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RESEARCH AND DEVELOPMENT ON ANDROID APPLICATION-BASED EDUCATION FOR SELF-CARE MANAGEMENT IN TYPE 2 DIABETES PATIENTS

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ABSTRACT

Diabetes Mellitus type 2 is a chronic disease that requires long-term management, including the patient's ability to perform self-care independently. This study aims to develop an Android-based application that can help type 2 DM patients in carrying out self-care activities, such as regulating diet, monitoring blood sugar levels, physical activity, and managing medicatio.. This research aims to develop an Android-based application for DM patients type 2 as a promotive and rehabilitative effort. Methods: The research design used is research and development (R&D) with a descriptive analysis approach. The application development process follows the stages of the system development model which includes needs analysis, design, implementation, and evaluation. The data collection method used is primary data, secondary data, interviews and questionnaires to type 2 DM patients and health workers to identify user needs. The Pearson Product Moment correlation technique has been used to examine the validity of 25 questionnaire items with 30 respondents, covering program usability, interface display, convenience of use, and educational benefits. Cronbach's Alpha was used for the reliability test, and the result was 0.87 (reliable). Inclusion Inclusion criteria included type 2 DM patients and health workers (nurses) at Bojonegoro Hospital. Three steps were taken in the data analysis process for this study: data reduction, data display, and data verification. Results The development results show that the application created can be well received by users, and is considered useful in improving patient understanding and skills in carrying out self-care independently. Conclusion: The development of an Android-based application for self-care in patients with Diabetes Mellitus type 2 has been successfully carried out with the aim of increasing patient awareness, knowledge, and compliance with self-management of their disease. This application provides various educational and interactive features such as recording blood sugar levels, medication reminders, healthy diet guidelines, recommended physical activities, and educational materials about diabetes mellitus type 2. This application is expected to be one of the alternative technology-based solutions in supporting chronic disease management, especially Diabetes Mellitus type 2.

Keywords: android application; diabetes mellitus type 2; health education; research and development; self care management

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INTRODUCTION

Diabetes Mellitus (DM) type 2 is one of the non-communicable diseases whose prevalence continues to increase globally, including in Indonesia. Based on data from the International Diabetes Federation (IDF), in 2021 there were more than 537 million adults living with diabetes, and this number is expected to continue to increase in the coming years. Type 2 diabetes is the most common form of diabetes, characterized by insulin resistance and impaired glucose metabolism. This condition can lead to serious complications if not managed properly, such as heart disease, kidney failure, and visual impairment (Atlas, 2019) Diabetes Mellitus is a degenerative disease that requires proper and serious treatment efforts. If not handled carefully, it can cause various serious complications. Chronic hyperglycemia and metabolic disorders of diabetes will cause damage to organ tissues such as the eyes, kidneys, nerves and vascular system (Alfaqih et al., 2021). Patient self-care, or autonomous care, is an important element of type 2 diabetes management. Self-care tasks include

monitoring blood sugar levels, controlling food, engaging in physical activity, taking medicine as prescribed, and recognising the signals of problems. However, many patients struggle to practise self-care on a consistent basis, either due to a lack of information, motivation, or access to health education services (Anisa, 2023).

Based on the results of a preliminary study conducted at dr Sosodoro Djatiekoesomo Bojonegoro Hospital, it was found that out of 10 patients, 8 patients showed poor self-care in the diet and foot care education section. Poor glycemic control and lack of self-care in type 2 DM patients result in an increased risk of acute and chronic complications in type 2 DM patients, so continuous monitoring is needed (Mufidah, 2020)Along with the growth of information technology, particularly the rising use of smartphones, the development of Android-based health applications has the potential to improve the self-care capabilities of type 2 diabetes patients. This program can give education, medication reminders, blood sugar level monitoring, and other features to help people manage their diseases independently and sustainably(Ikawati et al., 2024). This strategy allows patients to be more actively involved in their health management, which is intended to improve quality of life and lower the risk of problems. The development of Android-based applications for self-care of type 2 DM patients is important as an innovation in the modern health care system. Not only does it provide easy access to information and self-monitoring, this application can also be a bridge between patients and health workers in providing more personalized, efficient, and sustainable care (Gayatri et al., 2019).

A mobile application is an application that has been designed specifically for a mobile platform (e.g. iOS, Android, etc.). In many cases, a mobile application has a user interface with unique interaction mechanisms provided by the mobile platform, a web-based interface that provides access to a variety of information relevant to the application, and local processing capabilities for collecting, analyzing, and formatting information in a manner best suited to the mobile platform (Suryn, 2014). Self-care is an individual's activity in caring for themselves in fulfilling and maintaining life. Self-care itself has three nursing systems, one of which is a supportive or educational nursing system. In this system, patients can form or learn from internal or external but cannot be done without assistance. Self-care is one form of effort that can be done to control type 2 DM patients. There are five pillars of diabetes that need to be controlled, namely regulating diet, doing physical activity, taking diabetes medication or insulin, monitoring blood sugar and education (Gayatri et al., 2019).

Self-management is the ability of the patient to take an active role in the care and management of their health condition. They should develop skills to manage their health in everyday life and make decisions based on the information they receive about their care (Riegel et al., 2019). The goal is to improve the quality of life for the patient, optimize health outcomes, and reduce the cost of healthcare services by empowering patients to take an active role in their maintenance. Patients with a high level of self-management are expected to be more successful in achieving their objectives, while those with a low level of self-management may question their ability to achieve their health objectives (Ferawati & Kurniati, 2019).The problems of type 2 DM sufferers can be minimized if sufferers are able to control their disease by increasing self-care through education. Chai & Hu's (2016) research explains that the group that followed the education program for 3 months showed improvements in knowledge, self-care, BMI and HbA1C in the first to third months, after which it decreased again after the education program was not carried out. The use of technology in the treatment of DM type 2 can facilitate improved communication between nurses and patients, reliable data collection, and the provision of a comfortable life for patients. An important goal of electronic media care is to provide patients with the opportunity to receive health education effectively without interruption (Mufidah et al., 2021).

This research aims to develop an Android-based application for DM patients type 2 as a promotive and rehabilitative effort.

METHOD

This research employs the development technique (Research and Development). This process was broadly separated into two parts: product design and Android application products. The first year of the R&D approach focuses on designing product designs, while the second year focuses on testing product designs to target. The qualitative descriptive analysis in this study validates the development of the *DiabetesKu* application using multiple sources as validators/informants. The data collection methods used in the development of the DiabetesKu application as self-care management in controlling blood glucose levels in diabetes mellitus type 2 are primary data, secondary data, and in-depth interviews.The stages of research and development implementation are as follows: 1. Needs analysis, 2. Plans, and 3. Product creation (applications). A needs analysis is conducted to determine which problems will be addressed. Before beginning the analysis step, the researcher conducted a survey of the research respondents. The survey was undertaken to identify issues that arise in the field. The researcher's problem, based on a preliminary investigation at the Bojonegoro hospital, is managing blood glucose levels in order to avoid consequences. The difficulty discovered was that numerous of DM type 2. The next stage is the creation of the DiabetesKu application with the method that has been planned by researchers and colleagues. The method that used in the development of this system application uses the waterfall model method. The inclusion criteria for this study were all DM type 2 patients at Bojonegoro Hospital.

The DiabetesKu application development approach in this study consisted of two parts. The first stage is the preparation for application creation. The second stage is to implement the development of the diabetes care application.The following design for developing the DiabetesKu application in this study:

1. Use case
2. Flow chart
3. User interface

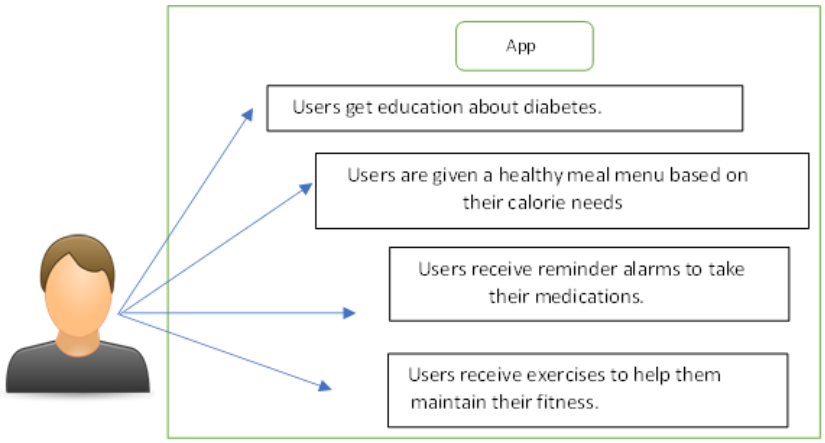

Figure 1. Use Case

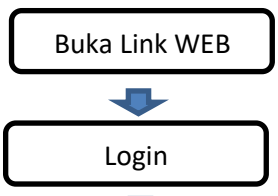

Figure 2. Flow chart

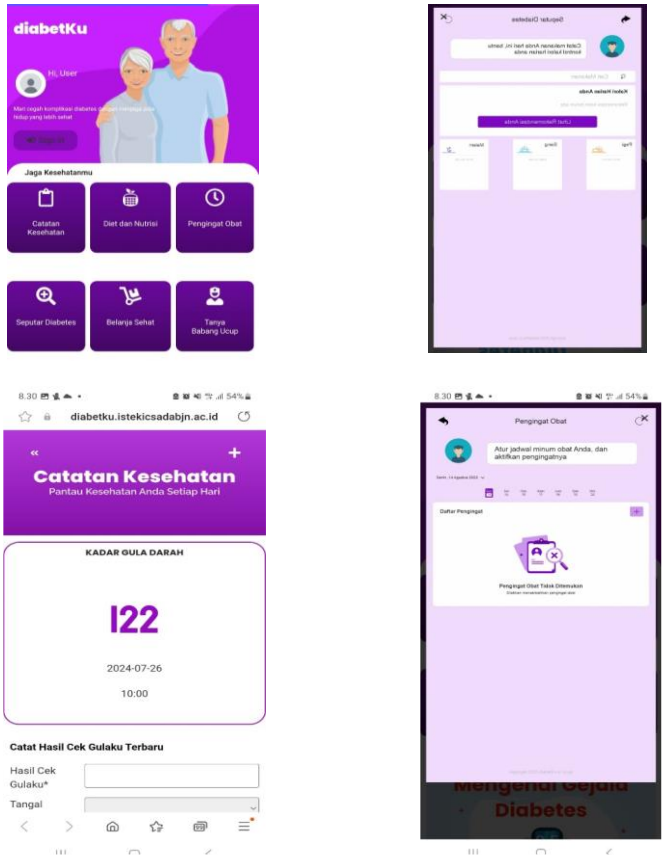

Figure 3. User Interface

RESULT

The research conducted resulted in an android-based application as self-care management in controlling blood glucose levels in patients with type 2 diabetes mellitus. Self-care management in patients with type 2 DM can be supported by the development of information technology. The DiabetesKu application is a development of information technology combined with the world of nursing in helping patients with DM type 2 carry out self-care management.Further details of the research results reviewed can be found in some Figures below.

Figure 4. Cover

On the front page there is a display of the application name "DiabetKu" and a column for filling in the user name. The user must fill in the name first and click the Sign In button to continue using the DiabetKu Application.

Figure 5. Health records

This menu displays the DM patient's Notes or History (Medical Records). so that DM patients can find out how the patient's blood sugar history records during treatment. And makes it easier to see the increase or decrease in blood sugar that DM patients have last month and the current month and or previous examinations and current examinations.

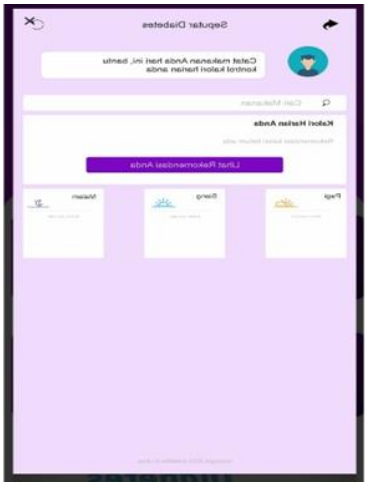

Figure 6 All about diabetes mellitus

This menu displays Health Articles and the latest research results about diabetes, and in this menu DM sufferers can also see the recommended menu that should be consumed by type 2 DM sufferers

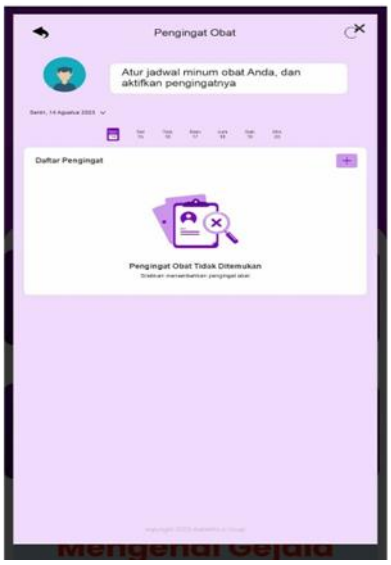

Figure 7 Medication Reminder

This menu displays the edit option, so that patients can activate or deactivate their medication schedule.Figure 8 Ask Brother ucupThis menu displays the ease of this application to be able to share directly with the application maker (nurse) to be able to consult regarding the condition or complaints experienced by the patient

DISCUSSION

The results of the DiabetesKu application's operational function research through black box testing were obtained by comparing the functional success of the scenario anticipated at the start of the development process to the scenario in the finished application. This is in line with the results of research by (Dwi Cantika & Hermanto, 2018) stating that blackbox testing is centered on the functional needs of the application based on the specifications of the application's needs. Jiang (2012; quoted by (Dwi Cantika & Hermanto, 2018) argues that the blackbox approach is useful for finding out whether all software functions have run according to the defined functional needs. This is in line with the results of research conducted by (Angger Anugerah Hadi Sulistyo & Mohamad Roni Alfaqih, 2023) which explains that the use of Individual Real Time Video Counseling is an effective and efficient method of health education as an effort to improve attitudes towards preventing DM complications.

The Diabetes application was tested by looking at the functionality of the application that had been planned at the beginning. DiabetesKu application is tested by looking at the functionality of the application success that has been planned at the beginning. DiabetesKu application performs the function according to the instructions. Several steps of operational function stages are executed and obtain the desired output results according to the scenario. The output results will be analyzed to determine the feasibility of the diabetes care application. This is in line with researchers by (Febiharsa et al., 2018) who conducted a black box test in their research and argued that the output results of the application would then be analyzed, so that this analysis would explain how far the application that was designed could carry out the appropriate function, and whether its function could be understood by the user or not.

The results of the research on the performance of the DiabetesKu application obtained information that the application performance is in accordance with the system on Android but needs further development so that it can be accessed by all mobile phones. The Android system is utilized by researchers in the field because many Indonesian users use Android.

Mobile phone users in Indonesia in July 2006 with the Android system reached 73.8% of the total number of smartphone users in Indonesia (Ramadani, 2020). The use of smartphones in the development of information technology is expected to be applied in the world of health. This is in line with research by (Febrianti & Rahman, 2020) stating that applications on smartphones on Android can be useful in all aspects of human life in helping to control and manage diabetes mellitus problems. DiabetesKu application is part of the development of information technology progress in the world of health. The development of technological progress is claimed to be able to facilitate and support health aspects. The development of the DiabetesKu application is an application that uses smartphones in its application. The DiabetesKu application also makes use of the smartphone's built-in sensors. The findings of this investigation were gathered from informants who confirmed that the calories burned were as calculated. Other informants said that the steps and calories burned were not detected. The DiabetesKu application uses the cellphone's accelerometer sensor to monitor steps and the number of calories, so with this application, DM sufferers can carry out and improve a good lifestyle by exercising regularly, the more often they do activities and exercise, the more it will increase insulin sensitivity, reduce blood sugar levels, improve heart function, reduce blood pressure, and reduce body weight.. This is in accordance with the results of research conducted by (Rahman & Kurniawan, 2017) that a number of Android-powered telephones come with gadgets that allow users to create pedometer apps using the built-in sensors on Android, such as the accelerometer sensor, which measures an object's acceleration.

The results of the research conducted by researchers from all informants showed that the forms in the DiabetesKu application were in accordance with the calorie calculation factors for diabetes mellitus sufferers. According to (Perkeni, 2019), the way to calculate calorie needs is by calculating basal calorie needs which are 25-30 cal/kg of ideal body weight. The amount of these needs is increased or decreased depending on several factors, namely: gender, age, activity, weight, and others. Ideal body weight calculation using the Body Mass Index (BMI) formula is done to find calorie needs. This is in line with the Diabetes and Lipid Center by FK UI (2017), factors that affect calorie needs include gender, age, physical activity or work, complications, weight and pregnancy/lactation. However, the DiabetesKu application targets only type 2 DM patients who are not pregnant/lactating, so the pregnancy/lactation factor in the calculation is removed (Ramadhani & Adnan, 2018).

The calorie requirements, as established by the calculating forms, define the type of diet in the DiabetesKu application. Informants provided the study's findings, which showed that the diet type matched the total caloric requirements of DM patients. Depending on their demands, DM patients are provided the recommended diet. Types of diets in the Diabetes application include 8 types of diets according to energy content, meal and snack schedules for type 2 DM sufferers according to self-care management for type 2 DM sufferers. The results of this application are supported by research conducted by(Indriasari W & Manuel, 2016) explaining that the meal schedule for DM patients includes morning at 07.00, morning snack at 10.00, lunch at 13.00, afternoon snack at 16.00, and dinner at 19.00. The meal and snack schedule for type 2 DM patients is in line with Hartono's statement (2006) that type 2 DM patients must meet the appropriate meal schedule, namely eating 3 large meals, eating snacks in moderate portions and frequent intervals of 2-3 times per day. Education in the DiabetesKu application includes an introduction to diabetes mellitus, diet, exercise, foot care, insulin injections, and material on complications due to diabetes mellitus. The DiabetesKu application's instructional menu is anticipated to assist type 2 DM patients in lowering their blood glucose levels through self-management. Based on research findings from all informants, the DiabetesKu application is helpful in assisting people with type 2 diabetes in controlling their blood glucose levels.

CONCLUSION

The Android-based app created for this study was successful in encouraging individuals with type 2 diabetes mellitus to take care of themselves. With its educational features, blood sugar tracking, medication reminders, and healthy living guidelines, this app aims to empower patients to take charge of their health care. According to the trial results, this application is user-friendly, relevant to the needs of the user, and capable of improving patient comprehension of diabetes care. Additionally, this software is thought to be useful for assisting patients in routinely and independently monitoring their health problems. Therefore, this self-care app has a lot of potential as a supporting tool for managing type 2 diabetes and can help patients live better lives by using a useful and instructive digital approach.

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