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Advancing Organizational Capabilities to Improve Patient Engagement in Health Care

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Advancing Organizational Capabilities to Improve Patient Engagement in Health Care

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Abstract

Advancing Organizational Capabilities to Improve Patient Engagement in Health Care

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Health care delivery organizations are increasingly being encouraged to implement strategies to engage patients in their health and health care yet have varying capabilities to support patient-centered care. Improving the quality of health care delivery requires a better understanding of the multi-level organizational capabilities that enable patient engagement. This dissertation develops a conceptual framework to delineate the health care system, physician practice, and team factors associated with patient engagement in chronic care.

The first study links clinical data to surveys of patients with diabetes in fourteen community health center sites to examine if the availability of team member expertise is associated with patient experiences of chronic care, and whether the relationship is consistent for small versus large sites. The second study uses a nationally representative survey of physician practices and health systems to clarify how health systems may influence the adoption of patient engagement and chronic care management capabilities in constituent physician practices. The third study utilizes Mokken scale analysis and a survey of adult primary care practices to reveal potential pacing and foundation setting in the adoption of patient engagement strategies.

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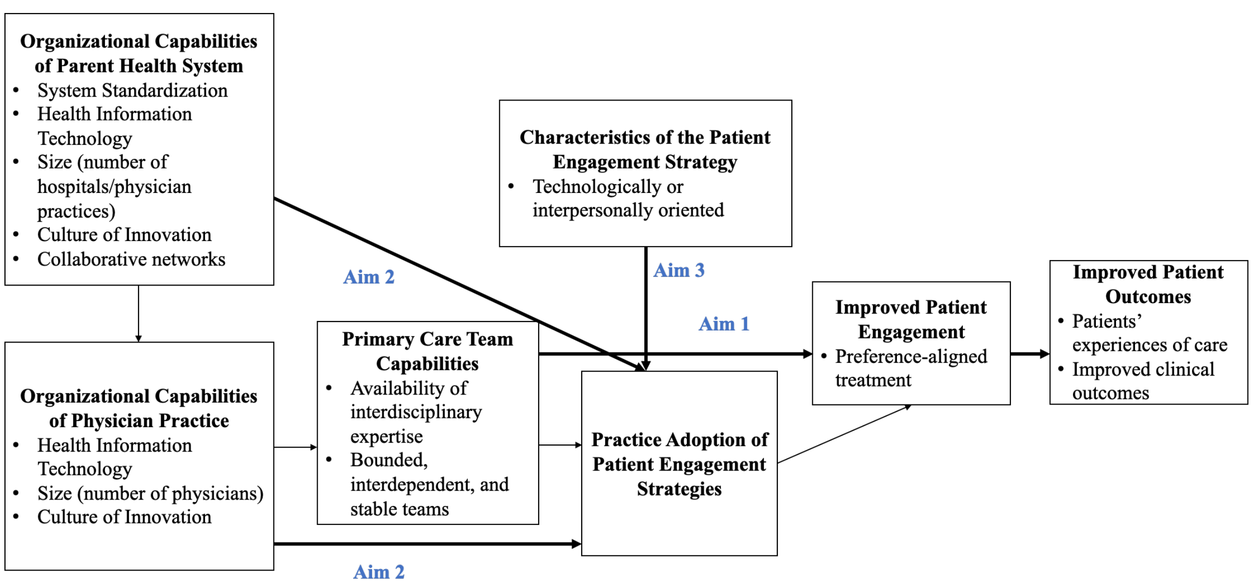
Conceptual Model and Aims

Health care systems and physician practices are increasingly being encouraged to implement strategies to engage patients in their health and health care. In their influential report Crossing the Quality Chasm*,* the National Academy of Medicine highlighted the importance of encouraging patients to be the source of control in their care and building systems that facilitate high-performing patient-centered teams and improved care coordination.[1] However, physician practices have varying capabilities to support the delivery of patient-centered care. Larger and health care system-owned physician practices may have greater organizational capability to engage patients compared to smaller and non-affiliated physician practices.[2] These differential capabilities may influence the adoption of patient engagement strategies, which are defined as formal processes to improve patient confidence and involvement in care. Improving the quality of health care delivery requires a better understanding of the organizational capabilities that enable patient engagement.

For greater precision in advancing patient engagement, a conceptual framework was developed to delineate the health care system, physician practice, and team factors associated with patient engagement in chronic care (Figure 1). Drawing from existing bodies of literature in the diffusion of innovations, implementation science, and organizational theory, the framework unifies the multi-level organizational influences on the formal adoption of patient engagement strategies. The framework describes that advancing organizational capabilities of primary care teams, physician practices, and health systems can lead to improved patient engagement and outcomes of care.

Figure 1: Conceptual Framework on Multi-level Organizational Capabilities to Improve Patient Engagement



As many patient engagement strategies are relatively new and innovative processes to most health care systems and physician practices, the conceptual framework draws on existing theories of innovation implementation. Rogers' work on the diffusion of innovations posits that the decision to adopt innovations such as patient engagement strategies is subject to the relative advantage, compatibility, complexity, observability, and trialability of the innovation.[3] Implementation science studies have applied diffusion of innovation theory in understanding how innovations spread and sustain in health care organizations.[4] This evidence base is used as a foundation to incorporate characteristics of patient engagement strategies that influence adoption, including whether they are interpersonally or technologically oriented.

Organizational capabilities of parent health systems may enhance capabilities of constituent physician practices through economies of scale, slack resources, and practices within the system learning from each other - enabling advanced physician practice uptake of innovations. Parent health systems may also enforce adoption of innovations through system-wide guidelines. These influences are likely subject to the degree of standardization of the health system, health systems can centrally make decisions or offer flexibility to their physician practices. The conceptual framework maps the simultaneous influence of parent health systems to enforce uptake of strategies as well as enhance practice ability to innovate strategies.

Structural capabilities of primary care practices include patient assistance and reminders, culture of quality, enhanced access, and electronic health records.[2] Previous research observed improved infrastructure for implementing care management processes and patient-centered medical home processes in physician practices owned by a larger entity such as a hospital or health system.[2,5–7] These capabilities of physician practices influence their ability to engage patients because patient engagement strategies often rely on a robust technical, financial, and personnel infrastructure to effectively implement and manage them.

Beyond technical ability to implement patient engagement strategies, physician practices need to be willing to adopt innovative processes. The diffusion of innovations describes that in the initial stages of adoption, innovators and early adopters should be willing to take risks.[3] Innovative cultures in physician practices may allow the confidence to try new processes. Innovative parent health systems may allow more flexibility for their physician practices to test new strategies. The conceptual framework incorporates this element by detailing innovation culture as a capability of physician practices and health systems.

A capability central to engaging patients with chronic conditions is providing patients with relevant interdisciplinary expertise to support patient self-management of their health and health care.[8] Effective teamwork relies on "real teams" that are bounded, interdependent and stable.[9] Organizational capabilities of physician practices and health systems can support interdisciplinary primary care teams by providing environments that promote effective teamwork. For example, access to more robust health information technology functions can support better care coordination across multiple clinicians.[10] Primary care teams engage patients directly and are also involved in the implementation of patient engagement strategies.

Guided by the conceptual framework, this dissertation examines team-, physician practice-, and health system-level factors associated with patient engagement. Three aims target specific components of the overall framework. The framework highlights the importance of productive interactions between informed patients and supported care teams. The first aim is to assess the physician practice and team capabilities associated with better patients' experiences of chronic illness care in safety net clinics (**Aim 1**). Next, physician practices and parent health system capabilities are disentangled to evaluate their relative association with practice adoption of patient engagement strategies and care management processes (**Aim 2**). Finally, the ordering of patient engagement strategy adoption by physician practices is examined to establish foundational patient engagement strategies that are required before expanding to more complex strategies (**Aim 3**).

Chapter 1: Interdisciplinary Primary Care Team Expertise and Diabetes Care Management in Community Health Centers

Background

Adult patients with type II diabetes and other chronic conditions need support to improve their self-management skills, particularly socioeconomically vulnerable populations that face more social and non-medical barriers to diabetes control.[8,11,12] The availability of broad interdisciplinary expertise on primary care teams may improve patient self-management by providing different skills in overcoming barriers to self-management. Previous research among commercially-insured patients indicates that access to nurse practitioner, nurse, and nutritionist expertise on care teams is associated with better self-management of diabetes,[13] but it remains unclear whether the benefits of broader team expertise extend to socioeconomically vulnerable patients receiving care in community health centers (CHCs). The unique organizational context of CHCs, including high turnover and financial instability,[14–16] may affect patient access to and experience with interdisciplinary care teams.

CHCs are safety net health care organizations with a mission to provide outpatient care to underserved and socioeconomically disadvantaged communities. CHCs have long faced staff shortages, with large vacancies in physicians and registered nurses.[16] Effective interdisciplinary primary care teams are essential for CHCs because high primary care clinician (PCC) turnover has led many CHCs to assign patients to care teams or sites rather than individual PCCs.[17] Care team assignment may be less than optimal for fostering PCC-patient relationships because continuous relationships with individual PCCs promotes patient trust and treatment adherence,[18–20] while care team approaches can be implemented in ways that are not patient-centered.[20,21]

Organizational facilitators of effective care teams may vary depending on CHC size. Higher volume facilities may have greater slack resources to hire staff and sufficient health information technology (HIT) to coordinate patient care compared to smaller volume facilities. However, small CHC sites have the benefit of fostering interpersonal relationships through small size,[22] and can use inter-organizational partnerships to share personnel and resources including data analysts, care coordinators, and nutritionists.[23] Previous research has demonstrated smaller primary care practices have better access to care and fewer potentially preventable hospital admissions than large primary care practices.[24,25] If care teams of small CHC sites are more effective in coordinating care because of their relationships, interdisciplinary expertise may improve patient self-management and HbA1c control, rather than result in process losses due to coordination problems.

We examine the extent to which the availability of interdisciplinary expertise on primary care teams is associated with better diabetic patients' experiences of chronic care and hemoglobin A1c control. To examine whether interdisciplinary expertise differs by practice size, we assess whether the relationship between expertise and patient outcomes differ in small versus large CHC sites. Previous studies have separately found that the expertise of individual care team members[26–35] and overall team expertise[13] contribute to effective chronic care management. We build on previous research by including community health workers and diabetes educators as expertise sources central to care management in CHCs, as well as disentangling the effect of specific team expertise from the overall expertise on the primary care team.

Methods

This study analyzes cross-sectional data collected as part of a cluster-randomized trial of fourteen CHC sites in California.[36] Patients were sampled in 2011 and the survey was fielded in 2012 (Response Rate=47%). The survey was mailed to a random sample of patients who were least 18 years old, had at least two visits to a participating CHC site, and had a type 2 diabetes diagnosis code or prescription per the SUPREME-DM definition.[37] A two visit criterion was used to assess the perspectives of established patients of the CHCs. The survey was fielded in English, Spanish and Chinese, and included a $10 gift card. Non-respondents were contacted by phone for up to eight attempts, patients were given the option to consent and complete the survey over phone. From 1396 total respondents, 119 patients (8.5%) were excluded due to incomplete survey responses, resulting in an analytic sample of 1,277 patient surveys which were linked with 2011-2012 clinical and administrative data.

The two study outcomes are 1) patients' experiences of chronic care and 2) HbA1c control. Patients' experiences of chronic care were assessed using a diabetes-specific adaptation of the Patient Assessment of Chronic Illness Care (PACIC-11).[38,39] Questions included: "Over the past six months, when I received care for my diabetes at this clinic, how often was I: given choices about treatments to think about; helped to set specific goals to improve my eating or exercise; and helped to plan ahead so I could take care of my condition even in hard times." Response categories included "never", "sometimes", "usually", and "always". To generate a composite, responses to PACIC-11 questions were scored as a continuous measure (range=0-100; internal consistency reliability, α=.91). Following the half-scale rule, a composite score was only calculated for patients with at least half of the questions completed.[40]

We measured HbA1c through a dichotomous measure coded as 1 for acceptable control (HbA1c result <8.0%) versus 0 for poor control.[41] This is consistent with the American Diabetes Association's guideline as a reasonable HbA1c goal for patients with comorbid conditions.[42]

Our main independent variables are: 1) access to specific team expertise, and 2) an overall count of interdisciplinary expertise on the primary care team. Access to team expertise was assessed using patient reports of CHC clinicians and staff endorsed as "help[ing] you with your diabetes", including community health workers, diabetes educators, nutritionists, pharmacists, mental health providers, and other general staff. Overall care team expertise is a count of the number of team expertise sources reported, ranging from 0 (none) to 6. Both expertise measures are measured at the patient-level given that patients have different constellations of clinicians involved in their diabetes care based on their needs and preferences. CHC site size was examined as a moderator of the team expertise and diabetes care management relationship and was measured by the annual (2012) unique adults with diabetes the site served. CHC sites served a range from 118 to 1,609 adult patients with diabetes. Sites were classified as large (n=6) if they cared for 250 or more adults with diabetes or small (n=8) if they cared for fewer than 250 adults with diabetes.

Patient sex, age, insurance, and comorbidity information was sourced from administrative and clinical data. Race, ethnicity, primary language information, and how long the patient was established with the CHC site (less than 3 years, 3-5 years, 5+ years) were collected in the patient survey. We constructed a combined categorical variable for race, ethnicity and language given their correlation in the patient responses:[43] Asian patients speaking Chinese (n=578), Asian patients speaking English (n=116), Latino patients speaking Spanish (n=132), Latino patients speaking English (n=166), and English-speaking patients of other racial/ethnic background (n=404), including Black and non-Latino White patients.

Descriptive statistics compare patient characteristics and predictor variables in small versus large CHC sites. T-tests were used for continuous variables and Chi-square tests for categorical variables. Multivariable logistic regression estimated the association of patient access to specific team expertise, overall care team expertise, and CHC site size (small versus large) on HbA1c control (<8.0%). To examine whether patients of small CHC sites benefit more from expertise, we tested an interaction between site size and overall interdisciplinary expertise. Then, multivariable linear regression models estimated the association of patient access to specific team expertise, overall care team expertise, and CHC site size (small versus large) on patients' experiences of chronic care (PACIC-11). An interaction between site size and overall interdisciplinary expertise was included to assess whether patients of small CHC sites benefit more from expertise. Models included random CHC site effects to account for the clustering of patients within CHC sites, and control for patient age, sex, race/ethnicity/language, insurance source, and comorbidities.

We used Little's test to assess covariate-dependent missingness,[44] then multiple imputation was conducted for missing values. We computed the Variance Inflation Factor (VIF) for all independent variables and used a cut-off of VIF>2 to assess potential collinearity. To examine the robustness of the HbA1c result, we estimated a logistic regression with an HbA1c cut point of <9.0% designated as acceptable control, as well as a linear regression model using a continuous measure of HbA1c. More clinically complex patients may have greater need for team expertise. To assess the sensitivity of our findings to potential selection effects, inverse probability of treatment weights (IPTW) were used for each patient. IPTWs were calculated equal to the inverse of the probability of having access to any non-PCC expertise, conditional on control variables. All statistical analyses were completed using STATA 16.0 by the authors and approved by the Institutional Review Board of the University of California, Berkeley.

Results

Distribution of patient characteristics are comparable in small and large CHC sites, except for patient sex (p<0.05) and race/ethnicity/language (p-value<0.001) (Table 1). Small CHC sites had a lower percentage of female patients compared to large CHC sites (overall: 57.6%, small sites: 54.1%, large sites: 59.8%). The most common category of race/ethnicity/language are Chinese-speaking Asian patients (overall: 40.3%, small sites: 30.4%, large sites: 47.5%), followed by Spanish-speaking Latino patients (overall: 29.4%, small sites: 38.8%, large sites: 23.6%), English-speaking Latino patients (overall: 12.5%, small sites: 13.8%, large sites: 11.6%), English-speaking patients of other racial/ethnic backgrounds (overall: 9.5%, small sites: 7.6%, large sites: 10.6%), and English-Speaking Asian patients (overall: 8.5%, small sites: 9.3%, large sites: 7.9%). Mean number of comorbid conditions is 2.99 (standard error=1.9) and more than half of patients are between 46-65 years old (58.3%). Medicaid is the most common insurance coverage (33.0%), followed by uninsured (31.0%), private insurance (27.9%), and Medicare (5.4%).

Interdisciplinary team expertise was similar for both small and large CHC sites (Table 2). The mean number of specific team members available beyond primary care physicians and nurses reported by patients was 0.88 (standard error=1.34) and this did not differ for small and large CHC sites. Roughly one out of five patients in both small and large CHC sites report access to the expertise of nutritionists, diabetes educators, pharmacists, and other general staff. There was no significant difference between small and large CHC sites in patient access to specific team expertise except for other general staff, where patients of small CHC sites were more likely to report access to other general staff in their diabetes care (p=0.01). Nutritionists were the most common care team member available to patients (overall: 30.9%, small sites: 30.4%, large sites: 31.1%), followed by general staff (overall: 24.3%, small sites: 28.7%, large sites: 21.6%), diabetes educators (overall: 21.0%, small sites: 22.1%, large sites: 20.3%), pharmacists (overall: 19.8%, small sites: 21.1%, large sites: 19.0%), CHWs (overall: 11.7%, small sites: 12.2%, large sites: 11.3%), and mental health providers (overall: 5.2%, small sites: 4.5%, large sites: 5.7%). Patients of small CHC sites reported higher PACIC-11 scores (overall: 51.3, small sites: 53.5, large sites: 49.9, p=0.02). Three out of four (75.0%) patients had HbA1c under control and this did not differ between small and large CHC sites (small sites: 75.8% vs. large sites: 74.6%).

In adjusted analyses, patients with access to CHWs (β=7.67, p<.01), diabetes educators (β=6.05, p<0.01), nutritionists (β=5.21, p=<0.01), and other general staff (β=4.96, p=0.02) had significantly higher PACIC-11 scores compared to patients without access to their expertise. Patients of small CHC sites who had broader overall team expertise reported better experiences of chronic care (β= 2.15, p=0.03), but this relationship did not hold for patients of large CHC sites. The interaction between large CHC site size and broader care team expertise range is statistically significant, where patients of large CHC sites with broader team expertise had lower PACIC-11 scores (β =-2.58, p=0.01) (Figure 1). These PACIC-11 findings are consistent in a regression model that included IPTW to account for potential selection effects, except for the association of access to CHWs and general staff with higher PACIC-11 scores, which attenuated.

Overall interdisciplinary expertise on the primary care team, access to specific team expertise, CHC site size, and the interaction of overall access and CHC site size were not associated with odds of HbA1c control (<8.0%) in adjusted analyses (Table 3). English-speaking (Odds Ratio (OR)=0.43, p<.01) and Spanish Speaking (OR=0.45, p<.01) Latinos had significantly lower odds of HbA1c control than English-speaking patients of non-Latino no-Asian backgrounds. Patients between the ages of 36-45 (OR=0.43, p<0.01) and 46-55 years old (OR=0.58, p<0.01) had significantly lower odds of HbA1c control compared to patients 56-65 years old. Estimating a logistic model with a control cut point of HbA1c <9.0% produced similar results, with minor deviations in coefficients and statistical significance levels for control variables (race/ethnicity/language and age), potentially due to different statistical power with less patients with glycemic control compared to the <8.0% HbA1c cut point. Sensitivity analyses that estimated a linear regression model for a continuous specification of the HbA1c outcome and included IPTW to account for potential selection effects produced consistent results with the logistic regression and unweighted regression model specifications.

Discussion

Our findings indicate that patient access to specific interdisciplinary care team expertise is associated with better experiences of chronic care for adult CHC patients with diabetes. Namely, patient access to CHWs, diabetes educators, nutritionists, and other general staff for diabetes care is associated with higher PACIC-11 scores. Interdisciplinary care team expertise, including CHWs and diabetes educators, have unique skills and experiences that can aid diabetes self-management for socioeconomically vulnerable patients, and our results provide evidence of their benefit in the patient experience. The benefit of empowering medical assistants to take more responsibility for patient care has been demonstrated in high-performing safety net clinics.[45] Diabetes educators and nutritionists are also well-positioned to provide self-management support that can advance patient-centered chronic care.[46–50]

Despite their potential advantages, access to non-PCC expertise was low overall, with only 10-30% of adults with diabetes reporting CHWs, diabetes educators, nutritionists, or other general staff as members of their care team. Patients of small and large CHCs sites have similar access to overall and specific interdisciplinary care team expertise, except patients of small CHC sites are more likely to report other general staff as care team members than patients at large CHC sites. Taken together, the results indicate that patients of small CHC sites do not necessarily have worse access to interdisciplinary care team expertise, potentially because CHC organizations and networks allow for small CHC sites to leverage centralized resources.

The relationship between broader primary care team expertise and better patients' experiences of chronic care, as measured by PACIC-11, was significant in small CHC sites but not large CHC sites. Patients of smaller primary care practices have fewer preventable hospital admissions[24] and better access to care compared to patients of larger primary care practices.[51] While smaller primary care practices have lower adoption of patient-centered medical home processes,[2,6,7,52] they can prioritize reforms that leverage their interpersonal advantages, such as professional team training or expanding the role of medical assistants to improve patient self-mangement.[53,54] Physician retention has been found to be lower in CHC sites with lower visit volume,[55] small CHC sites may be better positioned to foster patient relationships through team-based care because non-PCCs are more prepared to maintain relational continuity with patients due to high PCC turnover.

In adjusted analyses, broader interdisciplinary care team expertise was not associated with HbA1c control for either 8.0% or 9.0% cut points. Patients in the analytic sample had an average of three comorbid conditions. It is difficult to achieve HbA1c control when patients have multiple comorbidities,[36,56] and broadening of primary care team expertise may have diminishing returns to patient self-management, and consequently, HbA1c is not better for patients with access to broader team expertise.

Our study also revealed important racial and ethnic disparities in diabetes care management. Spanish-speaking and English-speaking Latino patients were approximately half as likely to have controlled HbA1c than our reference group of English-speaking patients of other racial/ethnic backgrounds. These findings are consistent with evidence from a national study which found that Latinos have worse HbA1c control than non-Latino white patients.[57] Both English and Spanish-speaking Latinos were less likely to have HbA1c controlled compared to other racial/ethnic groups, consistent with evidence that Spanish language preference was not associated with better glycemic control among Latino patients.[58] Latinos and English-speaking Asians had higher PACIC-11 scores than English-speaking patients of other racial/ethnic backgrounds. We are unable to assess why patients from certain racial and ethnic groups have different HbA1c control and experiences of chronic care, but previous analyses suggest factors we did not measure, including health literacy,[59,60] geographic variation,[61–63] and racial/ethnic patient-clinician concordance,[58,64] may account for differences.[59] These factors should be assessed in future research to understand whether they explain racial and ethnic differences in diabetes care management.

Our results advance previous research in important ways. Research in commercially-insured populations found overall care team expertise to be associated with better diabetes self-management support, but the effect of specific interdisciplinary expertise was not assessed.[13] Our results extend evidence about the benefits of interdisciplinary care teams to CHCs, and our study includes care team members central to CHCs, including CHWs, diabetes educators, and general office staff such as medical assistants and clerks. The positive associations of access to CHWs, diabetes educators, and general office staff on experience of chronic care for patients with diabetes is important because these team members are more common in safety net settings. These team members are more likely to come from similar socioeconomic and cultural backgrounds as patients, thereby reducing social distance and increasing connectedness, compared to PCC-only care. Medical assistants are one of the most diverse of all medical profession work forces and can serve as the "invisible glue" of primary care.[53,54] CHWs are often "insiders" from the community that can create bridges to health care delivery.[65] This study advances evidence about the benefits CHWs can have for diabetes care management for vulnerable populations.[66–69] Our results suggest that patients may experience fewer communication and trust barriers when CHWs are involved as care team members, and their involvement on primary care teams may promote positive experiences of chronic care.

Implementing team-based care can be disruptive to operational workflows and requires flexibility to address the varying needs and resources of individual CHC sites.[70–72] In resource-constrained CHCs, medical assistants are more likely than other staff to be pulled from their diabetes care management functions to support general operational tasks.[43] While team-based care requires adaptation to fit local needs, practice-based research highlights that implementing effective interventions requires protected staff time for diabetes care management, warm hand-offs from PCCs to interdisciplinary team members, active support from site leadership, and standardized performance measurement across sites.[43,73–75] Teams will need to allocate tasks differently depending on available expertise.[76,77] For example, CHWs and medical assistants are both well positioned to support diabetes self-management, and although they have different training, they can have fulfill common diabetes care management functions within and across CHC sites.[36] Fidelity of implementation to interdisciplinary care team models has previously been associated with improved HbA1c control among adult patients with diabetes of a large medical group, but this relationship has yet to be assessed in CHCs.[78] To advance research and practice, it will be important to clarify how the structural and relational features of primary care teams and fidelity of implementation can enable improved diabetes management for socioeconomically vulnerable patients.[79]

The study results should be considered in light of some limitations. First, we rely on patient reports of interdisciplinary expertise and cannot verify care team involvement. This study provides the opportunity to understand expertise that the patients directly identify as being involved in their chronic care. Doing so, however, may exclude "invisible" team members to patients, although patients' perspectives provide critical information about care teams.[20] Second, "other staff" can include medical assistants, clerks, and other non-clinical staff, and we are unable to disentangle these roles. There is likely more overlap in the tasks performed by these staff members compared to clinicians, however, as they do not have strict licensing and training requirements.[80–83] Third, we cannot assess causal relationships using cross-sectional data and we are unable to rule out bias due to survey non-response. Non-response analyses indicate minor differences in age and race/ethnicity/language between respondents and non-respondents (data not shown). To account for any differences, we include patient sex, age, race/ethnicity/language, insurance information, total comorbidities, and how long the site has been their usual clinic to help account for potential confounders. Further, we incorporate IPTW as a sensitivity analyses to account for potential selection bias. Finally, we are unable to assess how well non-PCC expertise is integrated into routine primary care. Information about team relational coordination and role clarity might elucidate the null HbA1c findings, as prior research highlights that factors beyond a care team's structure can impact patient outcomes.[84–86]

Conclusion

Over the past decade, CHCs have implemented diabetes self-management support,[87,88] but team-based models have the potential to be expanded to better support socioeconomically vulnerable patients. Interdisciplinary primary care team development in CHCs is critical because of the challenges of recruitment, burnout, and turnover.[15–17] Access to CHWs, diabetes educators, nutritionists, and other general staff support positive patients' experiences of chronic care. In small CHC sites, patients report better experiences of chronic care when they have broader access to expertise as well as access to specific interdisciplinary team members. Efforts to advance patient-centered care in CHCs should expand patient access to interdisciplinary expertise to support diabetes care management.

Tables

Table 1: Adult Diabetic Patient Characteristics for the Overall Sample and Compared Between Small and Large Community Health Center sites, 2011-2012.

Variable *Percentage of Population, Mean (Standard Error)*	**Overall**	**Small Community Health Centers**	**Large Community Health Centers**	**p-value**
Female	57.6%	54.1%	59.8%	0.048*
Age (years old)				0.36
26-35	3.0%	2.1%	3.5%	
36-45	10.1%	11.8%	9.1%	
46-55	23.8%	22.9%	24.3%	
56-65	35.5%	36.4%	34.9%	
66-75	19.3%	19.4%	19.3%	
76+	8.3%	7.4%	8.8%	
Race/Ethnicity/Language				<0.01*
Chinese-speaking Asian	40.3%	30.4%	46.3%	
English-speaking Asian	8.5%	9.3%	7.9%	
English-speaking Latino	12.5%	13.8%	11.6%	
Spanish-speaking Latino	29.4%	38.8%	23.6%	
English-speaking Other	9.5%	7.6%	10.6%	
Insurance Source				0.20
Medicaid	33.0%	36.9%	30.7%	
Medicare	5.4%	6.0%	5.0%	
Other	2.8%	2.8%	2.8%	
Private	27.9%	26.0%	29.0%	
Uninsured	31.0%	28.3%	32.5%	
Total Comorbidities	2.9 (1.9)	3.0 (1.9)	2.9 (1.9)	0.56
How Long Usual Clinic				0.18
<3 years	32.5%	32.4%	32.5%	
3-5 years	28.7%	31.4%	27.0%	
5+ years	38.9%	36.2%	40.5%	
Observations	1277	484	793	

This comparison of means analyses utilizes Chi square tests for categorical variables and t tests for continuous variables to compare patient characteristics in small versus large community health center sites. P-values represent the significance of differences in individual characteristics between small versus large sites.

Table 2: Descriptive Statistics for Care Team Expertise, Hemoglobin A1c Control, and Patients' Experiences of Chronic Care (PACIC-11) in the Overall Sample and Compared Between Small and Large Community Health Center (CHC) sites, 2011-2012.

Variable *Percentage of Population, Mean (Standard Error)*	**Overall**	**Small Community Health Centers**	**Large Community Health Centers**	**p-value**
Overall Team Expertise, count	.88 (1.34)	.88 (1.39)	.87 (1.31)	0.94
Interdisciplinary Expertise on the Primary Care Team, %				
Community Health Worker	11.7%	12.2%	11.3%	0.65
Diabetes Educator	21.0%	22.1%	20.3%	0.44
Nutritionist	30.9%	30.4%	31.1%	0.77
Pharmacist	19.8%	21.1%	19.0%	0.38
Mental Health Provider	5.2%	4.5%	5.7%	0.38
Other Staff	24.3%	28.7%	21.6%	0.01*
Hemoglobin A1c Control (<8.0%)	75.0%	75.8%	74.6%	0.99
Patients' Experiences of Chronic Care (PACIC-11)	51.27	53.53	49.90	0.02*
Observations	1277	484	793	

This comparison of means analyses utilizes Chi square tests for categorical variables and t tests for continuous variables to compare average values of main predictor variables for patients in small versus large community health center sites. P-values represent the significance of differences in individual characteristics between small versus large CHC sites.

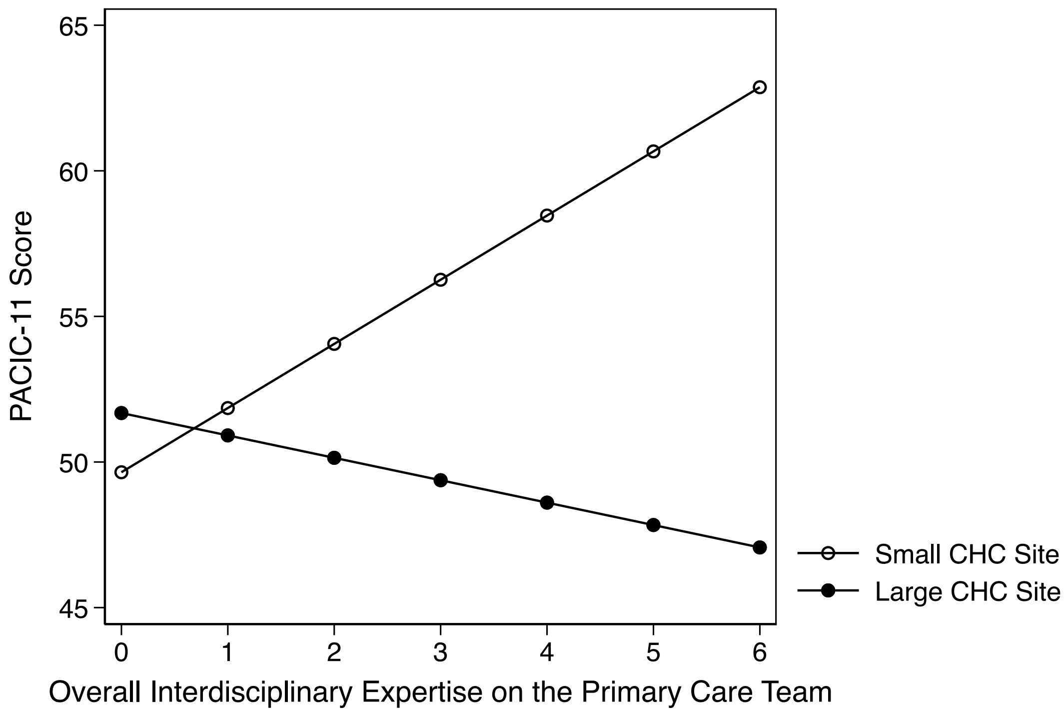
Table 3: Predictors of Odds of Hemoglobin A1c (HbA1c) and Patients' Experiences of Chronic Care (PACIC-11), 2011-2012.

	Model 1: Odds of HbA1c Control	**Model 2:** PACIC-11 Score
Overall Team Expertise	1.07 (0.11)	2.15* (1.02)
Large CHC Site	0.76 (0.21)	1.89 (2.12)
Large CHC Site # Overall Team Expertise	0.92 (0.10)	-2.58* (1.04)
Interdisciplinary Expertise on the Team:		
Community Health Worker	0.93 (0.26)	7.67** (2.68)
Diabetes Educator	0.69 (0.15)	6.05** (2.00)
Nutritionist	1.05 (0.22)	5.21** (1.98)
Pharmacist	0.84 (0.19)	-0.17 (2.19)
Mental Health Provider	0.98 (0.34)	-0.42 (3.29)
Other Staff	1.11 (0.24)	4.96* (2.03)
Total Comorbidities	0.99 (0.04)	-0.03 (0.39)
Female	1.26 (0.20)	-1.96 (1.45)
Race/Ethnicity/Language		
Chinese-speaking Asian	0.99 (0.36)	-5.37 (2.89)
English-speaking Asian	0.58 (0.22)	10.73** (3.32)
English-speaking Latino	0.49* (0.17)	7.85** (3.00)
Spanish-speaking Latino	0.45* (0.14)	8.63** (2.74)
English-speaking Other	Ref.	Ref.
Insurance Source		
Medicaid	Ref.	Ref.
Medicare	1.44 (0.58)	0.48 (3.34)
Other	0.70 (0.34)	3.62 (4.73)
Private	1.21 (0.29)	-1.87 (2.18)
Uninsured	1.30 (0.31)	-1.06 (2.07)
Age (years old)		
26-35	0.46 (0.19)	-0.36 (4.20)
36-45	0.43** (0.11)	2.61 (2.54)
46-55	0.58** (0.11)	-0.65 (1.84)
56-65	Ref.	Ref.
66-75	1.03 (0.25)	1.47 (2.11)
76+	1.29 (0.44)	-0.08 (2.84)
How Long Usual Clinic		
<3 years	Ref.	Ref.
3-5 years	1.22 (0.24)	2.63 (1.78)
5+ years	1.09 (0.21)	2.45 (1.77)
Constant	0.88 (0.36)	50.97*** (3.13)
ψ	0.37 (0.14)	2.07 (2.19)
θ		24.00 (0.48)
Observations	1125	1277

Standard errors in parentheses. Model 1 displays odds ratio. We were unable to assess 125 patients with no documented of glycated hemoglobin (HbA1c) during the study period, leading to a Model 1 sub-sample of 1125. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figures

Figure 1: Association of Community Health Center Size (CHC) and Interdisciplinary Care Team Expertise with Patient Assessment of Chronic Care, 2011-2012



Margin plots depict adjusted score for Patient Assessment of Chronic Illness Care (PACIC-11). Overall interdisciplinary primary care team expertise includes community health workers, diabetes educators, nutritionists, pharmacists, mental health providers, and other general staff. Small CHC sites have less than 250 adult patients with diabetes compared to large community health center sites with 250 or more adult patients with diabetes.

Chapter 2: Health Care System and Physician Practice Characteristics Associated with Chronic Care Management and Patient Engagement Capabilities

Background

Physician practices in the United States are increasingly being acquired by health care systems to enable economies of scale and respond to incentives stimulated by federal payment and delivery system reforms.[89,90] Acquisition of physician practices by health care systems is associated with higher prices and spending,[91,92] but health care systems have the potential to improve practice-level infrastructure to deliver chronic care management, such as supporting health information technology (health IT) infrastructure, which can improve quality of care.[93] Improving practice capabilities to manage chronic conditions, including diabetes and cardiovascular disease (CVD), is a high priority for population health because CVD is the leading cause of death in the United States and patients with diabetes are at increased risk of CVD.[94]

Organizational capabilities central to improving care for adults with diabetes and/or CVD include chronic care management capabilities and patient engagement capabilities. Chronic care management capabilities are evidence-based processes, such as electronic health record decision support tools and patient registries, with demonstrated benefit to improved outcomes for patients with diabetes and CVD.[95,96] Health care systems and physician practices also have incentives through risk-based payment arrangements to better engage patients in their health and health care.[97] Patients with diabetes and/or CVD with high confidence in managing their own health and health care (known as patient activation) have better outcomes.[98] Health systems can help physician practices implement capabilities to improve patient engagement, including shared decision-making, shared medical appointments, and motivational interviewing.[99–101]

Despite increased recognition of their importance, patient engagement and chronic care management capabilities have been inconsistently adopted by physician practices. Fewer than half of recommended evidence-based chronic care management processes have been adopted by physician practices on average.[52] Further, only one-third of family physicians report working in practices with high-intensity patient engagement, defined as a having a patient advisory council or patient volunteers in quality improvement activities.[102] Patient engagement capabilities can benefit chronic care delivery by improving patient preference-aligned treatment, but require substantial technical, financial, and interpersonal capabilities to implement them effectively.[103]

Physician practices often need support to manage complex organizational changes and health care systems are well positioned to provide resources, guidance and facilitation that enable physician practices to customize chronic care management and patient engagement capabilities to fit their needs.[104] Health care systems can provide central implementation guidance to their physician practices to aid practice-level adoption of these capabilities, including providing central health IT support and developing local champions to assist in change management.[105] Previous studies of chronic care management and patient engagement capability adoption have examined the role of health care system ownership,[7,106] but the relative association of parent health care systems and physician practice characteristics on adoption of these capabilities remains unexplored.

Little is currently known about how health care systems influence the adoption of innovations in their member physician practices. This study examines the extent to which physician practices and health care system characteristics are associated with the adoption of chronic care management and patient engagement capabilities for patients with diabetes and/or

CVD. Understanding the relative roles of health care system-level and physician practice-level influences on implementation of these capabilities can inform the design of policies to improve the performance of physician practices as they are increasingly acquired by health care systems.

Theory

To illuminate the mechanisms through which health care systems could influence the adoption of practice-level patient engagement and chronic care management capabilities, we developed a logic model (Figure 1). The logic model depicts how advancing organizational capabilities of parent health care systems and their physician practices leads to improved chronic care delivery. Our logic model integrates concepts from diffusion of innovations theory,[3] organizational change management,[107] and previously published evidence of chronic care management and patient engagement capability adoption[7,52,106,108] to inform our study hypotheses.

Health care systems can support the adoption of innovations in member physician practices, however, health care systems may influence innovation adoption differently depending on the strength of evidence on implementation strategies. Studies assessing implementation strategies provide actionable evidence about how interventions can be adapted fit local practice needs, culture, and resources.[109] Systems can develop central capabilities that support implementation across member physician practices when innovations have evidence-based implementation strategies or are conducive to standardization throughout the system.

Health care systems supporting the adoption of chronic care management capabilities benefit from robust practice-based evidence on implementation, as these capabilities have been central to well-documented health care delivery transformations including Patient-Centered Medical Homes and the expansion of health IT in physician practices.[105,110,111] In contrast, there are fewer large-scale efforts to integrate patient engagement capabilities into routine care as compared to chronic care management capabilities.[102,112,113] Consequently, systems have less evidence to identify established implementation strategies to support the adoption of patient engagement capabilities, such as learning collaboratives or local coaching.

Hypothesis 1: Health care system characteristics will be more strongly associated with practice-level adoption of chronic care management capabilities compared to patient engagement capabilities for diabetes and/or CVD.

The degree to which health care systems standardize administrative and financial processes across physician practices, such as physician compensation and performance measurement, may influence how consistently innovations are adopted in member physician practices. Diffusion of innovations theory posits that an innovation's compatibility to organizational structure, routines, and resources can promote uptake.[3] Health care systems with strong standardized processes may promote compatible capabilities that can be similarly deployed throughout physician practices consistently, such as chronic care management capabilities. Conversely, patient engagement capabilities for adults with diabetes and/or CVD typically require extensive customization to work within the local context of a particular physician practice. For example, shared medical appointments require adaptation to the local environment, including addressing idiosyncratic scheduling and physical space considerations.[114] Consequently, systems have less influence because centralized and standardized resources are less useful for adopting innovations that require local tailoring.

Hypothesis 2: Health care system standardization will be positively associated with practice-level adoption of chronic care management capabilities, but not associated with practice-level adoption of patient engagement capabilities for diabetes and/or CVD.

Advanced adoption of patient engagement and chronic care management capabilities in physician practices rely on a robust cultural and technical infrastructure,[2] which may be enhanced by parent systems through central guidance, slack resources, and economies of scale. To identify effective implementation strategies and nurture successful adoption, physician practices can institute an internal process to evaluate novel research evidence. Similarly, health care systems are well-positioned to provide a robust central process to identify and disseminate new evidence among member practices.

Previous studies have found that improved health IT functionality in physician practices is positively associated with the adoption of care management capabilities.[106,108] Health care systems with advanced health IT functions may also serve as central technical resources to aid member physician practices in the adoption of innovations. Finally, innovative organizational cultures can provide practices with the confidence to test new capabilities while innovative parent systems may encourage innovation in member practices.

Hypothesis 3: Health care systems and physician practices with processes in place to assess new clinical evidence, more advanced health IT functions, and innovative cultures will be positively associated with practice-level adoption of patient engagement and chronic care management capabilities for diabetes and/or CVD.

Methods

This study analyzes health care system and physician practice data collected from the National Survey of Healthcare Organizations and Systems (NSHOS) on the adoption of patient engagement and chronic care management capabilities for adults with diabetes and/or CVD. NSHOS is a nationally representative survey administered between 2017-2018 to U.S. primary care practice sites (N= 2,190, Response Rate=47%), and health care systems that owned or managed at least two primary care multi-specialty medical practices or acute care hospitals (N=325, Response Rate=60%). A knowledgeable key informant at each organization responded to the survey questions, including physician practice administrators/managers and health care system Chief Executive Officers or Chief Medical Officers. We linked surveys with data on organization characteristics provided by IQVIA, an information services provider. We utilized a subset of the sample where we could link physician practice surveys (N=820) with the surveys of their parent health care system (N=253). We excluded six systems with missing data on key covariates, leading to an analytic sample of 796 physician practices in 247 parent health systems.

Composite measures of chronic care management and patient engagement capabilities have been examined in previous research.[7,52,108,115] The first outcome measure is physician practice-level adoption of twelve patient engagement capabilities for diabetes and/or CVD. Physician practices reported their adoption of shared medical appointments (diabetes, CVD), motivational interviewing (smoking cessation, weight loss/diet, increase in physical activity, medication adherence, training staff or clinicians), decision aids for selecting diabetes medication, and shared decision-making (physician/staff formally trained in shared decision-making, routinely engage in shared decision-making, routinely use decisions aids, and follow-up after shared decision-making). Items with dichotomous response options were scored as 0 for no practice-level adoption and 100 for adoption. Ordinal response questions assessing how many physicians and staff in the practice adopted specific items were scored as 0 for "none"/"some," and 100 for "most"/"all." A composite scale was calculated by averaging the twelve item responses (range=0-100; internal consistency reliability, α=0.87).

The second outcome measure is physician practice-level adoption of eight chronic care management capabilities for diabetes and hypertension. Physician practices reported their adoption (Yes/No) of evidence-based protocol guidelines, electronic health record based clinical decision-support tools, disease registries, and individual feedback on clinician performance. A composite scale was calculated by averaging the item responses (range=0-100; α=0.82).

Health care systems reported whether they had a process in place to assess new clinical evidence (Yes/No) which we included as a dichotomous variable. Health care system culture was assessed by questions based on the Competing Values Framework, which categorizes culture based on focus level (internal or external) and the degree of influence they exert on operations (controlling or flexible).[116] Respondents allocated 100 points to four organizational culture types aligned with the Competing Values Framework. Whether their healthcare system is: "a very personal place; a lot like an extended family; people seem to share a lot of themselves" is called a Clan/Group culture; "A very dynamic and entrepreneurial place where people are willing to try new things to see if they work" is called an Innovative/ Developmental culture; If described as "a very formalized and structured place with bureaucratic procedures generally govern what people do" it is called a Bureaucratic/Control culture. If the system was described as a "very production oriented with the major concern is getting the job done" it was called a Rational/Market culture. We measure culture of innovation from the points allocated to developmental/innovative culture (0-100).

Health care systems reported how many hospitals/medical groups within the system had five advanced health IT capabilities: patients have electronic access to their medical records, patients have the ability to electronically comment on and/or input information to their medical records (such as Open Notes), physicians and patients are able to communicate with one another via email, physicians are able to know whether their patients have filled their prescriptions, and advanced analytic systems such as data mining. Items were scored as 0 for "none," 33.3 for "some," 66.6 for "most," and 100 for "all." A composite scale was determined by calculating the average of the five item responses (range=0-100; α=0.70).

To measure standardization, we examined responses to seven items that health care systems described as standardized (done the same way) across their member hospitals and medical groups. These included: physician compensation, performance management of primary care physicians, primary care processes and team structure, hospital discharge planning, human resources functions, financial arrangements between the larger system and individual practices/hospitals, data elements included in the electronic health record, and strategic planning. Each item was scored as 0 for "not at all," 33.3 for "somewhat," 66.6 for "mostly," and 100 for "fully." A composite scale was calculated as the average of all responses (range=0-100; α=0.88).

Health care systems reported how many of the hospitals/primary care medical groups in their health care system were participating in risk-based payment reform. The four programs included: capitated contracts with commercial health plans, Medicare ACO risk-bearing contracts (Pioneer, Next Generation, Medicare Shared Savings Program track three), Medicaid ACO contracts, and commercial ACO contracts. Items were scored as 0 for "none" or "some," and 1 for "most," and "all." Total counts are summed in an index measure of total health care system involvement in payment reform (0-4). Health care systems similarly reported whether "most" or "all" of their hospitals and primary care medical groups participated in a primary care improvement and support programs (e.g., Comprehensive Primary Care Initiative, Patient Centered Medical Homes), which we included as a dichotomous variable.

Physician practices reported whether they had a process in place to assess new clinical evidence (Yes/No), which we included as a dichotomous variable. To measure physician practice culture of innovation we analyzed responses on the extent that five different items describe the physician practice culture: successful care delivery innovations are highly publicized within the practice, team members openly share patient care challenges and failures with each other, there is protected time given to generate new ideas and innovations, we encourage trying new ideas to see if they work, and we consider ourselves to be the testing ground for new approaches to engage patients in their care. Each item was scored as 0 for "never," 33.3 for "sometimes," 66.6 for "often," and 100 for "always." A composite scale was formed based on the average of all responses (range=0-100; α=0.80). We measured practice-level advanced health IT functionality using an index of five parallel practice-specific items described above for health care system health IT. An index was calculated as the number of practice-level advanced health IT functions adopted (0-5), as measured in prior literature [117].

We include physician practice size (number of employed physicians in the practice), health care system size (number of physician practices in system), practice proportion of primary care physicians ("0-33%," "33-99%," and "100%"), percentage of practice revenue from Medicaid (None (0%), Low/moderate (1-29%), and High (30%+)), and practice geographic region (West, South, Northeast, or Midwest) as covariates.

Descriptive statistics assessed the unadjusted adoption of each of the patient engagement and chronic care management capabilities for adults with diabetes and/or CVD. Our two main models utilized multivariable linear regression to examine the association of parent health care system characteristics (process in place to assess new clinical evidence, culture of innovation, advanced health IT functionality, participation in payment/delivery reform, standardization, and number of physician practices) and practice-level adoption of patient engagement and care management capabilities for adults with diabetes and/or CVD, controlling for physician practice characteristics (process in place to assess new clinical evidence, culture of innovation, participation in payment/delivery reform, advanced health IT functionality, number of employed physicians in the practice, percent of all physicians that are primary care physicians, Medicaid percentage, and geographic region). Random system effects were used to account for the clustering of physician practices in health care systems. To improve the legibility of regression coefficients, continuous measures were standardized with a mean of 0 and a variance of 1.

To help differentiate system and practice effects, we estimate the adoption of chronic care management and patient engagement capabilities in two "null" models only incorporating a random health system effect. The Intraclass Correlation (ICC) was used to explain the variation between and within parent health systems in these null models. We then calculate the Akaike information criterion (AIC) to compare the goodness of fit of the full multivariable model to two reduced models containing: 1) only health care system-level variables, and 2) only physician practice-level variables, for both patient engagement and chronic care management capabilities. We conducted robustness checks for our final multivariable model specifications, including calculating collinearity and model overfit diagnostics. We computed the Variance Inflation Factor for each independent variable to determine whether multicollinearity was present. We checked covariates for high correlation and drop those with correlation above 0.60. All statistical analyses were completed using STATA 15.0 by the authors.

Results

Characteristics of health systems and physician practices are detailed in Table 1. Most systems owned between 1-22 physician practices (45.3%). Most physician practices had 1-9 physicians (69.7%). The proportion of total revenue from Medicaid was low, 67.8% of physician practices had low Medicaid revenue (1-29%), and 8.5% served no Medicaid patients.

Adoption rates of all individual chronic care management and patient engagement items are shown in Table 2. On average, physician practices adopted less than half of the patient engagement capabilities assessed (mean=41.4, standard deviation (SD)=28.5). Shared medical appointments for CVD (4.3%) and diabetes (11.6%) were the least adopted. Fewer physician practices reported their physicians/staff being formally training in shared decision-making (38.2) or providing follow-up after shared decision-making (44.5%) than reported routinely engaging in shared decision-making (54.3%). On average, chronic care management capabilities were adopted more than patient engagement capabilities (mean=69.7, SD=29.9). More practices collected physician performance data for diabetes (85.8%) than for hypertension (75.1%), while more practices reported written guidelines for diabetes (72.1%) than hypertension (65.7%). Psychometric analyses indicate that patient engagement and chronic care management capabilities are distinct constructs. Exploratory factor analyses demonstrate high Eigenvalues (range: 2.39-5.79) for both constructs, high internal consistency reliability (alphas=0.82-0.86), and a low correlation (r=0.38) between the measures.[118]

Results of the multivariable models are summarized in Table 3. Health care systems with a process in place to assess new clinical evidence (β=6.79, p=0.004), and more advanced health IT functionality (β=2.85, p=0.028) have greater practice-level adoption of care management capabilities for adults with diabetes and/or CVD, controlling for all model covariates. There was no significant association between health care system characteristics and practice-level adoption of patient engagement capabilities. There was no significant association of system standardization, participation in payment reform, or delivery reform on either outcome.

Characteristics of physician practices were significantly associated with practice-level adoption of both patient engagement and chronic care management capabilities for adults with diabetes and/or CVD. Having a process in place to assess new clinical evidence at the physician practice level was positively associated with the adoption of patient engagement (β=4.44, p=0.010) and chronic care management capabilities (β=7.37, p<0.001). Advanced health IT functionality in physician practices was positively associated with the adoption of patient engagement capabilities (β=3.18, p<0.001) and chronic care management capabilities (β=5.59, p<0.001). Physician practices with more innovative cultures adopted more patient engagement capabilities (β=10.73, p<0.001) and chronic care management capabilities (β=9.70, p<0.001).

The ICC was larger for the multivariable model predicting chronic care management capabilities (18%) than for the model predicting patient engagement capabilities (10%) for adults with diabetes and/or CVD, with 18 percent of the variation in practice adoption of chronic care management capabilities estimated to be between systems, compared to 10 percent for practice adoption of patient engagement capabilities. Model fit for patient engagement capabilities was better (lower AIC) in the full model (AIC=7204) compared to a model with only health care system-level variables (AIC=7351), and similar to a model with only physician practice-level variables (AIC=7189). Similarly, model fit for chronic care management capabilities was better in the full model (AIC=7460) compared to a model with only health care system-level variables (AIC=7653), and similar to a model with only physician practice-level variables (AIC=7462).

Discussion

Given limited understanding of how health care systems influence their owned physician practices, this study advances evidence about the organizational factors associated with physician practice capabilities to care for adults with diabetes and/or CVD. Supporting hypothesis 1, health care system characteristics were associated with practice-level adoption of chronic care management capabilities, but not patient engagement capabilities. These findings support the explanation that systems exert relatively less influence on practice adoption of innovative patient engagement capabilities compared to chronic care management capabilities. This pattern is consistent with diffusion of innovations theory, which suggests that organizations can influence the adoption of innovations with more established evidence compared to relatively novel innovations.[3] This may reflect a strategic use of system resources to ensure that established processes are widely implemented, such as chronic care management capabilities, while allowing practices latitude in adopting innovative patient engagement capabilities that rely on high local readiness for change and a supportive implementation climate.[119]

Consistent with hypothesis 2, health care system standardization was not associated with practice-level adoption of patient engagement capabilities for diabetes and/or CVD. However, contrary to hypothesis 2, there were no significant associations of health care system standardization with practice-level adoption of chronic care management capabilities for diabetes and/or CVD. These null associations may reflect a high standardization of processes throughout parent health care systems (mean=73.6, SD=19.8). This may also signal that the standardized items measured (e.g., physician compensation and performance measurement) are distal to the adoption of chronic care management and patient engagement capabilities.

We find partial support for hypothesis 3. Health systems with more advanced health IT functions and processes in place to assess new clinical evidence have greater adoption of chronic care management capabilities, but not patient engagement capabilities. These technical capabilities may provide the infrastructure and evidence-based information needed to support broad dissemination of chronic care management capabilities. The health IT functions assessed directly relate to patient engagement, including providing patients the ability to access and input data into their medical records. These patient-focused technical capabilities can provide a particularly relevant infrastructure to support chronic care management capabilities. While more innovative physician practice cultures were associated with greater adoption of both patient engagement and chronic care management capabilities, innovative system cultures were not associated with practice adoption of either capability. These findings suggest cultures oriented to innovation aid local practice stakeholders in overcoming uncertainty when adopting capabilities with both strongly established and less established evidence of implementation strategies.

As external pressures to improve patient engagement capabilities increases, health care systems can assist their practices through appraising and disseminating evidence-based implementation strategies for these capabilities and providing central training resources to promote the learning of new processes in their physician practices. Importantly, our results highlight that even among health care system-owned physician practices, formal training for motivational interviewing and shared decision-making is not widely available. This training gap will be important to fill, as evidence indicates that motivational interviewing and shared decision-making are difficult to implement with high fidelity without training and leadership facilitation.[120,121]

Overall, physician practice characteristics were more strongly associated with practice-level adoption of patient engagement and chronic care management capabilities than health care system characteristics. This is consistent with research underscoring the role of health care systems as sources of guidance, but not direct implementers of care delivery innovations.[104] This may reflect the importance of local leadership and frontline team acceptance in implementation.[105,114]

Our findings should be considered in light of some limitations. First, while motivational interviewing, shared decision-making, and shared medical appointments are core patient engagement capabilities, they do not represent the full array of patient engagement capabilities. Patient advisory councils and efforts to involve patients in quality improvement are not included, which may be influenced by health systems differently. Second, NSHOS is a single informant survey for an entire physician practice or health care system. Respondents were selected for their knowledge of internal processes, however, and were encouraged to consult with others when completing the survey. Finally, the lack of association between most system characteristics and practice-level adoption of chronic care management and patient engagement capabilities could be a result of differing levels of influence on heterogeneously integrated member physician practices. A health system may have a stronger influence on longstanding physician practice relationships compared to recent acquisitions. We are unable to differentiate heterogenous influences due to sample size restrictions, but this should be explored in future research.

This study provides a foundation for subsequent research on the multi-level influences of parent health care systems and system-owned physician practices. Greater evidence on implementation strategies may provide guidance for systems to develop central resources to support member physician practices adopting innovations. To advance health care systems' influence on practice-level adoption of patient engagement capabilities for diabetes and/or CVD, practice-based research is needed that evaluates the impact of shared decision-making, motivational interviewing, and other patient engagement innovations on patient outcomes.

Conclusion

Health care systems may have more influence on practice-level adoption of evidence-based chronic care management capabilities compared to innovative patient engagement capabilities where there is less evidence to guide effective implementation. While physician practices with processes in place to assess new clinical evidence, a culture of innovation, and advanced health IT functionality are positively associated with practice-level adoption of both patient engagement and chronic care management capabilities for diabetes and/or CVD, we only find significant associations of health care system characteristics and the adoption of chronic care management capabilities. We know less about what parent health care systems can do to advance the adoption of patient engagement in member physician practices.

Future research should explore unassessed health system capabilities that may influence the adoption of innovative activities in member physician practices. For example, evidence from studies of managerial competencies[122] may lend insight into how health care systems translate central strategy into physician practice operations. Health care systems may also need to support the development of organizational change management competencies necessary for physician practices to overcome the complex operational changes involved in adopting patient engagement capabilities, which has been central to Accountable Care Organizations[103] and the Veteran

Affairs Healthcare System[123] in their efforts to improve patient engagement. Policies to advance patient engagement and chronic care management capabilities for diabetes and/or CVD should prioritize advancing innovative organizational cultures, expanding health IT, and improving processes to assess new clinical evidence at the practice level relative to their development at the health system level.

Tables

Table 1: Descriptive Statistics for Health Care Systems and System-Owned Physician Practices (2017/2018)

		Total Mean (Standard Deviation) Frequency (Percentage)
Parent Health Care System Characteristics		N=247
Process to Assess New Evidence		139 (56.3%)
Culture of Innovation		25.1 (15.2)
Advanced Health Information Technology		53.7 (23.7)
Participation in Delivery Reform		144 (58.3%)
Participation in Payment Reform		0.9 (1.1)
Health Care System Standardization		73.6 (19.8)
Size (Number of Physician Practices)	1-22 Practices	112 (45.3%)
	22-68 Practices	73 (29.6%)
	69-165 Practices	46 (18.6%)
	166+ Practices	16 (6.5%)
For-Profit Status		62 (25.1%)
System Ownership of a Health Plan		72 (29.1%)
System-Owned Physician Practice Characteristics		N=796
Process to Assess New Evidence		395 (49.6%)
Culture of Innovation		52.6 (20.7)
Advanced Health Information Technology Index		3.1 (1.2)
Size (Number of Physicians)	1-9 Physicians	555 (69.7%)
	10-20 Physicians	141 (17.7%)
	21+ Physicians	100 (12.6%)
Primary Care Physicians (% of Total Physicians)	<33%	57 (7.2%)
	33-99%	611 (76.8%)
	100%	128 (16.1%)
Medicaid Revenue (% of Total Revenue)	None	68 (8.5%)
	Low (1-29%)	540 (67.8%)
	High (30%+)	188 (23.6%)
U.S. Census Region	West	209 (26.3%)
	South	295 (37.1%)
	Northeast	118 (14.8%)
	Midwest	174 (21.9%)

Data are presented as mean (standard deviation) for continuous measures, and n (%) for categorical measures. Source: National Survey of Healthcare Organizations and Systems (NSHOS).

Table 2: Adoption of Chronic Care Management and Patient Engagement Capabilities for Diabetes and Cardiovascular Disease in System-owned Physician Practices (2017/18)

	Mean (Standard Deviation) Frequency (Percentage)
Chronic Care Management Capabilities Composite	69.7 (29.9)
Written Guidelines: Diabetes	574 (72.1%)
Written guidelines: Hypertension	523 (65.7%)
EHR Decision Support: Diabetes	549 (69.0%)
EHR Decision Support: Hypertension	467 (58.7%)
Registry: Diabetes	586 (73.6%)
Registry: Hypertension	461 (57.9%)
Collect Physician Performance: Diabetes	683 (85.8%)
Collect Physician Performance: Hypertension	598 (75.1%)
Patient Engagement Capabilities Composite	41.4 (28.5)
Shared Medical Appointment: Cardiovascular Disease	34 (4.3%)
Shared Medical Appointment: Diabetes	92 (11.6%)
Motivational Interviewing: Smoking Cessation	475 (59.7%)
Motivational Interviewing: Weight Loss/Diet	477 (59.9%)
Motivational Interviewing: Increase in Physical Activity	460 (57.8%)
Motivational Interviewing: Medication Adherence	448 (56.3%)
Motivational Interviewing Training (Staff or Clinicians)	397 (49.9%)
Decision Aid: Selecting Medication for Diabetes	221 (27.8%)
Physician/Staff Routinely Use Decision Aids	256 (32.2%)
Physician/Staff Formally Trained in Shared Decision Making	304 (38.2%)
Physician/Staff Routinely Engage in Shared Decision Making	432 (54.3%)
Physician/Staff Follow-up After Shared Decision Making	354 (44.5%)
Observations	N=796

Composite scale values are presented as mean (standard deviation). Individual items are presented as the frequency (percentage) of sampled physician practices that report adopting that strategy.
Source: National Survey of Healthcare Organizations and Systems (NSHOS).

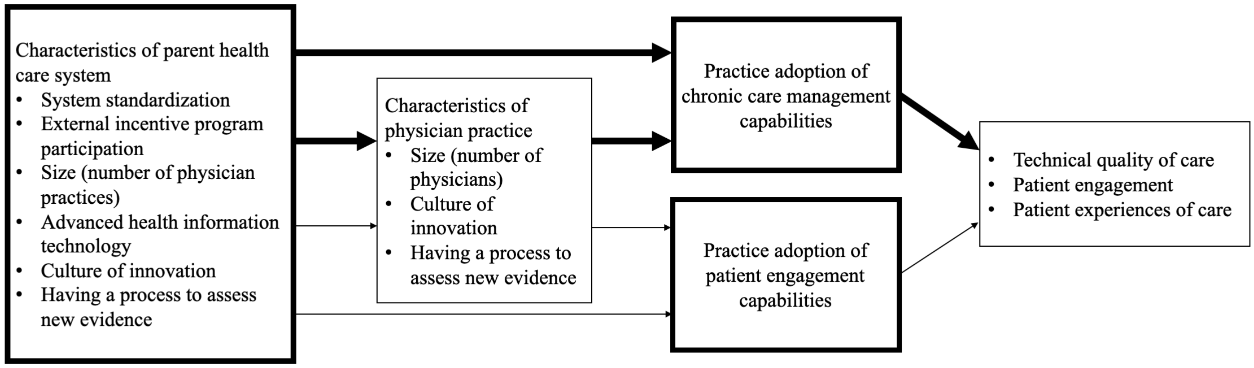
Table 3: Health Care System and Physician Practice Characteristics Associated with Patient Engagement and Chronic Care Management Capabilities for Adults with Diabetes and/or Cardiovascular Disease (2017/2018)

	Patient Engagement Capabilities	Chronic Care Management Capabilities
	Coefficient (Robust Standard Error)	
Health Care System Characteristics		
Process to Assess New Evidence	1.36 (2.45)	6.79** (2.35)
Culture of Innovation	-1.05 (1.12)	-1.18 (1.36)
Advanced Health Information Technology	0.30 (1.15)	2.85* (1.30)
Participation in Delivery Reform	-1.67 (2.48)	-0.26 (2.56)
Participation in Payment Reform	0.83 (1.21)	-1.32 (1.21)
Health Care System Standardization	-0.65 (1.19)	1.54 (1.42)
Size (Number of Physician Practices)		
1-22 Physician Practices	Ref.	Ref.
22-68 Physician Practices	-3.51 (2.80)	4.16 (3.15)
69-165 Physician Practices	-3.57 (3.24)	-0.39 (2.96)
166+ Physician Practices	-0.54 (3.82)	1.65 (3.95)
Physician Practice Characteristics		
Process to Assess New Evidence	4.44* (1.97)	7.37*** (1.88)
Culture of Innovation	10.73*** (0.89)	9.70*** (0.97)
Advanced Health Information Technology	3.18*** (0.87)	5.59*** (1.08)
Size (Number of Physicians)		
1-9 Physicians	Ref.	Ref.
10-20 Physicians	-2.11 (2.39)	0.40 (2.67)
21+ Physicians	-4.55 (2.80)	-3.09 (2.90)
Proportion Primary Care Physicians		
<33% Primary Care Physicians	Ref.	Ref.
33-99% Primary Care Physicians	-0.74 (3.25)	-5.61 (3.88)
100% Primary Care Physicians	6.14 (4.09)	-4.05 (4.58)
Medicaid Percentage		
None	Ref.	Ref.
Low (1-29%)	1.00 (3.55)	6.09 (3.90)
High (30%+)	1.85 (4.02)	5.23 (4.22)
Census Region		
West	Ref.	Ref.
South	-3.96 (3.05)	-1.93 (2.96)
Northeast	-5.68 (3.99)	-8.41 (4.52)
Midwest	-4.67 (3.52)	-6.97* (3.35)
Constant	44.36*** (6.05)	63.78*** (6.19)
sd(Health System)	8.58*** (2.02)	8.77*** (2.19)
sd(Constant)	23.83*** (0.74)	24.25*** (0.91)

***P < 0.001; **P < 0.01; *P < 0.05. Source: National Survey of Healthcare Organizations and Systems (NSHOS). Sample consists of 796 physician practices nested within 246 parent health care systems.

Figures

Figure 1: Logic Model of Health Care System Influences on Practice Adoption of Patient Engagement and Chronic Care Management Capabilities



Arrows represent the direction and magnitude of influences on the adoption of chronic care management and patient engagement capabilities for patients with diabetes and/or cardiovascular disease in health care system-owned physician practices. Thicker lines represent a relatively larger influence compared to thinner lines.

Chapter 3: The Sequencing of Physician Practice Adoption of Patient Engagement Strategies

Background

There is increased interest in understanding the translation of evidence-based programs and innovations into routine clinical practice. Patient engagement strategies are formal processes to improve patient involvement in care that have been inconsistently adopted despite benefits to clinical and patient-reported outcomes.[124] Only one-third of family physicians report working in practices with high-intensity patient engagement, including patients in quality improvement activities and advisory councils.[102] The relative ease of adopting patient engagement strategies is important as practices build their portfolio of strategies in the face of multiple simultaneous adoption decisions, and many practices are struggling with competing priorities for improving patient care.

Currently no roadmap exists for how practices might build their patient engagement efforts incrementally. Although they recognize the importance of patient engagement efforts generally, clinicians and staff have reported limited understanding of specific patient engagement strategies.[145] To promote full awareness of new strategies by clinicians and staff, practices may choose to establish a foundation of relatively easier strategies before implementing more complex changes. Practices may test a strategy with a priority disease area before moving it forward with other clinical foci. Assessing patterns in the landscape of patient engagement strategies can illuminate typical adoption journeys, signaling paths of pacing and foundation setting.

The literature on organizational learning and absorptive capacity posits that prior knowledge strengthens the ability of organizations to learn new processes and concepts in that area.[125–128] Pacing the adoption of patient engagement strategies can provide organizations the time to fully integrate the innovation through mechanisms such as shifts in norms over time or revised performance standards.[129] Promoting pacing in the adoption journey may nurture the integration of strategies into routines and not overwhelm organizations. For example, previous research found that over one-third of physician practices de-adopted chronic care management processes (CMPs) over time.[130]

Miake-Lye and colleagues studied patterns in the use of care management processes, focusing on adoptability, defined as the ordering of strategy adoption among organizations.[131] Physician practices would have already adopted lower ranked more adoptable strategies before moving toward less adoptable higher ranked strategies. They find that innovation adoptability may be influenced by the type of care management processes, where physician practices adopt patient reminders and disease registries earlier than provider reminders, provider feedback, or provider education. Registries may provide a foundation for understanding the patient population to target future strategies. For a physician practice beginning to build care management processes into their organization, it follows that patient reminders and disease registries would be logical first steps.

The adoption of care management processes can be a useful comparison to patient engagement strategies. Both consist of evidence-based processes that practices have the option to adopt, but patient engagement strategies are more recent efforts. Given that compared to care management processes, patient engagement strategies are earlier in the diffusion process and are not adopted widely by health care delivery organizations, they may be particularly sensitive to concerns of implementation feasibility.[3] If disease registries and patient reminders ground care management processes, practices can benefit from understanding if there are core strategies that are foundational as they build a portfolio of patient engagement strategies. In addition, for physician practices at an existing stage of patient engagement implementation, understanding the relative "difficulty" of patient engagement strategies can guide the pace and potentially, the ordering of implementation to improve the success of patient engagement initiatives.

One distinction among the range of patient engagement strategies that may influence their relative adoptability by organizations is whether the strategies require more technological or interpersonal resources to effectively implement. For example, a technological patient engagement innovation such as allowing patients to input patient preferences into the electronic health record (EHR) would not disrupt clinical routine, but does require advanced technological capabilities to implement, such as advanced EHR infrastructure.[132] To contrast, shared medical appointments for patients with chronic conditions are interpersonally and operationally complex, benefitting from supportive leadership and adaptation to local organizational resources.[114] While the decision to adopt all patient engagement strategies can each be grounded in the similar objective of improving patient engagement in care, organizations may find the adoption of a specific strategy to be more related to similarly oriented strategies. Strategies within activity types likely require more similar resources and capabilities to adopt than across activity types. Rather than building a portfolio of patient engagement strategies generally, organizations may want to follow distinct adoption paths based on whether effectively implementing strategies depends on technological versus interpersonal capabilities.

Understanding if strategy types are related to adoptability can contribute to a more calculated practice-level uptake of patient engagement and can inform how leaders and policymakers prioritize adoption. In this exploratory study, we utilize Mokken scale analysis to examine whether a natural ordering of organizational adoption emerges among 12 individual patient engagement strategies in 71 adult primary care practices. Based on the distinction between technologically oriented and interpersonally oriented strategies, we assess adoption within these strategy types as well as overall.

Methods

Study Setting and Data

This study analyzes data from a study of adult primary care practices of two large Accountable Care Organizations (ACOs), Advocate Health Care in Chicago, IL, and DaVita HealthCare Partners in Los Angeles, CA (now owned by Optum Health). Both ACOs participated in the Medicare Shared Savings Program and other risk-bearing contracts. A total of 71 practice leaders of adult primary care practices (44 Advocate Health Care and 27 DaVita HealthCare Partners physician practices) were surveyed about their practices' adoption of patient engagement strategies, as described elsewhere.[133]

We assessed physician practice adoption of twelve patient engagement strategies, six technologically oriented and six interpersonally oriented. Technologically oriented strategies include routine health risk assessments (HRAs), telehealth available for patients with diabetes and/or cardiovascular disease (CVD), shared decision-making videos, staff can note patient preferences in the EHR, and patients can input patient information in the EHR. Interpersonally oriented strategies include motivational interviewing training for clinicians, motivational interviewing training for staff, shared medical appointments for diabetes and/or CVD, patient advisory councils for diabetes and/or CVD, patients involved in governance and/or quality improvement (QI), and peer-peer programs for diabetes and/or CVD. Respondents indicated the extent to which their clinicians/staff were participating in each patient engagement strategy with possible answers of: "No," "Yes, but not regularly," "Yes, partially implemented," "Yes, fully implemented." These items were converted to a dichotomous variable of whether the activity had been at least partially/fully implemented or not.

Analysis

First, we conducted descriptive analyses on the overall unadjusted prevalence of each patient engagement strategy, determining the most and least common strategies adopted in our sample. We then calculated a tetrachoric correlation matrix, estimating correlations for all item responses.[134] We investigated highly correlated items (coefficient: 0.70 or higher),[135] which may suggest that strategies should be grouped together.

We used Mokken scale analysis to evaluate adoption ordering and difficulty among patient engagement strategies. Mokken scale analysis is a method to determine if there is a latent trait among a group of measures or if they are independent of one another.[136–139] It can elaborate if there is a hierarchical order of responses that demonstrate an ordered difficulty. It is used here to analyze whether there is an ordering among the patient engagement strategies, suggesting a pathway to building strategy use.

There is still no consensus on the minimum sample size required for Mokken scaling, and the literature on Mokken scaling has examples of sample sizes ranging from 133 to 15,022 respondents.[140] Two studies, one simulation-based and one empirical, suggest sample sizes of at least 250 subjects may be needed for Mokken scaling, although this area of research remains largely unstudied.[140,141] Given the novel application of this technique in this new area of patient engagement, and the exploratory nature of this study, we utilized our sample of 71 physician practices despite potential limitations related to sample size.

To form a monotonely homogenous model of Mokken (MHMM), all items must meet three assumptions: 1. Unidimensionality, 2. Local independence, and 3. Monotonicity. Unidimensionality assumes that all items share a common latent trait. Local independence assumes the latent trait is the reason for item responses, not external item or respondent characteristics. Monotonicity assumes that the proportion of positive responses increases with the level of the latent trait.

We employed multiple techniques to define whether a set of strategies forms a scale, assess the strength of the scale, and detect potential ordering of responses. The Mokken scale analysis of each set of strategies determines a criterion of monotonicity. A criterion above 80 would suggest that monotonicity cannot be assumed. A criterion between 40 and 80 is uncertain but may signal monotonicity. A criterion below 40 suggests we can assume monotonicity. We assess the range of criteria for all twelve patient engagement strategies, as well as for strategies within interpersonal and technological types. We also conducted a visual inspection of the traces of the items in the scale, which should be steadily increasing to assume monotonicity. The default minimum size for groups of observations to check for monotonicity is 50 for sample sizes less than 150. Given our sample size of 71, we set the minimum size for groups of observations to 22, which is our sample size multiplied by 0.30, rounded up to the nearest integer.[142]

The extent to which items measure the same latent trait are signaled by the Loevinger's H coefficient of scalability, our main outcome of interest. The Loevinger's H coefficient of scalability is measured from 0 to 1, with higher values signaling a stronger scale. Coefficients at or below 0.30 are not considered a scale, while any value above 0.30 is considered a scale. Scales can be interpreted by their strength with weak scaling above 0.30, medium scaling at or above 0.40, and strong scaling at or above 0.50.[142] We compared the strength of scaling among strategies overall, as well as specific interpersonal and technological types, to understand if there is a defined progression of general and targeted strategy adoption.

If the patient engagement strategy responses demonstrated scalability (Overall H coefficient greater than 0.3) and satisfied the MHMM requirements (criteria<80), then we tested if they also showed consistent ordering, referred to as a doubly monotonely homogeneous model of Mokken (DMHMM). To determine whether the model satisfies as a DMHMM we assessed calculated criteria with the same reference points as utilized in the monotonicity check (criteria<80). In a DMHMM, strategies with higher adoptability will be lower in the series and lower adoptability will be higher in the series. For example, a finding that routine HRAs are lower in the series than other strategies would signal that HRAs may be adopted as a foundation for other strategy use.

All statistical analyses were completed using STATA 16.0 by the authors. Mokken scale analysis is accomplished through the *msp* and *loevh* commands.[143] As a sensitivity analysis we estimated the scales with a less conservative specification of patient engagement adoption for each measure, with "Yes, but not regularly," "Yes, partially implemented," and "Yes, fully implemented" classified as adopted versus not.

Results

The mean total number of patient engagement strategies adopted is 5.35 of 12 assessed, with three physician practices (4.2%) adopting all twelve possible strategies, and five physician practices (7.0%) adopting none (Figure 1). Adoption rates for individual patient engagement strategies are displayed in Table 1. On average, technological strategies (average: 50.3%) were adopted at a higher rate than interpersonal strategies (average: 39.0%). The most common technological strategy was having HRA results available to the care team, which was adopted by 71.8% of physician practices. The least common technological strategy was shared decision-making videos, which was adopted by 9.9% of physician practices. The most common interpersonal strategy was training clinicians in motivational interviewing, which was adopted by 62.0% of physician practices. The least common interpersonal strategy was patient advisory councils for patients with diabetes and/or CVD, which was adopted by 22.5% of physician practices.

Table 2 displays results of tetrachoric correlations for all twelve patient engagement strategies. Average correlation was low overall (correlation coefficient, $\rho=0.32$), and slightly higher between interpersonal strategies ($\rho=0.30$) than between technological strategies ($\rho=0.26$). Two strategies were perfectly correlated ($\rho=1.00$): shared medical appointments for diabetes and/or CVD and shared decision-making videos. Of the 7 physician practices that adopted shared decision-making videos, all had adopted shared medical appointments. Given these are distinct strategies we do not group them into a composite item.

Table 3 displays findings from the Mokken scale analysis of all twelve patient engagement strategies, as well as within technological and interpersonal strategy types. The Mokken scale of all twelve patient engagement strategies had medium scalability (overall Loevinger's H coefficient=0.46, range: 0.35 to 0.55). However, the scale did not meet the monotonicity assumption, as the criteria for shared decision-making videos was above the threshold value of 80 (criteria value=103). This violation of monotonicity is confirmed by a visual inspection of the trace line of shared decision-making videos, which was not increasing. Due to these violations, we do not observe a MHMM for the scale of all strategies.

The Mokken scale for the six interpersonal strategies has medium/strong scalability (overall Loevinger's H coefficient=0.54, range: 0.49 to 0.60). The scale met the monotonicity assumption, with each item criteria below the threshold value of 80 (range: -15 to -10). Each item criterion is below 80 when checking the assumptions for a DMHMM (range: -15 to 7). We conclude the scale has medium/strong scalability, satisfies all assumptions of a MHMM, and satisfies all assumptions of a DMHMM. The scale for the six interpersonal strategies is ordered (most to least adoptable): clinicians trained in motivational interviewing, shared medical appointments for patients with diabetes and/or CVD, staff trained in motivational interviewing, patient advisory councils for patients with diabetes and/or CVD, patients in governance and/or QI, and peer-peer programs for patients with diabetes and/or CVD (Figure 2).

The Mokken scale for the six technological strategies has weak/medium scalability (overall Loevinger's H coefficient=0.42, range: 0.31 to 0.54). The scale met the monotonicity assumption, with each item criteria below the threshold value of 80 (range: -12 to 0). Each item criterion is below 80 when checking the assumptions for a DMHMM (range: -11 to 27). We conclude the scale has weak/medium scalability, satisfies all assumptions of a MHMM, and satisfies all assumptions of a DMHMM. The scale for the six technological strategies is ordered (most to least adoptable): staff can view HRA, staff can input patient preferences in EHR, HRAs are conducted routinely over time, telehealth is available for patients with diabetes and/or CVD, and shared decision-making videos are used (Figure 2).

As a sensitivity analysis we measure patient engagement strategies using an alternative classification of adoption, with "Yes, but not regularly" as adopted. Results of scales using this specification met monotonicity assumptions for all patient engagement strategies, as well as within interpersonal and technological types. All three scales demonstrated borderline weak/no scalability (overall strategies, H=0.36; technological strategies, H=0.35; interpersonal strategies, H=0.29).

Discussion

There is a gap in the evidence to guide adult primary care practices in how to establish and expand patient engagement strategies. We find that, while all twelve patient engagement strategies do not demonstrate scalability, approaching interpersonally or technologically oriented strategies separately demonstrates scalability. We expected to detect scaling among all strategies as they are grounded in a shared objective to increase patient engagement in their care, similar to a previous study that observed medium scalability among care management processes regardless of type.[131] Our study results suggest that compared to patient engagement strategies, care management processes may share a stronger common latent trait as they have a relatively longer history and more consistent set of activities.

When categorizing patient engagement strategies by type, we observed medium scalability among technologically oriented strategies and strong scalability among interpersonally oriented strategies. This suggests that physician practices are influenced by whether the strategies require technological versus interpersonal capabilities when making adoption decisions. This may reflect distinct strategic priorities or foundational organizational capabilities of physician practices adopting within types that is not observed when the strategies are examined generally, without regard to whether they are technologically or interpersonally focused strategies.

To illustrate, the adoption of shared decision-making videos violated the assumptions to scale with all patient engagement strategies but was found to scale well when grouped with only technologically oriented strategies. Only seven physician practices had adopted shared decision-making videos, making it the least adopted strategy in our sample. Physician practices that have already successfully adopted numerous technological strategies may be comfortable adopting difficult and innovative shared decision-making videos as well. This pattern of ordered difficulty or preparation is not reflected when considering a mix of interpersonal and technological strategies.

Shared latent traits detected within scales of the same type may reflect paths of organizational learning. For example, physician practices that have learned to adapt quickly to operational changes in the adoption of SMAs[114] are prepared to overcome the interpersonally complex challenge of creating patient advisory councils.[144] The process of integrating interpersonal or technological patient engagement strategies may build absorptive capacity for the physician practice to adopt more difficult strategies of the same type.[125–128] In other words, the skills and processes that are accumulated in the adoption of interpersonal strategies may be more directly relevant to another interpersonal strategy rather than a technological strategy.

To encourage the expansion of patient engagement strategies by late adopters, policy and capacity building programs can encourage the paths most traveled. Within both interpersonal and technological types, the sequence of adoption follows the same ordering as the most to least prevalent strategies. This suggests defined pathways to building patient engagement strategies into organizational routines, with the most frequently adopted strategies usually being adopted before moving to the next most frequently adopted strategy.

For example, we find that allowing staff to view HRA results in the EHR may be foundational for physician practices building a portfolio of technological patient engagement strategies. Providing the option for staff to view important patient information at the time of care can be an initial step for physician practices. As they become more comfortable with reading and using new sources of patient information, staff can begin noting patient preferences in the EHR, the next strategy in the technological adoption order. Similarly, physician practices may choose to train clinicians in motivational interviewing before training staff.

We are unable to assess organizational characteristics of the adopting physician practices and future research should investigate how physician practices of varying organizational capabilities may follow divergent adoption journeys. For example, physician practices with low health information technology capabilities may adopt the full suite of interpersonal strategies before adding technological strategies. Preliminary results of analyses of the National Survey of Healthcare Organizations and Systems, suggest that motivational interviewing and SMAs tend to be adopted by physician practices with relatively less robust health information technology capabilities. Physician practices with less robust health information technology capabilities may choose to adopt motivational interviewing and SMA as they can leverage interpersonal organizational capabilities even in the absence of technological infrastructure. Segmenting physician practices by their health information technology capabilities may provide a more complete picture of strategy adoption, potentially revealing scaling among overall patient engagement strategies, not just by strategy type.

Limitations

Limitations include that the results are from 71 diverse adult primary care practices affiliated with one of two ACOs. Because of differential incentives and structures, these findings may not apply to practices that are not involved with risk-based payment arrangements such as ACOs. Potential measurement error may affect the internal validity of the study as all responses come from a key informant from each practice. However, these individuals were carefully picked based on their knowledge of patient engagement strategies and their leadership within the practice.

Further, due to our cross-sectional data, we do not observe the sequencing of patient engagement strategy adoption over time. However, our application of Mokken scaling provides a foundation for future research on the uptake of patient engagement strategies to consider potential groupings along interpersonal and technological types. Future research can investigate the adoption of patient engagement strategies longitudinally, as well as compare the de-adoption of technological and interpersonal strategies over time. Finally, adoption measures are simplified as adopted versus not adopted. We feel this is appropriate because we are considering the choice of adoption and not the extent of adoption. We conduct sensitivity analyses by classifying “Yes, but not regularly” as both adopted and not, and compare findings of the scales.

Conclusion

Our findings suggest that developing practice-level capabilities in patient engagement occurs along two potentially divergent paths: one interpersonally and one technologically oriented. We detect a predictable pattern of strategies accumulating in the separate types, which may indicate common pathways to building patient engagement capabilities. Rather than encouraging physician practices to adopt as many strategies as quickly and broadly as possible, effective policies, quality improvement toolkits, and capacity building programs may encourage a gradual and purposeful progression of strategies within activity types.

Figures

Figure 1: Distribution of the number of adopted patient engagement strategies within 71 physician practices.

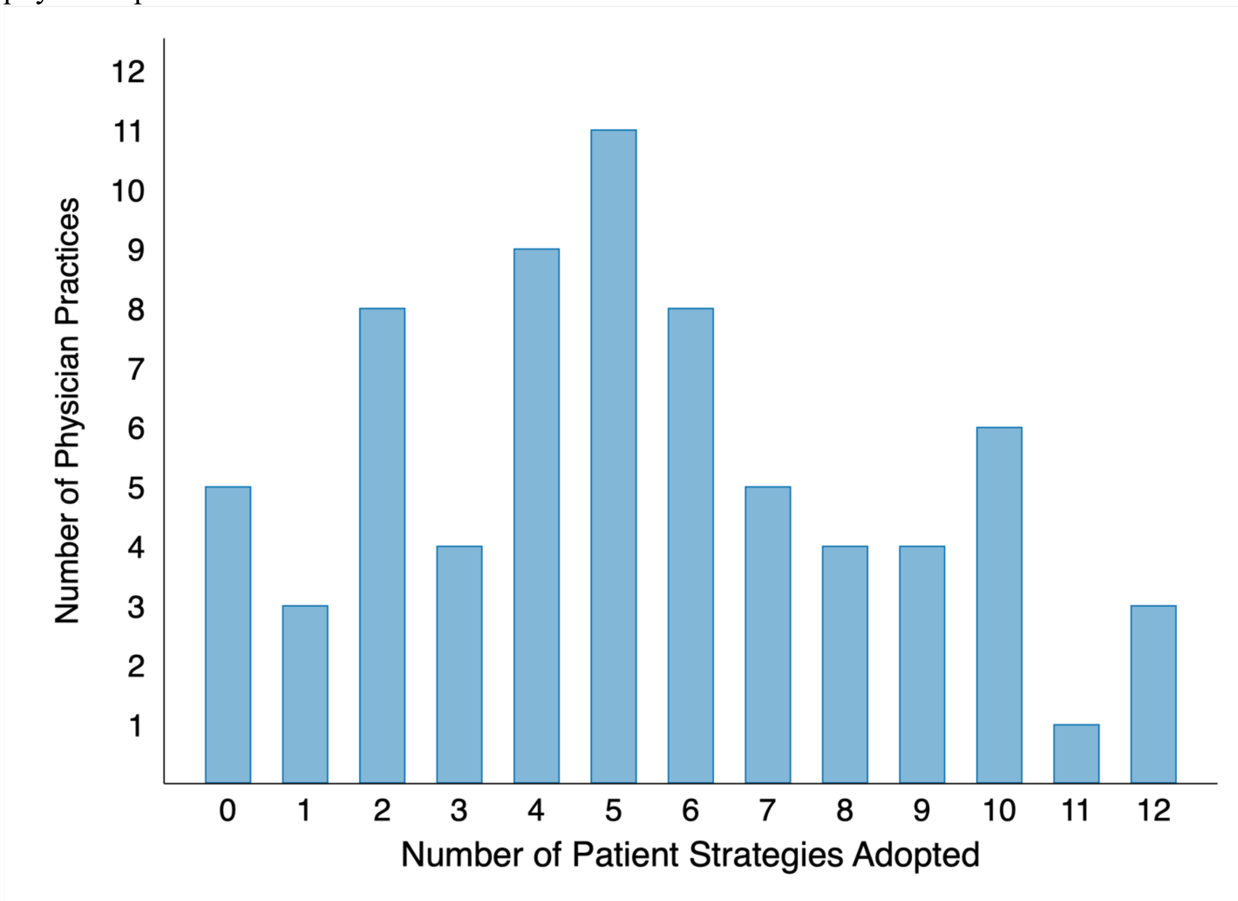
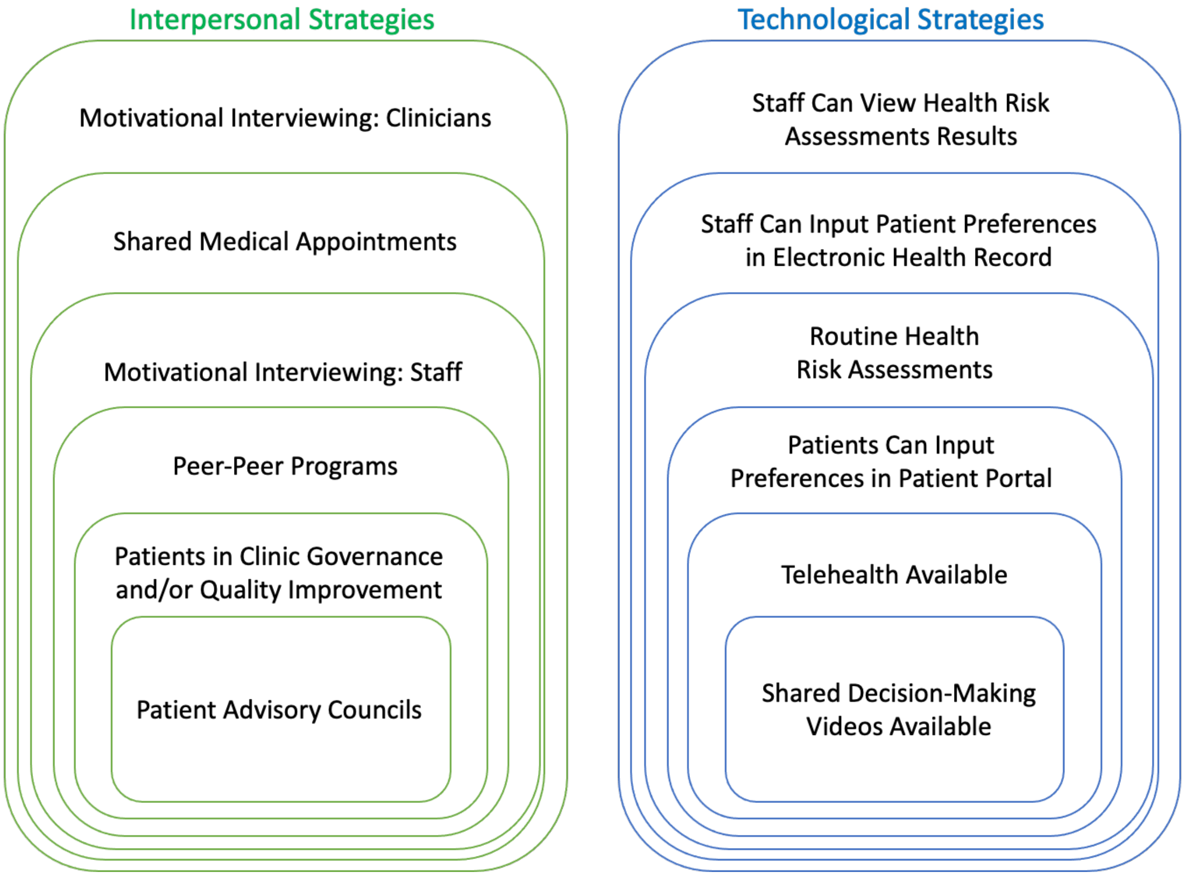


Figure 2: Adoptability order among interpersonally and technologically oriented patient engagement strategies.



This figure displays ordering of patient engagement strategies within two strategy types: interpersonal strategies displayed in green and technological strategies in blue. Larger boxes are the most adoptable strategies and inner boxes are the least adoptable strategies. Physician practices would have already adopted outer boxes before adopting nested boxes.

Tables

Table 1: Adoption of patient engagement strategies by physician practices

	Adoption by Physician Practices
	Number (Percentage)
Technological Patient Engagement Strategies (average)	50.3%
Health risk assessment results available to care team	51 (71.8%)
Staff can note patient preferences in electronic health record	50 (70.4%)
Routine health risk assessments	45 (63.4%)
Patients can input patient information in the electronic health record	43 (60.6%)
Telehealth for patients with diabetes and/or cardiovascular disease (CVD)	18 (25.4%)
Shared decision-making videos	7 (9.9%)
Interpersonal Patient Engagement Strategies (average)	39.0%
Clinicians trained in motivational interviewing	44 (62.0%)
Shared medical appointments for patients with diabetes and/or CVD	35 (49.3%)
Staff trained in motivational interviewing	29 (40.8%)
Peer-peer programs for patients with diabetes and/or CVD	24 (33.8%)
Patients in practice governance, including quality improvement teams	18 (25.4%)
Patient advisory councils for patients with diabetes and/or CVD	16 (22.5%)
	N=71

Table 2: Patient engagement strategies tetrachoric correlation results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Routine health risk assessment	1.00											
Telehealth available	0.44	1.00										
Shared decision-making videos	0.13	0.28	1.00									
Staff note patient preferences in EHR	0.44*	0.17	0.28	1.00								
Patients note preferences in EHR	0.35	0.61*	0.41	0.28	1.00							
HRA results available to care team	0.86*	0.61*	-0.01	0.54*	0.60*	1.00						
Motivational interviewing: Clinicians	0.47*	0.46*	0.39	0.50*	0.31	0.54*	1.00					
Motivational interviewing: Staff	0.62*	0.39	0.03	0.59*	0.32	0.56*	0.73*	1.00				
Shared medical appointments	0.35	0.55*	1.00*	0.24	0.16	0.30	0.48*	0.57*	1.00			
Patient advisory councils	0.67*	0.50*	0.68*	0.58*	0.42	0.56*	0.68*	0.29	0.36	1.00		
Patients in governance/QI	0.57*	0.31	0.64*	0.46	0.61*	0.61*	0.59*	0.49*	0.45*	0.69*	1.00	
Peer-peer programs	0.50*	0.62*	0.52*	0.36	0.35	0.45	0.42*	0.72*	0.79*	0.79*	0.62*	1.00

The blue region represents correlations between technological patient engagement strategies and green represents correlations between interpersonal patient engagement strategies.

Table 3: Strength of scaling among Mokken scales of patient engagement strategies

	Overall Strategies	Interpersonal Strategies	Technological Strategies
Overall Loevinger's H coefficient of scalability: Mean H (Individual H range)	0.47 (0.35, 0.55)	0.54 (0.49-0.60)	0.42 (0.31, 0.54)
Criteria for monotonely homogeneous model of Mokken: Mean, (range)	1 (-13, 103)	-11.8 (-15, -10)	-5.8 (-12, 0)
Criteria for doubly monotonely homogeneous model of Mokken: Mean, (range)	None	-6.2 (-15, 7)	10.8 (-11, 27)
Overall scalability	None	Strong	Medium/Weak
Ordering	None	Yes	Yes

Conclusion

Improving the quality of health care delivery requires a better understanding of the organizational capabilities that enable patient engagement. This dissertation developed a conceptual framework to delineate the health care system, physician practice, and team factors associated with patient engagement in chronic care. Through three empirical studies, we identified opportunities to support health care organizations in efforts to better engage patients in their care.

The first aim of this dissertation was to examine the physician practice and team capabilities associated with better patients' experiences of chronic illness care in community health centers. Surveys of 1,277 adults with diabetes that assessed non-physician team roles involved in managing their chronic care, including community health workers, diabetes educators, nutritionists, pharmacists, mental health providers, and other general staff, were integrated with clinical and administrative data from fourteen community health center sites. Random effects multivariable regression models estimated the association of team expertise, community health center size, and 1) patients' experiences of chronic care and 2) hemoglobin A1c control. We find that patients with access to care team expertise in self-management support, including diabetes educators, nutritionists, community health workers, and other general staff report better experiences of chronic care. These team roles may reduce barriers to patient self-management and improve patients' overall experiences of chronic care. Further, we find patients report better experiences of chronic care when they have broader access to expertise in small community health center sites. These findings suggest that efforts to advance patient-centered care in community health centers should expand patient access to interdisciplinary expertise to support diabetes care management.

Our second aim was to disentangle the associations of physician practice and parent health system-level capabilities and the adoption of strategies at the physician practice level. We linked a nationally representative survey of system-owned practices (n=796) and their parent health systems (n=247). Random effects multivariable linear regression examined the association of health system and physician practice characteristics and practice adoption of patient engagement and chronic care management capabilities. We find that physician practices owned by health systems with processes to assess clinical evidence and with more advanced health information technology functions adopted more chronic care management capabilities, but not patient engagement capabilities. Physician practices with innovative cultures, more advanced health information technology functionality, and with a process in place to assess clinical evidence were positively associated with adoption of patient engagement and chronic care management capabilities. Health systems may exert more influence to promote chronic care management capabilities, which have a strong evidence base, compared to innovative patient engagement strategies, which have less evidence to guide effective implementation. Policies to advance care for patients with diabetes and/or CVD should prioritize support at the physician practice level relative to the health system level.

Finally, our third aim was to examine ordering and staging in the adoption of patient engagement strategies by physician practices. We analyzed data from a survey of the adoption of twelve potential patient engagement strategies in 71 adult primary care practices within two accountable care organizations. We used Mokken scale analysis to reveal potential latent traits among a group of patient engagement strategies. Further, we examined possible hierarchical orders of responses that would demonstrate an ordered difficulty in adoption. We compared three groups of strategies: all twelve potential patient engagement strategies, six interpersonally oriented strategies, and six technologically oriented strategies. We detected ordered patterns in the adoption of strategies along both interpersonal and technological types, suggesting common and predictable pathways to patient engagement. The process of integrating interpersonal or technological patient engagement strategies may build absorptive capacity for the physician practice to adopt more difficult strategies of the same type. Rather than encouraging physician practices to adopt as many strategies as quickly and broadly as possible, effective policy may encourage a gradual and purposeful progression of strategies within types.

Our three studies support a consideration for the simultaneous influences of multiple organization levels outlined in the conceptual model. We were only able to observe patient outcomes in our first study, where we found broader interdisciplinary care team expertise to be associated with improved patients' experiences of chronic condition care but not hemoglobin A1c control. It will be important for future patient engagement research to connect multilevel organizational capabilities with both patient-reported and clinical outcomes. Our findings support our proposition that patient engagement is influenced by both structural and cultural capabilities at each organizational level. Future research can identify processes and actors that connect organizational levels, for example, how health care systems may utilize middle managers to translate central strategy into physician practice operation.

In conclusion, this dissertation provides evidence about modifiable aspects of health care delivery organizations that can inform policies to advance team-based care and patient engagement. Further, we extend empirical applications of organization theories that consider multi-level influences on the behavior of organizations. Only by considering the integration of care from different organization levels can we build high-performing health care delivery systems with the patient at the center.

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