Applications and Extensions of Organization Theory: The Context of Accountable Care Organizations

by

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Professor Stephen Shortell, Chair
Professor Hector Rodriguez
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Abstract

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Improving quality has a been a major focus of the United States healthcare system, which has led to an increase in financing schemes and care models designed to this end. Accountable care organizations (ACOs) are the among the largest of these efforts, providing incentives for providers to join together in assuming responsibility for a set of shared patients. Understanding how providers and the ACOs in which they participate achieve their quality outcomes is difficult given the complexity of the systems in which they operate. This dissertation investigates healthcare quality through several perspectives. The first paper uses a taxonomy of ACOs to explore whether the structural characteristics and prior experiences of these organizations are associated with their performance on publicly available quality and financial measures. In the second paper, practice-level characteristics including self-reported culture and ACO participation are used to explore what factors are associated with practices' use of decision aids in the context of shared decision-making. The final paper combines the practice and ACO-level variables into a single model to compare the relative contribution of each organizational level to ACO quality.

Contents

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Introduction

The question of how to improve the quality of healthcare in the United States is not new. The Institute of Medicine (now known as the National Academy of Medicine) published its landmark *Crossing the Quality Chasm* report nearly two decades ago[1] and the Affordable Care Act is almost a decade old.[2] A number of programs and strategies have been developed to tackle the high costs and inadequate quality of the U.S. health system, but the proliferation of care models and financing schemes creates new challenges in understanding how to achieve high quality care when providers are simultaneously managing the administrative requirements of multiple payers and programs.

One strategy for dealing with this complexity is to focus on organizations' structural characteristics and capabilities. Research has found characteristics such as leadership,[3] composition (e.g., primary care-focused providers),[4] and experience with commercial contracts[5] to be important factors in attaining high-quality patient outcomes. It can also be fruitful to turn to the processes that mediate provider efforts and patient outcomes. For example, incorporating decision aids into routine care can improve quality by helping providers discuss complex medical decisions in clinically informed yet accessible ways. Given that decision aids have been found to improve patient outcomes,[6] understanding the organizational characteristics associated with use of decision aids can provide insight into the intermediate steps to quality care. Yet another approach is to direct attention to the organizational culture as the context in which decisions about organizations' structures and processes are made. Culture plays an important role in healthcare organizations, with implications ranging from provider job satisfaction[7–10] to patient outcomes.[11–13]

Over the course of the three papers, this dissertation takes each of these approaches. The first paper uses a taxonomy of ACOs to investigate whether Medicare ACOs' organizational structures are associated with performance. The second paper focuses specifically on primary care practices, exploring whether factors including practice culture and ACO participation are associated with practices' use of decision aids in the context of shared decision-making. The concluding paper combines the practice and ACO-level analyses into a unified model, which presents an opportunity to compare the relative contribution of practice and ACO level factors as drivers of ACO performance. No studies to date have endeavored to build a multi-level model that incorporates both ACO and practice variables to examine ACO quality. Together these papers provide new insights and perspectives on how providers are able to provide high quality care and the strategies they use to do so.

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Chapter 1

Medicare Accountable Care Organizations of Diverse Structures Achieve Comparable Quality and Cost Performance

1.1 Background

Accountable Care Organizations (ACOs) are a major part of current efforts to improve the health care sector. The ACO model is designed to incentivize high value care that will reduce spending while improving quality. The model allows groups of providers— physician practices, hospitals and/or post-acute facilities—to join together in assuming financial and medical responsibility for a set of assigned patients. The Medicare Shared Savings Program (MSSP), the largest of the ACO models administered by the Centers for Medicare & Medicaid Services (CMS), encourages organizations to reduce spending and improve quality by developing structures and processes that enable providers to better coordinate care for their fee-for-service patients. Citing the $411 million in savings and improvements in 82% of the measures used to assess quality in the ACO program in 2014, the Department of Health & Human Services (HHS) and CMS expanded the ACO model through their sponsorship of the Next Generation ACO and ACO Investment Model programs.

Even as new payers, specialties, and providers are rapidly adopting the ACO model, little is known about the specific mechanisms that enable ACOs to achieve savings while simultaneously maintaining or improving quality. Pioneer ACOs were found to achieve savings when compared to similar patient populations,[1,2] as were some MSSP ACOs.[3,4] Muhlestein, Saunders, and McClellan found high levels of quality across MSSP participating ACOs.[5]

However, achieving savings and quality targets has not been uniform across ACOs. In their study of MSSP ACOs, McWilliams et al. found that ACOs comprised of independent

primary care groups achieved larger savings than ACOs with hospital-integrated medical groups.[1] Pioneer ACOs with higher baseline spending levels and those operating in higher-spending geographical areas were also able to achieve greater savings,[1] indicating that ACO programs may most advantage areas and organizations that are in the early stages of their efficiency efforts. Additionally, ACOs that held commercial contracts had higher quality scores, had lower per-beneficiary benchmark expenditures, and achieved smaller Medicare savings compared to ACOs that participated only in public Medicare or Medicaid programs.[6,7] A recent analysis by Muhlestein, Saunders, and McClellan did not find a strong relationship between ACO quality outcomes and net spending,[4] indicating that reductions in spending can be accomplished with little-to-no impact on quality and that organizations that select into ACOs have opportunities to become more efficient.

Some attention has also been given to the financial and quality implications of organizational characteristics at the practice-level. Understanding how practice characteristics, including their performance management and improvement activities, affect performance can be helpful for understanding ACO performance since ACOs build upon the existing structures of physician practices. For example, Casalino et al. found that smaller physician practices have lower rates of potentially preventable hospital admissions and that physician-owned practices had fewer of these admissions than hospital-owned practices.[8] Total per-beneficiary spending is also lower in small physician groups compared to medium-sized or large hospital-based groups.[9]

Our research builds on the early effort to provide insights into how ACOs are able to achieve high quality care at lower cost[2,6,10] by examining the extent to which ACOs of diverse organizational structures, as measured by an empirically derived ACO taxonomy, are systematically associated with performance on outcomes incentivized by the MSSP program. Previous research has provided useful insights by examining individual ACO characteristics in isolation, but focusing on individual characteristics limits the practical use of such research by ACOs. Building upon the ACO taxonomy, our research accounts for the co-occurrence of key ACO characteristics[11,12] and examines variability between ACOs according to their MSSP starting year. In the course of our analysis, we also address a measurement challenge not addressed by previous research: because CMS quality measure specifications vary by ACO starting year and performance year, it is important to compare ACOs using the same measures and measure specifications for a given performance year.

1.2 Conceptual Framework

The 923 ACOs in existence as of early 2017[13] have diverse organizational structures. Despite the diversity of these organizations, previous analyses demonstrate high co-occurrence of key ACO characteristics. Shortell et al. identified three ACO organizational types: (1) the large integrated ACOs, (2) small physician-led ACOs, and the (3) hybrid ACOs that lie between the extremes of the first two.[11] The taxonomy was updated and further validated by Wu et al.[12] Large integrated ACOs offer the greatest number of services, have fewer

percentages of their providers oriented toward primary care, and score lower on physician performance management even though they had greater prior experience in payment reform initiatives. In contrast, the small physician-led ACO cluster tends to offer fewer services, has a greater proportion of primary care providers, and tends to have greater performance management systems in place despite having little prior payment reform experience. The hybrid ACO type reliably falls between the other clusters in many ways. Hybrid ACOs are most often a joint venture by hospitals and physicians; they are smaller than integrated ACOs but larger than physician-led ACOs; they offer more services than the physician-led ACOs but fewer than integrated ACOs. However, hybrid ACOs tend to have proportions of primary care practitioners and physician performance management experience on par with physician-led ACOs.

Using the ACO taxonomy to understand performance differences among ACOs has two advantages: first, it recognizes that there are some commonalities among a diverse set of ACOs. Further, identifying the common clusters of ACO characteristics enables us to analyze the performance variation within and between these clusters in regard to quality and spending. The ability of an ACO to achieve its quality and performance targets, and the strategies ACOs adopt to do so, may be a function of its organizational capabilities and culture. Kreindler et al. find the ACO model to be amenable to a variety of organizational strategies, which indicates that ACOs may be able to achieve success no matter their organizational type or accompanying improvement strategy.[14] Evidence in physician organizations indicates that performance advantages accrue to larger and more integrated organizations potentially because they use more care management processes designed to lower spending and improve quality—such as use of care managers, electronic disease registries, and sharing quality data with physicians.[8,15–17] These strategies have enabled larger physician organizations to achieve better performance outcomes than their smaller counterparts,[18] even while operating at lower-per beneficiary costs.[19]

In hypothesizing about performance differences between integrated and physician-led ACOs, one must consider the possibility that the ACO types face different internal and external incentives. For example, ACOs led by hospitals may have less incentive to curb inpatient care if the hospital leadership believes that such losses will not be recouped through shared savings bonuses. Physician-led ACOs, on the other hand, are less likely to be negatively impacted by lower volume of hospital patients and may be better positioned to succeed in the ACO model.

In light of the mixed evidence, our first hypothesis is that large, integrated ACOs may be associated with higher quality but not higher spending when compared to smaller physician-led ACOs. This hypothesis is motivated by the greater use of chronic care management processes and previously identified performance advantages among large physician organizations as well as the possibility that economies of scale enable these organizations to make investments with high fixed costs (like IT infrastructure). However, smaller physician-led organizations have also been found to better prevent hospitalizations for ambulatory-care sensitive conditions,[8] and therefore achieve lower per-beneficiary spending.[9] Thus, our second hypothesis is that smaller, physician-led ACOs will be more likely to achieve shared

savings than larger integrated ACOs. Together, these hypotheses posit that large, integrated ACOs will have higher quality compared to physician-led ACOs, while physician-led ACOs will outperform integrated ACOs on spending measures. Additionally, we presume that the physician-led ACOs will emphasize physician services to achieve quality targets because these services are directly within their control and will, therefore, have higher per-person spending for physician-services compared to the integrated and hybrid ACO types.

1.3 Methods

Data

We integrated the National Survey of ACOs (NSACO) with the most recent CMS performance and financial data available at the time of this study. The NSACO is an ongoing online survey of ACOs that has been fielded in three waves: October 2012 through May 2013, September 2013 through March 2014, and November 2014 through April 2015. Each ACO is included in only one wave to date; each NSACO wave has been fielded to capture information on new ACO entrants. The response rate across all waves was 64 percent. Previous studies relying on the NSACO data have described the survey and data more fully.[20] There was no evidence of nonresponse bias on key variables when comparing respondent ACOs to the universe of ACOs in the first or second survey administration waves.[12,20] Review of wave three ACOs for the current analysis also showed no statistically significant differences in CMS reported outcomes for survey respondents and non-respondents. The ACO's annual Herfindahl-Hirschman Index (HHI) market concentrations for specialists and primary care physicians is calculated using the SK&A Office Based Physicians Database provided by IMS Health (now Quintiles).

We report the results of a series of repeated measures analyses that compare the three organizational types over their respective MSSP tenures. Our study sample consists of the 226 NSACO survey respondents that were also included in CMS' August 2015 release of MSSP financial and quality performance data. Because twenty-two ACOs were dropped due to item non-response on key NSACO survey questions, the final analytic sample consisted of 204 MSSP ACOs and 533 performance-year observations. We used unique identifiers to merge the NSACO responses to the organization's corresponding data in the CMS files. This strategy allows us to compare information gathered about the ACO's organizational characteristics shortly after the ACO's establishment with its performance in the subsequent years.

Measures

To assess and categorize each ACO, we used the empirically derived ACO taxonomy developed by Shortell and colleagues[11] and further validated by Wu et al.[12] The ACO taxonomy includes eight attributes measured in the NSACO to distinguish each ACOs type:

size (number of full-time equivalent (FTE) physicians), breadth of provider participation, scope of services provided, whether the ACO is an integrated delivery system, percent of physician FTEs who are primary care providers, the institutional leadership type, the degree of physician performance management, and payment reform experience.[11,12] Ouayogode et al. used some of the same variables to examine correlates of ACO performance,[7] but did not examine differences by ACO types—a more parsimonious way of examining potential associations with performance.

We use the publicly reported quality and financial performance measures released by CMS in 2013, 2014, and 2015. Of the financial data available, we focus on dichotomous indicators for achieving any savings during the performance year, as well as the inpatient, physician services, and total per-beneficiary-year spending amounts.

The task of comparing ACOs based on their performance is complicated by yearly changes in the measures used to assess performance. CMS updated its methodology for calculating performance measures each year covered by our analyses. As such, the quality measures and domain items for each performance year will differ slightly according to the year an ACO launched. While these updates are designed to improve the MSSP metrics, they make it difficult to compare ACOs of different starting years or ACOs over time. We address these challenges by measuring each ACO's *relative* performance within each quality domain: patient/caregiver experience, care coordination/patient safety, preventive health, and at-risk population treatment. Relative performance measures were created by identifying each ACO's ventile of performance on a given measure relative to ACOs of the same starting year. Ventiles—each containing $1/20^{\text{th}}$ or 5% of the population—were chosen as the most granular level of measurement given the limited number of observations in each combination of starting and performance years. Performance on reverse-coded quality measures was calculated such that lower scores were associated with higher ventiles. Measure-level performance was then averaged across each domain; the measures included in each domain were determined independently for each starting-year and performance-year stratum to account for both changes to the measures included in domains and for changes in the methods used to calculate each quality score.

The Herfindahl-Hirschman Index (HHI) was used to account for competition among primary care and specialist providers within an ACO's service area. A detailed account of the methods used to calculate the county-level HHI data is discussed elsewhere.[21] To summarize county-level HHI data at the corresponding state-level service areas publicly reported by CMS, we average the specialist and primary care HHIs for the entire service area, weighted by the number of Medicare fee-for-service beneficiaries in the area (as reported in the corresponding years of the CMS Geographic Variation Public Use File).

Indicators for the geographic region of the United States in which the ACO operates were included the analyses (Northeast, South, Midwest, and West as identified by The Dartmouth Institute's *Dartmouth Atlas*).

Statistical Analyses

While the ACO taxonomy addresses several important operational decisions through proxy measures such as use of performance management systems and scope of services provided, we also used t-tests and chi-square tests to conduct unadjusted comparisons of ACO types for additional measures—such as how the ACO planned to distribute any shared savings bonuses and previous experience with Medicare Advantage and capitated contracts. Pair-wise proportions tests, with Bonferroni corrections and Tukey's Honest Significant Difference (HSD) tests designed to identify the specific significant pairwise comparisons within overall statistically significant results, were conducted for significant Chi-squared and F-test results.

We compared the within-type and between-type variance for each of the performance measures used as dependent variables using a three-level linear restricted maximum likelihood estimation strategy. The levels for this analysis are performance year observations (level 1) nested within ACOs (level 2) nested within ACO types (level 3), allowing us to identify the extent to which differences in performance are attributable to differences in groups at each level. This analysis adjusts for region, physician HHI, and the year in which the ACO joined the MSSP.

We then leverage the repeated measures of performance year data to estimate a series of a two-level linear restricted maximum likelihood models, regressing the dependent financial and quality performance variables on the ACO taxonomy types, controlling for region, physician HHI, and the year in which the ACO joined the MSSP. Multi-level models clustered at the individual-ACO level enable us to account for unobserved heterogeneity between these organizations—a particularly appealing benefit given the limited number of covariates we can include given the modest ACO sample size.

Sensitivity Analyses

We performed several sensitivity analyses to ensure that the reported results are not artifacts of our model specifications. We assess whether there are systematic differences across years in terms of prior Medicare Advantage or capitated contract experience, or how shared savings bonuses were distributed. As a final robustness check, we compare the results of analyses that pool all ACOs with models for each starting year; while our main specification offers greater statistical power, the year-by-year analysis has the advantage of identifying whether there are statistically significant differences across ACO starting years.

1.4 Results

Sample Statistics

Average characteristics are largely indistinguishable between ACO types with only four instances of statistically significant differences between ACO types—and only one difference

between integrated and physician-led ACOs (Table 1). We find that a greater proportion of hybrid MSSP ACOs participate in commercial ACOs compared to physician-led ACOs, while a greater proportion of integrated ACOs participate in Medicare Advantage compared to hybrid ACOs. The average HHI for primary care providers is higher for integrated ACOs than for physician-led ACOs (2157 and 1723, respectively), indicating that physician-led ACOs tend to operate in primary care markets that are slightly more competitive. Additionally, of the ACOs that report having a plan for distributing shared savings bonuses, integrated ACOs report plans to retain a greater share of the bonus for the ACO body to offset overhead and infrastructure investments in information technology compared to hybrid ACOs (34.5% to 18.7%, respectively). No other differences between ACO types reached statistical significance.

Sources of Variance

There are no instances when the taxonomy groups account for a substantial portion of the variance on any of the performance measures in the three-level analysis (Table 2): the intraclass correlation coefficient column shows that the maximum proportion variance attributable to the ACO types is 0.05 (for spending on physician services). Instead, the greatest source of performance variation is between ACOs and *within* the ACO types. As such, performance is likely to be a function of organizational characteristics and activities that are present and varying within each type of ACO type.

Quality Outcomes

We do not find evidence to confirm our hypothesis that integrated ACOs demonstrate higher quality than physician-led ACOs when controlling for region, physician HHI, and MSSP starting year (Table 3). In all domains other than patient safety, integrated ACOs achieve higher relative performance compared to physician-led ACOs in adjusted analyses; however, these differences are not statistically significant.

Financial Outcomes

We find no evidence to refute our hypothesis that large, integrated ACOs may be associated with higher quality but not higher spending when compared to smaller physician-led ACOs. As Table 4 shows, there are no significant differences between ACO types in total per person-year spending or inpatient spending per person-year. In fact, the significant differences in physician spending indicate that integrated ACOs have *lower* spending in this category compared to physician-led ACOs. Higher physician-services spending among physician-led ACOs is consistent with our assumption that physicians are likely to increase use of ambulatory care services in the pursuit of lower overall spending through reduced inpatient utilization for ambulatory care sensitive conditions.

Table 1: Sample Statistics, by ACO Type

	Physician-Led (N = 98)	*Hybrid (N = 38)*	*Integrated (N = 68)*	χ^2	*p*	*PrTest*
Region (No. of ACOs)						
Northeast	22	10	13	(6, 204) = 9.99	.13	—
South	47	12	23			
Midwest	14	12	18			
West	15	4	14			
Previous experience (No. of ACOs)						
Commercial/private ACO	35	23	36	(2, 204) = 8.72	.01	Hybrid > Phys
Medicare Advantage	33	17	37	(2, 122) = 6.17	.05	Int > Hybrid
Capitated contracts	26	12	16	(2, 112) = 1.20	.55	—
	Mean (SD)	*Mean (SD)*	*Mean (SD)*	*F*	*p*	η^2	*HSD*
Beneficiary characteristics (Percent of ACO population)							
Disabled	14.5 (7.2)	15.5 (6.9)	16.4 (9.8)	(2, 206) = 1.18	.31	0.01	—
End-stage renal disease	1.1 (0.7)	1.0 (0.7)	1.0 (0.6)	(2, 206) = 0.40	.67	0.00	—
Medicaid eligible	8.6 (11.2)	6.2 (6.4)	7.9 (10.1)	(2, 206) = 0.79	.46	0.01	—
Female	53.1 (4.8)	54.8 (4.6)	54.7 (4.8)	(2, 193) = 2.90	.06	0.03	—
Race/ethnicity							
Black	9.4 (12.1)	7.9 (7.4)	7.9 (7.9)	(2, 193) = 0.55	.58	0.01	—
Hispanic	2.6 (5.4)	2.1 (3.8)	1.9 (3.4)	(2, 193) = 0.49	.61	0.01	—
Asian	1.6 (6.6)	0.9 (1.3)	2.4 (8.8)	(2, 193) = 0.57	.57	0.01	—
Native American	0.2 (0.5)	0.1 (0.3)	0.2 (0.5)	(2, 193) = 0.52	.59	0.01	—
Other	1.9 (1.4)	1.9 (1.0)	2.4 (2.0)	(2, 193) = 1.96	.14	0.02	—

Continued

Table 1 *Continued*

	Mean (SD)	*Mean (SD)*	*Mean (SD)*	*F*	*p*	η^2	*HSD*
HHI (Average HHI score)							
Average All Providers	2,426 (1,019)	2,580 (1,080)	2,885 (1,136)	(2, 205) = 3.69	.03	0.04	—
Primary care	1,723 (746)	1,987 (926)	2,157 (932)	(2, 205) = 5.48	.01	0.05	Int > Phys
Specialty care	3,130 (1,406)	3,173 (1,379)	3,614 (1,469)	(2, 205) = 2.48	.09	0.02	—
ACOs with plan for distributing bonus (percent of ACOs)	75.0	68.8	75.5				
Distribution of bonus							
Kept by ACO administrative body	27.3 (18.9)	19.9 (17.2)	35.6 (27.8)	(2, 102) = 3.47	.04	0.07	Int > Hybrid
Shared with member organizations	28.6 (27.6)	43.2 (33.8)	30.6 (24.8)	(2, 83) = 1.75	.18	0.04	—
Shared directly with physicians	44.6 (30.0)	34.7 (26.7)	37.9 (28.9)	(2, 95) = 0.95	.39	0.02	—
Shared with external partners	7.4 (12.5)	7.5 (15.0)	12.2 (16.8)	(2, 74) = 0.90	.41	0.02	—
Other	4.4 (19.0)	4.8 (12.4)	7.5 (18.6)	(2, 59) = 0.19	.82	0.01	—

Notes. PrTest: Pairwise test of proportions with Bonferroni corrections to identify pairwise significant differences; η^2: the proportion of variance attributable to ACO types; Tukey's honest significant difference (HSD) test: identifies significant pairwise comparisons within overall statistically significant results.

Table 2: Sources of Variance

	Variance between ACO Types	*ICC*	*Variance between ACOs*	*ICC*	*Residual Variance*	*N*
Quality (Ventile of performance)						
Patient experience	0.27	0.01	2.37***	.554	2.14***	491
Patient safety	6.16×10^{-10}	4.14×10^{-20}	2.43***	.642	1.81***	493
Preventive health	6.49×10^{-9}	3.18×10^{-18}	2.98***	.673	2.08***	484
Diabetes	2.28×10^{-10}	3.31×10^{-21}	3.09***	.607	2.49***	484
Hypertension	4.99×10^{-5}	8.61×10^{-11}	4.17***	.601	3.40***	484
Ischemic vascular disease	0.46	0.01	2.65***	.324	3.88***	484
Heart failure	3.92×10^{-10}	4.62×10^{-21}	3.02***	.275	4.91***	480
Coronary artery disease	1.29×10^{-8}	6.69×10^{-18}	3.14***	.399	3.86***	484
Financial outcomes						
Overall spending ($)	332.4	0.01	2,070.7***	.440	2,365.0***	533
Physician services ($)	167.8	0.05	742.2***	.964	146.6***	533
Inpatient services ($)	4.8×10^{-5}	2.50×10^{-15}	935***	.939	238.8***	533
Any savings achieved (0/1)	2.4×10^{-7}	7.13×10^{-15}	2.19***	.593	—	493

Notes. ICC: Intraclass correlation coefficient, proportion of total variance shared among units in same cluster (Taxonomy and ACO).
***$p<.001$.

Despite differences in spending by ACO type, we find no differences in the likelihood of achieving any savings. As the final column of Table 4, the odds of achieving any savings are no greater for integrated ACOs compared to physician-led ACOs.

Sensitivity Analyses

The sensitivity analyses ruled out the possibility that the results were driven by several potential omitted variables: there were no systematic differences across ACO types and years in terms of prior Medicare Advantage or capitated contract experience, or how shared savings bonuses were distributed among ACO participants (Table 1). Likewise, we found that patient populations—in terms of demographics, concurrent Medicaid eligibility, and Medicare eligibility based on disability status or End-Stage Renal Disease diagnosis—did not systematically differ between ACO types. Our results did not differ when we added these variables into the regression model.

Our comparison of the analyses that pool all ACOs with models for each starting year shows no statistically significant differences across ACO starting years. Figure 1 depicts the coefficient plots from the robustness checks that compare our original model (all years combined) with separate models for each starting year. There is some variability between

Table 3: Quality Results by Domain: Performance Ventile

	Patient Experience	*Patient Safety*	*Preventive Services*	*Diabetes*	*Hypertension*	*Ischemic Vascular Disease*	*Heart Failure*	*Coronary Artery Disease*
Taxonomy (Reference: "physician-led")								
Integrated	0.68 (0.47)	−0.26 (0.47)	0.07 (0.57)	0.41 (0.61)	0.61 (0.81)	1.20 (0.63)	0.39 (0.76)	0.72 (0.70)
Hybrid	0.77 (0.57)	−0.26 (0.56)	−0.04 (0.68)	0.22 (0.72)	1.35 (0.97)	0.52 (0.75)	−0.80 (0.90)	0.49 (0.83)
Region (Reference: "northeast")								
South	−1.52** (0.53)	−0.13 (0.52)	−1.27* (0.63)	−1.45* (0.67)	−2.87** (0.91)	−1.16 (0.70)	1.57 (0.84)	0.14 (0.77)
Midwest	−0.74 (0.64)	−0.24 (0.62)	−0.86 (0.76)	−0.37 (0.81)	−0.00 (1.09)	0.32 (0.85)	0.42 (1.02)	0.69 (0.93)
West	−3.69*** (0.67)	1.64* (0.66)	−3.05*** (0.81)	−3.35*** (0.86)	−4.99*** (1.16)	−3.85*** (0.90)	−0.01 (1.08)	−2.09* (0.99)
Starting year (Reference: 2012)								
2013	−0.16 (0.48)	0.07 (0.47)	−0.14 (0.58)	−0.12 (0.61)	−0.79 (0.82)	0.19 (0.63)	0.48 (0.75)	0.05 (0.69)
2014	0.21 (0.51)	0.11 (0.50)	−0.48 (0.61)	−0.22 (0.66)	−0.73 (0.88)	0.03 (0.69)	−0.49 (0.83)	−0.33 (0.76)
Competition								
Physician HHI	0.00 (0.00)	0.00** (0.00)	0.00 (0.00)	0.00*** (0.00)	−0.00 (0.00)	0.00* (0.00)	−0.00 (0.00)	−0.00 (0.00)
Constant	10.91*** (0.57)	9.25*** (0.55)	11.00*** (0.67)	10.08*** (0.72)	12.55*** (0.98)	9.66*** (0.79)	10.21*** (0.95)	10.86*** (0.86)
Random part								
SD(ACO)	2.37***	2.44***	3.00***	3.11***	4.17***	2.65***	3.02***	3.15***
SD(Residual)	2.14***	1.81***	2.08***	2.49***	3.40***	3.88***	4.91***	3.86***
Observations	491	493	484	484	484	484	480	484

Notes. SEs in parentheses; performance ventiles calculated using ACOs of same starting and performance year; *p<.05, **p<.01, ***p<.001.

Table 4: Spending Results, by ACO Type

	Total Spending (per person-year)	*Physician Services (per person-year)*	*Inpatient Services (per person-year)*	*Achieved Savings (odds ratio)*
Taxonomy (Reference: "physician-led")				
Integrated	−829.71 (426.04)	−339.40** (123.64)	−155.23 (156.92)	1.21 (0.60)
Hybrid	−547.50 (498.95)	−296.86* (146.59)	−112.28 (185.94)	1.13 (0.67)
Region (Reference: "Northeast")				
South	−656.04 (481.51)	−28.20 (139.98)	−352.76* (177.67)	3.91* (2.20)
Midwest	−837.98 (570.38)	−463.46** (160.93)	−252.67 (204.65)	1.03 (0.68)
West	230.76 (590.41)	277.89 (172.54)	179.69 (218.90)	0.52 (0.37)
Starting year (Reference: 2012)				
2013	−1,685.91*** (419.46)	−139.16 (124.68)	102.43 (158.09)	0.89 (0.44)
2014	−1,607.64*** (470.14)	40.98 (134.50)	90.70 (170.75)	0.85 (0.46)
Competition				
Physician HHI	−0.31* (0.16)	−0.14*** (0.01)	−0.05* (0.02)	1.00 (0.00)
Constant	13,667.40*** (534.88)	3,883.22*** (134.59)	3,593.59*** (172.66)	0.93 (0.57)
Random part				
SD(ACO)	2,076.93***	742.57***	937.15***	2.19***
SD(Residual)	2,363.36***	146.59***	238.81***	—
Observations	533	533	533	493

Notes. Reference group: physician-led ACOs; all models include region and Herfindahl–Hirschman Index (HHI) market concentrations for physicians; models with all years combined also include indicators for ACO starting year.
*p<.05, **p<.01, ***p<.001.

ACOs of different starting years but these differences are not statistically significant.

1.5 Discussion

Previous research identified three major types or clusters of ACOs based on eight conceptually and empirically derived attributes (Shortell et al., 2014; Wu et al., 2016).[11,12] Performance on quality or financial measures in the first three years of the MSSP was not associated with ACO type. In fact, ACO type accounts for a maximum proportion of 5% of the variance in performance (Table 2, ICC columns). As such, each ACO type appears equally capable of achieving quality performance, which is consistent with early ACO research by Kriendler et al. (2012)[14], who found that the strategies employed to achieve integration varied according to the unique characteristics and needs of participants. This suggests that CMS and other payers should continue to support all types of ACOs while focusing attention on improving the effectiveness of the lowest performers in order to reduce performance variation within ACO types.

In an early step toward disentangling the heterogeneity in ACO performance, Peiris et

al. (2016)[6] found that Medicare ACOs that also held commercial ACO contracts tended to achieve smaller savings but had higher quality scores than those ACOs that did not participate in commercial payer ACO contracts. Such findings are consistent with other research that found noticeable differences between ACOs that contracted with public and private payers, such as greater experience with pay-for-performance initiatives and greater reliance on upfront care management payments for those ACOs contracting with private payers.[22] However, our sensitivity analyses found that our conclusions are largely unchanged by the inclusion of commercial contract information. Even though we find that hybrid ACOs are more likely to participate in commercial ACO contracts compared to physician-led ACOs, this trend does not lead to advantages (or disadvantages) in the quality or cost performance of ACOs.

ACO types are neither predictive of performance nor proxies for differences in production decisions, highlighting the importance of better understanding the sources of heterogeneity in performance within ACO types. Sources of within-ACO-type performance variation may include institutional pressures[23] faced in particular by the larger integrated group model ACOs; high transaction costs[24] faced by the smaller physician led ACOs; the need for each type to implement high reliability care management processes[25] and to accelerate learning of what works and does not work[26]. Insights on how to drive improvement within each ACO type can be gained by focusing on how professionals understand and apply the concept of integration within their organization. For example, Kreindler et al. found that ACO leaders understood integration in very different ways: some perceived it as more of an administrative formality while others strongly identified as partners with their new ACO colleagues.[14] Providers' commitment to the activities of coordinated care may be a function of how they conceptualize integration and the responsibilities it entails; participation in care management tasks is likely driven more by personal motivation and buy-in than by top-down reform efforts. Notions of what integration entails differ by ACO type, so future research examining the ways in which ACOs' integrate services based on their organizational structure may aid in identifying the drivers of within-ACO type variance in quality and cost performance. Conceptualizations of integration among ACO stakeholders may also be related to their willingness to undertake performance-enhancing initiatives such as implementing new patient communication technologies and dedicating resources to programs for patient education and engagement.[27] Clarifying the ways leaders design and execute their organizational integration strategies—and the extent to which providers buy-in to the approaches—can provide important insight into the differences in performance across organizations that are structurally similar.

1.6 Limitations

There are several limitations to our study, spanning both internal and external validity concerns. While our study uses repeated observations for the performance data that serve as dependent variables, the full NSACO survey data was collected from each site only once.

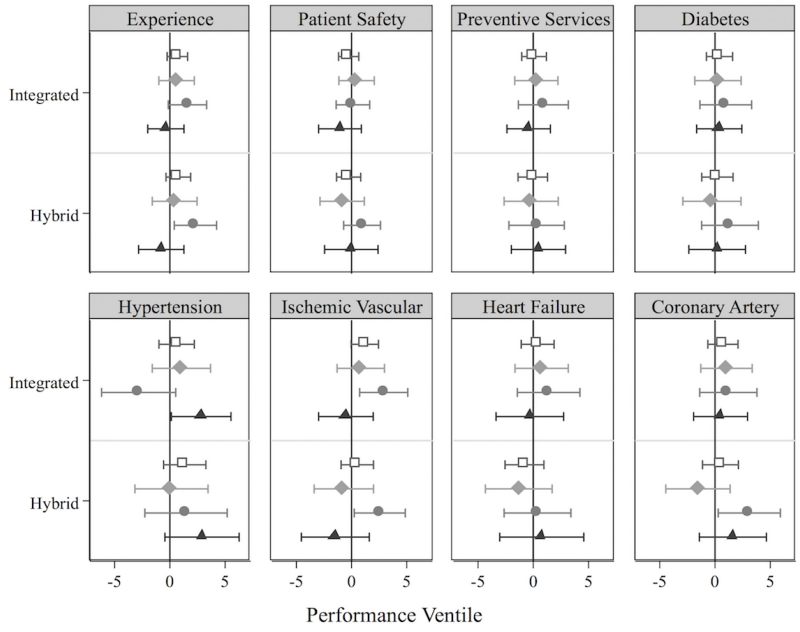
There is clear need for longitudinal analyses of survey-based information as ACOs evolve, and we look forward to leveraging future follow-up surveys to continue this work. We were also limited in the number of independent variables that could be examined due to a modest sample size. Third, while our results may be useful for analyzing Medicare ACOs, the lessons learned here might not be directly applicable to ACOs operating outside of the Medicare Shared Savings Program. Commercial ACOs are more numerous and cover more lives than federal ACOs on average,[5] so additional research is needed to assess whether the patterns we identified are exhibited amongst commercial ACOs.

1.7 Conclusions

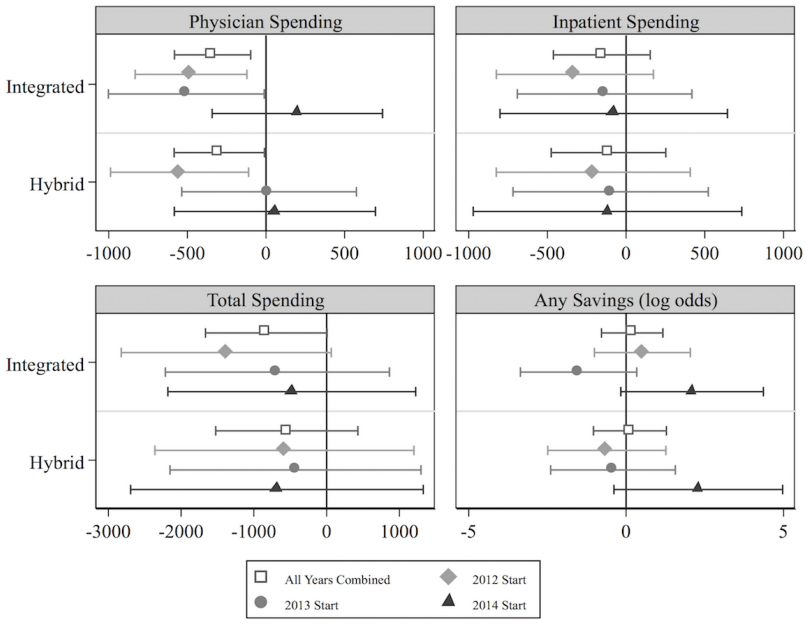
Patterns in quality and financial performance are generally not consistent across diverse ACO types. In analyzing the association of ACO type and performance on key quality and financial metrics, we find a substantial amount of performance heterogeneity within ACO types. As such, we recommend future research on ACO performance focus on previously unexamined factors that may account for variance within types, such as potential differences in organizational culture, leadership, use of team-based care, and different strategies to achieve organizational integration and how such differences interact with ACO structure and resources to influence performance. Inter-organizational learning between ACOs of the same type could enhance performance of individual ACOs by creating improvement strategies suited to the unique needs of the organization. Such collaborative learning exercise may also be of interest to policymakers who seek to improve overall ACO performance.

Our analyses also indicate that researchers and policy makers should be cautious when pooling ACOs of different implementation dates and performance years due to changes in measure specification, especially in high stakes performance-based financial incentive programs. While our robustness checks demonstrated no statistically significant differences in our analyses by starting year (Figure 1), the variations in coefficient plots underscore the importance of continued monitoring of associations between ACO type and performance. Finally, given we find a great deal of heterogeneity within ACO types, future research should identify the factors affecting organizational performance within as well as potentially between ACOs types.

a. Quality Outcomes



b. Financial Outcomes



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Chapter 2

The Role of Medical Practice Culture in Adopting Decision Aids for Use in Shared Decision-Making

2.1 Background

Shared Decision-Making

Shared decision-making is a key strategy for creating patient-centered healthcare. By actively participating in their treatment decisions, patients are able to make clinically informed healthcare decisions that are consistent with their personal values, goals, and lifestyles. Shared decision-making is a collaborative process between providers and patients in which both parties share information that helps patients make their decisions. The clinician presents information about treatment options while the patient provides insights into their preferences, goals, and capacities.[1–3] The purpose of shared decision-making is to make healthcare more patient-centered, ensuring that each patient's treatment decision is informed and reflects their personal values.

Decision aids facilitate this information sharing by guiding the discussion through key decision points.[4] The Elwyn model of shared decision-making[5] specifically addresses the use of decision supports, which encompass the gamut of decision aid formats: from brief texts to in-depth booklets, videos, and internet resources. Decision aids rely on medical evidence to present the risks and benefits of a set of treatment options, their relative effectiveness, and their costs. Employing decision aids help patients feel more knowledgeable and help them to articulate their personal values as they approach treatment decisions.[6] In contrast, when even well-intentioned providers are unguided by decision aids, they may present information that is too clinically unfamiliar or complex to patients or they may inadvertently bias or influence patients.[7] Implementing decision aids as a standard part of a robust shared decision-making process is an important step toward creating an atmosphere of patient-centered care. As such, there is a need to identify aspects of medical practices that might promote the effective

adoption and use of decision aids. One key aspect is the culture of the organizations involved in determining the extent to which decision aids are used.

Culture

There is a substantial literature on the role of organizational culture in health care. While some intensive care settings may benefit under hierarchical cultures[8], most research shows team-oriented cultures to be positively associated with clinician job satisfaction,[9–12], safety climates,[13] patient satisfaction,[14] and improved patient outcomes.[15]

Research has also found an interactive effect between organizational culture and implementing new process, group and innovative cultures are likely to implement quality improvement activities[16] and the effectiveness of interventions may be heightened when implemented in innovative cultures.[17] This body of research has helped in developing culture-focused interventions in support of implementing new care programs.[18,19] In order for shared decision-making and decision aids to become standard processes of care, medical practices must cultivate organizational cultures that support patient-centered approaches to care.[20]

Study Aim

This paper uses a nationally representative sample of primary care-focused medical practices in order to identify common culture types, and then to assess whether culture is associated with the use of shared decision-making and participation in patient-oriented efforts such as use of shared decision-making and participation in Accountable Care Organizations. This research serves as a bridge between the literature that has established the importance of organizational culture in health care settings and current interest in the factors associated with uptake of evidence-based, patient-centered processes such as the use of decision aids.

2.2 Methods

Data

This research is based on the National Survey of Healthcare Organizations and Systems (NSHOS), which was fielded from June 2017 through August 2018 with a response rate of 46%. The survey sampling frame included practices with at least three primary care physicians, using a stratified cluster sampling design to select practices both within and outside of healthcare systems. A knowledgeable key informant representative from each practice responded to questions on the practice activities and experiences, ranging from basic characteristics such as ownership and size to the adoption of patient engagement strategies, and assessments of practice culture.

Measures

Shared Decision-Making

Adoption of shared decision-making and use of decision aids was assessed via practice self-report. Using response options of "None," "Some," "Most," and "All," respondents reported how many staff and clinicians had received formal training in shared decision-making, how many providers routinely engage in shared decision-making, how many routinely use decision aids, and how many patients received follow-up on their treatment decisions after the initial shared decision-making discussion. Respondents separately reported the proportion of patients who receive decision aids before making a decision about selecting medication for diabetes, receiving treatment for osteoarthritis, and undergoing screenings for breast, prostate, colorectal, and lung cancers. Practices were considered to use shared decision aids in a decision-making context if they reported at least some formal training, routine use of shared decision-making, routine use of decision-aids, and routine follow-up with patients after initial discussion. The survey questions are shown in the Appendix.

Practices are considered to be engaging in shared decision-making only if they also conducted systematic follow-ups with patients, in order to differentiate practices with superficial implementation from those that follow the evidence-based guidelines.[21] Decision aids may be used in situations that would not be considered shared decision-making;[22] in true shared decision-making, most patients need time to discuss their options with family members and other healthcare providers, making the opportunity to allow patients time before a follow-up an important part of the process.[2,5] Limiting the definition of decision aid use to only those with comprehensive shared decision-making processes increases the likelihood that the decision aids are being used in the collaborative and deliberative manner for which they are intended.

Practice Culture

Culture is measured using the previously validated Competing Values Framework.[23,24] The competing values framework assesses organizational cultures along two orthogonal dimensions: orientation and level of control. The orientation dimension reflects whether the organization places its focus on its internal environment (e.g., relationships among people within the organization) or its external environment (e.g., openness to new ideas). The control-flexibility dimension measures the extent to which the organization is prescriptive or flexible in its operations. This 2x2 structure creates four culture quadrants: a team quadrant that emphasizes personal affiliation and group dynamics; an innovation-oriented quadrant that supports development and experimentation; a bureaucratic quadrant reflecting the values and norms associated with bureaucracy; and a rational quadrant wherein efficiency is emphasized. Organizations can reflect different combinations of these culture quadrants, which can vary across roles, departments, and levels of hierarchy.

In the National Survey of Healthcare Organizations and Systems (NSHOS), they key informant practice representative was asked to distribute 100 points across descriptions of

bureaucratic, rational, team, and innovative quadrants according to the extent to which each was reflective of their practice. Because the survey was unable to incorporate all questions from previously validated CVF culture assessment instruments, it instead included six additional questions on organizational activities and attributes associated with the culture quadrants most prone to social desirability response bias: the innovative and team quadrants. The questions, provided in full in Table 2.1, assess whether successful innovations are publicized, if there is protected time for generating new ideas, whether team members feel a sense of belonging, and whether team members feel safe raising concerns. The culture questions are then summarized into a practice culture "type" as described in Section 2.2.

Analysis

Practice Culture

The first step of the analysis was to determine whether there were trends in self-reported culture that could be used to create subgroups of practice culture types. The ten culture-related questions were summarized into categories of predominant culture types using Kohonen self-organizing maps (SOMs), unsupervised competitive neural networks.[25] Because SOMs rely on the number of clusters as an input, SOMs relying on different number of clusters need to be created and compared. As such, SOMs were created using 2 through 10 clusters. The final number of clusters was determined the most parsimonious model that allowed for meaningful distinctions between the types, as determined in a silhouette analysis[26] and a check for meaningful differences between groups. Upon selecting a three-cluster solution (more details provided in Section 2.3), practices were assigned to clusters using hierarchical clustering.

Practice Culture and Patient Engagement

The second step of the analysis was to conduct a series of logistic regressions in which the adoption or extent of adoption of decision aids is regressed on a series of control variables selected for their likelihood of correlating with both the adoption of patient engagement and practice culture. The model is defined as:

$$Y = \alpha + \beta_n X_n + \gamma_n Z_n + \epsilon \tag{2.1}$$

where X_n are the culture types as identified in Section 2.3, and the coefficients of interest are the β_n values. The Z_n variables represent the control variables, such that: Z_1 is practice ownership, Z_2 is the number of employed primary care physicians, Z_3 is number of employed nurse practitioners and physicians' assistants, Z_4 is a practice's previous experience with payment and delivery reform initiatives, Z_5 is an indicator for whether the practice reports having a system for identifying high need-high cost patients, Z_6 is the practice's electronic health record capabilities, Z_7 is the practices' use of evidence-based guidelines, Z_8 the availability of EHR-based clinical support tools, and Z_9 whether the practice reports

using culturally tailored interventions. The intercept is represented by α, and ϵ represents the error term.

2.3 Results

Predominant Cultures

The team and innovation questions (provided in Table 2.1) had Cronbach's α values of 0.71 and 0.81, respectively, indicating acceptable reliability. Results of the Kohonen self-organizing map showed that a three cluster solution best characterized the landscape of medical practice cultures, as it demonstrated meaningful differentiation between practice cultures. The three culture types identified in the analysis were labeled "Team," "Team-Innovative," and "Control." The average of practices responses for each culture type are provided in Table 2.1, and a visual representation of the average scores by Competing Values Framework quadrants is provided in Figure 2.1.

The team type is named for its dominant team-orientation and include 50% of practices. Practices of this culture type scored higher than the control-type culture on all innovation and orientation questions, as well as reporting somewhat greater implementation of team and innovation characteristics. The next culture type identified is the "Team-Innovation" culture, which comprises 42% of practices. The team-innovative culture has the highest self-identified scores in the team and innovation CVF quadrants, as well as higher scores across both the follow-up team and innovation questions (see Table 2.1). Practices with control cultures account for the remaining 7% and had the highest average scores in the bureaucratic (41.10) and rational (40.06) CVF quadrants. The control label was chosen culture because practices showed roughly equal distribution along the flexibility/control axis, with little differentiation along the orientation axis (see Figure 2.1)

Comparisons between culture types on dimensions such as ownership, number of physicians, and revenue sources is provided Table 2.2. The majority of practices within each culture type are owned by or participate in health care systems; of the practices that participate in a system, 52% are classified as "Team", 39% are classified as "Team-Innovative", and only 5% are considered "Control" cultures (not shown in Table). Team-innovative culture practices are most likely to participate in an ACO, though only the between control practices is statistically significant ($p = 0.002$). Team-Innovative practices are less likely to participate in a system than practices of either of the other culture types ($p = 0.02$).

Culture and Use of Decision Aids

Table 2.3 shows the difference in use of patient engagement activities by culture type, controlling for practice ownership, number of employed primary care physicians, number of employed nurse practitioners and physicians' assistants, previous experience with payment and delivery reform initiatives, whether the practice reports having a system for identifying

Table 2.1: Team and Innovation Question Averages, by Culture

Domain	Question	Team	Team-Innovative	Control
Self-Identified Culture	Our practice is a very personal place. It is a lot like an extended family. People seem to share a lot of themselves.	38.78 (24.25)	47.83 (19.23)	12.11 (10.32)
	Our practice is a very dynamic and entrepreneurial place. People are willing to try new things to see if they work.	14.91 (10.32)	23.67 (13.27)	6.73 (6.21)
	Our practice is a very formalized and structured place. Bureaucratic procedures generally govern.	19.00 (15.59)	12.13 (9.60)	41.10 (27.34)
	Our practice is very production oriented. The major concern is getting the job done.	27.31 (18.09)	16.37 (11.06)	40.06 (28.85)
Innovation	Successful care delivery innovations are highly publicized	1.48 (0.80)	1.89 (0.81)	0.80 (0.64)
	There is protected time to generate new ideas and innovations	0.95 (0.74)	1.68 (0.87)	0.23 (0.48)
	We encourage trying new ideas to see if they work	1.43 (0.64)	2.34 (0.61)	0.76 (0.66)
	We consider ourselves to be the testing ground for new approaches to engage patients in their care	1.27 (0.79)	2.03 (0.80)	0.55 (0.57)
Team	There is a strong sense of belonging	2.00 (0.66)	2.72 (0.48)	1.11 (0.69)
	Team members feel safe raising concerns regarding patient care	2.00 (0.65)	2.65 (0.50)	1.43 (0.90)

Self-Identified Culture based on distribution of 100 points across options presented.
Values for questions in Team and Innovation domains based on averages of 0-3 scale: Never (0), Sometimes (1), Often (2), Always (3).
All group differences are significant at $p < 0.001$

Table 2.2: Descriptive Statistics by Culture Type, weighted

	Team % N (N=1073)	Innovate % N (N=902)	Control % N (N=170)	All Sample % N (N=2145)
Ownership				
Independent	32.57	41.18	17.01	35.19
Larger Physician Group	11.72	12.62	11.70	12.11
Hospital	13.45	10.03	21.07	12.52
Healthcare system	36.31	30.41	45.45	34.40
Other	5.95	5.77	4.76	5.78
Total	100.00	100.00	100.00	100.00
Number of Physicians				
1-2	5.63	6.79	3.66	5.99
3-5	29.61	25.60	34.35	28.20
6-10	30.78	30.29	30.27	30.53
11-25	17.83	21.67	17.44	19.49
26-50	7.90	5.98	3.14	6.70
50+	8.24	9.67	11.15	9.09
Total	100.00	100.00	100.00	100.00
Participation and Designations				
In a System	61.13	54.24	75.41	59.17
In an Accountable Care Organization	36.27	40.56	24.33	37.26
Is a Federally Qualified Health Center	19.22	16.49	16.73	17.81
In an Independent Practice Association	24.03	27.01	14.19	24.62
	mean (sd)	mean (sd)	mean (sd)	mean (sd)
Percent Annual Revenue				
Medicare	33.34	31.13	34.25	32.34
	(17.50)	(17.14)	(17.82)	(17.38)
Medicaid	15.78	14.12	14.90	15.02
	(18.12)	(16.37)	(16.20)	(17.35)
Commercial	41.61	44.36	41.84	42.85
	(21.93)	(21.33)	(20.85)	(21.10)

Values weighted to reflect survey probability sampling
Ownership and Number of physician group totals as presented may not add to 100.00 due to rounding.

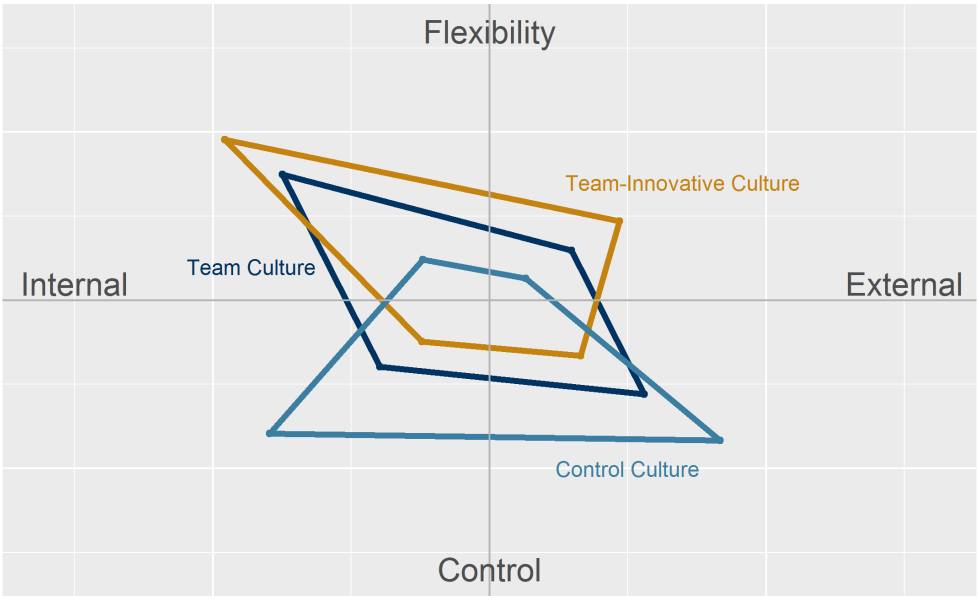

Figure 2.1: Average Competing Values Framework Scores, by Culture Type

high need-high cost patients, the practice's electronic health record capabilities, the use of evidence-based guidelines, the availability of EHR-based clinical support tools, whether the practice reports using culturally tailored interventions. The final analytic sample includes 2,141 practices, with four practices dropped due to item non-response.

Across all models as shown in Table 2.3, team-innovative practices are more likely to use decision-aids in a comprehensive shared decision-making context compared to both control practices and team practices. The odds of team-innovate practices adopting decision aids are between 2.18 and 2.6 times as great as practices with control culture, given the robust set of controls in the model. The differences between team and team-innovative practices are statistically significant for each of the models, with $p = 0.012$ for decision aids for diabetes medication selection and $p < 0.003$ for the other five models.

Among the staffing variables, only the use of non-clinical health coaches is significantly associated with increased likelihood of decision aid use, with practices that have these coaches demonstrating odds that are 1.5 times as great as practices that do not have them. Experience in commercial ACOs is the only payment reform consistently associated with increased decision aid use for all models; in addition, experience in bundled payments is positively associated with decision aid use, rising to statistical significance in decision aid use for breast cancer screening, diabetes medication selection, and osteoarthritis treatment decisions. The use of written guidelines and decision support tools integrated into the electronic health records were also associated with greater odds of use of formal decision aids.

2.4 Discussion

Shared decision-making and decision aids are not new to health care, but the above findings suggest they are most commonly adopted by practices characterized by their innovative cultures and their success in routinizing some aspects of care through treatment guidelines and electronic health record-based decision supports. The continued movement toward value-based payment is likely to create increased interest by practices in using decision aids as part of an overall process of better engaging patients in their care. However, the present results suggest that the extent of adoption may be limited by the practices ability to develop team oriented-innovative cultures that support the adoption and implementation of such innovations. Changing an organizations culture is often a challenging and time-consuming process (many cites here you can use) suggesting caution regarding expecting wide spread adoption in the short term. Such changes are likely to be embedded in efforts at overall practice redesign such as the Center for Medicare & Medicaids (CMS) Practice Transformation Initiative (PTI) and related state and private-sector initiatives. To the extent that there is a growing understanding and teaching in medical school that health is "co-produced by patients and their health care teams[27] through active engagement and shared decision-making processes it may be easier in the future for use of decision aids to be become standard clinical practice embedded in most practices regardless of their cultures. Alternatively, it may be that future newly trained physicians will gravitate toward those practices with more open team-oriented innovative culture.

It is notable that the team-innovative practices score higher than the team practices on every team-related survey question (see Table 2.1). This finding provides evidence that team and innovation cultures may be complementary. The notion of positive reinforcement and interactive effects across culture types has been discussed previously,[28] though the theoretical frameworks for organizational culture measurement have yet to be updated to reflect this more complex reality.

2.5 Limitations

Using a single key informant to assess practice organizational culture is a limitation. While including perspectives of all providers and staff within surveyed practices would be a preferable strategy for assessing culture, doing so for a national survey is not feasible. However, it is important to note that nearly 2/3 of the responding practices had five or fewer physicians–making it more likely that the key informants' assessment would be consistent with others' in the practice. Further, existing research has found consistent reporting of organizational culture across departments,[16,29] although organizational culture can coexist with subcultures.[30] A second limitation is that, like all cross-sectional research, the findings establish a non-causal association between certain culture types and use of decision aids. A longitudinal data set would be needed to examine changes in culture over time and changes in use of decision aids over time to explore potential causality.

2.6 Conclusions

Primary care practices that support innovation, such as by creating a psychological safe working environment and offering protected time for clinicians to generate new ideas, have greater odds of adopting decision aids as part of a comprehensive shared decision-making process. Expanding adoption of decision aids will likely require strategies involving overall practice redesign that take into account the need to develop more team oriented and innovative cultures supporting of such change. The continued movement by payers - both Medicare and the commercial sector - toward value-based payment will add impetus to these efforts.

Table 2.3: Results, Odds Ratios Reported

	(1) Breast cancer screening	(2) Prostate cancer screening	(3) Colorectal cancer screening	(4) Lung cancer screening	(5) Diabetes Medicine Selection	(6) Osteoarthritis Treatment Decision
Culture						
Team	1.321	1.459	1.501	1.386	1.256	1.535
	(1.11)	(1.44)	(1.67)	(1.24)	(0.82)	(1.61)
Team-Innovation	2.257**	2.590***	2.616***	2.500***	2.182*	2.619***
	(3.06)	(3.64)	(3.73)	(3.48)	(2.56)	(3.60)
Practice Ownership						
Physician Group	1.338	1.132	1.341	1.538*	1.073	1.413
	(1.63)	(0.70)	(1.57)	(2.36)	(0.39)	(1.60)
Hospital	0.756	0.784	0.740	0.915	0.875	0.856
	(-1.41)	(-1.24)	(-1.54)	(-0.46)	(-0.64)	(-0.74)
Healthcare system	0.932	0.961	0.945	0.954	0.803	1.079
	(-0.45)	(-0.26)	(-0.38)	(-0.30)	(-1.35)	(0.45)
Other	0.682	0.735	0.778	0.933	0.661	0.927
	(-1.30)	(-1.07)	(-0.89)	(-0.24)	(-1.27)	(-0.25)
Staffing						
Primary Care Physicians	0.999	1.000	1.000	1.001	0.999	1.000
	(-0.40)	(0.05)	(0.19)	(0.61)	(-0.56)	(0.15)
NPs, PAs	0.997	0.999	0.998	0.996	0.999	1.000
	(-0.81)	(-0.44)	(-0.61)	(-1.11)	(-0.25)	(-0.08)
Clinical Care Managers (0/1)	0.696	0.743	0.747	0.907	0.763	1.016
	(-1.78)	(-1.50)	(-1.48)	(-0.47)	(-1.26)	(0.07)
Non-clinical Health Coaches (0/1)	1.582***	1.510**	1.493**	1.343*	1.477**	1.583**
	(3.47)	(3.04)	(2.99)	(2.13)	(2.75)	(3.22)
Payment Reform Experience						
Bundled payments	1.350*	1.294	1.303	1.241	1.377*	1.364*
	(2.05)	(1.87)	(1.84)	(1.49)	(2.22)	(2.09)
Primary care program	0.802	0.811	0.813	0.851	0.665**	0.889
	(-1.52)	(-1.46)	(-1.46)	(-1.13)	(-2.70)	(-0.78)
Pay for performance	0.791	0.726*	0.841	0.774	0.854	0.810
	(-1.43)	(-2.08)	(-1.07)	(-1.62)	(-0.88)	(-1.25)
Capitated commercial plan	1.138	1.237	1.191	1.138	1.045	1.151
	(0.91)	(1.53)	(1.23)	(0.89)	(0.28)	(0.89)
Medicare ACO	0.965	1.064	0.978	1.040	0.883	0.776*
	(-0.28)	(0.50)	(-0.16)	(0.30)	(-0.93)	(-1.97)
Medicaid ACO	0.799	0.834	0.854	0.790	0.823	0.878
	(-1.59)	(-1.25)	(-1.12)	(-1.55)	(-1.29)	(-0.88)
Commercial ACO	1.495**	1.461*	1.434*	1.626**	1.398*	1.607**
	(2.71)	(2.53)	(2.43)	(3.09)	(2.12)	(3.09)
Identify high need, high cost patients (0/1)	2.063***	2.060***	2.173***	2.040***	1.843***	2.124***
	(4.39)	(4.47)	(4.84)	(4.21)	(3.64)	(4.27)

Table 2.3 – continued from previous page

	(1) Breast cancer screening	(2) Prostate cancer screening	(3) Colorectal cancer screening	(4) Lung cancer screening	(5) Diabetes Medicine Selection	(6) Osteoarthritis Treatment Decision
HIT Capabilities						
Patient has access to medical record	0.740 (-1.51)	0.705 (-1.74)	0.755 (-1.42)	0.767 (-1.30)	0.655* (-2.08)	0.719 (-1.62)
Patient can comment in medical record	1.217 (1.56)	1.095 (0.71)	1.095 (0.75)	1.161 (1.17)	1.333* (2.12)	1.183 (1.33)
Written Guidelines						
Preventive services	2.094*** (3.94)	2.041*** (3.95)	2.231*** (4.44)	1.737** (2.91)		
Diabetes					2.665*** (5.42)	
EHR Decision Support						
Preventive services	2.055*** (4.63)	2.034*** (4.66)	1.997*** (4.57)	2.096*** (4.57)		
Diabetes					1.704*** (3.34)	
Annual Revenue Source (%)						
Medicare	1.002 (0.53)	1.001 (0.30)	1.000 (0.03)	1.003 (0.85)	1.002 (0.50)	0.999 (-0.25)
Medicaid	0.998 (-0.55)	0.998 (-0.61)	0.996 (-0.84)	1.000 (0.01)	0.999 (-0.23)	0.999 (-0.33)
Constant	0.0693*** (-6.72)	0.0678*** (-6.98)	0.0651*** (-7.15)	0.0429*** (-7.99)	0.0704*** (-5.90)	0.0874*** (-6.02)
Observations	2141	2141	2141	2141	2141	2141

NP: Nurse Practitioners, PAs: Physician's Assistant; ACO: Accountable Care Organization
Exponentiated coefficients; t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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2.8 Appendix

NSHOS Survey Questions

Shared decision-making involves informing patients of their options and the benefits or harms of those options, supporting them to compare those options and then make choices that are aligned with their informed goals and values.
Decision aids provide objective information on benefits and harms to help patients clarify their goals, values and preferences and make decisions that are consistent with their goals.

32. Considering the physicians and staff in your practice, how many:

	None	Some	Most	All
Are formally trained in shared decision-making	☐	☐	☐	☐
Routinely engage in shared decision-making	☐	☐	☐	☐
Routinely use decision aids	☐	☐	☐	☐
Follow-up on patients' treatment decisions after initial discussion of treatment tradeoffs	☐	☐	☐	☐

33. How many eligible patients receive decision aids before making a decision about:

	None	Some	Most	All
Selecting medication for diabetes	☐	☐	☐	☐
Osteoarthritis *(hip or knee replacement)* treatment	☐	☐	☐	☐
Breast cancer screening	☐	☐	☐	☐
Prostate cancer screening	☐	☐	☐	☐
Colorectal cancer screening	☐	☐	☐	☐
Lung cancer screening	☐	☐	☐	☐

Chapter 3

The Quality Performance of Accountable Care Organizations: It's About Practice Capabilities, Not ACO Initiatives

Abstract

Background. Research into the performance of Accountable Care Organizations (ACOs) has largely focused on the ACO characteristics rather than the physician practices operating within ACOs. The extent to which ACO "types" and processes or physician practice capabilities are more strongly associated with ACO quality performance remains un-examined.

Objectives. To assess the relative strength of ACO and practice-level capabilities as they are associated with ACO quality performance, and to assess whether ACO "types" are associated with quality performance.

Methods. Cross-sectional study using structural equation modeling to decompose the explanatory power of ACO-level and practice-level variables associated with ACO quality performance. Study included 92 Medicare Shared Savings Program ACOs and 243 constituent practices for which there is 2017 Centers for Medicare & Medicaid performance data, National Survey of Accountable Care Organization (NSACO) data, and National Survey of Healthcare Organizations and Systems (NSHOS) data.

Results. Practice capabilities–including use of evidence based guidelines, electronic health record-embedded decision tools, systematic preventive screenings, systems for identifying high need-high cost patients, use of culturally tailored interventions and group culture–are

more strongly associated with quality performance than ACO processes. Explanatory power of the models, using the Bentler-Raykov squared multiple-correlation coefficient, decreased by 39% to 69% when limited to the ACO-level predictors. Significant differences by ACO type were found only for the ischemic vascular disease domain: the hybrid ACO types have quality outcomes 27.68 percentiles higher than physician-led ACOs ($p < 0.001$) and 30.06 percentiles higher than integrated ACOs ($p = 0.002$). No ACO initiative had similar statistically significant associations with quality performance across all domains. ACO cost-reduction strategies and quality improvement efforts were associated with worse performance in the diabetes ($\beta = -7.97$, $p < 0.001$) and depression ($\beta = -3.51$, $p = 0.013$) domains, respectively.

Conclusions. Variations in ACO performance are primarily associated with the capabilities of physician practices operating within ACOs; ACO initiatives currently have a weaker association with ACO-level quality outcomes as measured by CMS.

3.1 Background

As the Medicare Shared Savings Program enters its seventh year, research into the impact of the accountable care model on patient outcomes has grown. Much effort has been directed toward understanding the impact that accountable care organizations (ACOs) have on health outcomes,[1] while research has also begun to explore the mechanisms by which quality outcomes are achieved. For example, recent analyses have focused on understanding how ACOs manage aspects of care beyond their immediate control;[2,3] target high-need, high-cost patients;[4] and identify factors reported to be important to providing high quality care.[5] In addition, research has investigated the relationship between ACO-level characteristics and quality and spending performance.[6,7] Evidence thus far has been mixed. For example, large, hospital-led ACOs have higher overall quality scores,[7] while analyses focusing on the performance on more granular quality domains found little difference between large, integrated ACOs and smaller physician-led ACOs.[6] In qualitative work with stakeholders of high and low performing ACOs, much of ACO successes were built on the previously established care management and quality improvement infrastructure of high performing physician organizations.[5] Consistent with this finding, variance components analyses that decompose the role of physicians, practices, and groups on patient outcomes find that performance is driven by behaviors and processes closest to patient care delivery.[8–11]

While ACO research has examined the roles of ACOs and ACO-affiliated practices, no studies to date have incorporated both levels of analysis into quantitative analyses of ACO quality and patient outcomes. Comparing the relative contribution of these two levels of the ACO structure may aid in addressing the challenges that ACOs face when redesigning care to meet the the emerging value-based payment models.

Study Aim

Drawing on and updating existing research on ACO taxonomies,[12] this research assesses the extent to which ACO "types" and processes and practice characteristics and capabilities are associated with better ACO quality performance. Given that there is little evidence for ACO-level drivers of performance[6] and previous research has pointed to the important role of practice-level processes and infrastructure,[5,8] this study hypothesizes that practice-level variables will demonstrate stronger correlation with ACO performance.

3.2 Methods

Data

ACO Data

This study combines the most recent wave of the National Survey of Accountable Care Organizations (NSACO) with the 2017 CMS performance data. The NSACO is an online survey of ACOs that has been fielded in four waves, the latest of which surveyed all Medicare, Medicaid, and commercial ACOs in operation between late 2017 and early 2018. The overall survey response rate was 47.4%, with 332 Medicare ACOs responding for a Medicare-specific response rate of 61.8%. ACO performance data was taken from the 2017 Medicare Shared Savings Program (MSSP) quality performance results released by the Centers for Medicare & Medicaid Services (CMS). The average Herfindahl-Hirschman Index (HHI) market concentration for physician services across the ACOs' service area is calculated using the SK&A Office Based Physicians Database provided by IQVIA.

Practice Data

Practice level information is drawn from the National Survey of Healthcare Organizations and Systems (NSHOS), which surveyed individual physician practices, hospitals and health systems between June 2017 and August 2018. The survey used a stratified cluster sampling design to select primary care-focused practices operating independently as well as practices within systems. The final sample includes 2,190 practices, for an overall response rate of 46.9%. Of these practices, 243 could be linked to both the recent NSACO survey and the 2017 Medicare Shared Savings Program (MSSP) publicly available quality data; these 243 ACO-participating practices form the basis for the present analysis.

Measures

ACO Performance

ACO performance was assessed using the publicly available CMS performance data for 2017. Quality performance was measured separately for each of the seven domains: (1)

patient experience, (2) care coordination/patient safety, (3) preventive health, (4) depression, (5) diabetes, (6) hypertension, and (7) ischemic vascular disease (IVD). The outcome variable in the model is an ACOs performance percentile relative to other ACOs of its same starting/performance year. Relative performance was chosen because changes to both the measures included in the quality domains and the measure specifications make it impossible to compare the scores for ACOs of different starting years and performance years.[6]

ACO Types and Characteristics

First, an existing taxonomy of ACOs is updated using the fourth wave of the NSACO data previously described.[6,12,13] In addition, the number of care management transition tools used, cost-reduction strategies, and quality improvement efforts undertaken are also measured. Practices were asked if they employed any of the following care transition management tools: (1) medication reconciliation, (2) telephone follow-up within 72 hours of hospital discharge, (3) in-home follow-up within 72 hours of hospital discharge, (4) standardized process in place to ensure timely follow-up with primary/specialty care, (5) discharge summaries are transmitted to clinicians accepting care of the patient, (6) use of a patient navigator or care manager while patient is in the hospital, and (7) use of a care manager or health coach post-discharge.

The quality improvement questions assessed whether the practice had taken up any of the following quality improvement efforts: (1) streamlining services, (2) improving work flow processes, (3) implementing strategies like LEAN or Six Sigma, and actively managing patients' use of (4) emergency departments, (5) post-acute care, or (6) outpatient care. Respondents also reported implementation of any of the following strategies to reduce costs and improve care in the primary care settings: (1) same or next-day scheduling, (2) 24-hour call lines, (3) night/weekend appointments; or if they had been (4) expanding the number of participating physicians, (5) expanding the number of non-physician clinicians, (6) expanding the use of non-clinician providers, or (7) segmenting patients by risk. In order to reduce the number of variables in the model, and therefore minimize variance inflation factors, the capability indicator variables are summarized with counts of the processes by category. This dimensionality reduction better suits the study's modest sample size.

Categories for the number of participating physicians (as shown in Table 3.1) are also included. Control variables include the geographic region of the United States in which the ACO operates (Northeast, South, Midwest, and West as identified by The Dartmouth Atlas), and the average Herfindahl-Hirschman (HHI) for the ACO service area. The models use an aggregated HHI across physician services as of 2016. The HHI value, which ranges between 0 and $10,000$, is reported here in units of one hundred for ease of interpretation in the final results.

Practice Characteristics

Practice characteristics are derived from responses to NSHOS survey questions. Three variables measuring the extent of adoption of clinical best-practices were calculated: (1) the use of evidence-based guidelines, (2) electronic health record (EHR) decision support, and (3) screening for clinical conditions and social determinants of health. The NSHOS question on guidelines asked whether *written* evidence-based guidelines were used for the treatment of diabetes, congestive heart failure, asthma/COPD, coronary artery disease, hypertension, depression, serious mental illness, and/or to ensure uptake of preventive services. Respondents provided a yes or no response for each condition. Similarly, respondents were asked to report whether automated decision tools were integrated into the electronic health record for these same conditions. The same format was again used to determine whether practices had implemented systematic preventive screenings for tobacco use, opioid use specifically, substance use disorders (other than tobacco and opioid), polypharmacy, depression, low health literacy, food insecurity, housing instability, utility needs, interpersonal violence, transportation needs, need for financial assistance with medical bills, and Medicaid eligibility. As in the ACO-level variables, these practice-level variables were summarized as counts of evidence based guidelines, decision tools, and screenings.

Also included as covariates were two binary variables: whether the practice reported using a systematic strategy for identifying high need, high cost patients and whether the practice reported using culturally tailored interventions. Finally, a categorical practice culture variable the differentiates practices according to their reported focus on stability and standard procedures, team cohesion, or a combination of team-cohesion and innovation. Practices are classified as being control, team, or team-innovation oriented.

Analysis

Updated Taxonomy

Given slight changes to the NSACO wave 4 survey questions, the ACO taxonomy is validated and updated. Unlike the previous iteration of the taxonomy, this study relies on a partitioning around medoids (PAM) algorithm and subsequent silhouette analysis to identify the most appropriate number of ACO types. Greater detail is provided in the Appendix (section 3.8).

ACO Performance

Most multilevel regression models use outcomes measured at the lowest level of analysis (level 1), with higher level variables serving as contextual variables. For example, patient outcomes are often modeled as a function of patient-level characteristics (level 1) and contextual practice-level influences (level 2). In contrast, an analysis with outcomes measures at the ACO-level (level 2) are referred to as micro-macro models.[14] Micro-macro models

present special challenges, as care is needed to avoid the statistical bias created by manually aggregating practice-level (level 1) variables to the ACO-level (level 2).

This study relies on the latent variable multilevel approach introduced by Croon and Van Veldhoven[15] and further developed by Bennink, Croon, and Vermunt.[16] This strategy aggregates the practice-level variables into a single ACO-level latent variable, which can then be used in a structural equation model. In addition to reducing statistical bias related to aggregating level 1 variables, this approach has the advantage of providing the best linear unbiased predictor even in circumstances where individual practice-level values may not be reflective of the overall ACO, which makes the model robust to outlier practices.[16]

Figure 3.1 depicts the micro-macro model used in this study. The Z variables and Y_{ACO} outcome variables are measured at the ACO-level, while the level 1 practice-level variables are denoted by the lower gray box. The light gray lines from the ACO-level Z variables to the latent ξ_{ACO} represent covariances. While it is plausible that the practice-level characteristics in fact mediate the relationship between ACO processes and ACO outcomes, the final analytic sample for this study is not large enough to estimate the mediation model.

The regressions represented by Figure 3.1 are defined as follows, with probability weights used to account for the multi-level survey sampling design:

$$Y_{ACO} = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \gamma_6 Z_6 + \gamma_7 Z_7 + \alpha \xi_{ACO} + \epsilon \tag{3.1}$$

where Y_{ACO} is the ACO's relative quality performance, Z_1 is the ACO taxonomy, Z_2 is transition management, Z_3 is cost reduction, Z_4 is quality improvement, and Z_5 is the number of participating physicians. The ACO latent variable summarizing the constituent practice scores is represented by ξ_{ACO}, with a coefficient α that is automatically constrained to 1 in the unstandardized results presented in this study. The error term is represented by ϵ.

The equation specifying the relationships between the ACO score (ξ_{ACO}) and its constituent practice scores ($x_{p,ACO}$), where the subscript p, ACO indicates a given practice within the ACO and $v_{p,ACO}$ is the error term, are:

$$x_{p,ACO} = \xi_{ACO} + v_{p,ACO} \tag{3.2}$$

3.3 Results

ACO Taxonomy

The cluster analysis of the 332 wave 4 survey NSACO respondents found that ACOs continue to be characterized by three types: physician-led, integrated delivery system, and hybrid ACOs. The silhouette analyses indicate that the chosen clustering solution (as well as its neighboring 2- and 4-type options) is weak and may be capturing randomness in the data (additional details in the Appendix, section 3.8). However, reviewing the summary

Table 3.1: Descriptive Statistics, Overall and by ACO type

ACO Characteristics	Physician-Led (N=101) %		Hybrid (N=38) %		Integrated (N=104) %		All (N=243) %	
Leadership								
Physicians	96.0		43.1		33.1		60.9	
Hospital	0.1		7.2		4.8		3.2	
Physicians and Hospital	1.6		49.7		56.2		32.4	
Coalition	2.3		0.0		1.2		1.5	
Other	0.0		0.0		4.7		2.1	
Integrated Delivery System (0/1)	25.4		0		100		54.4	
Participating Physicians								
1-49	7.5		0		0		3.1	
50 - 99	15.9		0		1.2		7.2	
100 - 199	27.8		9.3		7.4		16.2	
200 - 399	32.3		30.9		7.2		21.1	
400 - 999	12.9		20.9		23.2		18.5	
1000 - 1999	3.7		36.2		27		18.5	
2000+	0		2.7		34.1		15.3	
	mean	(sd)	mean	(sd)	mean	(sd)	mean	(sd)
Percent Primary Care Providers	67.3	(28.4)	40.4	(17.3)	32.4	(10.9)	47.9	(26.4)
Services Offered (#)	1.0	(1.6)	2.6	(2.2)	3.7	(2.2)	2.4	(2.3)
Provider Types (#)	10.1	(2.4)	13.9	(2.8)	11.3	(0.9)	11.2	(2.4)
Performance Management Strategies (#)	3.8	(1.1)	3.2	(0.7)	3.5	(1.3)	3.6	(1.2)
Payment Reforms Participated In (#)	1.7	(1.1)	1.1	(1.0)	2.5	(1.3)	2.0	(1.3)
Patient Characteristics	%	(sd)	%	(sd)	%	(sd)	%	(sd)
Female	56.7	(1.1)	56.6	(2.0)	57.6	(1.1)	57.0	(1.4)
Age								
0-64	14.1	(5.4)	17.9	(4.2)	15.5	(5.2)	15.3	(5.3)
65-74	47.1	(4.3)	44.4	(3.7)	45.5	(5.1)	46.0	(4.7)
75-84	27.2	(2.2)	25.6	(2.9)	26.4	(2.4)	26.6	(2.4)
85+	11.5	(2.2)	12.1	(2.9)	12.6	(1.9)	12.1	(2.3)
Race & Ethnicity								
White	88.1	(8.8)	88.2	(7.2)	85.6	(6.8)	87.2	(7.8)
Black	6.2	(7.9)	6.6	(6.3)	8.6	(4.9)	7.2	(6.6)
Asian	1.0	(0.8)	0.9	(1.0)	1.2	(0.7)	1.1	(0.8)
Hispanic	1.5	(2.5)	1.4	(2.0)	1.3	(1.6)	1.4	(2.1)
Native	0.3	(0.6)	0.1	(0.2)	0.1	(0.4)	0.2	(0.5)
Other	3.0	(1.1)	2.8	(1.0)	3.1	(0.8)	3.0	(1.0)
End-Stage Renal Disease	0.7	(0.4)	0.9	(0.4)	0.7	(0.4)	0.7	(0.4)
Disabled	10.7	(5.1)	14.2	(4.0)	12.1	(5.2)	11.9	(5.1)
Medicare-Medicaid Dual Eligibility	5.4	(4.0)	7.1	(3.0)	6.0	(3.0)	5.9	(3.5)

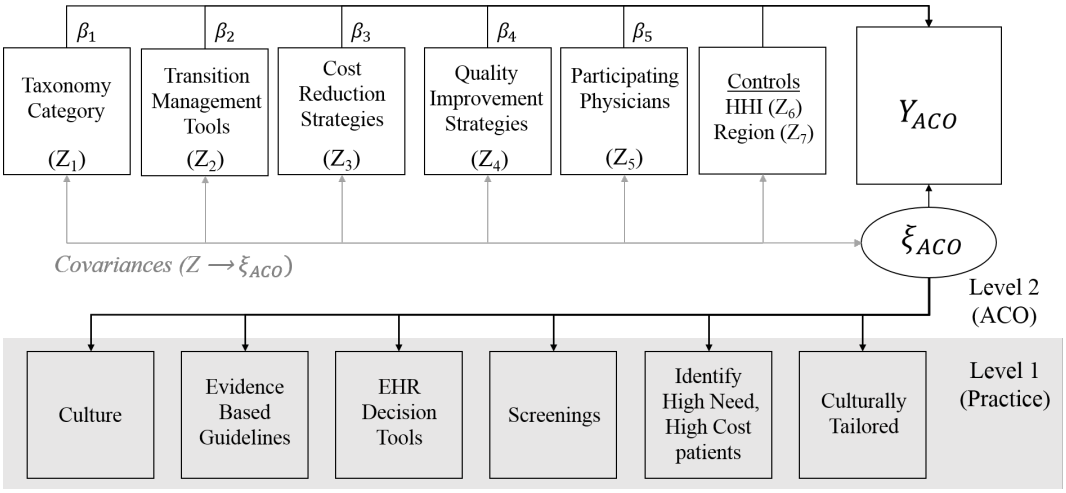

Figure 3.1: Micro-macro structural equation models, with covariances between ACO-level outcomes and the latent variable summarizing the within-ACO practice characteristics. Covariances are indicated by the light gray lines from the level 2 variables (Z_i) to the latent variable ξ_{ACO}

of characteristics by taxonomy group in Table 3.1 shows that there are meaningful and statistically significant differences between the identified ACO types.

Characteristics of the taxonomy groups are summarized in Table 3.1. The distribution of ACOs across types is similar to previous taxonomy analyses, for example: the current results show 41.6% of 2017 ACOs are categorized are physician-led, whereas 48% of ACOs were previously categorized as such.[6] Physician-led ACOs tend to have fewer participating providers ($p < 0.002$), fewer types of providers ($p < 0.001$) and are more primary-care oriented than either hybrid or integrated ACOs ($p < 0.001$). None of the data sources used in the study reported the number of practices that participate within ACOs, but the number of participating providers and provider types as gathered by the NSACO can provide some insight into the size of the ACO.

Integrated ACOs have experience with the greatest number of payment reforms ($p < 0.001$) and offer the most types of services ($p < 0.001$). In terms of beneficiary populations, physician-led ACOs are most different from hybrid ACOs, with lower proportions of high-cost, high-need populations such as end-stage renal disease patients ($p = 0.011$), disabled patients ($p = 0.001$), and patients who are dually eligible for Medicare and Medicaid ($p = 0.038$). Statistical significance of group differences was calculated with Bonferonni corrections.

ACO Performance

Results by Domain. As reported in the Table 3.2, there are statistically significant differences in relative performance by ACO type in only one of the seven quality domains:

hybrid ACOs perform better than either physician-led or integrated ACOs on the ischemic vascular disease metric. Contrary to expectation, the overall ACO measures of transition management tools, cost reduction, and quality improvement strategies showed only sporadic associations with quality performance. The number of care transition management tools is associated with slight improvement in relative performance in the care coordination domain, with each additional transition management tool associated with quality scores that are 1.69 ($p = 0.017$) percentiles higher than ACOs of the same starting/performance year. ACOs undertaking more quality improvement efforts had better performance only in the diabetes care domain ($\beta = 4.558$, $p < 0.001$), but worse performance in the depression domain, with each additional quality improvement effort associated with a 3.5 lower percentile score ($p = 0.013$). Notably, the number of cost reduction strategies used by ACOs is associated with worse performance in the diabetes domain: each additional cost-reduction strategy is associated with a quality score that is nearly eight percentiles lower than ACOs of the same starting/performance year. The raw, un-standardized coefficients on ξ for the practice-level portion of the model (where $\xi \rightarrow var$) are not shown because they are not directly interpretable in the same units as the ACO-level variables.

Model Statistics. For the coefficient of determination (CD), the conservative Bentler-Raykov squared multiple-correlation coefficient[17] (analogous to R^2 statistics in regression analyses) is used. The CD values are greater than 0.78 for all quality domains. Much of this explanatory power is driven by the practice-level factors, as the coefficients of determinations for the models run without these variables range from 0.252 to 0.525 across the quality domains. In contrast, models that include the latent variable and the practice-level factors maintain high coefficients of determination, ranging from 0.728 to 0.748. The standardized root mean square residual (SRMR)– a measure of model fit with a perfect fit being a value of zero and an acceptable level of fit being less than 0.08– has a maximum value of 0.0501 across all the domains.

3.4 Discussion

A greater amount of the proportion of ACO quality performance is attributable to the capabilities of practices operating within an ACO than ACO-level initiatives. The results provide quantitative evidence that ACO performance is largely a function of micro-level processes, consistent with previous work in non-ACO contexts.[5,8–11] Despite the relatively weaker association of ACO-level variables, there were some surprising negative associations between implementing quality improvement and efficiency-oriented processes and ACO performance in the depression and diabetes care domains. These domains, as well as the hypertension domain, are based on patient outcomes rather than process measures. The depression domain consists of a measure of remission at 12 months, while the diabetes domain includes a process measure (eye exams) and an outcome measure of poor A1C control. Perhaps for these particular domains, focusing ACO efforts on the cost and quality efforts described in

Table 3.2: Results, by Quality Domain

	Patient Experience	Care Coordination	Prevention	Depression	Diabetes	Hypertension	IVD
ACO Taxonomy (*Ref: Physician-Led*)							
Integrated	-1.250	-1.961	-0.897	11.97	-1.089	0.300	-2.381
	(-0.28)	(-0.56)	(-0.22)	(1.71)	(-0.19)	(0.06)	(-0.42)
Hybrid	-6.406	-1.294	1.226	4.064	12.33	12.07	27.68***
	(-1.52)	(-0.30)	(0.25)	(0.54)	(1.93)	(1.84)	(3.59)
Transition Management Tools	-0.773	1.690*	-0.0352	2.059	1.610	0.243	2.003
	(-0.81)	(2.40)	(-0.04)	(1.20)	(1.37)	(0.15)	(1.26)
Cost Reduction Strategies	0.351	-0.741	-0.440	2.885	-7.966***	-3.304	-1.701
	(0.40)	(-0.78)	(-0.42)	(1.78)	(-6.44)	(-1.92)	(-1.33)
QI Strategies	0.115	1.431	0.0687	-3.509*	4.558***	2.015	0.263
	(0.13)	(1.62)	(0.07)	(-2.51)	(4.42)	(1.25)	(0.19)
Participating Physicians (*Ref:* $1-49$)							
50 - 99	1.077	-0.766	30.14**	19.73	29.34**	28.17	55.26***
	(0.16)	(-0.11)	(3.10)	(1.41)	(2.69)	(1.75)	(3.64)
100 - 199	-0.115	2.141	-2.677	-6.226	1.389	3.564	28.70*
	(-0.02)	(0.35)	(-0.42)	(-0.49)	(0.27)	(0.26)	(2.35)
200 - 399	9.741	-1.186	5.826	5.674	4.091	15.83	19.08
	(1.85)	(-0.19)	(0.88)	(0.40)	(0.75)	(1.16)	(1.51)
400 - 999	-1.019	8.807	-4.396	-13.17	-13.66	-1.133	26.94*
	(-0.17)	(1.29)	(-0.58)	(-0.95)	(-1.81)	(-0.08)	(2.10)
1000 - 1999	-0.990	6.671	3.654	-25.23	11.93	6.357	30.74*
	(-0.13)	(1.02)	(0.49)	(-1.80)	(1.81)	(0.47)	(2.31)
2000+	5.410	-6.411	11.46	-34.05*	16.57*	24.71	51.10***
	(0.85)	(-0.94)	(1.49)	(-2.42)	(2.43)	(1.72)	(4.03)
Region (*Ref: Midwest*)							
Northeast	9.039*	6.483*	-2.595	9.880	-9.574*	2.049	-12.53**
	(2.46)	(2.37)	(-0.70)	(1.96)	(-2.01)	(0.43)	(-2.61)
South	-1.988	6.907	-5.771	17.52*	-25.99***	-14.38	-5.685
	(-0.49)	(1.95)	(-1.21)	(2.20)	(-4.56)	(-1.91)	(-0.73)
West	-15.09***	29.76***	-15.47***	25.38**	-41.65***	5.494	-24.80***
	(-4.62)	(8.37)	(-4.08)	(2.74)	(-6.01)	(0.74)	(-3.83)
HHI (100s)	0.158*	0.256***	0.328***	0.463***	0.331***	0.0821	0.565***
	(2.11)	(3.71)	(4.12)	(4.03)	(3.49)	(0.65)	(4.73)
ξ (constrained)	1	1	1	1	1	1	1
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Constant	45.03***	21.56**	36.05***	17.15	61.52***	46.07**	1.311
	(6.05)	(2.80)	(4.06)	(1.07)	(7.47)	(2.94)	(0.08)
N	197	197	193	193	187	193	193
Practice-level Variables Included	Y	Y	Y	Y	Y	Y	Y
SRMR	0.0484	0.0492	0.0492	0.0499	0.0501	0.0498	0.0491
CD (full model)	0.788	0.865	0.808	0.854	0.877	0.795	0.858
CD (ACO variables only)	0.252	0.525	0.247	0.468	0.505	0.244	0.409
CD (practice variables only)	0.728	0.730	0.733	0.734	0.748	0.734	0.733

CD: Coefficient of Determination, Bentler-Raykov squared multiple-correlation coefficient; SRMR: Standardized Root Mean Square Residual

Un-standardized coefficients on ξ for the practice-level variables are not shown because they are not directly interpretable in same units as the ACO variables.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; t statistics in parentheses

the survey comes at the cost of providing services that are particularly suited for treating depression and diabetes. The negative association between cost-reduction efforts and the diabetes domain may be the result of less patient outreach and less time spent monitoring patients. But since the hypertension domain is also an outcomes-based measure and does not show a negative relationship with the cost reduction or quality improvement efforts, any posited generalized-efforts-as-distraction explanation would need to account for the fact that not all patient outcomes are similarly affected.

Despite the lack of clarity surrounding the relationship between ACO-reported and practice-reported processes, the large drop in the coefficients of determination when restricting the model to ACO-level variables indicates that practice-reported processes are currently more closely associated with relative quality performance. However, Selby and colleagues warn against conflating current sources of variation with the potential impact of interventions at a given level.[18,19] And given that ACO-wide efforts are focused on the foundational work of developing data, administration, education, and care coordination services abilities,[20] it may only be a matter of time before ACOs begin to increase their footprint on the behaviors of participating practices and become more strongly associated with ACO outcomes.

3.5 Limitations

There are some study limitations to consider. First, the survey does not ask practices to report the impetus for adopting their processes, nor do the practices report the length of time the processes have been in place. It is possible that the practices are implementing processes as a result of ACO-wide efforts to disseminate evidence-based care processes. In turning to the ACO survey, it is unclear whether the respondent is reporting on processes and capabilities that are developed by the ACO leadership and disseminated to the practices or if the ACO is reporting processes based on whether any practices have adopted them independently. Future research should unpack these connections.

Second, this work focuses on Medicare Shared Savings Program (MSSP) participants, and is therefore unable to directly comment on quality performance in Medicaid or commercial ACOs. Similarly, as Medicare accountable care models grow to include new programs such as the Next Generation ACOs, the insights from this work are limited to a smaller subset of currently operating ACOs.

In addition, the changing CMS domains and measure specifications limits the ability to make comparisons across starting and performance years, but it also limits the ability to benchmark ACOs against objective quality thresholds. Measuring ACOs only on their performance relative to a peer group provides little information on whether ACOs, individually or collectively, are providing high-quality care. Even though adoption of certain processes is associated with higher relative performance, it is still possible that all organizations are performing at less-than-optimal levels.

3.6 Conclusion

ACO leaders may want to select practice partners with well-developed care coordination processes in place and focus on building capacities among all of its practice. For policymakers, however, the upshot is less clear. The ACO model is designed to serve as the mechanism by which practices increase their use of care coordination services and population health management strategies, but this study finds that the ACO-driven dissemination efforts are less strongly associated with performance compared to care management and quality improvement capabilities already developed by practices. ACO measures or financial rewards designed to directly incentivize increasing practices' care management capacity may be a step toward accomplishing the original goals of the ACO model.

3.7 References

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3.8 Appendix

Replicating the ACO Taxonomy: Detailed Methods and Results

Unlike previous work, this reproduction of the taxonomy is done via partitioning around medoids (PAM) algorithm. The first step of the PAM analysis is to calculate Gower distances, a measurement strategy that can calculate distances between observations when the variable set of interest includes numeric data as well as binary variables (e.g., integrated delivery system indicator) and categorical variables (e.g., ACO leadership type). A gower distance matrix is supplied to the PAM algorithm, which then clusters individual observations into a given number of groups and assesses the overall similarity of the members in the groups. Because the PAM clustering strategy requires that the number of groups is determined by the analyst *a priori*, the optimal number of groups is determined by replicating the PAM analysis for varying number of groups and comparing the outcomes. Silhouette analysis, a procedure which seeks to optimize the parsimony-information trade off, was used to quantify concordance within the groups. The silhouette value is a ratio between two terms: (1) The difference between the average distance from a given observation to members of the nearest neighboring and the average distance from a given observation to other members of the same group and (2) whichever average distance value (to the assigned or neighboring group) is larger.[21] In this way, distance is a measure of (dis)similarity: silhouette values that approach 1 indicate that observations are similar to others in its cluster, while values that approach 1 indicate that an observation is unlike others in its assigned cluster. In addition to the silhouette measurements, groups under each clustering solution are compared to ensure meaningful differences on the input variables.

The combined PAM and silhouette analyses of the 332 wave 4 survey NSACO respondents shows that ACOs continue to be characterized by three types: physician-led, integrated delivery system, and hybrid ACOs. The average silhouette widths were similar when comparing a 2-cluster (silhouette width=0.29) and 3-cluster solution (width = 0.28); however, a 3-cluster solution showed fewer negative silhouette values indicating fewer outliers within the clusters. In both cases, however, the average silhouette widths are fairly low, given that the rule of thumb for the silhouette widths is that values between 0.25 and 0.50 are weak and may be capturing randomness in data. As outlined in Section 3.3 Results, comparisons indicated meaningful differences between the groups.