International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR | Volume 9 | Issue 2 | Apr - Jun - 2021
www.ijamscr.com

Research article Medical research

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

Amelia Nurul Hakim[1], Hotma Rumahorbo[2], Sudirman[3]

[1]*Nursing Student, Postgraduate Program,Master Applied of Health*
[2]*Health Polytechnic Ministry of Semarang, Semarang, Indonesia*
[3]*Health Polytechnic Ministry of Semarang, Semarang, Indonesia*

***Corresponding Author: Amelia Nurul Hakim**
Email id: amelianurulhakim28@gmail.com

ABSTRACT

Background:Prediabetes is a condition that will develop into type 2 Diabetes Mellitus (DMT2) within 3-5 years.Glycemic control is the main intervention in long-term management, so structured education with appropriate and sustainable media is needed to use mobile health technology.
Method:Research and Development (R&D) and model testing using QuasiExperimental with *pretest posttest* control group design were carried out for 3 months from January to April 2021. Samples were taken by *purposive sampling* technique consisting of 15 intervention groups and 15 control groups. The data were tested using *Paired t-test* and *Independent t-test.*
Conclusion :It has been composed of "**Melpredia**" android based and can effectively improve the HbA1c levels and *self care* management of predibetibetes by providing Mel educational meanings.
Suggestion :The results of this study can be used as a reference in providing educational interventions to be patient with predibetes.

Keywords : Prediabetes Self Management Education, HbA1c, Application based android

INTRODUCTION

Before the occurrence of diabetes Mellitus, predabetes started.Prediabetes are a chronic disease and have an impact on the quality of life.This is caused by poor *self-management* behavior starting from meal planning (diet), less consumption of fruits and vegetables, not doing regular check-ups, and smoking habits. These predabetes can be prevented and controlled by controlling the risk factors for DM. If diabetes educators cannot be managed properly, it will cause new problems, namely facilityating the course of the disease towards complications.

There needs to be *self-management* of people with prediabetes to carry out *self-care* with diabetes. *Self-management* is a belief followed by an intention to take actions that are beneficial to health, including the identification of certain strategies that can be carried out well. The results of the research 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 conducted stated that after being given diabetes *self management education* intervention using media in the form of a calendar showed good results in treating diabetic feet, becoming more obedient in caring for feet with *p value* 0,000. Another study on online training which became a model of diabetes mellitus prevention strategy was well-received by users, namely professional health-based interactive modules that could increase the teaching components of health-based programs in transportion.

To overcome this problem, innovation is needed by making interventions that are in accordance with the needs of prediabetes, namely an approach through digital media, named Android-based Smartphone. The prediabetes *self management education* application is a media tool that is very easy to use for self-management because this method still exposes health information to predabet 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, namely application design and research design.The application design uses a research and development (R&D) approach using the Software development life cycle (SDCL) method and *quasi experimental* a *pretest posttest* research design with cintrol group.

The sampling method was simple random sampling through a 2-stage lottery. The first stage is to determine the sub-district used, namely the area with the highest number of predibetes, the intervention group is in the Clever field Village and the control group.

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 was 30 people who were divided into two groups, namely the intervention and control groups. Samples were selected based on inclusion and exclusion criteria.

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

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

The data obtained was then processed and analyzed statistically using SPSS 24. The data was tested for normality using the *Shapiro-Wilk* test because the number of samples was <50, then after obtaining a normal distribution of data, the *pre-post* treatment data in the intervention and control groups wasanalyzed 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

A. Application Design

1. Needs Analysis

Based on the needs of analysis, an assessment is obtained through the results of field studies and studies of existing products. The results of field studies conducted by means of interviews and observations with 9 participants from Citerep Village, Pelawad Village and PTM Puskesmas Ciruas told about health promotion media that are commonly used in the implementation of 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 have been made by application users to improve the diabetic lifestyle of diabetic patients and diabetic patients. Product studies in design will be designed by IT experts. Development of education for predabetes and diabetes in an android-based application called "**Melpredia**".

Melpredia is a Prediabetes *Self Management Education* application that is intended for people with prediabetes with the aim of being a measuring tool to guide people with prediabetes in carrying out 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 the stage of preparing the most optimal process, data, process flow and relationship between data to run the process and meet the needs according to the results of the needs analysis. At this stage, researchers compile information through flowcharts and interface designs which will be submitted to informatics experts to make products.

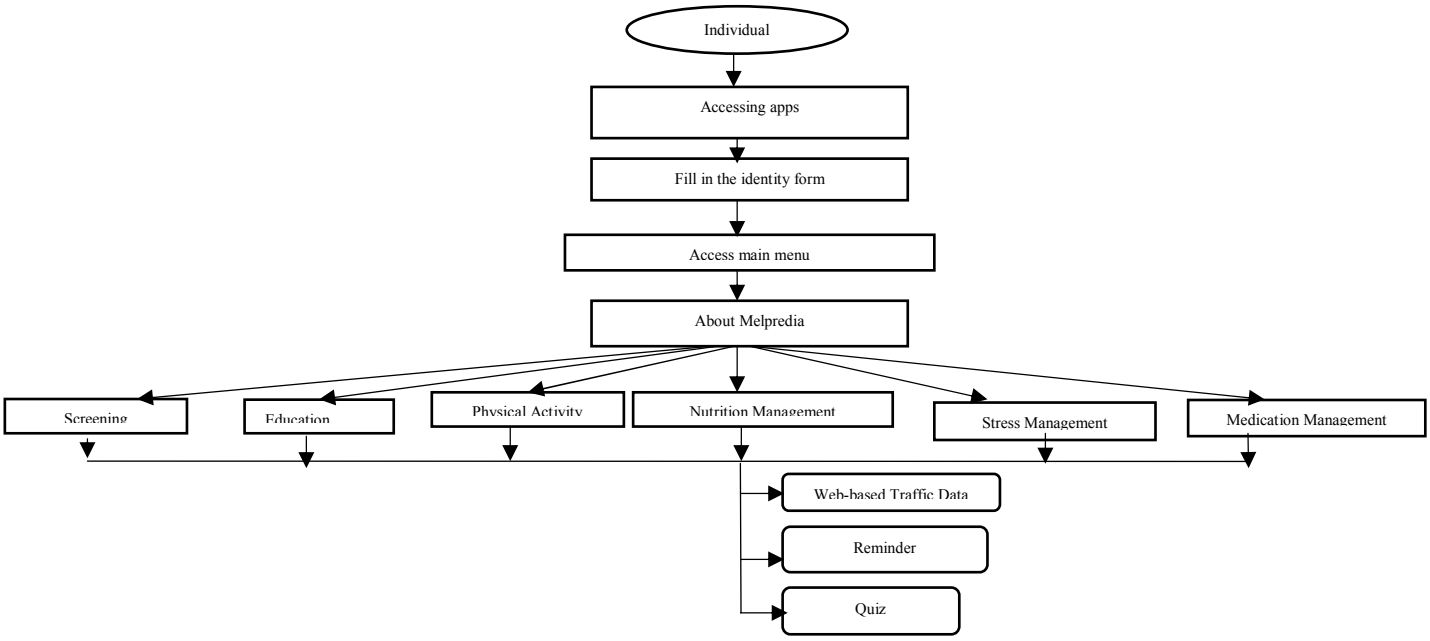


Figure 1. "Melpredia" application flowchart

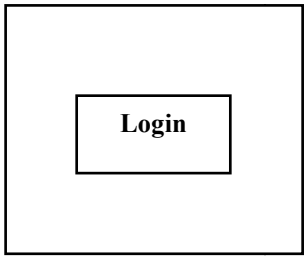


Figure 2. User Interface (Splash Screen)

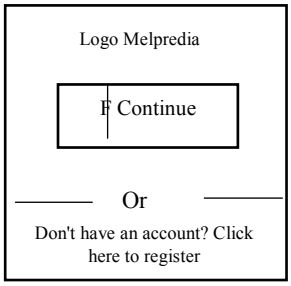


Figure 3. Login Menu Interface

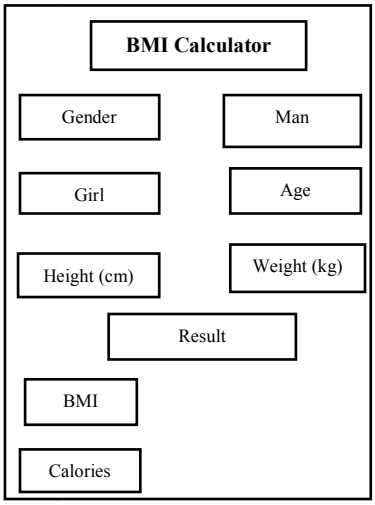


Figure 4. Screening Interface

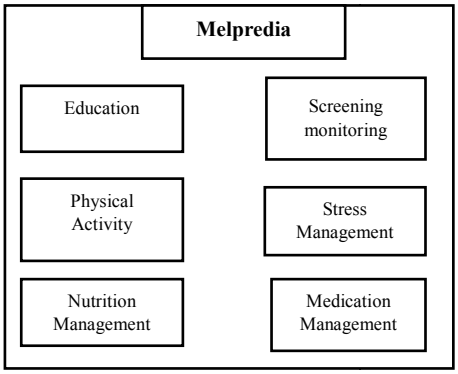


Figure 5. Interface

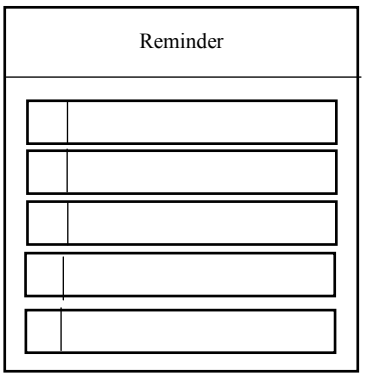


Figure 6. Interface Reminder

4. Implementation

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

5. Integration and Testing

This stage is testing the "**Melpredia**" application, the test is carried out by researchers by conducting an overall feasible test to determine the quality of the software. My 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 of78.5%. 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 an value of 83.3%. Testing the portability aspect is done by installing and running applications that can be developed on various Android systems, ringing 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 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%

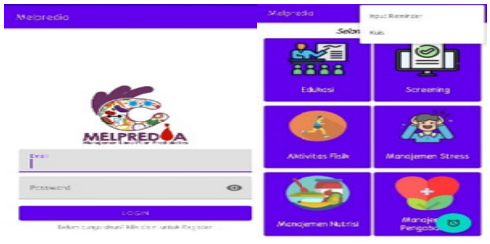
6. Operation and Maintenance

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 web, the sound in the video explanation of each menu was not clear, there was lagging of inputting nutrition data and physical activity.

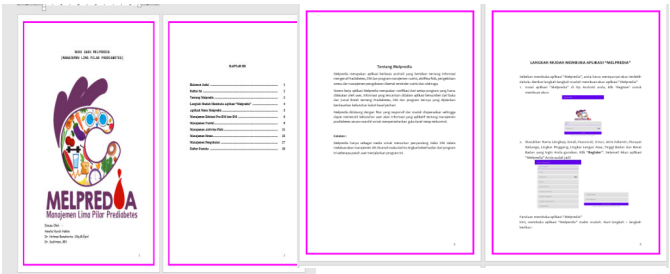
PRODUCT RESULTS

1. Android Based Melpredia Apps

MELPREDIA
Manalemen Lima Pilar Prediabetes



2. Guide pocket book



3. Melpredia website

B. Research And Design

1. Univariate Analysis

Table 1. Frequency Distribution Respondents Basedon 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**

Based on table 1, it can be seen that the average age of respondents in the intervention and control groups is 40 years which is the age in the middle adult category. This means that it represents the average age of the population.

Respondents with obesity had a mean BMI of 28 in both groups and a standard deviation of 5,250 in the intervention group and 6,422 in the control group. The proportion of hypertensive subjects had a mean systolic blood pressure of 139 and a standard deviation of 12,143 in the intervention group. The control group had a mean systolic blood pressure of 148 and a standard deviation of 14.139. The proportion of hypertensive subjects had a mean diastolic blood pressure of 95 and a standard deviation of 10,601 in the intervention group. The control group had a mean diastolic blood pressure of 93 and a standard deviation of 8,550.

The value of *Chi Square* test on the variables of age, obesity and hypertension showed p > 0,05 meaning that there was no difference in the average age, obesity and hypertension in the intervention and control groups, it can be concluded 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.

These results indicate that most of the prediabetes are in late adulthood with obesity and hypertension so that promotive and preventive activities are still needed, such as efforts to carry out PSME interventions (**Melpredia** application) using various sources related to prediabetes which aim to stabilize glycemic control for people with prediabetes to diabetes mellitus. .

2. Bivariate Analysis

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

HbA1c		Pre test	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**

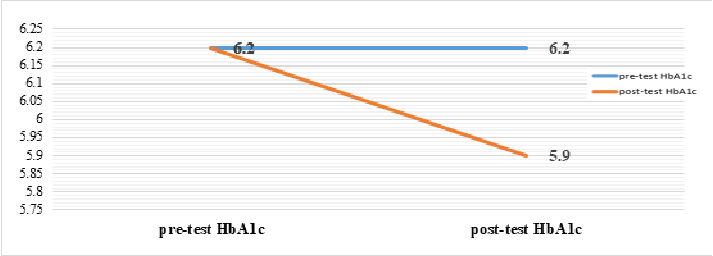


Chart 1. Decrease in HbA1c

Based on table 2 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 an android application that was significant (p value 0,002 <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 an android application that was significant (0,140 > 0,05). This shows that the use of the **Melpredia** application

Android-based applications as PSME media can significantly reduce the HbA1c value and the use of conventional media (leaflets) does not have a significant effect on the HbA1c value.

Table 3.EffectivenessOf Prediabetes Self Management Education Based On Melpredia ApplicationOn 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**

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 large 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 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			

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%. This shows that the effect of prediabetes self management education based on android applications has a high enough effect on decreasing HbA1c levels in people with prediabetes.

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	5	15	2,6	1,6	0,5	1,875	0
Control	13	2	15					

In this study, it 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 who were 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, the Absolute Risk Reduction (ARR) value in this study was 0,5, which means that when using the **Melpredia** application intervention based on the android application as therapy, the difference in the amount of decrease in Hba1c levels between the intervention and control groups was 5%.

DISCUSSION

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 not only used as data storage, but starting from the assessment process to evaluation can be utilized.[90] The development of health applications currently uses the Android system more because the use of the Android system has more ease of access, operation and ease of studying existing information, which are criteria that must be met by health applications.[13]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.[26]

The development of prediabetes *self management education* is part of the development of advances in information technology in the world of 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 2 material expert 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 the world of health. This is in line with research which 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.[61]

Melpredia application is an android-based application that is specifically designed to help people with prediabetes to improve their understanding of prediabetes and can be applied at home. This application contains material on education management, nutrition management, 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 in the form of a website and traffic data in the form of 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 information is conveyed by someone who is an expert in the field directly and voluntarily pays attention, then the message conveyed will be more interesting and easily understood by respondents.[91]

The nutrition management menu feature in this application consists of an explanation of food selection and how to choose 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 results of the study 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. 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. Approximately 75% to 87% of human knowledge is obtained or transmitted through the sense of sight, 13% through the sense of hearing and another 12% is channeled through the other senses.[92]Nutritional management has an influence on reducing HbA1c levels in people with prediabetes, because after participating in this study, prediabetes know more about what types of food are recommended, limited and avoided, know the body's calorie needs and can arrange the food menu in a day correctly. This is done well because the prediabetes already have the **Melpredia**Application which is equipped with a notice reminder if the prediabetes forgets the regularity of eating patterns and the prediabetes pocket book that has been used by the prediabetes. The evaluation of the food menu 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.[93]

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 2 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 people with prediabetes is in the form of diabetic foot exercises. Diabetic foot exercise is a promotive and preventive activity given to prediabetes to increase the sensitivity of the feet in order to improve blood circulation in the feet.[94] The results of the study were also obtained from research conducted by Wahyuni et al., that the results showed that there was an effect of foot exercise on the Ankle Brachial Index of people with diabetes mellitus.[95]

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 be able to manage stress well, so that

people can minimize problems better so as not to make stress lead to disease.[10]

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 to detecting DM as early as possible, this application was created to reduce morbidity and mortality due to DM. This innovation is expected to provide input for health policies related to non-communicable diseases, especially DM.Meal schedule reminders and physical activity on the **Melpredia** application show performance that utilizes the android system. The results of this study found that participants expected notifications and sounds on the **Melpredia** application alarm. This 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.[26]

The drawback of the **Melpredia** application is that the application features still need to be developed to make it more interesting 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.

The results of this study found that the feasibility of the **Melpredia** application was in accordance with 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 own 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, that 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 results of the research have shown that there is 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. This is because the provision of intervention for people with prediabetes is an important thing to improve self-management through the **Melpredia** application to reduce HbA1c levels in managing their own disease. Whereas in the control group, respondents only received leaflet and information from PTM posbindu activities related to diabetes mellitus, home care was not provided in detail and comprehensively, information obtained only from family, friends and neighbors. These results are also in accordance with previous studies related to the provision of interventions.

The results of a similar study conducted 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.[96]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.[90]

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.[22] The results of research that the provision of lifestyle interventions are proven to be effective in improving one's health status, health behavior and self-management and there are differences between the intervention group and the control group.[16] The intervention given emphasizes the management of prediabetes through prediabetes self management education based on an android application which was 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, in the control group, there was no significant change in the mean 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 obtained from post blood sampling within a period of 3 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 <0,005. Meanwhile, after being given PSME (Melpredia Application) the intervention and control groups the mean difference value to 0,210 experienced a significant decrease. This 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 researchs that progressive muscle relaxation carried out continuously has a very good impact on reducing HbA1c levels. The same thing was done by Husein et al. It was found that 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).[97] 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.[81]

According to the researcher, 3 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 group and the control group. This 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.[36]

Promotive and preventive activities with efforts to disseminate information and effective education to people with prediabetes need to be carried out, because prediabetes education is an activity that aims to control glycemic levels as a prevention of diabetes mellitus.[54]

Education with the aim of promoting health needs to be carried out as part of efforts to prevent and control prediabetes. The International Diabetes Association believes that to prevent complications of diabetes or ongoing disease, it is necessary to have health education on self-management behavior of prediabetes.[22]

The selection of the right method in the implementation of self-management health education is very important in terms of 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 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.[58]

The method of health education so far is still in the form of discussions, lectures and demonstrations. This 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 to obtain health information about disease management.

Melpredia application is part of the development of innovative media in the health sector, especially in managing the management of people with prediabetes. This education is one form of intervention to improve self-management of people with prediabetes in reducing HbA1c levels. **Melpredia** application menu features consist of five pillars of diabetes mellitus management including, prediabetes and diabetes mellitus education menu, nutrition management menu, physical activity menu, 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.[98]

Melpredia application is an intervention given to prediabetes referring to the management of 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.[4] 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 by maintaining glycemic control HbA1c can decrease to 6,4%. Management of prediabetes education is very necessary 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 major 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.[70]So, an educational program of at least 30 days is needed to keep the glycemic profile under control. This is in line with the results of the study where the use of 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 or 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 results of the study can be concluded that there is an influence of Prediabetes Self Management Education based on an android application on HbA1c levels of people with prediabetes. This is due to the development of information and communication technology as a means to encourage self-management for people with prediabetes. Innovative strategies are needed in an effort to improve *self-management* of people with prediabetes, although in its implementation it has certain obstacles caused by the diversity of community characteristics as well as diverse demographic and regional conditions.

CONCLUSION

PSME intervention with Android-based **Melpredia**Application media has an effect on lowering the level value, so it can be concluded

From the explanation of this research are as follows:

1. The Android-based **Melpredia** application is suitable for use as an educational medium for people with prediabetes. Based on the results of the expert feasibility test, the results obtained 89% (Fair) and the feasibility test of the material aspect with a percentage of 90% (very good).
2. There is a significant difference in reducing the HbA1c value before and after being given 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 had an effect on decreasing HbA1c levels by 0,210 (difference in mean decrease).

SUGGESTION

1. Department of Health
   Programs related to promotive and preventive efforts need to be reviewed with more attention to integration related to health education provided to people with prediabetes using various media that are more interactive and applicable according to the needs of prediabetes, namely 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 need 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 the form of virtual environments, reward-based and social life in cyberspace. The game method with reward-based, for example in 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 basically still has limitations, including the **Melpredia** application that still requires a sensor accuracy level of how good the accelometer device is in the cellphone. The higher the accelometer device on the cellphone, the more accurate the results of physical activity and the number of calories.The needs for additional devices that can measure actions so that they can change the behavior of prediabetes or people with diabetes in managing themselves to maintain blood sugar levels within normal limits. Such as a warning if the body weight exceeds the normal limit and a warning in stress management and physical activity.

REFERENCES

1. International Diabetes Federation. IDF Diabetes Atlas, 8th edn. Brussels, Belgium: International Diabetes Federation, 2017.
2. CDC. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: US department of health and human services, centers for disease control and prevention. 2011 Jan;201(1):2568-9.
3. Basina M, Higuera, V, dan Huffman, B. What is Prediabetes. Diabetes.co.uk. Diunduh dari https://www.healthline.com/health/type-2-diabetes/what-is-prediabetes pada tanggal 9 Agustus 2019.
4. Marathe PH GH, Close KL. American D iabetes A ssociation Standards of Medical Care in Diabetes 2017.
5. Lokononto ADM. Gambaran Risiko Prediabetes, Aktivitas Fisik, Perilaku Sedentari, Dan Pola Makan Karyawan Di Perusahaan "X". Jurnal Psimawa. 2019 Dec 5;2(1):63-70.
6. Rumahorbo H. Mencegah diabetes melitus dengan perubahan gaya hidup. Edisi Kesatu. Media, Bogor. 2014.
7. Padrós G FA, Formiga F, Cunillera O, Badia T, Corbella X, Almeda J, Badia T, Fernández C, Ferrer A, Formiga F. Prevalence of Prediabetes and Associated Factors in the Oldest Old. A Cross Sectional Study in the Octabaix Cohort. International Journal of Gerontology. 2017 Jun 1;11(2):90-4.
8. Riskesdas. Laporan Nasional Riset Kesehatan Dasar (Riskesdas) 2018.
9. Yan Q SD, Li X, Chen G, Zheng Q, Li L, Gu C, Feng B. Association of blood glucose level and hypertension in Elderly Chinese Subjects: a community based study. BMC endocrine disorders. 2016 Dec;16(1):1-8.
10. Kemenkes. Diunduh dari http://p2ptm.kemkes.go.id/dokumen-ptm/buku-pintar-kader-posbindu pada tanggal 09 maret 2021.
11. Ledford CJ SD, Crawford PF. . The relationship between patient perceptions of diabetes and glycemic control: A study of patients living with prediabetes or type 2 diabetes. Patient education and counseling. 2019 Nov 1;102(11):2097-101.
12. Dany F KN, Pradono J, Kristianto Y, Delima D. Faktor Risiko Prediabetes: Isolated Impaired Fasting Glucose (i-IFG), Isolated Impaired Glucose Tolerance (i-IGT) dan Kombinasi IFG-IGT (Analisis Lanjut Riskesdas 2013). Indonesian Bulletin of Health Research. 2017;45(2):113-24.
13. Du H, et al. Fresh fruit consumption in relation to incident diabetes and diabetic vascular complications: a 7-y prospective study of 0.5 million Chinese adults. PLoS medicine. 2017 Apr 11;14(4):e1002279.; 14: e1002279.
14. Leontis LMdF, A.H. What Is Prediabetes? Here's What You Need to Know. Endocrine Web. Diunduh dari https://www.endocrineweb.com/conditions/prediabetes/pre-diabetes pada tanggal 10 Agustus 2020.
15. Joiner KL NS, Whittemore R. Lifestyle interventions based on the diabetes prevention program delivered via eHealth: A systematic review and meta-analysis. Preventive medicine. 2017 Jul 1;100:194-207.

16. Andriyanto A. Pengaruh emas (edukasi, manajemen nutrisi, aktivitas fisik, pengelolaan stres) terhadap kesadaran diri diabetisi tipe 2 di UPT wilayah kerja Puskesmas Mojosari Kabupaten Mojokerto= Effect of emas education, nutrutuon management, physical activity, stress management towards self-awareness type 2 diabetes in Mojokerto Distict.
17. PERKENI. Pengelolaan dan pencegahan diabetes melitus tipe 2 di Indonesia. Pb. Perkeni. 2015.
18. Utomo MR WH, Marunduh S. . Kadar HbA1c Pada Pasien Diabetes Melitus Tipe 2 Di Puskesmas Bahu Kecamatan Malalayang Kota Manado. eBiomedik. 2015 Feb 6;3(1).
19. Rachmawati N KN. Gambaran Kontrol dan Kadar Gula Darah pada Pasien Diabetes Melitus di Poliklinik Penyakit Dalam RSJ Prof. Dr. Soerojo Magelang (Doctoral dissertation, Universitas Diponegoro).
20. Sulistiowati E SM. Perkembangan Diabetes Melitus Tipe 2 dari Prediabetes di Bogor, Jawa Barat. Jurnal Penelitian dan Pengembangan Pelayanan Kesehatan. 2018 Apr 26:59-69.
21. Baghianimoghadam MH HM, Mohammadi M, Fallahzade H, Baghianimoghadam B. Current education versus peer-education on walking in type 2 diabetic patients based on Health Belief Model: a randomized control trial study. Rom J Intern Med. 2012 Apr 1;50(2):165-72.
22. Lari H TR, Noroozi A. Effect of electronic education based on health promotion model on physical activity in diabetic patients. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2018 Jan 1;12(1):45-50.
23. Chatterjee S DM, Heller S, Speight J, Snoek FJ, Khunti K. Diabetes structured self-management education programmes: a narrative review and current innovations. The Lancet Diabetes & Endocrinology. 2018 Feb 1;6(2):130-42.
24. Alligood MR. Nursing theorists and their work-e-book. Elsevier Health Sciences. 2017.
25. Widyanata KAJ. Penerapan Kalender DM Berbasis Aplikasi Android Sebagai Media DSME (Diabetes *Self Management Education*) Terhadap Self efficacy dan Kadar HbA1c Pada Pasien Diabetes Mellitus Tipe 2 (Doctoral dissertation, Universitas Airlangga).
26. Handayani PW MD, Pinem AA, Hidayanto AN, Ayuningtyas D. . Critical success factors for mobile health implementation in Indonesia. Heliyon. 2018 Nov 1;4(11):e00981.
27. Gayatri RW, Hartati E. Wardani, and Septa Katmawanti. Pengembangan Aplikasi Android untuk Pelayanan DM Tipe 2. Sport Science and Health. 2019 Oct 26;1(1):82-91.
28. Umaroh L. Pengaruh Diabetes *Self Management Education* (DSME) Melalui Media Kalender Terhadap Kepatuhan Perawatan Kaki Klien Diabetes Mellitus Tipe 2 Di Balai Pengobatan Muhammadiyah Lamongan (Doctoral Dissertation, Universitas Airlangga).2018.
29. Rider BB LS, Johnson TK, Hu DJ. . Interactive web-based learning: translating health policy into improved diabetes care. American journal of preventive medicine. 2016 Jan 1;50(1):122-8.
30. Luawo HP SE, Bahar B, Yusuf S, Irwan AM. Aplikasi e-diary DM sebagai alat monitoring manajemen selfcare pengelolaan diet pasien DM. NURSCOPE: Jurnal Penelitian dan Pemikiran Ilmiah Keperawatan. 2019 Jun 2;5(1):32-8.
31. Griauzde D KJ, Liestenfeltz B, Ansari T, Johnson EH, Fedewa A, Saslow LR, Richardson C, Heisler M. A mobile phone-based program to promote healthy behaviors among adults with prediabetes who declined participation in free diabetes prevention programs: mixed-methods pilot randomized controlled trial. JMIR mHealth and uHealth. 2019;7(1):e11267.
32. Adu MD, Malabu, U. H., Malau-Aduli, A. E., & Malau-Aduli, B. S. The development of my care hub mobile-phone App to support self-management in Australians with Type 1 or Type 2 diabetes. Scientific reports, 10(1), 1-10. 2020.
33. Erawantini F FS, Wulandari RA. Perancangan Aplikasi Penentu Faktor Risiko Diabetes Melitus Tipe 2 Secara Dini Berbasis Web. Jurnal Kesehatan. 2017;5(1):30-3.
34. Alligood MR. Areas for further development of theory-based nursing practice. MR Alligood (Ed.), Nursing theory: Utilization & application. 2014:414-24.
35. Pender NJ M, C. L., & Parsons, M. A. . Health Promotion in Nursing Practice. (E. Sullivan, Ed.) (Seventh). United States of America Julie Levin Alexander. . 2015.
36. Patandung VP. Pengaruh edukasi terstruktur dengan Telephone Health Coaching terhadap Health Literacy dan kadar HbA1c pada pasien DM tipe 2 (Doctoral dissertation, Tesis Fakultas Keperawatan Universitas Hasanudin).
37. Junita TV. Prevalensi Dan Faktor Prediksi Prediabetes Pada Penduduk Usia Produktif Di Indonesia Tahun 2013 (Analisis Data Riskesdas Tahun 2013). Pascasarjana Ui
38. Sofiana R, And Sutikno Sutikno. . Sistem Deteksi Dini Diabetes Mellitus Menggunakan Jaringan Saraf Tiruan Backpropagation Dengan Optimasi Adaptive Learning Rate Dan Momentum. Diss. Universitas Diponegoro, 2016.
39. Widianto SR. Rancang Bangun Aplikasi Telemedika untuk Pasien Diabetes Berbasis Platform iOS. Jurnal Elektra. 2017 Jul 2;2(2):65-73.
40. Bhuana GB KA, Fanani L. Rancang Bangun Prototipe Aplikasi Konsultasi Menu Makanan Berbasis Mobile Bagi Penderita Penyakit Diabetes Menggunakan Metode Harris Benedict. Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer e-ISSN. 2019;2548:964X.
41. Teo CH NC. White A. What do men want from a health screening mobile app? A qualitative study. PLoS One. 2017 Jan 6;12(1):e0169435.
42. Harvey J DS, McManus RJ, Powell J. Factors influencing the adoption of self-management solutions: an interpretive synthesis of the literature on stakeholder experiences. Implementation Science. 2015 Dec;10(1):1-5.
43. Soewondo P P. Prevalence, characteristics, and predictors of pre-diabetes in Indonesia. Medical Journal of Indonesia. 2011 Nov 1;20(4):283-94.
44. Association AD. Standards of medical care in diabetes—2013. Diabetes care. 2018 Jan;32(Suppl 1):S13.
45. Waspadji. Jurnal Care Vol. 4, No.3: 2016, hal 9–20.

46. Peciuliene I PA, Gustainiene L, Jarasiunaite G. Effectiveness of progressive muscle relaxation and biofeedback relaxation in lowering physiological arousal among students with regard to personality features. Procedia-Social and Behavioral Sciences. 2015 Oct 9;205:228-35.
47. Furnqniv A. Pengaruh Terapi Relaksasi Progresif Terhadap Stres Pada Remaja Penghuni Lembaga Pemasyarakatan. Psikoborneo: Jurnal Ilmiah Psikologi. 2016 Jun 30;4(2).
48. CDC. National diabetes statistics report, 2020. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services. 2020:12-5.
49. Brady V. Insulin Therapy: The Old, the New and the Novel-An Overview. The Nursing clinics of North America. 2017 Oct 5;52(4):539-52.
50. Grossmann V SV, Zeller T, Panova-Noeva M, Schulz A, Laubert-Reh D, Juenger C, Schnabel RB, Abt TG, Laskowski R, Wiltink J. Profile of the immune and inflammatory response in individuals with prediabetes and type 2 diabetes. Diabetes care. 2015 Jul 1;38(7):1356-64.
51. Febriani I AI, Darsono D, Sulistiowati E, Wahyono TY. Prediksi prediabetes dan diabetes tidak terdiagnosis serta pengembangan sistem skoring berdasarkan faktor risiko Riskesdas 2013= Prediabetes and undiagnosed diabetes prediction with development of scoring system based on Risk Factors Basic Health Research 2013 Abstract.
52. Okosun IS LR. Prediabetes awareness, healthcare provider's advice, and lifestyle changes in American adults. International Journal of Diabetes Mellitus. 2015 May 1;3(1):11-8.
53. Amelia M NS, Elita V. Analisis faktor-faktor yang mempengaruhi keluarga untuk memberikan dukungan kepada klien diabetes mellitus Dalam menjalani diet (Doctoral dissertation, Riau University).
54. Betteng R. Analisis faktor resiko penyebab terjadinya Diabetes Melitus tipe 2 pada wanita usia produktif Dipuskesmas Wawonasa. eBiomedik, 2(2). 2014.
55. Joseph JJ E-TJ, Talegawkar SA, Effoe VS, Okhomina V, Carnethon MR, Hsueh WA, Golden SH. Modifiable lifestyle risk factors and incident diabetes in African Americans. American journal of preventive medicine. 2017 Nov 1;53(5):e165-74.
56. Colberg SR SR, Yardley JE, Riddell MC, Dunstan DW, Dempsey PC, Horton ES, Castorino K, Tate DF. . Physical activity/exercise and diabetes: a position statement of the American Diabetes Association. Diabetes care. 2016 Nov 1;39(11):2065-79.
57. Tuomilehto J LJ, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, Keinänen-Kiukaanniemi S, Laakso M, Louheranta A, Rastas M, Salminen V. Standards of medical care in diabetes—2017 abridged for primary care providers. Clinical diabetes: a publication of the American Diabetes Association. 2017 Jan;35(1):5.
58. Usman Y IR, Rosita T, Lusiana M, Kosen S, Kelly M, Forsyth SJ, Rao C. Indonesia's Sample Registration System in 2018: A work in progress.
59. den Braber N V-HM, Oosterwijk MM, Gant CM, Hagedoorn IJ, van Beijnum BJ, Hermens HJ, Laverman GD. . Requirements of an application to monitor diet, physical activity and glucose values in patients with type 2 diabetes: The diameter. Nutrients. 2019 Feb;11(2):409.
60. Gayatri RW, Hartati E. Wardani, and Septa Katmawanti. Hubungan Hasil Deteksi Dini Diabetes Mellitus Menggunakan Aplikasi Android "DM Personal Screening" Dengan Kadar Gula Darah Acak Pengunjung Puskesmas Janti Kota Malang. Preventia: The Indonesian Journal of Public Health. 2020 Feb 3;4(2):116-23.; 4: 116-123.
61. Stanhope M LJ. Public health nursing e-book: Population-centered health care in the community. Elsevier Health Sciences; 2019 Aug 18.
62. Josef FM AT. Partisipasi dalam promosi kesehatan pada kasus penyakit demam berdarah (DB) ditinjau dari pemberdayaan psikologis dan rasa bermasyarakat. Jurnal Psikologi. diunduh 2021;37(1):65-81.
63. Halcomb KA. "Health Promotion And Health Education: Nursing Students'perspectives." (2010).
64. Srof BJ, & Velsor-Friedrich, B. . Health promotion in adolescents: A review of Pender's health promotion model. Nursing Science Quarterly, 19(4), 366-373. 2015.
65. Safaat N. "Android; Pemrograman Aplikasi Mobile Smartphone dan Tablet PC Berbasis Android." (2018).
66. Supardi IY. Koleksi Program Tugas Akhir dan Skripsi dengan Android. Elex Media Komputindo; 2017 Aug 28.
67. Salbino S. Buku pintar gadget android untuk pemula. Jakarta: Kunci Komunikasi. 2014.
68. Gajalakshmi. Software development lifecycle model (SDLC) incorporated with release management. International Research Journal of Engineering and Technology (IRJET). 2016;3(04).
69. Abshor MU. Sistem Informasi Pembayaran Sekolah Berbasis Sms Gateway Pada Smk Nu Miftahul Falah (Doctoral dissertation, Universitas Muria Kudus).
70. Kaufman N. Internet and information technology use in treatment of diabetes. International Journal of Clinical Practice. diunduh 20 oktober 2020;64:41-6.
71. Cotter AP DN, Agne AA, Cherrington AL. Internet interventions to support lifestyle modification for diabetes management: a systematic review of the evidence. Journal of Diabetes and its Complications. 2014 Mar 1;28(2):243-51.
72. Chomutare T F-LL, Årsand E, Hartvigsen G. Features of mobile diabetes applications: review of the literature and analysis of current applications compared against evidence-based guidelines. Journal of medical Internet research. 2011;13(3):e65.
73. Paputungan SR SH. Peranan pemeriksaan hemoglobin A1c pada pengelolaan diabetes melitus. Cermin Dunia Kedokteran. 2014 Sep 1;41(9):650-5.
74. Holt RI DGM, Lucki I, Hunter CM, Sartorius N, Golden SH. NIDDK international conference report on diabetes and depression: current understanding and future directions. Diabetes care. 2014 Aug 1;37(8):2067-77.

75. Organization WH. Self-care in the context of primary health care. WHO Regional Office for South-East Asia; diunduh 21 oktober 2020.
76. Di Pino A MS, Urbano F, Scicali R, Scandura S, D'Agate V, Piro S, Tamburino C, Purrello F, Rabuazzo AM. HbA1c identifies subjects with prediabetes and subclinical left ventricular diastolic dysfunction. The Journal of Clinical Endocrinology & Metabolism. 2017 Oct 1;102(10):3756-64.
77. Swarjana IK SM. Metodologi penelitian kesehatan. Penerbit Andi; 2012.
78. Connolly TM BC. Database systems: a practical approach to design, implementation, and management. Pearson Education; 2019.
79. Sugiono S. Metode penelitian kuantitatif, kualitatif, dan r & d. Bandung: Alfabeta. 2016.
80. Sommerville I. Software engineering 9th Edition. ISBN-10. 15 oktober 2020;137035152:18.
81. Nursalam. Metodologi Penelitian Ilmu Keperawatan Edisi ke-4. Jakarta: Penerbit Salemba Medika. 2015.
82. Sabri L, & Hastono, S. P. Statistik Kesehatan (ke-8). Jakarta: Rajawali Pers.2018
83. Sastroasmoro S IS. Dasar-dasar metodologi penelitian klinis. Jakarta: sagung seto. diunduh 2020;55.
84. Surucu HA KS, Ergor G. . The impacts of diabetes education on self care agency, self-care activities and hbA1c levels of patients with type 2 diabetes: A randomized controlled study. Int J Caring Sci. 2017 Jan 1;10(1):479.
85. Hidayat AA. Metodologi Penelitian Keperawatan dan Kesehatan. Jakarta: Salemba Medika. 2017;88.
86. Waluyo R DM, Dewi GD. . Pengukuran Kualitas Sistem Informasi Pelayanan Pasien Pada Klinik Xyz Menggunakan Iso 9126. Probisnis. 2018 Apr 9;11(1).
87. Siyoto S SM. Dasar metodologi penelitian. Literasi Media Publishing; 2015 May 1.
88. Tymms P. Effect sizes in multilevel models. National Foundation for Educational Research.2017.
89. Glasgow RE HA, Brownson RC. Expanding the CONSORT figure: increasing transparency in reporting on external validity. American journal of preventive medicine. 2018 Sep 1;55(3):422-30.
90. Toro-Ramos T MA, Anton M, Karim Z, Kang-Oh L, Argyrou C, Loukaidou E, Charitou MM, Sze W, Miller JD. Mobile Delivery of the Diabetes Prevention Program in People With Prediabetes: Randomized Controlled Trial. JMIR mHealth and uHealth. 2020;8(7):e17842.
91. Griauzde DH SL, Patterson K, Ansari T, Liestenfeltz B, Tisack A, Bihn P, Shopinski S, Richardson CR Mixed methods pilot study of a low-carbohydrate diabetes prevention programme among adults with pre-diabetes in the USA. BMJ open. 2020 Jan 1;10(1).
92. Elliot K SP. Exploring the use of effect sizes to evaluate the impact of different influences on child outcomes: Possibilities and limitations. But what does it mean. diunduh 10 januari 2021:6-24.
93. Warren R CK, Mihala G, Scuffham PA. . Effects of telemonitoring on glycaemic control and healthcare costs in type 2 diabetes: a randomised controlled trial. Journal of telemedicine and telecare. 2018 Oct;24(9):586-95.
94. Silalahi V LW, Hakimi M, Keperawatan BI, Kedokteran F, Mada UG. Efektivitas Audiovisual dan Booklet sebagai Media Edukasi untuk Meningkatkan Perilaku Skrining IVA Effectiveness of audiovisual and booklet as Education Media to. J Media Kesehat Masy Indones. 2018;14(3):304â.
95. Tuzzahroh F. Pengaruh Penyuluhan Gizi Seimbang dengan Media Video, Poster dan Permainan Kwartet Gizi terhadap Pengetahuan Gizi dan Status Gizi Siswa di Sekolah Dasar Negeri Karangasem III Kota Surakarta (Doctoral dissertation, Universitas Muhammadiyah Surakarta).
96. Herring MS BE, Stanton-Robinson CA, Witry MJ. What do I eat? Impact of an interactive teaching method for improving pharmacy students' diabetes nutrition knowledge and comfort in providing nutrition counseling. Currents in Pharmacy Teaching and Learning. 2018 Jul 1;10(7):918-24.
97. Aprina IT SE, Rajiani I. Walking as an alternative treatment of HbA1c levels control among type 2 diabetes mellitus patients. Indian Journal of Public Health Research & Development. 2018 Sep;9(9):220-3.
98. Wahyuni A. Senam Kaki Diabetik Efektif Meningkatkan Ankle Brachial Index Pasien Diabetes Melitus Tipe 2. Jurnal Ipteks Terapan. 2016 Feb 3;9(2):19-27.
99. Fottrell E AN, Morrison J, Kuddus A, Shaha SK, King C, Jennings H, Akter K, Nahar T, Haghparast-Bidgoli H, Khan AA. Community groups or mobile phone messaging to prevent and control type 2 diabetes and intermediate hyperglycaemia in Bangladesh (DMagic): a cluster-randomised controlled trial. The Lancet Diabetes & Endocrinology. 2019 Mar 1;7(3):200-12.
100. Hussein WI HK, Jaradat AA. Effectiveness of mobile phone short message service on diabetes mellitus management; the SMS-DM study. Diabetes research and clinical practice. diunduh 2020 Oct 1;94(1):e24-6.
101. Kao CK LD. Consumer mobile health apps: current state, barriers, and future directions. PM&R. 2017 May 1;9(5):S106-15.

How to cite this article: Amelia Nurul Hakim, Hotma Rumahorbo, Sudirman. The Effectiveness of Melpredia Prediabetes *Self Management Education* Based on Android Applications on HbA1c Levels in People with Prediabetes. Int J of Allied Med Sci and Clin Res 2021; 9(2): 410-421.

Source of Support: Nil. **Conflict of Interest:** None declared.