

Multilevel Influences on Patient Engagement and Chronic Care Management

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Physician practices in the United States are increasingly owned by health systems.^{1,2} Health system ownership of physician practices has been associated with higher prices and spending,^{3,4} but systems also have the potential to improve practice capabilities to manage chronic conditions.⁵ Improving practice capabilities to manage diabetes and/or 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.⁶

Organizational capabilities central to improving care for adults with diabetes and/or CVD include chronic care management processes and patient engagement strategies. Chronic care management processes are evidence-based processes, such as use of electronic health record (EHR) decision support tools and patient registries, with demonstrated benefits of improved outcomes for patients with diabetes and CVD.^{7,8}

Patient engagement strategies, including shared decision-making, shared medical appointments, and motivational interviewing, aim to improve patient participation in managing their own health and health care.⁹⁻¹¹ Past research findings have highlighted that patients with high confidence in managing their own health and health care, known as patient activation, can achieve better outcomes.¹² Shared medical appointments enable patients to learn from peers during visits where clinicians meet with multiple patients simultaneously.¹³⁻¹⁵ Shared decision-making is used to assist informed patients in making choices that are aligned with their goals and values.^{11,16-19} Motivational interviewing involves patient-centered prioritization techniques to support patients with goal setting for behavior change.^{10,20,21}

Despite increased recognition of the importance of chronic care management processes and patient engagement strategies, they are not consistently adopted. Recent national evidence indicates that only half of physician practices routinely use shared decision-making or provide motivational interviewing training, and less than a quarter offer shared medical appointments.²² On average, less than half of recommended chronic care management processes have been adopted by physician practices.²³

ABSTRACT

OBJECTIVES: Physician practices are increasingly owned by health systems, which may support or hinder adoption of innovative care processes for adults with chronic conditions. We examined health system- and physician practice-level capabilities associated with adoption of (1) patient engagement strategies and (2) chronic care management processes for adult patients with diabetes and/or cardiovascular disease.

STUDY DESIGN: We analyzed data collected from the National Survey of Healthcare Organizations and Systems, a nationally representative survey of physician practices (n = 796) and health systems (n = 247) (2017-2018).

METHODS: Multivariable multilevel linear regression models estimated system- and practice-level characteristics associated with practice adoption of patient engagement strategies and chronic care management processes.

RESULTS: Health systems with processes to assess clinical evidence ($\beta = 6.54$ points on a 0-100 scale; $P = .004$) and with more advanced health information technology (HIT) functionality ($\beta = 2.77$ points per SD increase on a 0-100 scale; $P = .03$) adopted more practice-level chronic care management processes, but not patient engagement strategies, compared with systems lacking these capabilities. Physician practices with cultures oriented to innovation, more advanced HIT functionality, and with a process to assess clinical evidence adopted more patient engagement strategies and chronic care management processes.

CONCLUSIONS: Health systems may be better able to support the adoption of practice-level chronic care management processes, which have a strong evidence base for implementation, compared with patient engagement strategies, which have less evidence to guide effective implementation. Health systems have an opportunity to advance patient-centered care by expanding practice-level HIT functionality and developing processes to appraise clinical evidence for practices.

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System ownership of physician practices is positively associated with the adoption of chronic care management processes and negatively associated with the adoption of patient engagement strategies compared with practices with other ownership arrangements, including independent practices.^{22,24,25} However, the relative association of health system and physician practice characteristics with adoption of patient engagement strategies remains unexplored. To advance evidence about the role of systems on innovation adoption, we examine system and practice characteristics associated with the adoption of chronic care management processes and patient engagement strategies using national surveys of health systems and physician practices.

Conceptual Model

We developed a conceptual model to depict how advancing capabilities of health systems and their owned physician practices can be associated with chronic care delivery (Figure). We integrated concepts from diffusion of innovation,²⁶ organizational change management,²⁷ and previous studies of chronic care management and patient engagement strategy adoption^{23,28-30} to inform our study hypotheses.

We posit that health systems can support practice adoption of innovations differently depending on the strength of evidence about implementation strategies to improve uptake and fidelity. Studies assessing implementation strategies provide actionable evidence about how to adapt interventions to fit local practice needs, culture, and resources.³¹ Health systems can develop central capabilities when innovations have evidence-based implementation strategies or are conducive to standardization throughout the system.

Adopters of chronic care management processes may benefit from robust practice-based evidence to support effective implementation,

TAKEAWAY POINTS

This national multilevel study examines health system and physician practice capabilities associated with adoption of patient engagement strategies and chronic care management processes.

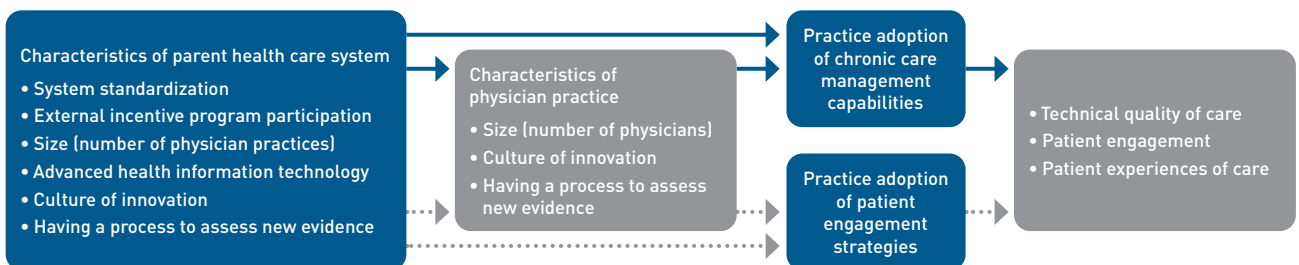
- ▶ Health systems with established processes to assess clinical evidence and with more advanced health information technology (HIT) functions had more practice-level chronic care management processes in place compared with practices of health systems that lack these capabilities. These system-level capabilities, however, were not associated with practice-level adoption of patient engagement strategies.
- ▶ Physician practices with processes in place to assess clinical evidence, cultures oriented to innovation, and more advanced HIT functions adopted more patient engagement strategies and chronic care management processes.
- ▶ Developing practice-level capabilities is essential for adopting disruptive care delivery innovations such as patient engagement strategies.

as their use has been well documented as part of patient-centered medical home implementation and the expansion of health information technology (HIT) in physician practices.³²⁻³⁴ In contrast, there are fewer large-scale efforts to integrate patient engagement strategies into routine care.³⁵⁻³⁷ Consequently, systems may be less likely to support the adoption of patient engagement strategies if they are disruptive to operations or compete with other priorities.

The degree to which systems standardize administrative and financial processes (eg, physician compensation and performance measurement) can influence how consistently innovations are adopted in system-owned practices. Diffusion of innovations theory posits that an innovation's compatibility with organizational structure, routines, and resources can promote uptake.²⁶ Health systems with strong standardized processes may promote compatible capabilities that can be similarly deployed throughout practices consistently, such as chronic care management processes.

Conversely, patient engagement typically demands extensive local customization. For example, shared medical appointments require idiosyncratic scheduling and physical space considerations.¹³ Consequently, health systems may have less influence on patient engagement strategies because centralized resources are less

FIGURE. Logic Model of Health System Influences on Practice Adoption of Patient Engagement Strategies and Chronic Care Management Processes*



*Arrows represent the predicted direction and magnitude of influences on the adoption of chronic care management processes and patient engagement strategies for patients with diabetes and/or cardiovascular disease in health system-owned physician practices. Solid blue lines represent a relatively larger predicted influence compared with dotted gray lines.

useful for adopting innovations that require local tailoring. We hypothesize that health system standardization of administrative functions and processes, including physician compensation and strategic planning, will be positively associated with practice-level adoption of chronic care management processes for diabetes and/or CVD but not patient engagement strategies (hypothesis 1).

Health systems can influence practice-level innovation adoption beyond establishing standardized administrative processes. For example, systems can establish processes to appraise clinical evidence, provide financial resources to support infrastructure investments, and foster organizational cultures oriented to innovation and learning. Systems can also provide instrumental support through guidance and facilitation to help practices address their unique needs, including reaching priority patient populations and supporting the expansion of practice-level capabilities such as HIT.²⁴ Past research indicates that physician practices with more advanced HIT functionality adopt more chronic care management processes.^{28,29} Further, systems can support practice cultures oriented to innovation and risk-taking, which can equip practices with the motivation and capabilities to test care delivery innovations.^{38,39} Accordingly, we hypothesize that health systems and physician practices with processes in place to assess new clinical evidence, more advanced HIT functionality, and cultures oriented to innovation will adopt more patient engagement strategies and chronic care management processes for diabetes and/or CVD compared with practices without these capabilities (hypothesis 2).

METHODS

Data Source

This study analyzed data from the 2017-2018 National Survey of Healthcare Organizations and Systems (NSHOS), which are nationally representative surveys of US primary care practice sites (N = 2190; response rate, 48.6%) and health systems that own or manage at least 2 primary care multispecialty medical practices or acute care hospitals (N = 325; response rate, 60.9%). A knowledgeable key informant at each organization, including physician practice administrators/managers and system CEOs or chief medical officers, responded to the survey questions. We linked NSHOS surveys with IQVIA One Key Data on system and physician practice characteristics. We integrated a subset of system-owned physician practice surveys (n = 820) with responses from each practice's health system (n = 253). We excluded 6 systems with missing data on key covariates, resulting in an analytic sample of 796 physician practices and 247 health systems. The research study was approved by the Office of Human Subject Protections, University of California, Berkeley (2015-04-7420).

Dependent Variables

Measures of patient engagement strategies and chronic care management processes were developed based on past survey research assessing these practice capabilities.^{23,28,30,40}

A composite measure of physician practice-level adoption of 12 patient engagement strategies was calculated and transformed to a scale of 0 to 100 (internal consistency reliability, $\alpha = 0.87$). Patient engagement strategies included shared medical appointments (diabetes, CVD), motivational interviewing (smoking cessation, weight loss/diet, physical activity, medication adherence, motivational interview training available) decision aids for selecting diabetes medication, and shared decision-making (clinicians/staff have formal training available, routinely engage in shared decision-making, routinely use decision aids, and follow-up after shared decision-making).

A composite measure of practice-level adoption of 8 chronic care management processes was calculated and transformed to a scale of 0 to 100 ($\alpha = 0.82$). Chronic care management processes included use of evidence-based protocol guidelines, EHR-based clinical decision-support tools, disease registries, and individual feedback on clinician performance.

Exploratory factor analyses demonstrated high eigenvalues (range, 2.39-5.79) for both constructs and low correlation ($r = 0.38$) between the measures.⁴¹ The [eAppendix](#) (available at [ajmc.com](#)) includes detailed descriptions of survey items.

Health System Variables

A dichotomous variable assessed whether health systems had a process in place to assess new clinical evidence, such as internal evaluation committees to identify and review research evidence or an organized program to pilot novel interventions. Health system culture was assessed from questions based on the Competing Values Framework, which categorizes culture based on focus level (internal or external) and the degree of influence that health systems exert on operations (controlling or flexible).⁴² We measured innovation culture based on points allocated to the developmental/innovative culture type (range, 0-100). Advanced HIT functions included patients' ability to access and comment on their medical records and communicate via secure message (range, 0-100; $\alpha = 0.70$).

System survey respondents reported the degree to which 8 processes were standardized ("done the same way") across physician practices. Processes were 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, data elements included in the EHR, and strategic planning. Responses were scored as 0 for "not at all," 33.3 for "somewhat," 67.7 for "mostly," and 100 for "full," and then a composite scale was calculated based on the mean of the responses (range, 0-100; $\alpha = 0.88$).

Physician Practice Independent Variables

A dichotomous variable was used to assess whether practices had a process in place to assess new clinical evidence. A composite scale assessed practice-level innovation culture based on 5 items describing practice culture, including that successful care delivery innovations are highly publicized and that team members openly

share patient care challenges and failures with one another (range, 0-100; $\alpha = 0.80$). Advanced HIT functionality was measured using a 5-item index (0-5).⁴³

Control Variables

System-level control variables included participation in delivery reform (yes or no), participation in payment reform initiatives (0-4 potential risk-based contracts), and size (number of physician practices, categorized into quartiles). Physician practice-level control variables included physician practice size (number of physicians), primary care physicians as a proportion of total physicians, percentage of revenue from Medicaid, and US Census region.

Statistical Analysis

Descriptive analyses of physician practice and system characteristics were conducted, and the adoption levels for each patient engagement strategy and chronic care management process were summarized. Two multivariable linear regression models separately estimated the association of health system and physician practice characteristics with the study outcomes of practice-level adoption of patient engagement strategies and practice-level adoption of chronic care management processes. Random system effects were used to account for the clustering of practices within systems. To aid in comparison of regression coefficients, continuous measures were standardized with a mean of 0 and a variance of 1.

We conducted robustness checks for our final multivariable model specifications, including calculating collinearity and model fit diagnostics. We computed the variance inflation factor for each independent variable to determine whether multicollinearity was present. We calculated the Akaike information criterion (AIC) to compare the goodness of fit of the full multivariable model with 2 reduced-form regression models containing (1) only health system-level variables and (2) only physician practice-level variables for both patient engagement strategies and chronic care management processes. We checked covariates for high correlation and dropped those with a correlation higher than 0.60. All analyses were completed using Stata 15.0 (StataCorp).

RESULTS

Approximately half of health systems (56.3%) and physician practices (49.6%) had processes in place to assess new evidence (Table 1). A quarter of physician practices owned 10 or fewer practices (25.7%) and a quarter owned more than 71 practices (26.9%). The majority of system-owned practices (69.7%) had between 1 and 9 physicians.

Patient engagement strategies were not widely adopted (mean [SD], 41.4 [28.5]) (Table 2) by system-owned practices. Formal training in shared decision-making (38.2%) was less available than the routine use of shared decision-making (54.3%). On average, chronic care management processes were adopted more than patient engagement strategies (mean [SD], 69.7 [29.9]). The most adopted capability was collecting physician performance data for diabetes (85.8%).

TABLE 1. Descriptive Statistics for Health Systems and System-Owned Physician Practices (2017-2018)^a

Characteristics	Mean [SD] or n (%)
Parent health system characteristics (n = 246)	
Process to assess new evidence (0, 1), n (%) answering yes	139 (56.3%)
Culture of innovation (0-100), mean (SD)	25.1 (15.2)
Advanced health information technology (0-100), mean (SD)	53.7 (23.7)
Health system standardization (0-100), mean (SD)	73.6 (19.8)
Participation in delivery reform (0, 1), n (%) answering yes	144 (58.3%)
Participation in payment reform (0-5), mean (SD)	0.9 (1.1)
Size (number of physician practices), n (%)	
1-10	63 (25.7%)
11-28	65 (23.6%)
29-70	58 (23.7%)
≥ 71	61 (26.9%)
System-owned physician practice characteristics (n = 796)	
Process to assess new evidence (0, 1), n (%) answering yes	395 (49.6%)
Culture of innovation (0-100), mean (SD)	52.6 (20.7)
Advanced health information technology index (0-5), mean (SD)	3.1 (1.2)
Size (number of physicians), n (%)	
1-9	555 (69.7%)
10-20	141 (17.7%)
≥ 21	100 (12.6%)
Primary care physicians as % of total physicians, n (%)	
< 33%	57 (7.2%)
33%-99%	611 (76.8%)
100%	128 (16.1%)
Medicaid revenue as % of total revenue, n (%)	
None	68 (8.5%)
1%-29%	540 (67.8%)
≥ 30%	188 (23.6%)
US Census region	
West	209 (26.3%)
South	295 (37.1%)
Northeast	118 (14.8%)
Midwest	174 (21.9%)

^aData are presented as mean (SD) for continuous measures and n (%) for categorical measures.

Source: National Survey of Healthcare Organizations and Systems.

Health systems with a process in place to assess new clinical evidence ($\beta = 6.54$ points on a 0-100 scale; $P = .004$) and more advanced HIT functionality ($\beta = 2.77$ points per SD increase on a 0-100 scale; $P = .028$) had greater practice-level adoption of chronic care management processes, controlling for all model covariates (Table 3). There was no significant association between health system characteristics and practice-level adoption of patient engagement strategies.

At the physician practice level, having a process in place to assess new clinical evidence was positively associated with the adoption

TABLE 2. Adoption of Chronic Care Management and Patient Engagement Capabilities for Diabetes and Cardiovascular Disease in System-Owned Physician Practices (2017-2018) (N = 796)^a

Capability	Mean (SD) or n (%)
Chronic care management processes composite	69.7 (29.9)
Written guidelines: diabetes	574 (72.1%)
Written guidelines: hypertension	523 (65.7%)
Electronic health record decision support: diabetes	549 (69.0%)
Electronic health record 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 strategies 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%)

^aComposite scale values are presented as mean (SD). Individual items are presented as the frequency (%) of sampled physician practices that report adopting that strategy.

Source: National Survey of Healthcare Organizations and Systems.

of patient engagement strategies ($\beta = 4.36; P = .01$) and chronic care management processes ($\beta = 7.37; P < .001$). Practices with cultures oriented to innovation adopted more patient engagement strategies ($\beta = 10.72; P < .001$) and chronic care management processes ($\beta = 9.75; P < .001$). More advanced practice-level HIT functionality was positively associated with adoption of patient engagement strategies ($\beta = 3.24; P < .001$) and chronic care management processes ($\beta = 5.57; P < .001$).

Model fit for patient engagement strategies was better (lower AIC) in the full model (AIC = 7204) compared with a model with only system-level variables (AIC = 7351) and similar to a model with only physician practice-level variables (AIC = 7189). Likewise, model fit for chronic care management capabilities was better in the full model (AIC = 7460) compared with a model with only system-level variables (AIC = 7653) and similar to a model with only physician practice-level variables (AIC = 7462). These results highlight that system-level variables are correlated with practice-level variables and that practice characteristics and capabilities account for a much larger share of the explainable variation than system characteristics and capabilities.

DISCUSSION

Given limited evidence about how health systems can support physician practice innovation adoption, this study highlights modifiable organizational capabilities associated with practice adoption of care management processes and patient engagement strategies for adults with diabetes and/or CVD. Health systems can support physician practices by expanding advanced HIT functionality, developing central processes to appraise clinical evidence, and supporting physician practice-level capabilities. Consistent with past research, our results underscore that health systems are sources of guidance for practices but not direct implementers of care delivery innovations.⁴⁴ Local leadership and frontline team acceptance are essential to implement disruptive innovations.^{13,32}

It is possible that health systems opt to devote their limited resources to adopt chronic care management processes because evidence-based implementation strategies are well developed. Diffusion of innovation theory suggests that innovation adoption is facilitated when there is established practice-based evidence focused on effective implementation, scaling, and sustainment of the innovation.²⁶ Patient engagement strategies that rely on high local readiness for change and a supportive implementation climate, in contrast, may be less influenced by health systems because evidence-based implementation strategies are not well established.⁴⁵ Health system investment in evidence-based capabilities over innovative strategies may be a reason that system ownership is positively associated with chronic care management process adoption and negatively associated with patient engagement strategy adoption.^{22,24,25}

Consistent with hypothesis 1, system standardization was not associated with practice-level adoption of patient engagement strategies. Contrary to hypothesis 1, however, there was no significant association of system standardization with practice adoption of chronic care management processes. Lack of associations may be due to the high level of standardization reported (mean [SD], 73.6 [19.8] of 100) or that the items measured (eg, physician compensation, performance measurement) were too distal to affect the adoption of care delivery innovations. The results suggest that even with standardized processes in place, health systems need to provide flexibility for local practice cultures.^{46,47} Systems with heterogeneous practice cultures may face more barriers of standardizing administrative processes compared with systems with more unified practice cultures.

We found partial support for hypothesis 2. Systems with more advanced HIT functionality and processes in place to assess new clinical evidence had greater adoption of chronic care management processes but not patient engagement strategies. The HIT functionalities were directly related to patient engagement, including allowing patients to access their medical records. Our results suggest that these patient-focused technical capabilities may support broad implementation of chronic care management processes. Although practice cultures oriented toward innovation adopted more patient engagement strategies and chronic care management processes,

system culture was not associated with adoption. Cultures oriented to risk-taking might aid local practice stakeholders in overcoming uncertainty when adopting care delivery innovations with and without robust evidence-based implementation strategies.

As pressures to improve patient engagement continue to increase, our results suggest that local capabilities are essential to the implementation of patient-centered innovations. Our observation of no significant association between system characteristics and patient engagement strategy adoption suggests that system resources might be most impactful if used to nurture practice-level cultural and technical capabilities. Our findings have implications for understanding the impact of larger trends in health care delivery, including increased consolidation and adoption of value-based payment models. Existing research suggests that physician-led accountable care organizations (ACOs) tend to outperform hospital-led ACOs,⁴⁸ which is commonly attributed to the incentive of hospital-led ACOs to use inpatient resources for treating patients. Our findings suggest that physician-led ACO practices may have more innovative cultures that promote care delivery innovation. Our results underscore that health systems must consider local physician practice culture and capabilities as they aim to improve chronic care management through system-level policies and interventions.

Limitations

Our study has several limitations. First, although motivational interviewing, shared decision-making, and shared medical appointments are core patient engagement strategies, we did not assess important organizational strategies, such as inclusion of patients on advisory councils and quality improvement committees. Second, NSHOS is a single-informant survey, but respondents were selected for their knowledge of internal processes and encouraged to consult with others. Third, we were unable to account for patient sociodemographic characteristics, but we included Medicaid revenue to partially account for case mix. Fourth, we did not have data to address individual physician/patient variability in adoption. Given high variation in the use of patient engagement strategies, future studies should examine physician-level variation in implementation to elucidate how best to disseminate these strategies. Finally, the cross-sectional design does not allow for causal claims to be made. For example, we did not observe ownership changes, so practice capabilities could have predated system ownership. Policies to advance shared decision-making after the passing of the Affordable Care Act¹⁷ may have also influenced capabilities, and we could not consider these factors.

CONCLUSIONS

Health systems with processes in place to assess clinical evidence and with more advanced HIT functionality had greater practice-level adoption of chronic care management processes compared with systems that lacked these capabilities. In contrast, there was no association between system-level capabilities and practice adoption

TABLE 3. Health System and Physician Practice Characteristics Associated With Patient Engagement and Chronic Care Management Capabilities for Adults With Diabetes and/or Cardiovascular Disease (2017-2018)*

Characteristics	Patient engagement strategies (0-100)	Chronic care management processes (0-100)
	Coefficient (robust SE)	
Health system characteristics		
Process to assess new evidence	1.85 (2.46)	6.54** (2.36)
Culture of innovation	-1.21 (1.10)	-1.10 (1.36)
Advanced health information technology	0.22 (1.14)	2.77* (1.28)
Health system standardization	-0.85 (1.14)	1.49 (1.39)
Participation in delivery reform	-1.54 (2.42)	-0.03 (2.46)
Participation in payment reform	0.97 (1.17)	-1.29 (1.21)
Size (number of physician practices)		
1-10	Reference	Reference
11-28	0.73 (3.73)	-2.28 (3.83)
29-70	-3.51 (3.27)	3.05 (4.09)
≥71	-2.53 (3.28)	-1.16 (3.50)
Physician practice characteristics		
Process to assess new evidence	4.36* (1.98)	7.37*** (1.88)
Culture of innovation	10.72*** (0.89)	9.75*** (0.97)
Advanced health information technology index	3.24*** (0.88)	5.57*** (1.08)
Size (number of physicians)		
1-9	Reference	Reference
10-20	-2.11 (2.39)	0.31 (2.67)
≥21	-4.46 (2.80)	-3.25 (2.93)
Primary care physicians as % of total physicians		
< 33%	Reference	Reference
33%-99%	-0.58 (3.22)	-5.93 (3.88)
100%	6.37 (4.09)	-4.14 (4.58)
Medicaid revenue as % of total revenue		
None	Reference	Reference
1%-29%	0.88 (3.60)	6.32 (3.91)
≥30%	1.68 (4.06)	5.58 (4.23)
Census region		
West	Reference	Reference
South	-4.05 (3.08)	-2.02 (2.93)
Northeast	-5.97 (3.95)	-8.54 (4.47)
Midwest	-4.85 (3.52)	-7.18* (3.35)
Constant	43.79*** (6.10)	65.46*** (6.61)
SD (health system)	8.67*** (2.04)	8.75*** (2.26)
SD (constant)	23.81*** (0.74)	24.26*** (0.92)

*P < .05; **P < .01; ***P < .001.

*Sample consists of 796 physician practices nested within 247 parent health systems. Continuous measures were standardized with a mean of 0 and a variance of 1.

Source: National Survey of Healthcare Organizations and Systems.

of patient engagement strategies. System-owned physician practices with cultures oriented to innovation and strong technical capabilities adopted more patient engagement strategies and chronic care management processes than practices without these capabilities. Taken together, the results indicate that the practice use of patient engagement strategies may be less influenced by health systems because implementation strategies for shared decision-making, motivational interviewing, and shared medical appointments are less established and come with more uncertainty.⁴⁵ To support practice-level adoption of evidence-based and patient-centered innovations, health systems should establish processes to identify, test, and disseminate new evidence. ■

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eAppendix. Additional Detail on Construction of Independent Study Variables

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).¹ 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 5 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; $\alpha=0.70$).

To measure standardization, we examined responses to eight 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; $\alpha=0.88$).

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. Health system size was measured by the number of physician practices in the system, categorized as 1-10 physician practices, 11-28 physician practices, 28-71 physician practices, and 71+ physician practices.

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; $\alpha=0.80$). We measured practice-level advanced health IT functionality using an index of five parallel practice-specific items: 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. An index was calculated as the number of practice-level advanced health IT functions adopted (0-5), as measured in prior literature.²

We include physician practice size as the number of employed physicians in the practice, categorized as 1-9 Physicians, 10-20 Physicians, 21+ Physicians. Physician practice proportion of primary care physicians is categorized as 0-33%, 33-99%, and 100%. The percentage of practice revenue from Medicaid is categorized as none (0%), low/moderate (1-29%), and high (30%+). Practice geographic region was included with options for West, South, Northeast, or Midwest.

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