



Education Needs Analysis Through Smart-Phone Applications in Changing Knowledge, Attitude, and Behavior among Patients with Diabetes Mellitus

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ARTICLE INFO

Article history:

Received 10 October 2022

Accepted 31 January 2023

Published 20 March 2023

Keyword:

Diabetes Mellitus
E-MMCD application
Knowledge
Attitude
behavior

ABSTRACT

Introduction: Diabetes Mellitus is one of the non-communicable diseases which is currently increasing in number. DM is a precursor of other diseases such as hypertension, heart disease, and stroke. Uncontrolled DM causes comprehensive complications. Increased knowledge, attitudes, and correct actions from patients and families are needed to prevent disease complications. **Objective:** This study aims to analyze the educational needs through information technology-based applications in DM patients in changing knowledge, attitudes, and behavior. **Methods:** This study uses a quantitative method with a cross-sectional design. The study population was all DM patients at Aisyiah Kudus Hospital in October 2022 with a total of 106 patients. Samples were taken by a simple random sampling of 84 respondents who met the inclusion criteria. Univariate analysis was used to determine the level of knowledge, attitudes, and behavior. Bivariate analysis was used to compare DM patients' education level, knowledge, attitudes, and behavior. **Results:** The result showed no significant difference between knowledge, attitude, and behavior ($p\text{-value}=0.322$) based on education level. The result of this research is expected to provide health education through the E-MMCD application for diabetes mellitus patients to increase their knowledge, attitude, and behavior. Health education is also needed to prevent the disease from getting worse.

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Kata kunci:

Diabetes Mellitus
aplikasi E-MMCD
pengetahuan
sikap
perilaku

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DOI: 10.30604/jika.v8i1.1512
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ABSTRAK

Pendahuluan: Diabetes Mellitus (DM) merupakan salah satu penyakit tidak menular (PTM) yang saat ini jumlahnya semakin meningkat. DM merupakan prekursor penyakit lain seperti Hipertensi, penyakit jantung, dan stroke. DM yang tidak terkontrol menyebabkan komplikasi yang bersifat menyeluruh. Peningkatan pengetahuan, sikap, dan tindakan yang benar dari pasien dan keluarga sangat diperlukan untuk mencegah terjadinya komplikasi penyakit. **Tujuan:** Penelitian ini bertujuan untuk menganalisis kebutuhan edukasi melalui aplikasi berbasis teknologi informasi (E-MMCD/Electronic Muhammadiyah Monitoring Chronic Disease) pada pasien DM dalam mengubah pengetahuan, sikap, dan perilaku. **Metode:** Penelitian ini menggunakan metode kuantitatif dengan desain cross sectional. Populasi penelitian adalah seluruh pasien DM di RS Aisyiyah Kudus bulan Oktober 2022 dengan jumlah 106 pasien. Sampel diambil dengan cara acak sederhana dan sampel sebanyak 84 responden memenuhi kriteria inklusi. Untuk mengetahui tingkat pengetahuan, sikap, dan perilaku digunakan analisis univariat dan bivariat untuk melihat perbedaan tingkat pendidikan dengan pengetahuan, sikap, dan perilaku penderita DM. **Hasil:** Hasil uji statistik Kruskal Wallis menunjukkan tidak

ada perbedaan yang signifikan antara pengetahuan (p-value = 0,194), sikap (p-value 1,091), dan perilaku (p-value = 0,322) berdasarkan tingkat pendidikan. Penelitian ini berharap pemberian edukasi kesehatan melalui aplikasi E-MMCD dapat meningkatkan pengetahuan, sikap, dan perilaku penderita DM. Pendidikan kesehatan juga diperlukan untuk mencegah memburuknya kondisi penyakit DM.

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INTRODUCTION

Non-communicable diseases (NCDs) are not caused by infection with microorganisms such as protozoa, bacteria, fungi, or viruses. About 70% of deaths result from groups of non-communicable diseases. Although NCDs cannot be transmitted, weak control of risk factors can affect the increase in NCD cases. It is reported that NCDs that show a significant increase are diabetes mellitus (DM), hypertension, stroke, and joint disease. Diabetes Mellitus (DM) is one of the non-communicable diseases whose number of sufferers continues to increase (Kemenkes, 2020). Indonesia is ranked 5th out of 10 countries with 19.5 million sufferers in 2021 (Sun et al., 2022). Data from The Basic Health Research on non-communicable diseases, DM increased from 1.1% in 2007 to 1.5% in 2013, and 2% in 2018 (Riskesdas, 2019). This high increase in sufferers is due to an unhealthy lifestyle and poor eating habits. The increase in the number of people with DM has also led to an increase in mortality rates, especially in industrialized countries (Chand et al., 2020). This disease has a serious impact on public health throughout the world because of its high morbidity and mortality as well as causes high burden of treatment cost (Beaglehole et al., 2011). In Aisyiyah hospital itself, DM disease ranks 5th out of the top 10 diseases.

Table 1.
Data on the top 10 diseases at Aisyiyah Kudus Hospital in 2021.

No	Code ICD 10	Diagnosis	Sum
1	A91	Dengue Haemorrhagic fever	616
2	A09	DADRS	606
3	B34.2	Covid-19	535
4	E11.9	NIDDM (<i>without complications</i>)	500
5	P39.9	Neonatal Infections	470
6	J18.0	Bronchopneumonia	414
7	I10	Hypertension	340
8	D64.9	Anemia	316
9	A49.9	Bacterial infection	275
10	I50.0	Congestive Heart Failure	263

The high prevalence of DM in Indonesia is influenced by lifestyle changes in line with the better economic level of the Indonesian people. Non-compliance of patients in the management of DM, including lack of understanding of diet, benefits of physical exercise, old age, physical limitations, incorrect understanding of the benefits of drugs, and non-compliance in taking medications are conditions that are commonly found in society. People's habit of eating fast food, busyness due to work, and stress at work increase the possibility of diabetes mellitus.

DM is a precursor to other diseases such as hypertension, heart, and blood vessel disease, stroke, kidney failure, and blindness (Toharin et al., 2015). The *World Health Organization* (WHO) reports that the increase in the incidence of DM is due to four main risk factors, namely: unhealthy diet, lack of physical activity, tobacco use, and alcohol use (Kemenkes, 2020, Haskas et al., 2020).

The management of DM requires the participation of various parties, not only doctors, nurses, nutritionists, and other health workers, but the role of patients and families is also very important. Education to patients and families is needed to be able to provide an understanding of the course of the disease, disease prevention, management, and its complications (Ogurtsova et al., 2017, Perkumpulan Endokrinologi, 2015). On the other hand, health education is also important to improve the knowledge of patients and families after patients are discharged from the hospital. It is expected that patients and families will be able to carry out treatment independently (Habibah et al., 2019). Increased knowledge and understanding of DM followed by awareness to behave and act in healthy lives plays an important role in preventing complications due to DM. Increased knowledge about DM will cause patients and families to be able to understand that the management of DM depends not only on treatment but lifestyle changes such as exercise and dietary arrangements can also prevent the aggravation of the disease (Yamaoka et al., 2019).

The hospital functions to provide curative, rehabilitative, and promotive services (Yaghoubi et al., 2016). The issue of *Health Promoting Hospital* (HPH/PKRS) is a concern because the prevalence of non-communicable diseases due to lifestyle changes and chronic diseases is getting higher so people need continuous support. Promotive activities in hospitals are usually carried out in Hospital Health Promotion activities. This activity is one of the efforts made by the hospital for the prevention of diseases, including DM disease (Suhada and Ain, 2021, Winarto, 2019). This is following the mandate contained in law no. 44 of 2009 concerning hospitals. Hospitals are developed to improve everyone's ability to control and improve their health and make hospitals healthy workplace (Prahesti, 2018). Aisyiyah Kudus Hospital is a muhammadiyah business charity. The management of Aisyiyah hospital is currently starting to make some changes to the efficiency and modernization of health services. One of the strategies carried out for efficiency is to replace paper medical records with electronic medical records. In addition, registration and queues for outpatients also started using the Android-based Online application. This condition provides benefits for reducing the waiting time (queue) of outpatients. But on the other hand, the PKRS program, which was previously carried out with in-person lectures, can no longer be done because more patients are waiting from home. Based on these conditions, management began to think about being able to

carry out the PKRS program using application-based technology.

The E-MMCD (*Electronic Muhammadiyah Monitoring Chronic Disease*) application is one of the information technology-based mHealth applications developed to monitor the condition of patients with chronic diseases. This application is installed and applied by patients suffering from chronic diseases such as DM or hypertension and is expected to improve the patient's condition. By applying this E-MMCD application, the patient will know the patient's current condition.

Electronic Muhammadiyah Monitoring Chronic Disease (E-MMCD) is an information technology-based application that can be used to meet the educational needs of DM patients. The application is designed according to the needs and desires of the patient. Patients can easily install and download the *Google App* easily. This application has not been tested for effectiveness to assess the extent of the effectiveness of existing products. Patients who install the application and fill out survey data related to their health status will receive an initial *assessment* of whether the condition in question is not at risk, medium risk, or high risk. Furthermore, from the initial assessment, the patient can understand what things need to be improved so that their condition becomes better. Patients can make an assessment independently by looking at whether their physical activity is lacking, their diet is not good, or the regularity of taking medications that need to be improved.

This study is a preliminary study before the application of E-MMCD was intervened in DM patients. The purpose of this study was to analyze the educational needs of DM patients through the E-MMCD application at Aisyiyah Kudus hospital by looking at differences in knowledge patterns, attitudes, and patient education-based behaviors. The expected benefit of this study is that the measurable knowledge, attitudes, and behavior of DM patients can be used as a basis for providing educational interventions through the application of E-MMCD so that it can help and train DM patients in changing their knowledge, attitudes, and behaviors.

METHODS

Participant characteristics and research design

This study used a quantitative method with a *cross-sectional* design to see the patient's need for diabetes mellitus education by looking at differences in knowledge, attitudes, and behaviors of diabetes mellitus patients. This research was conducted in October 2022 at the Aisyiyah Kudus Hospital in Central Java. The study population was all DM patients aged 18 to 80 years old without complications who were still undergoing routine treatment at Aisyiyah Kudus Hospital in October 2022 with a total of 106 patients. This research obtained ethical clearance from the Institute for Research and Community Service (LPPM) of Muhammadiyah Kudus University, Central Java No. 11 / Z-7 / KEPK / UMKU / VI / 2022 on June 27, 2022.

Sampling procedures

The sample of the study was patients with diabetes mellitus who met the inclusion criteria of the subjects of this study, namely patients Non-Insulin Dependent Diabetes Mellitus aged 18 to 80 years old, there are no complications both microvascular and macrovascular, patients has an android-based mobile phone that can connect to the internet

network, patients can use the E-MMCD application independently, patients are willing to be a subject in this study. The exclusion criteria are patients with DM with incomplete medical record status and patients with DM with psychiatric disorders.

The sample selection procedure was determined based on the slovin formula and the sample was taken in a simple random way based on inclusion criteria so that 84 respondents were (sugiyono, 2011). Data was collected at Aisyiyah Kudus Hospital, Central Java, by taking into account ethical aspects, namely respondent approval, security, and safety of the responder.

Measuring instrument

Data collection in this study was carried out directly with respondents. The research instrument uses questionnaires to determine the level of knowledge, attitudes, and behaviors by linking to the *Google Form* application. Primary data obtained through questionnaires that have been filled out by respondents include the characteristics of diabetic patients, namely age, occupation, education, telephone number., data knowledge, attitudes, and behaviors of diabetic patients. Secondary data was obtained from the results of the patient's medical records at the Aisyiyah Kudus hospital in Central Java. Measurement of knowledge, attitudes, and behaviors based on the development of questions on the E-MMCD application and a reliability validity test has been carried out.

Methods used to collect data

The data collector collected data from the respondents directly to the respondents at the Aisyiyah Kudus hospital including questions about knowledge, attitudes, and behaviors, and then guided the patient to download the Muhammadiyah Monitoring Chronic Disease (EMMCD) electronic technology application. Instrumen used have been tested for validity and reliability. The questionnaire was compiled based on the recommendations of endocrinologists and several previous studies (Kusumo et al., 2021). The questionnaire on knowledge consists of 15 questions with 3 answer choices namely yes, no, and doubt. The questionnaire on attitudes consists of 15 questions with answer choices using the Likert scale, namely strongly agree, agree, doubt, disagree, and strongly disagree. The questionnaire on behavior consists of 15 questions with 5 answer choices i.e. always, often, sometimes, rarely, and never. The test of the validity and reliability of the questionnaire is carried out by testing the validity of the content, the validity of the form, through SPSS and is declared valid (probability with $P < 0.05$), all questionnaire questions are reliable with Alpha Cronbach (knowledge 0.556, attitude 0.568, and action 0.582). Data analysis of this study was carried out with the application of SPSS (*Statistical Product and Service Solution*).

Data analysis

Data on the characteristics of the sample were analyzed using *univariate analysis*. This analysis is used to provide a descriptive picture of the frequency distribution and proportion of each variable under study. To determine the differences in the level of knowledge, attitudes, and behaviors of DM patients based on their level of education, a *bivariate* analysis was carried out using the comparative Kruskal Wallis (Dahlan, 2011).

RESULT AND DISCUSION

The results of the study are shown in the form of descriptive and inferential statistics.

Table 1 shows the data on the characteristics of the respondent. Respondents had a gender of 78% female and 21% male. The age characteristics of respondents in the age range of 35 to 49 years are as much as 21%, the age of 50 to 64 years as much as 61%, and the age of more than 64 years as much as 16%. The education characteristics of the majority of respondents were low-educated 73.8%, middle 20%, and high 6%.

Table 2 shows the respondents' knowledge level data. Respondents who have a better knowledge level are 85.7%, the knowledge level is sufficient at 11.9% and the knowledge level is less than 2.4%. The level of the respondent attitude was found to be a positive category of 3% and a negative attitude of 81%. Research data on the respondent behavior of the category is good at 7.1% and the behavior of the category is less good at 92.9%.

Table 3 shows the data from the bivariate analysis test results, a comparative test using the *Kruskal Wallis* difference test. The results of the analysis found that there was no significant difference in the level of knowledge of respondents based on the level of education of respondents with a p-value of 0.194. The results of the analysis test also did not have a significant difference in respondents' attitudes based on the respondent's education level with a p-value of 0.580 and no significant difference was found in aspects of respondents' behavior based on education level with a p-value of 0.322. Because the p-value of each variable is more than p-0.05 so it can be concluded that there are no significant differences in the knowledge, attitudes, and behavior of sufferers of diabetes based on the level of education of the respondent.

Table 2
Characteristic respondents

Variables	N	percent
Sex		
Female	66	78.6
Male	18	21.4
Age		
35-49	18	21.4
50-64	52	61.9
65	14	16.7
Education		
Low	62	73.8
Middle	17	20.2
High	5	6.0

Table 3
Knowledge, attitude, and behavior

Variables	n	percent
Knowledge		
Detailed	72	85.7
Moderate	10	11.9
Poor	2	2.4
Attitude		
Positive	3	3.6
Negative	81	96.4
Behavior		
Good	6	7.1
Enough	0	0
Poor	78	92.9

Table 4
Compare the test with Kruskal Wallis

Variables	Education	df	P value
Knowledge	3.281	2	0.194
Attitude	1.091	2	0.580
Behavior	2.266	2	0.322

Characteristics of diabetes mellitus

The results of this study found that diabetes mellitus in Aisyiyah Kudus hospital was mostly suffered by the group of women in the age range of 35 to over 64 years. This condition suggests that diabetes mellitus disease can be suffered by those in the productive age group. The results of this study are in line with data from the *International Diabetic Federation (IDF)* stated that in 2019 globally there were 463 million people aged between 20-79 years who suffered from diabetes mellitus.

The increasing prevalence of DM seen from the economic side is disrupting macroeconomic growth. This is due to a decrease in the quality of the labor force. Labor productivity will decrease because workers who have DM disease will have the potential for frequent work permits(Chand et al., 2020). One of the challenges faced is that DM not only affects the elderly group, but also the productive age group. Not only that, the high incidence of DM worldwide, causes a high burden of health care costs (Beaglehole et al., 2011).

Age is one of the risk factors for diabetes mellitus. This is likely to occur due to a decrease in body activity, causing an increase in body weight caused by an increase in body fat and a decrease in muscle mass (Fatimah, 2015, Fadilah et al., 2016).

In this study, it was also found that patients with diabetes mellitus were mostly poorly educated and then followed by the middle-educated group.

Education and knowledge

Education is one of the essential aspects of changing a person's knowledge. People with higher levels of education generally find it easier to get better access to information (Mohammadi et al., 2015). In this study, it was found that the majority of people with diabetes mellitus in the Kudus aisyiyah hospital were low-educated individuals. However, the results of the survey also showed that there was no difference in the average knowledge of diabetes mellitus patients in low-educated patients, middle, and high. The results of measuring the level of knowledge of diabetes mellitus patients in the aisyiyah hospital are good because they have obtained information and education about their disease during the treatment process. Individuals can gain knowledge both formally through education and informally through educational activities.

The process of communication and education that is intensely carried out during treatment by the doctor can continue to gradually improve the patient's knowledge so that individuals who did not know at first become aware will be the disease. This education is very helpful for patients in understanding diseases, management efforts, treatment, and complications that may be experienced. This education hopes that patients can manage their disease and not experience worsening conditions due to the disease suffered and can implement a healthy lifestyle while suffering from diabetes mellitus.

Increased knowledge and understanding of DM followed by awareness to behave and act in a healthy living plays an important role in preventing complications due to DM. Increased knowledge about DM will cause patients and families to be able to understand that the management of DM depends not only on treatment, but lifestyle changes such as exercise, dietary regulation, and regular monitoring of blood sugar levels can also prevent the aggravation of the disease (Yamaoka et al., 2019, Bukhsh et al., 2019).

Significant differences in knowledge and attitude changes occur in diabetics who have been given health education after 3 months. The importance of education about diabetes mellitus from an early age is a necessity for behavior and lifestyle changes as well as social support (Adam et al., 2018).

Higher knowledge of diabetes did not translate into good practice. Knowledge does not always result in a good attitude or positive behavioral changes (Herath et al., 2017).

Education and attitude

The findings in this study are the lack of positive attitudes possessed by diabetes mellitus patients. The results of the analysis also stated that there was no difference in the average attitude of people with diabetes mellitus based on their level of education. Table 2 shows a high level of knowledge that is not balanced with a positive attitude of people with diabetes mellitus. The formation of attitudes in the individual is influenced by the stimulus or object he encounters and involves thoughts and feelings. An individual's belief in the decisions made on a stimulus is important to have in determining an attitude.

Attitudes are the key construct to understanding an individual's trend to adopt and maintain certain standard behaviors. Knowledge is conceptualized as a set of information individuals need to master to administer their health condition. Only knowledge change is not enough, however, promoting behavior change also involves other variables including education, diagnosis time, health and disease-related beliefs, family support, and easy access to health services, among other dimensions (Rodrigues et al., 2009).

Education and behavior

This study found that the majority of diabetes mellitus patients had poor behavior in managing their disease conditions. The results of the analysis obtained there was no difference in the average behavior of diabetes mellitus patients based on their level of education. The process of formation of behavior is influenced by several factors. Unlike the case with the knowledge that can be changed quickly, the process of changing individual behavior takes quite a long time (Sulaeman, 2016). This means that educational activities alone have not been able to have an impact on changes in a person's behavior so internal and external motivation, role models, and continuous training are needed so that individuals can change their behavior according to the behavior expected in people with diabetes mellitus. Hospitals need to find strategies to shape the behavior of diabetes mellitus patients through ways such as reinforcing to patients.

Knowledge, attitude, behavior, and education

In general, this study shows that good individual knowledge is not always followed by changes in attitudes

and good behavior. Several factors influence a person's behavior including ability, needs, expectations, and environment. A good ability to understand the condition/disease experienced and the risks that may occur will form awareness to be able to behave and behave positively in efforts to cure a disease. This raises thoughts about the importance of the need for health information and education about what individuals need to achieve hope to achieve healthy living. Of course, the role of the social environment, especially the family, also forms a gradual change in individual attitudes and behavior.

Changing healthy living attitudes and behaviors requires continuous promotion so that they can improve their quality of life (Murad et al., 2020). Hospital health promotion (HPH/PKRS) is an effort to improve the understanding of patients, families, and visitors about various types of diseases and appropriate ways of prevention. In addition, PKRS is a hospital initiative to improve the ability of patients, families, and hospital visitors to play an active role in efforts to cure and prevent complications of disease (Muharani, 2020).

Providing information to improve the knowledge of DM patients is essential to improve patient empowerment. Empowerment is the process by which an individual has a greater ability to make decisions regarding self-care and carry out activities to maintain his health (Lambrinou et al., 2019). Following the principles of DM management, which includes lifestyle modifications, namely changing an unhealthy lifestyle into a healthy lifestyle such as regulating a diet, doing regular physical activity, and taking antidiabetic drugs a sticky according to the doctor's recommendations (Toharin et al., 2015).

Hospital health promotion is carried out at 5 levels of prevention which include health care in healthy community groups to improve health, preventive level health promotion in high-risk groups to prevent them from falling ill (*specific protection*), curative level health promotion so that patients recover quickly or do not become more severe (*early diagnosis and prompt treatment*), promotion health at the rehabilitative level to limit or reduce disability (*disability limitation*), promotion health in newly recovered patients (*recovery*) and recovery due to disease (*rehabilitation*).

In DM patients, health promotion is given with the aim that the disease does not become more severe due to complications of both microvascular and macrovascular.

During the Covid pandemic like today, there are many limitations encountered to being able to conduct education directly. So an information technology-based application is needed that can easily reach the entire community (Al Momani et al., 2021). There are many studies on patient education using information technology approaches that have been successful in transforming patient actions into healthy living actions to prevent the aggravation of disease (Zhai and Yu, 2020). The use of information technology to improve the quality of care for patients with diabetes mellitus enables health workers to more effectively manage patients and to help patients manage their disease (Pudiyanti and Afriani, 2020).

Self-management in diabetics has been recommended as a person's guide in making appropriate decisions. This includes knowledge, skills, ability, and confidence in making daily decisions, choosing and making positive behavior changes, and self-coping mechanisms by involving the emotional aspects of the disease with the context of his life. The patient's knowledge, attitudes, and behavior are influenced by several factors such as age, gender, education, marital status, occupation, diagnosis, and treatment and knowledge is oneself does not always bring a change in

attitude. Other studies have also shown the impact of education and psychological interventions on psychosocial outcomes such as depression, and diabetes associated with anxiety and quality of life. Educational techniques are shifting from didactic presentations focused on knowledge and information acquisition to patient-involved interventions, collaboration, empowerment, and interaction (Adam et al., 2018).

Health professionals need to understand that patients' difficulties to engage in behavior change can only be overcome through the transformation of attitudes and beliefs about the disease and treatment (Rodrigues et al., 2009).

New educational strategies are needed to enable people with diabetes to obtain knowledge to manage the disease and also to incorporate this knowledge into their daily routine, that is knowledge can transform people's attitude toward the disease (Rodrigues et al., 2009).

LIMITATIONS OF THE STUDY

This study has limitations during the data collection process. Data is collected in the hospital so that it may interfere with the patient's activities during treatment. To anticipate this, researchers minimize it by guiding the filling out of the questionnaire.

CONCLUSIONS AND SUGGESTIONS

The results of this study showed that there was no significant difference between the knowledge, attitudes, and behavior of diabetes mellitus patients based on their level of education. These results can be used as a basis for hospitals in developing an effective health promotion model for diabetes mellitus patients. Assistance for diabetes mellitus patients in managing their disease is needed as an effort to improve services in hospitals, where this assistance can be done directly or through information technology-based media. The use of information technology-based health promotion media is a need for patients who are currently relevant to the times. Its advantages include being efficient, routinely accessible, and easily accessible to its users to help patients recognize self-risks and train patients in forming good attitudes and behaviors.

ACKNOWLEDGMENT

The research team would like to thank the Director of Aisyiah Hospital who facilitated the research site and also LPPM, University of Muhammadiyah Kudus, for facilitating ethical clearance.

CONFLICT OF INTEREST STATEMENT

Researchers stated that this study did not cause potential conflicts when this study was published.

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