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Integration of Digital Health in Nursing Practice for the Prevention and Management of Diabetic Foot Wounds: A Scoping Review

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ABSTRACT

Diabetic foot ulcers (DFUs) are serious complications of diabetes mellitus that require continuous monitoring, early detection, patient education, and coordinated management. Digital health technologies offer opportunities to strengthen nursing practice and improve continuity of care. This review aimed to map the evidence regarding the integration of digital health into nursing practice for the prevention and management of DFUs. A scoping review was conducted following the Joanna Briggs Institute methodology and reported according to the PRISMA-ScR guidelines. Literature searches were conducted in PubMed/MEDLINE, Scopus, Web of Science, CINAHL, ScienceDirect, ProQuest, and the Cochrane Library, with additional grey literature from Google Scholar. Studies published in English between 2015 and 2026 were considered. From 1,290 identified articles, 35 studies met the eligibility criteria and were included in the synthesis. The identified technologies included telemedicine and telenursing, mobile health (mHealth), digital wound imaging, remote monitoring, wearable devices, and artificial intelligence. These technologies supported early detection, wound assessment and monitoring, patient education, self-care, communication, and continuity of nursing care. Reported outcomes included improved foot-care knowledge and behavior, self-management, access to care, wound monitoring, and potential prevention of amputation. However, evidence remained heterogeneous, with challenges related to infrastructure, cost, digital literacy, interoperability, data security, and user acceptance. Digital health has considerable potential to strengthen nurse-led, patient-centered care for DFUs. Further research is needed to evaluate long-term effectiveness, cost-effectiveness, safety, nursing outcomes, and sustainable implementation across diverse healthcare settings.

INTRODUCTION

Diabetes mellitus is a chronic disease with a health burden that continues to increase globally and is associated with various serious complications, one of which is...diabetic foot ulcer (DFU)(Zhang et al., 2017). Foot ulcers (LKD) are a complex and multifactorial complication associated with peripheral neuropathy, peripheral arterial disease, foot deformity, repetitive mechanical stress, infection, and impaired wound healing. Globally, LKD is a complication of diabetes that poses a significant clinical and economic burden and requires ongoing management (Armstrong et al., 2017). LKD has serious consequences for the physical, psychological, social, and economic well-being of patients. Untreated wounds can progress to infection, osteomyelitis, lower extremity amputation, mobility limitations, decreased quality of life, and an increased risk of death (McDermott et al., 2023). Patients with LKD also have a higher risk of mortality than diabetic patients without foot ulcers, while amputations due to diabetic foot complications can increase the risk of long-term mortality.

Prevention of LKD requires early identification of risk factors and ongoing monitoring of foot condition. Routine foot examinations and educationfoot care, use of appropriate footwear, controlling risk factors, monitoring foot pressure and temperature, and increasing abilityself-careis an important component in the prevention of LKD

(van Netten et al., 2024). Evidence suggests that educational interventions, foot examinations, temperature monitoring, the use of therapeutic footwear, and an integrated foot care approach can help reduce the risk of LKD occurrence and recurrence (Bus et al., 2020). In the prevention and management of LKD,nurses have a strategic rolebecause they interact directly and continuously with patients. Nurses play a role in assessing foot and wound conditions, identifying risk factors, providing wound care, monitoring the healing process, preventing infection, providing foot care education, and improving patient care.self-management, and coordination of multidisciplinary services (Armstrong et al., 2017). A nursing approach oriented towards patient education and involvement is becoming increasingly important because the success of LKD prevention is greatly influenced by the patient's ability to perform independent foot care.

However, the implementation of nursing care for patients with LKD still faces various challenges, including the need for long-term monitoring, limited access to competent healthcare professionals in wound care, geographic distance, cost of care, and limited patient ability to independently monitor foot conditions (Zhang et al., 2024). These barriers can lead to delays in detecting changes in wound condition and reduce continuity of care (Armstrong et al., 2023). Innovative approaches that can strengthen patient monitoring and communication between patients and healthcare professionals without relying entirely on face-to-face visits are needed.digital healthprovide opportunities to strengthen nursing practice in the prevention and management of LKD (Klonoff et al., 2020). Various technologies such astelemedicine,tele-nursing,mobile health (mHealth), smartphone apps, digital wound photography,remote monitoring,wearable devices,smart insoles, pressure and temperature sensors, as wellartificial intelligence (AI)Technology has begun to be developed to support early detection, assessment, monitoring, education, and management of DFS (Yap et al., 2021). This technology enables faster and more sustainable patient data collection and can support clinical decision-making.

One development that is receiving increasing attention isartificial intelligencein Wound Health Assessment (LKD) assessment. AI can be used to detect the presence of wounds, identify wound characteristics, segment wound areas, measure wound size, classify severity, and help predict the risk of complications (Chen et al., 2026). The use of AI has the potential to help nurses obtain objective information about wound conditions and support clinical decision-making, although external validation, data quality, model generalization, and readiness for implementation in practice remain challenges (Wartakusumah et al., 2026). In addition to AI,telemedicine and tele-nursingTelemedicine has the potential to improve continuity of care for patients with LKD. Through remote consultations, image-based monitoring, digital communication, and regular wound evaluation, patients can gain access to healthcare professionals without having to constantly visit a healthcare facility (Zhang et al., 2024). Evidence from clinical studies suggests that telemedicine has the potential to provide benefits in the management of LKD, including potentially reducing the risk of amputation and healthcare costs, although research findings regarding wound healing and mortality are mixed.

mHealth Technologyalso has significant potential to support nursing interventions, particularly in education and self-care. Smartphone-based applications can be used to provide foot care education, foot exam reminders, self-care behavior monitoring, foot condition documentation, and communication between patients and healthcare professionals. mHealth-based interventions have shown potential in improving foot care knowledge and behavior in diabetic patients, making them an additional component of nursing strategies to prevent diabetic foot complications (Zhang et al., 2026; Adu et al., 2023; Kebede et al., 2021). Wearable technologies such as smart insoles, smart socks, and pressure and temperature sensors are also emerging as approaches to support DFD prevention. These devices enable continuous monitoring of risk factors and can provide alerts when changes in plantar pressure or foot temperature potentially increase the risk of tissue damage. While promising, the implementation of wearable technology still faces challenges related to accuracy, comfort, compliance, cost, and patient and healthcare professional acceptance (Orlando et al., 2021; Waaijman et al., 2024; Frykberg et al., 2020).

Even though the development of digital health in LKD is increasingly rapid,evidence regarding the integration of these technologies specifically into nursing practice remains fragmentedWhile some studies focus on the

diagnostic accuracy of AI, others evaluate telemedicine, mHealth, wearable technology, or wound imaging systems separately. This situation results in a lack of a comprehensive picture of how digital technology is used in the nursing process, how the role of nurses is evolving, and the nursing and patient outcomes that can be achieved through digital technology integration (Yap et al., 2021; Keestra et al., 2023; Zhang et al., 2026). Beyond technological aspects, the implementation of digital health in DFS care is also influenced by the social, economic, geographic, and healthcare system contexts. Differences in digital infrastructure, patient and nurse digital literacy, device availability, cost, internet access, healthcare worker competency, and organizational readiness can impact the success of technology implementation. Therefore, a global perspective is needed to identify patterns of digital health implementation in nursing practice and understand disparities between countries and different service contexts (Klonoff et al., 2020; Orlando et al., 2021; Keestra et al., 2023).

Based on this description, a scoping review is needed to comprehensively map the scientific evidence regarding the integration of digital health into nursing practice for the prevention and management of diabetic foot ulcers globally. This review will identify the types of technology used, forms of nursing interventions, the role of nurses, the purpose of technology use, patient outcomes, service contexts, benefits, barriers to implementation, and research gaps based on geographic context. The study results are expected to form the basis for the development of evidence-based nursing practice, improving nurses' digital competency, developing nurse-led digital care, and innovating more integrated, sustainable, and patient-oriented LKD services.

METHODS

This study used a scoping review design to map and synthesize scientific evidence regarding the integration of digital health into nursing practice for the prevention and management of diabetic foot ulcers (DFUs). The scoping review approach was chosen because it allows researchers to identify characteristics, concepts, types of technology, intervention forms, service contexts, and research gaps in a broad and multidimensional field. The scoping review process was conducted based on the Joanna Briggs Institute (JBI) methodology for scoping reviews and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) (Peters et al., 2020; Tricco et al., 2018). The research questions were developed using the PCC (Population, Concept, and Context) framework as recommended by the JBI. The population in this study were patients with diabetes mellitus who were at risk for or had experienced diabetic foot ulcers and the nursing staff involved in the care. The concept encompasses the integration of digital health into nursing practice, including tele-nursing, telemedicine, mobile health (mHealth), digital applications, remote monitoring, digital wound photography, wearable technology, smart devices, sensors, and artificial intelligence. The context encompasses a wide range of healthcare facilities and systems worldwide, including primary care, community settings, hospitals, wound clinics, outpatient care, and home-based care.

A systematic literature search was conducted in several electronic databases relevant to the fields of health, nursing, and health technology. The databases used included PubMed/MEDLINE, Scopus, Web of Science, CINAHL, ScienceDirect, ProQuest, and the Cochrane Library. Additionally, grey literature was searched through Google Scholar and other relevant sources to identify publications not indexed in the main databases. The search strategy was developed based on three main concepts: diabetic foot ulcers, digital health, and nursing practice. Keywords and Medical Subject Headings (MeSH) were combined using the Boolean operators AND and OR. The Boolean operators used were ("Digital Health" OR Telemedicine OR "Telehealth" OR "Tele-nursing" OR mHealth OR "Mobile Health" OR "Remote Monitoring" OR "Artificial Intelligence" OR "Machine Learning" OR "Wearable Technology" OR "Digital Imaging").

Inclusion and exclusion criteria were established before the literature selection process. Included studies were those involving patients with diabetes who were at risk for or had experienced DFS, as well as those involving nursing

staff in DFS services. The primary concept that must be included in the research is the use of digital health technology for the prevention, detection, assessment, monitoring, education, self-care, or management of DFS that is relevant to nursing practice. Studies conducted in hospitals, wound clinics, primary care, community settings, home care, or outpatient settings in various countries will be considered. Relevant outcomes include ulcer prevention, wound healing, early detection, wound assessment, amputation prevention, improved self-care, quality of life, adherence, access to care, patient safety, and nursing outcomes. Types of studies eligible for inclusion include randomized controlled trials, quasi-experimental, cohort, cross-sectional, case-control, qualitative research, mixed methods, pilot studies, and feasibility studies. Studies unrelated to DFS, not involving digital health aspects, or not relevant to nursing practice will be excluded. Editorials, commentaries, letters to the editor, opinion pieces without empirical data, and research protocols will also be excluded. Literature published in English between 2015 and 2026 will be considered to capture contemporary developments in digital technology in the prevention and management of DFS.

All search results from various databases will be compiled and managed using reference management software to identify and remove duplicate articles. The selection process is carried out in two stages: title and abstract screening, followed by full-text screening based on predetermined inclusion and exclusion criteria. The selection process is carried out independently by two reviewers. If there are differences in decisions between the two reviewers, these differences will be resolved through discussion and consensus. If consensus cannot be reached, a third reviewer will be involved to make the final decision. The process of article identification, screening, eligibility assessment, and inclusion will be presented in a PRISMA flow diagram and reported in accordance with PRISMA-ScR (Tricco et al., 2018).

Data from articles meeting the inclusion criteria were extracted using a form developed based on JBI recommendations. The extracted data included author names, year of publication, country of study, research objectives, research design, characteristics and sample size, DFS characteristics, type of digital health used, purpose of technology use, type of nursing intervention, nurse role, service context, duration of intervention or monitoring, patient outcomes, nursing outcomes, benefits of technology, barriers to implementation, and aspects of security, privacy, and ethics. The extraction process was conducted by one reviewer and verified by a second reviewer to ensure the consistency, completeness, and accuracy of the data obtained.

RESULTS

The literature identification and selection process was conducted based on the PRISMA-ScR guidelines. An initial search of seven electronic databases and additional sources yielded 1,290 articles. After removing duplicate articles, 1,004 articles proceeded to the title and abstract screening stage. At this stage, 872 articles were excluded because they did not align with the research focus. A total of 132 articles were then retrieved in full text and assessed based on inclusion and exclusion criteria. After full-text assessment, 97 articles were excluded because they did not specifically address diabetic foot ulcers, did not use digital health technology, were not related to nursing practice, or did not report relevant outcomes. Thus, 35 studies met the criteria and were included in the final synthesis of the scoping review.

The 35 studies included in the synthesis showed variation in research design, location, population characteristics, type of digital technology, and healthcare context. The identified studies included quantitative, qualitative, mixed methods, technology development studies, feasibility studies, and experimental studies. This variety of designs demonstrates that the integration of digital health in the prevention and management of DFS remains a developing field of research and encompasses a variety of methodological approaches. Geographically, the studies came from diverse regions of the world, with a greater concentration of research in Europe, North America, and Asia, while research from Africa and some low- and middle-income countries remains relatively limited. This distribution highlights a geographic gap in the research evidence on the application of digital technology to DFS care.

Most studies were conducted in hospitals, wound clinics, outpatient settings, and community settings, while research specifically evaluating technology integration in home care is more limited.

The mapping results show that technologies used in the prevention and management of LKD include telemedicine and tele-nursing, mHealth, digital wound imaging, remote monitoring, wearable technology, and artificial intelligence (AI). These technologies are used to support early detection, wound assessment, wound progression monitoring, patient education, self-care, and communication between patients and healthcare professionals. Furthermore, digital health integration expands the role of nurses in LKD services. Nurses play a role in assessment, wound monitoring, education, wound care, communication, improving self-management, and coordinating services. Digital technology enables nurses to continuously monitor patients and provide education without always relying on in-person visits. The nursing outcomes found include wound healing, early detection, amputation prevention, improved foot care knowledge and behavior, self-care, compliance, quality of life, access to services, and service efficiency. Several studies also report technology outcomes, such as detection accuracy, usability, feasibility, and user acceptance. Overall, digital health shows potential in strengthening nursing practice for the prevention and management of DFS through early detection, monitoring, education, self-management, documentation, and continuity of care. However, the available evidence remains heterogeneous and does not fully describe an effective and sustainable model for integrating digital health into nursing practice globally.

DISCUSSION

The results of the scoping review indicate that the integration of digital health into nursing practice for the prevention and management of diabetic foot wounds (DFUs) is developing in various forms of technology, ranging from telemedicine, tele-nursing, mobile health (mHealth), digital wound imaging, remote monitoring, wearable technology, and artificial intelligence (AI). These findings indicate a paradigm shift in DFU care from a face-to-face approach to a more sustainable, connected, and data-driven service model. This development is relevant to the characteristics of DFUs, which require long-term monitoring, repeated education, ongoing care, and active patient involvement in the healing process.

Integration of Digital Health in Nursing Practice

Key findings indicate that digital health has the potential to expand the role of nurses across the entire nursing process for patients with LKD. Nurses are no longer limited to direct wound care but can also conduct remote assessments, monitor wound conditions, provide digital education, provide therapeutic communication, enhance self-management, and coordinate services through digital platforms (Klonoff et al., 2020). This shift supports the concept of more patient-centered care because it allows patients to continue receiving nursing support even outside of healthcare facilities (Kamei et al., 2020). The integration of digital technology can also strengthen the continuity of nursing care. LKD is a condition that requires repeated monitoring and often requires the involvement of multiple healthcare professionals. Through digital systems, information on wound progression can be documented serially and communicated to a multidisciplinary team (Keestra et al., 2023). Thus, digital health has the potential to reduce fragmentation of care and improve interprofessional coordination. However, the effectiveness of this integration depends heavily on the extent to which the technology can be adapted to clinical workflows and the competencies of healthcare professionals (Yap et al., 2021).

Tele-Nursing and Continuity of Care

One important finding is the growing use of telemedicine and telenursing to support the monitoring of patients with LKD (Dardari et al., 2023). This approach allows nurses to conduct consultations, education, image-based wound monitoring, and follow-up remotely. This is particularly relevant for patients experiencing geographic barriers or limited access to wound clinics and specialist healthcare providers. These findings align with research showing that telemedicine has the potential to improve access to care and support the management of LKD (Zhang et al., 2024). A meta-analysis of telemedicine suggests a potential

reduction in amputation risk and cost of care in certain groups, although evidence regarding wound healing and mortality remains inconsistent (Kamei et al., 2020). Therefore, telenursing is best viewed as a complement to face-to-face care, not a complete replacement for the clinical examination process. From a nursing perspective, the use of telenursing also requires strong clinical skills. Nurses must be able to determine which conditions can be monitored virtually and which require in-person examination. Wounds with signs of severe infection, impaired perfusion, necrosis, or deteriorating condition still require in-person clinical evaluation. Therefore, digital technology should be incorporated into a clear clinical pathway to avoid delays in referral or intervention.

mHealth and Self-Care Strengthening

Research findings indicate that mHealth plays a crucial role in supporting education and self-management. Using a smartphone app allows patients to obtain information about foot examinations, wound care, footwear usage, signs of infection, and actions to take when changes in the feet are detected. For nurses, the app can serve as an educational tool that can be used repeatedly outside of consultations. These findings align with evidence that mHealth-based interventions can improve foot care knowledge and behavior in diabetes patients (Zhang et al., 2026; Adu et al., 2023; Kebede et al., 2021). This is crucial because the success of foot care prevention depends not only on healthcare provider intervention but also on the patient's ability to consistently perform foot care. However, increased knowledge through apps does not necessarily translate into long-term behavior change. Therefore, nurses remain essential in providing reinforcement, assessing barriers to self-care, and tailoring education to the patient's individual circumstances. The most promising mHealth integration extends beyond simply providing information to creating a lasting relationship between patients and caregivers through reminders, monitoring, feedback, and decision-making support.

CONCLUSION

The integration of digital health into nursing practice has great potential to support the prevention and management of diabetic foot ulcers through tele-nursing, mHealth, digital wound imaging, remote monitoring, wearable technology, and artificial intelligence (AI), which can assist nurses in assessment, early detection, wound monitoring, education, self-care improvement, and service coordination. However, its implementation still faces challenges such as limited infrastructure, costs, digital literacy and competency, system interoperability, data security, and user acceptance. Research evidence still focuses more on technology development and accuracy than on its integration into the nursing process. Therefore, digital health needs to be developed as part of nurse-led digital care that is evidence-based, patient-centered, and sustainable, with further research directed at long-term effectiveness, cost-effectiveness, quality of life, nursing outcomes, safety, and its application in various global healthcare contexts..

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