

BARRIERS AND FACILITATORS TO IMPLEMENTATION OF DIGITAL NURSING TECHNOLOGIES IN HEALTHCARE SETTINGS: A SYSTEMATIC REVIEW

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Abstract. This systematic review aimed to synthesize evidence on barriers and facilitators to the implementation of digital nursing technologies (DNTs) in healthcare settings. A PRISMA-guided search of Scopus and Web of Science identified 2,847 records; after screening and full-text review, 45 empirical and review articles published between 2015 and 2025 were included. The review found that implementation success depends on interacting technical, organizational, individual, and system-level factors, rather than technology characteristics alone. Technical and infrastructure barriers included inadequate connectivity, limited hardware, poor usability, and lack of interoperability, which were especially pronounced in low- and middle-income and rural settings. Organizational barriers encompassed insufficient and one-off training, weak leadership support, poor change management, unclear policies, high workload, and staffing constraints, while individual-level barriers involved low digital literacy, technophobia, low motivation, and concerns about autonomy, safety, privacy, and data security. System-level barriers related to limited government support, funding, regulatory clarity, and interoperability mandates. Key facilitators included strong leadership and clear vision, supportive organizational culture, continuous competency-based training and just-in-time support, user-friendly and reliable systems that integrate with workflows, high digital literacy, professional motivation, and enabling policy and funding environments. The review concludes that effective DNT implementation is a sociotechnical transformation requiring coordinated action across all levels, sustained organizational commitment, and context-sensitive strategies that protect clinician well-being and patient safety. These findings inform implementation planning and highlight priority gaps for future research, particularly in emerging technologies and under-resourced settings.

Keywords: Digital Nursing Technologies; Implementation; Barriers; Facilitators; Nursing Informatics; Electronic Health Records; Telehealth; Mhealth; Organizational Change.

I. INTRODUCTION

Digital nursing technologies (DNTs) represent a fundamental transformation in healthcare delivery, encompassing diverse technological innovations designed to enhance, support, and augment nursing practice in modern healthcare environments. These comprehensive technologies include Electronic Health Records (EHRs), telemedicine and telehealth platforms, electronic nursing care (ENC) systems, mobile health (mHealth) applications, clinical decision support systems (CDSS), wearable monitoring devices, artificial intelligence (AI)-driven solutions, and sophisticated health information management systems (Finnegan & Mountford, 2025; Martínez & Leyva-Moral, 2024; Walzer, Armbruster, Mahler, Farin-Glattacker, & Kunze, 2025). The primary objective underlying the development and implementation of these technologies is to improve the overall quality, safety, and efficiency of nursing care delivery while simultaneously reducing medical errors, enhancing patient monitoring capabilities, and optimizing healthcare operational efficiency (Turchioe, Austin, & Lytle, 2025; Walzer et al., 2025). Over

the past two decades, an unprecedented acceleration in global digital health transformation has occurred across healthcare systems, driven by technological advancement, increasing healthcare demands, and policy initiatives (Nascimento et al., 2023; Yew, Trivedi, Adanan, & Chew, 2025).

The importance of embracing digital nursing technologies in the contemporary healthcare environment cannot be overstated. When effectively implemented, DNTs have demonstrated substantial potential to improve care coordination among multidisciplinary teams, reduce the incidence of preventable adverse events and medication errors, enhance real-time patient monitoring and early detection of clinical deterioration, increase operational efficiency through automation of routine administrative tasks, and ultimately contribute to improved patient safety and quality of care outcomes (Kruse et al., 2018; Walzer et al., 2025). Furthermore, the integration of digital technologies into nursing workflows has been associated with enhanced communication among healthcare providers, improved access to comprehensive patient information, better documentation

accuracy, and streamlined clinical decision-making processes (Mahalli, 2015; Wahyuningtyas & Abd-Elrazek, 2024). These benefits collectively position digital nursing technologies as critical enablers of evidence-based, patient-centered care delivery in the twenty-first century healthcare environment (Laukvik, Lyngstad, Rotegård, & Fossum, 2024).

Despite substantial scientific evidence supporting the effectiveness of digital nursing technologies and significant financial and organizational investment in their development and implementation, a persistent paradox exists in contemporary healthcare: the rate of successful and sustainable adoption remains disappointingly low across many healthcare settings (Martínez & Leyva-Moral, 2024; Walzer et al., 2025). This implementation gap manifests through several concerning patterns. First, adoption rates remain suboptimal in numerous healthcare facilities, with many organizations failing to achieve widespread utilization of available digital technologies even years after initial implementation (Asiri, 2024; Mahalli, 2015). Second, when DNTs are implemented, they frequently fail to integrate effectively into established nursing workflows and clinical routines, creating disruption rather than enhancement of care processes (Arikan, Kara, Erdogan, & Ulker, 2021). Third, implementation outcomes are remarkably inconsistent across different organizations, healthcare systems, and countries, suggesting that technology implementation is not a straightforward process but rather a complex, context-dependent phenomenon influenced by multiple interconnected factors operating at individual, organizational, and systemic levels (Brommeyer, Whittaker, & Liang, 2024).

The reasons underlying this implementation gap are multifaceted and complex. Healthcare organizations and policymakers increasingly recognize that successful technology implementation is not simply a technical matter of acquiring software and hardware systems, but rather a complex socio-technical challenge requiring attention to human factors, organizational readiness, cultural considerations, and systemic supports (Dehghan, Behzadi, Mehrolhassani, & Ghaemi, 2025; Handrean et al., 2025). This recognition has prompted researchers and implementation scientists to investigate the specific barriers and facilitators that influence whether digital nursing technologies are successfully adopted, integrated, and sustained in real-world healthcare settings. Understanding these factors is essential not only for improving implementation success rates but also for developing context-appropriate strategies that account for the diversity of healthcare settings, nursing populations, technological capabilities, and organizational contexts globally (Kruszyńska-Fischbach, Sysko-Romańczuk, Napiórkowski, Napiórkowska, & Kozakiewicz, 2022). Without a comprehensive understanding of the specific barriers and facilitators relevant to different contexts and technology types, healthcare organizations risk repeating failed implementation attempts, wasting valuable

resources, and potentially compromising the quality and safety of patient care.

Research literature has identified numerous barriers to DNT implementation operating at multiple levels of analysis. Technical and Infrastructure Barriers represent foundational constraints limiting implementation feasibility. Inadequate or unstable internet connectivity remains pervasive, particularly in rural and remote regions and many LMIC healthcare facilities, making real-time access to cloud-based systems and telemedicine platforms impossible or unreliable (Laukvik et al., 2024). Many facilities lack sufficient hardware resources due to financial constraints or procurement system inadequacies (Wahyuningtyas & Abd-Elrazek, 2024). System unreliability characterized by frequent errors, unexpected downtime, and data unavailability undermines user confidence and creates patient safety concerns motivating resistance to adoption (Yew et al., 2025; Zadvinskis, Chipps, & Yen, 2015). The lack of interoperability between different technological systems creates fragmented information ecosystems failing to provide integrated patient information (Dehghan et al., 2025). Poor system usability and counterintuitive user interface design often resulting from development by technical experts lacking deep understanding of nursing workflow create barriers to efficient use (Cho et al., 2024).

Organizational Barriers significantly impede successful implementation. Insufficient training and inadequate educational programs represent perhaps the most consistently identified barrier, with many organizations failing to provide comprehensive, ongoing training tailored to diverse staff competency levels (Tischendorf et al., 2024). High staff turnover rates and chronic understaffing compound training challenges (Shan, Shang, Yan, & Ye, 2023). Lack of leadership support and insufficient organizational commitment to digital transformation create environments resistant to change. Poor change management strategies that fail to engage staff result in resistance and incomplete adoption (Nurmaidah, Kustiningsih, & Rahayu, 2024). Unclear policies and procedures governing DNT use and limited technical support from IT departments leave nurses without adequate resources (Brommeyer et al., 2024; Mahalli, 2015). Excessive workload, unrealistic time expectations, and insufficient staffing ratios create contexts where nurses lack capacity to engage with technologies (Ward et al., 2014).

Individual-Level Barriers are substantial. Insufficient digital literacy and inadequate technical skills, particularly among older nurses or those with limited computer experience, create fundamental competency gaps (Alrasheedday et al., 2023). Psychological apprehension and fear of technology represent significant emotional barriers (Schürmann, Westmattmann, & Schewe, 2025). Low motivation and negative attitudes toward change actively resist adoption efforts (Tabaeeian, Hajrahimi, & Khoshfetrat, 2022). Concerns about

professional autonomy, patient safety, and accuracy of diagnosis through technology-mediated care create ethical hesitations (Giebel et al., 2025; Oei et al., 2025). Privacy and data security concerns represent legitimate fears impeding trust.

System-Level Barriers constrain implementation possibilities. Inadequate government support, lack of dedicated funding, and unclear reimbursement mechanisms create financial uncertainty (Nascimento et al., 2023). Absence of clear regulatory guidelines creates legal uncertainty (Jayakumar, Parida, & Tomar, 2022). Limited interoperability requirements create fragmented digital ecosystems (Gabriel, Richwine, Strawley, Barker, & Everson, 2012). The rapid pace of technological change outstrips organizational capacity to develop appropriate governance structures.

Leadership and Organizational Support emerges as among the most powerful facilitators. Strong leadership commitment shapes organizational culture supporting adoption (Brandsma, van de Wetering, & Stoffers, 2025). Clear policies and nursing leadership advocacy prove particularly influential (Dehghan et al., 2025; Turchioe et al., 2025). Comprehensive Training and Support Systems are critical facilitators. Effective training must be tailored to diverse competency levels, with just-in-time support more effective than initial training alone (Su et al., 2025). Mentorship and peer learning opportunities leverage social relationships. Educational programs extending beyond device-specific training address fundamental gaps.

Technology characteristics significantly influence adoption. User-friendly and intuitive design substantially reduces learning barriers. Reliable system performance builds user confidence and trust (Asiri, 2024; Mahalli, 2015). Seamless workflow integration and good interoperability enhance perceived usefulness. Individual Factors facilitate adoption. High digital literacy reduces learning barriers (Yew et al., 2025; Zadvinskis et al., 2015). Positive prior experiences reduce technophobia (Schürmann et al., 2025). High motivation and understanding of technology benefits increase engagement (Andargeery & El-Rafey, 2025). Psychological readiness and openness to change enable innovation engagement (Erfani et al., 2025).

System and Environmental Factors support implementation. Favourable government policies create enabling environments (Lestari, Miranda, & Fuady, 2024). Adequate funding allocation ensures resources match needs. Clear reimbursement mechanisms create financial sustainability. Progressive interoperability implementation facilitates exchange (Gabriel et al., 2012). External pressures such as accreditation requirements can drive adoption. Recent evidence highlights concerning relationships between EHR implementation and clinician burnout. Documentation burden emerges as a significant contributor to emotional exhaustion among nurses (Cho et al., 2024; Gesner, Dykes, Zhang, & Gazarian, 2022). Workflow interruptions during EHR tasks

elevate nurses' mental workload and increase error risk (Shan et al., 2023; Tischendorf et al., 2024). Understanding complex relationships between documentation burden, EHR usability, workflow integration, and clinician well-being represents an important synthesis area requiring attention.

Understanding barriers and facilitators to DNT implementation is essential for developing context-appropriate strategies that optimize implementation success across diverse global healthcare settings. Successful implementation requires simultaneous attention to technical, organizational, individual, and system-level factors, with sustained commitment throughout the implementation process. Healthcare leaders, policymakers, nursing educators, and implementation scientists require evidence-based guidance for optimizing DNT implementation while protecting clinician well-being and patient safety. Therefore, in this research, there are three research questions, including:

1. What are the barriers to the implementation of digital nursing technologies in healthcare settings?
2. What are the facilitators to the implementation of digital nursing technologies in healthcare settings?
3. What are the challenges and recommendations for future research on digital nursing technology implementation in healthcare settings?

II. RESEARCH METHODS

Systematic Literature Review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. To ensure methodological transparency and compliance with the PRISMA 2020 guidelines (Page et al., 2021). Walzer et al. (2025) added that PRISMA is very suitable for use in analyzing papers comprehensively to find significant findings.

In this systematic review, literature searches were conducted on 2 electronic databases: Scopus and Web of Science. The terms searched using Boolean Logic were: (digital nursing technolog* OR electronic health record* OR EHR OR telemedicine OR telehealth OR electronic nursing care OR ENC OR mobile health OR mHealth OR clinical decision support system* OR CDSS OR health information system* OR HIS OR nursing informatics OR digital health OR ehealth OR health information technolog*) AND (implementation OR adoption OR barrier* OR facilitator* OR enabler* OR challenge* OR factor* OR uptake OR utilization OR integration OR acceptance) AND (nurs* OR healthcare professional* OR health personnel OR clinician*). The studies were selected based on the inclusion and exclusion criteria in Table 1 below.

TABLE 1
INCLUSION AND EXCLUSION CRITERIA

Inclusion	Exclusion
Discussing the barriers and/or facilitators to the implementation of digital	Not discussing the barriers and/or facilitators to the implementation of digital

nursing technologies in healthcare settings	nursing technologies in healthcare settings
Focusing on nursing staff or healthcare professionals including nurses	Focusing exclusively on patient perspectives without healthcare provider involvement
Empirical article (qualitative, quantitative, mixed-methods), systematic reviews	Conference paper, book chapter, editorial, opinion pieces without empirical data
Non-duplicate paper	Identical duplicate paper
Full-text can be accessed	Full-text cannot be accessed
Use English language	Does not use English language
Published from 2015 to 2025	Published before 2015

The data extraction was conducted by identifying relevant information from the selected articles, including publication information (author, year, country, publisher, Scopus/Web of Science quartile), study design (qualitative, quantitative, mixed-methods), healthcare setting (primary care, hospital, long-term care, community health), digital nursing technology type (EHR, telemedicine, ENC, mHealth, CDSS, wearable devices, AI-driven solutions), barriers identified (categorized by level: technical/infrastructure, organizational, individual, system-level), facilitators identified (categorized by level: leadership/organizational support, training/support systems, technology characteristics, individual factors, system/environmental factors), implementation outcomes, and recommendations for practice and research.

III.RESULT AND DISCUSSION

A systematic article selection process was conducted using Scopus and Web of Science, initially identifying 2,847 articles. After screening, 876 articles met the preliminary criteria and were read in full text. In the final inclusion stage, 45 articles published between 2015 and 2025 were selected to ensure the quality and relevance of the literature used in this study.

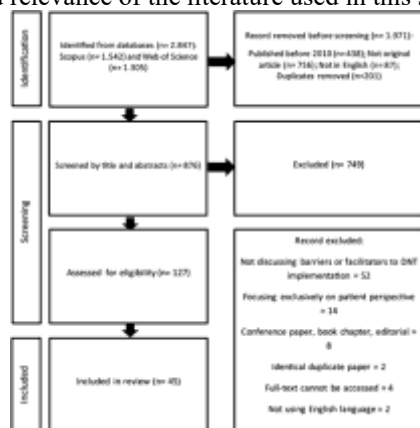


FIGURE 1. PRISMA METHODOLOGY FLOWCHART

45 papers were selected in the inclusion category. This research would comprehensively discuss the barriers, facilitators, effectiveness outcomes, challenges, and recommendations for future research on digital nursing technology implementation in healthcare settings. RQ1. What are the barriers to the implementation of digital nursing technologies in healthcare settings?

TABLE 2
 BARRIERS TO DIGITAL NURSING TECHNOLOGY
 IMPLEMENTATION IN HEALTHCARE SETTINGS

Author	Specific Barriers Identified
(Lestari et al., 2024; Nascimento et al., 2023; Walzer et al., 2025)	Inadequate or unstable internet connectivity in rural and remote regions
(Yew et al., 2025; Zadvinskis et al., 2015)	System unreliability, characterized by frequent errors
(Abdulkadir, Waziri, Alhassan, & Ismaila, 2024; Dehghan et al., 2025; Kruse et al., 2018)	Lack of interoperability between different technological systems
(Arikan et al., 2021; Cho et al., 2024; Walzer et al., 2025)	Poor system usability and counterintuitive user interface design
(Nascimento et al., 2023; Tischendorf et al., 2024; Walzer et al., 2025)	Insufficient training and inadequate educational programs
(Arikan et al., 2021; Shan et al., 2023)	High staff turnover rates and chronic understaffing
(Brommeyer et al., 2024; Hospodková et al., 2021; Walzer et al., 2025)	Lack of leadership support and insufficient organizational commitment
(Martínez & Leyva-Moral, 2024; Wahyuningtyas & Abd-Elrazek, 2024)	Poor change management strategies
(Brommeyer et al., 2024; Mahalli, 2015)	Unclear policies and procedures governing DNT use
(Turchioe et al., 2025; Walzer et al., 2025)	Work environment challenges
(Alrasheedday et al., 2023; Pugal, Villar, & Nashwan, 2021; Walzer et al., 2025)	Insufficient digital literacy and inadequate technical skills among nurses; Fundamental competency gaps
(Erfani et al., 2025; Tischendorf et al., 2024)	Inadequate knowledge about specific functionalities
(Schürmann et al., 2025; Wahyuningtyas & Abd-Elrazek, 2024)	Psychological apprehension and fear of technology (technophobia)
(Kruse, Kothman, Anerobi, & Abanaka, 2016; Tabaeian et al., 2022)	Low motivation to engage with new technologies
(Giebel et al., 2025; Walzer et al., 2025)	Concerns about professional role and autonomy
(Oei et al., 2025; Schürmann et al., 2025)	Concerns about patient safety and accuracy of diagnosis through technology-mediated care
(Kruse et al., 2018)	Privacy and data security concerns
(Arikan et al., 2021; Walzer et al., 2025)	Emotional responses
(Lestari et al., 2024; Nascimento et al., 2023)	Inadequate government support for digital health initiatives
(Kruse et al., 2016; Yew et al., 2025)	Lack of dedicated funding
(Jayakumar et al., 2022; Schürmann et al., 2025)	Absence of clear regulatory guidelines
(Dehghan et al., 2025; Gabriel et al., 2012; Kruse et al., 2018)	Limited interoperability requirements at system level
(Wahyuningtyas & Abd-Elrazek, 2024)	Competition for scarce resources
(Walzer et al., 2025)	Rapid technological change outstripping organizational capacity

Digital nursing technology implementation succeeds when technical solutions align with organizational commitment, staff engagement, competence development, and supportive system-level conditions. Healthcare organizations must balance technical problem-solving with human-centered approaches that address nurses' concerns, build competence and confidence, and foster cultures of innovation and continuous

improvement. This multilevel, human-centered paradigm treats implementation as an organizational change process rather than a purely technical project, improving success rates while protecting clinician well-being and patient safety.

RQ2. What are the facilitators to the implementation of digital nursing technologies in healthcare settings?

TABLE 3
 FACILITATORS TO DIGITAL NURSING TECHNOLOGY
 IMPLEMENTATION IN HEALTHCARE SETTINGS

Author	Specific Facilitators Identified
(Brommeyer et al., 2024; Dehghan et al., 2025; Walzer et al., 2025)	Strong leadership commitment to digital transformation
(Aldogihier & Halim, 2025; Martínez & Leyva-Moral, 2024)	Clear organizational vision
(Brandsma et al., 2025)	Positive organizational culture valuing innovation
Dehghan et al. (2026); Bani Issa (2020)	Clear policies and procedures supporting DNT use
(Turchioe et al., 2025)	Nursing leadership advocacy
(Nascimento et al., 2023; Tischendorf et al., 2024)	Comprehensive and continuous training programs
(Doerner, Connerton, & Wijesuriya, 2025; Erfani et al., 2025)	Training tailored to diverse staff competency levels
(Su et al., 2025)	Just-in-time technical support availability
(Tischendorf et al., 2024)	Mentorship and peer learning opportunities
(Jatnika, Yuswandi, Ismafiati, Badrujamaludin, & Hadiana, 2025)	Educational programs enhancing digital literacy
(Cho et al., 2024)	User-friendly and intuitive system design
(Yew et al., 2025)	Convenient and easy-to-use technology
(Asiri, 2024)	Reliable and robust system performance
(Dehghan et al., 2025)	Seamless integration with existing workflows
(Anand & Sadhna, 2023)	Good interoperability with other systems
(Oei et al., 2025)	Real-time feedback and monitoring capabilities
(Alrasheeday et al., 2023; Yew et al., 2025)	High eHealth and computer literacy among nurses
(Schürmann et al., 2025)	Positive previous experiences with technology
(Walzer et al., 2025)	High motivation to adopt
(Andargeery & El-Rafey, 2025)	Perceived usefulness
(Erfani et al., 2025)	Sense of professional efficacy
(Martínez & Leyva-Moral, 2024)	Understanding of technology rationale
(Kruszyńska-Fischbach et al., 2022)	Psychological readiness for change
(Lestari et al., 2024)	Favorable government policies
(Gariépy-Saper & Decarie, 2021)	Regulatory guidelines providing clarity regarding appropriate use
(Macabato, Velasco, Escabarte, Poblete, & Isla Jr, 2024)	External pressure or incentive for adoption
(Gabriel et al., 2012)	Progressive implementation of interoperability frameworks and standards

Table 4 shows that current evidence on digital nursing technology implementation still leaves major gaps about what works, for whom, and in which contexts. It highlights challenges such as limited implementation guidance, high risk

of failure, missed opportunities for innovation, and threats to clinician well-being and patient safety. At the same time, the table outlines research recommendations that call for geographically inclusive studies, long-term outcome evaluations, multilevel mechanism research, and stronger research infrastructure. Addressing these priorities would allow implementation science to mature, giving healthcare organizations robust, evidence-based guidance instead of relying on trial and error. Ultimately, filling these gaps is expected to improve implementation success rates and promote more equitable, effective, and sustainable use of digital nursing technologies across healthcare settings.

A. DISCUSSION

This systematic review synthesizes evidence from 45 high-quality studies examining barriers and facilitators to digital nursing technology implementation across diverse healthcare settings globally (Dehghan et al., 2026; Nascimento et al., 2023; Walzer et al., 2025; Yew et al., 2025). The findings reveal that successful DNT implementation does not depend on single isolated factors but rather on complex interactions among technical, organizational, individual, and system-level elements. The multilevel conceptual framework presented in Figure 2 illustrates how these factors operate interdependently to influence implementation outcomes. At the center of this framework lies implementation success, which emerges from the alignment and mutual reinforcement of facilitating conditions across all levels. When barriers predominate at any single level, they create cascading effects that undermine implementation at other levels, while facilitators at one level create enabling conditions for progress at others.

The technical and infrastructure barriers identified in this review, including inadequate internet connectivity, insufficient hardware resources, system unreliability, lack of interoperability, and poor usability, represent foundational constraints that must be addressed for any implementation to succeed (Lestari et al., 2024; Nascimento et al., 2023; Walzer et al., 2025; Yew et al., 2025). These technical barriers are particularly pronounced in low- and middle-income countries and rural healthcare settings where infrastructure limitations remain important obstacles to technology access (Lestari et al., 2024). However, the review reveals that even when technical barriers are addressed, organizational and individual barriers frequently still prevent successful adoption. This finding underscores that technology implementation is fundamentally a sociotechnical challenge rather than merely a technical one, requiring simultaneous attention to human, organizational, and system factors alongside technological considerations (Dehghan et al., 2026; Nascimento et al., 2023).

Organizational-level factors emerge from this review as perhaps the most critical determinants of implementation success or failure. Insufficient training and inadequate educational programs represent the most consistently identified barrier across diverse contexts, suggesting that organizations chronically underestimate the training intensity and duration required for nurses to develop genuine competence and confidence with complex digital systems (Walzer et al., 2025; Nascimento et al., 2023; Shankar, Dewi, Ang, & Dev, 2025). Traditional one-time training approaches prove inadequate for building sustained competence, particularly when staff enter implementation with varying baseline digital literacy levels.

The most effective strategies involve longitudinal, competency-based education, tailored to diverse competency levels, and supplemented with ongoing coaching, peer support, and simulation-based learning opportunities that train clinicians in realistic scenarios while challenging common organizational assumptions that training is a discrete event rather than an ongoing organizational commitment (Su et al., 2025).

Organizational culture and leadership climates likewise emerge as foundational facilitators or barriers. In organizations where leaders view digital transformation purely as a technical procurement exercise, nurse involvement in decision-making is limited, resource allocation is minimal, and digital tools are introduced without adequate alignment to workflows, professional values, or staffing realities (Brommeyer et al., 2024; Walzer et al., 2025). Under these conditions, frontline nurses perceive technologies as externally imposed burdens, digital surveillance tools, or threats to professional autonomy, which fuels resistance, work-around behaviors, and low utilization. In contrast, organizations that embrace digital transformation as a strategic, relational, and learning-oriented change process—supported by visible leadership commitment, protected time for learning, mechanisms for continuous feedback, and authentic engagement of nurses in design and implementation—tend to report higher acceptance, better fit between technology and practice, and more sustainable use over time (Dehghan et al., 2026; Su et al., 2025; Walzer et al., 2025). These findings collectively position digital nursing technology implementation as an ongoing organizational change process rather than a one-time technical deployment, demanding sustained investment in people, infrastructure, and learning systems.

IV. CONCLUSION AND SUGGESTION

This systematic review shows that successful digital nursing technology implementation depends on interacting technical, organizational, individual, and system-level factors, rather than on technology characteristics alone. Technical barriers such as inadequate usability, reliability, and interoperability create foundational constraints, while organizational factors including leadership, training, and change management shape staff engagement, and individual factors such as digital literacy, motivation, and psychological readiness also play critical roles. The multilevel conceptual framework explains how these factors align or conflict to influence outcomes, underscoring that implementation is a sociotechnical transformation requiring sustained commitment, organizational support, and attention to the human dimensions of change. Healthcare organizations must therefore adopt holistic, context-sensitive strategies that address emerging technologies, LMIC contexts, clinician well-being, and sustainability, rather than relying on one-off technical deployments. Ultimately, robust implementation of digital nursing technologies has the potential to enhance patient safety, care quality, and nursing professional practice, but only if these multilevel influences are deliberately understood and managed.

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