Diabetes Self-Management Education (DSME) Methods using Web-Based and Application

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Abstract

Introduction: Diabetes Self-Management Education (DSME) is a process of providing knowledge to people with diabetes about self-care strategies to optimize metabolic control, prevent complications, and improve the quality of life of people with diabetes. Web-based and application interventions would be very helpful in addressing the significant burden of diabetes mellitus and are tools to assist healthcare professionals in controlling diabetes mellitus issues. The purpose of this literature review is to identify the use of Diabetes Self-Management Education (DSME) methods based on the web and applications for people with diabetes mellitus.

Methods: The research design for this study was a literature review. Article searches were conducted using five journal databases, namely PubMed, ProQuest, Science Direct, Research Gate, and Google Scholar. The inclusion criteria used for data collection were full-text availability, and journal publications from 2018 to 2023, in English and Indonesian. A total of 10 articles that met the inclusion criteria were reviewed.

Results: The results of the literature review showed that the use of applications and web-based interventions from the nine journals reviewed can affect the quality of life, self-efficacy, self-management, knowledge, weight, and clinical conditions of patients such as HbA1c level and lipid profiles.

Conclusion: The use of applications and the web are very effective as people with diabetes do not require a lot of money and time compared to direct control at health facilities. Applications can also be accessed at any time, thus helping to improve self-management in people with diabetes mellitus.

Keywords: DSME, web-based, application, smartphone, diabetes

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INTRODUCTION

Diabetes mellitus (DM) is a chronic condition when there is an increase in blood sugar levels because the body cannot produce or use insulin effectively [1]. Diabetes Mellitus can also be called the mother of Disease because DM is the parent of various diseases such as hypertension, stroke, kidney failure, blindness, and leg amputation. 1 in 2 people with diabetes are still unaware that they have diabetes. Diabetes Mellitus will be very dangerous if the sufferer is unable to regulate blood sugar and will cause complications that can endanger the health of the body [2].

People with diabetes (diabetes) require systematic, routine, and organized care by health care providers. Management of DM treatment must be carried out for life. In 2015, as many as 415 million adults suffered from DM, up to 4 times the 108 million people in the 1980s. By 2040 it is estimated that the number of people with diabetes will increase to 642 million people [1]. Nearly 80% of people with diabetes are in low- and middle-income countries [2]. In 2015, Indonesia was ranked seventh in the prevalence of people with diabetes in the world after China, India, United States, Brazil, Russia, and Mexico with approximately 10 million people with diabetes [3]. The prevalence of people with diabetes in Indonesia aged ≥15 years tends to increase from 5.7% (2007) to 6.9% (2013) with the number of people with diabetes reaching 12,191,564 million people. As many as 2/3 of people with diabetes in Indonesia do not know they have diabetes and tend to have complications so it is too late to access health services [4].

This situation will have an impact on people with diabetes experiencing readmission. Readmission according to the National Quality Forum America is defined as the occurrence of patient visits with conditions that interfere with their health during a period of ≤ 30 days from previous hospitalization. The readmission limit referred to above is for a patient who has received treatment at the same or a different hospital for ≤ 30 days in a certain period [5]. It is likely that people with diabetes are at higher risk of being re-admitted than people who do not have diabetes. In a study of 4769 medical patients, diabetes was associated with a statistically significant 40% increased risk of re-admission within 30 days [6].

Diabetes Self-Management Education (DSME) is a process of providing knowledge to people with diabetes about self-care strategies to optimize metabolic control, prevent complications, and improve the quality of life for people with diabetes. The purpose of DSME is to support decision-making, self-care behavior, problem-solving, and active collaboration with the health team to improve clinical outcomes, health status, and quality of life [7]. Healthy living education is a promotion of healthy living that needs to be done. Education is a part of prevention efforts and is very important in managing diabetes mellitus holistically, including education about diet, physical activity patterns, regularity of taking medication/insulin, and foot care. Efforts made to prevent complications are highly dependent on the patient’s knowledge of the disease, the patient’s knowledge is influenced by several factors, such as age, education,
occupation, experience, information, socio-culture, and economy [8].

There is ineffectiveness in education related to the education method provided, namely group-based sessions, lasting half a day or all day for several weeks. Many patients who are working or uncomfortable in this group will cause ineffectiveness in providing related education. In the UK, more than 80% of households had internet access in 2015. There are potential advantages and convenience of using video and graphics to present complex information in a format accessible to those with low literacy [9]. In addition, Audiovisual-based diabetes self-management education has an influence on the knowledge and skills of patients with type 2 diabetes in performing self-care [10]. Furthermore, the MDFEET application also shows promising, valid, and reliable features to enable patients with type 2 diabetes to perform self-assessment for their feet. Through this mobile application, patients can perform early detection of diabetes independently anytime and anywhere, in addition to getting ongoing health education [11].

Currently, the internet has developed greatly, given its rapid development and increasing coverage worldwide, application and web-based interventions will hold great promise to remedy the huge burden posed by diabetes mellitus and are one of the tools that assist health workers in controlling the problem of diabetes mellitus. Actions that can be taken to improve self-management are to choose effective methods that can easily provide knowledge about diabetes mellitus, exercise weight control, engage in physical activity, comply with taking medication insulin, and manage disease by teaching self-care and behavior change to people with type 2 diabetes [12]. Based on the description above, people with diabetes is predicted to increase and this will increase the risk of being readmitted after returning from the hospital. So, an effective method is needed that can reach more people with diabetes mellitus. The purpose of this literature review is to determine the use of web-based diabetes self-management education methods and applications in diabetes.

METHODS

The research was conducted using the literature review method. The literature review was employed as a scientific approach aimed at analyzing, evaluating, synthesizing, and critiquing research findings on the topic of DSME (Diabetes Self-Management Education) through web-based and application methods. The search for relevant articles was carried out using several database journals, including PubMed, ProQuest, Science Direct, ResearchGate, and Google Scholar.

The keywords used in this literature review were adjusted to focus on DSME, web-based and application methods, smartphones (Android), and Diabetes Mellitus (Type 2). Inclusion criteria for the selection of studies in the literature review encompassed original research, such as quasi-experimental studies, randomized control trials, qualitative research, and cross-sectional studies. Full-text articles that were related to interventions involving the diabetes self-management
education method through web-based applications were considered. Additionally, articles published between 2014 and 2023 were included, and articles written in English and Indonesian were eligible. On the other hand, exclusion criteria entailed articles that did not discuss web-based and application-based diabetes patient education, as well as articles in the form of systematic reviews and meta-analyses.

The researchers initially identified 119 articles matching these criteria. After careful examination, 18 duplicate articles were identified and excluded, leaving a total of 101 articles. Subsequently, the researchers conducted a screening process based on the titles, abstracts, and full texts of these 101 articles, aligning them with the theme of the literature review. Through this assessment, 15 articles were identified as meeting the eligibility of the inclusion and exclusion criteria. The selection process for these study articles is illustrated in the Flow Diagram (Fig. 1).

The articles were selected after going through a selection process that referred to the article inclusion criteria as determined and carried out by the two researchers. To avoid bias in the article selection process, the researcher uses the Critical Appraisal Tool (CASP) [14], and determines articles that have a score above 50% of "YES" answers to be selected or determined.

![Flow Diagram](Fig. 1. Literature Review Flow Chart Based on PRISMA 2009)
RESULTS

Based on the ten articles that met the inclusion criteria (Fig. 1), there are three diabetes self-management education methods used, namely using an application (7) and the web (3). Most of the research designs used are quasi-experimental and randomized experimental studies. There is one study that uses a qualitative study. The average number of participants is more than hundreds. Overall, all studies discuss the effect of diabetes self-management education using applications or the web. Studies consistent with the average systematic review were carried out in Indonesia with 5 studies [15]; [16]; [17], and the others were two studies in America [18]; [19] and one study each in Canada, Iran, and Australia [20]; [21]; [22]. The ten studies describe the use of applications and the web as a method to educate people with diabetes that it is important to monitor health according to the four pillars of diabetes self-management education.

Table 1
Literature Search Results

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<thead>
<tr>
<th>Title, authors and years</th>
<th>Study design, Sample, Variable, Instrument, Analysis</th>
<th>Outcome of Analysis Factors</th>
<th>Summary of Results</th>
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<tr>
<td>Mobile App for Improved Self-Management of Type 2 Diabetes (Agarwal P et al., 2019) [20]</td>
<td>Design: Randomized control trial Sample: 110 participants randomized to the immediate treatment group (ITG), and 113 participants randomized to the wait-list control (WLC) group received usual care. Instrument: Bluestar App, Glucose control measured by HbA1c levels at 3 months, Quality of life measures using the EuroQol-5D (EQ-5D). Analysis: Analysis of covarian (ANCOVA)</td>
<td>Mobile App for improved self-management of type 2 diabetes, Assessed intervention impact on patient self-management, experience of care, and self-reported health utilization using patient-reported outcomes measures and patient-reported experience measures.</td>
<td>The results showed no difference between intervention and control arms for the primary clinical outcome of glycemic control measured by HbA1c levels. Although there was low usage of the app among participants, results indicate contextual factors, particularly site, had a significant impact on overall usage.</td>
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<td>The Effect Of Health Education Through Sessionhealth Application Media On Behavior Management Behavior Of Diabetes Melitus In Bengkulu City (Hanifah, 2019) [17]</td>
<td>Design: Pre-experiment design with one group pre test post-test Sample: 384 respondents Instrument: Diabetes self-management behavior questionnaire The Summary of Diabetes Self Care Activities Analysis: Wilcoxon Signed Rank Test</td>
<td>The effect of health education through the Salam – Sehat application media on diabetes self-management behavior.</td>
<td>It is expected that the research results of the Salam-Sehat application can be used as an online-based health education media that provides convenience in obtaining health information without being limited by space and time for people</td>
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<td>Mobile phone applications and their use in the self-management of Type 2 Diabetes Mellitus (Jeffrey B et al., 2019) [22]</td>
<td>Design: Qualitative study Sample: Participants were conducted with 16 app and 14 non-app users. Instrument: Interviews were based on the Technology Acceptance Model, Health Information Technology Acceptance Model (HITAM) and the Mobile Application Rating Scale. Analysis: Deductive content analysis</td>
<td>Mobile phone applications and their use in the self-management of Type 2 Diabetes Mellitus</td>
<td>Most app-users found apps improved their T2DM self-management and health.</td>
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<td>DM-calendar app as a diabetes self-management education on adult type 2 diabetes mellitus (Kusnanto, et al., 2019) Indonesia [20]</td>
<td>Design: Randomized experimental design Sample: 80(40 in the experimental group and 40 in the control group) Instrument: diabetes management self-efficacy scale (DMSES), blood sampling performed by competent personnel. Analysis: Paired t-test, Wilcoxon, and an Independent t-test</td>
<td>The DM-Calendar application is an Android-based application designed by the researchers as self-care education media for patients with DM living alone.</td>
<td>Education with these electronic media has increased the perception of self-efficacy and improved the behavior of good self-management that can be seen from changes in controlled HbA1c level, lipid profile and insulin.</td>
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<td>Mobile-Enhanced Peer Support for African Americans with Type 2 Diabetes (Presley Caroline et al., 2020) [18]</td>
<td>Design: Randomized control trial Sample: 120 participants randomized, 97 completed the study. Instrument: mHealth web-based application, Questionnaire diabetes distress scale, center for Epidemiologic Studies Depression scale, Questionnaire Perceived Diabetes Self-Management</td>
<td>To compare a community-based diabetes self-management education (DSME) plus mobile health (mHealth)-enhanced peer support intervention to community-based diabetes self-management education (DSME) alone for African American adults with Community-based DSME with and without peer support led to improved glycemic control. Peer support linked to clinical care led to a larger reduction in diabetes distress, which has important implications for the overall wellbeing of</td>
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| Nutri Diabetic Care Application as a Counseling Media to Improve Diabetes Mellitus Diet Adherence (Winangnisih, 2020) [23] | Scale, EuroQol visual analog scale Analysis: T test and chi-square test  
Design: Quasi-experiment  
Sample: 20 respondents, namely type 2 DM patients at Puskesmas Gamping 1  
Instrument: Food frequency questionnaire, Nutri diabetic care application  
Analysis: Wilcoxon | poorly controlled type 2 diabetes  
Differences in dietary compliance before and after nutrition counseling using the nutri diabetic care application | There is an effect of Nutri Diabetic Care application media on DM diet compliance. |
Sample: 100 patients  
Instrument: Teman Diabetes application on smartphones, SMBG questionnaire and self-diabetes self-care activities (SDSCA) questionnaire.  
Analysis: T-test, Mann Whitney U test and Chi-square test  
Design: Quasi-experimental design  
Sample: The respondents were people with type 2 DM, willing to be respondents, had been treated at puskesmas, and had internet access and a handphone that could browse is 30 people.  
Instrument: The research instrument is a questionnaire, data collection tool, and observation sheet. The questionnaire used in the study uses demographic data and Diet Behavior data a standardized questionnaire.  
Analysis: Paired t-test | Effect of using Teman Diabetes application on subjects' SMBG performance, Effect of using Teman Diabetes application on self-care activities | The study found that using the SMBG application helps manage diabetes in T2People with diabetes. |
| Diabetes Self-Management Education (DSME) Based-Website on Dietary Behavior among Type 2 Diabetes Mellitus During Covid-19 Pandemic (Ernawati et al., 2021) [16] | The effectiveness of the website-based Diabetes Self-Management Education (DSME) based website method on dietary behavior among Type 2 DM | Implementing Diabetes Self-Management Education (DSME) website based can improve diet behavior in Type 2 People with diabetes during the covid-19 pandemic. With an increase in diet behavior, people with type 2 diabetes will have the understanding and skills to improve their quality of life. |
| Learning in a Virtual Environment to Improve Type 2 Diabetes Outcomes (Johnson C et al., 2023) [19] | The purpose of the Diabetes LIVE study was to compare the effects of the LIVE intervention on diet (fat, fiber, fruit, and vegetable intake) and physical activity behaviors (minutes of moderate physical activity per week),  
Instrument: Surveys and clinical, laboratory, and Fitbit measures | This study confirmed that there were minor positive changes on glycemic targets in both groups over the 12-month study period; however, the majority of the participants began with optimal HbA1c |
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<td>Effectiveness of diabetes self-management education and support via a smartphone application in insulin-treated patients with type 2 diabetes; results of a randomized controlled trial (TRIGGER study) (Boels et al., 2019) [30]</td>
<td>Analysis: Examined by comparing the means and SDs of the outcomes across the 4 time points between study arms, followed by multilevel modeling on trajectories of the outcomes over the 12 months. Design: The study is described as an &quot;Open two-arm multicenter parallel randomized controlled superiority trial.&quot; Sample: The study included 230 participants recruited from 66 general practices and five hospital outpatient clinics. The intervention group had 115 participants, and the control group had 115 participants. Variable: The primary outcome variable was HbA1c at 6 months. Other outcomes included HbA1c ≤53 mmol/mol (≤7%) without any hypoglycemic event, body mass index, glycemic variability, dietary habits, and quality of life. Instrument: The primary intervention was self-management education and support provided via a smartphone app. The text does not specify the instruments used for collecting data on other variables. Analysis: The analysis involved multiple imputation and regression models adjusted for baseline value, age, sex, and other factors.</td>
<td>behavioral outcomes (foot care, blood glucose monitoring, and medication adherence), as well as metabolic outcomes (glycated hemoglobin [HbA1c] level, lipids, blood pressure [BP], BMI, and waist circumference) in adults with T2DM over 12 months compared to a DSME/S control website (WebControl). The primary outcome was the comparison of HbA1c levels at 6 months between the intervention group and the control group. The study also assessed the odds of achieving an HbA1c level ≤7% without any hypoglycemic event. The results indicate that the smartphone app had small and clinically not relevant effects, and there was no significant impact on secondary outcomes. No adverse events were reported.</td>
<td>The study found that after 6 months, the HbA1c levels in the intervention group were 63.8 mmol/mol (8.0%) compared to 66.2 mmol/mol (8.2%) in the control group. The adjusted difference was -0.93 mmol/mol (-0.08%), with a 95% confidence interval from -4.02 to 2.17 mmol/mol (-0.37% to 0.20%), p=0.557. The odds of achieving an HbA1c level ≤7% without any hypoglycemic event were lower in the intervention group, with an odds ratio (OR) of 0.87 (95% CI 0.33 to 2.35). The study did not find any significant effects on secondary outcomes, and no adverse events were reported.</td>
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<td><strong>Effectiveness of Variations of Diabetes Self-Management Education (DSME) on Self Care Behavior in Type-2 Diabetes Mellitus Patients in Tengku Chik Ditiro Hospital</strong> (Kartika et al., 2022) [31]</td>
<td>diabetes duration, and insulin dose. Design: The study used a quasi-experimental pretest-posttest design with control groups. Sample: The study included 45 participants in total, divided into three groups: the control group, the group given DSME intervention, and the DSME variation group. Each group consisted of 15 individuals. Variable: The main variable of interest in the study is self-care behavior in Type 2 Diabetes Mellitus (DM) patients. Instrument: The text does not specify the specific instruments used for data collection or measurement of self-care behavior. Analysis: Data analysis was performed using paired t-tests and an ANOVA test.</td>
<td>Control Group: After the intervention, the mean value of self-care behavior in the control group increased (Mean= 46.26; SD= 5.0) compared to before (Mean= 43.33; SD= 8.24), but this increase was not statistically significant (p= 0.959). DSME Group: In the group given DSME intervention, the mean self-care behavior score significantly increased after the intervention (Mean= 66.67; SD= 5.77) compared to before (Mean= 43.06; SD= 7.05) with a p-value of less than 0.001. DSME Variation Group: Similar to the DSME group, the DSME variation group also showed a statistically significant increase in self-care behavior after the intervention (Mean= 68.46; SD= 6.92) compared to before (Mean= 44.7; SD= 8.72) with a p-value of less than 0.001.</td>
<td>The study concluded that Diabetes Self-Management Education (DSME) activities, both in the standard DSME group and the DSME variation group, were effective in improving the self-care behavior of Type 2 Diabetes Mellitus patients. In contrast, the control group, which did not receive DSME, showed a non-significant increase in self-care behavior. This suggests that DSME interventions can enhance the ability of diabetic patients to independently manage their self-care behavior.</td>
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<td><strong>DIMAS (Diabetes Management Support) Application: Mobile-Phone Based Intervention to Support Diabetes Self-Management Activities</strong> (Kartika, Widyatuti and Rekawati, 2023) [32]</td>
<td>Design: The study employed an experimental design with a One Group Pre-Posttest Design to assess the effect of the DIMAS application on Diabetes Self-Management activities. Sample: The study included 24 respondents who participated in the intervention, although further details about the sample characteristics are not provided in the text.</td>
<td>The analysis revealed statistically significant changes between pre- and post-intervention measures in Diabetes Self-Management activities assessed by SDSCA (p=0.000) and the level of knowledge (p=0.000). The most significant improvements in self-care activities were observed in foot care (increase of 2.4) and exercise (increase of 3.5). The study found that the DIMAS (Diabetes Management Support) application had a positive impact on Diabetes Self-Management activities, with significant improvements in self-care activities and knowledge level. The application helped patients maintain a connection with nurses, even when...</td>
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<td>Cell Phone-Based Diabetes Self Management Education To Improve Self-Care And Hba1c In Adults With Type II Diabetes (Simon, 2020) [33]</td>
<td>Variable: The study aimed to evaluate the impact of the DIMAS (Diabetes Management Support) application on Diabetes Self-Management activities, including aspects such as health education, self-care monitoring (medication reminders, blood sugar and exercise records), and consultation with nurses. Instrument: Data were collected using the Summary of Diabetes Self-Care Activity (SDSCA) questionnaire to assess self-management activities. The study used the DIMAS mobile app and WhatsApp communication as intervention tools. Analysis: Data analysis was conducted using a one-paired sample t-test, and SPSS version 22 was used for the analysis. Design: The project appears to be an observational study, without a specific study design mentioned. It focuses on evaluating the effectiveness of using the smartphone application Care4life to support patient education, improve self-care, and glycemic control in patients with Type 2 Diabetes Mellitus (T2DM) at Wahiawa Health. Sample: The study involved 20 patients attending Wahiawa Health's Diabetes Self-Management Education class. However, only four of these patients participated in the project. Variable: The primary variables of interest include patient education, self-care, and glycemic control in</td>
<td>0.8. Respondents reported that the application was beneficial in reminding them to take medication and facilitating communication with nurses. The results showed that self-care increased post-study, as reflected in the SDSCA questionnaire scores. The pre-study mean (M) was 7.45 (standard deviation, SD = 2.93), and the post-study mean was 8.75 (SD = 3.91). The study did not provide HbA1c values or glycemic control outcomes due to limitations in follow-up and inadequate BG readings. The use of the Care4life smartphone application had the potential to support self-care in patients with Type 2 Diabetes Mellitus. However, due to the small sample size and limitations, such as a lack of HbA1c data, the study recommends longer intervention periods, larger sample sizes, and repeated observations in future studies to further evaluate the application’s effectiveness in improving glycemic control and self-care for T2DM patients.</td>
<td>facing geographical constraints, and provided practical benefits for nursing services at home.</td>
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patients with Type 2 Diabetes Mellitus.

**Instrument:** The study used the "Summary of Diabetes Self-Care Activities (SDSCA)" pre- and post-self-management questionnaire to assess changes in participants' self-care activities. The Care4life smartphone application was used as an intervention tool.

**Analysis:** The study provides data on changes in self-care activities based on SDSCA questionnaire scores. However, it mentions that an HbA1c follow-up was not possible due to time restrictions, and blood glucose (BG) readings were inadequate for converting to HbA1c values.

**Design:** The paper describes the development process of the My Care Hub mobile phone application, with a focus on the application's features and the iterative development process. The development process included multiple iterations and usability testing. Feedback from twelve respondents indicated good user satisfaction with the application, with identified needs for simplifying the documentation features to improve usability.

**Outcome of Analysis Factors**

- The paper reports that the development of the My Care Hub mobile phone application involved a comprehensive process that considered various factors, including behavioral change strategies, user needs, expert consensus, data security, and privacy. The development process included multiple iterations and usability testing.

- The paper describes the development of the My Care Hub mobile phone application, which is intended to support self-management in people with Type 1 or Type 2 diabetes. It emphasizes the iterative development process, usability testing, and the inclusion of features like self-management documentation, analytics, and messages for diabetes self-management. The feedback received from respondents suggested a generally high level of user satisfaction, with areas for improvement related to the documentation features.
DISCUSSION

Use of Web-Based and Application DSME Methods

The use of the web or application in daily life is one of the right choices which provides effectiveness in continuous learning. Mobile technology and the internet are available for 24-hour access and can be used for health promotion and changing behavior [25]. Several studies have shown that the use of the web or application can affect not only blood sugar levels in the body but also self-management behavior, dietary behavior, knowledge about the disease, and the quality of life of people with diabetes. Kustanto’s research (2019) stated that the application of the DM calendar increases self-efficacy and improves good self-management, which can be seen from changes in HbA1c levels controlled by lipid profiles and insulin. This application contains three of the four pillars of DM, namely blood sugar control, educational programs, nutritional therapy, and physical activity [15].

At this time, technology is developing very fast. Caused by many factors, including the rapid development of the human mindset. Community needs in terms of information, science, and working world mechanisms, web application developers are needed so they can continue to be active and innovate [22]. In this fast-paced world of technology, a network is needed that can simplify and speed up the delivery of information widely and can be easily and quickly used by anyone who has access to the internet (Bekti H, 2015). The use of the web as a DSME method also has an influence where sufferers can access where and when to prevent complications and maintain dietary patterns by increasing their knowledge and skills [18].

The various applications include various health interventions, especially education with the aim of improving health and having positive benefits for improving quality of life [26]. The variety of types of applications is evidenced by Hanifah’s research (2019) in Bengkulu using the healthy greeting application which has a chat room feature available in the application and can see videos about how the DM process can occur in the body. Not only that, the application developed by Kshanti et al. also has features that can be filled manually or automatically. Patients can record data on blood glucose levels (BG) (before eating, after eating, and before going to bed). SMBG can help patients and doctors to understand the profile and dynamics of the patient’s blood glucose towards changes in diet, and physical activity, along with the use of anti-hyperglycemic drugs with insulin and certain clinical conditions [24]. This also has an effect on dietary patterns and influences on blood glucose levels where there is an influence on the use of the application as a DSME method [27]. The use of virtual media (LIVE) where people with diabetes will create their own character (Avatar). The web supports the DSME program. From the results of the study, it was found that the use of LIVE and the diabetes self-management education and support control website had no significant effect, but the results showed that LIVE users lost more weight [19].

This literature review focusing on the effect of web-based DSME methods and
applications on people with diabetes mellitus, on average research reveals that DSME has a positive effect on People with diabetes to improve their quality of life, knowledge, self-management behavior, self-efficacy, and condition patient's clinical condition such as HbA1c, lipid profile. In addition, it also affects the weight of the application or web user. However, in one study, the use of the Bluestar app for diabetes self-management showed no difference between the intervention and control groups for primary clinical with glycemic control results as measured by HbA1c. In addition, there was no effect of secondary intervention on the results of measuring diabetes self-efficacy, quality of life, and health service utilization behavior [20]. There was low usage of the app overall, with nearly half of the users in the intervention group having minimal engagement with the app. Many of the app's underused features, including diet and exercise tracking, were previously shown to play a critical role in T2DM self-management [28].

There were several study design factors that likely contributed to the low app usage and lack of a detected intervention effect. Instead of downloading the app, participants were given the intervention on a second phone they used for the duration of the study in an attempt to standardize implementation by the funder. However, the use of a second phone to deliver eHealth interventions has been a noted barrier to usage in previous studies, and future mobile app evaluations would likely benefit from allowing participants to use their own smartphones when possible [27]. Given previous evidence on the benefits of strong primary care participation in diabetes self-management apps, the use of the primary site of recruitment likely had a negative impact on enrollment, usage, and clinical impact.

**Nursing implication**

The studies suggest several nursing implications. Nurses should become knowledgeable about diabetes management mobile apps and guide patients in their effective use. They should also consider contextual factors that influence app utility and adjust recommendations accordingly. Nurses can support health education through these apps, facilitate peer support networks, promote weblogs to enhance patient quality of life and teach patients to integrate smartphone apps for self-monitoring. Encouraging patient participation in Diabetes Self-Management Education programs is crucial, and nurses should stay updated on the latest app features. Patient feedback on app usability is valuable for customization. Nurses should empower patients to engage with digital resources and provide continuous monitoring and support. Overall, nurses play a vital role in promoting and supporting technology in diabetes self-management, emphasizing individual patient needs and contextual factors.

**CONCLUSION**

Most of the use of the web and applications as a DSME method greatly affects the quality of life, self-efficacy, self-management, knowledge, body weight, and clinical conditions of patients such as blood glucose...
levels, HbA1c, and lipid profiles. However, one study showed no difference between the intervention and control groups for primary clinical with glycemic control results as measured by HbA1c. In addition, there was no effect of secondary intervention on the results of measuring diabetes self-efficacy, quality of life, and health service utilization behavior. There was low usage of the app overall, with nearly half of the users in the intervention group having minimal engagement with the app. Many of the app's underused features, including diet and exercise tracking, have previously been shown to have an important role in T2DM self-management. With the very rapid development of technology, it is hoped that more and more applications and websites will be developed so that they can make it easier and reach everyone with diabetes mellitus in order to reduce the number of complications due to diabetes mellitus.

CONFLICT OF INTEREST

The author states that there is no conflict of interest in writing this article.

FUNDING

There is no relevant financial or material interest in the research described in this article.

ETHICAL APPROVAL

Not applicable.

AUTHOR CONTRIBUTIONS

Each author significantly contributed to the following aspects of the paper: (1) formulating and planning the study, (2) providing their final approval for the submitted version and thoroughly reviewing the article’s content, (3) reviewing the article’s content and (4) reviewing the article’s content.

REFERENCES


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