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Review article

The effects of mobile phone-assisted health education programs on patients with type 2 diabetes mellitus: a systematic review

Emilia Erningwati Akoit [1], Ferry Efendi [1,4] *, Yulis Setiya Dewi [1], Santo Imanuel Tonapa [2], Apryadno Jose Al Freadman Koa [3]

[1] *Universitas Airlangga, Faculty of Nursing, Surabaya, Indonesia*
[2] *Kaohsiung Medical University, College of Nursing, Kaohsiung, Taiwan*
[3] *National Cheng Kung University Tainan, Department of Nursing, Tainan, Taiwan*
[4] *Research Centre of Advancing Community Healthcare, Surabaya, Indonesia*

Abstract
Background: Diabetes mellitus (DM) is one of the most prevalent metabolic disorders, with type 2 DM being the most common form. It ranks as the sixth-leading cause of death worldwide, yet medication adherence and self-care remain low. Given that knowledge significantly influences these outcomes, this paper aims to evaluate the effect of mobile phone-assisted health education programs on patients with type 2 DM.
Methods: A comprehensive literature search was conducted using databases such as Scopus, Web of Science, PubMed, and EBSCOhost, employing keywords relevant to the research topic. The research question was structured using the PICOS framework: (1) Population: patients with type 2 diabetes mellitus; (2) Intervention: health education via mobile phone; (3) Comparison: conventional health education; (4) Outcome: diabetes self-management, glycemic control, and medication adherence; (5) Study design: randomized controlled trials.
Results: The search identified approximately 678 articles discussing health education interventions using mobile phones. After a thorough screening process, 10 articles met the inclusion criteria. The findings suggest that mobile phone-based education interventions can enhance adherence to diabetes self-management, improve glycemic control, and positively impact clinical parameters such as lipid levels, body mass index, blood pressure, and medication adherence.
Conclusion: Health education interventions delivered by healthcare professionals through mobile phones can significantly improve self-care management and prevent complications in patients with type 2 diabetes who maintain controlled blood glucose levels.

Keywords: Adherence; Health education; Mobile phone; Outcome; Type 2 diabetes mellitus

Introduction

Diabetes mellitus (DM) is a common chronic metabolic disease that poses a significant threat to public health (Ong et al., 2023). DM is characterized by hyperglycemia resulting from disruptions in insulin secretion, insulin action including insulin resistance, or both (ADA, 2020). The prevalence of DM, particularly type 2, has increased steadily over the last three decades due to lifestyle changes and is estimated to affect 415 million people (Jiang et al., 2021). Improper management of DM can lead to serious complications, with cardiovascular diseases, including hypertension and heart disease, being among the most common outcomes (Lumu et al., 2021). Other complications include stroke, kidney failure, blindness, and nerve damage (neuropathy); all of which can reduce the life expectancy of individuals with diabetes (Degefa et al., 2020).

Non-compliance with diabetes treatment and care programs is a significant risk factor for complications. Failure to achieve adequate glycemic control can lead to various complications for DM patients (Berkoh et al., 2022). This issue often arises when patients do not receive proper information about diabetes treatment. Health education is crucial for informing and encouraging DM patients to practice diabetes self-management (Rahmatullah et al., 2021). With proper compliance, type 2 DM patients can routinely and regularly engage in self-management, leading to effective blood sugar control.

Diabetes is the sixth leading cause of death worldwide, yet compliance with self-care and treatment remains low (Ahrary et al., 2020). Several factors influence this low compliance, including minimal education, lack of self-confidence, cultural influences, poor communication, and limited access to health services (Goff et al., 2021). Compliance with DM treatment has been reported to range from 30% to 89.7% (Trevisan et

* **Corresponding author:** Ferry Efendi, Universitas Airlangga, Faculty of Nursing, Jl. Mulyorejo Kampus C Unair Surabaya, Indonesia, 60285; e-mail: ferry-e@fkp.unair.ac.id
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al., 2020). This low compliance results in uncontrolled blood sugar levels, leading to various complications. To address this issue, health education is essential for increasing knowledge, understanding, and compliance in DM treatment.

Health education involves planned efforts to provide health information to individuals, families, and communities. When delivered appropriately and effectively, it can enhance patient understanding of DM management and help prevent complications (Chawla et al., 2019). Research indicates that health education positively influences the behavior of type 2 diabetes patients in managing their condition (Moyeda-Carabaza et al., 2020). Nurses often serve as educators, and studies have demonstrated that education provided by nurses can increase knowledge, shape attitudes, and promote self-care behaviors in diabetes patients (Sousa et al., 2019). Furthermore, effective health education can boost patients' self-confidence, foster new thought patterns, and enhance adherence to self-care regimens (Moyeda-Carabaza et al., 2020).

Health professionals who provide education to diabetes patients should utilize diverse and innovative methods to improve understanding and motivate patients to participate in self-care activities. In today's digital age, health education can capitalize on various easily accessible applications, including those on mobile phones. Research suggests that using smartphone applications can improve glycemic control and reduce body weight in Asian adults (Lim et al., 2021). Other studies also demonstrate that mobile health technology positively impacts self-efficacy and physical exercise in patients with type 2 DM (Young et al., 2020). Given their essential and user-friendly nature, mobile phones play a crucial role in accessing a wide range of information, including guidance on diabetes mellitus care.

Previous literature reviews have highlighted the benefits of using cell phones for health education in managing chronic diseases. This assertion is supported by the fact that tele-coaching education (utilizing landlines, mobiles, or smartphones) doesn't require technical knowledge or internet connections from patients (Imanuel Tonapa et al., 2021). However, there's a lack of systematic reviews specifically addressing the effectiveness of mobile phone usage, including SMS, combined SMS and mobile phone calls, and mobile applications for patients with type 2 diabetes mellitus, based on randomized controlled trials. Furthermore, this systematic review was conducted considering various factors, such as the rising prevalence of type 2 DM, the necessity for efforts to prevent DM complications, and the proven benefits of mobile phone usage in supporting patients with their care management. Mobile phones offer advantages such as interactivity, accessibility, and independent usability, unlike websites which may be somewhat challenging to access. Moreover, while several previous studies have demonstrated the effectiveness of mobile phones, others have reported ineffective results. The aim of this systematic review was to determine the impact of a mobile phone-based health education program for patients with type 2 diabetes mellitus.

Materials and methods

Research questions

The central question addressed in this literature review is: "What is the impact of providing education using mobile phones on patients with type 2 Diabetes Mellitus?"

Literature search strategy

We conducted a comprehensive search using online bibliographic databases (Scopus, Web of Science, PubMed, and EBSCOhost) with keywords equivalent to ("mobile phone" OR "cellular phone" OR "smartphone") AND ("type 2 Diabetes" OR "Diabetes Mellitus type 2" OR "T2DM") AND ("health education" OR "health teaching" OR "patient education" OR "health intervention") AND "randomized controlled trial". Peer-reviewed articles published in English were included, with the search extending until December 2022.

Inclusion and exclusion criteria in this study

The inclusion criteria, guided by PICOS, were as follows: (1) Population: patients with type 2 diabetes mellitus; (2) Interventions: health education using a mobile phone aimed at improving the health of type 2 diabetes mellitus patients; (3) Comparison: ordinary health education; (4) Outcome: diabetes self-management, glycemic control, and medication adherence; (5) Study design: randomized controlled trial. Literature reviews or studies solely based on surveys or descriptive research were excluded.

Data evaluation

Two authors independently assessed the methodological quality of the research utilizing the Joanna Briggs Institute instrument for randomized controlled trials (Barker et al., 2023). This instrument comprises 13 question items categorized into five subscales: assessment bias regarding selection and allocation, intervention/exposure administration, outcome measurement, participant retention, and strength. Each item was rated as "yes", "no", "clear", or "not applicable" based on information from the relevant article. Studies were classified as high, medium, or low quality based on scores of 75% or higher, 50% to 74%, and below 50%, respectively.

Data analysis

The data analysis involved examining research objectives, participant characteristics, intervention details, measuring tools, and outcomes. Results were summarized in a matrix, and outcomes were evaluated against predetermined inclusion criteria. Statistical tests before and after the intervention were considered. The authors discussed and validated conclusions, resolving any discrepancies to ensure consensus. A summary table (Table 1) containing pertinent study data is provided.

Table 1. Study characteristics

Author (year), country	Study design	Population, sample size	Health education methods in the intervention group	Health education methods in the control group	Measures and instruments	Outcome
Asante et al., 2020, Ghana	Randomized controlled trial	60 adults with type 2 DM EG (*n* = 30) CG (*n* = 30)	12 weeks Mobile phone call and usual care in Diabetes Center	Usual care in Diabetes Center	A self-management adherence questionnaire HbA1c	Improved diabetes self management (foot care) and changes in post-intervention self-management scores (exercise, diet, and foot care) in the intervention group compared to the control group. Lower HbA1c levels in the intervention group.
Azelton et al., 2021, United States	Randomized controlled trial	30 patients with type 2 diabetes T-SMS (*n* = 16) CG (*n* = 14)	12-week telephone and Short Messages Service (SMS)-based digital health training program	Regular health education	HbA1c and fasting blood glucose	HBA1c, weight and blood pressure levels were lower in the intervention group than the control group.
Güner and Coşansu, 2020, Turkey	Randomized controlled trial	101 patients with type 2 DM SGE-SMS (*n* = 50) CG (*n* = 51)	Structured group education and short message service (SMS) reminders	Regular education in family health care	The Diabetes Self-Care Scale (DSCS) The World Health Organization (WHO) Goodness Scale Sphygmomanometer and stethoscope Laboratory tests	HbA1c, fasting blood glucose, lipid levels (except triglycerides), blood pressure and body mass index were lower in the intervention group than the control group after 6 months of intervention.
Islam et al., 2021, Bangladesh	Randomized controlled trial	200 type 2 DM patients TMI (*n* = 106) CG (*n* = 94)	Text messaging intervention	Regular health education and care	Dietary habits: WHO STEPS and Indian Migration Study Food Frequency Questionnaire	Text messaging programme in patients with type 2 diabetes did not significantly improve dietary behavior. However, the consumption of sugar in tea per week was lower in the intervention group than in the control group (p-value < 0.05).
Jayasree and Stalin, 2019, India	Randomized controlled trial	49 type 2 DM patients MPC (*n* = 25) CG (*n* = 24)	Mobile phone calls	Standardized health education	Testing FBG level The Morisky 4 Item Self Report MEASURE	Improves glycemic control. Improves medication adherence.
Sun et al., 2019, China	Randomized controlled trial	91 type 2 DM patients MP-TA (*n* = 44) CG (*n* = 47)	Mobile phone–based telemedicine application	Regular health education	Medical history Physical examination Laboratory test (HbA1c)	Decreased post-prandial plasma glucose and glycated hemoglobin (HbA1c) levels.
Wang et al., 2020, China	Randomized controlled trial	171 type 2 DM patients SMS-SE (*n* = 85) CG (*n* = 86)	Short messages service (SMS) and SMS evaluation	Short messages service (SMS) regular	Diabetes Questionnaire Fasting plasma glucose (FPG) Postprandial glucose (PPG) Glycosylated hemoglobin (HbA1c) Lipid levels	Decrease in fasting blood glucose levels. Decreased post-prandial blood glucose levels. Improved self-management including weight control, vegetable consumption, fruit consumption, and physical activity.
Wungrath and Autorn, 2021, Thailand	Randomized controlled trial	60 type 2 DM patients LA-TBC (*n* = 30) CG (*n* = 30)	LINE application and telephone-based counseling	Standardized routine health education	Diabetes Medication Adherence Knowledge (DMAK) Diabetes Medication Adherence Behavior (DMAB)	Improved medical adherence knowledge and treatment adherence behaviour.

Table 1. ***(continued)***

Author (year), country	Study design	Population, sample size	Health education methods in the intervention group	Health education methods in the control group	Measures and instruments	Outcome
Yasmin et al., 2020, Bangladesh	Randomized controlled trial	273 type 2 DM patients MPVC (*n* = 142) CG (*n* = 131)	Mobile phone voice call: a call every ten days and a reminder call 1 or 2 days before scheduled hospital visit	Standardized health education	A structured questionnaire	Improved adherence to diet, physical exercise, and controlled blood glucose levels.
Yu et al., 2019, China	Randomized controlled trial	185 type 2 DM patients) MP-TDCA (*n* = 93) CG (*n* = 92)	Mobile phone application: The Diabetes-Carer application	Regular health education	Diabetes management self-efficacy questionnaire Body mass index HbA1c Fasting plasma glucose	HbA1c levels were lower in the intervention group than the control group after 24 weeks of intervention.

Note: CG – Control Group, EG – Experimental Group, FBG – Fasting Blood Glucose, MPC – Mobile Phonce Calls, MPVC – Mobile Phone Voice Call, LA-TBC – Line Application-Telephone Based Counseling, MP-TA – Mobile Phone-Telemedicine Application, MP-TDCA – Mobile Phone-The Diabetes Care Application, SMS-SE – Short Message Service-Short Message Service Evaluation, SGE-SMS – Structured Group Education-Short Message Servise, TMI – Text Message Information, T-SMS – Telephone-Short Message Servise.

Results

Identification of studies and study selection

Initially, 678 records were identified across the four databases. After evaluating the titles and abstracts of the remaining 562 records, 430 were excluded for not meeting the PICOS criteria. This left 132 records to be retrieved; however, 54 of these could not be retrieved. Consequently, 78 studies underwent full-text screening. Of these, 68 studies were excluded: nine did not match the study design, and six studies employed qualitative approach. Ultimately, 10 studies were included in the synthesis (Diagram 1).

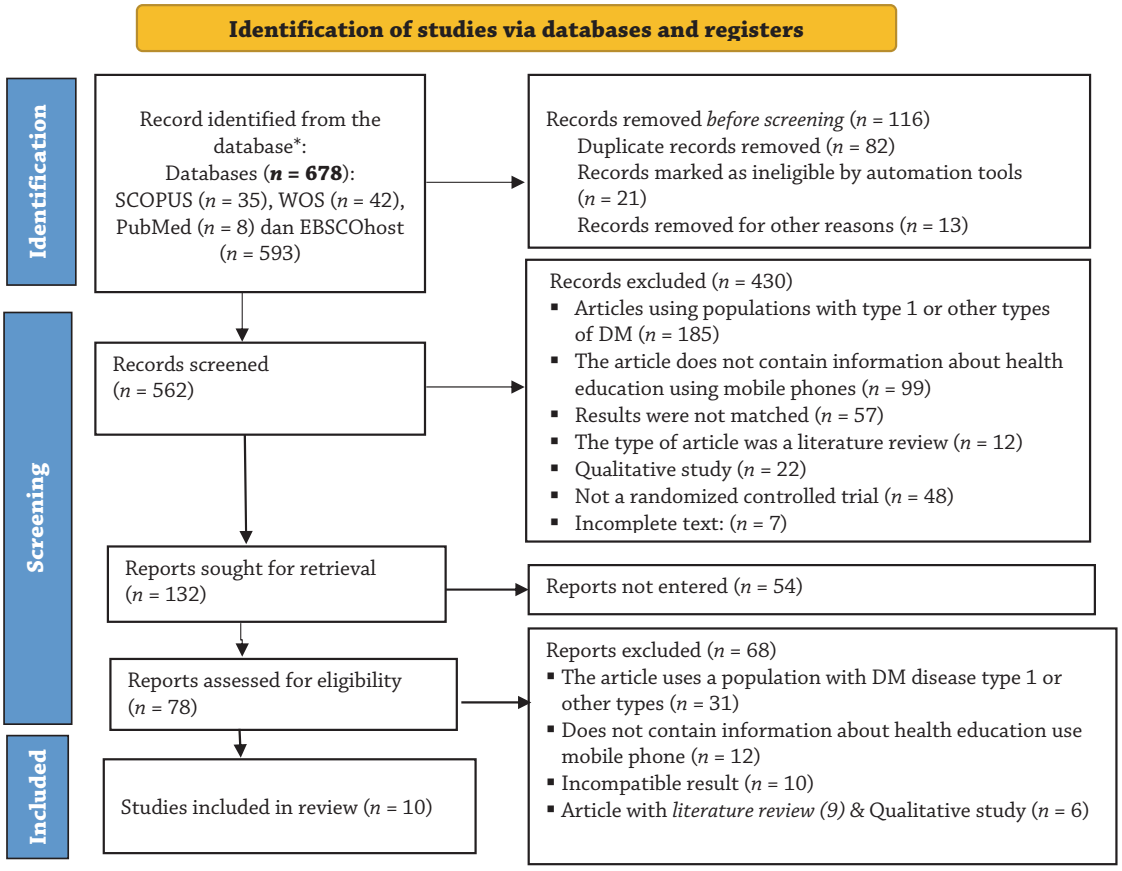

Diagram 1. Flow chart of study selection

Study and subject characteristics

Table 2 illustrates the characteristics of study participants from the ten included studies. Eight studies were conducted on the Asian continent: China (Sun et al., 2019, Wang et al., 2020; Yu et al., 2019); Bangladesh (Islam et al., 2021; Yasmin et al., 2020); Turkey (Güner and Coşansu, 2020); Thailand (Wungrath and Autorn, 2021); South India (Jayasree and Stalin, 2019). One study was conducted on the United States (Azelton et al., 2021) and one on Ghana (Asante et al., 2020).

Overall, the studies included 1,220 participants with type 2 diabetes mellitus, aged between 18 and 80 years. The participants were divided into two groups: 621 in the intervention group and 599 in the control group. Regarding research settings, seven studies were conducted in hospital settings (Asante et al., 2020; Islam et al., 2021; Sun et al., 2019; Wang et al., 2020; Wungrath and Autorn, 2021; Yasmin et al., 2020; Yu et al., 2019), while three studies were conducted in primary health care settings (Azelton et al., 2021; Güner and Coşansu, 2020; Jayasree and Stalin, 2019). All studies used a randomized controlled trial (RCT) design.

The participants included 481 men (39.4%) and 739 women (60.6%). The average age of the participants ranged from 18 years (Azelton et al., 2021; Güner and Coşansu, 2020) to 80 years (Wang et al., 2020).

Study design

This study was a systematic review that synthesizes relevant research articles to discuss health education methods using mobile phone applications and their effects on patients with type 2 diabetes. The review followed the PRISMA guidelines for systematic literature reviews (Page et al., 2021). Note that no meta-analysis was conducted on the quantitative data.

Methodological appraisal of included studies

The quality appraisal of the ten randomized controlled trial (RCT) studies revealed that all were of high quality (Table 2). However, there were some methodological concerns. One study did not conceal the allocation to the treatment group (Yu et al., 2019). Four studies indicated that participants were aware of their treatment (Azelton et al., 2021; Sun et al., 2019; Wungrath and Autorn, 2021; Yu et al., 2019). Eight studies showed that those providing care were aware of the treatment (Azelton et al., 2021; Güner and Coşansu, 2020; Islam et al., 2021; Jayasree and Stalin, 2019; Sun et al., 2019; Wang et al., 2020; Wungrath and Autorn, 2021; Yu et al., 2019). Additionally, two studies indicated that the assessors knew about the treatment (Islam et al., 2021; Wang et al., 2020). Furthermore, four studies did not provide complete follow-up data and did not explain or analyze differences between groups in terms of follow-up (Jayasree and Stalin, 2019; Sun et al., 2019; Wang et al., 2020; Yasmin et al., 2020).

Measurements

Diabetes self-management measures

Three articles investigated the impact of mobile phone-assisted health education programs on diabetes self-management (Asante et al., 2020; Wang et al., 2020; Yasmin et al., 2020). The tools used to assess diabetes self-management included a questionnaire on self-management adherence (Asante et al., 2020), a structured questionnaire (Yasmin et al., 2020), and the Diabetes Questionnaire (Wang et al., 2020).

Glycemic control measures

Seven studies examined HbA1c levels, fasting blood sugar levels, and clinical parameters such as lipid levels and blood pressure (Asante et al., 2020; Azelton et al., 2021; Güner and Coşansu, 2020; Jayasree and Stalin, 2019; Sun et al., 2019; Wang et al., 2020; Yu et al., 2019). The instruments used to study glycemic control included HbA1c levels and fasting blood sugar levels (Asante et al., 2020; Azelton et al., 2021; Güner and Coşansu, 2020; Jayasree and Stalin, 2019; Sun et al., 2019; Wang et al., 2020 ; Yu et al., 2019). Additionally, clinical parameters such as lipid levels and blood pressure were measured, with blood pressure assessed using a sphygmomanometer (Güner and Coşansu, 2020; Wang et al., 2020).

Table 2. Study quality assessment for RCT

First authors	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	%
Asante et al., 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.0
Azelton et al., 2021	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	84.6
Güner and Coşansu, 2020	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	92.3
Islam et al., 2021	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	84.6
Jayasree and Stalin, 2019	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	84.6
Sun et al., 2019	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	76.9
Wang et al., 2020	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	76.9
Wungrath and Autorn, 2021	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	84.6
Yasmin et al., 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	92.3
Yu et al., 2019	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	76.9

Question description:

(Q1) Was the randomization process carried out correctly when dividing participants into treatment groups? (Q2) Is allocation to treatment groups confidential? (Q3) Were the treatment groups similar from the start? (Q4) Are participants unaware of the treatment they are taking? (Q5) Is the individual who is administering the treatment unaware of the treatment? (Q6) Are the treatment groups treated equally without any vested interest in the intervention? (Q7) Do outcome assessors need to study the treatment administered? (Q8) Are the outcomes measured in the same way for the treatment groups? (Q9) Are the results measured accurately? (Q10) Has follow-up been completed, and if not, have differences between groups in terms of follow-up been described and analyzed accurately? (Q11) Are participants analyzed in randomly divided groups? (Q12) Is the statistical analysis used appropriate? (Q13) Was the trial design appropriate, and were any deviations from standard RCT design (individual randomization, parallel groups) taken into account in the conducting and analysis of the trial?

Medication adherence measures
Medication adherence was investigated in two studies (Jayasree and Stalin, 2019; Wungrath and Autorn, 2021). The instruments used to evaluate treatment efficacy included the Morisky 4-Item Self-Report Measure of Medication-Taking Behavior (MMAS-4) (Jayasree and Stalin, 2019), Diabetes Medication Adherence Knowledge (DMAK), and Diabetes Medication Adherence Behavior (DMAB) (Wungrath and Autorn, 2021).

Effects of interventions on outcome measures

Effect of mobile phone-assisted health education programs on adherence to diabetes self-management
Mobile phone applications have a positive impact on individuals with type 2 diabetes mellitus (DM). Research indicates that delivering health education through mobile phones, specifically mobile phone calls, can positively influence self-management in DM patients, focusing on areas such as diet, exercise (physical activity), and foot care (Asante et al., 2020). This study found that health education delivered through a one-day workshop refreshed participants' knowledge of diabetes mellitus self-management. Nurses conducted phone calls to provide educational content on diabetes self-management. An evaluation conducted at the session's end assessed the program's impact, provided by registered nurse specialists. Other studies also suggest that health education through interactive phone calls can enhance adherence to diet and physical exercise and contribute to blood glucose level control (Yasmin et al., 2020). In this study, interactive voice calls were conducted every 10 days, excluding Fridays and national holidays, over a year. Each call lasted 10 minutes, supporting participants in following recommended diabetes self-management and lifestyle modifications.

Health professionals, particularly nurses, play a crucial role in providing health education that improves the self-care skills of DM patients, focusing on regulating diet, exercise, medication administration, foot care, and blood sugar level monitoring (Lie et al., 2019). Health education interventions using short message service (SMS) also positively affect patients with type 2 diabetes. One study demonstrates that text messaging interventions can enhance self-management (Wang et al., 2020). Participants received 42 messages covering health awareness, diet management, physical exercise, lifestyle, and weight control, with each message focusing on one topic consisting of approximately 70 words. Additionally, participants received evaluation messages. However, the results of another study suggest that health education interventions using text messages did not significantly improve dietary behavior in patients with type 2 diabetes (Islam et al., 2021). Participants received daily text messages for 6 months, covering information about medication, diabetes, its complications, and diabetes self-management. An evaluation conducted post-intervention assessed the impact of text messaging on dietary behavior.

Effect of mobile phone-assisted health education programs on glycemic control and clinical parameters
The use of mobile phones has shown promising results in improving glycemic control and various clinical parameters in patients with type 2 diabetes mellitus (DM), including blood pressure, lipid levels, body weight, and body mass index (BMI). For instance, a study reported that a 12-week phone call and digital health training program based on a short message service (SMS) reduced HbA1c levels, body weight, and blood pressure (Azelton et al., 2021). Participants received weekly phone calls for 10 to 15 minutes and a daily SMS, with weekly calls including components such as assessing participants' stage of change, discussing weekly fasting and target blood glucose level results, and setting goals for the next stage of intervention. Trained health coaches conducted this intervention, focusing on motivational techniques and building participants' self-confidence. These findings are supported by other studies, indicating that telephone calls and SMS can reduce HbA1c levels, lipid levels, blood pressure, and BMI (Güner and Coşansu, 2020). In another study, face-to-face education was provided to small groups of participants, covering general information about diabetes, diabetes complications, and physical activity. Participants received a reminder SMS immediately after the education sessions, followed by weekly evaluations for 6 months to assess compliance.

Similarly, a literature review highlighted that health education through mobile phone calls improved glycemic control, with interventions involving monitoring fasting blood sugar levels and regular phone calls over a 2-month period (Jayasree and Stalin, 2019). Additionally, a study using mobile phone-based telemedicine applications demonstrated reductions in post-prandial plasma glucose levels and HbA1c levels (Sun et al., 2019). The intervention included training participants on using M-Health independently, with the medical team managing patient data and providing reminders for blood glucose monitoring. Nutrition consultations were conducted between participants and nutritionists through the application. Additionally, one study on health education using mobile phone applications reported positive outcomes. The Diabetes-Carer application demonstrated a decrease in HbA1c levels after 24 weeks of intervention (Yu et al., 2019). This educational program, accessible to both patients and doctors, encompasses four crucial components: diabetes education, diabetes self-management, patient community interaction, and communication between clinicians and patients. Clinicians can utilize the professional version of the application, available 8 hours a day, 5 days a week, to address patient queries and provide recommendations based on the data entered by patients. The system automatically assesses blood sugar level results and alerts patients to report any increases to their doctor.

Effect of mobile phone-assisted health education programs on medication adherence
Health education delivered by professionals is expected to positively influence self-care among patients with type 2 diabetes mellitus (DM). Research suggests that utilizing mobile phone calls and short message services (SMS) for health education can improve medication adherence and fruit intake (Jayasree and Stalin, 2019). During these sessions, patients receive regular reminders for medication adherence, and their adherence is evaluated after the two-month intervention period. Moreover, the use of LINE applications and telephone-based counseling has been found to enhance treatment compliance behavior (Wungrath and Autorn, 2021). In this study, educational programs consisted of eight video clips, each lasting 5–7 minutes, covering information on the five principles of medication. These video clips were distributed via the LINE app from week two to week seven, with one sent each week on Mondays. Additionally, counseling sessions lasting 5–10 minutes by phone were conducted in weeks 3, 5, and 7 to address potential misuse of prescription medications proactively.

Discussion

This study aimed to assess the impact of a mobile phone-based health education program on individuals with type 2 diabetes mellitus. Findings from multiple studies indicate that such programs can enhance self-management, control blood sugar levels, and promote treatment adherence in patients with type 2 diabetes. Additionally, these mobile phone-assisted health education programs employed diverse modalities, including SMS, a combination of SMS with phone calls, and the use of mobile phone applications.

Effect of a mobile phone-assisted health education program on adherence to diabetes self-management

This review identified a significant impact of delivering health education through mobile phones on the self-care and management of type 2 diabetes. One study found that mobile phone calls were associated with improved self-care management, including foot care, exercise, and diet among diabetic patients. Health professionals conducted these mobile phone-based education sessions to assess and enhance the self-care activities of diabetic patients, aiming to improve patient compliance and discipline in self-management (Asante et al., 2020). Similarly, other research indicates that health education delivered through voice calls can enhance adherence to diet and physical exercise, aiding in controlling blood glucose levels. This process involves phone calls every 10 days, supplemented by SMS reminders one or two days before scheduled hospital visits (Yasmin et al., 2020). In contrast, another study found that text messages did not enhance dietary behavior in type 2 diabetes patients (Islam et al., 2021). Factors like misconceptions about avoiding fruit sugar may lead to non-compliance with recommended portions (Islam et al., 2021). Therefore, health professionals, especially nurses, should enhance patient understanding, knowledge, behavior, and adherence to the recommended diet by providing explanations. In conclusion, mobile phones interventions have the potential to facilitate adherence of diabetes management in patients with type 2 diabetes mellitus, leading to better-controlled blood glucose levels.

Effect of mobile phone-assisted health education programs on glycemic control and clinical parameters

Study results indicate that mobile phone-assisted health education programs can lead to a reduction in HbA1c levels among patients with type 2 diabetes mellitus (Yasmin et al., 2020). HbA1c levels serve as an indicator of blood glucose control over the past three months. Patients who received phone call interventions exhibited lower HbA1c levels compared to those who received standard health education in healthcare settings. The telephone-based education involved two calls per week for the initial four weeks, followed by one call per week for the subsequent eight weeks, concluding with routine treatment at the Diabetes Center (Asante et al., 2020). These findings are consistent with other studies, which also found that education through mobile phone calls can improve glycemic control in patients with type 2 DM (Jayasree and Stalin, 2019). Additionally, one study demonstrated that health education via mobile phone-based telemedicine applications can effectively lower postprandial plasma glucose levels and HbA1c levels (Sun et al., 2019). Another study found that using telephones and SMS can reduce HbA1c levels, fasting blood glucose, lipid levels, body mass index, and blood pressure after a six-month educational intervention. This approach involved providing educational modules followed by biweekly SMS reminders on Mondays and Thursdays (Güner and Coşansu, 2020). From these studies, it can be concluded that mobile phone-based health education has the potential to maintain normal blood sugar levels in patients with type 2 diabetes mellitus. Nurses should consider using mobile phones as a creative and innovative tool for providing education to DM patients.

Effect of mobile phone-assisted health education programs on medication adherence

One study found that education delivered via cell phone calls can improve medication adherence in individuals with type 2 diabetes mellitus (Jayasree and Stalin, 2019). The utilization of mobile phones for health education positively impacted medication adherence among these patients. This technology-based intervention allows health professionals to effectively fulfill their roles and responsibilities, especially in enhancing patient adherence to disease management and treatment. Providing education is a crucial approach to promoting patient compliance with diabetes care behaviors. Research findings substantiate this assertion, indicating that nurse-provided health education ensures medication compliance, thereby positively contributing to blood sugar control (Trevisan et al., 2020). Another study highlighted that health education delivered through LINE applications and telephone-based counseling can enhance behaviors related to treatment adherence (Wungrath and Autorn, 2021). In this type of education, participants watched video clips and received counseling via telephone. The results suggest that it is important for health workers to provide further explanations and conduct observations regarding patient behavior through home visits. This approach benefits patients by increasing treatment compliance for type 2 DM through the use of mobile phone applications.

Conclusion

Health education significantly enhances patient knowledge, attitudes, and behaviors toward managing diseases like diabetes. In today's digital era, mobile phones serve as a highly effective tool for this purpose. This literature review demonstrates that mobile phone-based health education improves adherence to diabetes self-management, glycemic control, and medication adherence. Such programs aim to foster awareness, willingness, and ability among type 2 diabetes patients to enhance self-care behaviors, thereby achieving better glycemic control and reducing complications. Nurses can leverage mobile phones to innovate and improve the delivery of health education. This study highlights that mobile phones facilitate the ongoing evaluation of patients' diabetes management. Future research should explore the impact of combining multiple electronic media with audiovisual aids and home visits for health education.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authorship contribution statement

EEA was the principal investigator in the study. *FE, YSD* designed the study. *EEA, FE, YSD, SIT* and *AJAFK* performed data collection. *EEA* carried out data analysis. All authors have contributed to, written, revised, and approved the final manuscript.

Ethics approval and consent to participate
An ethical statement was unnecessary as study data were extracted from previously published articles.

Conflict of interest
The authors have no potential conflict of interest to declare with respect to the research, authorship, and/or publication of this work.

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