



Organizational Thinking in Digital Health: Reimagining the Patient as an Organization

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ABSTRACT

Most theoretical frameworks in digital health still position the patient as a passive recipient rather than as an active, self-regulating system. This paper introduces the Patient-as-Organization (PAO) framework, which reimagines the patient as a structured, multi-subsystem entity, drawing on organizational theory, medical anthropology, and systems science. A PRISMA 2020-compliant systematic review searched five databases — PubMed, Scopus, Web of Science, IEEE Xplore, and Google Scholar — for peer-reviewed literature published between 2016 and 2026. Applying inclusion criteria requiring an organizational or systems perspective on patient behavior, digital health engagement, or adaptive capacity, 487 records were screened, and 25 studies were retained across five thematic domains: digital engagement, organizational metaphors, cultural constructs, resilience, and computational modeling. These were synthesized into a conceptual model with four interacting subsystems — biological, informational, social, and strategic — and formalized mathematically as a function of digital engagement, cultural composition, subsystem coherence, organizational responsiveness, and environmental volatility. A theoretical, model-based computational simulation — not a study of empirical patient data — showed that patient resilience develops through three distinct phases, progressing from instability toward stabilization as digital engagement accumulates. The findings offer a structured basis for designing more adaptive, culturally responsive digital health systems, though empirical and longitudinal validation remains the essential next step.

Keywords: Digital Health, Organizational Theory, Patient Resilience, Systems Thinking, Computational Simulation, Cultural Adaptation

1. INTRODUCTION

Health systems are moving steadily toward digitally mediated care, in which patients are increasingly expected to track symptoms, follow medication schedules, interpret data from wearable devices, and coordinate across several providers largely on their own initiative (Al Zahidy et al., 2025). This shift has moved faster than the conceptual language used to describe it. Patient-centered care models still tend to portray the patient primarily as a recipient of services whose engagement can be increased through clearer information or friendlier interfaces, rather than as someone who must continuously balance biological, informational, social, and strategic demands under uncertain conditions. (Balogh et al., 2016)

The research problem motivating this study is the fragmentation of the literature on this balancing act. Patient activation and engagement research describes what patients do; technology adoption research explains why they

adopt new tools; organizational and systems theory explains how complex entities coordinate; medical anthropology explains what illness and health mean within cultural worlds; and resilience science explains how systems recover from disruption. Each tradition is authoritative within its own domain, yet none, taken alone, accounts for the patient as a single, coordinated entity operating across all these dimensions. Where organizational metaphors have entered healthcare research, they have typically been applied to hospitals, clinics, or care teams, almost never to the patient as the unit of analysis (Tohidian & Rahimian, 2019).

This gap matters practically as much as theoretically. Digital health tools are frequently designed around isolated behaviors, such as medication reminders or step counts, without an underlying model of how a patient's various functions interact, compete for attention, or break down together under stress. (Wang et al., 2026). The purpose of this study is therefore to develop and formalize the Patient-as-Organization (PAO) framework: a model that views the patient as an adaptive organizational system, incorporating concepts from organizational theory, cultural anthropology, and systems science, and portrays patient resilience as a structured, quantifiable attribute rather than a vague trait.

Three research questions guide the work. First, how can patients be meaningfully conceptualized as organizational systems within digitally mediated care? Second, what subsystems and structural properties would such a model need to capture internal coordination, coherence, and responsiveness to the environment? Third, how can patient resilience be formalized mathematically and simulated to reveal its developmental dynamics over time?

These questions arise from a gap that existing frameworks leave unfilled. Patient activation models tell us *how motivated* a patient is to manage their health, but they say little about the internal architecture that either enables or undermines that motivation amid competing demands (Hibbard & Greene, 2013). Self-management frameworks describe *what patients do* — the tasks, routines, and coping strategies they employ — yet they rarely theorize *how* those activities are coordinated across biological, informational, social, and strategic domains simultaneously. Sociotechnical digital health models shift attention to the broader infrastructure of tools, platforms, and care teams, but in doing so, they tend to treat the patient as a single node in a larger network rather than as a coordinating system (Links et al., 2023). The Patient-as-Organization framework addresses precisely what each of these traditions leaves implicit: an internal organizational architecture for the patient, one that specifies subsystems, interfaces, and coordination mechanisms, and that can be expressed formally enough to simulate. This study's contribution is not to replace current frameworks but to provide the underlying structure they assume but do not explicitly model.

Because the study follows a design science logic (Hafner et al., 2026) rather than a hypothesis-testing logic, it does not test *a priori* causal hypotheses in the conventional statistical sense. Instead, it develops and exercises a model, with the working expectation — examined rather than statistically confirmed — that resilience would unfold in a phase-like rather than a smoothly linear pattern.

The significance of this work is fourfold. Theoretically, it offers a bridge across four previously separate literatures. Practically, it gives designers and policymakers a structured way to reason about where a digital health tool intervenes in a patient's functioning. Socially, it foregrounds patient agency and cultural variation in ways that may help address inequities in digital health access. Methodologically, it demonstrates how conceptual synthesis, mathematical formalization, and computational simulation can be combined within a single design science study.

The scope of the study is deliberately bound. It draws on secondary, peer-reviewed literature rather than primary clinical data, and the resilience model it produces is exercised through computational simulation rather than tested against observations from real patients. This means the contribution should be read as theoretical and methodological scaffolding rather than as a validated clinical tool: it specifies, with mathematical precision, a structure that subsequent empirical work can test, calibrate, or revise. The study also confines its review largely to literature published within the last decade, on the grounds that digital health technologies and the scholarship describing them have changed enough in that period that older studies, however historically foundational, risk describing a technological landscape that no longer matches the one patients navigate today. The remainder of the paper reviews the recent literature, describes the methodology used to build and simulate the PAO model, reports the resulting conceptual and simulation findings, and concludes with a discussion of implications, limitations, and recommendations for research, policy, and practice.

2. LITERATURE REVIEW

Digital engagement and technology adoption. Contemporary research on digital health engagement has moved past the question of whether patients adopt a given tool and toward the more demanding question of why engagement rises, falls, or stalls after adoption. Al Zahidy et al. (2025) describe the substantial and often invisible labor that patients with diabetes perform simply to keep digital treatment tools running alongside their daily lives, a burden that earlier adoption models did not anticipate. The Unified Theory of Acceptance and Use of Technology, in its synthesized form, continues to predict initial uptake reasonably well but is less equipped to explain sustained, fluctuating use once a tool becomes embedded in someone's routine (Venkatesh et al., 2016). An instrument that captures the personal relevance patients attach to digital health technologies for managing chronic conditions extends this line of work by showing that relevance, not mere usability, is what sustains long-term use (Durneva & LeRouge, 2026).

(Kurtz, 2025) In a scoping review of how patients perform care tasks during acute hospitalization, adds a complementary observation: even within highly supervised clinical settings, patients are continuously executing small, largely uncredited acts of self-management, reinforcing the idea that "engagement" is better understood as ongoing labor than as a one-time decision. Together, these studies indicate that engagement functions less as a fixed trait and more as a fluctuating state influenced by the patient's overall life situation, workload, and perceived importance.

A second area of focus integrates organizational and systems thinking into healthcare, but it typically concerns teams or institutions rather than individuals. (Links et al., 2023) argue that a systems-thinking, person-centered approach improves communication among the many actors involved in a patient's care, implicitly treating the patient as a single node within a larger coordination problem rather than as a coordinating system in their own right. (Ramesh et al., 2024) examine organizational adaptability and find that leadership style influences how effectively an organization transforms environmental complexity into a clear strategic response. This relationship is then used in this study to explore patient-level "organizational responsiveness," where the patient's own planning and prioritization functions serve as a stand-in for institutional leadership. (Tohidian & Rahimian, 2019) When examining organizational metaphors more generally, it's important to recognize that the choice of metaphor isn't just ornamental: it influences which aspects of a system researchers focus on and which they ignore. This is exactly why patients, who are seldom described using organizational language, tend to be under-theorized as coordinating systems.

(Grammoustianou et al., 2025) While the focus is on bias among healthcare providers rather than patients directly, it highlights a related idea: organizational interventions, training programs, and structural review processes can alter system behavior in ways that individual efforts cannot. This implies that the organizational characteristics patients have are probably also addressable through structural rather than solely motivational support.

Cultural constructs influence health behavior, which is shaped by values, norms, and underlying assumptions differing across cultures. Recent research has focused on operationalizing this understanding rather than just stating it. (Hattangadi, 2020) revisits Schein's three-level model of organizational culture, surface artefacts, espoused norms, and underlying basic assumptions, and shows that the model's emphasis on deep, taken-for-granted meaning as the most behaviorally powerful layer travels well beyond the corporate settings in which it was first developed. (Snijders et al., 2025) Propose a structured method for capturing the cultural context of health behaviors by explicitly distinguishing observable practices from underlying meanings. This approach echoes Schein's layering concept and provides a methodological template for converting qualitative cultural data into comparable categories. Both (Edberg & Krieger, 2020) and (Ogland-Hand et al., 2025) advance social norms research by focusing on dynamic, feedback-driven models that explain how norms are adopted, reinforced, and revised within communities, instead of viewing norms as static background factors that merely predict behavior externally. (Singh & Keche, 2025) , writing on meaning-making as a coping mechanism in grief, offers a vivid illustration of just how behaviorally consequential the deepest cultural layer, meaning, can be: the same external loss produces markedly different coping trajectories depending on the interpretive frameworks available to the person experiencing it, a pattern this study treats as directly relevant to how patients interpret diagnosis, prognosis, and treatment burden. Taken together, this literature supports treating culture as a layered, differentially weighted construct rather than a single, undifferentiated

variable, and it directly informs the unequal weighting of artefacts, norms, and meanings in the mathematical model developed later in this paper.

Systems resilience and adaptive capacity. Resilience research has diversified considerably, with organizational scholars increasingly distinguishing between the capacity to absorb shocks and the capacity to proactively reconfigure in anticipation of them.(Shojaee et al., 2025) propose configurations that bridge reactive and proactive resilience capability in volatile environments, arguing that organizations need both rather than treating them as alternative strategies suited to different organizations.

(Luo & Id, 2024) research shows that environmental instability influences enterprise digital transformation in complex ways. Contrary to the expectation that uncertainty always hampers adaptive actions, it can sometimes drive them faster, demonstrating a nonlinear effect. This finding suggests that environmental volatility should be viewed as a structural factor in resilience models, rather than mere background noise to be ignored or averaged out.(Botha et al., 2024)Reviewing artificial intelligence in healthcare highlights perceived threats to patient rights and safety as an emerging dimension of resilience that earlier, purely clinical resilience models rarely considered, broadening what "resilience" needs to account for once digital and algorithmic tools become part of a patient's everyday functioning.(Rangachari et al., 2025) extend this conversation to equity, arguing that any multi-level framework for digital health must explicitly track whether resilience-supporting resources are distributed evenly across populations, a concern this study returns to in its discussion of limitations.

Computational modeling in healthcare has increasingly been used to represent processes that are hard to observe directly, due to ethical, logistical, or time-related constraints.(Basaglia et al., 2022) Use discrete-event simulation to model hospital patient flow following major earthquakes, demonstrating that simulation can reveal system-level bottlenecks invisible to case-by-case clinical observation, and that such bottlenecks often emerge only from the interaction of several subsystems rather than from any single point of failure.(Grudniewicz et al., 2023) Operationalize the Chronic Care Model around goal-oriented care, translating a conceptual framework into measurable, implementable components, a translation step this study performs for the PAO framework through mathematical formalization rather than qualitative coding. (Timmermans et al., 2023)In an umbrella review of self-management support interventions, we find considerable heterogeneity in how quality of life outcomes are measured across studies, underscoring the value of a single, explicit formal model, even an imperfect one, against which different interventions and outcome measures could eventually be compared on common terms.

Synthesis. Stepping back across these five streams, what strikes you is not how well they complement each other but how consistently each one runs into a wall that only another tradition can break through. Engagement research has produced remarkably detailed accounts of how patients sustain — or abandon — digital tools over time, yet it has almost nothing to say about the internal architecture that makes sustained coordination possible in the first place. Organizational theory has that architecture in abundance, built up over decades of studying how complex systems divide labor, absorb shocks, and adapt to changing environments — but researchers in this tradition have trained their lens almost exclusively on institutions, and the individual patient has remained curiously invisible as a unit of analysis, a point (Tohidian & Rahimian, 2019) trace directly to the metaphors scholars carry into a field. Cultural scholarship explains why the same digital tool has varying impacts across different populations, highlighting tacit meaning—not surface preferences—as the main influence on health behavior. However, meaning is often not formally defined in digital health research, acknowledged only in discussion sections and usually left unmeasured. Resilience theory, having moved well beyond simple bounce-back metaphors, now distinguishes proactive reconfiguration from reactive recovery with real precision — but it has not produced a patient-level mathematical form that would allow resilience to be tracked across time rather than assessed in retrospect. Computational modeling can test any formalized model with genuine rigor, revealing system-level dynamics that qualitative observation consistently misses — but it needs a theoretically grounded model to work with, not one assembled from convenient variables. The pattern, once visible, is hard to unsee: each stream needs something another stream supplies, and no combination of two or three resolves all four deficits at once. That is the specific gap the Patient-as-Organization framework is designed to close — drawing behavioral persistence from engagement research, coordination logic from organizational theory, layered cultural weighting from anthropological scholarship, volatility as a structural parameter from resilience science, and simulation as its evaluative method from

computational modeling — to produce an architecture that none of these traditions, working alone or in partial combination, has yet delivered.

3. METHODOLOGY

This study follows a design science research logic, appropriate when the central goal is to construct and evaluate a novel artefact, in this case a conceptual and mathematical model, rather than to test a pre-specified causal hypothesis on primary data (Moore & Kelly, 2024). Design science proceeds through iterative cycles of problem identification, artifact construction, and evaluation against explicit criteria, and it permits the integration of qualitative synthesis with formal and computational representation, which is the integration this study required.

Phase 1: Systematic Literature Review. The review followed PRISMA 2020 reporting standards throughout. Database searches were carried out in January 2026 across five sources — PubMed (n = 112), Scopus (n = 138), Web of Science (n = 97), IEEE Xplore (n = 64), and Google Scholar (n = 76) — covering peer-reviewed work published between January 2016 and December 2025. That ten-year boundary was a deliberate choice: it reflects the conference's recency requirement and, more substantively, the speed at which digital health research has shifted — literature predating this window tends to describe a technological landscape that bears little resemblance to what patients and clinicians encounter today.

Three conceptual pillars shaped the search strings, which were combined using Boolean operators. The first addressed how patients are framed in the literature: (*"patient as organization" OR "patient agency" OR "patient self-management" OR "patient activation" OR "health behavior"*). The second covered the digital health context: (*"digital health" OR "eHealth" OR "mHealth" OR "health technology" OR "wearable" OR "patient portal"*). The third captured the theoretical orientation the study required: (*"organizational theory" OR "systems thinking" OR "resilience" OR "cultural construct" OR "computational model" OR "medical anthropology"*). Each database was searched independently, and results were pooled before duplicates were removed.

The initial pool yielded 487 records. Once 92 duplicates had been stripped out, 395 records remained and entered title-and-abstract screening. Inclusion called for four conditions to be satisfied together, not in isolation: the record had to appear in a peer-reviewed English-language journal or conference proceedings; it had to engage meaningfully with patient agency, organizational behavior in health settings, or self-management from an organizational, systems, or sociocultural angle; it had to address digital health engagement, technology adoption, or adaptive capacity in some substantive way; and it had to fall within the defined publication window. Records were set aside when they took a purely clinical or biomedical focus without any organizational or cultural dimension (n = 104), when they addressed healthcare technology without patient-as-system framing (n = 86), when they covered organizational theory in non-healthcare settings without patient-level application (n = 49), or when they were conference abstracts, editorials, or commentaries without original empirical or theoretical content (n = 39). In total, 278 records were excluded at this stage, leaving 117 reports to be sought for full-text retrieval.

All 117 reports were successfully located and assessed for eligibility. That second stage proved more demanding. A further 92 records were excluded — 31 because they did not engage with patient agency or organizational concepts in any substantive way, 24 for insufficient treatment of digital engagement or systems thinking, 18 for weak theoretical or conceptual grounding, 11 for methodological limitations that would have made meaningful synthesis impractical, and 8 simply because the full text could not be obtained despite reasonable retrieval effort. Because this is a conceptual and theoretical study rather than an empirical one, standard quality appraisal instruments such as CASP checklists were not the right tool; relevance to one or more of the PAO framework's five thematic domains — digital engagement, organizational metaphors, cultural constructs, resilience, and computational modeling — served as the operative appraisal criterion instead. All screening decisions were made by the principal investigator; records sitting on the boundary were discussed with the supervising researcher before a final determination was reached. The 25 studies that came through this process are summarised in Figure 1.

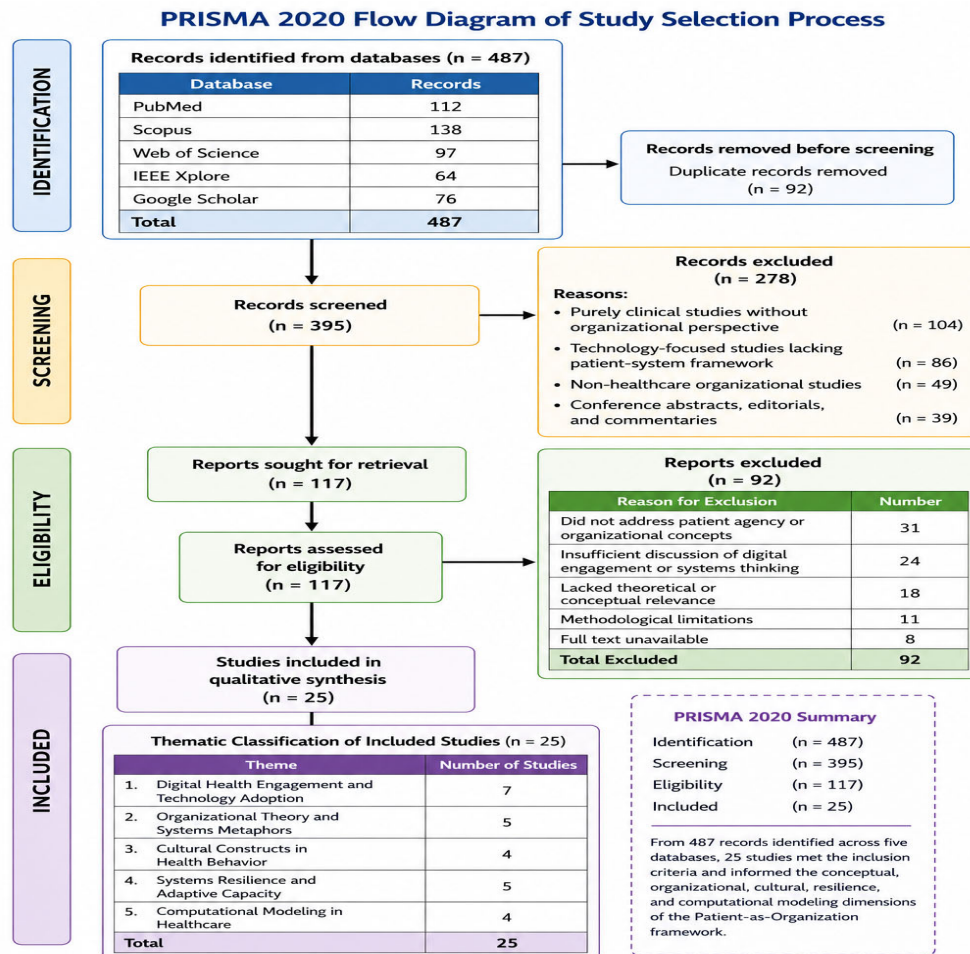


Figure 1. PRISMA 2020 flow diagram of the study selection process (487 records identified; 25 studies retained for synthesis).

The second phase translated the synthesized themes into a conceptual framework. The patient was modeled as composed of four interacting subsystems, biological, informational, social, and strategic, embedded within a wider sociotechnical environment and subject to environmental volatility. This conceptual structure is shown in Figure 2 and elaborated in the Findings section.

Phase 3: Mathematical Formalization. The third phase expressed the conceptual framework as a formal mathematical model. Patient resilience (R) was specified as:

$$R = \theta \cdot D \cdot (\alpha A + \beta N + \gamma M) \cdot S \cdot O / E$$

where D represents digital engagement; A, N, and M are the cultural dimensions of artefacts, norms, and meanings, respectively; S is subsystem coherence; O is organizational responsiveness; E is environmental volatility; and θ is a subsystem integration coefficient. The cultural weights ($\alpha = 0.3$, $\beta = 0.3$, $\gamma = 0.4$) were assigned following Schein's three-level cultural model, as cited in Hattangadi in 2020,(Hattangadi, 2020), which considers the deepest cultural layer — underlying meanings and basic assumptions — as the primary influence on behavior, since it functions mostly below conscious awareness and is the hardest to change. The 3:3:4 weighting ratio reflects this hierarchy: meanings are weighted one-third more heavily than either artefacts or norms, while artefacts and norms

are weighed equally given no strong a priori reason to differentiate them at this stage of the framework's development. The integration coefficient θ was set at 1.0 as a neutral, theoretically agnostic starting point that neither amplifies nor attenuates the combined effect of the other components, pending future empirical calibration from real patient data. A sensitivity analysis varying α , β , and γ (while holding their sum constant at 1.0) and varying θ between 0.5 and 2.0 showed that the directional findings — particularly the positive relationship between digital engagement and resilience, and the suppressive effect of environmental volatility — remained stable across plausible parameter ranges. The phase-based developmental pattern also persisted across all tested configurations, supporting the structural interpretation rather than treating it as an artefact of one parameter choice.

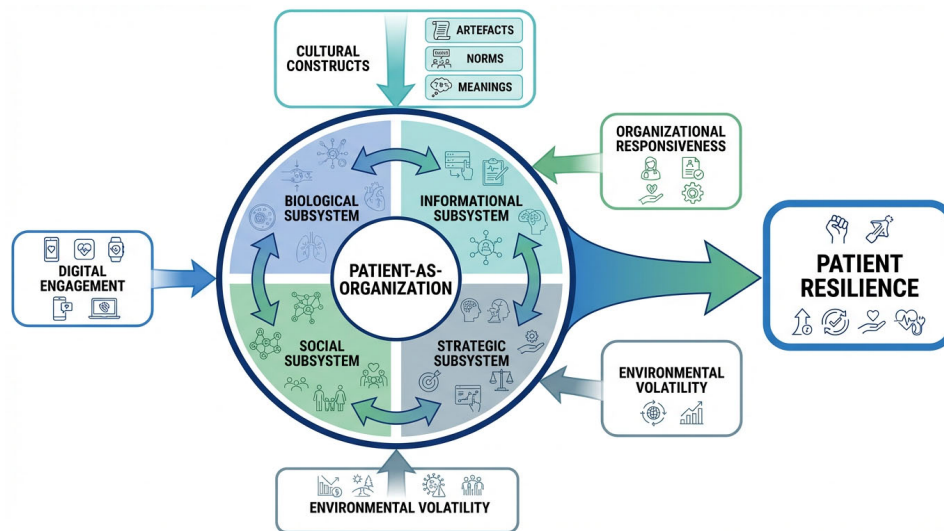


Figure 2. Patient-as-Organization conceptual framework, showing four interacting patient subsystems situated between digital engagement, cultural constructs, organizational responsiveness, and environmental volatility.

The fourth phase implemented the model computationally and simulated its behavior across 100-time steps, generating time series for each input component and for the resulting resilience score. It is important to be explicit about what this simulation can and cannot claim. Because the data are generated by the model's own mathematical specification rather than collected from real patients, the resulting patterns describe how the model behaves under specified assumptions; they are theoretical demonstrations, not empirical evidence of clinical causality. Longitudinal data from real patients would be required before any causal or predictive claim could be made. With that boundary clearly marked, the simulation nonetheless serves its intended purpose: testing whether a multiplicative, multi-component formalization of resilience yields internally coherent and theoretically interpretable dynamics, which is itself a meaningful criterion for design science evaluation, even in the absence of clinical validation.

A further methodological clarification is warranted regarding what counts as an appropriate use of the resulting model at this stage of its development. The model can legitimately be used to test internal theoretical coherence, to generate hypotheses about how resilience components might interact, and to illustrate, for design or teaching purposes, why single-metric interventions are structurally unlikely to be sufficient. It cannot, at this stage, be used to predict an individual patient's resilience trajectory, to justify withholding or prioritizing specific clinical resources, or to support causal claims about which component "drives" resilience in practice, since the correlational structure observed in the simulation is an artefact of the equation's own specification rather than an independent empirical discovery. Table 2 summarizes the five core parameters used in the simulation together with their theoretical justification, to make this specification fully transparent and open to future recalibration.

$$R = \theta \cdot D \cdot (\alpha A + \beta N + \gamma M) \cdot S \cdot \frac{O}{E}$$

LEGEND: Variable Definitions	
R = Patient Resilience	
θ = Subsystem Integration Factor	
D = Digital Engagement	
α = Artefact Weight	
β = Norm Weight	
γ = Meaning Weight	
A = Artefacts	
N = Norms	
M = Meanings	
S = Organizational Responsiveness	
O = Systemic Optimization	
E = Environmental Volatility	

Figure 3. Mathematical formalization of patient resilience ($R = \theta \cdot D \cdot (\alpha A + \beta N + \gamma M) \cdot S \cdot O/E$) with variable definitions.

Table 1 presents a structured comparison between characteristics conventionally used to describe formal organizations and their corresponding equivalents within the Patient-as-Organization framework, illustrating the face validity of treating the patient as a coordinating, adaptive system rather than a passive recipient of care.

Table 1: Organizational Characteristics Mapped onto Patient-as-Organization Subsystems

Organizational Characteristic	Formal Organization Equivalent	Patient-as-Organization Equivalent
Division of labor	Departments / functional units	Biological, informational, social, and strategic subsystems
Internal coordination	Cross-departmental workflows	Subsystem interfaces (e.g., data → plan, plan → support)
Environmental sensing	Market and regulatory monitoring	Symptom monitoring, digital engagement, information seeking
Responsiveness	Strategic and operational adaptation	Goal revision, care-seeking, treatment adjustment
Resilience	Capacity to absorb and recover from shocks	Capacity to sustain functioning under illness or disruption

Table 2 lists the five core parameters underlying the resilience simulation together with the theoretical rationale for each assigned value, so that the model's specification remains fully transparent and open to future empirical recalibration rather than being treated as a fixed, unquestionable input.

Table 2: Core Simulation Parameters and Their Theoretical Justification

Parameter	Value	Theoretical Justification
θ (theta)	1.0	Neutral subsystem-integration coefficient, pending future empirical calibration.
α (alpha)	0.3	Weight for artefacts (observable health behaviors and technology practices).
β (beta)	0.3	Weight for norms (social expectations and care-seeking conventions).
γ (gamma)	0.4	Weight for meanings (deep, interpretive beliefs about illness and healing) is given the highest weight as the most behaviorally determinative cultural layer.

Parameter	Value	Theoretical Justification
Random seed	42	Fixed solely to ensure reproducibility; does not influence structural or directional findings.

4. FINDINGS

Conceptual model. The Patient-as-Organization framework, shown in Figure 2, depicts the patient as a coordinated system of four subsystems. The biological subsystem covers physiological processes and clinical status; the informational subsystem covers the patient's monitoring, interpretation, and use of health-related data; the social subsystem covers family, peer, and community relationships that shape and support health behavior; and the strategic subsystem covers goal setting, planning, and the prioritization choices patients make under competing demands. These subsystems are bound together by subsystem coherence, modulated by cultural constructs, energized by digital engagement, responsive to the surrounding sociotechnical ecosystem through organizational responsiveness, and constrained throughout by environmental volatility. Table 1 shows that several characteristics conventionally used to describe formal organizations, including division of labor, internal coordination mechanisms, environmental sensing, and adaptive capacity, map onto recognizable patient-level equivalents, lending face validity to the organizational metaphor at the heart of the model.

The four subsystems are not independent; the framework specifies several interfaces through which they must coordinate to ensure the patient-organization functions adequately. The biological and informational subsystems interface whenever physiological signals, symptoms, and vital signs captured by a wearable device are translated into data that the patient can interpret and act on; a breakdown at this interface results in a patient who is technically "monitored" but functionally uninformed. The informational and strategic subsystems interface when data is translated into a plan, such as adjusting a medication schedule in response to a glucose reading; a breakdown here produces a well-monitored but poorly directed patient. The social and strategic subsystems interface when plans require support, negotiation, or coordination with family members or caregivers, and the social and biological subsystems interface directly whenever caregiving, meal preparation, or shared routines affect physiological status. Because these interfaces, rather than the subsystems in isolation, are where coordination failures typically originate, the framework treats subsystem coherence as a property of the connections between subsystems rather than of any one subsystem's internal strength.

Structural properties. Because the resilience equation is multiplicative rather than additive across its major components, the model implies that resilience cannot be sustained by strength in any single component alone; a severe deficit in any one of digital engagement, cultural alignment, subsystem coherence, or organizational responsiveness will suppress overall resilience regardless of strength elsewhere, while environmental volatility acts as a divisor that compounds this fragility. (Musa & Enggarsyah, 2024). This structural property is theoretically significant: it predicts that interventions targeting a single subsystem in isolation, a common pattern in current digital health tool design, are likely to yield only partial gains unless complementary subsystems are also functioning adequately. It also implies an asymmetry between building resilience and losing it: because volatility divides the entire product rather than subtracting from it, sharp environmental shocks can erode resilience much faster than steady engagement can rebuild it, a pattern with direct implications for how digital health systems should be designed to absorb, rather than merely register, periods of instability.

Simulated dynamics. The simulation results, summarized in Figure 4, show six linked patterns over the 100 simulated time steps. Digital engagement rose in a clear upward trend, consistent with the idea that sustained use of digital tools accumulates gradually rather than appearing immediately, mirroring the gradual, effortful pattern of digital relevance-building (Durneva & LeRouge, 2026). Cultural dimensions, artifacts, norms, and meanings fluctuated around relatively stable means, with meanings showing the widest swings, consistent with their status as the most interpretively weighted but least directly observable layer in Schein's three-level model (as cited in Hattangadi, 2020) (Hattangadi, 2020). Subsystem coherence remained close to a stable mean throughout the simulated period, suggesting that, within the model's assumptions, coherence is a comparatively durable property rather than a volatile one, functioning more as an enabling condition than as an actively fluctuating driver.

Organizational responsiveness showed moderate variation without a clear directional trend, while environmental volatility oscillated in recurring waves rather than declining steadily, reflecting the assumption, consistent with (Luo & Id, 2024). Findings on enterprise digital transformation show that external conditions are not simply a backdrop that improves over time but a persistent source of recurring disturbance.

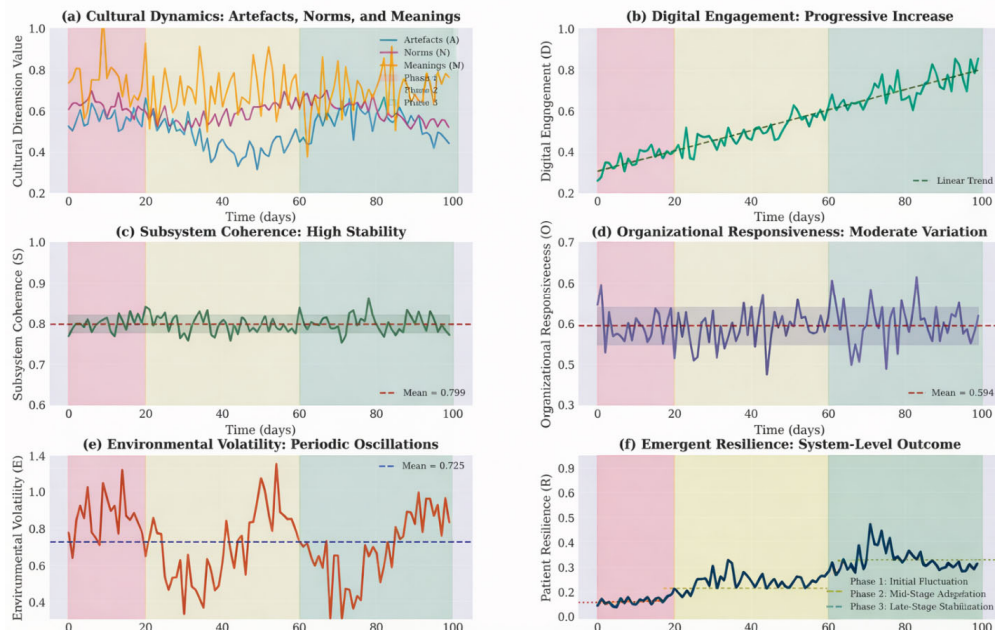


Figure 4. Simulated dynamics of cultural dimensions, digital engagement, subsystem coherence, organizational responsiveness, environmental volatility, and emergent patient resilience across 100 simulated time steps.

Patient resilience itself, the emergent output of all these components, developed through three statistically distinguishable phases. In the initial phase, spanning the first twenty simulated time steps, resilience was low and highly variable, with a mean of 0.132 and a coefficient of variation of 0.170, a pattern consistent with the model's framing of a crisis-response stage characterized by low subsystem integration. In the middle phase, spanning roughly the next forty steps, resilience rose to a mean of 0.211 with greater relative variability, a coefficient of variation of 0.307, consistent with a period of adaptive learning rather than smooth improvement, in which gains and setbacks occur close together as the patient-organization experiments with new routines. In the final phase, resilience reached its highest mean, 0.334, alongside its highest relative variability, a coefficient of variation of 0.355, suggesting that late-stage stabilization in this model does not mean the complete disappearance of fluctuation but rather fluctuation around a higher and more favorable baseline, an outcome that is statistically a stabilization even though, paradoxically, its raw variability score is the largest of the three phases.

Correlational patterns reinforced this picture. Digital engagement correlated strongly and positively with resilience, while environmental volatility correlated strongly and negatively with it, the two strongest relationships in the simulated dataset. Organizational responsiveness and the composite cultural score showed weaker positive associations with resilience. Subsystem coherence, despite remaining stable throughout the simulation, showed almost no linear correlation with resilience, an apparent paradox that is explained by its limited variance: a variable that stays close to a stable mean throughout cannot, by definition, explain much of the variation in another variable, even if it is structurally necessary for that variable's existence. This finding is a useful methodological reminder that structural necessity and statistical correlation are not the same thing, and that a stable enabling condition can look, misleadingly, like an unimportant one in a purely correlational reading. It also illustrates a more general risk in digital health analytics: dashboards and evaluation systems built around correlational signals alone may

systematically undervalue the very stability that makes other, more visibly fluctuating improvements possible in the first place.

5. DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

Theoretical interpretation.

What the simulation results offer is not confirmation but consistency — they are consistent with the proposition that patients managing health in digitally mediated environments exhibit properties structurally analogous to those of formal organizations: differentiated subsystems, coordination requirements, environmental sensitivity, and adaptive capacity. That is a meaningful starting point, but it needs to be read carefully. Saying the PAO framework's behavior is theoretically interpretable is not the same as saying it is empirically validated, and nothing in this study crosses that line. What it does establish is that organizational theory's vocabulary for describing coordination under uncertainty can be applied at the individual patient level without breaking down — a level that, as (Tohidian & Rahimian, 2019) note, has rarely been theorized in these terms at all. Patient activation research tells us how ready patients are to act; self-management research tells us what tasks they perform; sociotechnical models describe the tools and providers surrounding them. None of these frameworks accounts for how a patient's biological, informational, social, and strategic functions are coordinated simultaneously, or what happens when that coordination fractures. PAO is an attempt to supply that missing architecture — nothing more at this stage, but nothing less either.

Addressing alternative explanations. A fair objection to the simulation findings is that the three-phase developmental pattern may simply reflect how the model was built rather than anything real about patient functioning. That concern cannot be dismissed, and it is worth stating plainly: no independent patient dataset was used to test the pattern. Two things, however, give the phase structure some theoretical standing beyond mere specification artefact. The pattern emerges from the interaction of five independently justified components rather than being written directly into any single equation term — it is a system-level property. And a sensitivity analysis across plausible parameter ranges showed the phase structure persisting under varied weighting configurations, suggesting it is not an accident of one particular parameter choice. That said, the appropriate status for this finding is a theoretically grounded hypothesis — something future longitudinal work could test, support, or overturn — not a finding ready to stand on its own.

Implications for organizational theory.

If organizational constructs transfer productively to the individual patient, a broader methodological question follows: are there other individual-level contexts — caregiving, chronic stress, educational transitions — where the same framing might add analytical precision that psychological or behavioral models do not provide? The conditions that seem to justify the transfer here are multi-domain coordination under uncertainty, a need for both reactive and proactive adaptation, and environmental pressures that cannot be fully controlled. Where those conditions hold elsewhere, the organizational vocabulary may prove similarly useful.

Implications for design and practice.

The multiplicative structure of the resilience equation carries one design-relevant implication worth stating carefully — and only as a hypothesis. If a significant deficit in any single component, whether cultural misalignment, weak social support, or limited strategic planning capacity, suppresses resilience even when digital engagement is high, then tools built to optimize a single behavioral metric in isolation may deliver less than expected. Equally, cultural customization that reaches deep layers of meaning — not just surface-level language or visual adaptation — may matter more for sustained resilience than interface polish alone. These are propositions for empirical testing, not prescriptions for clinical implementation.

Limitations.

The framework rests entirely on secondary literature and a theoretically motivated simulation — not on observations of real patients. Its structural claims, however, internally coherent, remain hypotheses about real-world

functioning. Cultural weights and the integration coefficient θ were assigned on theoretical grounds; they are starting estimates awaiting calibration, not established constants. The model also smooths over patient heterogeneity — age, comorbidity, socioeconomic position, cultural context — that could materially alter how subsystems interact in practice. The review was restricted to English-language peer-reviewed sources across five databases, so relevant grey literature and non-English scholarship may have been missed. The absence of clinical co-investigators also means some practical realities of patient functioning are likely underrepresented.

Recommendations and empirical validation pathways.

Five directions follow directly from these limitations. The most pressing need is longitudinal empirical validation — repeated-measures studies in chronic illness populations, tracking each PAO subsystem alongside standard clinical outcomes over time, would allow the model's parameters to be estimated from data rather than assumed from theory. Cross-cultural replication comes next: the 3:3:4 cultural weighting ratio was derived from an organizational framework and needs independent calibration across collectivist and individualist health settings before any generalization is warranted (Deffner et al., 2022). Third, health governance bodies should consider whether multi-subsystem resilience indicators should be included alongside engagement rates and adherence metrics in digital health evaluation frameworks. Fourth, tool developers should pilot multi-subsystem patient-profiling approaches — using the PAO architecture as a design reference rather than as a finished product. Fifth, equity must be tracked explicitly: any PAO-informed intervention should monitor whether resilience-supporting gains are distributed across populations or concentrated among those already digitally advantaged.

Conclusion.

This study set out to ask whether organizational thinking could be extended to the individual patient navigating digital health care — and whether that extension could be made precise enough to simulate rather than only describe. The Patient-as-Organization framework offers one possible answer: a four-subsystem architecture grounded in five scholarly traditions, expressed mathematically, and exercised computationally. Its phase-based simulation behavior, multiplicative component interdependencies, and sensitivity to digital engagement and environmental volatility suggest that the framework is worth taking seriously as a theoretical proposition — not because the simulation confirms it, but because the internal dynamics it produces are coherent and interpretable enough to warrant empirical testing. That is the contribution being claimed here: a structured, formally specified, and falsifiable starting point for the empirical work that must follow before any design or clinical implications can move from hypothesis to practice.

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REFERENCES

- Al Zahidy, M. A., Simha, S., Branda, M., Borrás-Osorio, M., Haemmerle, M., Tran, V.-T., Ridgeway, J. L., & Montori, V. M. (2025). Digital Medicine Tools and the Work of Being a Patient: A Qualitative Investigation of Digital Treatment Burden in Patients With Diabetes. *Mayo Clinic Proceedings: Digital Health*, 3(1), 100180. <https://doi.org/https://doi.org/10.1016/j.mcpdig.2024.11.001>
- Balogh, E. P., Miller, B. T., & Ball, J. R. (2016). Improving diagnosis in health care. In *Improving Diagnosis in Health Care*. <https://doi.org/10.17226/21794>
- Basaglia, A., Spacone, E., van de Lindt, J. W., & Kirsch, T. D. (2022). A Discrete-Event Simulation Model of Hospital Patient Flow Following Major Earthquakes. *International Journal of Disaster Risk Reduction*, 71, 102825. <https://doi.org/https://doi.org/10.1016/j.ijdr.2022.102825>



- Botha, N. N., Segbedzi, C. E., Dumahasi, V. K., Maneen, S., Kodom, R. V., Tsedze, I. S., Akoto, L. A., Atsu, F. S., Lasim, O. U., & Ansah, E. W. (2024). *Artificial intelligence in healthcare : a scoping review of perceived threats to patient rights and safety*. 1–26.
- Deffner, D., Rohrer, J. M., & Mcelreath, R. (2022). *A Causal Framework for Cross-Cultural Generalizability*. <https://doi.org/10.1177/25152459221106366>
- Durneva, P., & LeRouge, C. (2026). The personal relevance of digital health technologies for self-management of chronic conditions: instrument development and validation. *European Journal of Information Systems*, 1–39. <https://doi.org/10.1080/0960085X.2025.2605343>
- Edberg, M., & Krieger, L. (2020). Recontextualizing the social norms construct as applied to health promotion. *SSM - Population Health*, 10, 100560. <https://doi.org/https://doi.org/10.1016/j.ssmph.2020.100560>
- Grammoustianou, M., Maccarone, S., Gillanders, E., Menvielle, G., Preau, M., Ginguene, S., Everhard, S., Delpierre, C., Guillemin, F., Vaz-Luis, I., & Franzoi, M. A. (2025). Tackling healthcare providers bias: a systematic review of interventions with implications for inclusive clinical research. *EClinicalMedicine*, 89, 103513. <https://doi.org/https://doi.org/10.1016/j.eclinm.2025.103513>
- Grudniewicz, A., Steele, C., Pauline, G., Jan, B., & James, D. M. (2023). Operationalizing the Chronic Care Model with Goal - Oriented Care. *The Patient - Patient-Centered Outcomes Research*, 16(6), 569–578. <https://doi.org/10.1007/s40271-023-00645-8>
- Hafner, A., Ketata, A., & Wittges, H. (2026). *Making Informal Work Visible: Multimodal AI-Enabled Process Discovery in Public-Sector Meetings*. https://doi.org/10.1007/978-3-032-28570-6_9
- Hattangadi, V. (2020). Edgar Schein's three levels of Organizational Culture. *Juni Khyat Journal*, 10, 112–118.
- Hibbard, J., & Greene, J. (2013). What The Evidence Shows About Patient Activation: Better Health Outcomes And Care Experiences; Fewer Data On Costs. *Health Affairs (Project Hope)*, 32, 207–214. <https://doi.org/10.1377/hlthaff.2012.1061>
- Kurtz, C. (2025). *Patient Performance of Care Tasks During Acute Hospitalisation : A Scoping Review*. 2573–2590. <https://doi.org/10.1111/jocn.17668>
- Links, M., Martin, P., & Morgan, M. (2023). A Systems-Thinking and Person-Centred Approach to Healthcare Communication. *Australian Journal of Clinical Education*, 12. <https://doi.org/10.53300/001c.89083>
- Luo, F., & Id, C. T. (2024). *Navigating uncertainty : The impact of environmental instability on enterprise digital transformation*. 1–22. <https://doi.org/10.1371/journal.pone.0314688>
- Moore, A. R., & Kelly, D. M. (2024). Getting Real About Critical Realist Interviewing: Five Principles to Guide Practice. *International Journal of Qualitative Methods*, 23, 16094069241299312. <https://doi.org/10.1177/16094069241299311>
- Musa, S., & Enggarsyah, D. (2024). Absorptive capacity, organizational creativity, organizational agility, organizational resilience and competitive advantage in disruptive environments. *Journal of Strategy and Management*, 18. <https://doi.org/10.1108/JSMA-10-2023-0265>
- Ogland-Hand, C., Biroscak, B., Kim-Mozeleski, J., Williams, S. M., & Hovmand, P. S. (2025). Social norms structure underlying health behaviors: Developing a feedback theory of social norm adoption for public health. *Social Sciences & Humanities Open*, 12, 102165. <https://doi.org/https://doi.org/10.1016/j.ssaho.2025.102165>
- Ramesh, P., Bhavikatti, V., OMNAMASIVAYA, B., CHAITANYA, G., TEJASWINI, Hiremath, S., GONDESI, H., & Jada, K. (2024). ORGANISATIONAL ADAPTABILITY: A STUDY OF THE MEDIATING ROLE OF LEADERSHIP IN THE INFLUENCE OF STRATEGIES, COMPLEXITY, AND TECHNOLOGY. *International Journal of Innovation Management*, 27. <https://doi.org/10.1142/S1363919623500366>
- Rangachari, P., Arkoubi, K. Al, & Shindi, R. (2025). *A multi-level framework for advancing digital health equity in learning health systems : aligning practice and theory with the Quintuple Aim*. 4.

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- Shojaee, A., Rashed, M., Islam, M. F., & Vasa, L. (2025). Innovative configurations for organizational resilience: Bridging the proactive and reactive capability in volatile environments. *Sustainable Futures*, 10, 101236. <https://doi.org/https://doi.org/10.1016/j.sftr.2025.101236>
- Singh, M. P., & Keche, Y. N. (2025). *Ethical Integration of Artificial Intelligence in Healthcare : Narrative Review of Global Challenges and Strategic Solutions*. 17(5), 1–16. <https://doi.org/10.7759/cureus.84804>
- Snijders, V., Bach, K., Robert, H., Fischer, E., Thomas, F., Leask, J., Scherzer, M., Mazhnaia, A., & Fietje, N. (2025). *An approach to capturing the cultural contexts of health behaviours*. *April*, 978–985. <https://doi.org/10.1007/s00103-025-04105-6>
- Timmermans, L., Golder, E., Decat, P., Foulon, V., Van Hecke, A., & Schoenmakers, B. (2023). Characteristics of self-management support (SMS) interventions and their impact on Quality of Life (QoL) in adults with chronic diseases: An umbrella review of systematic reviews. *Health Policy*, 135, 104880. <https://doi.org/https://doi.org/10.1016/j.healthpol.2023.104880>
- Tohidian, I., & Rahimian, H. (2019). Bringing Morgan’s metaphors in organization contexts: An essay review. *Cogent Business & Management*, 6. <https://doi.org/10.1080/23311975.2019.1587808>
- Wang, X., Yang, F., Trafford, J., Qiu, W., & Conn, C. (2026). *What counts as care ? Structural critique of digital health models*. 12, 1–9. <https://doi.org/10.1177/20552076251411273>