy resulted in minimal changes to education practices. Nearly two-thirds of interviewees (n=17) clearly stated that care delivery and workflow were not altered. B1 explained, “I’ve never modified [my interactions with caregivers] because I think ideally, hopefully, I started that way.” Other interviewees echoed this sentiment, adding that “I feel like we did it before anyways” (B4) and that “only change that I would recognize is that on admission, patients can identify a caregiver” (P3).

Our observations largely validated UPMC’s perception of caregiver notification and education. Of the 279 direct observations of education, we observed 100 occurrences where a family member was present. The healthcare professional engaged the family member 76% of the time. The high level of engagement illustrates that when the family was present, the unit staff did include the family member in the education process. However, these family members were not necessarily the caregiver designated upon admission by the patient. The research team did observe difficulties related to caregiver education when clinician workflow and designated caregiver presence did not align. In a daily reflection, MCR noted an example in which a nurse

was responsible for five discharges towards the end of her shift. One patient asked the nurse to wait for her husband to arrive before providing the discharge instructions. The nurse insisted that there were no major changes to the home care plan and asked twice if the patient really felt the need for her husband to be present. The patient eventually relented, and though the nurse provided very thorough discharge instructions, the patient was receiving the instructions without her caregiver. M7 summarized the problem, saying: “[it is difficult] trying to coordinate when the caregiver can get here and when we also have time to do it. Cause sometimes when people can get here, it’s for like one hour, and you don’t have time to get in there for that one hour.”

Phone calls were used as a substitute to in-person caregiver education when necessary, but were less desirable than face-to-face education. M8 said, “Usually if I talk to a family member over the phone that’s not able to come in, it’s usually more of giving them updates on the patient’s situation as opposed to education on home care.” Similarly, M3 stated “when the caregiver can’t get there, it’s kind of challenging. You can’t always call them on the phone. There’s not always time.” Our research team was not present for any phone calls in which notification or education was provided.

Because of the difficulty in schedule coordination and delivery of education over the phone, the designated caregiver is not necessarily the family member receiving the post-discharge care instructions as required by the legislation. P8 articulates this reality of practice, saying “[as clinicians] we’re trying to educate anybody that we can, in regards of how to help the patient. Whether it’s Bob, Tina, George or Bill. That’s a true statement. They’re identifying ‘this is the person that I count on,’ but in reality, that’s not the person that’s around.”

#### **2.4.4 Evidence: Sub-elements of Research and Clinical Experience**

Evidence is the research and best practices which inform implementation in the PARIHS framework. We found that UPMC had to alter processes to demonstrate compliance with the CARE Act. This was done without the benefits of research on caregiver identification, notification, and education models or established evidenced-based practices for a general inpatient population. Due to that, the traditional, PARIHS-defined concept of evidence does not cleanly align with this case study. However, the interviewees provided recommendations on how to improve the implementation and discharge planning process. A few suggested a system-wide standard to learn about the CARE Act. M6 said “there could be like a formal class about it...so that everyone is all on the same page,” while another interviewee suggested a learning module be required to be completed annually. Two other interviewees (P4 and P8) requested modifications to the EHR, including additional reminders to document education and assistance in locating and utilizing educational resources.

Most of the recommendations revolved around workflow and teamwork, specifically communication and roles and responsibilities. Interviewees talked about the inclusion of caregivers across the entire hospitalization and indicated this could help avoid information overload at time of discharge. P1 states that the “ideal process would be starting them off early, that way when it is time for discharge, they feel like they’re completely comfortable in leaving.” Another interviewee agreed and continued: “I think it would be great to have a caregiver present at the hospital with the patient as much as possible, so that they could see the process from day to day. That way, on discharge, there’s not just a lot of information thrown at them” (B6).

Interviewees also provided recommendations to overcome the struggle to align clinician and caregiver schedules. They suggested inviting the family to be in the room during morning

rounds, sharing educational materials over email, and scheduling a formal meeting to review patient needs. A care manager volunteered to conduct those meetings, stating: “That would be one thing that I would be willing to do, is have a formal meeting with the caregiver. I’m sure we would have documentation or little cheat sheets or recommendations from therapy and doctors to go over that... Even if it’s a half hour before they’re picking up the patient.” Interviewees also expressed issues with information sharing between professions and shifts. P1 said “We’re all trying to work together to make sure they got their education done, but you don’t know where they left off.” By reducing gaps in communication and improving interprofessional practice, interviewees indicated that patient and caregiver preparation for post-acute care tasks and the overall efficiency of care delivery could be improved.

The drive to innovate and improve care was omnipresent. Frontline staff easily identified barriers to caregiver identification, notification, and education and suggested improvements. Interviewees recognized the importance of the Act’s goals, with B5 stating: “I think it was very important not only to have the patient involved in their own care, but a family member that listened to the same instructions and can help the patient in every way that they need. I think that definitely would help the outcome of patient care. I mean, honestly, I really, I really like how they added that. And hopefully a lot more can branch off of that.”

## **2.5 DISCUSSION AND IMPLICATIONS**

Our results show that the organizational context and EHR capability were instrumental to CARE Act implementation and integration into workflow at all three units. These factors are commonly cited as both facilitators and/or barriers to healthcare quality improvement initiatives

and are core concepts of implementation and organizational change theories.<sup>29,30,36-40</sup> UPMC leadership worked within organizational and time constraints to achieve CARE Act compliance. They succeeded in making positive changes to the EHR to aid in identification, and frontline staff continued to educate present family members at high rates. Yet, opportunities for improvement exist and include refining the notification and instruction to the designated caregiver, reducing variation in knowledge among clinical professions, and improving use of the EHR fields later in the inpatient stay. Based on our results, we propose future directions for iterative and incremental change to enhance performance and engagement of designated caregivers during an inpatient stay under the domains of the PARIHS framework (*Table 3*).

### **2.5.1 Context**

Due to the size of UPMC, the organization is a more resource-rich and complex organization than most stand-alone hospitals and small health systems. UPMC had the resources available to quickly mobilize an implementation team to create a compliance strategy for caregiver identification, notification, and education. It had the ability to make changes into the EHR and had previously invested into robust patient education resources. Building upon existing infrastructure, UPMC created a straightforward compliance strategy for employees.

In order to achieve compliance and alter processes, the communication of UPMC's strategy had to efficiently flow cross-hierarchical structures. High levels of bureaucracy have been identified as a barrier to quality improvement implementation.<sup>38</sup> UPMC's implementation utilized a variety of communication methods and engaged a network of nursing professionals to communicate and disseminate the changes necessitated by the CARE Act. Despite navigating the hierarchical and layered nature of the system, the information did not reach all professions and managers. This created differences in knowledge and may inhibit team performance related

to the inclusion of the designated caregiver in instruction of post-discharge care tasks. It also limited interprofessional practice and collaboration around CARE Act objectives. Future implementation should employ strategies to overcome professional siloing and bureaucracy.

External to UPMC, the incentives to rework care delivery to better include and educate caregivers are lacking under the CARE Act in Pennsylvania. Compliance is being evaluated through an auditing process, but there are no specific penalties or rewards associated with the legislation. Alterations to the care delivery processes require time and resources. Not only does that equate to upfront investment by hospitals, it increases frontline staff workload. Though caregiver education is not billable as a separate service under Medicare Part A, “Patient and Caregiver-Centered Experience of Care/Care Coordination” is a domain of Medicare’s Hospital Value-Based Purchasing (VBP) Program. Performance in the Hospital VBP results in a payment adjustment to the base operating Medicare Severity Diagnosis-Related Group payment.<sup>41</sup> This can have significant impact on the hospital finances and represents a huge step forward in rewarding hospitals for patient and caregiver experience of care. To demonstrate the value and system-level return on investment of caregiver inclusion in discharge planning, future legislation and payment should continue to help support hospital innovation and reward high-performers.<sup>42-</sup>

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### **2.5.2 Facilitation**

UPMC leadership took several proactive steps to capture systematic information within the EHR. They collaborated with the EHR team to create structured fields for caregiver identification and contact information, and they added a caregiver option in the “Individuals Taught” tab of the education section of the EHR. Despite these actions, gaps within the EHR platform exist that impede clinician ability to perform CARE Act requirements consistently. The

caregiver information is not pulled through from the admission consent form to the education area. To confirm that correct person is notified and educated, the clinician must go to another section of the EHR. Interviewees admit that this is rarely occurring. Previous research on use of EHR and clinical decision support has indicated that the design of information should be timely, fit within workflow, and be easy to use.<sup>47-50</sup> These concepts have also been demonstrated in behavioral economics literature, described as nudges.<sup>51</sup> By integrating the designated caregiver information into appropriate areas of the EHR, frontline staff can efficiently confirm that the correct individual has been notified and is receiving the discharge instructions. Further EHR and clinical decision support enhancements would facilitate the alignment of clinician workflow and patient- and family-centered care. These adjustments would help hospitals be able to better fulfill the intent of the Act.

UPMC implemented the changes necessary to demonstrate compliance with the CARE Act. Based upon the regulations and assessment of current performance, UPMC determined that it needed only to modify current documentation procedures, rather than alter its education process. This task-orientation corresponds with expectations of organizational response to a regulation.<sup>52</sup> Frontline staff easily made the relatively simple change in behavior by altering the admission process and increasing documentation. Many clinicians did not modify interactions to ensure the inclusion of the designated caregiver in the care delivery process and were still educating any available family member. This illustrates that system and procedural barriers to instructing the patient-identified caregiver remain. To address these barriers would require large overhauls in workflow, responsibilities, and processes. We need further evidence on how to best include caregivers in the discharge process for a general inpatient population.

### **2.5.3 Evidence**

The CARE Act has provided a legislative catalyst for improvement to caregiver identification, notification, and education across all types of inpatient stays. There are no guidelines or established best practices for implementation yet, leaving it up to every acute hospital to design a compliance strategy. The lessons learned from this study can help other hospitals and health systems as they attempt to comply with the Act's requirements. Building the evidence-base is critical to maximizing efficiency and effectiveness of caregiver notification and education during the discharge planning process.

## **2.6 LIMITATIONS**

Although these findings parallel issues common in other healthcare improvement initiatives and extend the current literature, some limitations should be noted. This study occurred within one health system and may not be generalizable to other hospitals or health systems. Other smaller hospitals may not have capability or capacity to respond as quickly or be able to modify existing technology to fulfill CARE Act requirements. They may also not encounter some of the hierarchical and bureaucratic issues, which could ease implementation. We also did not see much difference based upon geography within our study, but further research should be done to explore response by geographic location and organizational size. Similarly, state-level differences in response and compliance should be examined.

Secondly, during our observations, we were not witnessing the entirety of a patient's length of stay. This restricted our ability to view the full course of inpatient caregiver engagement and education. We also had limited ability to see how education was documented in

the EHR. Despite this, research team members did ask to sit with and were able to observe some clinicians as they completed their notes. We relied heavily on the interviews to overcome these observational barriers and used triangulation to increase the rigor of our data. Additionally, UPMC's implementation team aided in the identification and selection of units for inclusion. This could have biased our results to higher performing units. The units were also not blinded to the purpose of the study, which did influence overall knowledge levels of the Act. We saw this during our interviews, where refreshers on the legislation occurred to inform staff about the project. Finally, UPMC also helped to refine our observational tools, which could present some bias in the information collected.

## **2.7 CONCLUSIONS**

General acute hospitals and health systems in all states that have passed the CARE Act will be making or have made similar decisions on how to operationalize the regulatory components and demonstrate compliance. In this multi-site case study, we examined early implementation in three units within one large health system. Through linking results to the PARIHS framework, we identified organizational structure, leadership, use of professional networks, remaining system and procedural barriers, and need for more research as key factors of current implementation. We provide recommendations for further improvement and iterations of implementation, which ultimately strive to better embed caregivers into the inpatient care delivery process. This study and our recommendations can help to inform other hospitals and health systems as they design and improve their CARE Act compliance and implementation

strategies. Further research is needed to fully understand the clinical impact of the CARE Act, including effect on readmissions and caregiver and patient health outcomes and satisfaction.

### 3.0 MEDICARE SHARED SAVINGS PROGRAM ACO NETWORK COMPREHENSIVENESS AND PATIENT PANEL STABILITY

#### 3.1 ABSTRACT

**Background:** The current Medicare Shared Savings Program (MSSP) Accountable Care Organization (ACO) attribution methodology uses prospective assignment with retrospective reconciliation. This creates unpredictability for ACOs developing and deploying strategic initiatives aimed at improving value. The goal of this study is to determine if ACO network comprehensiveness is associated with the stability of assigned Medicare beneficiaries from 2013 to 2014.

**Methods:** We utilized a beneficiary-level logistic regression model to determine association of network comprehensiveness on stable attribution to a MSSP ACO in 2013 and 2014. We defined network comprehensiveness using the Medicare Advantage specification of the minimum providers necessary for network adequacy.

**Results:** 84.38% of beneficiaries were attributed to the same ACO in 2013 and 2014, and average ACO network comprehensiveness was 25.78% (SD = 19.67). We found that a 0.10 increase in the network comprehensiveness score significantly increased the odds of remaining attributed to the same ACO by 3.8% (P = 0.001). Patient panel stability was significantly

associated with improved diabetes (P = 0.003) and hypertension (P = 0.014) control, timely access to care (P = 0.002), and delivery of health education (P = 0.03) over the two-year period.

**Conclusions:** The comprehensiveness of a MSSP ACO's contracted provider network is associated with stable patient assignment year-to-year. Patient panel stability was significantly associated with improved diabetes and hypertension control in the short-term. This indicates that patient panel stability may aid in the longitudinal management of some conditions and that prospective assignment alone may be a sufficient means of attribution.

**Key Words:** Population Health; Network Adequacy; Organizational Structure; Attribution; Performance

### 3.2 INTRODUCTION

The Medicare Shared Savings Program (MSSP) is an alternative payment model (APM) to traditional Medicare fee-for-service (FFS) and incentivizes the provision of efficient and effective healthcare utilization through various levels of risk-sharing.<sup>53</sup> To participate in the MSSP, healthcare providers and organizations voluntarily collaborate and enter into a contract to create an Accountable Care Organization (ACO). The ACO's providers become collectively responsible for the overall quality and cost of care for assigned Medicare FFS beneficiaries. Beneficiaries are assigned to an ACO based upon primary care utilization of contracted providers.<sup>54,55</sup> CMS continues to reimburse MSSP ACOs on a fee-for-service basis, but the ACOs can receive additional payments, called shared savings, if costs and quality metrics achieve certain benchmarks.<sup>53,55,56</sup> The MSSP has continued to grow since its creation in 2012. As of January 2018, 561 ACOs are responsible for 10.5 million beneficiaries.<sup>57</sup>

The Centers for Medicare & Medicaid Services (CMS) specify only one ACO eligibility requirement related to the composition of the contracted provider network. The ACO simply needs to include a sufficient number of primary care physicians to be assigned 5,000 beneficiaries.<sup>53</sup> This design latitude has led to the proliferation of uniquely organized and structured ACOs.<sup>58</sup> Researchers have linked ACO structural differences to external market forces through the application of resource dependence and institutional theories of organization.<sup>58,59</sup> These differences have been categorized into measures of: size of provider network, scope of services, breadth of provider type participation, proportion of primary care in network, leadership type, integrated delivery system membership, performance management strategies, and prior payment reform experience.<sup>58,60,61</sup> Researchers have used structural and organizational measures to evaluate the cost and quality outcomes of ACOs, but have yielded mixed results.<sup>61-63</sup>

The attribution process mediates the relationship between organizational structure and outcome performance. CMS uses a prospective attribution method with retrospective reconciliation to assign beneficiaries to ACOs in the Track 1 and Track 2 MSSP models.<sup>54</sup> A beneficiary must receive a plurality of primary care services from one of the contracted providers to be assigned to an ACO. This directly links the ACO's network to the attribution process. ACO leadership receive preliminary panels during the performance year based upon historic utilization. These panels are adjusted at year's end to reflect actual performance year utilization.<sup>64,65</sup> The ACO's cost and quality performance is calculated using this final list.

Organizations rely upon complete and perfect information to make operational decisions that minimize risk.<sup>66-69</sup> The retrospective reconciliation process introduces large uncertainty about the beneficiaries for whom an ACO is responsible. ACOs want to optimize the investment

of organizational resources to improve population health and achieve MSSP goals.<sup>70</sup> However, it is difficult to maximize performance without knowing the target one needs to reach. The uncertainty produced by MSSP attribution can potentially affect an ACO's proactive development and deployment of strategic interventions and initiatives aimed at improving value.<sup>64,65</sup>

Furthermore, the implementation of strategic and targeted population health initiatives often does not result in immediate and lasting changes. It can take years to modify utilization patterns, curve costs, and improve condition management—tenets central to the MSSP. This adds another important dimension to MSSP attribution process: patient panel stability over time. When an attributed population remains stable year-to-year, the ACO has greater opportunity to enact interventions and to witness returns on investment.<sup>71,72</sup> Previous research has shown that ACO patient panel stability is moderately associated with better ACO performance.<sup>71,73</sup>

It is critical to evaluate supply-side response and perceptions to understand program impacts and to identify effective strategies and best practices. In this study, we expand on prior ACO organizational literature by exploring the mediating relationship of the attribution process. Specifically, we analyze if ACO patient panel stability over time is a result of provider network comprehensiveness, or the inclusion of a minimum number of primary care and specialty providers necessary to serve a population. We then determine if patient panel stability is associated with patient and caregiver experience performance and changes in some select quality metrics.

## **3.3 METHODS**

### **3.3.1 Conceptual Framework**

We created a conceptual framework to detail the relationship between the ACO's provider network and shared savings (Figure 1). The direct relationship illustrates that the ACO's provider network achieves shared savings through changes to utilization. We hypothesized that the attribution process has a mediating effect on performance. The ACO's provider network informs the attribution process, which then impacts for which individuals an ACO is responsible and can alter utilization. This has an indirect effect on cost and quality performance. We identified organizational structure, market, and patient demographic/care-seeking behavior factors that could influence the attribution process.

We were particularly interested in the comprehensiveness of the ACO's provider network, which we defined as the necessary number of providers in each specialty to provide sufficient access and deliver care to a panel of patients. We hypothesized that the more complete the network, the better able a beneficiary would be to receive care or a referral to a provider contracted to the same ACO. By reducing or limiting the need to receive care outside of the ACO's contracted providers, the more likely a beneficiary would be to remain attributed to an ACO from year-to-year. We referred to this as patient panel stability.

### **3.3.2 Data and Analysis**

We obtained complete 2013 Medicare FFS beneficiary and provider files and 2014 Medicare FFS beneficiary and provider files for those beneficiaries with Medicare Part D from CMS. We began by defining our measure of network comprehensiveness. Due to its application in Medicare, its overall acceptability, and available data, we chose to use the Medicare

Advantage (MA) minimum number requirement definition for network adequacy.<sup>74</sup> We needed to modify the included specialties to better reflect MSSP objectives and CMS' attribution methodology. To do so, we used the 2013 Medicare FFS administrative claims to examine the proportion of evaluation and management (E&M) visits provided by each specialty for: 1) all Medicare FFS beneficiaries; 2) all Medicare FFS beneficiaries in the outpatient setting; and 3) Medicare FFS beneficiaries without a visit to a primary care provider (PCP). Based upon our analysis, we decided to include PCPs (general practice, family medicine, internal medicine, and geriatric) and all provider types delivering more than 1% of E&M visits to beneficiaries without a visit to a PCP. We chose this method because it aligned most closely with the MSSP ACO attribution methodology.<sup>75</sup> This resulted in the inclusion of 20 provider specialties listed in *Table 4*.

We used the 2013 Medicare MSSP provider file to count the number of contracted providers by specialty for each of the 2013 MSSP ACOs. We then identified all Medicare beneficiaries attributed to an ACO in 2013. Based upon the beneficiary residency, we generated a state-county code for each individual. The state-county codes correspond with the MA Health Services Delivery table, which provides the number of minimum providers per 1000 needed for network adequacy in that region.<sup>74</sup> These were weighted at the ACO-level and were calculated for each of the 20-identified provider specialties. Using the 2013 CMS MSSP ACO Public Use File (PUF), we adjusted the minimum number of providers needed by specialty category to account for the size of an ACO's attributed beneficiary panel.<sup>76</sup> We then created proportions of the number of contracted providers over the minimum number of providers needed in each specialty. We capped the proportions at one and created a score of network comprehensiveness for each ACO by averaging the proportions of all 20 provider categories. Thus, the network

comprehensiveness score represents the average of the ACO's network size across specialties relative to Medicare Advantage benchmarks.

In addition to network comprehensiveness, we controlled for other variables included in the conceptual framework. Organizationally, we adjusted for ACO-contract changes. To do that, we created a proportion of providers remaining within the ACO contract from 2013 to 2014 using the Medicare MSSP provider file. At the market level, we included a measure of an ACO's "footprint," which we defined as the proportion of providers delivering E&M services within a hospital service area (HSA) who are contracted with the ACO. We also generated a Herfindahl-Hirschman Index (HHI) measure at the HSA-level to account for variation in market concentration among ACOs. The HHI measures concentration of E&M providers for all of Medicare FFS.

To adjust for differences in attributed beneficiary populations, we included age and number of chronic conditions as defined by the Chronic Condition Warehouse (CCW). We included number of E&M events and number of emergency room visits from the beneficiary summary file and applied CMS' attribution methodology to determine if the beneficiary had the same attributing provider year-to-year to capture utilization patterns. Next, we included a series of patient population demographic variables, such as race, sex, and disabled and/or have end-stage renal disease. We also used the ZIP Code Tabulation Areas (ZCTA)-level demographic variables of percentage of individuals with a college degree, percentage living in a rural area, and median income to account for differences in care-seeking behavior.<sup>77-79</sup>

After creating these variables, we dropped six of the 220 ACOs that did not continue into 2014. We utilized a beneficiary-level logistic regression to determine the impact of network comprehensiveness on attribution to the same MSSP ACO in 2013 and 2014.

Finally, using 2013 and 2014 CMS ACO PUF, we obtained information on each ACO's quality performance for six-selected measures. We selected the quality measures that we believed were sensitive to composition of the ACO's network and population management over time. The measures include: 1) ACO 1: Getting Timely Care, Appointments, and Information; 2) ACO 4: Access to Specialists; 3) ACO 5: Health Promotion and Education; 4) ACO 21: Proportion of Adults who had blood pressure screened in past 2 years; 5) ACO 27: Percent with diabetes whose HbA1c in poor control; and 6) ACO 28: Percent with hypertension whose blood pressure <140/90.<sup>76,80</sup> We merged the performance results onto an ACO-level file for a sub-analysis. We ran generalized estimating equations (GEE) for normal distribution models for the ACO's patient/caregiver experience measures (ACO 1, 4, and 5) and population health management performance (ACO 21, 27, and 28) in 2013 and 2014 to determine within-ACO change. We included the ACOs' patient panel stability percentage as a key explanatory variable.

All analyses were conducted using SAS 9.4 and Stata 14.1.<sup>81,82</sup>

### **3.4 RESULTS**

Among all 220 ACOs in 2013, average network comprehensiveness was 25.78% (median = 23.64%), and there was substantial variation (SD = 19.67). The most comprehensive network included 86.0% of the minimum required number of in-network providers across the 20 specialty categories. ACOs were most sufficiently contracted with PCPs, averaging inclusion of 63.2% of the minimum providers necessary (median = 64.4%). Gynecology had the second highest score and was the only other specialty with a comprehensiveness measure over 50% (mean = 53%; median = 55.2%). There were three specialties (Vascular Surgery, Dermatology, and Oncology-

Medical, Surgical) averaged less than 10% of the contracted providers necessary to be considered adequate. *Table 4* includes the results for all 20 specialties.

There were 2,645,025 beneficiaries attributed to the included 214 ACOs in 2013. We matched 1,317,858 of these beneficiaries to our sample of 2014 Medicare beneficiaries with Part D coverage. A majority of these beneficiaries remained attributed to the same ACO between 2013 and 2014 (84.38%). Structurally, the ACO's provider network was also relatively consistent, with an average of 84.06% (median = 89.06%) of providers remaining contracted to the same ACO. The ACOs were operating in lowly concentrated markets (HHI <1500) and contracted with an average 9.38% of the E&M providers in the HSAs they are serving (median = 6.80%).

Beneficiaries were an average of 71.42 years old, mostly white (84.93%), and majority female (59.96%). The average chronic condition burden within the ACO panel was 3.89 conditions (median = 4.0). Within the ACO service areas, 30.46% of beneficiaries had a college degree, and 20.13% of the beneficiary's zip codes were rural. The average median income was \$59,480 (*Table 5*).

Using the logistic regression, displayed in *Table 6*, we found that, after controlling for market influences, patient demographic/care seeking behavior, and other organizational factors, a 0.10 increase in the network comprehensiveness score was associated with a 1.04 times greater odds of a beneficiary remaining attributed to an ACO ( $P < 0.001$ ). The percentage of providers remaining contracted to the ACO was also associated with greater odds of attribution stability (OR = 2.99;  $P < 0.001$ ). From a market perspective, a one percentage increase of providers contracted to an ACO within a Dartmouth-defined HSA increased the odds of maintaining an attributed patient from 2013 to 2014 by 8.04 times ( $P < 0.001$ ). Related to care seeking behavior,

greater numbers of E&M visits (OR = 0.99; P <0.001) and hospital emergency department visits (OR = 0.97; P <0.001), and having a disability or end-stage renal disease (OR = 0.97; P <0.001) were associated with lower odds of being attributed to the same ACO year-to-year. Also, a beneficiary receiving a majority of their E&M services from the same provider in both years, captured by the same attributing provider covariate, increased the odds of remaining attributed to the same ACO by 5.37 times. This was significant even after adjusting for ACO consistency in provider contracts (P <0.001).

To determine the association with quality, we ran six separate GEE with normal continuous distributions models. For patient/caregiver experience measures, patient panel stability was positively associated with the receipt of timely care, appointments, and information ( $\beta= 0.061$ ; P = 0.002) and the provision of health promotion and education ( $\beta= 0.039$ ; P = 0.03). The measure was not significantly associated with ACO performance related to access to specialists. For the population health management measures, we found that patient panel stability was significantly associated with decreases in the percent of beneficiaries with uncontrolled HbA1c values ( $\beta= -0.115$ ; P = 0.004) and increases in the percent of beneficiaries with hypertension and blood pressure readings less than 140/90 ( $\beta= 0.102$ ; P = 0.014). The measure of network comprehensiveness was also significantly associated with better diabetes control ( $\beta= -0.108$ ; P = 0.01). Patient panel stability was not associated with blood pressure screenings. Other significant covariates for all models are found in *Table 7*.

### 3.5 DISCUSSION

This study provides initial insights into ACO structural impact on attribution over time. We hypothesized that the current retrospective nature of the Track 1 and Track 2 MSSP ACO attribution process introduces many potentially mediating factors that influence the stability of patient panels. Stable patient panels may allow clinicians to efficiently and effectively build and target programs to achieve cost and quality benchmarks. We found that several structural and market influences increased the likelihood of a beneficiary staying with an ACO in 2013 and 2014. In particular, the more comprehensive the ACO provider network, the greater the odds of patient panel stability from year-to-year. We also found that patient panel stability is associated with several positive quality outcomes.

Based upon the HHI, we know that ACOs are operating in highly competitive HSA markets ( $HHI < 1500$ ), which indicates that most beneficiaries have the choice of many E&M providers.<sup>83</sup> This has a twofold effect on ACOs: 1) because beneficiaries have the ability to see any Medicare provider, the number of options threatens an ACO's ability to coordinate effective and efficient patient care within their ACO, and 2) E&M visits to other providers outside of an ACO's contract could affect attribution. To that extent, we identified that the more providers contracted to an ACO within a HSA increased the odds of a beneficiary remaining with an ACO from 2013 to 2014. These results, coupled with the significance of network comprehensiveness, indicate that an ACO's leadership needs to consider market competition in contracting with providers. Reducing external competition can improve patient panel stability. This can help ACOs better anticipate and strategically manage attributed beneficiaries. The overall success of the MSSP model may be moderated by the highly competitive Medicare FFS market in which many MSSP ACOs currently operate. In the Notice of Proposed Rulemaking of 2017 Benefit

and Payment Parameters, CMS even offered proportion of providers covered in a geographic area as an alternative measure of network adequacy for qualified health plans on the federally-facilitated exchanges.<sup>84,85</sup> This reinforces the market's importance on the provision of care and management of beneficiaries.

The quality models showed positive associations between certain disease management measures and patient panel stability. Specifically, patient panel stability was associated with improved diabetes and hypertension control. Though the results are promising, we are unable to determine specific provider behaviors that are responsible for the improvements. Qualitative studies have been and should be continued to be conducted to understand ACO care coordination and disease management over time. In particular, length of provider-beneficiary relationship and variation in self-management strategies should be explored. We discovered in our beneficiary-level logistic regression that the consistency of provider-beneficiary relationships increases odds of remaining attributed to the same ACO. This potentially indicates that length of relationship affects management strategies and a beneficiary's overall utilization. Though more research is needed, our findings validate the conceptualization of the ACO model and its ability to impact longitudinal patient-level outcomes.

Finally, we found that a high percentage (84.38%) of beneficiaries were attributed to the same ACO in 2013 and 2014. This indicates that prospective assignment alone may be a sufficient attribution strategy. Using prospective assignment can better support care coordination and program innovation for participating provider organizations, which echoes the arguments of several ACO advocacy groups. We recommend additional qualitative work to explore how attribution influences ACO strategizing and programming.

### 3.6 LIMITATIONS

The cross-sectional nature of this study limits our ability to understand the impact of organizational network comprehensiveness and other important covariates on patient panel stability over time. Relatedly, there is limited structural and process insights that can be gleaned from administrative claims data. This restricted our capacity to control for management structure, use of care coordination and case management, and hospital-associated or provider-led status. These factors have been shown to influence ACO performance in previous literature.<sup>61,86,87</sup> We also only had claims available for Medicare Part D enrollees in 2014. These individuals may be inherently different from those beneficiaries who do not have Part D coverage, which could influence our outcomes. We also recognize the potential for endogeneity between attribution to the same provider and the outcome variable. We decided to include attribution to the same provider, capturing consistency of provider-patient relationships as an important measure of care-seeking behavior

We chose to utilize a Medicare Advantage specifications for network adequacy in our measure development. We selected this definition for our measure of network comprehensiveness because it is a widely accepted measure for the Medicare population, and it allowed us to capture a wide scope of provider specialties. The use of time and distance from beneficiary to provider was not feasible in this study based upon available data. Though we selectively chose what provider types were included, the overall definition may not be appropriate for ACOs. The Medicare Advantage network specifications were created for a distinctively different entity than ACOs. Medicare Advantage plans have the capability to deny services provided by certain providers. The network adequacy specifications ensure access to care for members, and ACOs are not able to restrict access in the same way as those plans. Still,

this provides a benchmark for the Medicare population that can be used to understand ACO network comprehensiveness and how it is associated with patient attribution and performance.

### **3.7 CONCLUSIONS**

As the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) implementation continues, CMS will be providing bonus payments for Medicare provider participation in APMs like the MSSP ACO model. CMS hopes to have a majority of providers participating in advanced APMs in the near future. In an advanced APM, the providers assume some downside risk for performance. The push to participate in APMs and the escalating risk associated with participation will add pressure to providers to plan, structure, and implement the models and programs in the strongest manner possible. Providers are the true mechanism of change in these APMs. It is critical to know how the supply-side perceives and responds to incentives, so that adjustments can be made to improve overall program performance. This study contributes to the existing literature and informs future decision-making. Our findings are important because they can empower ACOs to compose a provider network that mitigates the effect of the attribution process, positioning the ACO for better performance in select quality measures. Researchers will need to continue to explore organizational influences on ACO performance to identify and spread best practices.

## **4.0 HOME- AND COMMUNITY-BASED SERVICE PROVIDER RESPONSE TO RATE STANDARDIZATION**

### **4.1 ABSTRACT**

**Background:** Pennsylvania experienced a 213% growth in home- and community-based services (HCBS) expenditures from 2003 to 2011. To better control costs, Pennsylvania Act 22 of 2011 provided the PA Department of Human Services the ability to establish a standardized fee schedule for HCBS programs. While reducing large disparities in payment, this approach also dramatically changed level of payment for some providers. Changes in reimbursement can impact the decisions providers make about regional scope of practice and how services are delivered. In this study, we examine HCBS provider behavior and response to this exogenous rate standardization.

**Methods and Results:** We used Pennsylvania Medicaid claims data from 2011 to 2013 to analyze the volume of services provided by HCBS providers in the Aging waiver, which serves nursing-facility eligible adults over the age of 60. We focused on high volume provider categories: adult day care (ADC), agency personal assistant services (PAS), and home delivered meals for analysis purposes. We used a logistic regression with a 6-month lag to evaluate HBCS providers' exit, a linear regression with 6-month lag to evaluate entry of new providers, and a generalized estimating model with a Poisson distribution to measure volume changes.

In the 6 months prior to the rate change, there were 102 ADC, 407 PAS, and 57 meal providers operating in Pennsylvania. After the 6-month lag, there were 99 ADC, 438 PAS, and 54 meal providers.

The rate change did not significantly affect exit for PAS ( $p=0.88$ ) or ADC providers ( $p=0.32$ ). Meal providers were 6.4 times more likely to continue services in counties when the rate increased by \$0.10 than when it remained constant ( $p=0.01$ ). Rate changes did not significantly affect provider entry for any service line.

There was evidence that rate changes and market conditions affect volume. PAS providers decreased the number of units billed monthly by 3.1% when the rate increased by one dollar. ADC providers also had a significant 1.9% reduction in monthly volume when rates increased ( $p<0.001$ ). Contrastingly, an increase in the rate was associated with a 3.7% increase in meals delivered per month.

**Conclusions and Policy Implications:** We identified variation in response by type of service. Meal providers were sensitive on both the extensive and intensive margin, while ADC and PAS providers only showed a response on the intensive margin, or the volume of service units billed. Each of these provider types are structured differently. This indicates that HCBS providers are making strategic operational and production decisions based upon their organizational structure and operating expenses.

The Commonwealth of Pennsylvania Medicaid is transforming to managed long-term services and supports (MLTSS) beginning in 2018. Under this new policy, rates will be set by private insurance companies. These findings suggest that attention to both cost and volume is important to understanding the impact of the policy change.

**Key Words:** Organizational Behavior; Volume Offset; Payment; Exit; Medicaid; Waiver

## 4.2 INTRODUCTION

A large proportion of Medicaid dollars are devoted to a relatively small, high-cost patient population. In fact, nearly 66% of total Medicaid spending is devoted to 28% of all enrollees. Those 28% fall into the categories of older adult and/or disabled beneficiaries.<sup>88,89</sup> To address the needs of these subpopulations, there has been a refocused effort to expand home- and community-based services (HCBS) as the preferred, lower-cost alternative to institutionalized care.<sup>90,91</sup> In Pennsylvania, the HCBS program expenditures grew by 213% from 2003 to 2011, equating to a growth of over \$1 billion.<sup>92</sup>

Until 2011, the Area Agencies on Aging (AAA) negotiated service rates locally and individually with each HCBS provider.<sup>93,94</sup> Pennsylvania Act 22 of 2011 changed this process and exempted the PA Department of Human Services (DHS) from Regulatory Review Act, section 205 of Commonwealth Documents Law, and section 204(b) of the Commonwealth Attorneys Act regulations.<sup>94</sup> Essentially, Act 22 provided DHS the ability to establish a standardized fee schedule for HCBS programs independent of the oversight of the General Assembly or the Independent Regulatory Review Commission.

DHS divided the state into 4 regions for payment and used a rate methodology that accounted for regional differences in program expense, such as wages, travel time, and oversight costs.<sup>95</sup> While reducing large disparities in payment across the Commonwealth and establishing centralized contract management, this approach also dramatically changed the level of payment for some providers. Many provider and advocacy groups were concerned about the impact of the fee schedule on the ability to maintain solvency and meet the needs of the waiver population.<sup>96-98</sup>

We focus on high volume and reliably billed provider categories for analysis purposes: adult day care (ADC), agency personal assistant services (PAS), and home delivered meals.

Researchers have determined that these three categories are complementary and substitutable in the Pennsylvania Aging waiver.<sup>99</sup> Participants often receive some combination of these services and may have alterations in constellation of services as care needs change.<sup>99</sup> The structure and format of delivery vary, which may influence provider response. ADC providers must have a physical location where clients convene to receive services.<sup>100</sup> PAS agency providers have a completely distributed workforce, which is composed of agency-employed individuals responsible for providing services in the home.<sup>101</sup> Meal providers need a centralized location for meal pick-up and distribution and often rely upon volunteers to deliver meals.<sup>102</sup> These differences can help distinguish the effects of payment by operational structure.

The overall goal of the proposed study is to examine the impact of rate changes on ADC, agency PAS, and meal provider behavior. Specifically, we are interested in building understanding about the Pennsylvania Aging Network's response and ability to adapt to new payment models. To evaluate the impact of the rate change, we determine how the rate change affected HCBS providers' market entry and exit and measure changes in service volumes prior to and after the rate change.

### **4.3 CONCEPTUAL FRAMEWORK**

We designed the study to explore potential changes to an HCBS provider's extensive (Aim 1) and intensive margin (Aim 2). The extensive margin refers to an organization's decision on where to operate, whereas the intensive margin refers to how much to produce.<sup>103,104</sup> In particular, we were interested in location of operation and changes in volume of services. For

both aims, we have developed a hypothesis, rooted in economic theory and connected to existing literature.

HCBS providers deliver services within the patient's home or community. If services are provided in the home, HCBS providers may require a diffuse workforce. This creates capacity to care for individuals across a wide geographic service area. HCBS providers must make decisions about where to deliver services and how to deploy employees to maximize profits and obtain cost-efficiencies.<sup>105</sup> Specifically, HCBS providers are trying to achieve economies of scale, where the fixed costs to operate in a particular geographic area are manageable.<sup>106,107</sup> If the fixed costs are too great, the provider must reduce costs by reducing waste and/or non-productive expenses.<sup>108</sup> In other words, travel time to client, number of employees, types of services offered, and/or size of service area could be targets for waste reduction. We hypothesize that the number of providers declined and fewer providers entered into the market in counties where rates decreased.

The evidence on reimbursement's impact on Medicaid HCBS markets is limited. We turned to research on Medicare home health and nursing homes to inform our hypotheses. After changes to Medicare home health care financing in the Balanced Budget Act of 1997,<sup>109</sup> researchers examined impact to home health market exit and entry. When payment was reduced, entries were limited, and exits increased.<sup>110</sup> Specifically, Choi and Davitt found greater closures and fewer market entries as the transition to the Prospective Payment System occurred. After which, greater numbers of branch offices were closed.<sup>111</sup> Entrants into the Medicare home health market were more likely to act in ways that maximized profit margins.<sup>112-114</sup> This evidence indicates that the home health market is responsive to payment reform. This can impact market structure and potentially access to services.<sup>110</sup> Similar research has been done on nursing homes,

finding that lower capacity, market competition, and lower Medicaid reimbursement rates are associated with greater likelihood of closure.<sup>115,116</sup>

Addressing changes to the intensive margin, we hypothesize that the HCBS providers will increase the number of units billed to recover lost revenue if rates are reduced. Provider attention has turned to their bottom-line, focusing their actions on maintaining revenue levels and operating margins.<sup>117</sup> Providers have fixed, variable, and marginal costs that need to be met in order to remain solvent in the short- and long-run.<sup>118</sup> Based upon past performance and present conditions, providers and practice managers can estimate what level of production needs to occur or, more accurately, the number of services needed to be delivered to achieve desired financial goals.<sup>105,119</sup> When rates change, providers may offset volume. Volume offset is a provider-induced demand for services that lessens or negates the decline in income.<sup>120-124</sup>

Researchers have previously explored volume offset, or changes in the volume of services to counteract payment changes, amongst physicians participating in Medicare. Some studies have shown that physicians increased volume to offset nearly half the drop in payment rates,<sup>120,125</sup> while others have found no significant relationship between rate changes and volume of services.<sup>121,126</sup> McKay and Domer applied volume offset to determine physician response to a Medicaid reimbursement method, but found no significant impact in the following years.<sup>127</sup>

Our study builds upon this existing evidence and addresses several important gaps. We add to the field by focusing on specific HCBS providers participating in Medicaid, the primary payer for HCBS. As indicated in prior research, rate changes have the potential to shift markets. It is important to understand HCBS provider response to rate changes, particularly as federal and state-level governments attempt to rebalance institutional and community-based long-term services and supports.<sup>128,129</sup>

## 4.4 METHODS

### 4.4.1 Data

This natural experiment has been built around a Pennsylvania policy change in June of 2012. Pennsylvania Medicaid administrative claims data from 2011 to 2013 are used to analyze the operations of HCBS providers in the Aging waiver, which serves nursing-facility eligible adults over the age of 60. The dataset was restricted to select HCBS categories for analysis purposes. We selected the following HCBS categories: ADC; agency PAS; and meals. All facilities, providers, and suppliers that were reimbursed by Medicaid for these in-home services are included within the claims dataset.

We used the 2012 and 2013 fee schedules to determine the per unit price of a service. There is no publically available information on what providers were paid per unit in 2011. To determine the per unit price for each HCBS category and provider, we divided the paid amount by the units billed, which is included on the claim details. This enables comparisons to the standard rates implemented in the following years.

To answer our two aims, we utilize two distinct timeframes centered around the June 2012 rate standardization. We decided on this approach so that the associated market changes could be observed. For Aim 1, we created a 6-month pre-period (12/1/2011 to 5/31/2012) and a lagged 6-month post-period (1/1/2013 to 6/30/2013). We utilized a 6-month lag after June 2012 to allow for market stabilization. We hypothesized that market exit, in particular, would not happen immediately following the change, but rather, it would take time for providers to feel its impact and make decisions regarding future operations. Also, we dropped providers who billed services in the pre-period, but exited the market prior to the rate change in Aim 1. For Aim 2, we used 3/1/2012 to 9/30/2012, which is three months prior, the month of, and three months after

the rate change. We applied this timeframe to capture providers' immediate volume offset behavior. Providers anticipate monthly expenditures and are able to adjust the intensive margin or service units delivered to cover those costs. We wanted to capture on-the-fly ability to modify production around the June 2012 rate change.

#### **4.4.2 Measurement**

We utilized the same covariates in all regressions models, though number of beneficiaries served is excluded in the volume offset model. Weights vary based upon level of analysis. From the claims data, we calculated total number of beneficiaries served, total number of units billed, change in provider rate, and the Herfindahl-Hirschman Index (HHI) for market concentration.<sup>83</sup> In Aim 1, these were aggregate at the county-level. We included ZIP Code Tabulation Area (ZCTA)-level demographic variables from the American Community Survey and Census data to capture percentage of households with an individual 65 years or older living alone, median income, and rurality.<sup>77,79,130</sup> These measures were weighted by beneficiary-ZCTA for each county in which the HCBS provider operated in Aim 1, but remained at the beneficiary-level for Aim 2. Finally, we included two market-level variables: average hourly pay for home health workers and non-residential lease revenue. Home health worker wages were obtained for Pennsylvania's metropolitan and non-metropolitan areas from the Bureau of Labor Statistics.<sup>131</sup> Non-residential lease revenue for each county was obtained from the Economic Census of the US.<sup>132</sup> We input a regional average based upon Pennsylvania Medicaid regions for the 8 counties in which data was not available.

### 4.4.3 Statistical Analyses

We calculate descriptive statistics to illustrate the HCBS provider landscape for Pennsylvania's Aging waiver before and after the rate change, aligning with Aim 1's timeframe. The frequency of providers and claims are summarized by service category. We then run three models to test our hypotheses. To measure market exit, we utilize a logistic regression at the provider-county level. Our dependent variable is continued operation in a county in the pre- and post-period. Because we do not have any pre-period information on new entrants to a county, we create a proportion of new entrants to total number of providers. This serves as our dependent variable. We run an ordinary least squares (OLS) regression, utilizing the average rate change experienced by providers in that county as our primary independent predictor. We also tested a generalized linear model with a logit link and binomial distribution because the dependent variable was a proportion. Results were consistent.

Finally, we used a generalized estimating equation with a Poisson distribution to measure volume changes. We generated a unique provider-beneficiary identification number, on which we grouped the data over time. Conclusions about provider response to the exogenous rate change are made through summarization and analysis of model results.

We use SAS 9.0 and Stata 14.1 for our analyses.<sup>81,82</sup>

## 4.5 RESULTS

In the 6 months prior to the rate change, there were 102 ADC, 407 PAS, and 57 meal providers operating in Pennsylvania (*Table 8*). After the 6-month lag, there were 99 ADC, 438 PAS, and 54 meal providers. Correspondingly, PAS and ADC providers were participating in a

moderately concentrated market, while meal providers were in highly concentrated markets across both periods. Meal providers served beneficiaries in counties that averaged \$0.23 less in hourly wages for home health workers and earned \$617,560 less in non-residential lease revenue than ADC and PAS providers. On average, meal providers served beneficiaries in 12.58% more rural areas. The percentage of households with a 65 or older individual living alone ranged from 12.26% to 12.95% for all service providers in the pre- and post-period. The number of beneficiaries served and total volume of services billed increased for PAS and meal providers, but decreased for ADC providers.

In regards to the price change, ADC providers experienced an average increase of \$5.11 per day, while PAS rates decreased \$0.10 for each 15-min unit and meal rates decreased by \$0.05 per meal. We further examined the rate change by region for each service line (*Figure 2*). PAS providers in Region 1, which encompasses Southwest Pennsylvania, experienced an average rate cut of \$0.46 per unit (SD: 0.59), which was the largest of the four regions. Contrastingly, PAS providers in the more rural, central and northern tier of Pennsylvania, or Region 2, had an average increase of \$0.23 (SD: 0.49) per service unit. Meal rates decreased by around \$0.04 for the Capital/Lehigh and Southeastern regions (3 and 4, respectfully), while they increased by an average \$0.11 (SD: 1.05) in the Southwest. We saw average increases in overall ADC payment in all regions but the Southeast, which includes Philadelphia and surrounding counties. When separated by type of ADC, it is clear that the rate change is most dramatic amongst full-day (n=88) and half-day (n=14) providers. Providers of full-day ADC had the highest variation in payment change (SD: 10.65). Those in Delaware and Philadelphia counties experienced rate cuts over \$18.63 per day, while some counterparts in Northampton, Blair, and Armstrong saw increases in daily payment upwards of \$22.86.

Over three-fourths (78.3%) of providers continued to provide services in the same Pennsylvania counties 6 months after the rate standardization. There were 5 ADC, 36 PAS, and 1 meal provider that left the market prior to the rate change. During the 6-months after the rate change, 13 new ADC, 77 new PAS, and 3 new meal providers began to serve Pennsylvania's Aging Waiver. Compared to 80.3% of PAS and 79.7% of meal providers, only 65.3% of ADC providers were active in the same counties in the post-period. There were differences amongst ADC providers by types of service. Only 59.5% of full-day service providers and 28.57% of half-day service providers remained operating in the same counties. Among the enhanced day service providers, who did not experience a large price change, retention was 76.09%. The rate change did not significantly affect exit for PAS ( $p=0.89$ ) or ADC providers ( $p=0.32$ ) (*Table 9*). When we examined subsets the ADC providers, full-day ADC service providers trended towards being 5.9 times more likely to continue providing services for every dollar increase in payment ( $p=0.07$ ). Similarly, meal providers were 6.4 times more likely to continue services in counties when the rate increased by \$0.10 ( $p=0.01$ ). PAS providers were also more likely to remain in operation in the county for every 1,000-unit increase in services billed. Additionally, as the percentage of households with someone over the age of 65 living alone increased, PAS providers trended towards a greater likelihood of continued operation ( $p=0.07$ ). Other market place predictors were not significantly associated with exit from the county.

In regards to entry, new providers composed an average of 16.70% of the ADC county-level market, 17.08% of the PAS agency county-level market, and 11.64% of the meals county-level market. The market concentration of meal providers was the only predictor significantly related to the proportion of new providers across all three service types (*Table 10*).

There was evidence that rate changes and market conditions affect volume, shown in *Table 11*. PAS providers decreased the number of units billed monthly by 3.1% when the rate increased by one dollar. ADC providers also had a significant 1.9% reduction in monthly service units when rates increased ( $p<0.001$ ). Contrastingly, an increase in the rate was associated with a 3.7% increase in meals delivered per month. Rurality had differential effects on volume. As participants lived in increasingly rural settings, ADC and meals decreased by 13% and 11%, respectively, while PAS increased by 7%. From a market perspective, a one-point increase in market concentration resulted in a 1% decrease of PAS units per month ( $p<0.001$ ) and meals per month ( $p<0.001$ ). Increases in median household income and non-residential lease revenue in the county of residence were all significantly associated with increased volume of services for ADC, PAS, and meals ( $p<0.001$ ). Greater percentages of households with a 65 year old and older adults living alone were associated with significantly higher volume of PAS services, but a reduction in number of ADC services and meals ( $p<0.001$ ).

All other things being held constant, volume of PAS services is growing. Marginal predicted volume of services is 340.25 units per month three months prior to the rate change. Volume increases to a predicted 346.84 units per month prior to the rate standardization, and it continues to increase to 359.90 units during the month of the rate change and over the following two months. The final month of observation shows a 2.9 unit decrease from the previous month. The average difference between units billed in the 3 months prior and the 3 months after the rate change is 13.84 units per month. There does not appear to be a clear pattern of growth in billed units per month for ADC or meal services.

In addition to the primary analyses, we measured the impact of the rate change on provider diversification. Prior to the change, all provider types averaged slightly over one

service line. After the rate change, meal providers increased diversity by 0.51 services, on average, while ADC and PAS providers did not have large changes in number of service lines. We found that the addition of service coordination was associated with 83 times more likelihood of increased diversity. Service coordination was newly introduced as a billable HCBS at the same time as the rate change.

#### **4.6 DISCUSSION:**

In this study, we explore how select HCBS providers responded to an exogenous rate change. We identified variation in response by type of service. Meal providers were sensitive on both the extensive and intensive margin, while ADC and PAS providers only showed a response on the intensive margin, or the volume of service units billed. Each of these provider types are structured differently. By applying knowledge about organizational structure, we can better explain differences among significant factors that motivated operational decisions and production.

As brick-and-mortar entities, ADC providers have high fixed costs. The ADC's physical location must meet mandated requirements, such as including "50 square feet of indoor program space for each client" and a specified parking area for the arrival of clients.<sup>133</sup> The long list of requirements can escalate the rent, maintenance fees, and/or overall fixed costs of remaining in operation. ADCs also must not exceed a 1:7 staffing-client ratio, meaning only a certain number of clients can be served at any time. Contrastingly, agency PAS providers hire and employ workers, which they send out to client homes. There is no convening location to receive services, which can reduce overhead costs. PAS providers lose revenue on travel time to clients.

Because of this, employees typically have a regional responsibility, creating a diffuse workforce. The diffuse workforce allows the PAS provider to easily shift or hire employees in areas where unmet care needs exist. Still different, meal providers require a central location to prepare the meals. These locations must meet food safety standards. Employees or, more often, volunteers then deliver meals to client homes several times a week.<sup>102,134</sup>

We did not determine that the rate change was an important predictor of county-level exit and entry among ADC providers. However, the rate change trended towards a significant association with the exit of full-day ADC providers, a subset that experienced the largest price shocks. We further found that ADC providers were more likely to continue operation when they served more beneficiaries. Based upon these findings, it appears that the ability to cover costs is fundamental to keeping doors open.<sup>100,135</sup> Revenue generated is a calculation of the rate paid and service units delivered. In this case, the number of beneficiaries served may be a better predictor than service units delivered, due to the capacity restraints of ADC centers.<sup>100</sup> In regards to entry to the market, the number of ADC providers decrease across the state over the selected period. We may not have appropriately captured larger market trends that affect ADC entry.

PAS providers were significantly more likely to remain in operation within the county when they billed more service units and trended toward continued operation when the percentage of older adults living alone increased. Increases in the units of PAS delivered is associated with complexity and level of need.<sup>136,137</sup> The significant association between service units, but not number of beneficiaries, potentially indicates that PAS providers are serving high-need individuals and providing greater intensity of care. When older adults are living alone, they may not have support available to help in activities of daily living (ADL).<sup>136,138,139</sup> In those instances, having a home health aide sent to the home could be critical. Due to their business structure and

model of care delivery,<sup>101</sup> they are able to easily redistribute and alter the number of workers employed. This ability to flex employees corresponds with the model results, showing continued operation in areas where high-need exists and in-home support may not be readily available. It appears that PAS providers are actively pursuing economies of scale, as hypothesized.

Similar to ADC, we did not find significant results between hypothesized covariates and PAS provider entry to the market. The number of PAS providers did increase over this time. This, in combination with the decreased number of ADC providers, could reflect a larger market trend of changing consumer preferences and the desire to receive services in the home.

Meal providers were the only group whose county-level exit was significantly associated with the rate change. They utilize a different business model than ADC and PAS providers. Unlike ADC or PAS providers, there is minimal capacity to reduce workforce. The operating budget for these providers is often slim, which is why the volunteer network is essential. Owing to this, meal services may not be the primary service line for many organizations. It can be an additional support that AAAs or other organized healthcare delivery systems offer to clients.<sup>140,141</sup>

In the entry analysis, the proportion of new meal providers was greater in counties with more concentrated markets. This means that there were less competitors, creating room for new entrants. With less competitors, there may be greater unmet need. It appears that meal providers operate in markets where they see the potential to make a margin on the meals delivered and where the service is needed and in-demand. More qualitative and quantitative research on organizational differences between provider types should be done to verify and validate these findings.

For Aim 2, we hypothesized that providers would be able to estimate the level of production needed to remain solvent and adjust volume and output based upon those projections. The ADC and PAS providers significantly decreased the volume of services billed per month when the reimbursement rate increased. This corresponds with the anticipated volume offset behavior. However, meal providers moved in the opposite direction. When rates increased, the number of meals delivered also increased. These results may also be related to the organizational structure of meal providers. If meal provision is not the primary line of business, providers could use it as a method to supplement revenue. Furthermore, the marginal cost of an extra meal is not large. This means it could be easy to increase output to make some additional money. The marginal costs for ADC and PAS providers is much more substantial, including transportation and employee wages. These results are consistent with our explanation for the entry and exit of meal providers.

ADC and PAS providers were both likely to decrease volume when the home health workers hourly pay was higher. ADCs have physical and staffing capacity concerns within their facilities.<sup>100</sup> The facilities can only hold so many people at a given time, and the ADC must maintain a program staff-client ratio of 1:7.<sup>133</sup> In combination with other fixed costs and capacity issues, higher hourly wages may push the ADC to hire fewer workers. This would potentially restrict the number of hours or days a beneficiary could spend at the ADC center and/or restrict the number of beneficiaries served. We see the impact on beneficiary ADC days in our model. Similarly, PAS providers appear to be making similar decisions. If wages increase, PAS providers may decide to eliminate a position—a major cost. The caseload for that position would be redistributed, assuming that they wanted to maintain the same number of clients. However, there is only so much capacity for one home health worker. Due to that, volume of

care delivered per beneficiary would most likely decrease. We do not see the same effect in meal providers, which makes sense based upon the traditionally-used volunteer model.

By reviewing the rest of the volume offset results simultaneously, one can see the complementary and substitutable nature of the service lines. The volume of services delivered by ADC and meal providers decrease as rurality and those over the age of 65 living alone increases. Coordinating transportation from rural communities to ADC centers can be difficult, and the length of travel time could be a deterrent for beneficiaries in more remote communities.<sup>100,142,143</sup> Because of this, PAS may be used as an alternative service, where the home health worker instead travels to the client's home to provide care. The results show that as rurality and those over the age of 65 living alone increases, PAS volume also increases. Once in the home, PAS providers assist with the beneficiary's ADLs. This can include cooking meals and feeding the individual, reducing the need for a meal delivery service. From these results, we can potentially see some substitution in services based upon rurality and living status. Further research is needed to fully understand the relationship between HCBS lines.

#### **4.7 LIMITATIONS**

There are several limitations to this study. First, we define HCBS to include only the Pennsylvania Medicaid services that we believe are complementary and substitutable. This strategy may have excluded other relevant services delivered in the home and community. Additionally, Pennsylvania Medicaid provider codes do not have readily accessible or clearly classified definitions, so it is difficult to determine how providers are precisely operating and delivering services. Some providers in the system may simply be acting as third-party

administrators. It is nearly impossible to discern provider role and function from the claims data. Researchers should attempt to include organizational structure data in future analyses, which would enhance understanding and interpretation of results.

Another limitation is the inability to know definitively the 2011 provider HCBS reimbursement rate. We use the best methodology available to calculate the per-unit cost for each provider and service. Also, there were other changes going on across Pennsylvania during the study period in the healthcare realm and the greater external environment. Though the assumption is made that all providers were exposed to similar experiences during that timeframe, some may have had unanticipated exposures that were not controlled for in the analysis plan. In other words, history may be acting as a threat to internal validity.

Finally, we do not control for case mix in this study. We are assuming that the population is relatively homogenous in its care needs and complexity based upon the criteria needed to be eligible for Aging Waiver benefits. Additionally, we are interested in the providers' operational response. This is not likely tied to any individual-level characteristics, but rather trends across the beneficiaries served. We attempt to control for these larger socio-economic and demographic characteristics in our models. By not adjusting for case mix, we are leaning on several assumptions that can be seen as a limitation in our modeling decisions and hypothesis development.

## **4.8 CONCLUSIONS**

The Commonwealth of Pennsylvania Medicaid is going through even greater transformation as managed long-term services and supports is implemented in 2018 through

2020. It should be a priority to understand how the HCBS providers are responding to payment changes and altering operations in regards to waiver populations, who require specific care services to meet their needs. In particular, assessing the composition of the Aging Network will be of particular interest as attention and energies are devoted to helping individuals receive care and remain in their home and community as a lower cost and patient-preferred option. This study provides a foundation for understanding the impact of rate changes in the Commonwealth on HCBS provider behavior and service delivery, and it creates a baseline for future analyses.

## APPENDIX TABLES AND FIGURES

**Table 1: Summary of Qualitative Data Collection by Unit**

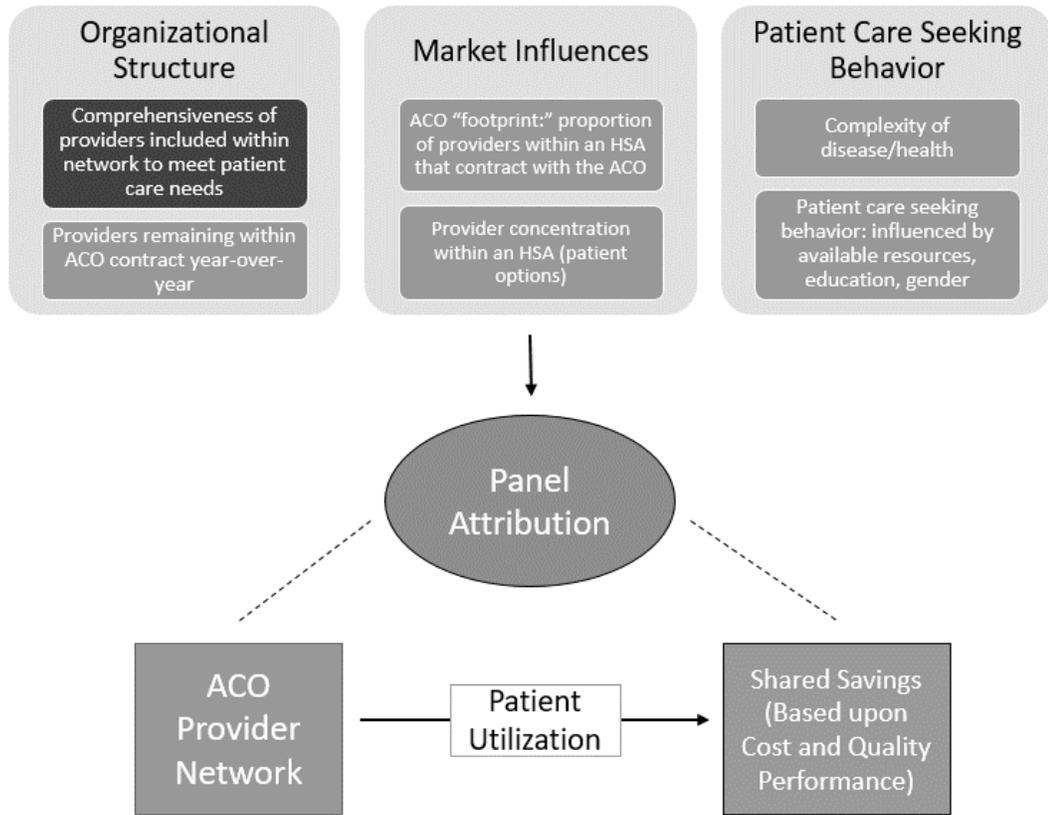
| Location        | Beds (n) | Observation Time | Unique Observations (n) | Interviews (n) | Positions Interviewed  |
|-----------------|----------|------------------|-------------------------|----------------|--|
| <b>Rural</b>    | 49       | 32 hours         | 106                     | 10             | 6 Registered Nurses<br>2 Physician Assistant Hospitalists<br>1 Care Manager<br>1 Hospital Unit Coordinator |
| <b>Suburban</b> | 437      | 40 hours         | 116                     | 9              | 6 Registered Nurses<br>1 Unit Manager<br>1 Care Manager<br>1 Patient Care Coordinator                      |
| <b>Urban</b>    | 489      | 34 hours         | 80                      | 8              | 6 Registered Nurses<br>1 Unit Manager<br>1 Admissions Team Member  |

**Table 2: Interview Codes, Definitions, and CARE Act or PARIHS Component**

| CODE  | CHILD CODES                             | DEFINITION  | CARE ACT/PARIHS COMPONENT                             |
|---|---|---|---|
| <b>CARE ACT IMPLEMENTATION</b>                  |   | The local implementation of a system-wide initiative and the integration into current workflow and processes                                | PARIHS: Context                                       |
|   | Changes in Practice                     | Perceived changes as a result of the initiative   | PARIHS: Context                                       |
|   | Communication of CARE Act               | How did frontline staff learn about the initiative and its goals  | PARIHS: Context and Facilitation                      |
|   | Recommendations for Improvement         | Opportunities for continued learning around this initiative and for future system-wide roll-outs as identified by frontline staff           | PARIHS: Evidence                                      |
| <b>COLLABORATIVE PRACTICE AND COMMUNICATION</b> |   | Interprofessional interactions in the delivery of patient and caregiver education   | PARIHS: Facilitation                                  |
| <b>LANGUAGE</b>                                 |   | The impact of word selection and communication in patient and caregiver identification and education  | PARIHS: Evidence                                      |
| <b>PATIENT-CENTERED CARE AND EDUCATION</b>      |   | Descriptions of how patients are placed at the center of the care team and have their values and opinions reflected in the delivery of care | PARIHS: Facilitation                                  |
| <b>UNIT CULTURE</b>                             |   | Descriptions of the unit, patient population, and approach for delivery care/working together   | PARIHS: Context                                       |
| <b>PROCESSES</b>                                |   | Descriptions of the overall workflow and care process   | PARIHS: Context                                       |
| <b>CAREGIVER EDUCATION</b>                      |   | The delivery of training and education to family caregivers   | CARE Act: Education                                   |
|   | Place or Point of CG Education Delivery | The time and place in the delivery of care workflow that education is being delivered to caregivers   | CARE Act: Education and PARIHS: Context               |
| <b>CAREGIVER ENGAGEMENT</b>                     |   | The inclusion and active participation of caregivers in the care process  | CARE Act: Identification and PARIHS: Context          |
|   | Barriers to Caregiver Engagement        | Perceived barriers to caregiver participation, as defined by frontline staff  | PARIHS: Context, Facilitation, and Evidence           |
|   | Benefits                                | Perceived benefits in the delivery of care and post-acute outcomes when the caregiver is engaged  | PARIHS: Facilitation and Evidence                     |
|   | Caregiver Activities                    | When the caregiver is engaged, how do they behave and interact with the frontline staff   | PARIHS: Context                                       |
|   | Caregiver Notification                  | How does frontline staff notify a caregiver about the discharge plan  | CARE Act: Notification                                |
|   | Facilitators to Caregiver Engagement    | Perceived facilitators to caregiver participation, as defined by frontline staff  | PARIHS: Context, Facilitation, and Evidence           |
| <b>DOCUMENTATION</b>                            |   | The noting and recording of patient education and caregiver information in the medical record   | CARE Act: Identification, Notification, and Education |

**Table 3: Recommendations for Future Refinements**

| <b>Gap</b>                                       | <b>PARIHS Framework</b> | <b>Recommendation</b>   |
|--|-------------------------|---|
| <b>Local leadership buy-in</b>                   | Context                 | Find a local champion to effectively communicate the goals of caregiver initiatives and support ongoing improvement efforts   |
| <b>Communication to all provider types</b>       | Context                 | Invoke a communication strategy that leverages the numerous health professional networks within the hospital or health system |
| <b>Incentives to redesign care processes</b>     | Context                 | Demonstrate return-on-investment for caregiver initiatives  |
| <b>Accessible caregiver contact information</b>  | Facilitation            | Integrate caregiver information as clinical decision support tool that fits within in workflow                                |
| <b>Change to caregiver educational process</b>   | Facilitation            | Expand evidence on caregiver education and engagement for a general inpatient population                                      |
| <b>Institutional research and best practices</b> | Evidence                | Utilize stakeholder feedback and evaluation to refine and develop best practices  |



**Figure 1: Conceptual Framework**

**Table 4: ACO Network Comprehensiveness by Provider Category based upon Medicare Advantage Definition (n=220)**

| Provider Specialty                 | Code | Uncapped Mean | Capped Mean | SD    | Median | ACOs with No Contracted Providers in Specialty (n) | ACOs Contracted with Minimum Providers in Specialty (n) |
|------------------------------------|------|---------------|-------------|-------|--------|--|---|
| Primary Care                       | S03  | 1.143         | 0.632       | 0.342 | 0.644  | 1  | 77  |
| Gynecology, OB/GYN                 | 16   | 1.025         | 0.53        | 0.437 | 0.552  | 57   | 83  |
| Cardiology                         | 8    | 0.45          | 0.347       | 0.366 | 0.208  | 52   | 33  |
| General Surgery                    | 15   | 0.271         | 0.23        | 0.301 | 0.098  | 66   | 13  |
| Psychiatry                         | 29   | 0.321         | 0.226       | 0.33  | 0.043  | 95   | 17  |
| Pulmonology                        | 30   | 0.236         | 0.213       | 0.274 | 0.092  | 73   | 9   |
| Gastroenterology                   | 14   | 0.24          | 0.211       | 0.267 | 0.105  | 72   | 8   |
| Neurology                          | 19   | 0.238         | 0.21        | 0.275 | 0.106  | 80   | 10  |
| Orthopedic Surgery                 | 25   | 0.227         | 0.208       | 0.304 | 0.053  | 93   | 11  |
| Endocrinology                      | 12   | 0.18          | 0.166       | 0.223 | 0.08   | 94   | 4   |
| Nephrology                         | 18   | 0.171         | 0.162       | 0.234 | 0.057  | 92   | 5   |
| ENT/Otolaryngology                 | 13   | 0.171         | 0.158       | 0.243 | 0.021  | 107  | 6   |
| Urology                            | 32   | 0.154         | 0.145       | 0.242 | 0.005  | 110  | 4   |
| Physiatry, Rehabilitative Medicine | 26   | 0.15          | 0.131       | 0.225 | 0      | 115  | 5   |
| Ophthalmology                      | 23   | 0.117         | 0.102       | 0.195 | 0      | 113  | 3   |
| Rheumatology                       | 31   | 0.102         | 0.102       | 0.158 | 0.03   | 100  | 0   |
| Podiatry                           | 28   | 0.114         | 0.1         | 0.166 | 0.035  | 83   | 3   |
| Vascular Surgery                   | 34   | 0.1           | 0.098       | 0.165 | 0      | 127  | 1   |
| Dermatology                        | 11   | 0.08          | 0.078       | 0.156 | 0      | 119  | 1   |
| Oncology-Medical, Surgical         | 21   | 0.055         | 0.054       | 0.144 | 0      | 134  | 1   |

**Table 5: Descriptive Data of Beneficiary-level Variables**

| Covariate  | Mean   | SD     | Median | IQR (25 and 75 <sup>th</sup> %) |        |
|--|--------|--------|--------|---------------------------------|--------|
| Remained in same ACO from 2013 to 2014 (%)                           | 84.38  |        |        |                                 |        |
| <b>Organizational Structure</b>                                      |        |        |        |                                 |        |
| Network Comprehensiveness  | 25.78  | 19.67  | 23.64  | 8.35                            | 34.45  |
| Providers contracted with the beneficiary's ACO in 2013 and 2014 (%) | 84.06  | 16.17  | 89.06  | 82.05                           | 91.82  |
| <b>Market Influences</b>   |        |        |        |                                 |        |
| Hospital Service Area (HSA) Herfindahl-Hirschman Index               | 604.77 | 389.40 | 505.75 | 330.36                          | 753.14 |
| Providers contracted with the ACO within a beneficiary's HSA (%)     | 9.38   | 8.96   | 6.80   | 2.52                            | 13.24  |
| <b>Patient Care Seeking Behavior</b>                                 |        |        |        |                                 |        |
| Age (years)  | 71.42  | 12.19  | 72     | 66                              | 79     |
| Female (%)   | 59.96  |        |        |                                 |        |
| White (%)  | 84.93  |        |        |                                 |        |
| Disabled or End Stage Renal Disease (%)                              | 16.01  |        |        |                                 |        |
| Total CCW-Identified Conditions (count)                              | 3.89   | 2.60   | 4      | 2                               | 5      |
| E&M Events (count)   | 6.42   | 16.01  | 2      | 0                               | 6      |
| Hospital ER Visits (count)   | 0.45   | 1.39   | 0      | 0                               | 0      |
| Rural (%)  | 20.13  | 31.57  | 2.78   | 0.00                            | 27.28  |
| College (%)  | 30.46  | 16.17  | 27.10  | 17.70                           | 40.10  |
| Median Household Income (\$)   | 59,480 | 24,366 | 53,794 | 42,247                          | 71,526 |
| Attributed to the Same Provider in 2013 and 2014 (%)                 | 49.89  |        |        |                                 |        |

Analysis is at the beneficiary-level (N = 1,317,858). Included are some ACO-level variables: network comprehensiveness calculated using the Medicare Advantage Minimum Number definition; providers contracted with ACO in 2013 and 2014 calculated from the ACO provider file; and Hospital Service Area Herfindahl-Hirschman Index and percent of providers contracted within a HSA calculated using the Dartmouth definition of HSAs and Medicare ACO provider and claims files. The percent female, white, and disabled and/or End Stage Renal Disease are based upon Medicare enrollment data on attributed beneficiaries. Number of E&M visits and hospital ER visits were extracted from the Medicare summary file. The number of CCW-identified conditions were calculated from the Chronic Condition Warehouse file. Median household income, percent with a college degree, and the percent rural are measured at the beneficiary zip-code level and are from the Census Bureau. Attribution to the same provider was determined applying CMS' methodology to Medicare claims.

ACO indicates Accountable Care Organization; CCW, Chronic Condition Warehouse; E&M, evaluation and management; ER, emergency room.

**Table 6: Logistic Regression Model (Dependent Variable: Remained in Same ACO)**

|   | Odds Ratio | [95% Confidence Interval] |      |
|---|------------|---------------------------|------|
| Network Comprehensiveness                                 | 1.38***    | 1.33                      | 1.43 |
| Providers remaining in ACO contract from 2013 to 2014 (%) | 2.99***    | 2.91                      | 3.07 |
| HSA Herfindahl-Hirschman Index                            | 0.07***    | 0.06                      | 0.08 |
| Providers contracted with ACO within HSA (%)              | 8.04***    | 7.41                      | 8.71 |
| Age (years)   | 0.99***    | 0.99                      | 0.99 |
| Female  | 1.06***    | 1.05                      | 1.07 |
| White   | 1.11***    | 1.09                      | 1.13 |
| Disabled and/or End Stage Renal Disease                   | 0.80***    | 0.78                      | 0.81 |
| Category of CCWs  |            |                           |      |
| Medium (3 to 4 Conditions)                                | 1.23***    | 1.21                      | 1.25 |
| High (≥5 Conditions)                                      | 1.10***    | 1.08                      | 1.11 |
| E&M Events (count)  | 0.99***    | 0.99                      | 0.99 |
| Hospital ER Visits (count)                                | 0.97***    | 0.97                      | 0.98 |
| Rural (%)   | 1.32***    | 1.29                      | 1.35 |
| College degree or higher (%)                              | 1.00***    | 1.00                      | 1.00 |
| Median household income (\$)                              | 1.00***    | 1.00                      | 1.00 |
| Had the same attributing provider in 2013 and 2014        | 5.37***    | 5.3                       | 5.44 |
| Constant  | 0.86***    | 0.83                      | 0.89 |

See Table 5 for a description of each variable.

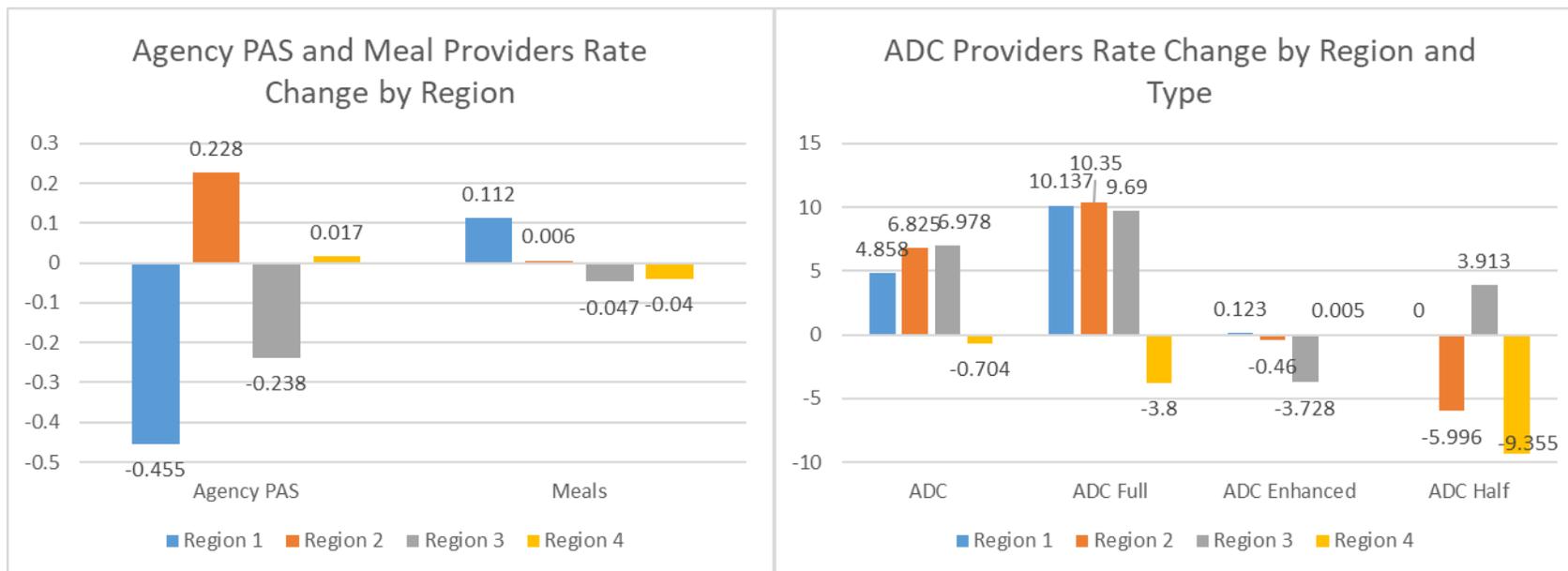
\*\*\*:  $p < 0.001$

**Table 7: GEE Models for Normal Distributions of ACO Quality Performance Measures (n=214)**

| Dependent Variables                                    | Patient/Caregiver Experience Measures                      |                               |  | Population Management Quality Measures                           |  |  |
|--|--|-------------------------------|--|--|--|--|
|  | Getting Timely Care, Appointments, and Information (ACO 1) | Access to Specialists (ACO 4) | Health Promotion and Education (ACO 5) | Proportion with blood pressure screened in past 2 years (ACO 21) | Percent with diabetes whose HbA1c in poor control (ACO 27) | Percent with hypertension whose blood pressure < 140/90 (ACO 28) |
| Year   | -0.956***  | -1.234***                     | 0.380                                  | -12.982***   | -5.332***  | 1.720*   |
| Patients remaining in the ACO from 2013 to 2014 (%)    | 0.061**  | 0.011                         | 0.039*                                 | -0.194   | -0.115**   | 0.102*   |
| Network Comprehensiveness                              | -0.013   | -0.007                        | 0.012                                  | -0.150   | -0.108**   | 0.049  |
| Providers in the ACO contract from 2013 to 2014 (%)    | -0.010   | -0.007                        | -0.009                                 | -0.022   | -0.006   | -0.032   |
| HSA Herfindahl-Hirschman Index                         | 19.468*  | -9.925                        | 22.150*                                | 5.622  | -5.063   | 48.385*  |
| Providers remaining contracted with ACO within HSA (%) | 0.091*   | 0.009                         | -0.024                                 | -0.163   | -0.056   | 0.088  |
| Female (%)   | 0.288***   | 0.084                         | 0.223**                                | -0.624   | -0.246   | -0.205   |
| White (%)  | 0.098***   | 0.061***                      | 0.063***                               | -0.074   | -0.151***  | 0.092**  |
| Disabled or End Stage Renal Disease (%)                | -0.031   | 0.046                         | 0.118*                                 | -0.361   | -0.053   | 0.034  |
| CCW Conditions (#)                                     | -0.839   | -0.467                        | 1.013                                  | 6.761*   | -0.271   | 2.109  |
| E&M Events (#)   | 0.665***   | 0.290***                      | 0.264*                                 | -0.325   | 0.388  | -0.017   |
| Hospital ER Visits (#)                                 | -1.196   | -1.845                        | -3.252                                 | 24.831   | 18.375***  | -10.162  |
| Rural (%)  | 0.036**  | 0.011                         | -0.024                                 | -0.020   | -0.034   | -0.059   |
| College degree or higher (%)                           | 0.066  | -0.043                        | 0.150***                               | 0.383  | -0.223*  | 0.086  |
| Median household income (\$)                           | -0.000   | 0.000                         | -0.000**                               | -0.000   | 0.000  | -0.000   |

**Table 8: HCBS Provider Descriptive Statistics Before and After the Rate Change**

|   | Before: December 1, 2011 to May 31, 2012 |                                       |                   | 6-Months After Change: January 1, 2013 to June 30, 2013 |                                       |                    |
|---|--|---------------------------------------|-------------------|---|---------------------------------------|--------------------|
|   | Adult day care                           | Personal Assistance Services (Agency) | Meals             | Adult day care  | Personal Assistance Services (Agency) | Meals              |
| Provider (n)  | 102                                      | 407                                   | 57                | 99  | 438                                   | 54                 |
| Counties of Operation (n)   | 48                                       | 67                                    | 66                | 36  | 67                                    | 67                 |
| Providers in County: mean (SD)  | 3.65(5.31)                               | 16.69(16.07)                          | 3.26(2.38)        | 3.75(5.46)  | 17.31(18.39)                          | 2.97(1.98)         |
| Beneficiaries Served: mean(SD)  | 16.46(30.84)                             | 33.83(66.97)                          | 96.58(271.68)     | 15.01(28.80)  | 34.33(70.46)                          | 105.74(335.68)     |
| Units Billed: mean(SD)  | 1119.06(2246.04)                         | 52780.89(101767.5)                    | 11922.82(33986.5) | 1039.91(2030.46)  | 61969.47(124820.7)                    | 12809.59(41698.17) |
| Rate: mean(SD)  | 60.56(14.17)                             | 4.73(0.59)                            | 5.40(1.27)        | 65.67(9.32)   | 4.63(0.19)                            | 5.35(1.01)         |
| HHI: mean(SD)   | 1217(900)                                | 1244(857)                             | 5803(1928)        | 1160(900)   | 1211(827)                             | 5846(1999)         |
| Home Health Hourly Rate: mean(SD)   | 12.09(0.54)                              | 12.00(0.54)                           | 11.84(0.68)       | 12.12(0.55)   | 12.03(0.54)                           | 11.82(0.65)        |
| Non-Residential Lease Revenue: mean(SD)                                   | 2642.99(1506.99)                         | 2569.17(1454.12)                      | 1984.05(1221.15)  | 2763.14(1441.19)  | 2646.06(1427.66)                      | 2091.51(1261.30)   |
| Characteristics of Beneficiaries Served by Providers                      |  |                                       |                   |   |                                       |                    |
| Percent of Households in a ZCTA with a 65 Year Old Living Alone: mean(SD) | 12.56(2.56)                              | 12.43(2.43)                           | 12.95(1.92)       | 12.26(2.62)   | 12.38(2.37)                           | 12.95(2.12)        |
| Median Income of a ZCTA, \$: mean(SD)                                     | 35735.13(5953.94)                        | 36047.82(7105.76)                     | 32401.11(3650.94) | 36276.84(6719.17)                                       | 35650.52(6528.05)                     | 32618.8(3793.07)   |
| Percent of ZCTA that is Rural: mean(SD)                                   | 14.70(18.76)                             | 17.69(19.83)                          | 28.64(26.61)      | 15.02(22.55)  | 16.32(19.48)                          | 28.38(26.39)       |



**Figure 2: Average Rate Change by Region**

**Region 1, Southwest PA:** Allegheny, Armstrong, Beaver, Fayette, Greene, Washington, Westmoreland

**Region 2, Central and Northern PA:** Bedford, Blair, Bradford, Butler, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Columbia, Crawford, Elk, Erie, Forest, Indiana, Jefferson, Lackawanna, Lawrence, Luzerne, McKean, Mercer, Mifflin, Monroe, Montour, Northumberland, Pike, Potter, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Venango, Warren, Wayne, Wyoming

**Region 3, Southcentral PA:** Adams, Berks, Carbon, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Lehigh, Northampton, Perry, Schuylkill, York

**Region 4, Southeast PA:** Bucks, Chester, Delaware, Montgomery, Philadelphia

**Table 9: Logistic Regression of Exit by Service Line, Odds Ratio**

|   | ADC (N=171) | PAS Agency (N=1085) | Meals (N=207) |
|---|-------------|---------------------|---------------|
| <b>Change in Provider Rate</b>                              | 1.03        | 0.98                | 1.86*         |
| <b>Beneficiaries Served</b>                                 | 1.46**      | 1.07                | 1.05          |
| <b>Units Billed</b>   | 0.14        | 1.19***             | 2.56          |
| <b>HHI</b>  | 1.00        | 0.99                | 1             |
| <b>Non-Residential Lease Revenue</b>                        | 0.99        | 1.00                | 1.00          |
| <b>Households in a ZCTA with a 65 Year Old Living Alone</b> | 1.08        | 1.05                | 1.08          |
| <b>Median Income of ZCTA</b>                                | 1.00        | 1.00                | 1.00          |
| <b>Proportion of ZCTA that is Rural</b>                     | 2.032       | 1.69                | 1.69          |
| <b>Home Health Hourly Pay Rate</b>                          | 1.11        | 1.11                | 0.79          |
| <b>Constant</b>   | 0.01        | 0.08                | 0.76          |
| <b>R2</b>   | 0.31        | 0.36                | 0.31          |

\*\*\*: p<0.001

\*\* : p<0.01

\*: p<0.05

**Table 10: Proportion of New Providers by Service Line, Coefficients**

|   | <b>ADC (N=49)</b> | <b>PAS Agency (N=67)</b> | <b>Meals (N=66)</b> |
|---|-------------------|--------------------------|---------------------|
| <b>Percentage of Providers who are New:<br/>mean(SD)</b>        | 16.70(25.09)      | 17.08(11.56)             | 11.64(20.03)        |
| <b>Change in Provider Rate</b>                                  | 0.125             | -7.49                    | -0.713              |
| <b>Beneficiaries Served</b>                                     | -0.217            | 0.008                    | 0.004               |
| <b>Units Billed (1000s)</b>                                     | 3.237             | -0.004                   | -0.096              |
| <b>HHI</b>  | -0.001            | -0.001                   | 0.003*              |
| <b>Non-Residential Lease Revenue</b>                            | -0.002            | -0.001                   | 0.001               |
| <b>Households in a ZCTA with a 65 Year<br/>Old Living Alone</b> | -0.910            | -0.673                   | -0.94               |
| <b>Median Income of ZCTA</b>                                    | 0.000             | 0.000                    | 0.000               |
| <b>Proportion of ZCTA that is Rural</b>                         | -6.224            | 6.206                    | -12.429             |
| <b>Home Health Hourly Pay Rate</b>                              | 6.11              | -0.720                   | -1.730              |
| <b>Constant</b>   | -27.22            | 24.10                    | 32.36               |
| <b>R2</b>   | 0.13              | 0.14                     | 0.17                |

\*\*\*:  $p < 0.001$

\*\*:  $p < 0.01$

\*:  $p < 0.05$

**Table 11: GEE with Poisson Distribution for Volume Offset, IRR**

|   | ADC     | PAS Agency | Meals   |
|---|---------|------------|---------|
| <b>Observations (N)</b>                                     | 8,895   | 73,461     | 29,032  |
| <b>Groups (N)</b>   | 1669    | 14,156     | 5,995   |
| <b>Change in Provider Rate</b>                              | 0.98*** | 0.98***    | 1.04*** |
| <b>HHI</b>  | 1.00*** | 0.99***    | 1.00*** |
| <b>Non-Residential Lease Revenue</b>                        | 1.00*** | 1.00***    | 1.00*** |
| <b>Households in a ZCTA with a 65 Year Old Living Alone</b> | 0.99*** | 1.00***    | 0.99*** |
| <b>Median Income of ZCTA</b>                                | 1.00*** | 1.00***    | 1.00*** |
| <b>P of ZCTA that is Rural</b>                              | 0.87*** | 1.07***    | 0.89*** |
| <b>Home Health Hourly Pay Rate</b>                          | 0.94*** | 0.99***    | 1.00    |
| <b>Month</b>  |         |            |         |
| <b>-3</b>   | 1.01    | 0.97***    | 1.01    |
| <b>-2</b>   | 1       | 0.98***    | 0.99    |
| <b>-1</b>   | 1       | 0.99***    | 1.04*** |
| <b>0 (Rate Takes Effect)</b>                                |         |            |         |
| <b>1</b>  | 0.99    | 1.01***    | 0.91*** |
| <b>2</b>  | 1.03*** | 1.02***    | 1.06*** |
| <b>3</b>  | 0.93*** | 1.01***    | 0.96*** |
| <b>Constant</b>   | 28.97   | 346.86     | 33.69   |

\*\*\*: p<0.001

\*\*: p<0.01

\*: p<0.05

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