Published in final edited form as:

Health Care Manage Rev. 2019 ; 44(2): 104–114. doi:10.1097/HMR.0000000000000182.

Factors Associated with Hospital Participation in Centers for Medicare and Medicaid Services' Accountable Care Organization Programs

Askar S. Chukmaitov, M.D., Ph.D.,

Associate Professor, Department of Health Behavior and Policy, School of Medicine, Virginia Commonwealth University

David W. Harless, Ph.D.,

Professor, Department of Economics, School of Business, Virginia Commonwealth University

Gloria J. Bazzoli, Ph.D., and

Bon Secours Professor of Health Administration, Department of Health Administration, School of Allied Health Professions, Virginia Commonwealth University

Yangyang Deng, M.S.

Data Analyst, Department of Health Behavior and Policy, School of Medicine, Virginia Commonwealth University

Abstract

Background—In 2012, the Centers for Medicare and Medicaid Services (CMS) initiated the Medicare Shared Savings Program (MSSP) and Pioneer Accountable Care Organization (ACO) programs. Organizations in the MSSP model shared cost savings they generated with CMS and those in the Pioneer program shared both savings and losses. It is largely unknown what hospital and environmental characteristics are associated with development of CMS ACOs with one-sided or two-sided risk models.

Purpose—To assess the organizational and environmental characteristics associated with hospital participation in MSSP and Pioneer ACOs.

Methodology—Hospitals participating in CMS ACO programs were identified using primary and secondary data. The ACO hospital sample was linked with the American Hospital Association, Health Information and Management System Society, and other datasets. Multinomial probit models were estimated that distinguished organizational and environmental factors associated with hospital participation in MSSP and Pioneer ACOs.

Results—Hospital participation in both CMS ACO programs was associated with prior experience with risk-based payments and care management programs, advanced HIT, and location in higher income and more competitive areas. While various health system types were associated with hospital participation in MSSP, centralized health systems, higher numbers of physicians in tightly integrated POAs, and location in areas with greater supply of primary care physicians were

associated with Pioneer ACOs. Favorable hospital characteristics were, in the aggregate, more important than favorable environmental factors for MSSP participation.

Conclusion—MSSP ACOs may look for broader organizational capabilities from participating hospitals that may be reflective of a wide range of providers participating in diverse markets. Pioneer ACOs may rely on specific hospital and environmental characteristics to achieve quality and spending targets set for two-sided contracts.

Practice Implications—Hospital and ACO leaders can use our results to identify hospitals with certain characteristics favorable to their participation in either one- or two-sided ACOs.

Keywords

Hospitals; Accountable Care Organizations; Medicare Shared Savings Program; and Pioneer Accountable Care Organizations

BACKGROUND

The Centers for Medicare and Medicaid Services' (CMS) ACO programs – the Medicare Shared Saving Program (MSSP) and the Pioneer Program – are expected to have a major impact on health care expenditures and quality in the U.S. health care system (GPO 2015, CMS 2016). These ACOs' accountability for the cost and quality of care varies significantly across these two types of ACOs (Fisher, Shortell, Kreindler et al., 2012). MSSP ACOs took on a "one-sided" risk model, which, after meeting quality benchmarks, allows participating organizations to share in cost savings with CMS (CMS 2013a). Pioneer ACOs, on the other hand, face substantial downside risks in a two-sided model that provides greater financial rewards than the MSSP's model, but also holds Pioneer ACOs responsible for spending over their pre-determined budget (CMS 2014). CMS authorized 355 MSSP ACOs in 2012–2013 (GPO 2015, CMS 2016). Thirty two Pioneer ACOs were authorized to begin operation in 2012 (CMS 2013b, 2014). MSSP and Pioneer ACOs were formed by a wide range of health care providers and were established across diverse markets.

Several studies have examined organizational and environmental factors affecting ACO formation with ACOs as the unit of analysis. This study examines parallel questions but with hospitals as the unit of analysis. Hospitals are important for implementing ACOs. Hospitals provide start-up capital, additional care management staff, and have established health information technology (HIT) systems that allow data sharing and performance reporting (Colla et al., 2016). Hospitals may also serve as a link for vertical integration of primary, outpatient, and post-acute care services within an ACO network, allowing for improved patient transitions across care settings, lowering transaction costs associated with transfer of patients outside of ACOs, and improving ACO performance (Chukmaitov et al. 2015, Diana, Walker, Mora & Zhang, 2015).

A few studies have evaluated organizational and environmental characteristics associated with hospital participation in ACOs. Yeager et al. (2015) identified that hospital characteristics (i.e., partial and full EHR functionality, hospital affiliation with centralized and decentralized health systems) and environmental factors (i.e., location in areas with higher income and HMO penetration) were associated with hospital participation in CMS

ACOs. Hospitals located in urban areas, those with nonprofit ownership or with a smaller share of Medicare patients were more likely to participate in ACOs (Colla et al. 2016). Bazzoli, Harless, and Chukmaitov (2017) suggested that ACO leaders may decide to align with hospitals based on hospital capabilities that can advance ACO strategic goals. Some hospital capabilities, such as HIT and physician-hospital alignment, were found to be important for hospitals participating in either MSSP or Pioneer ACOs. Other capabilities such as linkages with ambulatory providers, may be less important for ACOs seeking out hospital participation as these ACOs may have already developed capabilities in this area (Bazzoli, Harless, & Chukmaitov 2017). However, previous research did not compare the relative importance of organizational and environmental factors for hospital participation in MSSP and Pioneer ACO program.

Even though the federal health policy is likely to change, value-based purchasing and market-based solutions, such as ACOs, are believed to have strong bipartisan support (Colla & Fisher 2017). It is also expected that health care delivery innovations will continue to develop as more private payers are “buying into” the ACO concept. As some hospital leaders may be contemplating their participation in value-based payment initiatives, it may be helpful for them to gauge their preparedness for one- or two-sided risk models based on understanding of organizational and environmental characteristics that were important for hospital involvement in the original CMS ACOs.

Purpose

Our study has several distinct contributions to the literature. First, we examined individual associations of hospital organizational and environmental factors with hospital participation in either the MSSP or Pioneer ACO programs. Second, we compared the relative magnitude of the effects of organizational or environmental factors on hospital ACO participation in the MSSP or Pioneer ACO programs. This is important because our study identifies internal and external circumstances where development of ACOs with one-sided and two-sided risk contracts involving hospitals is most likely to occur. Finally, as it is important to track ACOs, their characteristics, and environments over time, we looked at hospital CMS ACO participants at baseline, and also conducted analysis excluding hospitals that exited the Pioneer ACO program.

THEORY/CONCEPTUAL FRAMEWORK

Fisher et al. (2012) conceptualized a logic model for ACO development. The model describes three interconnected domains of ACO development: “contract characteristics, ACO structures, capabilities, and activities, and local context within which ACO launched” (Fisher et al. 2012). Favorable ACO capabilities for converting ACOs from low- to high-risk contracts are as follows: (1) ability to negotiate and manage new contracts; (2) having competent leadership and management to overcome fragmentation, to foster joint physician and hospital decision making, and to achieve clinical integration; (3) using advanced HIT for evidence-based practice of medicine, patient engagement, and care coordination; (4) linking various providers across an extensive care continuum. In addition, a favorable local context,

or environment, is described by the extent of its munificence (Yeager et al. 2015), and by local policy and market characteristics (Fisher et al. 2012).

Following previous research (Chukmaitov et al. 2015, Whaley et al. 2015, Auerbach et al., 2013, Bazzoli, Shortell, Dubbs, Chan, & Kralovec, 1999, Dynan, Bazzoli, & Burns, 1998, Furukawa, Raghu, & Shao 2011), we either operationalized or applied data reduction approaches to consolidate various organizational variables into dimensions that were conceptually aligned with favorable capabilities needed for implementing an ACO (Fisher et al. 2012). The first dimension is ability to manage risk-based contracts. Hospitals with prior experience with risk-based payment systems and care management programs for high cost beneficiaries may have developed expertise with financial, management, and care coordination systems that can be beneficial for ACOs (Whaley et al. 2015, Auerbach et al., 2013). The second dimension is related to ACO leadership and management. Chukmaitov et al. (2015) suggested that hospitals in certain types of health systems can provide ACOs with established leadership and management structures, extended hospital services, and developed physician-organizational arrangements (POAs). POAs are important for implementing an ACO as established POAs may foster clinical integration between hospitals and physician groups (Burns & Muller 2008, Chukmaitov et al. 2015).

The third dimension is HIT capability. Hospitals with established HIT may offer expertise and resource to expand electronic health records (EHR) to other ACO partners so as to aid the ACO in meeting quality and cost benchmarks (Diana et al. 2015, Chaudhry et al. 2006, Furukawa, Raghu & Shao 2011, Fisher et al. 2012). The fourth dimension is linking providers on the care continuum. Hospitals integrated with ambulatory providers can improve care coordination within ACOs vertically integrating with outpatient providers (Diana et al. 2015). Finally, hospital location in a munificent environment may provide financial, professional, and other resources important for implementing an ACO (Yeager et al. 2015). Hospitals located in munificent environments are likely to pursue resource-intensive strategies such as participation in an ACO that require investment in new technology and personnel needed for integration (Dess & Beard, 1984; Sharfman & Dean, 1991). As such, we hypothesize that certain organizational and environmental capabilities are likely to be associated with hospital participation in CMS ACO programs.

MSSP ACOs were established to gain needed structural capability and financial experience before they took on higher-risk contracts, while Pioneer ACOs were to rely on their established capabilities to manage two-sided financial risks, population health, and utilization of services. Higher levels of integration and centralization of inpatient, physician, and outpatient services may assist Pioneer ACOs to manage these contracts (Chukmaitov et al. 2015). As such, we hypothesize that more advanced organizational capabilities of hospitals participating in ACOs, and their location in highly munificent environments, are more important for managing two-sided risk contracts.

METHODOLOGY

Identifying hospital participants

Identification of hospitals participating in CMS's ACO programs required multiple approaches and sources of information. We limited our attention to initial participants in CMS ACOs in the 50 states and the District of Columbia that had one of the three MSSP ACO-agreement start dates (April 1 or July 1 of 2012 and January 1, 2013) or the start date for Pioneer ACOs (January 1, 2012). We identified a total of 158 hospitals that participated in a Pioneer ACO and 521 hospitals that participated in an MSSP ACO. Because our analysis uses data from multiple sources (i.e., the American Hospital Association (AHA) Annual Survey, Health Information and Management System Society (HIMSS) information technology data, databases on participants of CMS-initiated pilots and demonstrations, and the Area Health Resource File (AHRF)), the number of hospital participants with complete data from all sources is smaller: 105 Pioneer and 340 MSSP participating hospitals along with 3,296 hospitals that did not participate in either CMS ACO during the study period. For these sources, we used data from 2011 to examine hospital participation beginning in the spring and summer of 2012 to January 1, 2013. We chose 2011 because this reflects the hospital's characteristics and circumstances at, or immediately before, the time decisions were made about ACO participation, namely when applications for Pioneer ACO status were submitted in August 2011 and the first set of applications for MSSP ACOs were submitted in early 2012.

Study Variables and Data

Table 1 describes variables for organizational and environmental factors favorable to hospital participation in ACOs and their sources. To identify hospitals with prior experience with risk-based payments and care management (Whaley et al. 2015, Auerbach et al., 2013), we relied on publicly available CMS databases of participants in the *Premier Hospital Quality Incentive Demonstration* pilot (CMS, 2016) and in the *Physician Group Practice (PGP) transition* or *Care Management for High-Cost Beneficiaries Demonstration (CMHCB)* pilots (CMS, 2016). PGP transition and the Premier Hospital Demonstration were pilot programs that involved shared savings and pay-for-performance for participating providers (CMS, 2016). CMHCB introduced care management programs for high cost beneficiaries (RTI, 2013). We used centralized, moderately centralized, decentralized, and independent *health system affiliation* developed by Bazzoli et al. (1999). As in Dynan et al. (1998), measures of physician-hospital integration were developed as *the number of physicians affiliated with tightly integrated physician-organizational arrangements* (POAs). HIMSS data were used to count both *basic and advanced health information technology* (HIT) features as developed by Furukawa et al. (2011). As in Chukmaitov et al. (2015), *hospital linkages with ambulatory facilities* were measured by the count of the five services. Following Yeager et al. (2015), *environmental munificence* was measured as hospital location in urban areas, and counties with higher income, and larger supply of primary care physicians and specialists. Other hospital, geographic, and market controls are described in Table 1.

In order to compare the magnitude of the effects of favorable organizational characteristics to the influence of favorable environmental characteristics, we report findings estimating the

change in the probability of hospital participation in the MSSP and Pioneer programs that are associated with organizational and environmental factors changing from less to more favorable conditions. Less favorable structural conditions were defined as being a free-standing hospital with the 25th percentile values of the variables physicians in tightly integrated POAs in hundreds (0 physicians), basic HIT (4 applications), advanced HIT (1 application), and linkages with ambulatory providers (1 provider). More favorable conditions reflect a hospital associated with a centralized health system, participation in the Premier Hospital Demonstration, participation in the PGP Transition or CMHCB Demonstrations, and the 75th percentile values of the variables physicians in tightly integrated POAs in hundreds (0.1 physicians), basic HIT (5 applications), advanced HIT (2 applications), and linkages with ambulatory providers (3 providers).

Less favorable environmental conditions reflect a hospital in a rural location with the 25th percentile values of the variables natural log of median household income (3.673 or approximately \$39,630), PCPs per 1,000 population (0.431), and specialists per 1,000 population (0.237). More favorable dimension reflects a hospital in an urban location with the 75th percentile values of the variables natural log of median household income (3.956 or approximately \$52,240), PCPs per 1,000 population (0.905), and specialists per 1,000 population (1.553).

Model and estimation

We estimate a model reflecting three possible hospital participation outcomes: non-participant, participant in an MSSP, and participant in a Pioneer ACO. Two standard empirical models exist to examine choices between three or more options, specifically the multinomial logit and multinomial probit models. Both models can be formulated either as simply a model of the underlying probability that hospital *i* will be categorized with a particular outcome, or as arising from a maximization model where there is a latent variable representing utility from each outcome (but subject to error). The multinomial logit model requires the stringent independence of irrelevant alternatives property (e.g., implying that the relative odds of choosing between non-participation and MSSP participation is unaffected by the presence of the Pioneer option), while the multinomial probit model does not. We conducted a standard specification test (Hausman and McFadden 1984) that indicated the independence of irrelevant alternatives assumption was violated. Thus, multinomial probit was used in our analysis.

It is also noteworthy that some hospitals ceased ACO participation and that some ACOs ceased operation altogether. This was more common among Pioneer participants as the number of ACOs declined from the 32 initially launched to just nine Pioneer ACOs in 2016. Of the 105 hospital Pioneer ACO participants in our estimation sample, 28 (26.7%) no longer participated in a Pioneer ACO by the end of 2014 (with 11 transitioning to an MSSP). For MSSP participants, however, only eight (2.4%) ceased participation by the end of 2014. As a supplementary analysis, we also estimated a multinomial probit model that excluded hospitals that ceased CMS ACO participation or that transitioned from Pioneer ACO to MSSP.

RESULTS

Summary statistics for all explanatory variables, by CMS ACO participation category, are provided in Table 2. We do not report a mean value representing the proportion of Independent Health System (IHS) member hospitals among Pioneer ACO participants. Although there were such IHS participants, all had missing values for one or more of the variables from AHA or HIMSS (or both). Thus, we excluded all IHS hospitals in estimating our multinomial probit model below. We report these observations in Table 2 as it is worth noting that the proportion of non-participants that were classified as IHS members was twice as large as the proportion of MSSP participants. The proportion of Decentralized Health Systems' (DHS) hospitals did not differ significantly by participation status, but the proportion of both Centralized Health System (CHS) and Moderately Centralized Health System (MCHS) membership did differ significantly and was approximately twice as large for participants as non-participants (but these proportions did not differ significantly between Pioneer ACO and MSSP participants).

Significant differences in means across the three participation types are observed for all other explanatory variables, except for the Premier Hospital Demonstration. MSSP or Pioneer ACO participants had a higher mean for variables representing favorable structures, except for the basic HIT applications for MSSP participants. On average, non-participants had fewer beds, were more likely to be for-profit or publicly owned and were more often located in areas that were rural, had lower median income, fewer PCPs and specialists per 1,000 population, and lower competition as measured by the HHI.

Some statistically significant differences in means existed between MSSP and Pioneer ACO participants. Pioneer ACO participants had a larger proportion of hospitals that had been involved with the PGP Transition or CMHCB demonstrations. Pioneer ACO participants had a much higher mean number of physicians in tightly integrated POAs (70% higher than for MSSP participants) and also significantly higher for the basic HIT applications. Pioneer ACO participants were located in counties with significantly higher median incomes, lower percent Medicare, higher Medicare Advantage penetration, and more competition as measured by the HHI.

Table 3 presents the estimates (and standard errors) for the marginal effects – the estimate of the change in the probability of a particular participation outcome associated with a one-unit increase in the regressor, holding other factors constant. The marginal effects make clear the importance of system membership to CMS ACO participation. Compared to unaffiliated hospitals, hospitals in a CHS are estimated to have a .1282 higher probability of participating in an MSSP and a 0.0243 higher probability of participating in a Pioneer ACO. Comparisons of these marginal effects, however, should be made relative to the rate of participation in the two ACO types. There were approximately 3.2 MSSP participants for every Pioneer participant. Taking into account this base rate, if the number of hospitals participating in MSSP were the same as Pioneer, the marginal effect of 0.1282 would instead be $.1282/3.2 \approx 0.04$; this is still greater than .0243, but on a scale that is more appropriately compared. Using this base rate adjustment, the effect of being in a moderately centralized health system has an essentially similar effect on participation in both programs, $0.1007/3.2$

≈ .031 for MSSP compared to the marginal effect of 0.0289 for Pioneer. The marginal effect estimates for MCHS membership are of a similar magnitude. DHS membership also has a relatively large marginal effect for MSSP participation (but not for Pioneer participation). PGP Transition or CMHCB project participation is associated with higher probability of participation in both CMS ACO programs.

The two HIT application variables have mixed effects, with the MSSP marginal effect being significant and negative for basic HIT applications but significant and positive for the more advanced HIT applications. The number of physicians in tightly integrated POAs does have a positive and statistically significant marginal effect for Pioneer ACOs. Finally, the multinomial model indicates statistically significant differences in participation by ownership and several of the external environment characteristics, such as the number of PCPs, median income, and HHI.

We present Table 4 to assess the overall magnitude of organizational characteristics and environmental munificence. Panel A of Table 4 presents the probabilities of participation with less and more favorable hospital characteristics as well as the differences in probability associated with this change. The aggregated effect of the more-versus-less-favorable comparison is substantial: a change in the probability of non-participation of −0.554 and a change in the probability of MSSP participation of 0.448. The change in the probability of Pioneer ACO participation, 0.106, was not statistically significant. Again adjusting for the different base rates, $0.448/3.2 \approx 0.14$ for MSSP still exceeds the change in probability of Pioneer ACO participation.

Panel B contains the same calculations of probabilities and changes in probabilities associated with less and more favorable environmental munificence circumstances. The contrast with the results of Panel A is noteworthy: though the differences in probability are statistically significant, they are an order of magnitude smaller.

When we estimated our multinomial probit model excluding hospitals that ceased CMS ACO participation or transitioned from Pioneer ACO to MSSP by the end of 2014 (see the last two columns of Table 3), our estimation results for MSSP participants were essentially unchanged. Result for Pioneer ACO participants changed for some variables. The marginal effect for membership in a CHS became smaller in magnitude and was no longer statistically significant. The marginal effects for the more advanced HIT applications and for participation in the Premier Hospital Demonstration program become greater in magnitude and statistically significant. The estimated negative effect for the Premier Hospital Demonstration variable in the Pioneer model may reflect factors expressed by leaders of some exiting ACOs that CMS benchmarks for determining shared savings and losses, which were ambiguous at the time of program inception, ended up being based in part on an organization's historical expenditures (Evans 2014, Wehrwein 2013). The impression of these ACO leaders was that this put certain organizations at a disadvantage, namely those that had previously made substantial investments in cost control and quality, such as Premier Hospital Demonstration participants.

Table 4 also contain parallel results when we excluded hospitals ceased CMS ACO participation or transitioned from Pioneer ACO to MSSP by the end of 2014. In their totality, the hospital characteristics continue to have a much larger magnitude relative to environmental munificence variables for MSSP participation.

DISCUSSION

Our findings suggest that both organizational and environmental factors favorable to hospital participation in CMS ACO programs were indeed correlated with their involvement in these arrangements. Several organizational and environmental factors were important for hospital participation in both MSSP and Pioneer ACOs; whereas other characteristics were specific to either MSSP or Pioneer ACO involvement.

Prior hospital participation in risk-based payments and care management programs for high cost beneficiaries was associated with hospital involvement in both MSSP and Pioneer ACOs. These experiences may have allowed hospitals to develop expertise important for ACO development. Having more advanced HIT applications was associated with hospital participation in MSSP, and also for hospitals that sustained their participation in Pioneer ACOs. Advanced HIT applications, such as electronic nursing documentation and electronic medication administration systems, may improve disease management and team-based approach to care (HIMSS 2012). Additionally, hospitals with advanced HIT and utilization management capability may assist in achieving quality and cost benchmarks important for avoiding financial penalties in Pioneer ACOs (Diana et al. 2015). Consistent with Yeager et al. (2015), we found that hospitals participating in both CMS programs were located in areas with higher median income, where they may have access to external resources important for ACO implementation. We also found that hospitals in more competitive markets were more likely to participate in CMS ACO programs. Previous research suggests that competitive environments may have promoted informal coordination among providers and had a positive effect on ACO development (Frech et al. 2015).

Several hospital characteristics were associated with MSSP participation. In general, hospitals affiliated with any health system types were more likely to participate in an MSSP. Health systems may provide additional resources and access to established networks of providers not only for their affiliated hospitals but also for a broader set of organizations involved in MSSP ACO. Hospital's affiliation with decentralized health systems was associated with their involvement in MSSP. These systems are organized around hospitals that tend to offer extensive array of services and spread out over a broad geographical area (Bazzoli et al., 1999) providing MSSP ACOs with opportunities for referrals and a greater geographic representation. We also found that basic HIT was negatively associated with hospital MSSP participation and that may be due to a widespread use of these applications (25th percentile value was 4 out of the 5 technologies) and, perhaps, HIT compatibility issues among various providers participating in MSSP ACOs.

Favorable hospital characteristics were, in the aggregate, more important than favorable environmental factors in affecting the probability that a hospital participated in an MSSP ACO. MSSPs have been described as “training wheels” for participants to build up their

ACO capabilities and experience with risk-based contracts (Goldsmith & Kaufman, 2015). As such, it is expected that MSSP ACOs would first focus on developing their internal capabilities and may be doing so through careful screening and selection of hospitals with needed competencies. However, a potential negative association of hospital MSSP participation in areas with high Medicare Advantage (MA) deserves attention in future research as it may be indicative of the areas with lower Medicare spending leaving ACOs with less slack resources to operate with.

The relative importance of having more favorable organizational and environmental conditions was evident for hospitals participating in MSSP. This contradicted our original hypothesis of the importance of advanced internal and external circumstances for managing two-sided risk contracts. MSSP ACOs were established by a wide variety of providers that may have lower initial levels of ACO preparedness and needed to gain organizational capabilities via participating hospitals.

Hospital participation in a Pioneer ACO was positively associated with more centralized systems and tightly integrated physician-hospital alignment. More centralized health systems organized hospital services at the system level rather than at an individual hospital level and are located in urban areas with hospitals in close proximity to each other (Bazzoli et al. 1999). More centralized structures may allow for reliable channels of communication and improved effectiveness that are important for implementing a Pioneer ACO. In addition, hospitals with tightly integrated POAs – achieved via acquisition, employment, or shared-risk contracts (e.g. salary, foundation, or management service organization models) – may help Pioneer ACOs develop successful care coordination programs and to move toward clinical integration (Frech et al. 2015, Chukmaitov et al. 2015). In addition, being located in areas with a sufficient supply of primary care physicians was important for hospital participation in Pioneer ACOs, while there was a negative marginal effect of the supply of specialists for hospital Pioneer ACO participation. ACOs tend to have a higher ratio of primary care physicians to specialists highlighting ACOs' primary care focus (Shortell et al. 2015) that may improve care coordination and patient transfers across care settings. A primary care focus for Pioneer ACOs may improve population health and generate savings via management of referrals to specialists and hospitals.

We also conducted a supplementary analysis describing characteristics of 28 hospitals in Pioneer ACOs that either left the program altogether or switched to MSSP. Hospitals that left Pioneer ACOs belonged to centralized health systems and participated in the Premier Hospital Demonstration pilot. These hospitals were also located in less munificent environments characterized by low rate of PCPs per 1,000 population, low median income, and high Medicare Advantage penetration. Previous studies described some of the providers that left the Pioneer ACO program as “flagman” integrated delivery systems known for past effectiveness and efficiency that resulted in diminished ability to generate new savings under the Pioneer program (Goldsmith & Kaufman, 2015). Hospitals that switched from Pioneer ACOs to MSSP were in decentralized health systems and located in areas with low Medicare Advantage penetration, which are consistent with our findings for MSSP hospital participation.

Our study has several limitations. We used administrative data that could not directly measure decisions, processes, and activities relevant to healthcare delivery transformations (e.g. ACO initiated care coordination, disease management, experience with new payment models, and a team-based approach to care delivery). In addition, administrative data may be prone to missing data and reporting bias, which may potentially have contributed to some of the mixed findings. Lastly, because of a lack of access to data from private payers, we do not have information on private ACOs. Even though CMS ACO programs are now taking a leading role in the ACO development in the U.S., more research on private ACO formation is needed.

PRACTICE IMPLICATIONS

Notwithstanding these limitations, our findings provide important insights for hospital and health organizational leaders who are implementing or considering participation in an ACO. ACO leaders favorably assess the internal characteristics of potential hospital participants, such as hospital expertise with risk-based payment systems, strengths of their affiliated health systems, and advanced HIT. By capitalizing on these internal hospital capabilities, ACOs enhance their ability to meet the quality and cost benchmarks that have been established for them. Thus, hospital leaders are advised to concentrate on these capabilities to make their organizations more attractive to existing ACOs or if they contemplate developing their own ACO. Also, our results suggest that ACO leaders prefer to recruit hospitals located in munificent environments (e.g., those with relatively high median incomes) and avoid hospitals located in areas potentially unfavorable for ACO development (e.g., with high Medicare Advantage penetration). Thus, in addition to assessing their own internal capabilities, hospitals desiring to participate in an ACO should conduct environmental scans to assess what attributes present opportunities to ACOs in their community and to understand what might detract from their involvement.

Our results suggest that MSSP ACOs may have looked for broader organizational capabilities from participating hospitals, such as affiliation with health systems, which in aggregate, were more important than broader environmental characteristics. This may be reflective of a wide range of providers participating in MSSP in diverse markets. But this also implies that hospitals may be able to make compelling arguments to ACO leaders about their participation by highlighting their internal capabilities, which may mitigate potential concerns that could arise about community factors that ACO leaders view as undesirable. Alternatively, we found that Pioneer ACOs may rely on more specific hospital and environmental characteristics, e.g., more centralized services, tight physician-hospital alignment, and availability of primary care providers, that might assist Pioneer ACOs in achieving quality and spending targets set for two-sided risk contracts. As such, these findings provide specific suggestions on the capabilities that hospitals need to develop and highlight if they plan on participating or forming ACOs that take on higher levels of financial risk.

Acknowledgments

This research was supported through a grant from the Agency for Healthcare Research and Quality, R01 HS023332. This study was reviewed and deemed exempt by the Virginia Commonwealth University IRB.

References

- Alexander JA, Lee SY, Bazzoli GJ. Governance forms in health systems and health networks. *Health Care Manage Rev.* 2003 Jul-Sep;28(3):228–42. [PubMed: 12940345]
- Auerbach DI, Liu H, Hussey PS, Lau C, Mehrotra A. Accountable care organization formation is associated with integrated systems but not high medical spending. *Health Aff (Millwood).* 2013 Oct; 32(10):1781–8. [PubMed: 24101069]
- Bazzoli GJ, Harless DW, Chukmaitov AS. A taxonomy of hospitals participating in Medicare accountable care organizations. *Health Care Manage Rev.* 2017 Mar 3.
- Bazzoli GJ, Shortell SM, Dubbs N, Chan C, Kralovec P. A taxonomy of health networks and systems: bringing order out of chaos. *Health Serv Res.* 1999 Feb; 33(6):1683–717. [PubMed: 10029504]
- Burns LR, Muller RW. Hospital-physician collaboration: landscape of economic integration and impact on clinical integration. *Milbank Q.* 2008; 86(3):375–434. [PubMed: 18798884]
- Center for Medicare and Medicaid Innovation (CMS). [accessed on August 6, 2015] Pioneer ACO Model. 2013a. Available at: <https://innovation.cms.gov/initiatives/Pioneer-ACO-Model/index.html>
- Center for Medicare and Medicaid Services (CMS). [accessed on August 25, 2015] Medicare Shared Savings Program. Accountable Care Organizations Participant Taxpayer Identification Numbers Names. 2013b. Available at: <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/Downloads/ACO-Participant-TIN-Names.pdf>
- Center for Medicare and Medicaid Services (CMS). [accessed on October 15, 2015] Medicare Shared Savings Program. Accountable Care Organizations Participants. 2014. Available at: <https://data.cms.gov/browse?category=ACO&utf8=>
- Center for Medicare and Medicaid Services (CMS). [accessed on April 15, 2015] Medicare Demonstration Projects & Evaluation Reports. 2016. Available at: <https://www.cms.gov/Medicare/DemonstrationProjects/DemoProjectsEvalRpts/Medicare-Demonstrations.html>
- Colla CH, Fisher ES. Moving Forward With Accountable Care Organizations: Some Answers, More Questions. *JAMA Intern Med.* 2017 Apr 1; 177(4):527–528. [PubMed: 28192555]
- Colla CH, Lewis VA, Tierney E, Muhlestein DB. Hospitals Participating In ACOs Tend To Be Large And Urban, Allowing Access To Capital And Data. *Health Aff (Millwood).* 2016 Mar; 35(3):431–9. [PubMed: 26953297]
- Chukmaitov A, Harless DW, Bazzoli GJ, Carretta HJ, Siangphoe U. Delivery system characteristics and their association with quality and costs of care: implications for accountable care organizations. *Health Care Manage Rev.* 2015 Apr-Jun;40(2):92–103. [PubMed: 24566250]
- Chukmaitov AS, Bazzoli GJ, Harless DW, Hurley RE, Devers KJ, Zhao M. Variations in inpatient mortality among hospitals in different system types, 1995 to 2000. *Med Care.* 2009 Apr; 47(4): 466–73. [PubMed: 19238101]
- Chaudhry B, Wang J, Wu S, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Annals of Internal Medicine.* 2006; 144(10):742–52. [PubMed: 16702590]
- Diana ML, Walker DM, Mora AM, Zhang Y. Vertical Integration Strategies in Healthcare Organizations. *Journal of Health Administration Education.* 2015; 32(2):223–244.
- Dynan L, Bazzoli GJ, Burns R. Assessing the extent of integration achieved through physician-hospital arrangements. *J Healthc Manag.* 1998 May-Jun;43(3):242–61. [PubMed: 10181800]
- Evans, M. Medicare's Pioneer program down to 19 ACOs after three more exit. *Modern Healthcare;* 2014. Available at: <http://www.modernhealthcare.com/article/20140925/NEWS/309259938> [accessed on November 16, 2016]
- Fisher ES, Shortell SM, Kreindler SA, Van Citters AD, Larson BK. A framework for evaluating the formation, implementation, and performance of accountable care organizations. *Health Aff (Millwood).* 2012 Nov; 31(11):2368–78. [PubMed: 23129666]
- Frech HE, Whaley C, Handel BR, et al. Market Power, Transactions Costs, and the Entry of Accountable Care Organizations in Health Care. *Rev Ind Organ.* 2015; 47:167.
- Furukawa MF, Raghu TS, Shao BB. 2011; Electronic medical records, nurse staffing, and nurse-sensitive patient outcomes: Evidence from the national database of nursing quality indicators. *Medical Care Research and Review.* 68(3)

- GPO. [accessed on August 6, 2015] Federal Register/Proposed Rules 2015. Medicare Program, Medicare Savings Program: Accountable Care Organizations. 2015. Available at: <https://www.gpo.gov/fdsys/search/searchresults.action?st=Medicare+Savings+Program%3A+Accountable+Care+Organizations>
- Hausman JA, McFadden DL. 1984; Specification tests for the multinomial logit model. *Econometrica*. 52:1219–1240.
- HIMSS. [accessed on April 10, 2016] The Advisory Board Company and HIMSS Analytics: EMR Benefits and Benefit Realization Methods of Stage 6 and 7 Hospitals. Hospitals with advanced EMRs report numerous benefits. 2012. Available at https://www.longwoods.com/articles/images/ABC_&_HIMSS_research-1.pdf
- Research Triangle Institute International (RTI). [accessed on April 15, 2015] Evaluation of the Extended Medicare Care Management for High Cost Beneficiaries (CMHCB) Demonstration: Massachusetts General Hospital (MGH). 2013. Available at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Reports/downloads/McCall_MontefioreFinalReport_May_2011.pdf
- Shortell SM, Colla CH, Lewis VA, Fisher E, Kessel E, Ramsay P. Accountable Care Organizations: The National Landscape. *J Health Polit Policy Law*. 2015 Aug; 40(4):647–68. [PubMed: 26124295]
- Wehrwein, P. [accessed on November 18, 2015] Pioneer ACOs: And Then There Were 23 Managed Care. 2013. Available at: <http://www.managedcaremag.com/archives/2013/9/pioneer-acos-and-then-there-were-23>
- Whaley C, Frech HE 3rd, Scheffler RM. Accountable Care Organizations in California: Market Forces at Work? *J Health Polit Policy Law*. 2015 Aug; 40(4):689–703. [PubMed: 26124301]
- Yeager VA, Zhang Y, Diana ML. Analyzing Determinants of Hospitals' Accountable Care Organizations Participation: A Resource Dependency Theory Perspective. *Med Care Res Rev*. 2015 Dec; 72(6):687–70. [PubMed: 26156971]

Table 1

Variable Definition and Data Sources.

Variable	Definition	Source
Favorable Conditions		
Health system affiliation	(1) Centralized Health Systems (CHS); (2) Moderately Centralized Health Systems (MCHS); (3) Decentralized Health Systems (DHS); (4) Independent Hospital Systems (IHS); (5) Freestanding Hospital (referent)	AHA
Premier Hospital Demonstration	(1) Yes; (2) No (referent)	CMS
Physician Group Practice (PGP) or CMHCB demonstrations	(1) Yes; (2) No (referent)	CMS
Physicians in tightly integrated physician-organizational arrangements (POAs)	Number of physicians in Management Service Organization (MSO), Integrated Salary, Equity, and Foundation measured in hundreds	AHA
Basic HIT	Count of five basic HIT applications: (1) Pharmacy, (2) Laboratory, (3) Radiology information systems, (4) Clinical data repository, and (5) Clinical decision support.	HIMSS
More advanced HIT	Count of two advanced HIT applications: (1) Nursing documentation and (2) Electronic medication administration.	HIMSS
Linkages with ambulatory facilities	Count of five linkages with ambulatory facilities: (1) Freestanding outpatient center, (2) Hospital-based outpatient care center, (3) Primary care department, (4) Home care, and (5) Urgent care.	AHA
Environmental Munificence		
Primary care physicians supply	Sum of physicians in internal medicine, family practice, and pediatrics per 1,000 residents in a county	AHRF
Specialists supply	(Total number of physicians - physicians in internal medicine, family practice, and pediatrics) per 1,000 population in a county	AHRF
Median income	Median household income in a county (in thousands of dollars)	AHRF
Hospital location	(1) Urban; (2) Rural (referent)	AHA
Controls		
Preventative services scope and mix	Count of 11 services: (1) Breast cancer screening; (2) Community outreach; (3) Crisis prevention; (4) Community health education; (5) Health screenings; (6) Immunization program; (7) Indigent care clinic; (8) Patient education center; (9) Patient representative services; (10) Social work; (11) Transportation to health services	AHA
Structural Quality Score	Count of seven categories for being/having/providing (1) in a highest quartile for inpatient admissions; (2) Joint Commission's accreditation; (3) Commission of Cancer's accreditation; (4) transplant services; (5) level I trauma center; (6) in a highest quartile for nurse-to-bed ratio; (7) teaching hospital status.	AHA
Hospital size	Total beds set up and staffed	AHA
Hospital ownership	(1) Nonprofit; (2) Public; (3) For-profit (referent)	AHA
Medicare enrollment	Medicare enrollment as percent of county population	AHRF
Medicare Advantage penetration	Medicare Advantage enrollment as percent of county Medicare enrollment	AHRF
Herfindahl-Hirschman Index	Sum of squared market shares of inpatient days measured in a county	AHA

AHA - American Hospital Association Annual Survey, CMS - Centers for Medicare and Medicaid Services, HIMSS - Health Information and Management System Society, AHRF - Area Health Resources Files; HCUP SID - Healthcare Cost and Utilization Program State Inpatient Database

Table 2

Variable Means (Standard Deviations) in 2011, by 2012–2013 CMS Accountable Care Organization Participation.

Variable	Nonparticipant	MSSP	Pioneer
Centralized Health System	0.096 (0.295)	0.259 (0.439)	0.229 (0.422)
Moderately Centralized Health System	0.146 (0.353)	0.282 (0.451)	0.352 (0.480)
Decentralized Health System	0.242 (0.428)	0.238 (0.427)	0.190 (0.395)
Independent Health System	0.064 (0.245)	0.032 (0.177)	-
Premier Hospital Demonstration	0.057 (0.233)	0.082 (0.275)	0.076 (0.267)
PGP Transition or CMHCB demonstrations	0.005 (0.070)	0.056 (0.230)	0.086 (0.281)
Physicians in tightly integrated POAs	0.30 (1.23)	0.66 (1.84)	1.13 (4.00)
Basic HIT	4.39 (1.15)	4.37 (1.19)	4.70 (0.80)
More Advanced HIT	1.33 (0.85)	1.58 (0.75)	1.61 (0.70)
Linkages with ambulatory facilities	2.12 (1.33)	2.43 (1.30)	2.21 (1.23)
PCPs per 1,000 population	0.68 (0.39)	0.88 (0.56)	0.93 (0.48)
Specialists per 1,000 population	1.04 (1.19)	1.62 (1.69)	1.67 (1.55)
Median income (in thousands of dollars)	46.7 (12.0)	51.3 (12.1)	55.2 (12.9)
Urban	0.734 (0.442)	0.879 (0.326)	0.905 (0.295)
Preventative services scope and mix	6.37 (2.47)	7.39 (2.16)	7.35 (2.21)
Structural Quality Score	1.73 (1.60)	2.51 (1.63)	2.54 (1.64)
Hospital size	156 (189)	230 (230)	243 (245)
Not-for-profit ownership	0.594 (0.491)	0.871 (0.336)	0.924 (0.267)
Public ownership	0.251 (0.434)	0.094 (0.292)	0.010 (0.098)
Percent Medicare enrollment	17.5 (4.5)	16.6 (4.1)	15.2 (3.6)
Medicare Advantage penetration	20.3 (13.8)	21.8 (12.8)	25.8 (14.9)
Herfindahl-Hirschman Index	0.669 (0.323)	0.551 (0.307)	0.451 (0.299)
Number of hospitals	3,296	340	105

PGP - *Physician Group Practice*, CMHCB – *Care Management for High-Cost Beneficiaries Demonstration*, HIT - *Health Information Technology*, PCPs – *Primary Care Physicians*.

Table 3Estimates of Marginal Effects from Multinomial Probit Model of CMS ACO Participation.^a

Variable	Full Estimation Sample		Excluding Hospitals Ceasing Participation by the End of 2014	
	MSSP	Pioneer	MSSP	Pioneer
Centralized Health System	0.1282 *** (0.0183)	0.0243 * (0.0095)	0.1317 *** (0.0186)	0.0078 (0.0077)
Moderately Centralized Health System	0.1007 *** (0.0150)	0.0289 ** (0.0088)	0.0961 *** (0.0149)	0.0198 * (0.0080)
Decentralized Health System	0.0543 *** (0.0114)	0.0035 (0.0061)	0.0537 *** (0.0114)	-0.0048 (0.0053)
Premier Hospital Demonstration	-0.0246 (0.0146)	-0.0093 (0.0082)	-0.0238 (0.0147)	-0.0201 *** (0.0042)
PGP Transition or CMHCB demonstration	0.2693 *** (0.0647)	0.1006 * (0.0450)	0.2855 *** (0.0655)	0.0843 * (0.0392)
Physicians in tightly integrated POAs	-0.0002 (0.0028)	0.0028 * (0.0014)	0.0003 (0.0028)	0.0024 * (0.0011)
Basic HIT	-0.0226 *** (0.0052)	0.0057 (0.0038)	-0.0211 *** (0.0052)	0.0012 (0.0033)
More advanced HIT	0.0365 *** (0.0077)	0.0045 (0.0045)	0.0352 *** (0.0078)	0.0095 * (0.0044)
Linkages with ambulatory facilities	-0.0019 (0.0043)	-0.0050 (0.0026)	-0.0019 (0.0043)	-0.0042 (0.0023)
PCPs per 1,000 population	0.0373 (0.0229)	0.0325 * (0.0144)	0.0192 (0.0239)	0.0425 *** (0.0122)
Specialists per 1,000 population	-0.0048 (0.0077)	-0.0103 * (0.0052)	-0.0004 (0.0078)	-0.0116 ** (0.0042)
$\ln(\text{Median income})$	0.0575 * (0.0229)	0.0328 * (0.0136)	0.0599 ** (0.0227)	0.0407 *** (0.0120)
Urban	0.0279 (0.0145)	-0.0086 (0.0130)	0.0241 (0.0148)	-0.0000 (0.0105)
Preventative services scope and mix	0.0030 (0.0028)	0.0002 (0.0016)	0.0035 (0.0028)	0.0005 (0.0014)
Structural Quality Score	0.0034 (0.0044)	-0.0008 (0.0026)	0.0041 (0.0044)	-0.0027 (0.0022)
$\ln(\text{Hospital size})$	-0.0012 (0.0070)	-0.0017 (0.0042)	-0.0038 (0.0069)	0.0026 (0.0037)
Not-for-profit ownership	0.0797 *** (0.0106)	0.0244 *** (0.0068)	0.0773 *** (0.0107)	0.0132 * (0.0066)
Public ownership	0.0396 ** (0.0140)	-0.0112 (0.0059)	0.0378 ** (0.0140)	-0.0112 (0.0062)
Percent Medicare enrollment	0.0024 (0.0014)	-0.0017 (0.0009)	0.0015 (0.0014)	0.0004 (0.0008)
Medicare Advantage penetration	-0.0013 *** (0.0004)	0.0001 (0.0002)	-0.0015 *** (0.0004)	0.0003 (0.0002)
Herfindahl-Hirschman Index	-0.0392 * (0.0192)	-0.0346 ** (0.0120)	-0.0456 * (0.0191)	-0.0291 ** (0.0105)
Number of Hospitals	3,518	3,482		

^aStandard errors of marginal effects in parentheses,*
 $p < 0.05$,**
 $p < 0.01$,***
 $p < 0.001$

Table 4

Predicted Probabilities of CMS ACO Participation for Hospitals with Less and More Favorable Conditions for Participation.^a

Panel A. Hospital characteristics.						
Participation Probabilities and Differences						
Full Estimation Sample (N=3,518)						
Excluding Hospitals Ceasing Participation by the End of 2014 (N=3,482)						
Conditions ^b	Nonparticipant	MSSP	Pioneer	Nonparticipant	MSSP	Pioneer
Less Favorable	0.941 *** (0.011)	0.039 *** (0.008)	0.020 ** (0.007)	0.943 *** (0.010)	0.038 *** (0.008)	0.019 ** (0.007)
More Favorable	0.387 *** (0.085)	0.487 *** (0.095)	0.126 * (0.064)	0.427 *** (0.091)	0.545 *** (0.094)	0.027 (0.026)
Difference	-0.554 *** (0.088)	0.448 *** (0.097)	0.106 (0.066)	-0.516 *** (0.093)	0.507 *** (0.096)	0.008 (0.028)

Panel B. Environmental munificence.						
Participation Probabilities and Differences						
Full Estimation Sample						
Excluding Hospitals Ceasing Participation by the End of 2014						
Conditions ^c	Nonparticipant	MSSP	Pioneer	Nonparticipant	MSSP	Pioneer
Less Favorable	0.918 *** (0.014)	0.055 *** (0.011)	0.027 ** (0.010)	0.933 *** (0.012)	0.057 *** (0.011)	0.010 (0.005)
More Favorable	0.862 *** (0.007)	0.107 *** (0.007)	0.031 *** (0.003)	0.871 *** (0.007)	0.105 *** (0.007)	0.024 *** (0.003)
Difference	-0.056 *** (0.017)	0.052 *** (0.015)	0.004 (0.011)	-0.062 *** (0.016)	0.048 *** (0.015)	0.014 * (0.007)

^aStandard errors in parentheses.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

^bLess favorable conditions reflect a free-standing hospital with the 25th percentile values of the variables physicians in tight POAs in hundreds (0), basic HIT (4), more advanced HIT (1), and hospital linkages with ambulatory facilities (1). More favorable conditions reflect a hospital associated with a centralized health system, participating in both the Premier Hospital Demonstration and PCP Transition or CMHCB Demonstration, and with the 75th percentile values of the variables physicians in tight POAs in hundreds (0.1), basic HIT (5), more advanced HIT applications (2), and hospital linkages with ambulatory facilities (3).

^cLess favorable conditions reflect a hospital in a rural location with the 25th percentile values of the variables natural log of median household income (3.673 or approximately \$39,630), PCPs per 1,000 population (0.431), and specialists per 1,000 population (0.237). More favorable conditions reflect a hospital in a urban location with the 75th percentile values of the variables natural log of median household income (3.956 or approximately \$52,240 thousand dollars), PCPs per 1,000 population (0.905), and Specialists per 1,000 population (1.553).