

Variation of hospital-based adoption of care coordination services by community-level social determinants of health

Jie Chen

Eva Hisako DuGoff

Priscilla Novak

Min Qi Wang

Background: Hospital investments in care coordination services and innovative delivery models represent an important source for improving care efficiency and population health.

Objective: The aim of this study was to explore variation of hospital-initiated care coordination services and participation in Accountable Care Organizations (ACOs) by community characteristics within an organizational theory framework.

Methods: Our main data sets included the 2015 American Hospital Association Annual Survey, Survey of Care Systems and Payment, American Community Survey, and Area Health Resource File. Two main outcomes were (a) hospital-reported initiation of care coordination practices (such as chronic disease management, post-hospital discharge continuity of care, and predictive analytics) and (b) participation in ACO models. State fixed-effects models were used to test the association between the adoption of care coordination practices and hospital characteristics, community-level sociodemographic characteristics, and health policies.

Results: Hospitals with large bed size, located in urban areas, and/or with high volume of operations were more likely

Key words: accountable care organization, care coordination, health care system, health equity, poverty, rural area

Jie Chen, PhD, is Associate Professor, Health Services Administration, School of Public Health, University of Maryland at College Park. E-mail: jjchen@umd.edu.

Eva Hisako DuGoff, PhD, is Assistant Professor, Health Services Administration, School of Public Health, University of Maryland at College Park, and Visiting Assistant Professor, Department of Population Health Sciences, University of Wisconsin-Madison.

Priscilla Novak, MPH, is Graduate Student, Health Services Administration, School of Public Health, University of Maryland at College Park.

Min Qi Wang, PhD, is Professor, Behavioral and Community Health, School of Public Health, University of Maryland at College Park.

This work was supported by the National Institute on Minority Health and Health Disparities (Grant R01MD011523).

The authors have disclosed that they have no significant relationship with, or financial interest in, any commercial companies pertaining to this article.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's web site (www.hcmjournal.com).

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/HMR.0000000000000232

Health Care Manage Rev, 2020, 45(4), 332–341

Copyright © 2018 The Authors. Published by Wolters Kluwer Health, Inc.

to adopt care coordination practices and participate in the ACO models. Hospitals serving communities with high uninsurance rates and/or poverty rates were significantly less likely to provide care coordination practices. More stringent Community Benefit Laws (CBLs) were positively associated with the implementation of care coordination practices suggesting strong normative impacts of CBLs.

Conclusion: Greater hospital-initiated care coordination practices and innovative ACO models were available in well-resourced areas. Policymakers may consider increasing resources for care coordination practices in rural, underserved, and high-poverty-high-uninsured areas to ensure that vulnerable populations can benefit from these services.

Promoting care coordination is one of the six National Quality Strategy priorities (Agency for Healthcare Research and Quality, 2015). The Agency for Healthcare Research and Quality's working definition of care coordination—*marshalling and coordinating resources to carry out patient care* (McDonald et al., 2007)—includes activities such as the exchange of information between hospitals and doctor's offices, medication reconciliation at transitions of care (Lee et al., 2018; Pandolfe, Crotty, & Safran, 2016), and Information Technology-enabled case management. It also involves novel approaches such as predictive analytics to identify high-needs, high-cost patients (Hawkins et al., 2015).

Hospital's investments in care coordination practices and innovative delivery models represent an important frontier for improving care efficiency, improving population health, ensuring access to care, and improving health equity (Alley, Asomugha, Conway, & Sanghavi, 2016; Casalino, Erb, Joshi, & Shortell, 2015; Issel, 2017; Sherry et al., 2016; Shortell, Washington, & Baxter, 2009). Evidence suggests that specific hospital-initiated care coordination practices have a role in quality improvement. Information exchange between hospitals and community providers can help reduce the number of repetitive services, such as repeated diagnostic radiology services (Adler-Milstein et al., 2017; Bailey et al., 2013); medication reconciliation reduces medication errors by clarifying current medications (Jack et al., 2009; Pronovost et al., 2003); and case management helps ensure that the patient receives the services he or she needs to avoid readmission. A limitation of this literature is that studies of hospital roles in care coordination and innovative delivery models are often focused on a singular service or program, such as medication reconciliation postdischarge (National Committee for Quality Assurance, 2017).

The objective of this article is to identify variations in adoptions of hospital-initiated care coordination practices and Accountable Care Organization (ACO) models and their correlation with hospital characteristics, community-level sociodemographics, local health resources, and state policies. We constructed a composite index as a sum of 12 different hospital-initiated care coordination practices. State health policies and Community Benefit Laws (CBLs) are a normative force influencing hospital behavior. We examined whether hospital-initiated care coordination intensity varied by the state

implementation of CBLs (Somerville, Nelson, & Mueller, 2013) and state Medicaid expansion status. Based on the conceptual framework presented below, we hypothesized that fewer hospital-initiated care coordination practices would be provided in communities with high poverty rates and uninsured rates, as well as in rural areas, in states with fewer CBLs, and in states that did not expand Medicaid coverage.

Conceptual Framework

The adoption and implementation of care coordination initiatives among hospitals vary by complex social determinants of health and the availability of community health care resources (Sherry et al., 2016; Shortell et al., 2009). Our study used organizational theory to explore the normative forces of state-level policies and CBLs that may induce greater provision of hospital-initiated care coordination services and active participation in an ACO.

Organizational theory (Meyer, 1977) has been widely used to frame the understanding of how hospitals respond to their internal and external environments (Harrison et al., 2016). For example, important work by Jennings highlighted how organizational factors influence "community orientation," which shares certain commonalities with the CBL we later describe (Jennings et al., 2017). In addition, Hogan utilized the organizational theory to explain population dynamism as a factor influencing management decisions to undertake vertical integration (Hogan et al., 2018). We focused on the external organizational contextual factors that may influence hospital investments in care coordination practices, as well as their participation in innovative care model, such as ACOs. We tested the hypothesis that external normative conditions such as communities' characteristics, state CBLs, Medicaid expansion, and federal regulatory requirements can induce more hospital-initiated care coordination practices and participation in innovative care models (Demiralp, He, & Koenig, 2017; Desai et al., 2016).

Hospitals in poor neighborhoods are often less likely to be profitable and, in turn, encounter limited resources for investing in care coordination practices (Bolin et al., 2015), compared to hospitals in wealthy areas (Colla et al., 2016). Barriers to coordinated treatment faced by underserved

populations may be caused by preexisting social disadvantages and contribute to the persistence of broader social inequalities. Furthermore, urban and rural hospitals face substantially different contexts. Rural hospitals are often smaller, nonprofit, and less well equipped than their urban counterparts (Mueller & Ullrich, 2016). Although individuals from rural areas may be more likely to benefit from hospital-initiated care coordination practices, rural hospitals have limited financial resources, challenging regulatory requirements, and limited institutional capacity to adopt coordination practices (Adler-Milstein et al., 2017; Bai & Anderson, 2016).

Nevertheless, even hospitals in poor neighborhoods are subject to state and federal policies, such as CBLs and Medicare payment innovation models. For example, under federal law, nonprofit hospitals must provide community benefits in order to keep their tax-exempt status (Rosenbaum, 2016). Under the Patient Protection and Affordable Care Act (ACA), required CBL activities include “conducting community health needs assessments and developing implementation strategies every three years, adopting and publicizing a financial assistance policy, and limiting charges, billing, and collections” (Somerville et al., 2013). As of 2015, only 11 states had a statute requiring hospitals with tax-exempt status to conduct assessments of community health needs, and only 10 states required implementation of community benefit plans.

State Medicaid innovation may serve as another external normative driver that impacts hospitals’ decisions to adopt care coordination programs (Demiralp et al., 2017). Under the Medicaid waiver program, states are allowed to propose service and benefit plan designs that will deliver essential Medicaid benefits (Shenoy et al., 2017). These designs may include components of mandatory care coordination delivery. Such state-based efforts to induce care coordination may produce hospital or state savings in Medicaid provision or may function through a penalty to hospitals and health systems, reducing their reimbursement. These state-level policies require a response from health systems.

Method

We constructed a multilevel data set (hospital level, hospital’s relevant geographic area level, county level, and state level) by linking multiple data sets using hospital and geographic identification codes. These merged data enabled us to examine the variation of adoptions of care coordination practices and/or ACO models, while controlling for a comprehensive set of hospital, community, and policy factors.

Measures of Care Coordination and the ACO Model

The American Hospital Association (AHA) Survey of Care Systems and Payment 2015 provides measures of

hospital-initiated care coordination practices and ACO participation. All the responses were reported by a hospital staff member on behalf of that specific organization, indicating their organizational practices and affiliations. The survey covers 1,017 general medical and surgical hospitals from 50 states and the District of Columbia that provide a wide range of health care services, including primary care, specialty care, hospital inpatient care, and urgent care/emergency care.

Two hospital-reported outcomes on participation in care coordination practices were constructed: (a) hospital-initiated Care Coordination Index (CCI) and (b) the adoption of ACO model within the hospital or health system. The CCI was the summation of 12 indicators on care coordination practices, including chronic care management, post-hospital discharge continuity of care, and home visits. Each indicator is measured at 5-point Likert scale from “not used at all” to “used widely.” CCI is a continuous variable from 12 to 60. Measure of ACO was a binary variable, taking a value of 0 if not participating and 1 if “hospital has established a separate legal entity for an ACO, is part of an ACO, or is actively working to establish an ACO in the future.” Specific measures and definitions are presented in the Supplemental Digital Content 1 (see Supplemental Digital Content 1, <http://links.lww.com/HCMR/A48>).

Community Characteristics

Community characteristics were captured within the 15-mile hospital’s relevant geographic area. We defined a hospital’s relevant geographic area as the collection of zip codes located within a 15-mile radius of each hospital (Baker, 2001; Robinson & Luft, 1985). The hospital addresses were geocoded into geographical coordinates as points, and a boundary of 15 miles was defined for each hospital. The boundary zone for each hospital was created as a circle around the hospital with a radius of 15 miles. Then, for each boundary zone of each hospital, the zip code tabulation areas that were spatially within or overlap with the hospital boundary were identified. We used ArcGIS 10.3 to determine the percentage of overlap for the boundary and the zip codes.

We used the American Community Survey to obtain the zip code-level measures of demographic variables, family incomes, and uninsured rates. We then aggregated the zip code-level information to the hospital’s relevant geographic area. We used the Area Health Resource File to capture the county-level health care resources with respect to the number of community health centers, the number of primary care physicians, and the number of hospitals.

Poverty and Uninsured Rate at the Hospital’s Relevant Geographic Area Level

We expected that hospitals serving communities with high poverty and uninsured rates would be less likely to adopt care

coordination practices and ACO models. We constructed an indicator of poverty and uninsured rate using two variables obtained from the American Community Survey (i.e., percentage of households with family income under 100% of the federal poverty level [FPL] and the percent uninsured). We defined a hospital's relevant geographic area as a *high-poverty–uninsured area* if both the percentage of “family income under 100% of FPL” and percentage of “uninsured” were *higher than* the medians of all hospitals studied, a *low-poverty–uninsured area* if both percentages were lower than the medians, and a *medium-poverty–uninsured area* otherwise.

The Community Benefit State Laws, Medicaid Expansion Status, and State Indicators

The *Community Benefit State Law Profiles* (Somerville et al., 2013), developed by the Hilltop Institute, identify state-level community benefit requirements relating to all central features of the requirement under the ACA to provide a community benefit. The intensity of state CBL is defined as the summation of the following components: (a) minimum community benefit requirement; (b) community benefit reporting requirement; (c) community health needs assessment; (d) community benefit plan/implementation strategy; (e) financial assistance policy; (f) financial assistance policy dissemination; and (g) limitations on charges, billing, and collections. CBL intensity is a continuous variable from 0 to 7, taking a value of 0 if there are no state requirements and a value of 7 if all of the aforementioned components are required per state law. State Medicaid expansion status was measured as of July 2015.

Analysis

We first defined and summarized measures of care coordination and participation in ACOs. We then compared the characteristics of hospital and hospital's relevant geographic area, and CBL intensity by the level of CCI. We used state fixed-effects multivariable regressions to explore the association between the adoption of hospital-initiated care coordination practices and ACOs and hospital, relevant geographic area, county, and state characteristics.

Our basic model was $E(CCI_{i,j,c,k}) = f(\beta_0 + \beta_H H_i + \beta_R RGA_{i,j} + \beta_C County_{i,j,c} + \beta_S CBL_{i,j,c,k})$, where $CCI_{i,j,k}$ is a measure of care coordination of hospital i , in hospital's relevant geographic area j , county c , and state k . f is the functional form. Multivariable linear regression was used for CCI. In addition to the composite index, we also examined each of the 12 measures of care coordination as a separate dependent variable. Multivariable logistic regressions were used for the participation of the ACO.

H_i is the vector of characteristics of hospital i . We controlled for hospital characteristics collected from the 2015

AHA Annual Survey, including hospital ownership (government, not for profit, and for profit), bed size (<50 beds, 50–199 beds, and 200 or more beds), teaching hospital status, and urban or rural location. We also controlled for the number of full-time personnel at the hospital and captured the units of inpatient surgical operations, emergency room visits, and hospital unit Medicaid days as indices for volume of hospital operations (Zhu et al., 2017). RGA_j was a vector of characteristics of hospital's relevant geographic area. $County_{i,j,c}$ indicated the availability of county-level health care resource, and S_k included the measure of the intensity of state-level implementation of CBL and the indicator of the Medicaid expansion status.

Sensitivity analyses were conducted to test the model specifications and the robustness of our findings. Specifically, we tested the robustness of our results using different indicators of neighborhood poverty rates and uninsured rates, applying various model specifications with different sets of control variables and testing the definition of the hospital's relevant geographic area by using a 5-mile radius. Findings in these sensitivity tests were consistent with the main results presented below and are available upon request.

Our final sample size was 943 hospitals that reported on CCI and 1,017 that reported on ACO participation. All regression modeling was done in STATA 14, and we defined $p < .05$ as the significance level a priori.

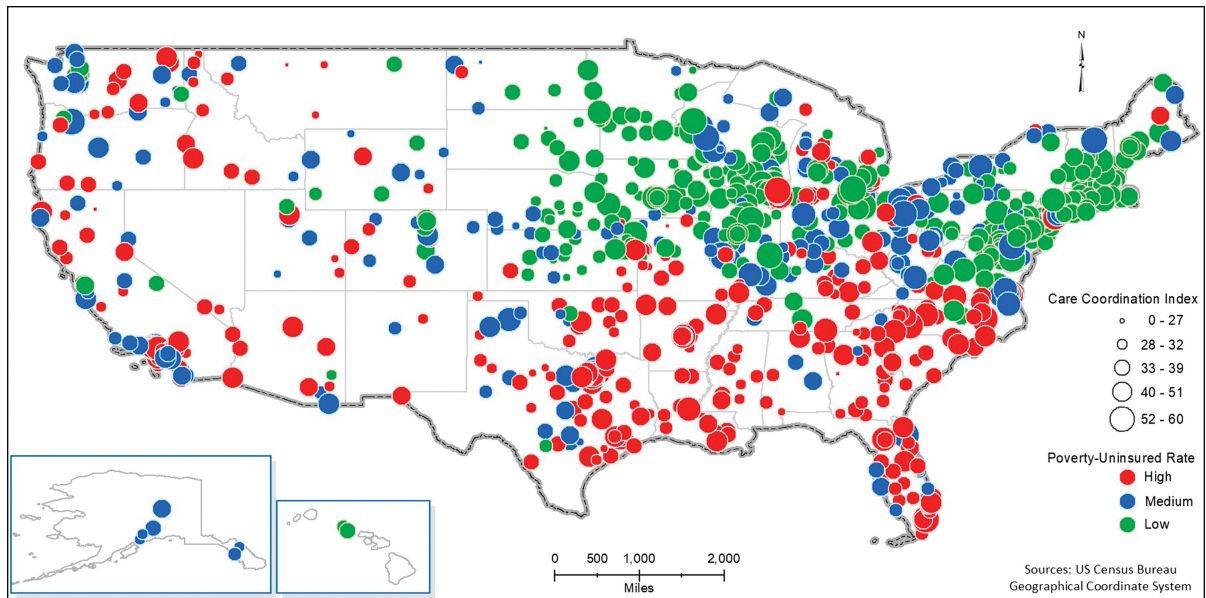
Results

Figure 1 describes the adoption of CCI at quintiles level by a hospital's relevant geographic area-level poverty–uninsured rate across the United States. CCI was normally distributed with a mean of 37.86 (median = 37) and a standard deviation of 10.01, ranging from 12 to 60. This suggests moderate levels of hospital-initiated care coordination practices at most hospitals, but with wide variation. Levels of the CCI were higher in the Northeast; meanwhile, areas with high-poverty–uninsured rates had lower CCI scores and were more likely to be located in the South.

Table 1 compares hospital and hospital geographic area characteristics by level of CCI (low: below the 50th percentile vs. high: above the 50th percentile). Compared to CCI low-scoring hospitals, hospitals had a higher CCI were more likely to be participating in ACO models (48% vs. 20%, $p < .001$). Hospitals reporting higher level of CCIs were more likely to be not for profit, have larger bed sizes, be teaching hospitals, and have larger scales of operation. They were less likely to be in rural areas (24% vs. 51%, $p < .001$) or high-poverty–uninsured areas (34% vs. 42%, $p < .01$). Hospitals adopting higher levels of CCIs were also more likely to be located in areas with more federally qualified health centers and in states actively implementing CBLs and/or with Medicaid expansion.

Figure 1

Geographic distribution of hospital care coordination and poverty–uninsured rates across the United States, 2015



Source: Our study used the linked data sets of the 2015 American Hospital Association (AHA) Annual Survey, AHA Survey of Care Systems and Payment™, American Community Survey, Area Health Resource Files.

Notes: Care Coordination Index (CCI) is calculated the summation of 12 individual coordination indicators at a 5-point Likert Scale. 12 measures were: a. Chronic care management processes or programs to manage patients with high volume, high cost chronic diseases; b. Use of predictive analytic tools to identify individual patients at high risk for poor outcomes or extraordinary resource use; c. Prospective management of patients at high risk for poor outcomes or extraordinary resource use by experienced case managers; d. Assignment of case managers for outpatient follow-up to patients at risk for hospital admission or readmission; e. Medication reconciliation as part of an established plan of care; f. Provision of visit summaries to patients as part of all outpatient encounters and scheduling of follow up visit and/or specialty referrals at the time of the initial encounter; g. Post-hospital discharge continuity of care program with scaled intensiveness based upon a severity or risk profile for adult medical-surgical patients in defined diagnostic categories or severity profiles; h. Arrangement of home visits by physicians, advanced practice nurses, or other professionals for homebound and complex patients for whom office visits constitute a physical hardship; i. Nurse case managers whose primary job is to improve the quality of outpatient care for patients with chronic diseases (e.g., asthma, CHF, depression, diabetes); j. Disease management programs for one or more chronic care conditions (e.g., asthma, diabetes, COPD); k. Hospitalists for medical/surgical inpatients; l. Telephonic outreach to discharged patients within 72 hours of discharge. The mean of CCI is 37.86 (std dev=10.01).

Table 2 presents results of the state fixed-effects model controlling for hospital, hospital's relevant geographic area-level characteristics, and state policy measures. Hospitals with medium and large bed sizes had significantly higher CCI scores (coefs = 3.86 and 3.98, $p < .001$, respectively) and were more likely to adopt the ACO model (coef = 1.25, $p < .001$, large bed size), compared to hospitals with small bed size. Compared to for-profit hospitals, government-owned hospitals, mainly VA hospitals, adopted significantly fewer care coordination practices (coef = -4.03, $p < .001$), and not-for-profit hospitals were more likely to adopt the ACO model (coef = 0.73, $p < .001$).

Hospitals operated in areas with high-poverty–uninsured rates adopted significantly fewer hospital-initiated care coordination practices (coef = -2.77, $p = .01$) and were less likely to have adopted the ACO model (coef = -0.67, $p = .02$), compared to hospitals operated in areas with low-poverty–uninsured rates. Intensity of CBL implementation was positively correlated with higher hospital-initiated

care coordination practices (coef = 0.61, $p = .03$). Associations with state Medicaid expansion status were not significant.

In regression models examining the factors associated with the adoption of each of the 12 care coordination measures (available in the Supplemental Digital Content 2, <http://links.lww.com/HCMR/A49>), we found hospitals serving communities with high-poverty–uninsured rates were less likely to use outpatient case management, home visits, dedicated case management nurses, disease management programs, and telephonic outreach after discharge. Hospitals with a large bed size were consistently more likely to adopt all care coordination practices.

Discussion

Care coordination is considered an important mechanism to improve quality of care and population health (Alley et al., 2016; Casalino et al., 2015; Sherry et al., 2016; Shortell et al., 2009). Our findings suggested that such

Table 1
Comparison of hospital characteristics by level of care coordination index

	Scores of care coordination index (median = 37)				
	Below the 50th percentile		Above the 50th percentile		
	<i>n</i> = 447		<i>n</i> = 496		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>p</i>
ACO	0.20	0.02	0.48	0.02	<.001
Hospital characteristics					
For profit	0.09	0.28	0.07	0.25	.34
Not for profit	0.57	0.49	0.79	0.41	<.001
Government	0.34	0.47	0.14	0.35	<.001
Bed size					
Small (1–49 beds)	0.43	0.50	0.13	0.33	<.001
Medium (50–199 beds)	0.31	0.46	0.37	0.48	<.05
Large (>200 beds)	0.27	0.44	0.50	0.50	<.001
Rural	0.51	0.50	0.24	0.42	<.001
Teaching	0.04	0.19	0.14	0.35	<.001
Inpatient surgical operations (unit 1,000)	1.65	2.69	3.61	4.51	<.001
Emergency room visits (unit 1,000)	27.25	31.50	51.04	46.11	<.001
Medicaid days (unit 1,000)	9.23	17.15	16.14	1.05	<.001
Full-time total personnel (unit 1,000)	0.80	1.19	1.79	2.54	<.001
Hospital 15-mile services area					
Uninsured	12.93	0.23	11.43	0.23	<.001
Family under 100% of the federal poverty level	10.91	0.21	10.14	0.17	<.01
Poverty–uninsured rate					
High	0.42	0.02	0.34	0.02	<.01
Medium	0.26	0.02	0.25	0.02	.80
Low	0.32	0.02	0.42	0.02	<.01
Racial demographics					
White	0.85	0.01	0.80	0.01	<.001
African American	0.07	0.01	0.10	0.005	<.001
Hispanic (100%)	0.10	0.01	0.12	0.005	<.10
County-level number of FQHCs (per 1,000 residents)	0.87	0.17	1.71	0.19	.001
State					
Intensity of the implementation of community benefit law (a score of 0–7)	2.77	2.45	3.61	2.44	<.001
Not a Medicaid expansion state in 2015	0.46	0.02	0.32	0.02	<.001

Note. Our study used the linked data sets of the 2015 American Hospital Association (AHA) Annual Survey, AHA Survey of Care Systems and Payment, American Community Survey, Area Health Resource Files, and collected data on state's community benefit law implementation policy. ACO = Accountable Care Organization; FQHCs = Federally Qualified Health Centers.

hospital-initiated care coordination practices were more likely to be adopted by large hospitals in urban and wealthier areas. Hospitals located in underserved areas often face limited resources (Alley et al., 2016; Casalino et al., 2015; Dark, Xu, & Ho, 2017) and disproportionately serve patients who were uninsured or had Medicaid, and patients often have worse health outcomes (e.g., higher mortality rates) than other hospitals (Corrigan, Fisher, & Heiser, 2015). It is likely that rural, uninsured, and low-income populations who may benefit from care coordination programs do not have equal access to such hospital-initiated

care coordination practices or innovative delivery models compared to populations served by large urban hospitals. Because we found that care coordination practices were largely concentrated in urban wealthier areas, these results suggest that expanding care coordination practices in a more equitable fashion may require allocating more resources toward underserved areas through incentives (Gaskin, Zare, Haider, & LaVeist, 2016).

We speculate that lack of financing and regulatory support, as well as the poverty and high uninsured rates in rural areas (Bolin et al., 2015), were main drivers of these

Table 2

Results of state fixed-effects model full model: Association of hospital characteristics, hospital's relevant geographic area, state community benefit law, and Medicaid expansion status

	Care coordination index			ACO		
	Coef	95% CI	p	Coef	95% CI	p
Hospital characteristics						
For profit		Reference			Reference	
Not for profit	−0.57	[−2.90, 1.76]	.63	0.73	[0.05, 1.41]	.03
Government	−4.03	[−6.63, −1.44]	<.001	0.42	[−0.36, 1.19]	.29
Bed size						
Small (1–49 beds)		Reference			Reference	
Medium (50–199 beds)	3.86	[2.20, 5.51]	<.001	0.65	[0.14, 1.16]	.01
Large (>200 beds)	3.98	[1.82, 6.15]	<.001	1.25	[0.64, 1.87]	<.001
Urban						
Rural	−0.08	[−1.69, 1.53]	.92	−0.39	[−0.84, 0.06]	.09
Teaching	1.27	[−1.61, 4.16]	.39	−0.61	[−1.30, 0.07]	.08
Inpatient surgical operations (unit 1,000)	0.01	[−0.33, 0.35]	.94	0.04	[−0.05, 0.13]	.40
Emergency room visits (unit 1,000)	0.04	[0.01, 0.06]	<.001	0.00	[−0.01, 0.01]	.98
Full-time total personnel (unit 1,000)	−0.09	[−0.73, 0.55]	.78	0.01	[−0.15, 0.17]	.88
Hospital unit Medicaid days (unit 1,000)	−0.02	[−0.06, 0.03]	.51	0.00	[−0.01, 0.01]	.91
Hospital services area						
Low-poverty–uninsured		Reference			Reference	
High-poverty–uninsured	−2.77	[−4.78, −0.76]	.01	−0.67	[−1.24, −0.10]	.02
Medium-poverty–uninsured	−0.40	[−2.07, 1.27]	.64	−0.26	[−0.70, 0.18]	.25
White (100%)	−10.17	[−23.98, 3.63]	.15	−0.18	[−4.07, 3.71]	.93
African American (100%)	2.84	[−13.98, 19.67]	.74	1.80	[−3.00, 6.60]	.46
Hispanic (100%)	3.44	[−4.62, 11.49]	.40	1.35	[−0.84, 3.53]	.23
County-level number of FQHCs (per 1,000 residents)	0.02	[−0.19, 0.24]	.82	0.04	[−0.02, 0.09]	.18
State						
Implementation of the intensity of community benefit law	0.61	[0.07, 1.16]	.03	−0.03	[−0.17, 0.11]	.65
Not a Medicaid expansion state in 2015 (100%)	0.78	[−3.05, 4.61]	.69	−0.47	[−1.43, 0.48]	.33

Note. We presented the full sets of regression results. Various model specifications with different sets of controlled variables (including models controlled for hospital characteristics only, different sets of hospital characteristics, and community characteristics) were tested. Collinearity test was conducted using variance inflation factor statistics = 2.90 for each model. Our findings were consistent with the main results presented above and are available upon request. Data source: 2015 American Hospital Association (AHA) Annual Survey, AHA Survey of Care Systems and Payment, American Community Survey, Area Health Resource Files, and collected data on State's community benefit law implementation policy. ACO = Accountable Care Organization; CI = Confidence Interval; FQHCs = Federally Qualified Health Centers.

disparities. The Centers for Medicare & Medicaid Services have made accommodations to include rural providers in innovative ACO delivery care models (Mueller & Ullrich, 2016). Additional support may be necessary to ensure equitable access to care coordination in rural and high-poverty–uninsured areas. Results showed that hospitals with smaller bed sizes struggle to provide care coordination practices. It is likely that the hospital bed size, location in the rural areas, and high-poverty–uninsured rates were correlated. Future research should further explore rural and urban disparities in access to high-quality care coordination practices.

Results indicated that hospitals located in states with strong state requirements to improve population health were more likely to adopt care coordination practices. Under guidelines of CBLs, public health and health promotion programs became a vital part of hospitals' effort to focus on

benefiting the community at large (Corrigan et al., 2015). CBLs push hospitals to work with community partners to improve care coordination and the social determinants of health. The finding of the positive association between CBL requirements and hospital care coordination and the adoption of the ACO model suggest strong normative effects of CBLs. More research is needed to see whether care coordination can improve population health outcomes in states that require CBLs. It is important to note that, although CBLs pertain to nonprofit hospitals, the findings of our study suggest that these laws were effective in inducing investor-owned for-profit hospitals to increase community benefit-orientated activities as well, and this finding is consistent with the literature (Ginn & Moseley, 2006; Issel, 2017). In this study we explored the cumulative association of seven commonly required CBL components. The impact of each CBL individually is outside the scope

of this analysis. Future research may further investigate the impact of specific CBL components, because each CBL rule, such as the requirement of community needs assessment or the requirement of the implementation strategy, can potentially impact care coordination practices differently.

Existing evidence suggests that state Medicaid innovation may promote care coordination; however, these reports largely focused on outpatient care. For example, in Michigan, a health home was proposed as part of Medicaid innovation to ensure access to care and coordination of care (Prokop, LaPres, Barron, & Villasurda, 2017). Another study of Massachusetts Medicaid beneficiaries suggests that beneficiaries saw care coordination as adding value to their care (Sheff, Park, Neagle, & Oreskovic, 2017). Medicaid ACOs (Center for Health Care Strategies, 2018)—currently being tested in 12 states—may promote hospital-initiated care coordination services; however, our study did not find a significant association between Medicaid expansion status and adoption of hospital-initiated care coordination practices. One possible explanation of this result is that the indicator of “poverty–uninsured” rate of the areas reflected the Medicaid expansion status partly (Figure 1). Another possibility is that, although Medicaid coverage expansions could significantly increase health care access and chronic illness treatment, these effects “may not happen quickly” (Sommers et al., 2017). It will be of ongoing policy interest to examine the impact of the Medicaid expansion in the long run as states move to manage costs and establish work requirements for able-bodied, nonpregnant adults.

Our study had several limitations. First, our study explored the distribution of hospital-reported care coordination practices and participation in an ACO. Detailed measures of hospital and community collaboration will be needed to fully understand how care coordination was delivered across settings and its impacts on population health. Second, characteristics of hospitals in our study sample were different compared to statistics collected from the broader AHA annual survey. Participant hospitals in our sample had larger bed size, were more likely to be located in urban areas, and had higher discharge and emergency department visit volumes. Results of our study might have underestimated the association between community poverty–uninsured rate and the adoption of hospital-initiated care coordination practices. In other words, income and location disparities should be more pronounced at the national level than what we observed in this study. Third, we focused on the “general medical and surgical” hospitals. Services provided should be more homogeneous compared to specialized hospitals (e.g., psychiatric hospitals, cancer centers). However, specific services provided at such hospitals can be different. Such variation can impact hospital-initiated adoption of care coordination strategies. Finally, our study explored the geographic distribution of hospital care coordination practices. Future study may focus on the health outcomes and study how to adjust the unequally distributed

care coordination practices to promote population health and reduce health disparities.

Practice Implications

Our principal finding that hospitals in rural and high-poverty–uninsured areas provided less hospital-initiated care coordination practices has several important policy implications. First, we would argue that it is more economically effective to incentivize hospitals to coordinate care than to penalize them for “underperforming” at care coordination. Programs that are aggregated into our CCI, such as chronic disease management and telephonic outreach within 72 hours of discharge, take time and money to implement and maintain. It is not reasonable to expect small hospitals to reach new levels of care coordination service provision without giving them the resources to do so. Health care organizations that are currently providing low levels of care coordination practices might increase offerings by undertaking a prioritization exercise to identify which services key stakeholders view as valuable and feasible also satisfies state regulatory requirements.

Second, we observed that, in states with robust CBLs, there was a higher level of hospital-initiated care coordination practices. This suggests that the organizational climate generated by states is a key driver of the implementation of care coordination practices and may encourage hospitals to work with physician practices, local nonprofits, departments of public health, and other local partners to ensure that needed services are delivered to those who need them the most. States looking to expand hospital-led care coordination practices could consider expanding CBLs.

Third, payment models for population health, including hospital-community integrated models, are needed (Machta, Maurer, Jones, Furukawa, & Rich, 2018). Although many of the services in question are not directly billable, the value of taxes not paid as a result of maintaining a tax-exempt status could be a significant motivator for hospitals to provide nonbillable services. We were surprised to find that, on average, hospitals reported using most care coordination practices minimally or moderately. Changes of reimbursement policies that reward physicians and hospitals for how well they manage patients across a continuum of services, greater use of information technology such as predictive analytics to identify high-need, high-cost patients, and shared-decision making could encourage a more patient-centered health system. Evidence on the cost-effectiveness of patient-centered, care-coordinated health systems is needed to understand how fully optimized care coordination practices might lead to improved health and how care coordination may save money in the long run. Such evidence is critical to encourage investment in care coordination practices and sustain these programs.

We speculate that hospitals could be encouraged to coordinate care with community partners to improve the

care continuation. Cost savings have been observed from the ACO models among high-cost patients, but the savings were not tied to the reductions of preventable hospitalizations (McWilliams, Chernew, & Landon, 2017). Such evidence suggests that ACOs may have provided sufficient incentives for hospitals to control cost; however, evidence on care coordination mechanisms (e.g., postdischarge management) is needed to help hospitals build a more effective health care system. In addition, different financial incentives (e.g., levels of cost-sharing) under different tracks of the ACO model can influence the extent to which hospitals and health care providers are motivated to coordinate care. Future research is needed to investigate the association between ACO models and different ACO financing models and the adoption of specific care coordination practices (Hilligoss, Song, & McAlearney, 2017).

Conclusion

It is vital to understand how substantial changes in health care markets and reorganization of health care systems might impact the adoption of care coordination practices. Evidence of the link between care coordination practices, clinical outcomes, and population health is also critical. Care coordination can serve as an important avenue to improve the efficiency and quality of care. Results of our study suggested that rural and uninsured–poor populations, who may be mostly likely to benefit from these services, have limited access to such care coordination practices. Policy-makers may consider increasing resources for care coordination practices in rural, underserved, and high-poverty–high-uninsured areas to ensure that vulnerable populations can benefit from these services.

References

- Adler-Milstein, J., Holmgren, A. J., Kralovec, P., Worzala, C., Searcy, T., & Patel, V. (2017). Electronic health record adoption in US hospitals: The emergence of a digital “advanced use” divide. *Journal of the American Medical Informatics Association*, 24(6), 1142–1148. doi:10.1093/jamia/ocx080
- Agency for Healthcare Research and Quality. (2015). *2015 National Healthcare Quality and Disparities Report and 5th Anniversary Update on the National Quality Strategy*. Retrieved from <https://www.ahrq.gov/research/findings/nhqrdr/nhqrdr15/priorities.html>
- Alley, D. E., Asomugha, C. N., Conway, P. H., & Sanghavi, D. M. (2016). Accountable health communities—Addressing social needs through Medicare and Medicaid. *The New England Journal of Medicine*, 374(1), 8–11. doi:10.1056/NEJMp1512532
- Bai, G., & Anderson, G. F. (2016). A more detailed understanding of factors associated with hospital profitability. *Health Affairs (Project Hope)*, 35(5), 889–897. doi:10.1377/hlthaff.2015.1193
- Bailey, J. E., Pope, R. A., Elliott, E. C., Wan, J. Y., Waters, T. M., & Frisse, M. E. (2013). Health information exchange reduces repeated diagnostic imaging for back pain. *Annals of Emergency Medicine*, 62(1), 16–24. doi:10.1016/j.annemergmed.2013.01.006
- Baker, L. C. (2001). Measuring competition in health care markets. *Health Services Research*, 36(1 Pt 2), 223–251.
- Bolin, J. N., Bellamy, G. R., Ferdinand, A. O., Vuong, A. M., Kash, B. A., Schulze, A., & Helduser, J. W. (2015). Rural healthy people 2020: New decade, same challenges. *The Journal of Rural Health*, 31(3), 326–333. doi:10.1111/jrh.12116
- Casalino, L. P., Erb, N., Joshi, M. S., & Shortell, S. M. (2015). Accountable care organizations and population health organizations. *Journal of Health Politics, Policy and Law*, 40(4), 821–837. doi:10.1215/03616878-3150074
- Center for Health Care Strategies. (2018). *Medicaid accountable care organizations: State update*. Retrieved from <https://www.chcs.org/resource/medicaid-accountable-care-organizations-state-update/>
- Colla, C. H., Lewis, V. A., Tierney, E., & Muhlestein, D. B. (2016). Hospitals participating in ACOs tend to be large and urban, allowing access to capital and data. *Health Affairs (Project Hope)*, 35(3), 431–439. doi:10.1377/hlthaff.2015.0919
- Corrigan, J., Fisher, E., & Heiser, S. (2015). Hospital community benefit programs: Increasing benefits to communities. *JAMA*, 313(12), 1211–1212. doi:10.1001/jama.2015.0609
- Dark, C., Xu, Y., & Ho, V. (2017). Freestanding emergency departments preferentially locate in areas with higher household income. *Health Affairs (Project Hope)*, 36(10), 1712–1719. doi:10.1377/hlthaff.2017.0235
- Demiralp, B., He, F., & Koenig, L. (2017). Further evidence on the system-wide effects of the hospital readmissions reduction program. *Health Services Research*, 53(3), 1478–1497. doi:10.1111/1475-6773.12701
- Desai, N. R., Ross, J. S., Kwon, J. Y., Herrin, J., Dharmarajan, K., Bernheim, S. M., ... Horwitz, L. I. (2016). Association between hospital penalty status under the hospital readmission reduction program and readmission rates for target and non-target conditions. *JAMA*, 316(24), 2647–2656. doi:10.1001/jama.2016.18533
- Gaskin, D. J., Zare, H., Haider, A. H., & LaVeist, T. A. (2016). The quality of surgical and pneumonia care in minority-serving and racially integrated hospitals. *Health Services Research*, 51(3), 910–936. doi:10.1111/1475-6773.12394
- Ginn, G. O., & Moseley, C. B. (2006). The impact of state community benefit laws on the community health orientation and health promotion services of hospitals. *Journal of Health Politics, Policy and Law*, 31(2), 321–344. doi:10.1215/03616878-31-2-321
- Harrison, M. I., Paez, K., Carman, K. L., Stephens, J., Smeeding, L., Devers, K. J., & Garfinkel, S. (2016). Effects of organizational context on Lean implementation in five hospital systems. *Health Care Management Review*, 41(2), 127–144. doi:10.1097/HMR.0000000000000049
- Hawkins, K., Ozminkowski, R. J., Mujahid, A., Wells, T. S., Bhattarai, G. R., Wang, S., ... Yeh, C. S. (2015). Propensity to succeed: Prioritizing individuals most likely to benefit from care coordination. *Population Health Management*, 18(6), 402–411. doi:10.1089/pop.2014.0121
- Hilligoss, B., Song, P. H., & McAlearney, A. S. (2017). Aligning for accountable care: Strategic practices for change in accountable care organizations. *Health Care Management Review*, 42(3), 192–202. doi:10.1097/HMR.0000000000000110
- Hogan, T. H., Lemak, C. H., Hearld, L. R., Sen, B. P., Wheeler, J. R. C., & Menachemi, N. (2018). Market and organizational factors associated with hospital vertical integration into subacute care. *Health Care Management Review*, doi:10.1097/HMR.0000000000000199

- Issel, L. M. (2017). Community, population health, and health care organizations. *Health Care Management Review, 42*(4), 281. doi:10.1097/HMR.0000000000000183
- Jack, B. W., Chetty, V. K., Anthony, D., Greenwald, J. L., Sanchez, G. M., Johnson, A. E., ... Culpepper, L. (2009). A reengineered hospital discharge program to decrease rehospitalization: A randomized trial. *Annals of Internal Medicine, 150*(3), 178–187.
- Jennings, J. C., Landry, A. Y., Hearld, L. R., Weech-Maldonado, R., Snyder, S. W., & Patrician, P. A. (2017). Organizational and environmental factors influencing hospital community orientation. *Health Care Management Review, doi:10.1097/HMR.0000000000000180*
- Lee, J. L., Dy, S. M., Gurses, A. P., Kim, J. M., Suarez-Cuervo, C., Berger, Z. D., ... Xiao, Y. (2018). Towards a more patient-centered approach to medication safety. *Journal of Patient Experience, 5*(2), 83–87. doi:10.1177/2374373517727532
- Machta, R. M., Maurer, K. A., Jones, D. J., Furukawa, M. F., & Rich, E. C. (2018). A systematic review of vertical integration and quality of care, efficiency, and patient-centered outcomes. *Health Care Management Review, Epub ahead of print. doi: 10.1097/HMR.0000000000000197*
- McDonald, K. M., Sundaram, V., Bravata, D. M., Lewis, R., Lin, N., Kraft, S. A., ... Owens, D. K. (2007). *Closing the quality gap: A critical analysis of quality improvement strategies (Vol. 7: Care coordination)*. Rockville, MD: Agency for Healthcare Research and Quality.
- McWilliams, J. M., Cherner, M. E., & Landon, B. E. (2017). Medicare ACO program savings not tied to preventable hospitalizations or concentrated among high-risk patients. *Health Affairs (Project Hope), 36*(12), 2085–2093. doi:10.1377/hlthaff.2017.0814
- Meyer, J., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), 340–363.
- Mueller, K., & Ullrich, F. (2016). Spread of accountable care organizations in rural America. *Rural Policy Brief, 5*, 1–4.
- National Committee for Quality Assurance. (2017). *Medication reconciliation post-discharge*. Retrieved from <http://www.ncqa.org/report-cards/health-plans/state-of-health-care-quality/2017-table-of-contents/medication-reconciliation-post-discharge>
- Pandolfi, F., Crotty, B. H., & Safran, C. (2016). Medication harmony: A framework to save time, improve accuracy and increase patient activation. *American Medical Informatics Association Annual Symposium Proceedings, 2016, 1959–1966*.
- Prokop, J., LaPres, M., Barron, B., & Villasurda, J. (2017). Implementing a health home: Michigan's experience. *Policy, Politics & Nursing Practice, 18*(3), 149–157. doi:10.1177/1527154417749849
- Pronovost, P., Weast, B., Schwarz, M., Wyskiel, R. M., Prow, D., Milanovich, S. N., ... Lipsitt, P. (2003). Medication reconciliation: A practical tool to reduce the risk of medication errors. *Journal of Critical Care, 18*(4), 201–205.
- Robinson, J. C., & Luft, H. S. (1985). The impact of hospital market structure on patient volume, average length of stay, and the cost of care. *Journal of Health Economics, 4*(4), 333–356.
- Rosenbaum, S. (2016). Hospital community benefit spending: Learning in on the social determinants of health. *The Milbank Quarterly, 94*(2), 251–254. doi:10.1111/1468-0009.12191
- Sheff, A., Park, E. R., Neagle, M., & Oreskovic, N. M. (2017). The patient perspective: Utilizing focus groups to inform care coordination for high-risk medicaid populations. *BMC Research Notes, 10*(1), 315. doi:10.1186/s13104-017-2638-1
- Shenoy, A. G., Begley, C. E., Revere, L., Linder, S. H., & Daiger, S. P. (2017). Innovating patient care delivery: DSRIP's interrupted time series analysis paradigm. *Healthcare (Amsterdam, Netherlands), Epub ahead of print. doi:10.1016/j.hjdsi.2017.11.004*
- Sherry, M., Wolff, J. L., Ballreich, J., DuGoff, E., Davis, K., & Anderson, G. (2016). Bridging the silos of service delivery for high-need, high-cost individuals. *Population Health Management, 19*(6), 421–428. doi:10.1089/pop.2015.0147
- Shortell, S. M., Washington, P. K., & Baxter, R. J. (2009). The contribution of hospitals and health care systems to community health. *Annual Review of Public Health, 30*, 373–383. doi:10.1146/annurev.publhealth.032008.112750
- Sommers, B., Gawande, A., & Baicker, K. (2017). Health insurance coverage and health — What the recent evidence tells us. *New England Journal of Medicine, 377*, 586–593.
- Somerville, M., Nelson, G., & Mueller, C. (2013). *Hospital community benefits after the ACA: The state law landscape*. Retrieved from <http://www.hilltopinstitute.org/publications/HospitalCommunityBenefitsAfterTheACA-StateLawLandscapeIssueBrief6-March2013.pdf>
- Zhu, X., Mueller, K., Vaughn, T., Ullrich, F., & MacKinney, C. (2016). Medicare accountable care organizations: Quality performance by geographic categories. *Rural Policy Brief, (2016 6)*, 1–4.