ORIGINAL ARTICLE

Effectiveness of Melpredia Prediabetes Self-Management Education Based on Android Applications on HbA1c Levels in People with Prediabetes

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ABSTRACT

Introduction*: Prediabetes is a condition that will develop into type 2 Diabetes Mellitus (DMT2) within 3-5 years. Glycaemic control is the primary intervention in long-term management, so structured education with appropriate and sustainable media is needed using mobile health technology.* ***Objectives****: The development of the "Melpredia" application based on an android application as a media for health promotion and its effect on HbA1c glycaemic control and self-care management.* ***Methods****: The Research type was Research and Development (R&D), and model testing using Quasi experiments with pre-test post-test control group design was carried out for three months from January to April 2021. The purposive sampling technique consisted of 15 intervention groups and 15 control groups. The data were tested using Paired t-test and an independent t-test. The research instrument used by application "Melpredia."* ***Results****: The Android-based Melpredia application obtained a percentage of 89% (Fair) and the feasibility test for material aspects with a percentage of 90% (excellent). Using the Melpredia application has the effect of Prediabetes Self-Management Education based on an android application on HbA1c levels of 5.927 ± 0.1831 in people with prediabetes than conventional health promotion (p = 0.001).* ***Conclusions****: Application "Melpredia" android based and can effectively improve the HbA1c levels and self-care management of prediabetes in preventing diabetes mellitus by utilizing educational menu, meal planning, physical activity, and reminders use applications. "Melpredia" is more effective than conventional.*

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Introduction

Before the occurrence of Diabetes Mellitus (DM), prediabetes started. Prediabetes is a chronic disease and impacts the quality of life (International Diabetes Federation, 2017). This condition is caused by poor self-management behavior starting from meal planning (diet), fewer fruits and vegetables, not doing regular check-ups, and smoking habits (CDC, 2011). This prediabetes can be prevented and controlled by controlling the risk factors for DM (Basina, 2019). If diabetes educators cannot be adequately managed, it will cause new problems, namely facilitating the course of the disease towards complications (Du, 2017).

There needs to be self-management of prediabetes to carry out self-care with diabetes (Rumahorbo, 2014). Self-management is a belief followed by an intention to take actions beneficial to health, including identifying specific strategies that can be carried out well (Ledford, 2019). The research results the provision of interventions must be accompanied by supporting media to make it easier to understand educational interventions by developing self-management of diabetes. Research findings suggest that after being given diabetes with self-management education intervention using media in the form of a calendar showed promising results in treating diabetic feet, becoming more obedient in caring for feet with a p-value of 0.000 (Umaroh, 2018).

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Another study on online training, which became a diabetes mellitus prevention strategy model, was well-received by users, namely professional health-based interactive modules that could increase the teaching components of health-based programs in transportation (Lari, 2018).

Thus, innovation is needed to overcome the problem by making interventions that follow prediabetes needs, namely an approach digital media named Android-based Smartphone. The prediabetes self-management education application is a media tool that is easy to use for self-management. This method still exposes health information to prediabetes workers and will provide diabetes.

Methods

The research was conducted in the Ciruas Public Health Center, Serang Regency. The research time was carried out in January April 2021. The type of research used in this study went through two stages: application design and research design (Sugiono.,2016). The application design uses a research and development (R&D) approach using the Software development life cycle (SDCL) method and quasi-experimental pretest-posttest research design with a control group.

The sampling method was simple random sampling through a 2-stage lottery. The first stage is to determine the sub-district used based on the area with the highest number of prediabetes; then, both intervention and control group was in the Ciruas Village.

The sampling technique was purposive sampling. The population of this study was people with prediabetes at the Work Area of the Ciruas Public Health Center, Serang Regency. Samples were 30 people divided into the intervention and control groups. Samples were selected based on inclusion and exclusion criteria.

The pretest was conducted simultaneously with the Melpredia application health screening in both groups by measuring TB, weight, blood pressure, and HbA1c. The final data (posttest) measurement was measured again by measuring HbA1C. The HbA1c examination was carried out at an International Standard Laboratory, namely at the Biomed Laboratory of Serang City.

The data obtained were then processed and analyzed statistically using SPSS 24. The data were tested for normality using the Shapiro-Wilk test because the number of samples was <50. After obtaining a normal distribution of data, the pre-post treatment data in the intervention and control groups were analyzed using the test Paired t-test. The difference between the posttest results of the intervention and control groups was analyzed using the Independent T-test.

Results and Discussion

3.1 Application Design

1. Needs Analysis

Based on the analysis needs, an assessment is obtained through field studies and studies of existing products. The results of field studies were conducted utilizing interviews and observations with 9 participants from Citerep Village, Pelawad Village, and PTM Puskesmas Ciruas talked about health promotion media commonly used to implement services for people with prediabetes or diabetes mellitus who still use conventional media (leaflet). Existing product studies, in a review of literature studies conducted by researchers regarding diabetes merits, mobile applications, which application users have made to improve the diabetic lifestyle of diabetic patients and diabetic patients. IT experts will design product studies in design. Develop education for prediabetes and diabetes in an android-based application called "Melpredia."

Melpredia is a prediabetes self-management education application intended for people with prediabetes to be a measuring tool to guide people with prediabetes in carrying out

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management at home as the success rate of the application for how obedient users are in running existing programs.

3. System and Design

This stage is preparing the most optimal process, data, process flow, and relationship between data to run the process and meet the needs according to the needs analysis results. At this stage, researchers compile information through flowcharts and interface designs submitted to informatics experts to make products.

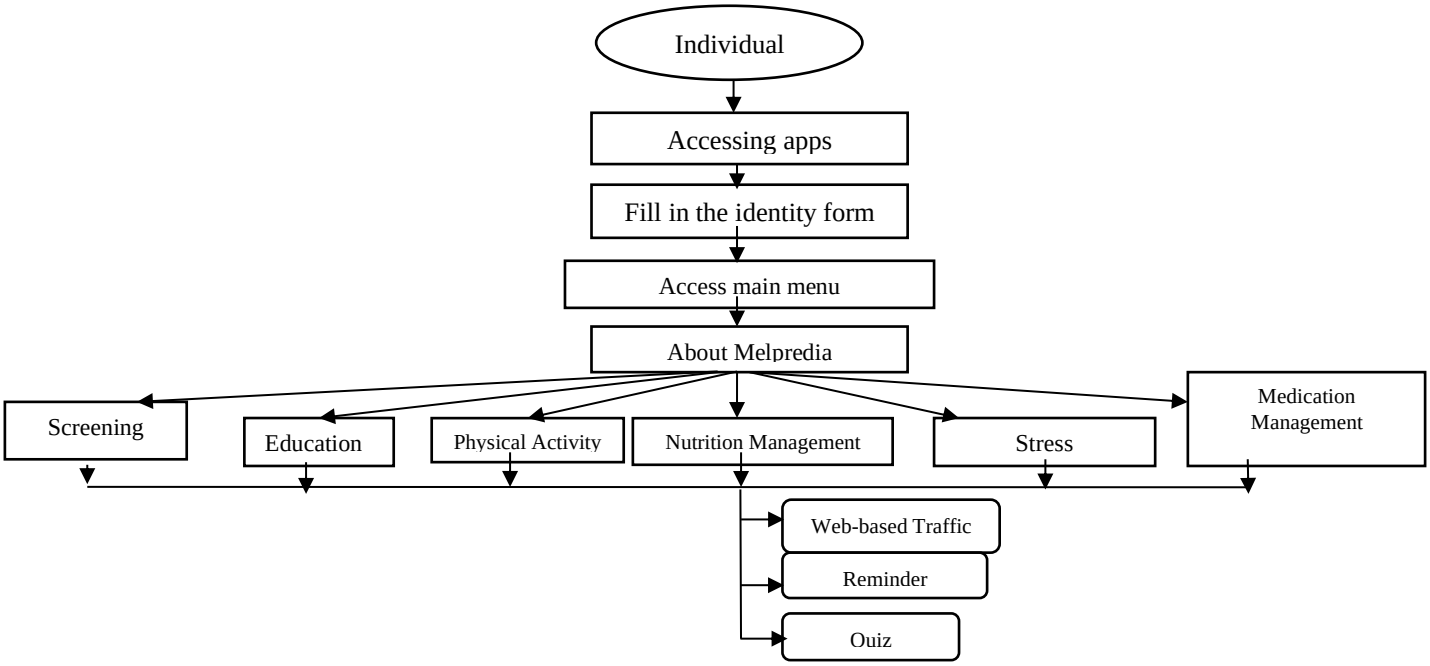

Figure 1. "Melpredia" application flowchart

4. Implementation

At this stage, the design translation that has been done previously uses the PHP programming language and uses a MySQL database.

5. Integration and Testing

This stage tests the "Melpredia" application; researchers conduct a feasible comprehensive test to determine the quality of the software. The measurement of software quality made in this study refers to ISO 9126.

The possibility test in the study was carried out on January 21, 2020, following the feasible test stages carried out by two IT experts, including the Functionality test with a value of 78.5%. Reliability test with a value of 87.5%. Usability test with a value of 89%. The efficiency test has a value of 93.75%. Maintainability test with a value of 83.3%. Testing the portability aspect is done by installing and running applications developed on various Android systems, echoing from Jelly Bean, KitKat, Lollipop, Marshmallow, Nougat.

The average Melpredia application feasible test obtained a value of 89% with the Good/Easy to use category according to the ISO 9126 standard. Material testing aims to determine

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the possibility of the application in terms of material aspects contained in the application. This test was carried out by internal medicine specialists and KMB specialist lecturers and obtained a score of 90%.

6. Operation and Maintenance

After the integration and testing stages were carried out, it was found that there were several errors in each action in the application; namely, the traffic data that appeared did not match on the web, the sound in the video explanation of each menu was not clear, there was lagging of inputting nutrition data and physical activity.

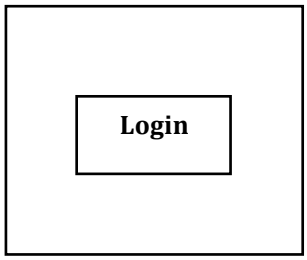


Figure 2. User Interface (Splash Screen)

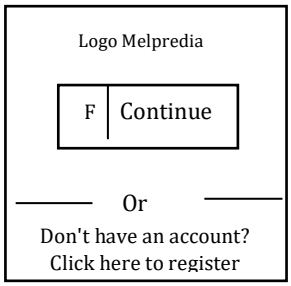


Figure 3. Login Menu Interface

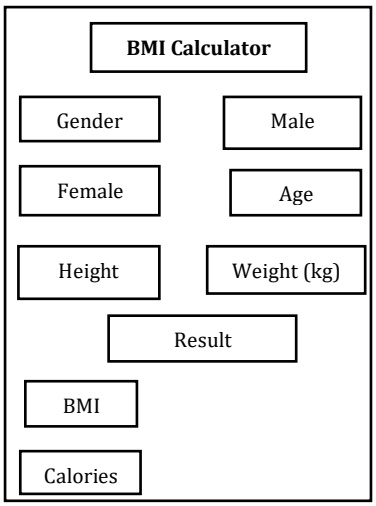


Figure 4. Screening Interface

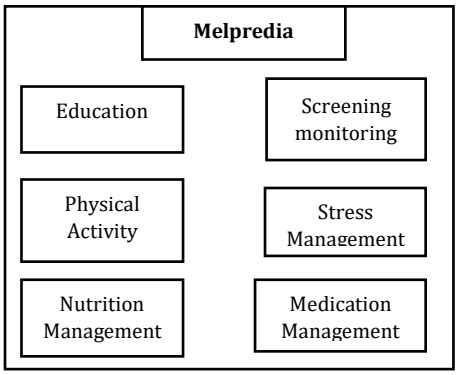


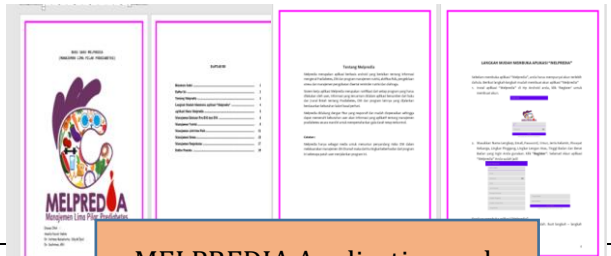
Figure 5. Interface

Figure 6. Interface Reminder

Product Results

1. Android Based Melpredia Apps

2. Guide pocketbook



3. Melpredia website

MELPREDIA Application web link
http://melpredia.com/

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3.2 Research and Design

1. Univariate Analysis

Table 1 described the respondent's frequency distribution based on age, obesity, and hypertension in intervention and control groups. The respondents' mean age is 40 years which is the age in the middle adult category. There were no significant differences in mean age, BMI of obesity, systolic, and diastolic blood pressure between the intervention and control groups (p>0.05), indicating that the effect that occurs on pure HbA1c levels is influenced by the intervention given. Not because of differences in the distribution of data on the characteristics of respondents in each group. Besides, these results indicate that most of the prediabetes is in late adulthood with obesity and hypertension, so promotive and preventive activities are still needed, such as efforts to carry out PSME interventions (**Melpredia** application) using various sources related to prediabetes, aiming to stabilize glycemic control for people with prediabetes to diabetes mellitus.

Table 1. Frequency Distribution Respondents Based on Age, Obesity, and Hypertension in the Intervention Group and Control Group at UPT Puskesmas Ciruas Serang Regency 2021

Variables	Group		p
	Intervention n (15)	Control n (15)	
	Mean ± SD	Mean ± SD	
Age	40±13,793	40±12,263	0,464*
Obesity	28±5,250	28± 6,422	0,289*
Hypertension			
Systolic blood pressure	139,80 ± 12,143	148,783±14,139	0,769*
Diastolic blood pressure	94,67 ± 10,601	93,67± 8,550	0,627*

*Chi-Square test p >0.05

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2. Bivariate Analysis

Table 2 illustrated the differences in HbA1C; it was found that in the intervention group, there was a significant difference in the HbA1c value of people with prediabetes before and after being given the **Melpredia** application as a PSME media based on a significant android application (p-value <0,05). While in the control group, there was no significant difference in the HbA1c value of people with prediabetes before and after being given **Melpredia** application as a PSME media based on a significant android application (0.140 > 0.05). This result shows that using the Melpredia application Android-based applications as PSME media can significantly reduce the HbA1c value, and conventional media (leaflets) does not significantly affect the HbA1c value.

Based on table 3, it was found that in the intervention and control groups, there were different mean values of HbA1c. It can be seen that between the two groups, the mean value of HbA1c is different, namely the intervention group of 5,927 and the control group of 6,173 so that the mean difference between the two groups is 0,210, which means that there is a significant difference between the two groups caused by a given treatment. The *p-value* is 0,001 < 0,005; then, according to the basis of decision making in the test, it can be concluded that Ho is rejected, which means that there is an effect of the **Melpredia** application on decreasing HbA1c levels in people with prediabetes.

Table 2. The Differences in Hba1c Levels in The Intervention Group and Control Group at UPT Puskesmas Ciruas Serang Regency, January – April 2021

HbA1c		Pretest	Post-test	Mean difference	p
Intervention	Mean	6,130	5,927	0,203	0,002*
	SD	0,1935	0,1831	0,013	0,140
Control	Mean	6,160	6,173		
	SD	0,1298	0,1981		

*Paired T-test

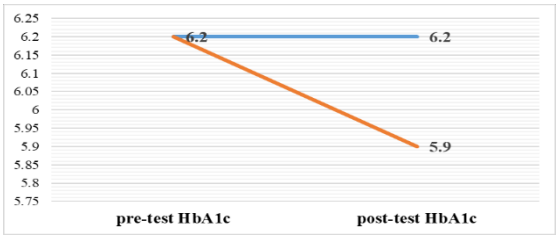

Table 3. Effect Of Prediabetes Self-Management Education Based on Melpredia Application on Hba1c Levels at UPT Puskesmas Ciruas Serang Regency, January – April 2021

Variable	Group	Mean	Std	ΔMean	P
HbA1c Post-test	Intervention	5.927	0.1831	0.210	0.001*
	Control	6.173	0.1940		

*Independent T-test

Table 4. shows that the acquisition of the effect size is 1.1, so in the high category and the effect size of the Prediabetes self-management education application before and after the intervention is around 86%. These findings show that prediabetes self-management education based on android applications has a high enough effect on decreasing HbA1c levels in people with prediabetes.

Table 4. Effect Size Results

HbA1c	Mean	Std	Effect size	Percentage (%)	Additional Information
Intervention	0.2167	0.14764	1.1	86%	High
Control	0.0141	0.20092			

This study can be seen from the effect size of 1.1, which means that this research is strong. Based on the table above, the RR value of 2.6 means that the subjects given the **Melpredia** application intervention based on the android application decreased HbA1c levels by 2.6% compared to the control group. Then the Relative Risk Reduction (RRR) value is 1.6, meaning that if the **Melpredia** application based on the android application is used as therapy, the decrease in HbA1c levels can be reduced by 62.5% compared to using only leaflet media. Furthermore, this study's Absolute Risk Reduction (ARR) value was 0.5. When using the **Melpredia** application intervention based on the android application as therapy, the decrease in Hba1c levels between the intervention and control groups was 5%.

Table 5. Comparison Of Hba1c Levels Between the Intervention and Control Groups at UPT Puskesmas Ciruas Serang Regency, January – April 2021

Group	HbA1c		Total	RR	RRR	ARR	NNT	NNH
	Yes	No						
Intervention	10		15	2,6	1,6	0,5	1,875	
Control	13		15					

Discussions

Feasibility of Prediabetes Self-Management Education (Melpredia Application) Based on Android Application Against HbA1c Levels in People with Prediabetes

Nursing information technology continues to develop today. Nursing information systems are used as data storage, from assessment to evaluation (Warren., 2018). The development of health applications currently uses the Android system more because the Android system has more ease of access, operation, and ease of studying existing information, which are criteria that health applications must meet (Du., 2017). The android system is used by researchers because many Indonesian users use Android. Mobile phone users in Indonesia amounted to 89,2% of the total number of Smartphone users in Indonesia (Handayani., 2018).

The development of prediabetes *self-management education* is part of the development of advances in information technology in health. The development of prediabetes self-management education made by the researcher was named the **Melpredia** Application (Management of the Five Pillars of Prediabetes) based on an android application, namely an application that has gone through the development stages referring to the provisions of ISO 9126 starting from the Functionality, Reliability, Usability, Efficiency, Maintainability and Portability tests. All the stages that were passed obtained an average result of 89% in the "Good/ Decent" category, while in terms of material, the material contained in the "**Melpredia**" application had been through a material aspect test carried out with two material experts' validators and obtained 90% results with the category "Very good". The use of smartphones in the development of information technology is expected to be applied in health. This finding is in line with research that states that applications on smartphones on Android can be useful in all aspects of human life in helping to control and control non-communicable diseases, especially DM (Srof., 2015).

Melpredia application is an android-based application specifically designed to help people with prediabetes improve their understanding of prediabetes and be applied at home. This

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application contains education, nutrition, physical activity, and stress management, equipped with video explanation features and notifications for eating schedules and physical activities such as diabetic foot exercises and prediabetes quizzes as primary measures independently at home. **Melpredia** application is available on a website and traffic data in statistics.

The advantages of the **Melpredia** application based on menu features include this educational menu feature contains an explanation of prediabetes and diabetes mellitus material until the treatment stage and is also equipped with a video explanation of the material. The results of the study support the results of research conducted explaining that if the information is conveyed by someone who is an expert in the field directly and voluntarily pays attention, then the message conveyed will be more exciting and easily understood by respondents (Silalahi., 2018).

The nutrition management menu feature in this application explains food selection and nutrition, but this feature is not explained in video form. This nutrition management menu feature contains a notification that can be set by people with prediabetes in managing their lifestyle. The study results that support this research are the research of Tuzzahro et al., showing that food video is one of the media for delivering messages that are considered effective. The knowledge that exists in a person is received through the senses. The sense that most transmits knowledge to the brain is the sense of sight. Human knowledge is approximately 75% to 87% obtained or transmitted through a sense of sight, 13% through the sense of hearing, and the rest 12% is channeled through other senses (Tuzzahro., 2015). Nutritional management influences reducing HbA1c levels in people with prediabetes. After participating in this study, prediabetes knows more about what types of food are recommended, limited, and avoided, knows the body's calorie needs, and can arrange the food menu in a day correctly. These tasks were done well because the prediabetes already has the Melpredia Application, equipped with a notice reminder if the prediabetes forgets the regularity of eating patterns and the prediabetes pocketbook that the prediabetes has used. The food menu evaluation has been carried out by researchers regarding what has been consumed by prediabetes in the application logbook **Melpredia**. This study also has the same results as the research conducted by Herring et al., related to nutritional counseling for people with diabetes and has been shown to increase respondents' knowledge and skills in determining balanced nutrition (Herring., 2018).

The physical activity menu feature in the Melpredia application contains material explanations and videos of diabetic foot exercises. Physical activity reported by the World Health Organization is carried out regularly as much as 3-5 times per week for at least 30 minutes with a total of 50 minutes per week and intervals of exercise not more than two consecutive days. In this Melpredia application feature, the researcher does not evaluate in a separate logbook, so the researcher cannot evaluate whether the respondent is obedient or not related to the physical activity carried out. The physical activity given to prediabetes is from diabetic foot exercises. Diabetic foot exercise is a promotive and preventive activity given to prediabetes to increase the feet' sensitivity to improve blood circulation in the feet (Aprina., 2018). The study results were also obtained from research conducted by Wahyuni et al. The results showed that there was an effect of foot exercise on the Ankle Brachial Index of people with diabetes mellitus (Wahyuni., 2015).

Another **Melpredia** application menu feature is stress management and medication. Stress management carried out by researchers is in line with the Ministry of Health Program contained in the smart program; the community is recommended to be able to manage stress well, which is one of the educations carried out in various community settings ranging from schools, households, workplaces, places of worship and places of worship. Public places. The purpose of the Ministry of Health is related to recommendations for the community to manage stress well, so

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that people can minimize problems better so as not to make stress led to disease (Kemenkes., 2019).

The Android-based **Melpredia** application designed by researchers by presenting several features shows that the **Melpredia** application is superior to other diabetes applications. In addition, this application was developed to detect DM as early as possible to reduce morbidity and mortality due to DM. This innovation is expected to provide health policies related to non-communicable diseases, especially DM. Meal schedule reminders and physical activity on the **Melpredia** application show the android system's performance. This study found that participants expected notifications and sounds on the **Melpredia** application alarm. It is intended to make it easier for people with prediabetes to remember eating schedules and physical activity. This application reminder is in line with it is known that the alarm can be used as a reminder medium for eating or taking medicine and can make changes if there is an error when entering data (Handayani., 2018).

The drawback of the **Melpredia** application is that the application features still need to be developed to make it more exciting and less overwhelming. An explanation of each educational menu needs to be added with a video for each menu feature of the **Melpredia** application, such as adding a meal planning video and medication.

This study found that the feasibility of the **Melpredia** application was under the self-management education guidelines for people with prediabetes but needed to be explained and refined in more detail in the future. Self-management is an individual's effort to regulate and control his behavior. Individual self-management can train them to evaluate, regulate, monitor, and be responsible for themselves.

Differences in HbA1c Levels of People with Prediabetes Before and After Being Given Prediabetes Self-Management Education Based on Android Applications Between Intervention and Control Groups

HbA1c levels of Prediabetes between the intervention and control groups were different. The results showed that using the Paired t-test, in the intervention group, there was a significant effect of PSME (**Melpredia** Application) on HbA1c levels of people with prediabetes (p-value < 0,05). Meanwhile, in the control group, there was no effect of PSME (**Melpredia** Application) on HbA1c levels of people with prediabetes (p-value > 0,05).

The study findings have shown a difference between the intervention group and the control group, which can be seen from the mean value of the intervention group that there is a significant decrease in HbA1c levels compared to the control group. It might be because the intervention for prediabetes is essential to improve self-management through the **Melpredia** application to reduce HbA1c levels in managing their disease. Whereas in the control group, respondents only received leaflets and information from PTM 'Posbindu' activities related to diabetes mellitus, home care was not comprehensively provided, and information was obtained only from family, friends, and neighbors. These results are also following previous studies related to the provision of interventions.

A similar study conducted results that the use of SMS as a medium through mobile phones for education with diabetes using the DSME component proved a significant decrease in HbA1c <7,0% (53 mmol/mol) in the intervention group compared to the control group. Another study conducted through a prediabetes and diabetes self-management program (telehealth) based on cellular phones and the web has shown changes in HbA1c at week 12. The telehealth application is claimed to save costs because patients are monitored from home (Warren., 2018).

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The results of a similar study were also carried out by developing a technological tool in the form of an electronic device used for health promotion with HPM-based diabetes to produce a self-management of physical activity and HbA1C (Lari., 2018). The research results show that the provision of lifestyle interventions is proven to improve one's health status, health behavior, and self-management, and there are differences between the intervention group and the control group (Andriyanto., 2018). The intervention given emphasizes the management of prediabetes through self-management education based on an android application named by the application researcher "**Melpredia**."

The purpose of the intervention application "**Melpredia**" is to control or reduce the HbA1c level of prediabetes to a normal condition. The average HbA1c value before was 6,130 to 5,927 after being given the "**Melpredia**" application in the intervention group. Meanwhile, there was no significant change in the mean in the control group due to using conventional media (leaflet).

The Effectiveness of Prediabetes Self-Management Education Based on Android Applications on HbA1c Levels of People with Prediabetes in the Intervention Group

The results were obtained from post-blood sampling within three months. The difference in HbA1c levels can be seen in table 4. after being given the Melpredia application, which is 5.927, it has decreased compared to the control group of 6.173 with a p-value of 0,001 <0.05. Meanwhile, after being given PSME (Melpredia Application) the intervention and control groups, the mean difference value to 0,210 experienced a significant decrease. It happened because the treatment given by the researchers to the two groups was different, resulting in a decrease in HbA1c levels. When viewed from the results of the effect size analysis, the effect of prediabetes self-management education based on an android application (**Melpredia** Application) is 86%. This result is also proven by previous studies that have been carried out.

The results of similar research that progressive muscle relaxation carried out continuously has a remarkable impact on reducing HbA1c levels. The same thing was done by Husein et al. The difference in HbA1c levels in the intervention group and the control group before and after being given self-care through Short Message Service (SMS) (Hussein., 2011). Other studies that support the effect of self-management education found differences in HbA1c levels in the intervention and control groups before and after being given self-care education (Surucu., 2018).

According to the researcher, three months is a short time to assess the PSME intervention based on an android application on HbA1c levels. Another study stated that the use of m-health for six months resulted in a decrease in HbA1c between the intervention and control groups. This finding is in line with Patandung's research that structural education with health training by telephone can increase health literacy and reduce HbA1c levels of people with Diabetes Mellitus (Patandung., 2018).

Promotive and preventive activities with efforts to disseminate information and practical education to people with prediabetes need to be carried out because prediabetes education is an activity that aims to control glycemic levels as prevention of diabetes mellitus (Tuomilehto., 2017).

Education to promote the health needs to be carried out as part of efforts to prevent and control prediabetes. The International Diabetes Association believes that in preventing diabetes or ongoing disease complications, it is necessary to have health education on self-management behavior of prediabetes (Lari., 2018).

The selection of the proper method in implementing self-management health education is crucial regarding who receives it, the willingness of time, and health promotion personnel. Promotive and preventive activities with effective dissemination of information and education through community nursing intervention strategies regarding prediabetes and diabetes mellitus

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need to be carried out because education for prediabetes and diabetes is an activity that aims to prevent the risk of complications caused by uncontrolled glycemic (Stanhope., 2019).

The method of health education so far is still in discussions, lectures, and demonstrations. It needs to be a concern, especially nurses, in carrying out their duties as educators to take advantage of technological advances, especially the use of android-based applications as educational facilities without being limited by space and time so that people with prediabetes and diabetes can access obtain health information about disease management (Gayatri., 2019).

Melpredia application is part of innovative media development in the health sector, particularly in managing people with prediabetes. This education is a form of intervention to improve people's self-management with prediabetes in reducing HbA1c levels. **Melpredia** application menu features consist of five pillars of diabetes mellitus management, including prediabetes and diabetes mellitus education, nutrition management, physical activity, stress management, and medication.

Another goal of this research is to reduce the gap in health status by applying multidisciplinary science between policy and digital technology. This strategy is considered more effective and cost-effective than conducting widespread health screening; the approach through a personal mobile system is more effective in meeting the needs of lifestyle modification, preventing the burden of chronic disease in the world because of its ineffectiveness in improving public health status without being constrained by distance and time.[57] This is supported by research by Kao and Liebovitz., 2017 that the development of mobile health-based applications needs to pay attention to aspects of self-management related to health and daily motivational support for people with diabetes to focus on planning independently at home (Kao., 2017).

Melpredia application is an intervention given to prediabetes referring to diabetes mellitus. In line with research conducted by Zhou et al., an android-based diabetes management application is effective in managing diabetes, lowering HbA1c levels, and improving clinical conditions, behavior, and knowledge of prediabetes (Lari., 2018). Mobile technology and the internet are widely accessible 24 hours and utilized to promote disease management and facilitate behavior modification. A decrease in HbA1c is considered clinically significant if it reaches prediabetes or normal levels. As quoted from the page of the American Diabetes Association, the following are the categories of HbA1c results, normal HbA1c <6,0%, prediabetes HbA1c 6,0-6,4%, and diabetic HbA1c 6,5%. For people with prediabetes themselves, it is generally expected that HbA1c can decrease to 6,4% by maintaining glycemic control. Management of prediabetes education is essential to keep the glycemic control of prediabetes under control; it can be seen from the HbA1c value. The average blood glucose level of the previous 30 days was a significant contributor to HbA1c. The average contribution of blood glucose to HbA1c was 50% from the last 30 days, 25% from the previous 30 -60 days, and 25% from the previous 60-120 days (Patandung., 2018). So, an educational program of at least 30 days is needed to keep the glycemic profile under control. This result is in line with the study results were using electronic media using the **Melpredia** application as a PSME medium effectively reduced the HbA1c value.

According to Cotter et al., the implementation of electronic or web-based interventions helps the management of prediabetes to facilitate the glucose monitoring process, allowing prediabetes to upload monitoring data so that doctors can adjust the dose of drugs given. The use of android-based electronic media to send text messages containing prediabetes self-management programs showed a significant decrease in HbA1c values compared to the control group.

The study results can be concluded that Prediabetes Self-Management Education is influenced by an android application on HbA1c levels of people with prediabetes. It is due to the development of information and communication technology to encourage self-management for

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people with prediabetes. Innovative strategies are needed to improve the *self-management* of people with prediabetes, although, in its implementation, it has certain obstacles caused by the diversity of community characteristics and diverse demographic and regional conditions.

Conclusion

PSME intervention with Android-based **Melpredia** Application media affects lowering the level value so that it can be concluded that the explanation of this research is as follows:

1. The Android-based **Melpredia** application is suitable for use as an educational medium for people with prediabetes. Based on the expert feasibility test results, the results obtained 89% (Fair) and the feasibility test of the material aspect with a percentage of 90% (excellent).
2. There is a significant difference in reducing the HbA1c value before and after receiving the **Melpredia** application. While in the control group, there was no difference in HbA1c levels before and after being given the **Melpredia** application.
3. PSME intervention with android-based **Melpredia** application as an educational medium for 12 weeks affected decreasing HbA1c levels by 0,210 (difference in mean decrease).

Recommendations

1. Department of Health

Programs related to promotive and preventive efforts need to be reviewed to integrate health education provided to people with prediabetes using various media. More interactive and applicable according to prediabetes needs, such as the Android application-based **Melpredia** application that will be given by researchers to hospitals and health centers for free so that the goals of education can be achieved.

2. Nurses and Health Workers

Nursing interventions should be tailored to the needs of prediabetes and diabetes and the Indonesian Health Program, which is growing with the existence of health technology through electronic media. This intervention can be carried out by health workers, especially nurses who act as educators, facilitators, and nursing care providers who are expected to be able to implement PSME regularly by socializing the educational media of the Android-based **Melpredia** Application to prediabetes and people with diabetes to be applied in managing self-management at home.

3. Prediabetes

Prediabetes needs to take advantage of existing health electronic media facilities to find out how to control their glycemic levels, so that information related to self-management education of prediabetes and diabetes can be applied in everyday life.

4. Further Research

Future researchers are expected to conduct further research on prediabetes self-management education interventions based on android applications by adding features of diabetes games in virtual environments, reward-based and social life in cyberspace. The game method with reward-based, for example, monitoring blood sugar, is enough to motivate people with prediabetes and diabetes to learn and practice it in real life.

Limitations of the research

This research still has limitations, including the **Melpredia** application that still requires a sensor accuracy level of how good the accelerometer device is in the cellphone. The higher the accelerometer device on the cellphone, the more accurate physical activity results and calories.The need for additional devices that can measure actions to change the behavior of prediabetes or people with diabetes in managing themselves to maintain blood sugar levels within

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normal limits. Such as a warning if the bodyweight exceeds the standard limit and a warning in stress management and physical activity.

Ethics approval and consent to participate

Ethical approval in this study was obtained from the Medical Research Bioethics Commission / Health Faculty of Medicine, Sultan Agung Islamic University, Semarang.

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