

Digital Health Literacy and Patient Experience in Digital Health Services: A Systematic Review of Engagement, Satisfaction, and Loyalty-Related Outcomes

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ABSTRACT

Background: Digital health services (e.g., telemedicine, patient portals, and mobile health apps) are increasingly embedded in care delivery, making digital health literacy (DHL/eHealth literacy) a plausible determinant of service outcomes. *Objective:* This systematic literature review (SLR) synthesises empirical evidence on the association between DHL/eHL and patient-reported outcomes that are central to service management: digital patient experience, patient satisfaction, and loyalty-related outcomes (intention to use and continuance intention). *Methods:* A PEO-informed search was performed in Scopus using a structured query combining DHL/eHL terms, service outcomes, and digital service contexts. Primary empirical studies measuring DHL/eHL and reporting relevant outcomes among patients/end-users were eligible; non-empirical publications and studies without explicit DHL/eHL measurement were excluded. Study quality was appraised using the Joanna Briggs Institute checklist for analytical cross-sectional studies. A narrative synthesis was conducted due to heterogeneity. *Results:* From 35 retrieved records, four cross-sectional studies (2020-2025) met inclusion and quality thresholds. Across mHealth apps, clinical digital services, online consultation and social-media-based consultation, higher DHL/eHL was consistently associated with stronger intention/continuance and higher satisfaction. Reported mechanisms involved technology acceptance perceptions (usefulness and ease of use), trust/privacy, digital information accessibility and attitudes, and patient-provider communication/empowerment processes. *Conclusion:* DHL/eHL appears to function as a foundational capability for positive digital service outcomes, but the evidence base is small and dominated by cross-sectional self-report designs. Longitudinal and intervention studies and more standardised outcome measurement are priorities for advancing theory and informing DHL-responsive service design.

INTRODUCTION

Digital health technologies—including telemedicine, patient portals, mobile health (mHealth) applications, wearable devices, and digitally mediated communication platforms—have become increasingly embedded within contemporary healthcare systems. Accelerated by advances in information technology and reinforced by healthcare digitalisation initiatives worldwide, these technologies are transforming how patients access information, interact with healthcare providers, and participate in health-related decision-making (World Health Organization [WHO], 2021; Kickbusch et al., 2021). As healthcare services continue to migrate from traditional face-to-face encounters toward digitally mediated environments, patients are increasingly expected to navigate complex information ecosystems, evaluate the credibility of online health information, communicate through digital interfaces, and manage their healthcare journeys through technology-enabled platforms.

Within this context, Digital Health Literacy (DHL), often discussed in relation to eHealth Literacy (eHL), has emerged as a critical capability influencing individuals' ability to effectively engage with digital health services. Building upon the foundational work of Norman and Skinner (2006), DHL/eHL can be understood as the ability to seek, locate, understand, appraise, and apply health information obtained from electronic sources to address health-related needs and make informed decisions. More recent conceptualisations extend beyond information processing to encompass interactive, communicative, and critical competencies required to engage effectively with increasingly sophisticated digital health ecosystems (Paige et al., 2018; van der Vaart & Drossaert, 2017). Consequently, DHL is no longer viewed merely as an individual characteristic but as a strategic capability that may shape patients' access to healthcare services, perceived ease of use, trust in digital platforms, service engagement, and long-term utilisation behaviour.

The growing importance of DHL has generated substantial scholarly interest across healthcare, information systems, and public health disciplines. Existing studies have linked higher levels of DHL to improved health behaviours, self-management capabilities, healthcare utilisation, treatment adherence, and health outcomes (Kim & Xie, 2017; Neter & Brainin, 2019). However, as digital health services become increasingly service-oriented, attention has begun to shift toward understanding how DHL influences service-related outcomes from the patient perspective. These outcomes include Digital Patient Experience (DPE), patient satisfaction, intention to use, continuance intention, recommendation behaviour, and other loyalty-related outcomes that are central to the sustainability and effectiveness of digital health service delivery (Alabdali & Husain, 2023; Mensah et al., 2024).

Despite this growing body of literature, evidence regarding the relationship between DHL/eHL and digital service outcomes remains fragmented. First, studies vary considerably in their conceptualisation and measurement of DHL, employing different theoretical frameworks and assessment instruments such as eHEALS, eHLQ, and Digital Health Literacy Instruments (DHLI) (Norman & Skinner, 2006; Paige et al., 2018). Second, research

frequently focuses on technology acceptance constructs—including perceived usefulness, perceived ease of use, trust, and behavioural intention—while treating literacy as a background variable or statistical control rather than as an explanatory mechanism influencing service experiences and outcomes (Davis, 1989; Venkatesh et al., 2003). Third, findings are dispersed across diverse digital health platforms, patient populations, and healthcare contexts, making it difficult to establish a coherent understanding of how DHL contributes to patients' experiences and post-adoption outcomes.

Furthermore, while previous reviews have examined digital health literacy in relation to public health outcomes, self-management behaviours, and health information seeking, fewer studies have systematically synthesised evidence concerning the service management consequences of DHL across digital healthcare settings. In particular, limited attention has been devoted to understanding whether DHL influences digital patient experience, patient satisfaction, and loyalty-related outcomes through consistent pathways across different digital health services. This gap is increasingly relevant because healthcare organisations are investing heavily in digital transformation initiatives while simultaneously seeking to improve patient-centred care, service quality, and long-term patient retention (WHO, 2021; Kickbusch et al., 2021).

To address this gap, the present systematic literature review synthesises existing empirical evidence regarding the role of DHL/eHL in shaping digital patient experience, patient satisfaction, and loyalty-related outcomes. Specifically, the review focuses on studies in which DHL/eHL is explicitly measured and linked to service-centric patient-reported outcomes. By consolidating fragmented findings across healthcare contexts and digital service platforms, this review seeks to clarify the direction, consistency, and underlying mechanisms of these relationships while identifying opportunities for future research in digital health service management.

Accordingly, this review addresses the following research question: Among patients and end-users of digital health services, how is Digital Health Literacy (DHL/eHL) associated with Digital Patient Experience (DPE), patient satisfaction, and loyalty-related outcomes such as intention to use, continuance intention, recommendation behaviour, and sustained utilisation of digital health services?

RESEARCH METHOD

Review design and reporting

This study employed a systematic literature review (SLR) to synthesize empirical evidence regarding the relationship between Digital Health Literacy (DHL/eHL) and patient-reported outcomes in digital health service environments. A systematic review approach was selected because it provides a transparent, replicable, and rigorous process for identifying, evaluating, and synthesizing evidence from multiple studies (Petticrew & Roberts, 2006; Snyder, 2019). The review followed the reporting principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement (Page et al., 2021),

which provides internationally recognized guidance for documenting identification, screening, eligibility assessment, and study inclusion procedures.

The review process comprised five stages: (1) formulation of the review question, (2) literature search and retrieval, (3) study screening and selection, (4) quality appraisal and data extraction, and (5) evidence synthesis. Because the manuscript available for this project was derived from an archived review draft rather than a live review workspace, only auditable information preserved in the source documents was reported. Any information that could not be independently verified from the archived materials was intentionally omitted to preserve methodological transparency and avoid retrospective reconstruction (Booth et al., 2016).

Research Question and PEO Framework

The review question was developed using the Population–Exposure–Outcome (PEO) framework, which is particularly appropriate for reviews examining associations between exposures and outcomes in healthcare and public health research (Bettany-Saltikov, 2012; Pollock & Berge, 2018).

Within the present review:

Population (P): Patients and end-users of digital health services.

Exposure (E): Explicitly measured Digital Health Literacy (DHL) or eHealth Literacy (eHL).

Outcome (O): Patient-reported outcomes associated with digital health service use, including Digital Patient Experience (DPE), user experience, patient satisfaction, intention to use, continuance intention, reuse intention, recommendation intention, electronic word-of-mouth (eWOM), and other loyalty-related outcomes.

Based on this framework, the review addressed the following question:

"Among patients and end-users of digital health services, how is Digital Health Literacy (DHL/eHL) associated with digital patient experience, patient satisfaction, and loyalty-related outcomes such as intention to use and continuance intention?"

Information Source and Search Strategy

Scopus was selected as the primary bibliographic database because of its extensive multidisciplinary coverage, strong representation of healthcare, information systems, and management journals, and advanced search functionalities (Mongeon & Paul-Hus, 2016; Martín-Martín et al., 2018). Scopus has also been widely used as the primary source in systematic reviews addressing digital health and technology adoption research.

The search strategy was developed iteratively to balance sensitivity and specificity. Search terms were derived from the review question and organized into three concept blocks: (1) Digital Health Literacy/eHealth Literacy, (2) patient-reported outcomes, and (3) digital health service contexts. These concepts were combined using Boolean operators and implemented through the TITLE-ABS-KEY search fields to maximize retrieval relevance.

The final search string is reported in Appendix A to ensure transparency and reproducibility. The archived draft preserved the final search syntax and overall retrieval counts; however, the exact search execution date was not retained in the archived file.

Consequently, the search date is reported as an author-verification item that should be completed using the original Scopus export log prior to manuscript submission, consistent with PRISMA recommendations regarding search transparency (Page et al., 2021).

Eligibility Criteria

Eligibility criteria were established a priori to ensure conceptual consistency with the review objective (Petticrew & Roberts, 2006).

Studies were included when they:

1. Reported primary empirical research.
2. Involved patients or end-users of digital health services.
3. Explicitly measured DHL or eHL using validated instruments or conceptually equivalent measures.
4. Examined digital health service settings, including telemedicine, telehealth, patient portals, personal health records (PHR), mobile health applications (mHealth), online consultations, or comparable digital healthcare platforms.
5. Reported at least one relevant patient-reported outcome, including digital patient experience, user experience, patient satisfaction, intention to use, continuance intention, reuse intention, recommendation intention, or related loyalty outcomes.

Studies were excluded when they:

1. Were editorials, commentaries, conference abstracts, dissertations, reviews, or theoretical papers.
2. Did not explicitly measure DHL/eHL.
3. Focused exclusively on healthcare professionals rather than patients.
4. Did not involve digital health service utilization.
5. Examined outcomes unrelated to patient experience, satisfaction, or loyalty-related behaviours.

Study Selection

Retrieved records were exported from Scopus and screened according to the predefined eligibility criteria. Where applicable, duplicate records were removed prior to screening. The study selection process followed a two-stage procedure commonly recommended in systematic review methodology (Page et al., 2021; Tranfield et al., 2003).

In the first stage, titles and abstracts were screened to assess conceptual relevance. In the second stage, full-text articles deemed potentially eligible were assessed against the inclusion and exclusion criteria. Reasons for exclusion at the full-text stage were documented to ensure transparency and auditability.

The complete selection process was summarized using a PRISMA flow diagram in accordance with current reporting standards (Page et al., 2021).

Quality Appraisal and Risk of Bias

Methodological quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies (Moola et al., 2020). This instrument was selected because the majority of studies within the DHL literature employ cross-sectional survey designs.

The checklist evaluates methodological rigor across several domains, including sample selection, measurement validity, confounding factors, statistical analysis, and outcome assessment. Each included study was assessed against all relevant criteria, and appraisal decisions were documented systematically.

To enhance transparency, an item-by-item appraisal matrix together with concise study-specific justifications is reported in Appendix C. This approach enables readers and reviewers to evaluate the basis of quality judgments and assess potential risks of bias independently (Aromataris & Munn, 2020).

Data Extraction

A structured data extraction form was developed prior to evidence synthesis to ensure consistency across studies (Booth et al., 2016). The extraction matrix captured:

- Bibliographic information (author, year, journal).
- Country and healthcare setting.
- Study population and sample characteristics.
- Digital health service context.
- DHL/eHL measurement instruments.
- Outcome measures.
- Analytical techniques.
- Main findings.
- Reported limitations.

The extraction process facilitated comparison across studies and supported thematic synthesis of findings.

Synthesis Approach

Given the substantial heterogeneity in digital health contexts, DHL measurement instruments, study populations, and outcome operationalisations, statistical meta-analysis was considered inappropriate. Instead, the review adopted a narrative synthesis approach following guidance developed by Popay et al. (2006) and further elaborated by Petticrew and Roberts (2006).

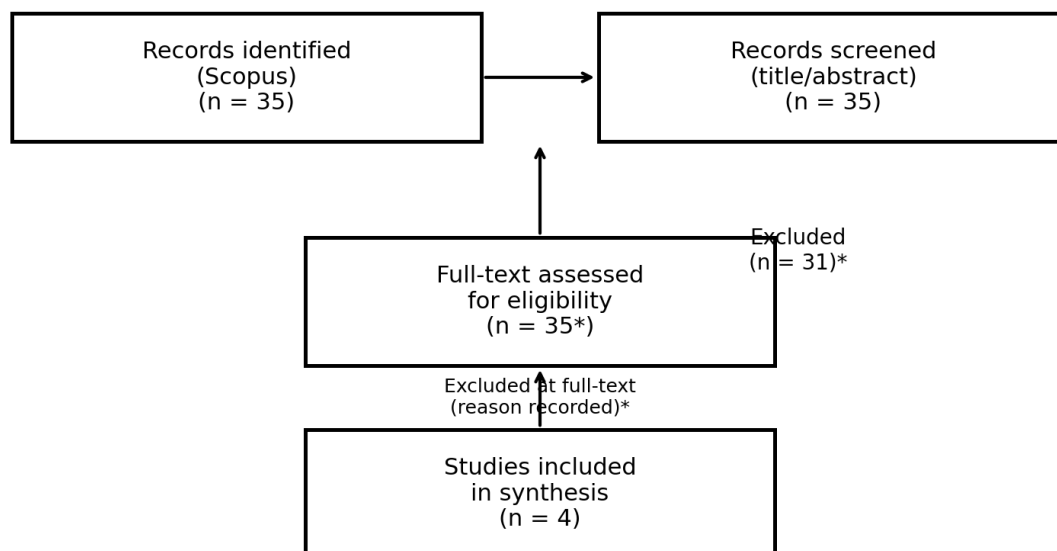
The synthesis proceeded in three stages. First, studies were descriptively profiled according to service context, population, and methodological characteristics. Second, findings were grouped according to major outcome domains, including digital patient experience, patient satisfaction, and loyalty-related outcomes. Third, studies reporting mediating or moderating mechanisms were examined to identify explanatory pathways linking DHL/eHL to service outcomes.

This approach enabled the review to move beyond simple aggregation of findings and develop a theoretically informed understanding of how and under what conditions DHL/eHL contributes to patient experiences and post-adoption behaviours within digital healthcare environments.

RESULT AND DISCUSSION

Study selection and evidence base

The search and screening process yielded 35 records. Following eligibility assessment and quality appraisal, four cross-sectional survey studies (2020-2025) were included in the synthesis. The retained evidence base is therefore small and primarily supports narrative interpretation.



*Stage counts beyond n=35→n=4 were not fully reported in the draft; update when final screening log is available.

Figure 1. PRISMA reporting note.

The archived review preserved two verified PRISMA counts: 35 records identified and 4 studies included in synthesis. Appendix B reports these verified counts together with the eligibility categories used during screening and explicitly marks the intermediate stage counts that still require verification from the original screening worksheet.

Characteristics of included studies

Table 1. Included studies and characteristics

Study	Country	Service context	Main outcomes	Key findings / mechanisms
Jamal et al. (2020)	Saudi Arabia	Psychiatric consultation via Twitter (social media)	Use; satisfaction; eHL	Descriptive study. Users reported convenience/accessibility; satisfaction linked to privacy and response-time concerns.
McKinley et al. (2022)	India	Digitally mediated care and communication (adults with chronic conditions)	Patient satisfaction	eHL associated with higher satisfaction via self-efficacy/empowerment, lower communication apprehension, and better patient-physician communication (mediation).
Ukaegbu & Fan (2025)	Nigeria	mHealth applications	Continuance intention	PLS-SEM. eHL increases perceived usefulness/ease of use and trust, which predict continuance intention (TAM-based pathway).
Cho et al. (2025)	South Korea	Digital healthcare services (multiple myeloma outpatients)	Intention to use	Serial mediation. Digital information accessibility predicts attitudes and DHL; DHL mediates the effect on intention to use.

Studies were conducted in Nigeria, South Korea, India, and Saudi Arabia. All relied on self-report questionnaires and cross-sectional designs, using analyses such as PLS-SEM, mediation models, and descriptive statistics. Service contexts ranged from structured platforms (apps and formal digital healthcare services) to communication-centric and social-media-based consultation.

Measurement approaches

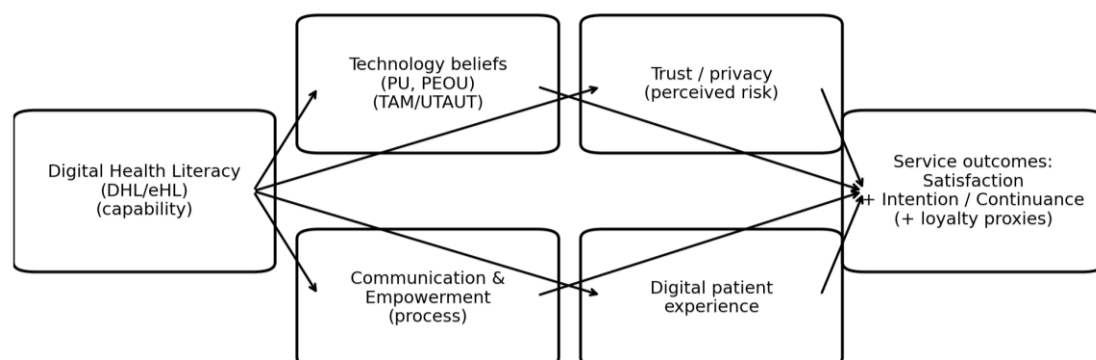
DHL/eHL was measured using Likert-type scales, most commonly eHEALS (or adaptations). Outcome measures varied: behavioural intention and continuance intention scales were prevalent, while satisfaction was measured in communication-focused studies. Formal loyalty constructs beyond intention (e.g., recommendation and repeat utilisation) were rarely measured.

Associations and mechanisms

Table 2. Summary of associations between DHL/eHL and service outcomes

Outcome domain	Direction of association with DHL/eHL	Illustrative pathways identified in included studies	Evidence caveats
Intention/continuance	Positive association in structured services (apps/clinical platforms)	DHL/eHL increases perceived usefulness/ease of use and trust; improves conversion of accessible information into intention	Cross-sectional; intention often measured rather than behaviour
Patient satisfaction	Positive association	DHL/eHL strengthens communication, self-efficacy and empowerment; reduces communication apprehension	Single-study dominance for satisfaction pathway; context-specific
Digital patient experience	Indirectly supported (via UX/service-quality mechanisms)	Trust/privacy and communication quality are salient; suggests DHL/eHL-sensitive design as a service determinant	Few studies explicitly measure DPE as a standalone construct
Loyalty (beyond intention)	Insufficient direct evidence	Proxy measures (intention/continuance) dominate; recommendation and repeat utilisation under-studied	Measurement gap; needs longitudinal and behavioural data

Overall, higher DHL/eHL was consistently linked to stronger intention or continuance of digital health service use and higher satisfaction. Mechanisms varied by context: perceived usefulness/ease of use and trust in mHealth; DHL/eHL as a mediator between information accessibility and intention in oncology services; and empowerment and communication processes for satisfaction.

**Figure 2.** Integrative pathways suggested by the included studies.

Discussion

Interpretation and contribution

This systematic literature review reveals a relatively consistent pattern across the retained evidence base: higher levels of Digital Health Literacy (DHL/eHL) are generally associated with more favorable service-related outcomes in digital healthcare environments, particularly patient satisfaction, intention to use, continuance intention, and other loyalty-related behaviours. These findings reinforce the foundational proposition of eHealth literacy theory that individuals require not only access to digital technologies but also the competencies necessary to effectively navigate, evaluate, and utilize digital health information and services (Norman & Skinner, 2006).

The findings further suggest that DHL functions as more than an individual capability. Rather, it appears to operate as a strategic enabler that influences how patients interact with digital health services and derive value from them. This interpretation aligns with broader perspectives on digital health literacy that conceptualize literacy as a multidimensional construct encompassing functional, communicative, critical, and technology-related competencies (Paige et al., 2018; van der Vaart & Drossaert, 2017). Patients with higher DHL are likely better equipped to understand digital interfaces, interpret health information, communicate with providers, and manage service interactions, thereby contributing to more positive service experiences.

The review also highlights several mechanisms through which DHL appears to influence patient outcomes. Across the literature, constructs commonly associated with technology acceptance and service evaluation—including perceived usefulness, perceived ease of use, trust, communication quality, and system usability—frequently emerge as mediating pathways between literacy and behavioural outcomes. These findings are consistent with the Technology Acceptance Model (TAM), which posits that users' perceptions of usefulness and ease of use shape technology adoption and continued utilization (Davis, 1989), as well as the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasizes the importance of facilitating conditions and user capabilities in shaping behavioural intentions (Venkatesh et al., 2003).

From a service management perspective, the review contributes by repositioning DHL from a background demographic characteristic to a central explanatory factor influencing digital patient experience, satisfaction, and loyalty-related outcomes. Existing digital health studies often focus on technological characteristics while treating literacy as a control variable. The present synthesis suggests that literacy itself constitutes an important mechanism through which patients evaluate and engage with digital health services. Consequently, the review contributes to the emerging intersection between digital health, healthcare service management, and patient experience research by proposing that patient capabilities and service characteristics should be examined as interdependent determinants of digital health service success.

Implications for Digital Health Service Management

The findings have several implications for healthcare organizations pursuing digital transformation strategies. First, DHL should be treated as a modifiable service determinant rather than a fixed patient attribute. Traditional approaches often assume that patients will adapt to increasingly complex digital systems. However, the evidence suggests that service effectiveness depends not only on technological sophistication but also on the extent to which services accommodate varying levels of patient literacy and digital capability (Kim & Xie, 2017; WHO, 2021).

Healthcare providers may therefore benefit from adopting DHL-responsive service design principles. Such approaches may include literacy-sensitive onboarding processes, simplified navigation pathways, plain-language communication, visual guidance tools, interactive tutorials, and comprehension-support mechanisms. These design features can reduce cognitive burden and facilitate more effective patient engagement, particularly among users with lower levels of digital competence (Neter & Brainin, 2019).

Second, the review highlights the importance of trust-building mechanisms within digital healthcare environments. Trust has consistently been identified as a critical determinant of technology adoption, satisfaction, and continuance intention in healthcare settings (Mensah et al., 2024; Venkatesh et al., 2003). Organizations can strengthen trust by providing transparent explanations regarding privacy protection, data security, information credibility, and platform governance. Such efforts may be particularly important for patients with limited DHL who may experience greater uncertainty when interacting with digital health technologies.

Third, communication quality emerges as an important mechanism connecting literacy to service outcomes. Features such as structured messaging systems, patient-provider communication channels, automated feedback loops, and opportunities for clarification may enhance both digital patient experience and patient satisfaction. These findings support patient-centered care principles, which emphasize communication, engagement, and shared decision-making as core dimensions of healthcare quality (Institute of Medicine, 2001; Doyle et al., 2013).

Research Agenda

The review identifies several priorities for future research. First, the existing literature remains dominated by cross-sectional survey designs, limiting the ability to establish causal relationships. Future studies should employ longitudinal designs, quasi-experimental approaches, and intervention-based research capable of examining how improvements in DHL influence subsequent changes in patient experience, satisfaction, and loyalty outcomes over time (Sørensen et al., 2012).

Second, researchers should distinguish more clearly between behavioural intentions and actual behaviour. Much of the existing literature focuses on intention to use or continuance intention, while relatively few studies examine actual usage intensity, repeat utilization,

sustained engagement, or recommendation behaviour. Understanding whether literacy influences actual behaviour in the same way it influences intentions remains an important empirical question.

Third, greater conceptual consistency is needed regarding both DHL and outcome measurement. The literature currently employs diverse literacy instruments, including eHEALS, eHLQ, and Digital Health Literacy Instruments, alongside heterogeneous measures of patient experience and satisfaction. Standardized measurement frameworks would improve comparability across studies and facilitate cumulative knowledge development (Norman & Skinner, 2006; Paige et al., 2018).

Fourth, future research should explicitly address health equity considerations. Existing evidence suggests that age, education, socioeconomic status, and digital access may influence both DHL and digital service outcomes (Kim & Xie, 2017; WHO, 2021). Examining how these factors interact could provide important insights into digital inclusion and healthcare accessibility.

Finally, comparative studies across digital health channels—including telemedicine, patient portals, mHealth applications, remote monitoring systems, and AI-enabled healthcare platforms—would help determine whether the mechanisms identified in this review operate consistently across different technological contexts.

Strengths and Limitations

This review possesses several strengths. First, it adopts a systematic and transparent methodology guided by PRISMA 2020 reporting standards (Page et al., 2021). Second, it focuses specifically on service-related outcomes, thereby extending existing DHL literature beyond traditional health behaviour and clinical outcome perspectives. Third, the review integrates insights from health literacy research, digital health studies, information systems theory, and service management scholarship, providing a multidisciplinary perspective on digital healthcare experiences.

Several limitations should also be acknowledged. The review relied primarily on a single bibliographic database, which may have limited retrieval coverage despite the extensive scope of Scopus (Mongeon & Paul-Hus, 2016). The restriction to English-language publications may also have excluded relevant evidence published in other languages. In addition, the retained evidence base remains relatively small and heterogeneous with respect to service settings, literacy measures, and outcome operationalisations. Most included studies employed cross-sectional self-report designs, increasing the possibility of common-method bias and limiting causal inference.

Consequently, the conclusions of this review should be interpreted as indicative rather than definitive. While the evidence consistently suggests positive relationships between DHL and service-related outcomes, additional longitudinal, experimental, and comparative research is required to establish the magnitude, directionality, and contextual contingencies of these relationships with greater confidence.

CONCLUSION

Across four cross-sectional studies, higher DHL/eHL was consistently associated with stronger intention/continuance of digital health service use and higher patient satisfaction. Mechanisms centred on technology acceptance perceptions, trust/privacy, information accessibility, and patient-provider communication. Longitudinal and intervention studies and more standardised outcome measurement are priorities for advancing theory and informing DHL-responsive service design.

All evidence synthesised in this article is drawn from published sources cited in the reference list. The extraction framework, PRISMA audit trail, and reconstructed JBI appraisal matrix are embedded in the appendices.

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