

Digital Innovation and Patient Engagement: Strategic Drivers of Health System Performance in Value-Based Healthcare

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Abstract:

Background: Value-based healthcare rewards the outcomes a system achieves for each unit of cost rather than the volume of care it delivers. Digital innovation and patient engagement are often proposed as the main routes to that goal. However, little is known about how the two operate together inside provider organizations, or which internal capabilities decide whether they pay off, particularly in emerging health systems such as India's.

Methods: We conducted a cross-sectional survey of 385 healthcare managers, hospital administrators, digital health officers, and senior clinicians drawn from 42 healthcare organizations in urban and semi-urban India. Organizations were selected through stratified sampling by ownership type, bed size, and region. A 47-item questionnaire using five-point Likert scales measured Digital Innovation, Patient Engagement, Organizational Integration, Strategic Management Orientation, and Health System Performance. The hypotheses were tested with partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4.0, and SPSS 27 was used for descriptive and reliability analyses.

Results: The measurement model showed satisfactory reliability and convergent and discriminant validity. Digital innovation ($\beta = 0.412$) and patient engagement ($\beta = 0.387$) each had a significant positive effect on health system performance (both $p < .001$), and the model explained 61.4% of its variance. Organizational integration partially mediated the digital innovation–performance relationship (indirect effect = 0.178) and fully mediated the patient engagement–performance relationship (indirect effect = 0.201). Strategic management orientation positively moderated the effect of digital innovation on performance ($\beta = 0.193$, $p < .01$), such that a given level of digital capability yielded larger performance gains in more strategically strong organizations.

Conclusion: Digital innovation and patient engagement improve health system performance primarily when organizations embed them into clinical and operational processes and, for digital innovation, when strategic management capability is strong. Technology purchases and engagement programs pursued in isolation are therefore unlikely to deliver proportionate value. Managers and policymakers in India and comparable settings should treat organizational integration and strategic management orientation as prerequisites of value-based healthcare improvement rather than as by-products of it.

Keywords: digital innovation; patient engagement; health system performance; value-based healthcare; organizational integration; strategic management orientation; PLS-SEM; India

Introduction

Healthcare organizations across all regions are being asked to demonstrate what their spending actually buys. Value-based healthcare defines value as the health outcomes achieved per unit of cost and moves the basis of competition from the volume of services provided to the results delivered to patients (Porter & Teisberg, 2006; Porter, 2010). Over the same period, hospitals and health systems have invested heavily in electronic records, telemedicine, decision-support tools, and patient-facing applications, expecting these to improve quality and reduce costs. The evidence that such investment reliably improves performance is, however, uneven. Reviews of health information technology report mostly favorable conclusions but wide variation across settings and technologies (Buntin et al., 2011), and large-scale studies of hospital adoption have found no consistent short-run gains in cost or quality (Agha, 2014). That pattern suggests a management problem more than a technology

problem: the same tool can lift performance in one organization and leave another unchanged, depending on how well it is woven into everyday work (Cresswell & Sheik, 2013; Greenhalgh et al., 2017).

Patient engagement is the second lever commonly associated with value. Patients who are knowledgeable, skilled, and confident in managing their own care tend to show healthier behaviors, better clinical indicators, and lower costs (Greene & Hibbard, 2012; Hibbard & Greene, 2013), and engagement is increasingly understood as something that organizations can design for at the level of direct care, organizational policy, and governance (Carman et al., 2013). In value-based models, it is part of the care delivery design itself rather than a courtesy added to it (Porter & Lee, 2013). Digital innovation and patient engagement are plainly related, since portals, mobile applications, and remote-monitoring tools are among the principal channels through which engagement is pursued. Even so, the two have largely been studied as separate performance levers, and we know little about how they combine at the organizational level.

India is a particularly informative setting for this question. The country is building national digital health infrastructure at speed, most visibly through the Ayushman Bharat Digital Mission (National Health Authority, n.d.). At the same time, its provider landscape remains highly fragmented across public, private not-for-profit, and private for-profit organizations that differ greatly in scale, resources, and digital maturity. In such systems, the quality of care is often constrained less by the availability of services than by how reliably they are organized and delivered (Kruk et al., 2018). Evidence on the organizational conditions under which digital and engagement investments translate into performance is correspondingly thin, because high-income health systems dominate the empirical base.

Existing theory explains parts of the puzzle but not the whole. The Technology Acceptance Model and its successor, the Unified Theory of Acceptance and Use of Technology, explain why individuals adopt digital tools but say little about how adoption affects system-level performance (Davis, 1989; Venkatesh et al., 2003). The Resource-Based View and the dynamic capabilities perspective explain why resources produce advantage only when paired with complementary organizational capabilities (Barney, 1991; Teece et al., 1997), but they are seldom applied to digital and engagement assets in healthcare. Value-based healthcare theory specifies the outcome that matters, yet it does not, by itself, identify the organizational conditions that translate investments into that outcome (Porter & Lee, 2013; Teisberg et al., 2020). No study that we are aware of combines these strands in a single empirical model.

This study addresses that gap. Drawing on the three perspectives above, we test a model in which digital innovation and patient engagement are expected to improve health system performance directly, organizational integration is expected to be the mechanism through which both exert their influence, and strategic management orientation is expected to determine how much performance an organization extracts from its digital capability. The model is tested on survey data from 385 respondents across 42 healthcare organizations in urban and semi-urban India, using PLS-SEM to estimate direct, mediated, and moderated paths simultaneously. The study contributes in three ways. Theoretically, it links technology adoption, resource-based, and value-based healthcare perspectives within a single testable framework. Empirically, it provides evidence from an emerging health system on the conditions governing the returns to digital and engagement investments. Practically, it identifies the organizational capabilities that managers and policymakers need to build alongside, and not after, technology and engagement programs. The remainder of the paper reviews the literature and develops the hypotheses, describes the methodology, reports the findings, discusses their implications and limitations, and concludes.

Review of Literature

Value-based healthcare as the performance frame

Value-based healthcare reframes the purpose of a health system around the outcomes that matter to patients relative to the cost of achieving them (Porter, 2010). Its strategic agenda, as set out by Porter and Lee (2013), includes organizing care around patient conditions, measuring outcomes and costs, integrating care across the treatment cycle, and building an information technology platform to support these changes. Teisberg et al. (2020) similarly describe value-based care as a strategic transformation in which technology is an enabler and

organizational design determines the result. This framing matters for the present study in two ways. It identifies health system performance, understood as effectiveness, efficiency, patient-centeredness, safety, and equity, as the outcome of interest, and it implies that digital innovation and patient engagement should be evaluated by what they contribute to that outcome rather than by how widely they are deployed.

Digital innovation and health system performance

Digital innovation refers to the creation of new ways of delivering and organizing care by combining digital technologies with existing clinical and operational resources (Fichman et al., 2014; Kohli & Melville, 2019). In healthcare, it spans electronic health records, clinical decision support, telemedicine, interoperable data platforms, and, more recently, artificial-intelligence-enabled tools. The performance evidence is substantial but heterogeneous. Systematic reviews generally report favorable effects of health information technology on quality, efficiency, and safety, with the clearest gains from decision-support applications (Buntin et al., 2011), while studies of hospital-level adoption show that benefits are not automatic and may take time to appear (Agha, 2014). The implementation literature explains much of this variation by pointing to the organizational context into which a technology is introduced (Cresswell & Sheik, 2013; Greenhalgh et al., 2017). Where digital capability is broad, interoperable, and used in routine care, organizations can monitor outcomes, coordinate across units, and reduce avoidable variation, all of which are central to value-based performance. We therefore expect digital innovation to be positively associated with health system performance.

H1: Digital innovation positively affects health system performance.

Patient engagement and health system performance

Patient engagement is the active participation of patients in decisions and actions concerning their health and care. It has been conceptualized at the individual level through patient activation, meaning the knowledge, skill, and confidence to manage one's own health (Hibbard et al., 2004), and through the psychological stages of engagement that patients move through as they come to terms with illness (Graffigna et al., 2017). At the organizational level, Carman et al. (2013) describe a continuum from consultation to partnership and shared leadership that extends from the clinical encounter to institutional governance. Higher activation has been linked to healthier behaviors, better clinical indicators, and lower costs (Greene & Hibbard, 2012; Hibbard & Greene, 2013). Because value-based healthcare depends on adherence, self-management, and responsiveness to patient priorities, organizations that engage their patients more effectively should achieve more favorable outcomes at a given cost (Porter & Lee, 2013). We therefore expect patient engagement to be positively associated with health system performance.

H2: Patient engagement positively affects health system performance.

Organizational integration as a mediating mechanism

The Resource-Based View holds that a resource confers advantage when combined with complementary capabilities that enable its effective deployment (Barney, 1991). The dynamic capabilities perspective emphasizes the ability to integrate, build, and reconfigure competencies as conditions change (Teece et al., 1997). In healthcare, the corresponding capability is organizational integration, defined here as the extent to which digital tools, clinical protocols, care teams, and engagement activities are aligned into a coherent care process. Implementation research consistently shows that technology yields little unless it is accommodated by changes in workflow, roles, and routines (Cresswell & Sheik, 2013; Greenhalgh et al., 2017), and the value-based care literature places integrated care delivery alongside information technology as a core component of the model (Porter & Lee, 2013; Teisberg et al., 2020). The same logic applies to engagement. An engagement initiative that is disconnected from clinical pathways, records, and follow-up processes can raise patient interest without changing outcomes. We therefore expect integration to carry part or all of the effect of both digital innovation and patient engagement on performance.

H3: Organizational integration mediates the relationship between digital innovation and health system performance.

H4: Organizational integration mediates the relationship between patient engagement and health system performance.

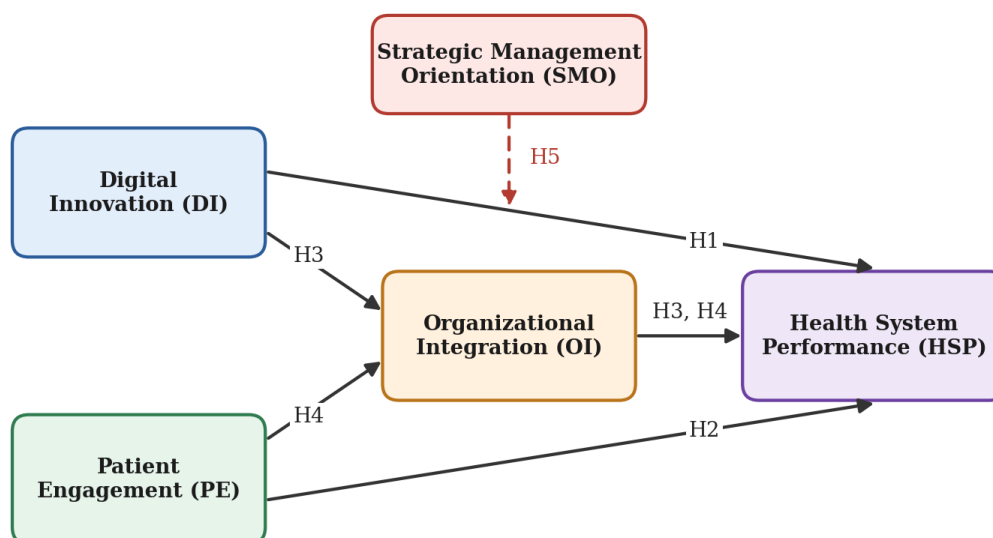
Strategic management orientation as a boundary condition

Strategic management orientation reflects the extent to which an organization proactively formulates strategy, aligns resources with strategic priorities, and monitors progress against those priorities. Organizations with this orientation are better placed to sense where digital capabilities can create value, commit complementary resources, and reconfigure processes accordingly (Teece et al., 1997). Resource-based reasoning leads to the same expectation: valuable resources produce superior performance only when management can deploy them deliberately (Barney, 1991). Digital innovation is especially dependent on this capability because it usually requires investment, coordination across professional groups, and sustained leadership attention. We therefore expect the performance return on digital innovation to be greater where strategic management orientation is stronger.

H5: Strategic management orientation positively moderates the relationship between digital innovation and health system performance.

Research gaps and conceptual model

Three gaps emerge from this review. First, technology adoption, resource-based, and value-based healthcare perspectives have developed in parallel, and few studies integrate them into a single testable framework. Second, digital innovation and patient engagement are usually examined as separate levers, which obscures the organizational mechanism that may connect them to performance. Third, evidence from emerging health systems on these questions is limited. Figure 1 presents the model that responds to these gaps. Digital innovation and patient engagement are specified as predictors of health system performance; organizational integration mediates both relationships, and strategic management orientation moderates the effect of digital innovation on performance.



Solid arrows: hypothesized structural paths. Dashed arrow: moderating effect of SMO on the DI → HSP path.

Figure 1. Conceptual model of digital innovation, patient engagement, and health system performance

Note. DI = Digital Innovation; PE = Patient Engagement; OI = Organizational Integration; SMO = Strategic Management Orientation; HSP = Health System Performance.

Research Methodology

Research design

The study used a cross-sectional, explanatory quantitative design grounded in a positivist orientation, in which constructs are treated as measurable, and their relationships are evaluated through statistical hypothesis testing (Saunders et al., 2019). A cross-sectional survey suited the research aim, which was to compare relationships across a diverse set of organizations at a single point in time rather than to track change within organizations. The consequences of this choice for causal interpretation are discussed under limitations.

Population, sampling, and sample size

The target population consisted of healthcare managers, hospital administrators, digital health officers, and senior clinicians working in healthcare organizations in urban and semi-urban India. India was chosen because of its fast-growing digital health ecosystem, the coexistence of well-resourced private hospital chains with resource-constrained public facilities, and the limited empirical evidence available from emerging health systems. Organizations were sampled using stratified random sampling so that the sample would represent ownership type (public, private not-for-profit, and private for-profit), organizational size (fewer than 100 beds, 100 to 500 beds, and more than 500 beds), and geographic region (North, South, East, and West). To take part, respondents had to hold managerial or senior clinical responsibility and work in an organization that had implemented at least one digital health technology in the previous three years, so they could assess the study constructs from direct experience.

The required sample size was set at 385 using Cochran's (1977) formula for a 95% confidence level and a 5% margin of error, with proportional allocation across strata. A power analysis in G*Power 3.1 (Faul et al., 2009) for the most heavily loaded part of the model, five predictors of health system performance, a medium effect size ($f^2 = .15$), $\alpha = .05$, and power of .95 indicated that fewer than 150 cases would suffice (Cohen, 1988), so the target of 385 comfortably exceeded the minimum for the analysis. A total of 450 questionnaires were distributed across the 42 participating organizations, and 407 were returned, a return rate of 90.4%. Twenty-two returns were excluded because of more than 10% missing data or straight-line responding, leaving 385 valid responses for analysis (85.6% of those distributed).

Survey instrument and measures

Data were collected using a structured questionnaire comprising 47 items measuring five constructs, all drawn from established scales and adapted to the Indian healthcare context. Digital Innovation (10 items) captured the breadth of technology adoption, depth of implementation, interoperability, and innovation capability, drawing on Fichman et al. (2014) and Kohli and Melville (2019). Patient Engagement (9 items) captured the cognitive, emotional, and behavioral dimensions of engagement as organizations support and observe them, drawing on Hibbard et al. (2004) and Graffigna et al. (2017). Organizational Integration (8 items) captured the alignment of digital and clinical processes, drawing on Teece et al. (1997) and Cresswell and Sheik (2013). Strategic Management Orientation (10 items) captured proactive strategy formulation and resource alignment, drawing on Barney (1991) and Porter and Lee (2013). Health System Performance (10 items) captured effectiveness, efficiency, patient-centeredness, safety, and equity, drawing on the World Health Organization's (2000) health system performance framework and the Institute of Medicine's (2001) quality dimensions. All items were rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The instrument was translated into Hindi and back-translated to confirm conceptual equivalence (Brislin, 1970).

Content validity, pilot testing, and psychometric assessment

A panel of seven experts, comprising academics, hospital administrators, a digital health specialist, and a health policy researcher, reviewed the draft instrument for relevance and clarity, and content validity was evaluated with Lawshe's (1975) content validity ratio. The revised instrument was piloted with 35 eligible professionals who were not part of the main sample. All five scales exceeded a Cronbach's alpha of .75 in the pilot; three items were reworded for clarity, and one low-loading Digital Innovation item was removed, which produced the final 47-

item instrument. In the main sample, convergent validity was judged against thresholds for average variance extracted ($AVE \geq .50$) and composite reliability ($CR \geq .70$; Fornell & Larcker, 1981), and discriminant validity was judged using the heterotrait–monotrait ratio ($HTMT < .85$; Henseler et al., 2015) and the Fornell–Larcker criterion.

Data analysis

Data were analyzed with PLS-SEM in SmartPLS 4.0 (Ringle et al., 2022), and SPSS 27 was used for descriptive statistics and preliminary reliability checks. PLS-SEM was preferred because the model combines constructs that have not previously been tested together, includes mediated and moderated paths estimated simultaneously, and serves a prediction-oriented purpose (Hair et al., 2019). The analysis followed the usual sequence. The measurement model was evaluated first (reliability, convergent validity, and discriminant validity), followed by the structural model (path coefficients, R^2 , effect sizes f^2 , and predictive relevance Q^2 obtained via blindfolding). Mediation was tested using bootstrapping (5,000 resamples, bias-corrected confidence intervals) and classified as partial or full based on whether the direct effect remained significant after including the mediator (Zhao et al., 2010). Moderation was tested with a mean-centered interaction term (Aiken & West, 1991). Common method variance was examined with Harman’s (1976) single-factor test, supported by procedural safeguards (Podsakoff et al., 2003), and non-response bias was examined by comparing early and late respondents (Armstrong & Overton, 1977).

Findings

The analytic sample consisted of 385 respondents, of whom 58.7% were men and 41.3% were women. By ownership, 31.4% worked in public hospitals, 28.8% in private not-for-profit organizations, and 39.7% in private for-profit organizations. By size, 22.3% worked in small organizations (fewer than 100 beds), 45.5% in medium-sized organizations (100 to 500 beds), and 32.2% in large organizations (more than 500 beds). By role, 29.4% were hospital administrators, 24.7% were healthcare managers, 19.2% were digital health officers, and 26.8% were senior clinicians. Table 1 gives the full distribution.

Table 1. Demographic and organizational characteristics of respondents (n = 385)

Variable	Category	n (%)
Gender	Male	226 (58.7)
	Female	159 (41.3)
Ownership type	Public	121 (31.4)
	Private, not-for-profit	111 (28.8)
	Private, for-profit	153 (39.7)
Organization size	< 100 beds	86 (22.3)
	100–500 beds	175 (45.5)
	> 500 beds	124 (32.2)
Professional role	Hospital administrator	113 (29.4)
	Healthcare manager	95 (24.7)
	Digital health officer	74 (19.2)
	Senior clinician	103 (26.8)

Note. Percentages may not sum to 100 because of rounding.

Measurement model

All five constructs met the recommended criteria for internal consistency (Cronbach's $\alpha \geq .70$ and $CR \geq .70$) and convergent validity ($AVE \geq .50$), as shown in Table 2. Discriminant validity was supported by the HTMT criterion, with the highest ratio, .76, between Digital Innovation and Organizational Integration, well below the .85 limit, and by the Fornell–Larcker criterion, since the square root of each construct's AVE exceeded its correlations with the other constructs.

Neither common method variance nor non-response bias appeared to affect the results. In Harman's single-factor test, the first unrotated factor accounted for 24.3% of the total variance, far below the 50% level that signals a problem. Predictor and criterion items were also separated in the questionnaire, responses were anonymous, and item order was randomized. Early and late respondents did not differ on any of the five construct scores (all $p > .10$).

Table 2. Reliability and convergent validity

Construct	Cronbach's α	CR	AVE
Digital Innovation	0.847	0.881	0.537
Patient Engagement	0.829	0.868	0.524
Organizational Integration	0.853	0.887	0.551
Strategic Management Orientation	0.862	0.893	0.563
Health System Performance	0.841	0.877	0.544

Note. CR = composite reliability; AVE = average variance extracted. All values meet the recommended thresholds ($\alpha \geq .70$, $CR \geq .70$, $AVE \geq .50$).

Correlations among constructs

All pairwise correlations among the constructs were positive and significant ($p < .001$; Table 3), in line with the proposed model. Health System Performance was most strongly correlated with Digital Innovation ($r = .69$) and Patient Engagement ($r = .66$). The two predictors were moderately correlated ($r = .58$), indicating that they overlap but are not redundant.

Table 3. Correlations among study constructs (n = 385)

Construct	1	2	3	4	5
1. Digital Innovation	—				
2. Patient Engagement	.58**	—			
3. Organizational Integration	.64**	.61**	—		
4. Strategic Mgmt Orientation	.52**	.47**	.55**	—	
5. Health System Performance	.69**	.66**	.63**	.57**	—

Note. ** $p < .001$ (two-tailed).

Structural model

The model accounted for 61.4% of the variance in Health System Performance ($R^2 = .614$) and 48.3% of the variance in Organizational Integration ($R^2 = .483$). By PLS-SEM rules of thumb, these values are moderate (Hair et al., 2019), and by conventional benchmarks for behavioral research, they are large (Cohen, 1988). Blindfolding

(omission distance = 7) showed predictive relevance for both endogenous constructs ($Q^2 = .338$ and $.261$, respectively). The effect sizes of Digital Innovation, Patient Engagement, and Organizational Integration on Health System Performance were all of medium size ($f^2 = .221$, $.197$, and $.183$; Table 4).

Table 4. Structural model summary

Metric	Value	Interpretation
R^2 — Health System Performance	0.614	Moderate to large
R^2 — Organizational Integration	0.483	Moderate
Q^2 — Health System Performance	0.338	Medium predictive relevance
Q^2 — Organizational Integration	0.261	Medium predictive relevance
f^2 — Digital Innovation → HSP	0.221	Medium
f^2 — Patient Engagement → HSP	0.197	Medium
f^2 — Organizational Integration → HSP	0.183	Medium

Hypothesis testing

Table 5 summarizes the tests of the five hypotheses. Digital innovation had a significant positive effect on health system performance (H1: $\beta = .412$, $t = 7.83$, $p < .001$, 95% CI [.306, .518]), as did patient engagement (H2: $\beta = .387$, $t = 7.14$, $p < .001$, 95% CI [.280, .494]). These two coefficients are the effects of each predictor on performance before the mediating role of integration is taken into account.

Organizational integration partially mediated the relationship between digital innovation and performance (H3: indirect effect = $.178$, 95% CI [.104, .253], $p < .001$), which means that digital innovation retained a significant direct effect on performance alongside its indirect effect. Integration fully mediated the relationship between patient engagement and performance (H4: indirect effect = $.201$, 95% CI [.130, .278], $p < .001$), because the direct effect of patient engagement was no longer significant once integration was included. Finally, strategic management orientation moderated the effect of digital innovation on performance (H5: $\beta = .193$, $t = 3.67$, $p < .01$, 95% CI [.090, .296]). The positive interaction indicates that the performance gain associated with a given level of digital innovation was larger in organizations with a stronger strategic management orientation. All five hypotheses were supported.

Table 5. Summary of hypothesis testing

Hypothesis	Relationship	β / effect	t	p	Decision
H1	DI → HSP	0.412	7.83	< .001	Supported
H2	PE → HSP	0.387	7.14	< .001	Supported
H3	DI → OI → HSP (mediation)	0.178	4.91	< .001	Supported (partial)
H4	PE → OI → HSP (mediation)	0.201	5.23	< .001	Supported (full)
H5	SMO × DI → HSP (moderation)	0.193	3.67	< .01	Supported

Note. Bootstrap resamples = 5,000; confidence intervals are bias-corrected. HSP = Health System Performance; OI = Organizational Integration; SMO = Strategic Management Orientation; DI = Digital Innovation; PE = Patient Engagement.

Discussion

This study examined whether digital innovation and patient engagement jointly explain the performance of healthcare organizations in India, and the role that organizational integration and strategic management orientation play in that relationship. All five hypotheses were supported, and the pattern of results gives a more conditional account of the value of digital and engagement investment than studies of either lever alone.

First, the two levers carried similar weights. The effects of digital innovation ($\beta = .412$) and patient engagement ($\beta = .387$) on performance were of similar magnitude, suggesting that engagement should not be treated as a secondary or purely clinical matter in digital strategy. This is consistent with evidence that technology can improve quality and efficiency (Buntin et al., 2011) and that engaged patients achieve better outcomes at lower cost (Greene & Hibbard, 2012; Hibbard & Greene, 2013).

Second, integration worked differently for the two levers. Digital innovation remained directly associated with performance, but part of its effect operated through the extent to which digital tools were aligned with clinical processes. This aligns with implementation research showing that benefits depend on how technology is integrated into routines (Cresswell & Sheik, 2013; Greenhalgh et al., 2017). The effect of patient engagement, by contrast, was fully channeled through integration. This is the more distinctive result. It implies that engagement initiatives influence organizational performance when they are connected to clinical protocols, information systems, and management routines, and that engagement efforts operating in isolation add little. The finding qualifies the view that engagement works mainly through the relationship between an individual patient and clinician, and it points to organizational design as the closer determinant of whether engagement affects performance. Because the engagement measure reflects how organizations support and observe engagement rather than patients' own reports, this interpretation applies to the organizational level.

Third, the moderating effect of strategic management orientation shows that returns to digital capability are not uniform. Organizations with proactive strategy formulation and resource alignment achieved higher performance at the same level of digital innovation, consistent with the resource-based argument that valuable resources yield advantage when management can deploy them deliberately (Barney, 1991; Teece et al., 1997).

Together, these findings suggest that digital innovation and patient engagement are necessary but not independently sufficient drivers of performance. Theoretically, the results show that technology adoption, resource-based, and value-based perspectives can be combined productively, with organizational integration serving as the conversion mechanism and strategic management orientation as the boundary condition. For managers, the implication is that investment appraisal for digital tools and engagement programs should include the integration work that makes them effective, such as workflow redesign, interoperability, cross-functional governance, and clinical ownership, and should consider whether the organization has the strategic capacity to deploy them. For policymakers designing programs such as the Ayushman Bharat Digital Mission, accountability frameworks tied to value-based outcomes should monitor integration and management capability alongside technology uptake.

Limitations and future research

Several limitations should be kept in mind. The cross-sectional design supports association but not firm causal inference. The model is grounded in theory, and the estimated paths are consistent with the proposed ordering. However, longitudinal designs are needed to establish the sequence in which integration develops and performance improves. All constructs were measured through self-reports from managers and clinicians using a single instrument, so common method variance cannot be entirely ruled out despite the procedural and statistical checks applied. The data capture organizational perceptions rather than patient-reported engagement or objective outcomes. Eligibility was restricted to organizations that had already adopted at least one digital technology so

that the sample may overrepresent organizations with above-average digital maturity, and the focus on urban and semi-urban settings limits generalization to rural and resource-constrained facilities.

Future studies could address these points by using longitudinal or multi-wave designs, combining survey measures with administrative and clinical outcome data, adding patient-reported measures of engagement, extending the sample to rural and low-resource settings where the role of integration may differ, and examining artificial-intelligence-enabled tools as an emerging form of digital innovation.

Conclusion

This study examined how digital innovation and patient engagement shape the performance of healthcare organizations under value-based care, using data from 385 respondents in 42 organizations in urban and semi-urban India. Both levers were positively associated with health system performance and, together with organizational integration, explained a substantial share of its variance. Integration was the mechanism that converted these assets into performance: it partially accounted for the effect of digital innovation and fully accounted for the effect of patient engagement. Strategic management orientation determined how much performance organizations achieved from their digital capabilities, with a stronger orientation yielding larger gains.

The practical message is that technology and engagement programs deliver value when they are built into the way care is organized and when management can direct them strategically. Healthcare managers should therefore plan and budget for integration and strategic capabilities alongside digital and engagement initiatives, and policymakers should look beyond adoption counts when evaluating national digital health programs. As India and other emerging economies move toward value-based care, the combination of digital innovation, patient engagement, organizational integration, and strategic management appears to be a central, manageable route to improved system performance.

Declarations

Availability of data and materials: The dataset analyzed during the current study is available from the corresponding author upon reasonable request, subject to institutional data-sharing protocols.

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Dr. Kamran Sultan: Methodology, formal analysis, writing review, and editing.

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