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THE EFFECTIVENESS OF *THE SELF-MANAGEMENT HYPERTENSION* (SMH) APPLICATION IN INCREASING KNOWLEDGE AND SELF-EFFICACY OF THE ELDERLY WITH HYPERTENSION IN MAKASSAR CITY

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ABSTRACT

Introduction: Poor knowledge and low compliance of the elderly with hypertension (HT) in terms of self-care, such as low adherence to medication, not maintaining diet, weight management, and physical activity, require different strategies in designing health education for the elderly with HT. A critical component in predicting self-care behavior is self-efficacy, which refers to people's beliefs about their ability to perform at a certain level of performance and includes a person's confidence to do an excellent job of self-care (Bandura, 1983). The effect of the application on improving the literacy and self-efficacy of the elderly with HT in terms of self-care of HT disease has been proven effective based on several research results in the world.

Research Objective: This study aims to see the effectiveness of SMH applications in increasing the knowledge and self-efficacy of elderly patients with HT.

Method: This study used *a quasi-experimental* design with *a pre and post-test control group design*. Samples of 80 older adults with HT in the treatment group and 40 elderly samples with HT were given therapy using the SMH application accompanied by an application use module.

In the control group, 40 elderly samples with HT were given health education about self-management plus pocketbooks.

Results: Wilcoxon test results showed significant differences in knowledge before and after treatment in both the control and intervention groups and self-efficacy*($p<0.05$).* Changes in pre- to post-test scores mainly increased (98%) in the control group, while in the intervention group, all elderly (100%) experienced increased knowledge and self-efficacy.

Conclusion: SMH application-based interventions effectively increase knowledge and self-efficacy in the elderly with hypertension.

Keywords: Effectiveness, SMH Application, Knowledge, Self-Efficacy, Elderly with Hypertension

INTRODUCTION

One of the leading medical problems experienced by the elderly is hypertension (Extremera & Gomez, 2012). The prevalence of hypertension in Indonesia aged 65-74 years is 63.2%, and the age over 75 years is 69.5% (Kemenkes RI, 2019 Data Riskesdas, 2018).Blood pressure increases with age; in older adults, isolated increases in systolic blood pressure are more common (Beevers, Gregory & O'Brien,2007).In Makassar City, only 49.5% of high blood pressure testing services receive health services is only 49.5% (Dinkes Kota Makassar, 2021).

Overall life expectancy has increased rapidly, as seen from the number of older adults aged 60 years and over in 2020, amounting to 1.4 billion. It is expected to grow to 2.1 billion in 2050 so that 1 in 6 of the world's population is elderly (WHO, 2022). Since 2021, Indonesia has entered an aging population structure where 1 in 10 Indonesians are elderly (Ministry of Health of the Republic of Indonesia, 2022; Elderly Population Statistics, 2023). This trend creates challenges in maintaining the health and quality of life of the elderly because increasing age tends to be accompanied by a decrease in the body's functional capabilities, which impacts the immune system, thereby increasing degenerative non-communicable diseases, one of which is hypertension.

Around 60-70% of the elderly in almost all countries experience hypertension (Chantakeeree et al., 2022). Ironically, research has found that most older adults have poor knowledge about hypertension (Gusty et al., 2022). Meanwhile, knowledge was shown to be positively correlated with self-care in people with hypertension, which contributed four times more as a driver of self-management behavior for hypertensive patients (Chimberengwa & Naidoo, 2018; Seangpraw & Ong-Artborirak, 2020; Wondmieneh et al., 2021).

Poor knowledge and low compliance of the elderly with HT in terms of self-care, such as low medication adherence, not maintaining diet, weight management, and physical activity, require different strategies in designing health education for the elderly with HT. Lack of knowledge about HT and HT-related diseases can hinder blood pressure control (Twum, 2015).

A critical component in predicting self-care behavior is self-efficacy, which refers to people's beliefs about their ability to perform a certain level of performance and includes a

person's confidence to do an excellent job of self-care (Bandura, 1983). With self-efficacy, individuals achieve more desirable results than self-care(Behzad et al., 2016). In one study, self-efficacy was a statistically significant predictor of treatment adherence in elderly hypertensive patients(Son& Won, 2017). The research results by Chalfont et al. (2021) said that self-care telehealth technology can help older people who live at home stay productive and support their self-efficacy. The effect of the application on increasing elderly literacy with HT in terms of self-care of HT disease has been proven effective based on the results of research by Li et al. (2019), conducting WeChat application-based interventions in the elderly with HT in Guangzhou, China, with self-efficacy theory and behavior change education where health education and self-efficacy are significantly increased, so that it can help the elderly in lowering their blood pressure.

METHOD

1. Research design.

This study used *a quasi-experimental*design with*a pre and post-test control group design*. In the treatment group, therapy was given using the SMH application accompanied by an application use module. The control group was given health education about self-management plus a pocketbook. Before treatment, knowledge and self-efficacy were measured, and then treatment was given for four months. Then, the knowledge and self-efficacy of older people were re-measured after treatment. This research was conducted at two Puskesmas in Makassar City, namely Puskesmas Malimongan Baru and Puskesmas Mangasa, to avoid contamination between the two groups. The composition of the research Puskesmas (PKM) consists of Puskesmas Malimongan Baru (PKM1) as the Puskesmas Treatment and Puskesmas Mangasa (PKM2) as the Control. The population in this study was all hypertensive patients in the Mangasa Health Centre and Malimongan Baru Health Center in Makassar City. This research was conducted after obtaining *informed consent* that respondents had signed.

In this study, the instruments used to measure the level of knowledge of respondents mainly refer to questionnaires adopted from Kebede et al. (2020), then modified by referring to the technical guideline module for the discovery and management of hypertension published by the Ministry of Health of the Republic of Indonesia, Directorate of Non-communicable Disease Control. To ensure the ethical consideration of this research, research ethics approval from the Health Research Ethics Committee of Hasanuddin University Makassar is required with Number: 2986/UN4.14.1/TP.01.02/2023.

2.Research sample

The research sampling technique was calculated using G*Power software. A priori analysis calculations are chosen in software because they are intended for sample size calculations performed before the study and before the design and planning stages of the study. Referring to the objectives and hypotheses of the study, the formula *t tests - Means: The difference between two independent means (two groups) was chosen* by entering the SD mean value, which refers to

the results of the studyBozorgi et al. (2021)Where the intervention group with a mean value of 95.5±3.66 while the control group with a mean value of 98.9±6.84. From the calculation results, the minimum number of samples for the treatment and control group was 32 people, each with a total sample of 64. However, drop-out of research subjects or non-compliance with research protocols is inevitable when conducting research. Therefore, researchers consider the expected drop-out rate of 20% when calculating the sample size using the following calculation formula (Kang, 2021):

$$N^D = \frac{N}{1-d} = \frac{64}{1-20\%} = \frac{64}{1-0.2} = \frac{64}{0.8} = 80\ Sample$$

Information:

N = sample size before considering drop-out

D = expected drop-out rate

ND = sample size considering drop-out

From the formula above, the minimum sample size considered drop-out is 80 people, consisting of 40 in the treatment group and 40 in the control group. Sample criteria include: a) Men or women with HT with initial BP screening results (BPS ≥140mmHg and BPD ≥90mmHg aged 60-75 years who are taking antihypertensive medication; b) Stay in the research center area for ± 6 months; c) Android smartphone users; d) Able to read and write using Indonesian fluently; e) Have a sphygmomanometer and be able to use it to monitor blood pressure yourself, or BP measurements can be done in health care every week. At the same time, the control group of BP measurements were carried out by cadres every week, after health education was carried out.

3.Research instruments

Knowledge variables were measured using a knowledge questionnaire about hypertension. The questionnaire had 10 questions with correct and incorrect answer choices. If the respondent answered correctly, it was given a score of 1; incorrectly, it was given a score of 0. The higher the respondents' total answers indicate, the better their knowledge of hypertension is.

Self-efficacy variables were measured using the*Self-Efficacy for Managing Chronic Disease 6-Item Scale*questionnaire validated and developed by Stanford University's Centre for Patient Education Research in the 1980s, which was widely used worldwide for the evaluation of the self-management effects of patients with chronic diseases (Schwarzer & Jerusalem, 1995). Six questions were included in the Self-Efficacy Subscale for managing chronic disease to help assess patients' confidence in performing certain activities. For each question, patients chose a score that matched the belief that they could perform the task regularly at this time; items were scored on a 10-point scale range. Assuming 1-7 = not at all sure until 8-10 = very sure once with a higher score indicates better self-efficacy (Hu et al., 2013).

4.Data analysis

For univariate analysis, the characteristics of respondents present the proportion of data accompanied by a homogeneity test to determine the variance of attributes of control and intervention group respondents. Bivariate data were first tested for normality, and then data were obtained for knowledge variables. Self-efficacy was not normally distributed, so non-parametric Wilcoxon and Mann-Whitney tests were selected. To determine the effectiveness of the treatment, N-Gain Score testing was carried out with intervention criteria said to be ineffective if the percentage is <40, less effective if the rate is 40 – 55, effective enough if 56 – 75, and effective if >75 (Meltzer, 2002), In addition, it also displays the value of the effect size obtained from the calculation of *Cohen's coefficient formula*, where Z is the value of the statistical standardization test, and n is the number of research amcap Z over the square root of n s, Coefficient results show a value of <0.20, which means that the effect size is small; 0.20-0.80 means medium effect size; and >0.80 means the size of the effect (Berben et al., 2012).The data is processed with the help of SPSS software.

RESULTS

Table 1. Frequency Distribution of Elderly Characteristics with HT (n=80)

Characteristic	Control (n=40)	Intervention (n=40)	Total	Homogeneity*
Gender				
Man	10 (25%)	11 (27.5%)	21 (26.3%)	0.802[a]
Woman	30 (75%)	29 (72.5%)	59 (73.8%)	
Education				
SD	21 (52.5%)	2 (5.0%)	23 (28.7%)	0.043[a]
SMP	7 (17.5%)	7 (17.5%)	14 (17.5%)	
SMA	8 (20.0%)	21 (52.5%)	29 (36.3%)	
DIII/S1	4 (10.0%)	10 (25.0%)	14 (17.5%)	
Income				
<RMW	38 (95.0%)	29 (72.5%)	67 (83.3%)	0.006[a]
RMW	2 (5.0%)	11 (27.5%)	13 (16.3%)	

Status nikah				
Unmarried	3 (7.5%)	2 (5.0%)	5 (6.3%)	0.649[a]
Marry	37 (92.5%)	38 (95.0%)	75 (93.8%)	
Umur				
Mean±SD	66.70±6.7	64.10±4.6	65.40±5.9	0.001[b]
Min-max	60 – 82	60 – 76	60 - 82	

**levene test of homogeneity; [a]based on median; [b]based on mean*

The characteristics of the elderly with hypertension who were respondents in the study are presented in Table 1. Of the 80 older adults, 40 were elderly in the control group and 40 in the intervention group. The homogeneity test showed that the sex and marital status of the elderly in both groups were relatively the same (homogeneous). When viewed from the gender, the majority of women and the dominant married status were married older people in the control and intervention groups. For education, the income and age of older people were seen to be diverse (heterogeneous) in both groups. Elderly education in the control group was primarily primary school (52.5%), but in the intervention group, it was primarily high school (52.5%). When viewed from income, almost all elderly in the control group had an income of <RMW (95%), while in the intervention group, only 72.5% and the rest had an income of RMW (27.5%). Older people in the control group had an average age of 67 years and the oldest 82 years, while older people in the intervention group had an average age of 64 years and an average age of 76 years. Heterogeneous education, income, and age of older people can affect intervention outcomes.

Differences in knowledge and self-efficacy of the elderly with hypertension before and after treatment are presented in the following table:

Table 2. Changes in Knowledge and Self-Efficacy of the Elderly with HT

Group	**Pre to post changes; n (%)**			**Z**	***N-Gain Score***	***p-value****
	Decreased	**Increased**	**Settled**			
Knowledge						
Control	0 (0%)	39 (98%)	1 (3%)	5.474	87%	<0.001
Intervention	0 (0%)	40 (100%)	0 (0%)	5.581	96%	<0.001

Group	Pre to post changes; n (%)			Z	*N-Gain Score*	*p-value**
	Decreased	Increased	Settled			
Self-efficacy						
Control	0 (0%)	39 (98%)	1 (3%)	5.452	45%	<0.001
Intervention	0 (0%)	40 (100%)	0 (0%)	5.523	69%	<0.001

**Wilcoxon signed the rank test*

The Wilcoxon test table 2 results showed significant differences in knowledge before and after treatment in the control and intervention groups and self-efficacy *($p<0.05$).* Changes in pre- to post-test scores mainly increased (98%) in the control group, while in the intervention group, all elderly (100%) experienced increased knowledge and self-efficacy.

The N-Gain Score of knowledge variables in the control group was 87%; in the intervention group, it was 96%, and the results were in the practical category. Based on these results, it can be concluded that providing health education about self-management plus pocketbooks has proven effective in increasing the knowledge of older people. The same thing also happens for therapy using the SMH application accompanied by a module on the application.

The N-Gain Score of self-efficacy variables in the control group, 45%, was in the less effective category, and in the intervention group, 69%, it was in the moderately effective category. Based on these results, it can be concluded that providing health education about self-management plus pocketbooks has proven less effective in increasing the self-efficacy of older people. Meanwhile, therapy using the SMH application accompanied by an application use module has proven to be quite effective in improving the self-efficacy of older people.

Comparison between SMH application intervention plus module with health education plus pocketbook in increasing knowledge and self-efficacy of elderly with hypertension is presented in the following table:

Table 3. Comparison Between SMH Plus Module Application Intervention with Counselling Plus Pocketbook in Increasing Knowledge and Self-Efficacy of Elderly with Hypertension

Variable	Group	Mean rank	Z	*Effect size*	*p-value**
Knowledge discrepancy	Control	36.20	1.711	0.191	0.087
	Intervention	44.80			
Self-efficacy	Control	34.04	2.497	0.279	0.013

Variable	Group	Mean rank	Z	*Effect size*	*p-value**
difference	Intervention	46.96			

**Mann-Whitney test*

Table 3 shows a difference in knowledge that is not significantly significant in the control and intervention group *(p >0.05)* in addition to the small effect size so that it can be interpreted that the provision of therapy using the SMH application accompanied by the application use module (intervention group) and the provision of health education about self-management of elderly patients with HT plus pocketbooks (control group) have a relatively similar effect on elderly knowledge. The difference in self-efficacy showed significant results between older people in the control and intervention groups (*p <0.05),* as well as a moderate effect size. This means that the provision of therapy using the SMH application accompanied by the application use module is better in increasing the self-efficacy of older people when compared to providing health education about self-management plus pocketbooks.

DISCUSSION

The percentage of high blood pressure screening services that receive health services in Makassar City is only 49.5%; this may cause a lack of control over BP in elderly patients with HT and cause elderly patients with HT not to get much education from health workers about managing their disease. Less knowledge impacts low self-efficacy in patients in elderly health care with HT. A study conducted by Osborn et al. (2011) and Zhang et al. (2021) found that patients' knowledge level impacted their self-efficacy and health status. According to Kim et al. (2020), health promotion actions by health workers are essentialin controlling hypertension in the elderly. In this study, the level of knowledge of elderly patients with HT in all groups was relatively low about hypertension, such as symptoms, causes, and effects of HT disease, due to the lack of motivation of the elderly to visit health services and find out information related to HT disease. The same statement from the research results of Putri et al. (2021) said that older people with HT were not motivated to go to the elderly integrated health center to check their condition.

Before the intervention in this study was carried out, we provided socialization and training on the use of the SMH application in the intervention group, invited them to WhatsApp groups, and taught them how to download the application and how to fill out questionnaires in the application. A questionnaire measuring the level of knowledge and self-efficacy was filled out. They can open educational video features and feature articles about knowledge and how to manage patient self-management in managing HT disease. While the intervention we carried out in the control group was visiting the homes of elderly patients with HT (homecare) and providing health education about self-management in managing HT disease plus pocketbooks, this activity lasted for four months, assisted by enumerators in this case, health cadres who had

been trained. Health education is carried out once a week with different educational themes; in addition to providing education, we also conduct weekly BP checks to control elderly BP with HT.

This study shows that before education was given to older people with HT, both in the form of health education about self-management plus pocketbooks and SMH application-based education accompanied by application usage modules, the results tended to be the same. After receiving the treatment, both groups showed significant improvements in their knowledge and self-efficacy levels. The results of this study are to Chalfont's (2021) research in systematic reviews; it was found that telehealth application-based technology can increase knowledge, self-care behavior, and self-efficacy of patients with chronic diseases such as heart failure and hypertension, where telehealth effectively supports the self-efficacy of the elderly who live at home. Likewise, the research of Wonggom et al. (2019) states the effectiveness of avatar-based technology in chronic disease patients can increase patient knowledge, self-care behavior, and the level of self-efficacy of patients with chronic diseases. Like the research of Ozoemena et al. (2019), community-based health education interventions targeted at the elderly can increase the elderly's knowledge about hypertension, improve skills and prevention, and enable the elderly to manage hypertension on their own. Research by Putri et al. (2021) found that home visits that offer self-management programs to older people with HT can help the elderly increase self-efficacy in changing to a healthier lifestyle ($p<0.001$). The same review conducted by Foroumandi, Kheirouri, and Alizadeh (2020) found several studies conducting self-management education programs in HT patients obtained results of increased self-efficacy, increased physical activity, dietary behavior, and medication adherence in HT patients, resulting in a decrease in blood pressure in patients.

Every elderly patient with HT has different knowledge and understanding of managing their disease; manyelderly 2020with HT are not sure of success in managing their disease because chronic diseases such as hypertension are lifelong diseases that need long-term management, so patients sometimes get bored to always adhere to the treatment recommended by their doctors (Farley, 2020; Devan et al., 2018). Therefore, support and motivation from families and health workers must continue so that the elderly with HT can manage their disease without boredom. Thus, the empowerment of older people in health literacy is essential to improve self-efficacy and self-care behavior, ultimately resulting in better health for older people. Self-care education improves patients' healthcare programs and reduces relapses and visits to healthcare centers (Darvishpour, 2022).

The results of this study showed that the self-efficacy of elderly patients with HT between the two groups was different based on the N-Gain Score; self-efficacy variables in the control group by 45% were in the less effective category and in the intervention group by 69% were in the moderately effective category. Based on these results, it can be concluded that providing health education about self-management plus pocketbooks has proven less effective in increasing the self-efficacy of older people. Meanwhile, therapy using the SMH application accompanied by an application use module has proven to be quite effective in improving the

self-efficacy of older people. The self-efficacy scores of older people with HT in the control group were less effective, probably due to several factors such as the education of the elderly in the control group of most elementary schools (52.5%) and almost all elderly in the control group had an income of <RMW (95%). A potential factor that may contribute to the effectiveness of health education programs is the literacy rate of the population (Tavakoly Sany et al., 2018). Previous research by Susanto et al. (2018)looked at the relationship between education and self-efficacy of the elderly with systolic hypertension, where it was found that education of elderly patients with low HT correlated with less self-efficacy, causing uncontrolled hypertension in the elderly.

The elderly population with hypertension who come from low socioeconomic backgrounds have many unmet needs in terms of treatment of their diseases, which affects the low self-efficacy that hinders the treatment of HT disease (Tan et al., 2019). There is a correlation between the level of self-efficacy in the elderly and socioeconomic characteristics and comorbidities. Healthy behavior change programs focusing on perceived self-efficacy will improve self-management of chronic diseases in the elderly (Yasaratna & Wijesinghe, 2019).

CONCLUSION

There were significant differences in knowledge before and after treatment in the control and intervention groups and self-efficacy *($p<0.05$).* Changes in pre- to post-test scores mainly increased (98%) in the control group, while in the intervention group, all elderly (100%) experienced increased knowledge and self-efficacy. The N-G, while in the intervention group, Score of knowledge variables in the control group was 87% and, in the intervention group, was 96%, and the results were in the practical category. The N-Gain Score value of self-efficacy variables in the control group was 45%, which was in the less effective category, and the intervention group of 69% was in the moderately effective category.

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