MOBILE EDUCATION APPS AND THEIR IMPACT ON DIABETES SELF-CARE: A SCOPING REVIEW

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ABSTRACT

Introduction: Type 2 diabetes mellitus (T2DM) present significant global health challenges, particularly in areas with limited health literacy and educational resources. Mobile education applications have become valuable tools for supporting diabetes self-management. This scoping review aims to evaluate the impact of mobile education apps in improving self-care practices among T2DM patients and their potential integration into nursing practice.
Methods: Following PRISMA-ScR guidelines, this review applied the PCC framework (Population: individuals with T2DM; Concept: Mobile health; Context: diabetes self-management). Relevant studies published from 2015 to 2025 were identified in PubMed, Scopus, ScienceDirect, and Google Scholar, yielding ten studies for analysis.
Results: Common app features included evidence-based education, self-monitoring, automated reminders, and personalized feedback. Regular app use significantly improved blood glucose monitoring, dietary management, physical activity, medication adherence, foot care, and reduced HbA1c levels. Successful implementation factors were nursing or educator support, ease of use, and culturally adapted content. Barriers included low digital literacy, declining engagement over time, and challenges integrating data into healthcare systems.
Discussion: Mobile education apps effectively enhance T2DM self-care by improving health literacy, fostering self-monitoring, and promoting healthy habits. Future research should address digital literacy, long-term engagement strategies, and effective integration into nursing practices and healthcare workflows.

Keywords: *Mobile Health, Mobile Education, Type 2 Diabetes Mellitus, Self-Care, Nursing.*

Introduction

Diabetes mellitus (DM) is a serious and complex global health issue, with a continuously increasing prevalence worldwide. In 2024, over 800 million adults globally were living with DM, nearly twice the number reported three decades earlier (Zhou et al., 2024).This surge is not only due to increased life expectancy and global population growth but also is the direct result of dietary changes, urbanization, and the widespread adoption of sedentary lifestyles (World Health Organization, 2016).

While the prevalence is increasing worldwide, the impact is most pronounced in low- and middle-income countries (LMICs), where access to basic healthcare services, routine screening, and health education remains limited (International Diabetes Federation, 2021). In Southeast Asia, including Indonesia, the rise in T2DM cases is driven by urbanization, dietary shifts, and lack of physical activity

(International Diabetes Federation, 2021). In 2021, Indonesia ranked among the top five countries globally, with 19.5 million cases of diabetes (Webber, 2021).

Beyond reducing individual quality of life, DM imposes a significant economic burden on both individuals and healthcare systems. The International Diabetes Federation estimated global diabetes-related expenditures at over USD 966 billion in 2021, encompassing the costs of chronic complications such as cardiovascular disease, kidney failure, and amputations. Indirect costs, including loss of productivity and premature disability, further exacerbate the socioeconomic impact (Spinean et al., 2024).

Optimal DM management heavily depends on patients' ability to perform effective self-care, such as blood glucose monitoring, medication adherence, maintaining a healthy diet, and engaging in physical activity (Srivastava et al., 2015). However, studies indicate that barriers including low health literacy, limited access to education, and socioeconomic constraints frequently hinder optimal self-care practices (Birhanu et al., 2024). For example, in Indonesia, the 2018 national health survey (Riskesdas) revealed that only 30% of patients with diabetes achieved good glycemic control, indicating suboptimal community-level self-care (Balitbangkes RI, 2018). Furthermore, patient education provided in healthcare facilities is often limited, unsustainable, and insufficient to drive long-term behavioral change (Chrvala et al., 2016).

To address these challenges, nurses play a crucial role in delivering ongoing education, supporting patients in daily practice, and facilitating the adoption of technologies that promote self-care. The development of mobile health (mHealth) technologies, especially mobile education apps, has emerged as a promising approach to enhance self-care among individuals with DM (Giger et al., 2025). These apps offer interactive content, reminders, real-time monitoring, and personalized feedback, providing continuous support beyond traditional clinical settings (Hou et al., 2018). Multiple systematic reviews and meta-analyses report that mHealth interventions are associated with improved patient knowledge, behavior change, and clinical outcomes such as significant HbA1c reduction (Boels et al., 2020).

Despite their great potential, the implementation and sustainability of mobile education tools remain inconsistent. Factors such as digital literacy, internet access, cultural adaptation, and nurse-patient interaction greatly influence their effectiveness and acceptability (Baig et al., 2015). Therefore, this review is essential to provide a comprehensive understanding of the potential, challenges, and integration strategies of mobile education apps in professional nursing practice. The objective of this review is to examine the role of mobile education apps in enhancing self-care among individuals with T2DM and to identify their potential for integration into nursing practice.

Methods

This study follows the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) and uses a framework developed by

Arksey and O'Malley, with a PCC (Population, Concept, Context) approach (Arksey & O'Malley, 2005). The components of PCC in this study consist of: Population, which is individuals with T2DM, Concept, which is Mobile health, and Context, which is diabetes self-management.

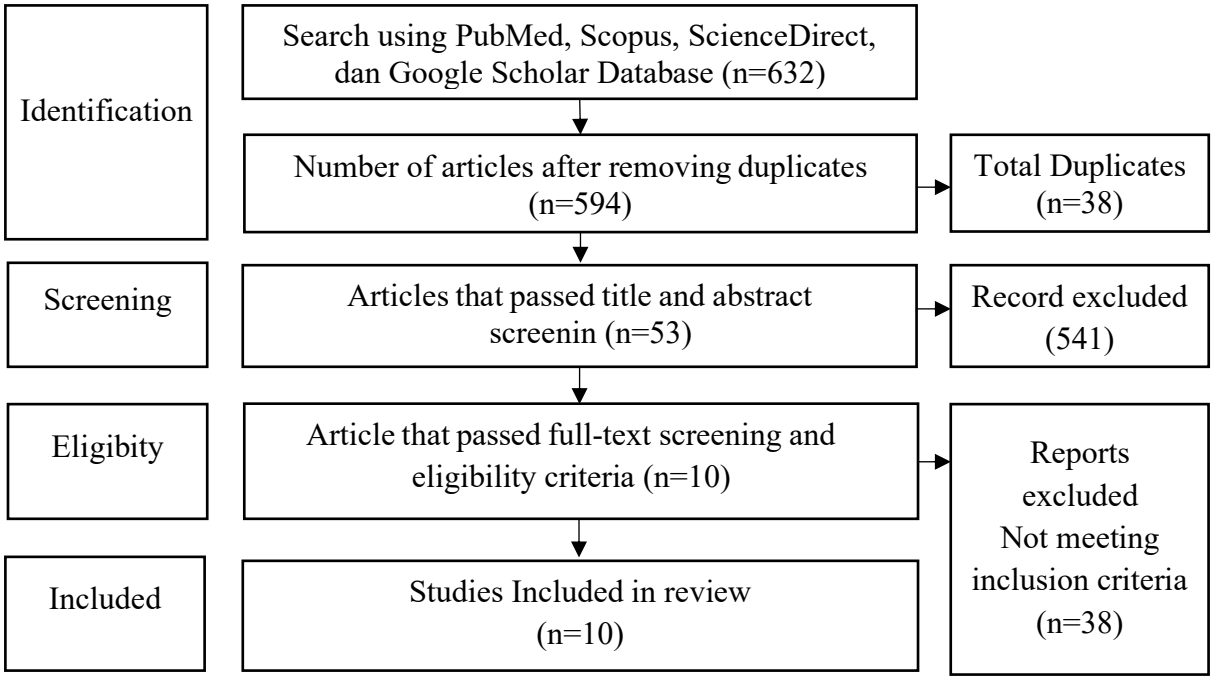
The inclusion criteria used in the study selection were: (1) primary research articles (quantitative, qualitative, or mixed methods) or reviews discussing the use of mobile education applications for improving self-care in T2DM patients, and (2) articles providing nursing implications or context, (3) published between 2015–2025, in full text, in English or Indonesian. Exclusion criteria include (1) Articles focusing only on type 1 diabetes (2) publications in the form of editorials, narrative reviews, readers' letters, and conference abstracts without full-text.

Search results were managed using reference management software (e.g., Mendeley), and study selection occurred in two stages: initial screening of titles and abstracts, followed by full-text review. The selection process was conducted independently by two reviewers, with discrepancies resolved through discussion.

Figure 1. Boolean Keywords

DATABASE	BOOLEAN KEYWORDS (SEARCH STRINGS)
PubMed	(“Type 2 Diabetes Mellitus” OR “T2DM”) AND (“mobile app” OR “mobile application” OR “smartphone app”) AND (“self-care” OR “self-management” OR “education”) AND (“nursing”)
Scopus	(“Type 2 Diabetes Mellitus” OR “T2DM”) AND (“mobile app” OR “mobile application” OR “smartphone app”) AND (“self-care” OR “self-management” OR “education”) AND (“nursing”))
ScienceDirect	(“Type 2 Diabetes Mellitus” OR “T2DM”) AND (“mobile app” OR “mobile application” OR “smartphone app”) AND (“self-care” OR “self-management” OR “education”) AND (“nursing”)
Google Scholar	“Type 2 Diabetes Mellitus” OR “T2DM” AND “mobile app” OR “mobile application” OR “smartphone app” AND “self-care” OR “self-management” OR “education" AND "nursing”

Figure 2. Prisma Flowchart



The selection process is carried out independently by two researchers, and any differences of opinion are resolved through discussion. A literature search was conducted in April 2025 using four main databases: PubMed, Scopus, ScienceDirect, and Google Scholar. Total of 632 articles were identified from the four databases. After removing 38 duplicates, 594 articles were screened by title and abstract. 541 articles were excluded for irrelevance, leaving 53 for full-text review. Of these, 38 did not meet the inclusion criteria. Ultimately, 10 articles were included in this review. Notably, this review did not conduct risk of bias assessment on included studies, consistent with the scoping review methodology.

Results

This review identified ten key articles published in the past decade that explored the use of mobile education applications among patients with type 2 diabetes mellitus. The selected studies utilized various research designs, including randomized controlled trials, qualitative studies, surveys, and feasibility trials, involving diverse demographic and geographic populations (1–10).

Key Features of Mobile Education Applications

Most mobile education apps analyzed combined evidence-based education, self-monitoring, automated reminders, individualized feedback, and interactive content. The targeted self-care domains included blood glucose monitoring, dietary management, physical activity, medication adherence, and foot care (1,2,5,7,9,10).

Impact on Self-Care Behaviors

Consistent use of mobile education applications was associated with improved self-care behaviors, such as increased frequency of blood glucose monitoring, reduced carbohydrate consumption, greater medication adherence, increased physical activity, and enhanced foot care (3,6,9).

Clinical Effectiveness (HbA1c Reduction)

Several studies reported significant reductions in HbA1c following the use of mobile education apps, indicating a positive impact on glycemic control (1,4,10).

Facilitators of Successful Implementation

Features most appreciated by users included individualized education, feedback from healthcare professionals, easy access, automated reminders, and integration with professional healthcare services (2,4,7,8).

Implementation Challenges

Implementation challenges included limited digital literacy, financial and access barriers, varying patient motivation, and the potential for increased workload among healthcare providers (4,10). Acceptance of the apps was greatly influenced by nursing support, ease of use, and cultural and patient preference adaptation (2,4,9)

Table 1. Summary of Included Studies

No	Author (Year)	Study Objective	Application/ Intervention	Study Design	Self-Care Domain Measured	Key Findings	Nursing Implications
1	Torbjørnsen et al., (2018)	Relationship between diabetes app acceptability and self-management skills in T2DM patients	FTA diabetes diary app	3-arm RCT,1 year	Glucose monitoring, activity, medication	Skill and technique acquisition correlated with app benefits.	Requires app guidance and digital skills education by nurses.
2	Lee et al., (2019)	Perceptions and experiences of using a digital diabetes diary app in T2DM self-management	Digital diabetes diary app	Qualitative (interviews)	Glucose monitoring, diet, activity	Acceptability influenced by healthcare provider support and app utility, although	Nurses should monitor digital distress and provide digital support.

						digital distress may arise.	
3	Leseure et al., (2024)	Development of DiaFriend, a culturally sensitive app for Portuguese-American T2DM	DiaFriend (education + tracking)	Developmental study	Glucose monitoring, culturally adapted diet, activity, medication	Culturally tailored app supports dietary and self-care behavior changes.	Culturally relevant education can improve diabetes education effectiveness.
4	Gimbel et al., (2020)	Trial of mHealth Care Environment (MHCE) for improving self-management in US military T2DM	MHCE platform + digital education	Single-blind RCT, 12 months	Medication, glucose monitoring, diet, exercise	Increased patient activation and self-care, especially in less active patients.	Digital collaboration requires motivational interventions; nurses play a key role.
5	Chen & Wu, (2023)	Effectiveness of digital foot self-management for self-efficacy and HbA1c in elderly T2DM	Digital foot care program	Single-blind RCT, 3 months	Foot care	Significant improvement in foot care self-efficacy and behavior, reduced HbA1c.	Interactive digital education is effective for foot complication prevention.
6	Gerber et al., (2023)	Effectiveness of telehealth + SMS + health coach for minority	Telehealth, SMS, health coach	2-arm RCT, 24 months	Glucose monitoring, medication, support, diet, activity	Significant HbA1c reduction in intervent	Interprofessional collaboration and mHealth are effective for

		T2DM in the US				ion group.	minority groups.
7	Kebede & Pischke, (2019)	Impact of popular diabetes apps on self-care behavior in digital communities	mySugr, Dexcom, etc. (education & tracking)	Cross-sectional survey	Glucose monitoring, diet, activity, medication	Higher self-care scores among app users.	Educational apps can be recommended to support patient self-care.
8	Guo et al., (2023)	Development of mHealth DM app with tracking, education, patient-provider communication, EHR integration	Smartphone app (tracking, education, messaging, communication)	Developmental study	Glucose monitoring, diet, activity, medication, patient-provider communication, education	Integrated app facilitates education, tracking, and communication.	App design should be inclusive (low literacy), integrated with clinical services.
9	Turchioe et al., (2019)	Exploration of app features that increase engagement in self-monitoring among low-income Latino T2DM	Mockup mobile app (education, feedback, social, goal setting)	Qualitative (focus groups)	Glucose monitoring, diet, education, goal setting	Motivational, social support, and feedback features are preferred; education is key for engagement.	Nurses need to adapt app features to patient needs and motivation.
10	Pichayapinyo et al., (2019)	Feasibility of IVR education + nurse coaching in T2DM	IVR education + nurse coaching	Pre-post trial, 12 weeks	Medication, diet, activity, foot care, adherence, self-efficacy	Improvement in HbA1c, adherence, diet, activity, foot	Nurse coaching via mHealth (IVR) is effective for self-care and

	in Thailand	care, and self-efficacy.	diabetes outcomes.

Discussion

The findings of this review comprehensively demonstrate that mobile education applications significantly contribute to improved self-care among individuals with type 2 diabetes mellitus. Key features such as evidence-based education, self-monitoring, automated reminders, and real-time feedbackare proven to enhance self-care behaviors, including blood glucose monitoring, dietary regulation, physical activity, medication adherence, and foot care (He et al., 2022; Torbjørnsen et al., 2018; LeSeure et al., 2024; Gimbel et al., 2020; Chen & Wu, 2023). Furthermore, several studies documented significant reductions in HbA1c, particularly among patients actively using the apps with nursing or educator support (Torbjørnsen et al., 2018; Gimbel et al., 2020; Pichayapinyo et al., 2019).

Mobile education applications operate through several main mechanisms. First, they enhance health literacy and patient self-efficacy by providing accessible and relevant information (LeSeure et al., 2024; Chen & Wu, 2023; Kebede & Pischke, 2019). Second, app-facilitated self-monitoring encourages patient responsibility for health behaviors and enables early detection of problems or complications. Third, reminders and personalized feedback support the formation of healthy habits and adherence to treatment regimens (Chen & Wu, 2023; Pichayapinyo et al., 2019). Interactive features such as personalized feedback, coaching, goal-setting, and two-way communication with healthcare providers are key success factors (Torbjørnsen et al., 2019; LeSeure et al., 2024; Kebede & Pischke, 2019). Culturally tailored or locally relevant apps are more accepted and effective, consistent with global meta-analyses highlighting the importance of individualized approaches (Khairat & Garcia, 2014; Turchioe et al., 2019).

Nursing professionals play a critical role not only as educators but also as technology facilitators, motivators, and credible feedback sources (Torbjørnsen et al., 2019; Gerber et al., 2023; Pichayapinyo et al., 2019). Studies involving nurse coaching or telehealth showed more consistent improvements in self-care compared to apps that were solely self-directed.

Several challenges hinder the implementation of mobile education apps, including heterogeneity in study designs, intervention durations, app features, and participant characteristics, limiting the generalizability of results. Additionally, low digital literacy, limited technology access, and increased provider workload remain significant barriers (Gimbel et al., 2020; Khairat & Garcia, 2014; Pichayapinyo et al., 2019). Some studies reported decreased patient engagement over time, emphasizing the need for adaptive and interactive features to sustain long-term engagement. Moreover, the integration of app-generated data into electronic medical records and formal

healthcare workflows requires further exploration.

Mobile education applications can serve as strategic tools in patient education, self-care monitoring, and early problem detection, especially in community and primary care settings. Addressing digital literacy barriers through collaboration between nurses and IT professionals is highly recommended during both app development and implementation phases. Nurses should be empowered through digital literacy training and culturally informed educational content development to act as agents of change in the digital health era (Kebede & Pischke, 2019; Turchioe et al., 2019). Future app development should emphasize personalized design, integration with formal healthcare services, and interactive features to sustain patient engagement. Future research should also explore the long-term effectiveness of apps, cost-effectiveness analyses, and optimal integration within nursing workflows and healthcare systems.

The findings of this review align with meta-analyses Hou et al., (2018) and systematic reviews Beratarrechea et al., (2018) however that demonstrate the significant impact of mobile applications on HbA1c reduction and improved self-care behaviors in T2DM patients across both developed and developing countries. However, this review specifically highlights the role of nurses as facilitators of technology integration and the importance of culturally adapted app content areas that are often under-discussed. Moreover, compared to prior systematic reviews Maiga et al. (2021) and meta-analyses Birhanu et al., (2024), this review adds insights into strategies for maintaining long-term patient engagement and overcoming implementation barriers in communities with low digital literacy, a gap frequently underexplored in global literature.

Major limitations of this review include the substantial variability in intervention design and duration, app features, and study population characteristics, necessitating cautious interpretation of results. Additionally, most studies reviewed had relatively short intervention periods and did not comprehensively evaluate long-term effects. This review also relied heavily on the quality and transparency of available studies, with potential publication bias. Not all studies detailed patient engagement rates or the integration process into formal healthcare systems, highlighting knowledge gaps for future research.

Conclusion

Mobile education applications have been shown to significantly improve self-care practices among patients with type 2 diabetes mellitus and have substantial potential for integration into professional nursing practice. However, implementation challenges including digital literacy, long-term engagement, and integration into healthcare systems require particular attention in future research and practice. Future research and practice should also prioritize developing user-friendly, culturally relevant apps, fostering interdisciplinary collaboration, and incorporating continuous professional

training for healthcare providers to optimize app utilization.

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