

SYSTEMATIC REVIEW

The Effect of Foot Self Care and Diabetes Self-management Mobile Application in Preventing Foot Ulcer Recurrence: A Systematic Review Study

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ABSTRACT

Introduction: Recurrence for diabetic foot ulcers is really high. Recurrence of diabetic foot ulcers can be prevent through self-care and self-management of diabetes. As DM patients require constant monitoring by a nurse, foot care behavior and diabetic self-management can be quite tough for nurses. Patients with diabetes mellitus are typically less exposed to training about their condition and have less access to healthcare. **Aim:** This systematic review aims to examine the mobile health applications are good to access information in the health sector, enhance self-management abilities, make it easier for patients to communicate with nurses, and boost patient compliance with the management of diabetes mellitus for prevent recurrence the diabetic foot ulcer. **Design:** Literature search was done using Scopus, Science Direct, PubMed, and Web of Science. Criteria search covered the last five years and focused on the period of vulnerability from 2017 to 2022. This systematic review, a critical evaluation will be done based on the guidelines from The Joanna Briggs Institute (JBI). The first study selection used the PRISMA guidelines. **Data sources:** This systematic review examines 15 journal articles selected from a total of 105 journal articles. **Results:** Using a mobile health app can help people with Diabetes Mellitus Type 2 take better care of their feet and manage their diabetes, which can prevent diabetic foot ulcer recurrence. **Conclusion:** The development of mobile health apps and virtual consultations through telemedicine is a good way to prevent diabetic foot ulcers from recurrence in people with type 2 diabetes mellitus.

Keywords: Diabetic foot ulcer; Self-management; Self-care; Recurrence; Mobile health application.

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INTRODUCTION

Diabetes Mellitus type 2 is rising and has comprehensive consequences, including the emergence of disease complications. Complications of diabetes will continue to develop if the patient keeps an unhealthy lifestyle and has other illness comorbidities. Diabetic foot ulcers are the most prevalent diabetes consequence (1 p. 1). Peripheral neuropathy causes the leg numbness and peripheral vascular disease, which lowers blood supply to tissues it can lead to infection and gangrene, increasing the risk of amputation. Diabetic foot problems leading cause of hospitalization for people with

diabetes and a significant economic burden on families and patients. Diabetic foot ulcers are distinguished by the appearance of infection, ulceration, and damage to the foot tissue. The prevention of diabetic foot ulcers sores gives significant clinical challenge because those with diabetic foot ulcers are more likely to have other diabetes complications and are more probable to have recurrence or recurrence of diabetic ulcers (2 p. 1040).

Prevention of recurrence in diabetic foot ulcers must be done by the individual himself through self-care behaviour, psychosocial self-management to maintain, and risk identification (3 p. 2). The strategy for prevent the recurrence of diabetic foot ulcers use of an Android platform application that includes a behavioral guide to foot care and diabetes mellitus management. The Android

platform has chose for application development because this type of device is the most commonly used. The Android operating system is used to create applications. Co-designed application content results in the selection of application layouts that support the continuous flow of information while providing a user-friendly and interactive layout (4 p.205).

Technological advancements on the Android platform have become an essential component of chronic disease self-care management interventions in recent years. The utilization technology in health interventions can help overcome disobedience factors and encourage individuals with diabetes mellitus to manage their health and prevent foot problems (5 p. 546).

PURPOSE

The purpose of this systematic review is to investigate a number of related facts. In preventing the recurrence of diabetic foot ulcers, foot care behavior independently and Diabetes Self-Management (DSM) based on an android application was used.

METHODOLOGY

Eligibility criteria of inclusion and exclusion

The PICOS framework criteria were used to develop study eligibility criteria (Table.I). The Systematic Review was carried out in accordance with a pre-determined protocol based on The Center for Review and Dissemination guidelines and the Joanna Briggs Institute Guidelines, which are listed in the attachment. When reporting on a systematic review, the PRISMA checklist (form attached) will be used to determine whether studies were discovered and adapted to the objectives of the systematic review.

Tabel I : Criteria PICOS framework for articles study.

Population	Patient with Diabetes Mellitus had a Diabetic Foot Ulcers
Intervention	Effectiveness of diabetic foot self-care and Diabetes Self-Management
Comparator	Patient with no diabetic ulcer
Outcome	Patient diabetic foot ulcer used mobile health to reminder for doing diabetic foot care and Diabetes Self Management
Study type	Original Research
Time	2017-2022
Language	English

Resource

The literature search covered the years 2017 to 2022 in the international context. The literature search was done in February 2022. The data used in this study were secondary data obtained from previous research instead of direct observation. Secondary data sources were obtained in the form of reputable journal articles with a predetermined theme from both national and international journals. Using the search engine, namely scimagojr.com, to see the quartiles and rankings of a journal, it is discovered that the highest journals are Scopus, Science direct, PubMed, and Web of Science. The Scopus, PubMed, and Web of Science databases were used for the literature search in this review, which had high and medium quality criteria (Q1 and Q2).

Selection of study

There are 407 journal articles found and match the keywords Diabetes Self-Management OR Diabetic Foot Care AND Mobile Health AND Diabetic Foot Ulcer based on the search results for journal articles published in four databases using these keywords. The obtained search results are then checked for duplication, which revealed 98 duplicate articles that were removed, as well as the remaining 309 articles. The researcher then conducted a screening based on the title (n=120), abstract (n=93), and full text (n=20), all of which were adjusted to match the theme of the systematic review. Based on the feasibility of the inclusion and exclusion criteria, the assessment yielded up to 15 articles that could be used in a systematic review.

Data extraction

The researcher extracted the data independently and checked to prevent possible errors. The three independent researchers resolved disputes that arose during the data extraction process. The extracted data include the publication year, application development, mobile health use, study language, and study design.

RESULTS

Study characteristic

The PRISMA Flow diagram is shown in Figure 1. Based on a search for literature studies across four databases, a total of 407 journal articles corresponding to these keywords were discovered. The obtained search results are then checked for duplication, which revealed 98 duplicate articles that were removed, as well as the remaining 309 articles. The researcher then conducted a screening based on the title (n=120), abstract (n=93), and full text (n=20), all of which were adjusted to fit the theme of the systematic review. Based on the

No	Author and Date	Study Design	Sample Participant	Clinical Conditions	Application Used	Main Finding
1	(Hassan, 2017)	Quantitative: A randomized controlled trial	225 Participants	Diabetic patient without Diabetic Foot Ulcer	Mobile Phone Text Messaging	Mobile phone text messaging is an economical, feasible, and effective method for educators to improve diabetic self-care, even in a developing country. Statistical testing showed significant gains in knowledge (by score and level) and nearly unanimous compliance with daily foot examination.
2	(Nguyen <i>et al.</i> , 2019)	Quantitative: A randomized controlled trial	58 Participants	Diabetes Mellitus Type 2 patient with previous Diabetic Foot Ulcer	Program Application 3STEPFUN	The study's findings provide evidence of 3STEPFUN on improving foot self-care behaviour and preventing minor foot problems. Further study with formal RCT design and longer follow-up time to examine the effects on decreasing foot ulcer incidence is recommended.
3	(Ming <i>et al.</i> , 2019)	Quantitative: A randomized controlled trial	300 Participants	Diabetes Mellitus type 1 and type 2 patient without Diabetic Foot Ulcer	Telemedicine sensor equipped insoles combined with photo documentation	The telemedicine structure implemented from study comprises a remote server as core controller in the study center and the smartphone application (SPDFA) as data collecting terminal. With the SPDFA, patients can immediately comprehend the initial analysis results of their measurements. Sensor data will be transmitted from the SPDFA to the study server, together with the initial evaluations, the requested photo series (at alarm levels 3 and 4). This approach will evaluate the effectiveness of activity reduction in order to delay or even avoid the development of DFU.
4	(Moradi <i>et al.</i> , 2019)	Quantitative Quasi Experimental	160 Participant	Diabetes Mellitus type 2 patient without Diabetic Foot Ulcer	Mobile Short Message Service (SMS)	The findings indicate that educational intervention based on short message service (SMS), resulting in improved foot care knowledge, foot care practices and metabolic control in patients with diabetes type 2.
5	(Dincer and Bahçecik, 2021)	Quantitative: A randomized controlled trial	130 Participants	Diabetes Mellitus type 2 patient without Diabetic Foot Ulcer	Mobile Diabetic Foot Care Education (M-DFCE)	The finding there was no difference between the groups at initial evaluation, individuals in the experimental group who received animation-supported M-DFCE had significantly higher knowledge, self-efficacy and foot care behaviour levels than the control group. The animation-supported mobile application developed for foot care education was effective in increasing the individuals' knowledge, self-efficacy and behaviour with respect to foot care.

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No	Author and Date	Study Design	Sample Participant	Clinical Conditions	Application Used	Main Finding
6	(Ridad <i>et al.</i> , 2020)	Quantitative: Pre-experimental Study	30 Participants	Diabetes Mellitus regardless of type patient without Diabetic Foot Ulcer	Project DiabEHT	The finding after 6 weeks of project implementation, the participants have showed significant improvement on the following diabetes self-care activities. Indeed, the project had improved the diabetic participants' self-care management and compliance, and glycaemic control. Nurses can take advantage of this innovation and consider integration into patient care. However, further studies are recommended to ensure sustainable incorporation and application into various settings.
7	(Lin and Lee, 2021)	Quantitative: Prospective Cohort Study	163 Participants	Diabetes Mellitus type 2 patient with Diabetic Foot Ulcer (>3 month)	Mobile Health-Based Thermometer for Monitoring Wound Healing	The mHealth-based thermometer was feasible and useful for foot temperature monitoring, which may provide health care professionals with a new endpoint for endovascular therapy. Foot temperature increases ≥ 2 °C after endovascular therapy were associated with faster wound healing in patients with chronic foot ulcer. Further studies are needed, however, to confirm these findings.
8	(Ploderer <i>et al.</i> , 2018)	Quantitative Cross-sectional study	11 Participant	Diabetes Mellitus type 2 patient with Diabetic Foot Ulcer	My Foot Care Application	MyFootCare shows promising features to engage people in DFU self-care. Most notably, ulcer size data are useful to monitor progress and engage people. However, more work is needed to improve the usability and accuracy of MyFootCare, that is, by refining the process of taking and analyzing photos of DFUs and removing unnecessary features. These findings open the door for further work to develop a system that is easy to use and functions in everyday life conditions and to test it with people with DFUs.
9	(Chang <i>et al.</i> , 2018)	Quantitative A Preliminary Study	22 Participant	Diabetes Mellitus type 2 patient without Diabetic Foot Ulcer	M-Health Programme	This study has examined the impact of m-health on the changes in knowledge, behavioural, and psychological outcomes. The results indicated that diabetes patients significantly improved in the self-care behaviours, including foot care, diet control, and exercise. Although no statistical differences between knowledge and psychological outcomes were identified, the posttest scores on psychological problems dropped considerably. This study provides a platform for diabetes patients the group to keep them posted with updated information, lectures, experience sharing, and social interaction, such that they are more willing to engage in their self-care activities.

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No	Author and Date	Study Design	Sample Participant	Clinical Conditions	Application Used	Main Finding
10	(Jeon and Park, 2018)	Quantitative	19 Participant	Diabetes Mellitus type 2 patient without Diabetic Foot Ulcer	Diabetes Self-management Mobile Application	The DSM app developed in this study has three characteristics based on behavioral change theory: personalized, evidence-based, and user-centered. To implement these 3 characteristics, 16 functions were integrated into a single DSM app. The DSM app was developed based on behavioral change theory through IMB models. It was designed to be evidence-based, user-centered, and effective. It remains necessary to fully evaluate the effect of the DSM app on the DSM behavior changes of diabetes patients.
11	(Kim, Lee and Seo, 2021)	Quantitative: A randomized controlled trial	68 Participants	Diabetes Mellitus type 2 patient without Diabetic Foot Ulcer	Smartphone Apps Diabetes Self-management	The program was effective in improving diabetes self-management behavior. This study created situation-specific manuals upon which the phone counseling was based, allowing shorter periods for more systematic counseling. Furthermore, the researcher analyzed the self-management behaviors recorded daily in the smartphone app and provided individual feedback on areas in which behaviors were inadequate using the chat function.
12	(Iversen <i>et al.</i> , 2020)	Quantitative: A randomized controlled trial	182 Participants	Diabetes Mellitus type 2 patient without Diabetic Foot Ulcer	DiaFOTo Application Telemedicine	The finding intention to treat analyses, differences between treatment groups were small and non-significant for the health and well-being scale scores, as well as for diabetes-related distress and foot ulcer-specific quality of life.
13	(Ogrin <i>et al.</i> , 2018)	Mixmethod	49 Participants	Patient with diabetic with low or high risk amputation	Diabetes Foot App	The findings were to have the app support PWD to seek help early for any foot complications and to undertake self-care activities that would reduce serious foot complications. Behaviours most likely to prevent amputation in PWD include: raising awareness and understanding of risk factors for amputations; avoiding injuries; daily foot inspection; foot hygiene; appropriate sock and footwear selection; appropriate nail care; footwear fitting; and seeking health provider support

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No	Author and Date	Study Design	Sample Participant	Clinical Conditions	Application Used	Main Finding
14	(Kilic and Karadağ, 2020)	Quantitative: A randomized pilot study	106 Participants	Diabetes Mellitus type 1 and type 2 patient without Diabetic Foot Ulcer	Mobile Foot Care Application	In this study, education and follow-up via the mobile app and verbal-only instruction increased the knowledge, behavior, and self-efficacy scores of patients in both groups. Post-study knowledge scores were significantly higher in the experimental group than in the control group. Patient education remains a crucial component of optimal care, and further development, refinement, and testing of mobile applications to improve self-efficacy and reduce the risk of diabetic foot are warranted.
15	(Lazo-Porras <i>et al.</i> , 2020)	Quantitative: A randomized controlled trial	172 Participants	Diabetes Mellitus type 2 patient with risk of Diabetic Foot Ulcer	M-health Thermometry	In this randomized trial, conducted in a LMIC setting, the uptake of the foot thermometry for the prevention of foot ulcers was 87% in the intervention and control groups, and the addition of mHealth was not effective in reducing foot ulceration or increasing adherence to thermometry after 18 months of follow-up. However, these results need to be interpreted with caution as the expected rates of DFU used in our sample size calculations were not met and there was a higher rate of previous DFU in the intervention group.

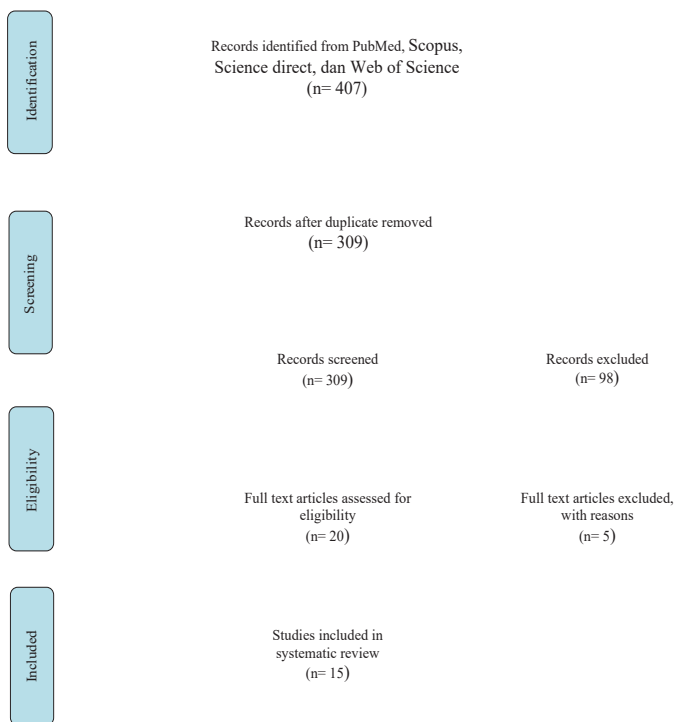


Figure 1 : Flow Chart of Study Selection.

feasibility of the inclusion and exclusion criteria, the assessment yielded up to 15 articles that could be used in a systematic review. Table II summarizes the study’s characteristics. Table II describes the characteristics of the study. All of the literature is a quantitative study with the Randomized Controlled Trial criteria (53.3%), with seven studies discussing the use of mobile phone health, three studies discussing foot care application programs, and five studies discussing the application of telemedicine.

Risk of bias

The selected study were critically review into search terms study bt data extraction for checked to prevent possible errors and risk of bias. The three independent researchers resolved disputes that arose during the data extraction process. The extracted data include the publication year, application development, mobile health use, study language, and study design.

DISCUSSION

We discover the several efficacies of mobile health application are good to prevent diabetes complications

especially diabetic foot ulcer recurrence in this systematic review. According to the findings, education and exercise level has a statistically significant relationship with the knowledge of foot care. Foot care and exercise are suggested to increase in vasodilation and tissue blood flow, which may potentially facilitate ulcer healing (7 p. 6). A few mobile health applications, including 3STEPFUN, expressed a substantial upgrade in precautionary care step conducted over a six-month season. It is possibly proposed that getting writing lonely (for instance, have care foot pamphlet) is possibly inadequate to better diabetic people with foot care behavior. Blood glucose monitoring was also found to be a predictor of lowering likely damaging foot care acts on its own (8 p. 30, 9 p. 2) The role of blood glucose tracking alone was also found to be a predictor of lowering the damage of foot care behaviors (8 p. 31).

Moreover, there goes on a DiabEHT project application that is specifically developed to fit the manage by them self practice of people with diabetes. They merge education in health, common wealth sources, and technology to support people with diabetic ulcer in foot. The project makes use of health education, community resources, and technology to help diabetic patients manage their own care. That approach, which comprises [1] every once while available the support group activities along with lecture [2] the use of the DiabEHT app, and [3] the availability of diabooshs at the public health care has strengthened and improved diabetes participants' self-care management and facilitated compliance (10 p. 235) According to, m-health has an impact on changes in knowledge, behavior, and psychological outcomes (11 p. 42). The findings revealed that diabetic patients significantly improved in self-care behaviors such as foot care, diet control, and exercise. Although no statistical difference was found between knowledge and psychological outcomes, post-test scores on psychological problems dropped dramatically. Though in a study conducted by the absorption of foot thermometry for the prevention of foot ulcers was 87% in the intervention and control groups, and the addition of mHealth was not effective in reducing foot ulceration or improving compliance, for thermometry after 18 months of follow-up (12 p. 9). After all, these findings should be interpreted with cautiousness because the expected DFU levels used in calculating the study sample size were not met, and the intervention group had a higher prior DFU rate (13 p. 127).

CONCLUSION

The development of mobile health applications and virtual consultation via telemedicine is an effective intervention for preventing the recurrence of diabetic foot ulcers in patients with type 2 diabetes mellitus. Further quality research should focus on

the type of diabetes foot care and diabetes self management to prevent the recurrence.

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