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Organizational characteristics associated with sustained participation in internal quality improvement: Findings from two waves of a national sample of physician practices in the United States☆,☆☆

Vanessa B. Hurley [a,*], Amanda L. Brewster [b], Matthew J. DePuccio [c], Dorothy Y. Hung [d], A. James O'Malley [e], Karen E. Schifferdecker [f]

[a] Health Management and Policy, School of Health, Georgetown University, St. Mary's Hall 231, 3700 Reservoir Rd. NW, Washington, DC, 20007, United States
[b] Health Policy and Management, School of Public Health, University of California, Berkeley, 2121 Berkeley Way #5435, Berkeley, CA, 94720, United States
[c] Health Systems Management, College of Health Sciences, Rush University, 1700 W. Van Buren St., 126B TOB, Chicago, IL, 60612, United States
[d] Center for Lean Engagement and Research, Health Policy and Management, School of Public Health, University of California, Berkeley, 2121 Berkeley Way, Berkeley, CA, 94720, United States
[e] Department of Biomedical Data Science and The Dartmouth Institute for Health Policy and Clinical Practice, Geisel School of Medicine, Dartmouth College, 1 Medical Center Dr., NH, 03766, Lebanon
[f] The Dartmouth Institute for Health Policy and Clinical Practice, Geisel School of Medicine, Dartmouth College, 1 Medical Center Dr., NH, 03766, Lebanon

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ABSTRACT

Background and purpose: Engagement in internal quality improvement (QI) within physician practices is a key avenue by which to deliver evidence-based and patient-centered care, but it can be difficult to sustain such engagement. Consequently, research is needed that identifies organizational factors associated with sustained internal QI. We utilized two waves of a national survey of physician practices to explore whether organizational innovation characteristics including organizational culture, health information technology (HIT) capacity, and Accountable Care Organization (ACO) affiliation distinguish physician practices that sustain their engagement in internal QI from those that do not.

Methods: We linked two waves of the National Survey of Healthcare Organizations and Systems (NSHOS) fielded between 2017-2018 and 2022–2023 among physician practices in the United States to assess organizational characteristics associated with sustained engagement in QI (n = 714 practices). Our final regression models incorporate survey and nonresponse weights and control for practice size and ownership.

Results: We found that higher innovative culture scores were associated with almost three times the odds of sustained QI (OR = 2.91, $p < 0.001$). Although high HIT capacity was also associated with greater odds of sustained versus non-sustained QI across both survey waves, this finding was not statistically significant (OR = 1.11, $p > 0.05$). We did not find statistically significant support for our final hypothesis that ACO affiliation (whether commercial, Medicare, or Medicaid) was associated with sustained internal QI (OR = 1.26, $p > 0.05$).

Conclusions: Our study is the first to our knowledge to underscore the critical importance of innovative organizational culture to sustaining internal QI among physician practices. Although ACO affiliation may signal willingness to participate in QI as a means to advance evidence- and value-based care and HIT capacity may facilitate improvement activities, these characteristics may not assure sustained internal QI engagement without an organizational culture aligned with QI.

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* Corresponding author.
E-mail address: vh151@georgetown.edu (V.B. Hurley).

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Practice implications: Policies that advance organizational capacity to develop a learning-oriented innovative culture could enable sustained QI engagement at the physician practice level.

1. Introduction

Engagement in quality improvement (QI) within health care organizations is a key avenue by which to deliver evidence-based and patient-centered care (Hempel et al., 2022). Although many definitions for QI have proliferated across the health care literature, it is most broadly considered to be a systematic effort to improve core features of health care delivery with special emphasis upon "iterative change, learning, and adaptation" through discrete projects frequently led by frontline staff (Backhouse and Ogunlayi, 2020, p. 7). Among physician practices, QI initiatives have proved essential to implementing care management processes that improve blood pressure and A1c levels in diabetes care (Peterson et al., 2023), increasing the frequency of pain assessments and depression screening for patients experiencing chronic pain (Wubu et al., 2017), and reducing the likelihood of referrals for low-value cardiac screening tests (Tao et al., 2023).

While the tools that can be utilized to carry out QI projects in these settings are diverse, prominent QI frameworks (including the Institute for Healthcare Improvement and LEAN) seek to foster a culture of continuous rather than sporadic improvement and innovation (Eide et al., 2022; van Elp et al., 2022). The ultimate goal of such projects is to enact changes that produce positive patient outcomes and in turn contribute to improved clinical performance (Batalden and Davidoff, 2007; Hespe et al., 2018). Notably, sustained engagement in QI is one pathway by which physician practices might begin to transform themselves into learning health systems which engage in iterative cycles of data collection and analysis to inform both institutional knowledge and evidence-based clinical practice (Borycki and Kushniruk, 2022; P. McDonald et al., 2024).

Even though many physician practices engage in QI projects, a much smaller number have been capable of sustaining such engagement over time (Taylor et al., 2014) despite evidence that sustained QI efforts are associated with both cost savings and improved clinical outcomes in health care settings (Shieh et al., 2015). Consequently, there is a need for research that identifies potential organizational factors that are associated with successful long-term engagement in QI. Distinguishing between the organizational characteristics associated with QI sustainment versus non-sustainment may provide us with unique insight to differentiate between physician practices that possess versus lack the capability to longitudinally sustain learning.

Organizational context (especially organization-level characteristics) has been shown to be a critical factor in understanding the extent to which QI is utilized across health care settings. A robust literature base demonstrates the important role of context in the form of organizational characteristics such as size, system affiliation, and maturing of health information technology (HIT) systems for QI efforts, especially at the physician practice level (Goldberg et al., 2013; Hurley et al., 2019; Rotenstein et al., 2023). Examining which organizational characteristics are associated with physician practice engagement in QI over longer time horizons may provide insight into which characteristics play an important role not only in encouraging the uptake of QI, but also in sustaining it.

We utilized two waves of the National Survey of Healthcare Organizations and Systems (NSHOS I & II), a nationally representative assessment of physician practices and health systems in the U.S. fielded between 2017-2018 and 2022–2023, to explore whether organizational characteristics including organizational culture, health information technology (HIT) capacity, and Accountable Care Organization (ACO) affiliation distinguish physician practices that sustain internal QI—that is, longitudinally utilize information on clinical quality, preventive services, and patient engagement to drive internal quality improvement—from those that do not. In an effort to address the need for research examining the use of internal QI across time - particularly in the physician practice setting which has been under-studied compared with hospital or health system settings - we leverage the sample of physician practices that are represented across both survey waves. In doing so, this study contributes to the knowledge base concerning the organizational factors contributing to sustained quality improvement across physician practice settings.

2. Theory

Organizational characteristics are inextricably linked to multiple facets of organizational change including knowledge dissemination and implementation of innovation (Kaplan et al., 2010). Engagement in quality improvement efforts represents an important source of knowledge and innovation advancement in clinical practice, especially in regard to elevating high quality patient care. Multiple conceptual frameworks pertaining to organizational change (Pearson et al., 2005; Wagner et al., 2001) and continuous quality improvement (Brennan et al., 2012) emphasize the critical importance of supportive operational structures, relational linkages between clinical team members, and information processing capacity to enable long-term investments in efforts to improve quality (K. McDonald et al., 2007). Models such as the Dynamic Sustainability Framework (DSF) - which explicitly focuses upon sustained engagement in improvement and innovation efforts - have also called attention to characteristics including culture and resource availability as essential to long-term sustainment of activities including quality improvement (Chambers et al., 2013). Collectively, these conceptual and theoretical models provide a helpful impetus and orientation for studying organizational characteristics associated with sustained QI participation within physician practice settings. However, to our knowledge, prior studies have not examined these relationships empirically in the context of physician practices.

Sustainability of QI processes among other clinical practice innovations has been highlighted as a critical yet understudied topic (Glasgow and Chambers, 2012). The concept of sustainment is of particular interest within the implementation science (IS) community, where the translational processes that bridge adoption and integration of improvement-focused efforts (to include the uptake of evidence-based practices) are at the heart of recent study (Shelton et al., 2018). From an IS perspective, sustainability – which is defined as the ongoing use of program or practice elements that enable the sustained achievement of key program goals – is inextricably linked to context since "fit" with existing organizational capabilities and priorities is understood to have significant bearing on the longevity of a practice or intervention in a given setting (Chambers et al., 2013). Since there is often a "latency period" between implementation of QI methods and the realization of improved process or clinical outcomes, understanding organizational contributors to sustained QI engagement is particularly critical to facilitate long-term impact (Scheirer and Dearing, 2011).

2.1. Organizational culture

From a delivery system design perspective, engagement in QI requires the coordinated actions of multiple organizational participants. Organizational culture – defined as the collection of values and norms shared across individuals within specific organizational settings – has been shown to impact (in negative or positive ways) an organization's ability to innovate and change (Davies et al., 2000; Sinkowitz-Cochran

et al., 2012). While some organizational cultures tend to embrace the status quo, other cultures emphasize (and encourage through concrete processes and policies supported by leadership) the generation of novel ideas to guide improvement and change. Cultures that embrace innovation can support the "fit" of QI processes with both explicit and implicit organizational values which promote QI sustainment (Klein and Sorra, 1996).

Engagement in QI processes and an organizational culture of innovation and learning could reinforce one another, with organizational culture fostering the uptake and sustainment of QI processes, and routine use of QI processes in turn reinforcing norms and values around innovation. In the context of QI efforts, recent work has highlighted the importance of an organizational culture that values innovation and collaboration for successful implementation of obstetric emergency safety bundles (Walker et al., 2020). Elsewhere, a study of organizational culture change in hospitals found that those hospitals with the most improvement in psychological safety and learning culture also reported the greatest uptake of evidence-based practices and reductions in risk-standardized mortality rates among patients with acute myocardial infarction (Curry et al., 2018). Given these insights, our first hypothesis is as follows:

Physician practices reporting highly innovative organizational culture will be more likely to engage in sustained internal quality improvement compared with practices reporting less innovative organizational culture (Hypothesis 1).

2.2. Health information technology (HIT) capacity

The value of clinical information systems for facilitating engagement in QI has been well-documented (Deo et al., 2009; Restuccia et al., 2014; Tolf et al., 2020). Most QI projects necessitate the use of data and feedback to longitudinally examine performance and adjust processes to improve performance. As part of the broader clinical information infrastructure, HIT enables data storage and analysis via the use of electronic health records (EHRs), clinical registries and centralized health information exchange (Higgins et al., 2015). These tools are leveraged in the creation of feedback loops that inform learning among frontline staff engaged in various QI efforts such that changes to practice can be implemented and continuously evaluated (Taylor et al., 2014).

One recent study found that community health centers with HIT capabilities meeting meaningful use requirements as set by the Centers for Medicare and Medicaid Meaningful Use program were better able to facilitate engagement in QI as it related to chronic care management processes (Bailieu et al., 2020). A review of systematic reviews evaluating key contextual factors explaining success of QI initiatives across hospitals found that both the availability and functionality of HIT to support data collection was critical to differentiating between those QI efforts that were effective compared with those that failed (Kringos et al., 2015). Collectively, these studies demonstrate that HIT capacity is associated with robust and comprehensive performance measurement and, by extension, should have the ability to strengthen patient care quality and delivery through thoughtful analysis of data and process adjustments over time. Our second hypothesis posits the following:

Physician practices with greater HIT capacity will be more likely to engage in sustained internal quality improvement compared with practices reporting lower HIT capacity (Hypothesis 2).

2.3. Accountable Care Organization (ACO) affiliation

A growing number of physician practices in the U.S. are affiliated with larger health care systems and networks belonging to Accountable Care Organizations (ACOs). The passage of the 2012 Affordable Care Act led to the establishment of Medicare ACOs, but they have since expanded to encompass both Medicaid and commercial payer versions (Rosenthal et al., 2019). In 2022, 438 Medicare ACOs served an estimated population of nearly 11 million beneficiaries (Spivack et al., 2023). ACOs place a distinct emphasis upon preventive care and care coordination to ensure the provision of high-quality population health while reducing costs via global budgets and pay for performance linked to the attainment of specific quality benchmarks (Bleser et al., 2020). As a result of these payment arrangements, physician practices within such organizational structures have inherent motivation to maintain improvement initiatives that elevate the quality of patient-centered care. Moreover, physician practices belonging to ACOs may have access to financial and infrastructure support to enable participation in QI efforts that may not exist to the same extent among practices without such affiliation (Hurley et al., 2019).

Prior research has shown that physician practices belonging to ACO systems demonstrate a tendency to engage in both external and internal quality improvement efforts (Gowda et al., 2019; Hurley et al., 2019). Such an orientation may position these practices to more readily achieve quality benchmarks while constraining overall health care costs in order to qualify for performance bonuses; for example, one study of a nationally representative sample of physician practices showed that ACO affiliation was associated with greater odds of participation in quality improvement collaboratives when compared with non-ACO affiliated practices (Hurley et al., 2019). Elsewhere, ACO-affiliated practices were found to be "systematically more likely than other practices to use clinician-level performance data for feedback, quality improvement, and compensation" (Rosenthal et al., 2019, p. 1220). Given these findings, as well as the financial incentives for ACO-affiliated practices to improve the quality of care via quality improvement efforts, our final hypothesis is as follows:

Practices that are affiliated with Medicare, Medicaid or commercial ACOs will be more likely to engage in sustained internal quality improvement compared with practices not reporting an ACO affiliation (Hypothesis 3).

3. Method

3.1. Study design and sample

We leverage data from two waves of the National Survey of Healthcare Organizations and Systems (NSHOS) fielded between 2017 and 2018 (NSHOS I - baseline) and 2022–2023 (NSHOS II – follow-up) to assess baseline organizational characteristics associated with sustained physician practice engagement in QI at follow-up. The NSHOS is a nationally representative survey assessing a variety of organizational characteristics across physician practices, hospitals, and health systems at large. Physician practices included in NSHOS are drawn from the OneKey database produced by IQVIA. Additional detail about the sampling design for NSHOS has been published elsewhere (O'Malley and Park, 2020). For both survey waves, a practice leader was asked to complete the survey. The comprehensive set of questions included in NSHOS is partially derived from the questionnaire developed for the National Study of Physician Organizations (fielded three times over 15 years), but also includes questions that assess topics ranging from staffing arrangements, social services linkages, internal quality improvement efforts and practice-level response to the COVID-19 pandemic (the latter of which is assessed in NSHOS II only) (Miller-Rosales et al., 2023). For this analysis, we link survey data collected across NSHOS waves I and II at the physician practice level (Wave I: N = 2333; response rate = 47%; Wave II: N = 1540; response rate = 38%). Our final analytic sample includes 714 practices responding to both surveys.

3.2. Dependent variable

Both NSHOS I and NSHOS II include questions assessing the extent to which physician practices utilize information about individual clinician performance to guide internal quality improvement. More specifically, we leveraged the following three survey questions: "How does your practice use information about individual clinician performance

pertaining to 1. clinical quality, 2. preventive services (e.g. immunizations, screenings), and 3. patient experiences (e.g. patient satisfaction)]?" A range of responses were possible for each question, but we focus on the response "Used for internal quality improvement." Our dependent variable compared responses indicating use of information about clinical quality, preventive services, and patient experiences for internal quality improvement in both survey waves (response of "Yes" to all three questions in both NSHOS I and II, which we categorized as "QI sustainers"). Non-QI sustainers were defined as practices that either responded "Yes" to all three questions in NSHOS I and "No" to all three questions in NSHOS II or "No" to all three questions in both NSHOS I and II.

We limited our analyses to those practices that responded either 'Yes' or 'No" consistently to all three questions about use of clinical quality, preventive services, and patient experiences for internal QI in order to assess sustainability of the most robust QI engagement at the physician practice level (compared with non-sustainment). Thus, physician practices with mixed responses across these three questions (e.g. 'Yes' to use of information about preventive services but 'No' to use of information pertaining to clinical quality and patient experience) were not included in our analysis. Finally, we excluded practices that answered 'No' to all questions in NHSOS I but 'Yes' to all questions in NSHOS II as we considered these practices to be late adopters of internal QI rather than non-sustainers. Data collected at the individual clinician level has been leveraged elsewhere in evaluations of QI initiative engagement and outcomes (Auffenberg et al., 2017; Cohen et al., 2018; Kiefe et al., 2001).

3.3. Key independent variables

Culture of Innovation: We assessed whether a physician practice reported a culture of innovation via a 5-item scale that assessed how often the following happens within the practice.

1. Successful care delivery innovations are highly publicized within the practice;
2. Team members openly share patient care challenges and failures with each other;
3. There is protected time given to generate new ideas and innovations;
4. We encourage trying new ideas to see if they work; and
5. We consider ourselves to be the testing ground for new approaches to engage patients in their care.

Possible answer choices for each question were: Never, Sometimes, Often, or Always. We assigned values to answer choices as follows: Never = 0, Sometimes = 33.33, Often = 66.66, and Always = 100. Composite scale scores were obtained by calculating the mean of the 5 items. The possible score range for this scale was 0–100.

Health Information Technology Capacity: To measure advanced HIT capacity, we utilized a different 6-item scale to indicate whether the practice's health information system (including the EHR) allowed the following (with possible answer choices for each being "Yes" or "No").

1. Connectivity between practice HIT and hospital information systems;
2. Patients have electronic access to their medical records;
3. Patients can electronically comment on and/or input information to their medical records (such as Open Notes);
4. Physicians and patients to communicate with one another via email;
5. Physicians know whether their patients have filled their prescriptions; and
6. Advanced analytic systems such as predicting future utilization, data mining, etc.

To calculate composite scale scores, we assigned values of No = 0, Yes = 100. Composite scale scores were obtained by calculating the mean of the 6 items.

Both the culture of innovation and HIT capacity scales were created by researchers who have used NSHOS survey data and utilized these scales in analyses of multiple published studies (Brewster et al., 2020; Frehn et al., 2022; Miller-Rosales et al., 2023; Rodriguez et al., 2022). Cronbach's alpha statistics calculated for each scale show internal consistency greater than 0.6 for both (0.65 for the HIT capacity scale and 0.72 for the culture scale).

ACO Affiliation: Finally, we utilized one dichotomous variable to capture current practice participation in any of the following three ACO types: Medicare, Medicaid, or Commercial.

3.4. Covariates

Our final statistical models controlled for other baseline practice-level characteristics that can be associated with engagement in internal QI including practice size and ownership (both of which were derived from IQVIA OneKey variables). Practice size is represented by a categorical variable assessing the number of physicians working within the practice: solo (1 physician), small (2–9 physicians), medium (10–20 physicians) or large (21+ physicians) while the ownership variable encompasses the following categories: independently owned, larger physician group, hospital, health care system, or Federally Qualified Health Center (FQHC). Notably, the categories included in the ownership variable were mutually exclusive. All key independent variables and covariates included in the regression models are drawn from Wave I survey data.

3.5. Statistical analyses

We examined changes over the two survey waves in physician practice internal quality improvement engagement and other variables of interest using t-tests and chi-square tests. Analyses incorporated both survey and nonresponse weights. Multivariable logistic regression was used to estimate the association between key independent organizational variables measured at baseline (innovative culture, advanced HIT capacity, and ACO affiliation) with internal QI sustainment versus non-sustainment from baseline to follow-up waves of NSHOS. Our final statistical models controlled for practice size and ownership. As a secondary analysis to explore whether variation across ACO types has bearing upon our outcome of internal QI sustainment, we also conducted a multivariable logistic regression with three binary variables to represent each ACO affiliation (i.e. Medicare, Medicaid, and commercial). Finally, we performed a test of combined significance across our three key independent variables to assess whether there was an overall significant association between innovative culture, advanced HIT capacity, and ACO affiliation with sustained internal QI. This latter test estimates whether there is an overall statistically significant impact of all three coefficients upon the dependent variable of interest against the null hypothesis that all three coefficients equal 0. All analyses were carried out using Stata software (STATA version 17.0, College Station, TX, USA).

4. Results

Among the 714 physician practices responding to both NSHOS survey waves, 396 reported using information about clinical quality, preventive care, and patient experience for internal QI in Wave I while 318 practices did not. Of those 396 practices reporting use of clinical quality, preventive care, and patient experience for internal QI in Wave I, only 223 (31.2%) sustained such use into Wave 2 (meaning that 173 practices (24.2%) only reported internal QI engagement in Wave 1 but not Wave 2). A total of 491 physician practices (68.8%) were non-sustainers (318 reporting no use of information about clinical quality, preventive care, and patient experience for internal QI in Wave 1 and Wave 2 alongside the 173 practices only reporting such use in Wave 1 but not Wave 2). Table 1 provides detail as to the distribution of QI sustainers vs. non-sustainers across survey waves.

Table 1
Distribution of Physician Practices Categorized as QI Sustainers vs. Non-QI Sustainers Across NSHOS Survey Waves.

	Survey Wave 1	Survey Wave 2	Count of practices	% of practices	Categorized as:
Physician Practices Report Use of Clinical Quality, Preventive Care, and Patient Experience for Internal QI	Yes	Yes	223	31.2%	QI sustainers
	Yes	No	173	24.2%	Non-QI sustainers
	No	No	318	44.6%	
Total			**714**	**100%**	

Descriptive statistics for the full set of independent variables are reported for both sustainer practices as well as non-sustainers by survey wave (Table 2). We find that mean innovative organizational culture scores are higher for sustainers compared with non-sustainers in both NSHOS 1 and II (0.61 vs 0.48 in NSHSOS I and 0.49 vs 0.37 in NSHOS II). The mean advanced HIT capacity scores (as measured by our composite index variable) were on average higher in NSHOS II compared with NSHOS I, mirroring the same trend as for innovative culture with scores being higher for sustainers compared with non-sustainers (3.69 vs 3.23 in NSHOS I and 4.46 vs 3.8 in NSHOS II). Sustainer practices reported comparatively greater ACO affiliation compared with non-sustainer practices across all three affiliation types and in both survey waves. For example, in NSHOS I, 42.6% of sustainer practices reported affiliation with a commercial ACO whereas 39.3% of non-sustainers reported the same. In NSHOS II, 59.6% of sustainer practices reported a commercial ACO affiliation compared with 51.7% of non-sustainers.

Table 2
Descriptive statistics for linked sample of physician practices responding to both NSHOS I & II survey waves by sustainer versus non-sustainer status (n = 714).

Variable N(%)	NSHOS I		NSHOS II	
	Sustainers	Non-Sustainers	Sustainers	Non-Sustainers
Innovative Organizational Culture (Mean, Standard Error)	0.61 (0.02)	0.48 (0.02)	0.49 (0.03)	0.37 (0.02)
Advanced HIT Infrastructure (Mean, Standard Error)	3.69 (0.11)	3.23 (0.07)	4.46 (0.09)	3.8 (0.07)
Medicare ACO	64 (28.7%)	134 (27.3%)	157 (70.4%)	318 (64.8%)
Medicaid ACO	109 (48.9%)	187 (38.1%)	105 (47.1%)	188 (38.3%)
Commercial ACO	95 (42.6%)	193 (39.3%)	133 (59.6%)	254 (51.7%)
Practice Size				
Solo	5 (2.2%)	9 (1.8%)	6 (2.7%)	12 (2.5%)
Small (2–9 physicians)	146 (65.5%)	365 (74.5%)	143 (64.4%)	357 (72.9%)
Medium (10–20 physicians)	37 (16.6%)	72 (14.7%)	35 (15.8%)	72 (14.7%)
Large (21+ physicians)	35 (15.7%)	44 (9%)	38 (17.1%)	49 (10%)
Ownership				
Independently Owned	65 (29.2%)	171 (34.8%)	48 (21.5%)	147 (30%)
Larger Physician Group	38 (17.0%)	67 (13.7%)	32 (14.4%)	53 (10.8%)
Hospital	19 (8.5%)	65 (13.2%)	12 (5.4%)	30 (6.1%)
Healthcare System	81 (36.3%)	158 (32.2%)	111 (49.8%)	229 (46.6%)
FQHC	20 (9.0%)	30 (6.1%)	20 (9%)	32 (6.5%)

Results of the primary multivariate logistic regression analyses are reported in Table 3. Overall, our statistical model demonstrated strong support for our first hypothesis that high

innovative culture at baseline is associated with over twice the odds of internal QI sustainment at the physician practice level, and this finding is highly statistically significant (OR = 2.91, $p < 0.001$, confidence interval (CI): 1.72–4.94). Advanced HIT at baseline is associated with increased odds of internal QI sustainment but is not statistically significant (OR = 1.11, $p > 0.05$, CI: 0.99–1.25). Although ACO affiliation at baseline (whether commercial, Medicare, or Medicaid) is also associated with increased odds of sustaining internal QI, our finding is not statistically significant (OR = 1.26, $p > 0.05$, CI: 0.89–1.77). We also explore the use of an alternate specification for the ACO variable (i.e. three separate dichotomous variables for each ACO type as opposed to one variable to capture any ACO affiliation) as reported in Supplemental Table 1. For this analysis, the findings for innovative organizational culture and HIT capacity are unchanged, and the only positive finding across the three ACO variables is for Medicaid ACO affiliation (OR = 1.62, $p < 0.05$). Finally, we conducted a three degrees of freedom joint test of significance which showed that the three primary independent variables in this analysis (e.g. culture of innovation, HIT capacity, and ACO affiliation) have a cumulative significant association with sustained internal QI engagement ($X^2 = 26.64$, $p < 0.000$).

5. Discussion

The aim of this study was to understand the association between key organizational variables at baseline and subsequent sustainment of internal QI at the physician practice level, which has been understudied compared with the hospital and health system contexts. We find a strongly positive and statistically significant relationship between innovative organizational culture and the likelihood of sustained internal QI, thus supporting our first hypothesis. Culture has been linked to effective learning environments across the health services literature; where individuals are encouraged to challenge assumptions and experiment, they may be more likely to learn from others and more effectively advance and implement change (van Elp et al., 2022). QI is fundamentally about improving upon baseline performance through the application of cycles of evaluation often complemented by learning from others, so a culture that enables team members to share their ideas and experiment with new processes is likely one where QI is better able to be sustained. Moreover, an innovative organizational culture where testing new ideas, protecting time for learning and celebrating successful efforts are all embraced lends itself well to continuous improvement as distinct from sporadic or box-checking engagement in QI to meet externally imposed requirements.

Table 3
Multivariate logistic regression - role of innovative organizational culture, advanced HIT capacity, and ACO affiliation in sustained versus non-sustained internal quality improvement among physician practices (n = 714).

Organizational Characteristics	Odds Ratio	Confidence Interval
Innovative Culture	2.91***	1.72–4.94
Advanced HIT	1.11	0.99–1.25
Any ACO Affiliation[a]	1.26	0.89–1.77
Ownership *(reference = Independently Owned)*		
Larger Physician Group	1.33	0.80–2.24
Hospital	0.70	0.38–1.28
Healthcare System	1.13	0.74–1.75
FQHC	1.79	0.92–3.47
Practice Size *(reference = Solo)*		
Small (2–9 physicians)	0.74	0.23–2.32
Medium (10–20 physicians)	0.83	0.25–2.77
Large (21+ physicians)	1.30	0.38–4.45

***p < 0.001, **p < 0.005, *p < 0.05.

[a] Any ACO affiliation indicates participation in either a Medicare, Medicaid, or commercial ACO.

There is a robust literature base that demonstrates the important relationship between innovative culture and commitment to QI across health care settings including hospitals (Kringos et al., 2015) and long-term care facilities (Nieboer and Strating, 2012). Although some research has explored the dynamic between culture and QI in the context of physician practices, it has largely done so through cross-sectional studies (Deilkas et al., 2022; Lindner et al., 2019). These same studies demonstrate that innovative and learning-oriented cultures have positive relationships with the likelihood of engagement in a variety of QI efforts, both internal and external. Our findings contribute a relatively unexplored insight to this literature – namely, that innovative culture is critical not only to short-term engagement but also to the *sustainment* of internal QI in the physician practice setting.

We found a positive but not statistically significant relationship between advanced HIT capacity and sustained engagement in internal QI. HIT infrastructure has been widely acknowledged as supportive for QI activities across levels of the health care ecosystem (Bailieu et al., 2020; Higgins et al., 2015) as it enables both data aggregation and the ability to uncover trends in key outcomes of interest as they pertain to discrete improvement projects (Varley et al., 2020). Conversely, a lack of such infrastructure is considered an impediment to cultivating capacity for improvement activities (Varley et al., 2020). Additionally, data-driven QI is at the core of both performance-based payment reform and value-driven system transformation which many health care organizations are striving to embrace or sustain (Hemler et al., 2018).

The lack of a statistically significant finding for the role of advanced HIT capacity in sustained internal QI engagement may be attributable to a few possible explanations. First, it is possible that the HIT scale that we constructed based upon available questions from NSHOS I and II is, at best a proxy for the type of HIT capabilities that effectively support sustained internal QI efforts. Many of the response options for our HIT scale referenced IT connectivity, patient-provider communication and electronic patient notes. Although these functionalities have bearing upon physician practices' ability to utilize data for QI, they may only enable indirect assessments of such a relationship and thus may not fully speak to the true capabilities of physician practices' IT platforms or how they are utilized to provide real-time access to patient or physician data, identify data trends and patterns, or inform the development of dashboards to track performance measurement longitudinally (Cadel et al., 2022).

This may translate into our measure of HIT capacity having less specificity to our outcome of interest or being biased towards the null hypothesis due to attenuation from measurement error. Additionally, it may be that our HIT variable was more dynamic (i.e. subject to change within a practice over time) compared with a variable that is more difficult to change over time, such as organizational culture, which may also result in less robust findings. The emergence of the COVID-19 pandemic between NSHOS waves (and the necessity for physician practices to pivot operations to address this public health crisis) may also have had implications for investment and sustainment of internal QI processes that we are unable to control for. For example, we lacked data regarding physician practice engagement in COVID-19 recovery activities (e.g. providing testing or vaccination services) which may have led practices to dedicating less time to engaging in internal QI. Notably, quality measurement including care process and outcome data captured in EHRs alone may not comprehensively facilitate the implementation of QI activities (Liss et al., 2020). Factors such as the extent to which HIT capabilities enable frequent data collection and analysis and whether quality measures embedded within the EHR align with quality improvement and payment initiatives could shape the likelihood that physician practices will be motivated to use embedded technologies to support QI.

The extent to which ACO affiliation translates to sustained internal QI engagement among physician practices has largely been unexplored. Our analyses highlight a positive but not statistically significant relationship between ACO affiliation (whether commercial, Medicare, or Medicaid) and sustained internal QI. It may be the case that while ACO affiliation could signal a physician practice's willingness to engage in evidence-and value-based activities including QI, it may not be an assurance of sustained internal QI engagement in isolation of other critical factors. There are important nuances in both structural and incentive arrangements across ACO types that may have implications for the likelihood of ACO affiliation being associated with internal QI sustainment. The three ACO types included in our analysis – Medicare, Medicaid, and commercial – each vary in regards to the nature of their financial reimbursement and risk management models, physician performance management approaches and beneficiary assignments and needs (Spivack et al., 2023). These factors, when overlaid with other key differentiators such as whether an ACO is physician-led, hospital- or health system-led and the length of affiliation with an ACO may all have bearing upon the extent to which an affiliated physician practice both participates in internal (or external) QI activities and sustains such engagement. For example, one early study of the ACO landscape found that commercial ACOs reported greater use of disease monitoring data to guide QI activities, more training of clinicians in continuous QI methods, and higher overall engagement in quality improvement processes compared with both Medicare and Medicaid ACOs (Peiris et al., 2016).

Moreover, our secondary analysis exploring an alternate specification for ACO affiliation disaggregated by type (i.e. Medicare vs. Medicaid vs. commercial ACO affiliation) reveals that the coefficient for Medicaid ACO only was positive and statistically significant. This finding, however, should be interpreted with caution since the number of states in which Medicaid ACOs currently operate are relatively few in number; as of 2023, the Kaiser Family Foundation noted that only 11 states within the U.S. reported Medicaid ACOs (Kaiser Family Foundation, 2023). When considered alongside other factors mentioned previously (such as the distinction between physician-, hospital-, or health system-led ACOs), such a result highlights the need for future work that could confirm and further clarify our finding regarding Medicaid ACO status and sustained internal QI.

Notably, during the COVID-19 pandemic, many ACOs pivoted their QI teams to address emergent pandemic-specific challenges and the return to engagement in more typical activities (such as oversight of internal QI efforts) may not have occurred or may not have been fully captured by the second fielding of the NSHOS survey in 2022–2023 (Hung et al., 2022). Future research examining how internal QI activities of physician practices are tied to specific ACO incentives that operate under a shared savings program may also provide valuable information about how ACOs (as models of care that continuously measure against national quality benchmarks) facilitate sustained internal QI.

Finally, the finding of our joint test of significance showed that the three variables of innovative organizational culture, advanced HIT capacity, and ACO affiliation have a significant combined impact upon internal QI sustainability. It may be that these three characteristics in concert with one another provide the strongest impetus for internal QI engagement through a combination of internal motivation (culture), capacity (HIT), and external structure (ACO affiliation). Such a possibility underscores the value of future work that examines through both quantitative and qualitative methods how physician practices with these three characteristics are encouraged to engage in and sustain internal QI processes.

5.1. Limitations

There are a few limitations to our study. First, respondents may have differed from non-respondents, but we employ sampling and nonresponse weights in our regression analyses to attempt to address this issue. Secondly, NSHOS does not specify what qualifies as a QI activity, allowing for broad interpretation across practices in what they considered to be internal quality improvement efforts. However, our principal interest was to understand sustainment of QI (in whatever form it may

be defined by practices) across both survey waves. A third limitation is that the surveys were completed by a single leader within each practice who may have differed across survey waves, may not have been well-versed in every aspect of practice operations and improvement, or who may overstate practice capabilities. Finally, we acknowledge that the causal direction of the relationship between ACO affiliation and sustained internal QI could be bidirectional (e.g. physician practices belonging to ACOs may be more likely to sustain internal QI engagement, but practices that sustain internal QI may also be more likely to participate in and remain affiliated with an ACO).

5.2. Theoretical and practical implications

Our study has important implications for examining the role of an innovative organizational culture in the sustainment of internal QI. Specifically, our research is unique in that it accounted for and modeled the dynamic relationship between innovative culture with internal QI across two survey waves, thereby providing stronger evidence than cross-sectional findings regarding its role in sustaining internal QI engagement. Considering our findings alongside existing frameworks for QI (e.g., Six Sigma, Plan-Do-Study-Act (PDSA) cycles) to enhance patient care and organizational performance, it may be especially important for health care leaders and practitioners to have a more nuanced understanding of how organizational culture facilitates the implementation of these frameworks to encourage practice improvement.

The organizational context surrounding the adoption of internal QI frameworks (e.g., how information is shared, the amount of dedicated time for employees to explore and test new ways of delivering care, and whether employees feel psychologically safe to voice opinions) could have implications for physician practices' capabilities (and motivation) to better align their actions with sustaining internal QI efforts. When internal QI initiatives are sustained, this may reinforce positive behaviors and cultural norms that echo a learning health system perspective by placing an active emphasis upon identifying areas for improvement, regularly assessing data, and sharing results among staff to enable learning both from failures as well as successes (Reid et al., 2024). The interplay between organizational culture and internal QI may also nurture a feedback loop that better positions physician practices to sustain improvement and successfully bridge research with evidence-based practice. Such an insight into an organizational characteristic associated with prioritizing and sustaining QI might prove to be a useful starting point for efforts to identify physician practices continuously (as opposed to sporadically) investing in improvement efforts that cultivate a learning system orientation.

In light of our findings, it may be beneficial for physician practices to explore the utility of organizational policies to support the sustainment of QI initiatives. For example, structures and governance to support ongoing evaluation of care processes and improvement have been identified by the National Academies of Medicine as a domain of learning health systems–that is, a system that "consistently delivers reliable performance and constantly improves, systematically and seamlessly, with each care experience" (Smith et al., 2012, p. 1637). However, few studies have looked at how physician practices can support a culture of continuous learning and innovation (Dammery et al., 2023; Fisher et al., 2024). Ongoing work in this area will be important for understanding which policies and leadership or governance structures can facilitate a culture of collaboration, ongoing learning, and practice innovation.

6. Conclusion

Our study illustrates the critical importance of an innovative organizational culture in sustaining internal QI at the physician practice level. Although ACO affiliation may signal willingness to participate in QI as a means to advance evidence- and value-based care and HIT capacity may facilitate improvement activities, we find that such characteristics may not assure sustained internal QI engagement without an organizational culture aligned with QI. Policies to advance organizational capacity to develop a learning-oriented innovative culture could in turn enable longitudinal internal QI sustainment.

CRediT authorship contribution statement

Vanessa B. Hurley: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Amanda L. Brewster:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Matthew J. DePuccio:** Writing – review & editing, Writing – original draft, Validation, Investigation, Formal analysis, Conceptualization. **Dorothy Y. Hung:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **A. James O'Malley:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis, Data curation. **Karen E. Schifferdecker:** Writing – review & editing, Resources, Project administration, Methodology, Funding acquisition, Data curation.

Ethics statement

We confirm that this study was reviewed and approved by the University of California, Berkeley Committee for the Protection of Human Subjects.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2025.117826.

Data availability

The authors do not have permission to share data.

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