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Digital health literacy and patient loyalty in smart hospitals: Insights from a qualitative Meta-Synthesis

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Abstract

The rapid digital transformation of healthcare has led to the emergence of smart hospitals that leverage technologies such as electronic health records, telemedicine, mobile health applications, and the Internet of Things. While these innovations hold promise for improving patient care and operational efficiency, the effectiveness of digital health interventions depends largely on patients' digital health literacy. This study presents a qualitative meta-synthesis of peer-reviewed research published between 2010 and 2025, examining how digital health literacy influences patient loyalty in smart hospital contexts. Using meta-ethnography and thematic synthesis approaches, 7 qualitative studies were analysed to identify overarching themes, including patient empowerment, trust in digital health systems, engagement with digital services, and organizational support for digital inclusion. Findings indicate that higher levels of digital health literacy enhance patient engagement, satisfaction, and long-term loyalty, while barriers such as digital inequality and limited organizational support may reduce these effects. The study offers a conceptual framework linking digital health literacy to patient loyalty and provides practical recommendations for hospital administrators to design patient-centred digital initiatives. These insights contribute to the theoretical understanding of patient engagement in digital healthcare and inform strategies for fostering loyalty in smart hospitals.

Keywords: Digital health literacy, Patient loyalty, Smart hospitals, Qualitative Meta-Synthesis, Patient engagement

Introduction

The healthcare industry is undergoing a profound transformation, driven by the integration of digital technologies aimed at enhancing patient care and operational efficiency. This phenomenon, known as digital transformation in healthcare, encompasses the adoption of Electronic Health Records (EHRs), telemedicine, mobile health applications, and the Internet of Things (IoT) to improve patient outcomes and streamline healthcare services [1,2].

Smart hospitals epitomize this transformation by leveraging advanced technologies to create interconnected healthcare environments. These institutions utilize IoT devices, artificial intelligence (AI), and EHR systems to optimize patient care, enhance operational workflows, and reduce costs [3]. For instance, the Surat Municipal Corporation's implementation of a new Hospital Management and Information System (HMIS) across multiple facilities has digitally processed over 89,000 patients, showcasing the efficacy of such digital initiatives in improving healthcare delivery [4].

Central to the success of these digital health initiatives is the concept of Digital Health Literacy (DHL), which refers to the ability of individuals to access, understand, and utilize digital health information effectively. DHL empowers patients to engage with digital health tools, leading to better health management and outcomes [5]. However, the relationship between DHL and patient loyalty—defined as the patient's commitment to continue using healthcare services and recommending them to others—remains underexplored, particularly within the context of smart hospitals.

This paper aims to bridge this gap by synthesizing qualitative studies to explore how DHL influences patient loyalty in smart hospital settings. By understanding this relationship, healthcare providers can design strategies that enhance patient engagement and foster long-term loyalty.

The healthcare sector is experiencing a significant digital transformation, characterized by the widespread adoption of technologies such as Electronic Health Records (EHRs), telemedicine, mobile health applications, and the Internet of Things (IoT). These advancements aim to improve patient care, enhance operational efficiency, and reduce costs [1,2]. Smart hospitals exemplify this transformation by integrating these technologies to create interconnected healthcare environments that optimize patient outcomes and streamline services [3].

Central to the effective utilization of these digital tools is Digital Health Literacy (DHL), which refers

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to the ability of individuals to access, understand, evaluate, and apply health information from electronic sources to address or solve a health problem [6]. DHL encompasses various dimensions, including functional, communicative, critical, and transactional literacies, each contributing to a patient's capacity to engage with digital health resources effectively [7].

Patient loyalty is a critical determinant of hospital sustainability and organizational success. Loyal patients are more likely to continue using a hospital's services, adhere to treatment plans, and recommend the institution to others, which collectively enhances health outcomes and operational efficiency [8,9]. In an increasingly competitive healthcare environment, fostering patient loyalty not only improves service quality but also provides a strategic advantage by strengthening the hospital's reputation, reducing patient churn, and promoting long-term financial sustainability [10]. Therefore, understanding and enhancing the factors that drive patient loyalty, such as digital health literacy and patient engagement, is essential for the ongoing success of modern smart hospitals.

Despite the growing adoption of digital technologies in healthcare, there is a limited understanding of how Digital Health Literacy (DHL) influences patient loyalty in the context of smart hospitals. While smart hospitals leverage electronic health records, telemedicine, mobile health apps, and IoT-enabled devices to enhance patient experience, the effectiveness of these technologies largely depends on patients' ability to access, comprehend, and utilize digital health information [6,7].

Current research on DHL and patient loyalty is fragmented and predominantly quantitative, focusing on metrics such as technology adoption rates, usage statistics, and patient satisfaction scores [1,2]. Few studies have explored the qualitative aspects of patients' lived experiences, including how digital literacy shapes trust, engagement, and long-term commitment to hospital services.

This gap hinders the development of effective strategies to foster patient loyalty through digital interventions and limits the theoretical integration of DHL within healthcare management and patient engagement frameworks.

Therefore, there is a pressing need to synthesize qualitative evidence to understand the mechanisms through which DHL affects patient loyalty in smart hospitals, providing insights for both theory and practice.

The primary objective of this study is to synthesize qualitative evidence on the relationship between digital health literacy (DHL) and patient loyalty in smart hospitals. By integrating findings from multiple qualitative studies, this research aims to uncover the mechanisms through which DHL shapes patient engagement, trust, and long-term commitment to healthcare services [6,7].

A secondary objective is to develop insights and a conceptual understanding that can inform hospital management practices and guide future research. Specifically, the study seeks to identify key themes, patterns, and contextual factors influencing how patients perceive and act upon digital health information, thereby providing a framework for designing interventions that foster patient loyalty in digitally advanced hospital environments [1,2].

This study offers both theoretical and practical contributions to the field of healthcare management and digital health research. By conducting a qualitative meta-synthesis, this research bridges gaps in the literature on Digital Health Literacy (DHL) and patient loyalty, particularly within the context of smart hospitals. Existing studies are largely quantitative and fragmented, limiting understanding of patients' lived experiences and the mechanisms through which DHL influences loyalty [6,7]. This study synthesizes qualitative evidence to generate a comprehensive understanding and conceptual framework that links DHL with patient engagement, trust, and loyalty, thereby extending service management and healthcare digitalization theories.

From a managerial perspective, the findings provide evidence-based recommendations for hospital administrators seeking to enhance patient loyalty through DHL initiatives. Insights from this study can guide the design of patient-centred digital tools, educational programs, and communication strategies that improve patient competence in using digital health resources. By fostering DHL, hospitals can strengthen patient trust, satisfaction, and long-term engagement, ultimately enhancing organizational performance and competitiveness in the digital healthcare era [1,2].

Methodology

This study employs a qualitative meta-synthesis approach to integrate findings from existing qualitative research on Digital Health Literacy (DHL) and patient loyalty in smart hospitals. Meta-synthesis enables the researcher to go beyond individual study results to generate higher-order interpretations and conceptual insights [11,12]. Specifically, this study considers meta-ethnography and thematic synthesis techniques to identify recurring themes, patterns, and relationships across studies.

A comprehensive literature search was conducted across multiple academic databases, including Scopus, PubMed, Sage, Wiley, Epistenomikos, ScienceDirect, and ProQuest, to capture peer-reviewed qualitative studies relevant to the research topic. These databases were selected due to their broad coverage of healthcare management, digital health, and patient engagement literature.

The search strategy utilized a combination of keywords and Boolean operators to maximize coverage of relevant studies. The primary search terms included:

- "Digital health literacy"
- "Patient loyalty"
- "Smart hospital"
- "Digital hospital"
- "E Health"
- "M Health"

Additional inclusion criteria were applied to ensure the relevance and quality of selected studies:

- Publication period: 2010–2025
- Language: English
- Study type: Peer-reviewed qualitative studies focusing on DHL, patient engagement, or patient loyalty in digital or smart hospital settings

Data were systematically extracted from each study, including information on study aim, methodology, participant characteristics, healthcare setting, and key findings. The extracted data were then synthesized using thematic coding to identify overarching themes and relationships. The process followed guidelines for qualitative meta-synthesis to ensure rigor, transparency, and reproducibility [13].

To ensure the relevance and rigor of the qualitative meta-synthesis, specific inclusion and exclusion criteria were applied during the literature selection process.

Inclusion criteria

- Peer-reviewed qualitative studies published between 2010 and 2025.
- Studies focusing on digital health literacy (DHL), patient experience, engagement, or loyalty in digital or smart hospital contexts.
- Research that provides in-depth qualitative insights, including patient perceptions, experiences, and narratives relevant to digital health tools and smart hospital services.

Exclusion criteria

- Studies that are quantitative only without qualitative findings, as they do not provide the rich, experiential data required for meta-synthesis [12].
- Publications not in English, to maintain consistency in interpretation and ensure accuracy of thematic analysis.
- Studies lacking full-text availability or methodological transparency, which could compromise the credibility of the synthesis.

By applying these criteria, the review ensures a focused and methodologically sound selection of studies, allowing for a robust synthesis of qualitative evidence on the relationship between DHL and patient loyalty in smart hospitals [13].

For each included study, relevant data were systematically extracted to capture key aspects of the research. The extracted elements included:

- Study aim: Objectives and research questions addressed.
- Method: Qualitative approach used, such as phenomenology, grounded theory, or case study.
- Setting: Healthcare context, including type of hospital (smart, digital, or traditional) and geographical location.
- Participants: Sample characteristics, such as patient demographics, healthcare staff, or mixed stakeholders.
- Themes: Key qualitative findings, including emergent patterns, codes, and categories identified in each study.

- Key Findings: Insights relevant to the relationship between digital health literacy (DHL) and patient loyalty [12,13].

The extracted data were analysed using a line-of-argument synthesis to identify overarching themes and relationships across studies [11]. This approach allows the integration of findings from multiple qualitative studies to construct higher-order interpretations, generating conceptual insights on how DHL influences patient loyalty in smart hospitals. Themes were iteratively compared, contrasted, and synthesized to develop a coherent framework highlighting key mechanisms, mediators, and contextual factors affecting patient engagement and loyalty.

To ensure methodological rigor and credibility of the synthesis, each study was critically appraised using the Critical Appraisal Skills Program (CASP) qualitative checklist [14]. The appraisal evaluated the clarity of research aims, appropriateness of methodology, study design, recruitment strategy, data collection, analysis, and ethical considerations. Only studies meeting predefined quality standards were included, enhancing the trustworthiness and reliability of the synthesized findings.

Result

Study selection

The study selection process and results were summarized in the flow chart, as shown in Figure 1. A total of 1131 relevant studies were obtained using the search strategies. After removing the duplicate, 797 studies remained. 733 studies were excluded due to an ineligible title and abstract. 57 studies were excluded because their methodologies were not suitable for qualitative meta-synthesis, and the remaining 7 studies were reviewed to produce meta-synthesis themes.

Study characteristic

A total of seven studies met the inclusion criteria and were included in this meta-synthesis.

These studies representing diverse digital health context, smart hospital implementation stages, and clinical service environment.

Healthcare setting capture were ranged from specialist rehabilitation units, outpatient musculoskeletal services, digital hospital transformation environment, ophthalmology care, and digital service portal co-design initiatives, extending across nations and health systems. The studies utilized mix of qualitative designs (interviews, observation, focus group) and mixed method approaches where open-ended narrative data supplemented survey-based measurements. Participant included is vary from patients, nurses, multidisciplinary clinical practitioners, healthcare managers and digital transformation stakeholder – reflecting perspectives of digital service form both provider and consumer side.

Across the included studies, qualitative data were primarily collected through interviews, focus group, structured observations and narrative survey comments. The data analysis method was predominantly thematic, although the depth, reporting detail and qualitative richness varied across studies. Collectively, the included studies provide an overview of how digital capabilities, digital maturity levels, usability experiences and patients digital health literacy shape patient experience, perceived value, engagement, and loyalty in the context of smart hospitals.

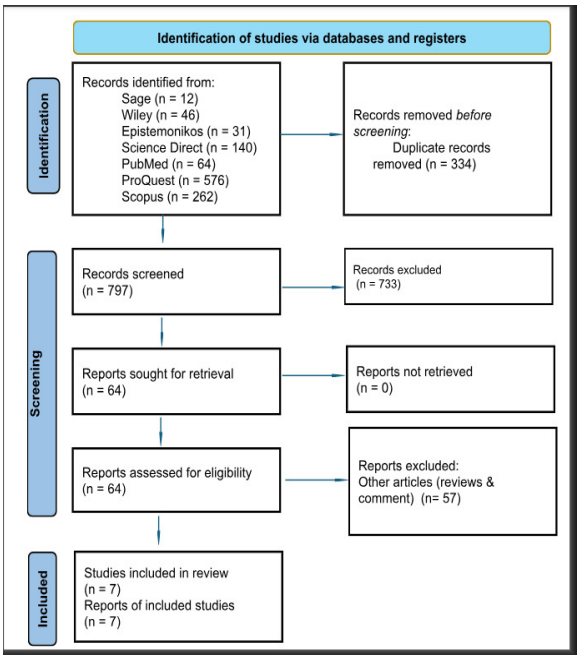

Fig 1

Table 1. Characteristic study table

Study ID	Setting	Study design	Aim	Participant	Sampling	Data Collection	Data analysis	Ethic/ consent	Key finding	Limitation	Implication
Hakim et al (2021)	Single clinical service setting	descriptive exploratory evaluation	To explore patient experience in corneal care service, identify opportunities for improvement in patient centred service pathways	Patient attending corneal service clinics	Recruitment from active patient clinic cohort attending corneal service appointments, survey distributed to current service users	Patient experience survey with open narrative comment fields focusing on satisfaction, waiting time, information understanding and pathway experience	Thematic summary interpretation of open text responses (not reported with formal coding framework, no detailed theoretical framework described)	Ethical governance stated, patient survey with anonymized feedback and implied consent via patient response	Theme included, waiting time concerns, communication needs, satisfaction with staff interaction, service improvement suggestion and pathway operational bottleneck	Single service context, descriptive survey, limited methodological explanation, quality depth constrained by survey instrument design	Useful for local service improvement cycle and targeted operational redesign to enhance patient journey and experience
Hughes et al (2024)	Ireland; development context of national digital children's hospital and ANP – led hydrocephalus service	Qualitative study using semi-structured interviews and focus group; thematic analysis (Braun & Clarke) supported by NVivo	To explore stakeholder views, requirements, perceived benefits, challenges and interoperability consideration in designing a national interoperable patient portal for children with hydrocephalus	Multi stakeholder sample: parent (carers of children with hydrocephalus), ANP team, HCPs, digital/IT experts, hospital administrator	Purposive recruitment via hospital ANP service network, national clinical digital networks and stakeholders involved in children's digital health service design	Online semi-structured interviews and focus group; audio recorded and transcribed verbatim; topic guides used; exploratory probing to elicit depth of perception related to portal function/interoperability/data sharing/ privacy	Thematic analysis guided by Braun & Clarke; NVivo software, iterative coding; independent coding initially then merged and agreed final themes	Ethical approvals obtained; written informed consent from all participant	Themes included: perceived portal benefits (efficiency, empowerment, information visibility), risk/concern (data governance, security, medico-legal boundaries, data quality), interoperability barriers, requirement for standardisation, need for national level governance model for integration	No young people included as participants; digital experience bias possible; single disease focus limit generalisability; policy implementation challenges recognised	Portal development must be interoperable across multiple hospital system, require national governance, regulatory clarity, digital trust and security, staged rollout and co-design to ensure sustainability and patient adoption
Van der ven (2023)	Outpatient musculoskeletal care service/	Mixed method survey (quantitati	To explore patient preferences and acceptance factors regarding digital	Adult patients with musculoskel	Recruited from patients with active	Structured survey instrument with Likert-based questions + open narrative fields for	Mainly descriptive quantitative; qualitative	Ethical approval and patient	Preferences influenced by convenience, access, condition	Single setting, survey based,	Digital health adoption for musculoskel

	clinical pathway setting	ve + qualitative narrative open text)	health, telemedicine and remote musculoskeletal care models	etal disorders under care pathways	musculoskeletal conditions attending care service	qualitative comments	narrative comments, summarised descriptively (no detailed coding/thematic methodology described)	consent obtained	severity, trust in digital consultation, digital readiness, technology usability and desire for hybrid models	qualitative depth limited, potential response bias	etal care must consider individual patient readiness, hybrid service preference, digital literacy and condition specific suitability
Antonacci et al (2023)	Italy, national survey across healthcare providers	Mixed method cross sectional survey	To explore drivers, benefits, challenges of telemedicine adoption from healthcare professional and manager perspectives	124 respondents (86 clinicians/ 38 managers)	Purposive sampling + database supplementation to maximize territorial coverage	Online survey (google forms) with closed item + open narrative questions	Thematic grouping / clustering descriptive summary; not fully reported coding procedure	Reported according to Italian regulation; implied consent; anonymised	Drivers: organisational, technological, regulatory. Benefits: improved efficiency, reduce travel, shorter waiting list, improved access. Challenge: interoperability and integration, physical exam limitation, digital divide, equity, sociocultural and digital literacy barrier	Low response rate (20%), mostly public sector respondents, mainly northern regions, heavy closed question structure	Telemedicine suitable to augment not replace face to face interaction; policy framework, interoperability, guidelines, training, equity access intervention needed
Woods et al (2023)	Multisite health system context	Qualitative study using semi-structured interviews	To explore stakeholders' perception towards the perceived influence/impact of digital health maturity implementation across service delivery context	Healthcare stakeholder involved in digital maturity environment	Purposive sampling to recruit stakeholders with experience and exposure to digital maturity deployment	In-depth semi structured interviews recorded and transcribed verbatim	Thematic analysis using recognised analytic framework and coding approach	Ethics approval documented; informed consent reported; confidentiality assured	Digital maturity influences perceived efficiency, system capability, decision support strength, data visibility, care coordination quality, and perceived return on value of digital transformation	Context dependent; potential variability across maturity stage between settings; reflexivity not elaborated	Digital maturity not only affects capability but strengthens systemic value realization, informing future investment prioritization and scaling model of digital

											health adoption
Burridge (2018)	Australia (Princess Alexandra Hospital, Queensland) – specialist spinal cord injury rehabilitation unit	Mixed qualitative dominant study: structured observation, focus group + patient experience survey	To investigate how practitioner work with EMR during interactions with patients and identify challenges/opportunities for PCC	Practitioners n=53 (FGD) + structured observation (50 encounters) + patient survey n=43	Convenience sampling supported by clinical manager referral	17.5 hours structured observation, nine focus groups, patient experience questionnaires	Thematic analysis for qualitative components; descriptive statistics for survey component	Institutional and university ethics approval; written informed consent reported	Functionality and emergent challenges; usability, workflow disruption, informal interaction loss; meaning/value impacts on PCC and relational care; nurses most strained	Convenience sample, single site, PCC survey instrument not rehab – specific	PCC requires adaptation of digital workflows; EMR design must consider specialty context; frontline discretionary adaptation is critical for sustaining PCC
Clay-Williams et al (2023)	Metropolitan Sydney, New South Wales, Australia; work shop conducted online (Zoom)	Mixed method (demographic survey + qualitative workshop / focus group), reported as qualitative thematic analysis for the qualitative component	To elicit consumers and providers expectation and perspectives on virtual care vs inpatient care to inform design of a new hospital	Consumers n=33; providers n=49 (total n=82 across 12 workshops). Demographics provided (age, gender, ethnicity, languages)	Expression of interest (REDCap) via LHD networks, local newspapers, LHD Facebook; translated advertisement and interpreter support for CALD participants. Workshop were voluntary; response to EOI implied consent for demographics	12 workshop (6 consumers, 6 provider), focus group (up to 5 people), audio-recording, facilitator scribe notes; workshop scripts and example clinical scenario (chest pain)	Thematic analysis: two researchers independently open coded then merged codes into sub-theme and themes; consumer and provider data analysed separately	PICF used; participant consent prior to each workshop; translated materials and interpreter support offered. Ethical approval study was obtained from the western Sydney local health district human research ethic committee	Advantages: patient wellbeing, accessibility, better care/outcomes, health system benefit. Disadvantages/risk: patient factor (digital literacy), accessibility inequities, resources/infrastructure, quality and safety concern. Consumer choice and appropriate selection emphasised	Zoom based may bias toward digital comfortable participant; single LHD in metro Australia; did not explore participant prior virtual care experience; low uptake among some non-English speaking groups	Virtual care is acceptable to many but need infrastructure, triage and escalation pathways, digital inclusion efforts, clinician and consumer training and governance for safety/data security

Methodological appraisal summary

Overall, methodological assessment using the CASP qualitative checklist indicated moderate quality across the included studies. Most studies clearly described their research aim, used appropriate qualitative or mixed methods design, and used thematic approach to analysing narrative data. However, reporting transparency varied, and some studies offered limited information regarding researcher reflexivity and its potential influence on data interpretation. Furthermore, explicit statements about data saturation were generally absent from most paper, reducing clarity around sampling adequacy and stopping rules. Data richness also varies, some studies providing in-depth observational data and qualitative interviews, while other relied primarily on survey-based open-text responses, yielding surface-level narrative insight. Despite these limitations, the collective evidence base was strong enough to support interpretive synthesis across the studies.

Synthesis of finding

The synthesis yielded 4 themes that explain how digital health literacy influences patient loyalty in the smart hospital environment.

Theme 1: Digital health literacy shapes patient's confidence, trust, and ability to engage with digital hospital services

Across studies, patient's ability to understand, navigate and interpret digital tools significantly impacts their confidence and perceived control in digital care [15,16]. Higher digital health literacy leads to more empowered patients [17], better decision-making[18], and greater ability to utilize digital-based service[16]. On the other hand, limited digital literacy creates uncertainty, reduce perceived safety, and increase dependence on providers [15,19]. This shows that literacy is not just a technical skill, but also a psychological determinant of digital readiness.

Theme 2: Smart hospital digital maturity influences perceived value, efficiency and quality of care

Studies conducted in high-maturity digital hospital environments shows that advanced interoperability, seamless data exchange, automation, and well-integrated workflows enhance patient and provider perceptions of system efficiency, coordination, and intelligence. As mentioned by Hughes et al. (2024) that interoperable patient portals and consistent system architecture enable smoother navigation and "seamless" care experiences, reinforcing trust and perceived value in digital services [16]. Similarly, Woods et al. (2023) highlighted that digitally mature hospitals create effective intraorganizational interoperability, thus reduce friction in clinical processes and support more reliable decision-making across departments [20]. On the other hand, Burridge et al. (2018) mentioned that low-maturity in digital hospital environments increased task complexity, therefore adds health staff's workload, hinder workflow efficiency, and negatively influence the quality of patient care [17].

As digital maturity increase, so does the perceived value and legitimacy of digital health technologies. Therefore, maturity not only reflects infrastructure readiness but also shapes how digital care is experienced and interpreted as valuable by users.

3.4.3 Theme 3: Relational care remains central and cannot be substituted by digital enablement

Even in technologically advance hospitals, the quality of human interaction, communication, empathy, and relational presence remain crucial to the perception of quality care[19]. Digital system changes the form of interaction, but do not replace the relational dimension of care[21].

When technological burden, usability issues, or system rigidity limit relational exchanges, patients perceive digital care as less personal and less therapeutic [17].

The success of patient care in the digital age is determined by the extent to which technology can support, not compete with, the human touch in care.

3.4.4 Theme 4: Digital divide factors shape uneven experience, acceptance, and loyalty toward digital health services

Usability challenges, unequal access to connectivity or devices, varying literacy levels, and differences in technology readiness contribute to differences in experience outcomes across patients and setting. Clay-Williams et al. (2023) highlight that virtual care becomes significantly less accessible for patients with poor digital literacy or no access to technology, raising concerns that these patients may not derive equal benefit from digital modes of care[15]. Similar patterns appear in van der Ven et al.

(2023), where patients explicitly described difficulties with digital devices, demonstrating that differences in digital skills and device access directly shape their ability to participate in eHealth services [18].

These digital divide factor not only influence adoption and satisfaction but also shape long-term engagement and loyalty to digital healthcare models. Patient who encounters barriers are more likely to demonstrate reduce engagement and lower willingness to continue using or recommend digital healthcare services.

Confidence in the Evidence (CERQual Assessment)

The level of confidence in each synthesized finding was assessed using the GRADE-CERQual approach, which evaluates methodological limitations, relevance, adequacy and coherence of the contributing studies. Assessments were informed by the CASP appraisal results and comparative analysis across the seven studies. Table 2 summaries the overall confidence assigned to each review finding.

Overall, the confidence level in the evidence ranged from moderate to moderate – high, indicating a credible and coherent qualitative evidence. Although some methodological limitation such as limited reflexivity and a lack of explicit saturation were described, inter study coherence was strong and conceptual relevance to the review objectives was high.

Therefore, the synthesized themes provide a reliable and context-rich understanding of how digital health literacy, digital maturity, relational care and digital divide factors influence patient experience, engagement and loyalty in smart hospital settings.

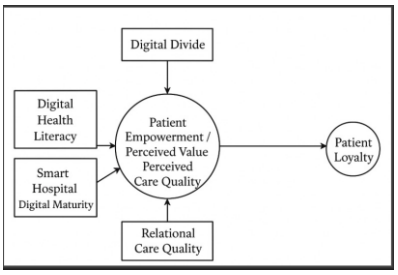

Fig 2.

Table 2. Summary of confidence in the evidence (CERQual Assessment)

Review Theme	Contributing Studies	Methodological Limitation	Relevance	Adequacy of Data	Coherence	Overall CERQual Confidence
Digital health literacy shapes patient's confidence, trust, and ability to engage with digital hospital services.	All seven studies	Moderate Concern (limited reflexivity and saturation reporting)	High Relevance	Moderate adequacy (variable depth)	Good coherence	Moderate confidence
Smart hospital digital maturity influences perceived value, efficiency and quality of care	Burridge et al (2018); Woods et al (2023); Hughes et al (2024); Clay-Williams et al (2023)	Minor – moderate concern	High Relevance	Moderate – high adequacy	High coherence	Moderate – high confidence
Relational care remains central and cannot be substituted by digital enablement	Burridge et al (2018); Clay-Williams et al (2023); Woods et al (2023)	Moderate concern	High relevance	Moderate – high adequacy	High coherence	Moderate – high confidence
Digital divide factors shape uneven experience, acceptance, and loyalty toward digital health services	All seven studies	Moderate concern	High relevance	Moderate adequacy	Good coherence	Moderate confidence

Discussion

Overview

This review synthesizes qualitative evidence from seven studies exploring how digital health literacy, digital maturity, relational care processes, and the digital divide influence patient experience, engagement and loyalty in smart hospital settings. Four interrelated themes emerge, illustrating that technological capabilities and human experience are interdependent dimension of digital

transformation. The discussion below interprets these findings through the combined perspectives of technology acceptance and trust, value co-creation within the service-dominant logic, and patient-centred care principles.

Digital health literacy shapes patient's confidence, trust, and ability to engage with digital hospital services

The first synthesis finding emphasized that digital health literacy (DHL) serves as a technical and psychological factor that drive participation in digital care. Consistent with the Technology Acceptance Model (TAM), perceived ease of use and usefulness are mediated by patient literacy levels, which shape trust and intention to use digital systems [22]. When patients understand how to navigate a patient portal or the virtual interface, they experience greater self-efficacy and a sense of control, consistent with previous evidence that literacy enhance autonomy and shared decision-making. On the other hand, limited DHL limits perceived behavioural control and increase dependence on provider or clinician, thereby reducing engagement [23].

From a Patient Centred Care (PCC) perspective, literacy not only support information exchange but also fosters partnership and mutual understanding, strengthening autonomy and shared decision-making [24-26]. Therefore, digital literacy training and inclusive interface design are crucial strategies for building trust and maintaining engagement in the smart hospital ecosystem [27].

Digital maturity and the perceived value of care

The second theme highlight that the smart hospital digital maturity influences perceived value, efficiency and quality of care.

Based on Service Dominant Logic (SDL), digital maturity can be defined as an organizational capability that enables the creation of shared value between patients and provider [28]. As interoperability and data visibility increase, stakeholders experience increased coordination and transparency, which strengthen the perceived value of service. In line with the concept of "perceived usefulness" in TAM, mature digital becomes one that generates value in service delivery.

Furthermore, digital maturity also determines trust in system reliability and decision support. When digital system supports seamless workflows and information flows, patient and clinician will perceive them as improvement, rather than complicating care [29,30]. These findings extend previous studies by demonstrating that perceived value in digital health is generated simultaneously through technological capabilities and user trust.

Relational care and human connection in digital environments

The finding in the third theme emphasizes that despite increasing automation, relational interactions remain the foundation of perceived quality of care. Within the PCC framework, authentic communication, empathy, and relational presence are core elements that technology should enable, rather than replace [31]. Observational studies show that clinician who adapt digital workflows to maintain eye contact and dialogue with patients preserved therapeutic connection and patient satisfaction [32].

Interpreted through SDL, this dynamic represents the process of relational value co-creation, where emotional connection and professional empathy are form of value themselves. Even highly digital hospitals rely on interpersonal relationship to humanize care; it is reminding us that technological advancement must be balanced by human presence. Therefore, smart hospitals must integrate relational design principles into user interface, workflow layouts, and staff training to maintain a human centric approach in a digital context [31-33].

The Digital divide and differential patient loyalty

The final theme revealed that usability barriers, inequitable access, and variability in technology readiness contribute to inequitable digital health experiences. Extending the trust value model of TAM, perception of fairness, accessibility, and usability influence initial acceptance and long-term loyalty [34]. Patients that facing technical or literacy barriers develop lower perceived value and reduced trust in digital system.

Within the service dominant logic, these inequalities reflect a failure in shared value creation – where the context of interactions prevents some patients from realizing the benefit of digital health.

Addressing this gap requires inclusive infrastructure, simplified digital interface, and proactive support for digitally vulnerable populations [27]. Therefore, reducing the digital divide is imperative to maintaining patient engagement and loyalty in smart hospitals [35].

Integrative interpretation

As shown in Figure 2, these four findings illustrate that smart hospital transformation is not simply a technological evolution or digitalization, but rather a socio-technical adaptation process based on literacy, trust, and relational values. Digital systems create value when it extends human capabilities, foster relational integrity, and ensure equitable access. The integration of the TAM, SDL and PCC frameworks clarifies that acceptance (TAM) foster co-created value (SDL), which in turn sustains person-centred trust and loyalty (PCC). In the end, the path to become true smart hospital maturity lies in aligning technological capabilities with human experience and ethical inclusivity.

Strength and limitation

This review has several strengths that enhance its credibility and contribution to the literature on smart hospital and digital health literacy. The synthesis capture perspective from patient, clinicians, and healthcare managers across diverse and digital transformation context. The use of systematic search strategy, structured PRISMA reporting and rigorous assessment using CASP checklist enhance methodological transparency. Furthermore, the integration of three complimentary theoretical frameworks – Technology Acceptance Theory, Service-Dominant Logic, and Patient-Centred Care – create robust interpretive perspective that enrich understanding of how digital health literacy, relational care, and digital maturity collectively shape patient engagement in smart hospital setting. However, this review also has limitation. A Limit of seven articles qualified for inclusion in the final sample. Since the search was in English, studies conducted in other languages may have been missed and overlooked. Several included studies provided limited reflexivity reporting and did not describe data saturation processes. The qualitative richness varied among the studies, particularly those that relied on open-ended survey comments, which may limit the depth of interpretive insight.

Furthermore, most studies were conducted in technologically advance or well-resourced health systems, potentially limiting the transferability of finding to hospital with lower digital maturity or limited resources.

Conclusion

This qualitative evidence synthesis demonstrates that digital health literacy, digital maturity, relational care processes, and digital divide factors collectively shape patient experience, engagement, and loyalty in smart hospital setting. These finding suggest that smart hospital transformation is not simply a technological development, but rather a social-technical process in which trust, usability, communication quality, and equitable access remain key determinants of perceived value. The integration of insights from technology acceptance theory, service-dominant logic, and patient centred care frameworks shows that digital systems only yield meaningful benefit if the improve – not replace – human connection and patient empowerment. Strengthening digital literacy, ensure relational care is integrated into workflows, and addressing the digital divide are critical strategies for advancing inclusive, efficient and patient centred smart hospitals.

Future research should further examine how these determinants evolve alongside rapid technological innovation and how digital transformation can be optimized to support sustained patient engagement and loyalty.

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