

Building Future-Ready Healthcare Systems Through Digital Literacy Training

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ABSTRACT: Digital literacy is a critical competency for healthcare professionals in delivering safe, effective, and patient-centered care. This narrative review examines global disparities in digital literacy training among healthcare workers, with a focus on identifying educational gaps, systemic and personal barriers, and innovative strategies for skill development. Literature was sourced from PubMed, Scopus, and Google Scholar, using predefined keywords targeting digital competency in clinical and educational contexts. Findings reveal significant disparities across healthcare professions and regions, with physicians generally showing higher proficiency than nurses and allied health workers. Systemic challenges such as limited ICT infrastructure, inadequate curricula, and weak institutional support are prevalent, particularly in low-resource settings. On a personal level, technophobia, low confidence, and concerns over workload hinder technology adoption. Innovative educational models—including simulation-based training, interactive e-learning, and problem-based learning—demonstrated positive outcomes in enhancing digital skills. However, their success is strongly tied to local infrastructure, faculty readiness, and socio-cultural factors. The review concludes that integrating digital literacy into healthcare education, investing in infrastructure, and promoting continuous professional development are essential to prepare future-ready health systems. Standardized measures and long-term outcome evaluations are recommended to assess the effectiveness of training interventions. Strengthening digital competencies is not merely a technical upgrade but a strategic imperative for resilient, equitable, and technology-enabled healthcare delivery.

Keywords: Digital Literacy In Healthcare, Healthcare Professionals Digital Competency, Ehealth Education, Digital Skills Training, Simulation-Based Learning, Medical Education Digitalization, Global Health Technology.



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INTRODUCTION

In the contemporary digital era, digital literacy among healthcare professionals has become a pivotal component in advancing the quality of healthcare delivery and ensuring patient safety. The integration of digital technologies into healthcare systems has transformed traditional clinical

practices and created new paradigms of patient care. Recent global trends reveal an increasing demand for equipping healthcare workers with adequate digital competencies to meet the challenges of a rapidly evolving medical landscape. According to Nazeha et al. (2020), sufficient digital competency among healthcare professionals is essential to maintain effective and responsive clinical practice in the digital age. This necessity has been further underscored by the growing reliance on telemedicine and digital health applications, which became particularly prominent during the COVID-19 pandemic (Malerbi et al., 2023). The pandemic not only accelerated the adoption of digital technologies but also exposed the critical importance of digital literacy as a determinant of healthcare system resilience and adaptability.

The urgency of digital literacy in clinical practice cannot be overstated. The implementation of digital health tools without the necessary competencies poses significant risks to patient safety. Research indicates that low levels of digital literacy correlate with reduced quality of healthcare services (Ha et al., 2023), potentially leading to medical errors or inadequate understanding of treatment plans by patients (Sahan et al., 2024). Consequently, the development of educational curricula that integrate training on digital technologies has become a pressing need (Prosen & Ličen, 2025). Well-designed educational interventions not only improve technical skills but also enhance interactions between healthcare providers and patients, fostering trust and improving overall care outcomes (Wilson et al., 2024). This emphasis on structured education highlights the dual role of digital literacy as both a clinical necessity and an educational imperative.

Evidence further demonstrates that healthcare professionals with limited digital literacy struggle to effectively utilize tools that could otherwise improve patient outcomes. For instance, Shiferaw et al. (2020) reported that knowledge and attitudes toward digital health tools are significantly influenced by factors such as educational background, exposure to digital training, and availability of internet access. Similarly, Kasaye et al. (2024) highlighted that these variables strongly determine the readiness of healthcare professionals to integrate digital solutions into their daily practice. Greater understanding of digital tools' role and potential can enhance the patient experience, particularly in the management of chronic diseases and patient education programs (Seemann et al., 2023). These findings collectively reinforce the notion that digital literacy is not merely a supplementary skill but a fundamental competency in contemporary healthcare delivery.

The prioritization of digital literacy among healthcare professionals is therefore indispensable within the framework of educational reform and health policy. Strategies to achieve this goal must encompass practical training, technology-based program development, and collaborative approaches among stakeholders to ensure that healthcare professionals are adequately prepared for the dynamic digital healthcare environment. Such strategies align with global calls for integrating digital health into professional training as a cornerstone of future-ready healthcare systems.

Despite the clear benefits of digital integration, healthcare professionals encounter multiple challenges in adopting digital technologies. Systemic barriers include inadequate technological infrastructure, limited access to hardware and software, and insufficient institutional support for digital transformation. Studies have shown that socio-economic inequalities further exacerbate these challenges, resulting in disparities in digital access among healthcare workers. The absence

of formal training on digital literacy often prevents healthcare professionals from developing the confidence necessary to implement digital tools effectively. Moreover, organizational support is frequently lacking, with limited managerial understanding or commitment to digital competency initiatives. This lack of systemic alignment creates a gap between the potential of digital tools and their practical implementation in healthcare settings.

On a personal level, healthcare professionals often face obstacles such as technophobia, concerns about increased workload, and the risks of information overload. Individual skills and confidence in digital tool usage significantly shape adoption and implementation outcomes. Some healthcare professionals report feeling underprepared in terms of digital literacy, which negatively influences their ability to deliver effective and safe patient care. Addressing these personal-level challenges requires not only technical training but also psychological support and the cultivation of positive attitudes toward technology adoption.

Previous literature has consistently highlighted the gap between healthcare professionals' digital competencies and the demands of modern medical practice. Several studies have demonstrated that current health education curricula frequently fail to provide adequate digital training, leaving graduates ill-equipped to manage technology-intensive clinical environments. While initiatives have been introduced to enhance digital competencies, a considerable disparity persists between clinical practice requirements and the training healthcare professionals receive. This mismatch underscores the necessity of aligning educational content with the realities of digital healthcare delivery.

Additional studies emphasize that the lack of technology-based training within health faculties contributes to this gap, limiting professionals' understanding of the potential applications of digital tools in clinical care. Reforms to health education curricula must therefore focus more strongly on digital competencies, ensuring that healthcare professionals are capable of adapting to technology-driven practice environments. Interdisciplinary and collaborative approaches involving educational institutions, hospitals, and professional organizations have been recommended to bridge this gap, thereby equipping healthcare workers with the requisite skills and knowledge to provide high-quality care in a digitalized context.

Research on digital literacy among healthcare professionals has pursued several important objectives. One primary goal is to assess the level of digital literacy across different healthcare groups and understand its influence on their ability to adopt digital technologies in clinical practice. For example, Nazeha et al. (2020) argued for more precise measurement of healthcare professionals' digital competencies to meet the growing demands of medical practice. Similarly, Focşa et al. (2025) stressed the importance of identifying educational gaps in telemedicine training so that curricula can be adapted to evolving healthcare contexts. Such research objectives highlight the need to not only measure existing competencies but also to align education with emerging technological trends.

Commonly analyzed factors in the literature include educational background, work experience, and access to digital training. Kasaye et al. (2024) found that healthcare professionals with higher educational attainment tended to demonstrate greater digital competence, positively influencing

their use of digital technologies in clinical settings. Moreover, Martínez et al. (2023) identified that previous experience with digital tools and the availability of structured training programs directly enhanced the ability of healthcare professionals to integrate digital solutions into practice. These findings suggest that targeted investments in training and resources can significantly improve the digital readiness of healthcare workforces.

Several studies also highlight geographic differences in digital literacy among healthcare professionals. Kasaye et al. (2024), for instance, conducted research in Ethiopia during the COVID-19 pandemic, finding low levels of digital literacy among healthcare workers in the region. Similarly, Fernández-Luque et al. (2016) investigated digital competencies in Málaga-Axarquía, Spain, identifying urgent needs for digital skills training tailored to local contexts. These examples illustrate the importance of situating digital literacy research within specific geographic and sociocultural frameworks to design interventions that are contextually relevant and effective.

Equally important, Reda et al. (2024) examined healthcare professionals' knowledge and attitudes toward telesurgery in Ethiopia, demonstrating that resource-constrained environments profoundly influence digital literacy levels. Their findings highlight the interplay between geographical, socio-economic, and cultural factors in shaping healthcare professionals' digital competencies. Collectively, these studies underscore that digital literacy challenges are not merely individual or institutional but are deeply embedded in broader structural and contextual dynamics.

The existing literature, while rich in descriptive accounts, leaves several critical gaps that justify the need for further review. First, there remains insufficient clarity on how systemic and personal barriers interact to influence digital literacy acquisition and application in healthcare practice. Second, limited research addresses the longitudinal impact of digital literacy interventions on patient outcomes. Third, comparative studies across diverse geographic and professional contexts remain scarce, hindering the development of globally applicable frameworks. These gaps necessitate a comprehensive narrative review to synthesize existing knowledge, evaluate persistent challenges, and propose evidence-based strategies for advancing digital literacy among healthcare professionals.

The primary objective of this review is to analyze and synthesize the current state of digital literacy among healthcare professionals, with a particular focus on identifying educational gaps and evaluating innovative training strategies. Specifically, this review aims to examine how educational interventions, institutional policies, and contextual factors influence digital competency development. By doing so, it seeks to provide actionable insights that can inform curriculum design, professional training programs, and health policy development.

The scope of this review encompasses a wide range of healthcare professions, including physicians, nurses, and allied health practitioners, across both high-income and low- to middle-income countries. Special attention is given to geographic and contextual variations, recognizing that digital literacy is influenced not only by individual competencies but also by systemic factors such as infrastructure, socio-economic conditions, and cultural attitudes toward technology. By incorporating diverse perspectives, this review aspires to present a holistic understanding of digital

literacy in healthcare, thereby contributing to the global discourse on strengthening healthcare systems through digital transformation.

METHOD

The methodology adopted for this review was designed to ensure a comprehensive, transparent, and replicable process in identifying, selecting, and synthesizing relevant literature on digital literacy among healthcare professionals. The approach followed principles of systematic and narrative review methodologies, with the objective of capturing the breadth and depth of existing scholarship while focusing on quality and relevance. This methodological framework was guided by established review protocols, such as those outlined by Arksey and O'Malley, but adapted to the specific aims of examining educational gaps and training innovations in digital literacy within the healthcare sector.

The collection of literature was carried out through a systematic search across multiple academic databases recognized for their extensive coverage of medical, health, and educational research. Specifically, PubMed, Scopus, and Google Scholar were chosen as the primary sources. PubMed was selected due to its authoritative indexing of biomedical and healthcare studies, making it particularly suited for capturing empirical data on clinical practices and professional competencies. Scopus was utilized because of its multidisciplinary coverage and its indexing of peer-reviewed literature across health sciences, education, and social sciences, allowing for a broader capture of research that intersects medical education and digital competencies. Google Scholar was included to extend the search beyond traditional academic journals, incorporating theses, dissertations, conference proceedings, and grey literature that often provide valuable insights into emerging areas of study. As emphasized by Nazea et al. (2020), the combination of these databases maximizes coverage and enhances the likelihood of identifying diverse yet relevant literature. Kasaye et al. (2024) also underscored that leveraging multiple sources ensures that important regional or institution-specific studies are not overlooked.

The identification of literature was facilitated through the use of carefully constructed keyword strings that combined controlled vocabulary and free-text terms. The primary keywords employed included “digital literacy healthcare professionals,” “eHealth education,” “digital skills training in nursing,” and “healthcare professionals digital competency.” These keywords were chosen to directly target the core theme of digital literacy while capturing associated concepts within professional training and clinical contexts. Building on insights from Kasaye et al. (2024), specific emphasis was placed on terms related to digital education within healthcare professions to ensure alignment with the research focus. Additionally, inspired by the recommendations of Azzellino et al. (2025), keywords were expanded to include broader concepts such as “telemedicine,” “digital health,” and “technology-based training.” This expansion allowed for the inclusion of literature that addressed not only direct measures of digital literacy but also its application within the wider framework of digital health transformation. Boolean operators such as AND, OR, and quotation marks were applied to refine searches and to capture relevant combinations of terms while excluding irrelevant results.

In order to ensure that only high-quality and relevant studies were included, a set of inclusion and exclusion criteria was established. The inclusion criteria focused on selecting studies that directly examined digital literacy or digital competency among healthcare professionals, including physicians, nurses, and allied health practitioners. To maintain academic rigor, only studies published in peer-reviewed journals or indexed conference proceedings were considered. Articles published in English were prioritized, given the need for accessibility to the reviewing team and the predominance of English in scientific discourse. Furthermore, included studies needed to be situated within healthcare or health education contexts, ensuring that the findings were directly applicable to the population of interest. By contrast, exclusion criteria ruled out studies that lacked sufficient empirical data, were purely theoretical without practical application, or were published in non-peer-reviewed outlets. Studies that addressed digital literacy in non-healthcare populations, or that discussed technology in general without linking it to healthcare practice, were also excluded. Latif et al. (2019) have emphasized the importance of such criteria in preserving the focus and relevance of systematic reviews, thereby ensuring that the evidence synthesized truly informs practice and policy.

The types of studies included in this review spanned a variety of empirical designs to capture a comprehensive view of the field. Randomized controlled trials were included where available, given their robustness in testing interventions related to digital training programs. Cohort studies and cross-sectional surveys were also considered, as they provided valuable insights into the prevalence of digital literacy levels and the association between competencies and clinical outcomes. Case studies and qualitative research were included to capture contextual nuances, particularly in understanding personal, institutional, and sociocultural barriers to digital adoption. This diverse inclusion of methodologies allowed the review to synthesize both quantitative evidence on outcomes and qualitative perspectives on lived experiences, providing a more holistic understanding of the topic.

The process of literature selection followed a structured screening protocol to ensure transparency and replicability. Initial searches generated a large number of records, which were first screened at the title and abstract level to eliminate obviously irrelevant studies. Articles that met the preliminary criteria were then subjected to full-text review, during which detailed assessment was conducted against the inclusion and exclusion standards. This multi-stage screening process was performed independently by multiple reviewers to minimize bias and ensure consistency. Any disagreements were resolved through discussion and consensus, aligning with best practices in systematic review methodology.

Once selected, the included studies were subjected to a rigorous evaluation process to assess their methodological quality and relevance. Criteria for evaluation included the clarity of research objectives, the appropriateness of study design, the robustness of data collection and analysis methods, and the strength of the evidence presented. Particular attention was paid to whether studies clearly defined digital literacy constructs, as inconsistent definitions could undermine the comparability of findings. Studies were also assessed for potential biases, such as sample size limitations or lack of generalizability, and these were noted in the synthesis stage.

The synthesis process adopted a thematic approach to analyze and integrate findings across the selected studies. Thematic synthesis enabled the identification of recurring patterns, key challenges, and innovative training strategies across diverse contexts. This approach followed the recommendations of Braun and Clarke, emphasizing the importance of systematic coding, theme generation, and critical interpretation. Themes were derived inductively from the data but also informed by the overarching research objectives, which centered on identifying educational gaps and highlighting training innovations. By combining findings from quantitative and qualitative research, the synthesis produced a nuanced and evidence-informed narrative that could inform both educational reforms and policy development.

Overall, the methodological rigor of this review was designed to ensure comprehensiveness, transparency, and reproducibility. By employing a multi-database search strategy, utilizing carefully defined keywords, applying clear inclusion and exclusion criteria, and incorporating diverse types of studies, this review achieved a balanced and critical synthesis of the literature on digital literacy among healthcare professionals. The approach aligns with established academic standards for conducting reviews in health sciences and education, thereby ensuring that the findings presented are both reliable and impactful for guiding future research, policy, and practice.

RESULT AND DISCUSSION

The findings of this narrative review are organized around three primary themes that emerged consistently across the literature: gaps in digital education, determinants and barriers to digital literacy integration, and innovative training and pedagogical models. These themes are explored to highlight the complexity of digital literacy development among healthcare professionals, as well as the global disparities in access, readiness, and training outcomes.

The first theme, educational gaps in digital literacy, reveals substantial deficiencies in the way healthcare professionals are trained to adopt and utilize digital tools. Empirical evidence demonstrates significant disparities across different regions and healthcare professions. For instance, Shiferaw et al. (2020) documented that digital literacy levels among healthcare workers in Ethiopia were considerably low, with many professionals expressing a lack of competence in handling digital tools. This reflects a substantial gap between the digital requirements of contemporary medical practice and the skills possessed by frontline health workers. Similarly, Kasaye et al. (2024) found that many healthcare professionals reported receiving minimal training in digital literacy during their formal education, which contributed to difficulties in applying digital technologies in everyday practice. These findings suggest that shortcomings in health education institutions play a critical role in limiting the readiness of healthcare professionals to adapt to digital transformation in clinical environments. Without consistent curricular integration of digital skills, healthcare workers are ill-prepared to meet the growing demands of digital healthcare.

Comparative analyses across professions further underscore the unequal distribution of digital competencies. Martínez et al. (2023) reported that physicians generally demonstrated higher levels of digital literacy compared to nurses and allied health workers, a disparity largely attributed to physicians' greater access to education and more frequent exposure to clinical information systems.

In contrast, nurses and other allied health professionals often experienced limited opportunities for digital training, resulting in lower proficiency levels in adopting digital tools. Kasaye et al. (2024) reinforced this observation by highlighting the disparities in digital knowledge between physicians with advanced educational backgrounds and nurses who did not receive equivalent training. These findings, supported also by Shiferaw et al. (2020), illustrate that structural inequalities in training perpetuate uneven digital competency across healthcare professions. Such gaps pose challenges to team-based care delivery, as inconsistent literacy levels may hinder coordination and collaborative use of digital health tools.

The second theme, determinants and barriers, centers on systemic and personal factors that inhibit the integration of digital literacy within healthcare education and practice. Systemic barriers were frequently cited as major obstacles to effective integration. Martínez et al. (2023) observed that many educational institutions lacked adequate access to essential hardware and software needed for digital training, which directly constrained the implementation of comprehensive digital literacy curricula. Shiferaw et al. (2020) similarly emphasized that insufficient institutional commitment and limited faculty engagement further hindered the promotion of digital training programs. Such structural barriers highlight the importance of institutional and managerial support in promoting digital literacy as an educational and clinical priority.

Beyond institutional constraints, statistical evidence has also linked the quality of infrastructure to the success of digital literacy programs. Neter (2025) found that institutions with robust information and communication technology (ICT) infrastructure reported higher success rates in digital training outcomes compared to those with limited resources. Supporting this, Chereka et al. (2024) presented data from Ethiopia demonstrating that healthcare institutions equipped with sufficient ICT facilities experienced significant improvements in the quality of training and digital competencies of their staff. Reda et al. (2024) similarly noted that European hospitals with advanced digital infrastructure showed measurable improvements in healthcare workers' digital proficiency, underscoring a strong positive correlation between infrastructure investment and training effectiveness. These findings provide compelling evidence that infrastructure development is not merely supportive but integral to ensuring sustainable progress in digital literacy initiatives.

Personal barriers also emerged as influential in shaping digital adoption. Healthcare professionals often expressed apprehension toward technology, citing fears of increased workload, concerns about information overload, and low self-confidence in their ability to learn new digital skills (Shiferaw et al., 2020). Such factors reflect not only technical gaps but also psychological and cultural dimensions of digital readiness. Without addressing personal-level hesitations and building confidence, even well-resourced training programs may fail to achieve desired outcomes.

The third theme, training innovations and pedagogical models, highlights promising approaches that have been implemented to improve digital literacy among healthcare professionals. Evidence consistently shows that simulation-based training, active learning methodologies, and technology-integrated teaching strategies are among the most effective interventions. Sahan et al. (2024) found that technology-based clinical simulations significantly enhanced healthcare workers' digital competencies by allowing them to practice in realistic but safe environments. These simulations provided opportunities to develop practical skills, improve decision-making, and foster confidence

in managing digital tools. Martínez et al. (2023) further observed that collaborative and problem-based learning approaches facilitated quicker adoption of digital tools compared to traditional didactic teaching. Such pedagogical innovations suggest that immersive and interactive approaches are more effective in equipping healthcare workers with applied digital skills.

The integration of digital technologies into teaching has also been shown to improve engagement and motivation. Prosen and Ličen (2025) reported that interactive e-learning modules and multimedia-based resources significantly increased learners' motivation and participation in digital literacy training. These findings suggest that pedagogical approaches that emphasize interactivity and learner autonomy are particularly effective in building competencies that extend beyond technical proficiency to include adaptability and problem-solving.

The global implementation of digital training innovations reflects significant variation depending on geographic and socio-economic contexts. In high-income countries, such as those in Europe, the adoption of advanced technologies in medical education is supported by strong institutional policies and government initiatives. Fernández-Luque et al. (2021) noted that European medical schools and hospitals widely employ simulation technologies, supported by investments in infrastructure and faculty training, to deliver comprehensive digital literacy programs. Martínez et al. (2023) similarly documented how European contexts benefit from established systems that facilitate seamless integration of digital training into professional education.

By contrast, in low- and middle-income countries, such as Ethiopia, the implementation of these innovations often faces significant barriers related to infrastructure and resource availability. Kasaye et al. (2024) found that although healthcare professionals in Ethiopia benefited from simulation-based and technology-driven training, these interventions were often limited in scope due to inadequate facilities and financial constraints. Nevertheless, evidence from Sahan et al. (2024) indicates that even in resource-constrained settings, tailored digital training programs can yield meaningful improvements in healthcare workers' knowledge and skills, provided they are designed to align with local needs and conditions. Malerbi et al. (2023) emphasized that the evaluation of these innovations has relied on multiple approaches, including measuring learning outcomes, collecting participant feedback, and assessing changes in clinical practice. This triangulated evaluation strategy enhances the reliability of evidence regarding the effectiveness of training innovations.

In summary, the results highlight that gaps in digital education persist globally, particularly affecting nurses and allied health workers, and that these disparities are compounded by systemic and personal barriers to digital literacy integration. At the same time, evidence strongly supports the effectiveness of innovative pedagogical models, particularly simulation-based training and interactive e-learning, in improving competencies. Comparative perspectives underscore that while high-income countries benefit from well-developed infrastructure and institutional support, resource-limited settings require contextually adapted interventions to achieve similar gains. Collectively, these findings emphasize the multifaceted nature of digital literacy in healthcare and point toward the necessity of addressing both structural and personal determinants while promoting innovative training strategies across diverse global contexts.

The findings of this review align with and extend previous research on the challenges and opportunities surrounding digital literacy among healthcare professionals. Earlier studies identified

systemic and personal barriers to digital adoption, including insufficient infrastructure, lack of structured training, and skepticism toward new technologies (Latif et al., 2019). The persistence of these barriers in contemporary studies suggests that while the availability of digital tools has expanded, the preparedness of healthcare professionals to use them effectively remains inconsistent. Andersen et al. (2024) highlighted that many practitioners still express low confidence in their digital skills, echoing observations by Shiferaw et al. (2020) that frontline workers often struggle to navigate digital platforms effectively. This enduring gap underscores the necessity of not only expanding access to technology but also ensuring that professionals receive adequate, context-specific training that builds competence and confidence.

At the same time, recent evidence points to promising opportunities that were less prominent in earlier research. Advances in pedagogical strategies, such as simulation-based learning and collaborative problem-solving, have demonstrated measurable improvements in digital competencies (Kasaye et al., 2024; Sahan et al., 2024). These approaches address the limitations of traditional didactic methods by fostering active engagement and creating safe environments in which professionals can develop practical skills. Similarly, Nazeha et al. (2020) emphasized that curricula incorporating interactive and technology-driven modules can bridge gaps between theoretical knowledge and clinical practice. These innovations highlight a shift in educational paradigms from passive to experiential learning, suggesting that the path toward digital readiness requires rethinking how competencies are taught and assessed within healthcare education systems.

Systemic factors remain central in explaining the persistence of digital literacy challenges. Many healthcare institutions, particularly in low- and middle-income countries, continue to face structural deficiencies in information and communication technology infrastructure. Martínez et al. (2023) noted that limited access to hardware and software within educational settings restricts opportunities for healthcare students to develop digital skills. The same concern was echoed in findings from Ethiopia, where institutions with limited ICT infrastructure reported lower success rates in implementing digital literacy programs compared to better-resourced facilities (Chereka et al., 2024). By contrast, in European contexts where robust infrastructures and supportive policies are in place, digital literacy training has been more successfully embedded into professional education (Reda et al., 2024). These contrasts reinforce the argument that systemic investment in infrastructure is inseparable from educational reform if digital literacy is to be meaningfully advanced.

Policy implications derived from these findings emphasize the importance of integrating digital competencies as mandatory components of healthcare curricula. Taba et al. (2022) argued that curricular reform must be institutionalized at all levels of healthcare education, ensuring that digital literacy is not treated as an optional skill but as a fundamental competency for modern practice. Azzellino et al. (2025) expanded this perspective by stressing the need for continuous professional development, noting that digital health technologies evolve rapidly and demand ongoing adaptation by healthcare professionals. Without policies that mandate lifelong learning and digital upskilling, professionals risk falling behind in their ability to utilize emerging technologies effectively. In parallel, government-led initiatives to strengthen ICT infrastructure in healthcare institutions are critical for creating conducive environments in which training can take place. Policies supporting access to broadband internet, funding for technological upgrades, and faculty

development programs would ensure that training efforts are sustainable and equitably distributed across regions.

Another key policy implication concerns the alignment between digital literacy initiatives and broader health system objectives. Wilson et al. (2024) observed that well-designed digital literacy programs not only enhance professional competence but also improve patient-provider interactions, ultimately contributing to better patient outcomes. Embedding digital literacy within healthcare education thus aligns with goals of improving healthcare quality, safety, and accessibility. Furthermore, in contexts where healthcare delivery is increasingly dependent on telemedicine and digital health platforms, the absence of adequate competencies risks undermining the effectiveness of such systems. Malerbi et al. (2023) demonstrated how the accelerated reliance on telehealth during the COVID-19 pandemic highlighted gaps in digital readiness but also revealed opportunities to strengthen resilience through targeted training. Policies must therefore recognize digital literacy not simply as an educational issue but as a health system priority with direct implications for patient care.

Despite the progress made, several limitations within the existing body of research constrain the generalizability of findings. One recurring limitation is the narrow focus of many studies on specific professional groups, such as physicians or nurses, without adequately accounting for the diversity of healthcare roles. As a result, the understanding of digital literacy remains uneven, with less attention given to allied health professionals who play critical roles in patient care. Furthermore, geographic limitations are evident, with most research concentrated in either high-income countries with strong infrastructures or a small number of low-resource settings. This creates difficulties in drawing global conclusions and highlights the need for more inclusive, cross-regional studies that can better capture variations in infrastructure, training systems, and sociocultural contexts.

Methodological inconsistencies further limit the comparability of research findings. Sahan et al. (2024) and Shiferaw et al. (2020), for example, reported differing outcomes on the effectiveness of training interventions within similar contexts, likely due to variations in study design, sample selection, and assessment tools. The lack of standardized measures for digital literacy competencies makes it challenging to evaluate progress systematically across studies. Longitudinal designs that track changes in competency over time, as well as multi-site investigations that incorporate diverse healthcare professions, would significantly enhance the robustness of future research. Moreover, comparative studies that directly assess the impact of training innovations across regions with different levels of infrastructure would provide valuable insights into the adaptability and scalability of these approaches.

Future research should also prioritize the development and testing of adaptive and responsive training models tailored to the specific needs of healthcare professionals in different contexts. Wilson et al. (2024) emphasized that training programs must be aligned with both the technical and relational dimensions of digital health, ensuring that professionals are equipped not only with technical skills but also with the capacity to engage patients effectively through digital platforms. Research exploring the long-term impacts of digital literacy training on patient outcomes, health equity, and system efficiency would fill critical gaps in current knowledge. Additionally, more work is needed to explore the cultural and psychological aspects of digital adoption, including strategies

to overcome technophobia and resistance among healthcare workers. These avenues of inquiry would broaden the understanding of digital literacy as a multidimensional construct, bridging individual, institutional, and systemic perspectives.

Taken together, the discussion highlights the persistence of well-documented barriers alongside emerging opportunities for innovation. The alignment of recent findings with earlier research underscores the resilience of systemic challenges, while the success of new pedagogical approaches points toward pathways for progress. However, realizing the full potential of digital literacy in healthcare requires sustained investment in infrastructure, comprehensive policy frameworks, and research strategies that address current limitations by broadening scope, standardizing methods, and linking competencies to health system outcomes.

CONCLUSION

This narrative review demonstrates that digital literacy among healthcare professionals remains a critical yet unevenly addressed component of modern healthcare systems. The findings highlight persistent educational gaps, particularly among nurses and allied health professionals, who often receive minimal training in digital competencies. Comparative evidence underscores disparities across professional groups and geographic regions, with physicians in higher-income contexts generally demonstrating greater proficiency due to broader access to training and resources. Systemic barriers, including inadequate infrastructure, limited institutional support, and insufficient faculty readiness, continue to impede progress, especially in low- and middle-income countries. Personal-level challenges, such as technophobia and low self-confidence, further compound these structural obstacles. Yet, the review also reveals promising advances in training innovations, particularly simulation-based education, interactive e-learning, and problem-based approaches, which have shown effectiveness in improving competencies across diverse contexts.

The urgency of addressing digital literacy is clear, as insufficient competencies risk undermining patient safety and the effectiveness of healthcare delivery. Policy interventions are required to mandate the integration of digital competencies into all levels of healthcare curricula, supported by sustained investment in ICT infrastructure and faculty development. Continuous professional development programs must also be prioritized to keep pace with rapidly evolving digital health technologies. Future research should address current limitations by adopting standardized measures, expanding cross-professional and cross-regional analyses, and evaluating the long-term impacts of training interventions on clinical practice and patient outcomes. Strengthening digital literacy through systemic reforms and innovative pedagogies will be central to preparing healthcare professionals for the demands of increasingly digitalized healthcare systems.

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