STUDY PROTOCOL

Effectiveness of Android-based Hypertension Self-Care Education to Improve Blood Pressure Control among Hypertensive Patients at Yogyakarta: Study Protocol

Tatik Pujiastuti, Musheer A. Aljaberi, Tukimin Sansuwito

Faculty of Nursing and Applied Sciences, Lincoln University, Petaling Jaya 47301, Malaysia

ABSTRACT

Introduction: Hypertension is a serious health problem and the major cause of early death worldwide. Hypertension prevalent is in 34.1% of all residents in Indonesia, even being the first of the top ten diseases in the Public Health Center Ngemplak I Sleman Yogyakarta. Although various efforts have been made, hypertension cannot be controlled optimally, so that there are still 21.48% of the target 100% who have not utilized health services. The study aims to develop, implement and evaluate android-based hypertension self-care education to improve blood pressure control among hypertensive patients at Public Health Center Ngemplak I Sleman Yogyakarta, Indonesia. **Methods:** This research is an exploratory sequential mixed-method design. It will begin with a qualitative study to explore the content for developing android-based hypertension self-care education. After that, we built the intervention and will implement it for three month in hypertensive patients. Then, it will evaluate the effectiveness of android-based hypertension self-care education on self-care knowledge, attitudes, behavior, and blood pressure control in hypertensive patients. The quantitative research design will use a Randomized Control Group Pretest – Posttest Design with a sample size of 108 hypertensive patients in the intervention and control group. **Discussion:** Android-based hypertension self-care education is a new method developed and seen for its effectiveness in improving blood pressure control abilities. The study results will help the hypertensive patients achieve optimal self-care.
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Corresponding Author:
Tatik Pujiastuti, MSc
Email: thtatikpujiastuti.Phd@gmail.com
Tel: +6281284136038

INTRODUCTION

Hypertension is a serious health problem worldwide. It is also recognized as a chronic global non communicable disease and a "silent killer" due to its high mortality rates and lack of early symptoms (1). Hypertension is the major cause of premature death worldwide (2). According to data from WHO, the prevalence of hypertension in adult increased 13,27% from an estimated 1.13 billion in 2015 to 1.28 billion in 2019 (2). The prevalence of hypertension increases every year, including in Indonesia. In Indonesia, the prevalence of hypertension increase 7.61% just for 5 years from 26,5% in 2013 to 34,11% in 2018 (3). This condition also occurs in Yogyakarta (DIY), one of the provinces in Indonesia. The prevalence of hypertension in Yogyakarta is 11.1%, over the average in Indonesia, which was 8.8% in 2018 (3). In addition, there are still 60.1% of people with

hypertension who do not routinely control their blood pressure, 21.5% never control their blood pressure, and only 18.4% routinely control their blood pressure in Indonesia (4).

Public Health Center Ngemplak I is one of the primary health care units in the Sleman district in Yogyakarta province, Indonesia, where hypertension is the first in the top 10 diseases. The prevalence of hypertensive patients at 13.2% (5). Various hypertension control programs have been carried out, including an integrated monitoring program, education, and early detection of risk factors for non-communicable diseases every three months, namely POSBINDU, and integrated education and health care service, namely POSYANDU, but the program has not been able to motivate all hypertensive patients to manage their health. As a result, there are still 21.48% of hypertensive patients who have not come to the Public Health Center from the 100% target in 2019 (6). In addition, the self-care for hypertension is not optimal, including the proportion of food consumption high in salt is 70.6%, the use of food preservatives and flavorings is 77.4%, and the consumption of fatty foods is

50.7%, and the lack of vegetable and fruit consumption by 95.5%, and the lack of activity by 33.5% (7). Then they don't see the doctor regularly, take antihypertensive drugs only if there are complaints, and don't go on a diet because they feel healthy. This phenomenon illustrates the importance of understanding self-care hypertension through more appropriate education. Hypertension patients hope that hypertension self-care education is easily accessible at any time and flexible. On the other hand, the development of communication technology facilities has expanded in the people of this region, especially the use of android smartphones. This condition can be an opportunity to make hypertension education accessible, interactive, and more cost-effective at the Public Health Center Ngemplak I.

Self-care is a necessary component of hypertension treatment. Self-care refers to hypertension self-management, which is defined as the activities of hypertensive patients to maintain and achieve the most standard blood pressure. Implementation of self-care in hypertensive patients is the maintenance, monitoring, and managing of hypertension (8). The output of self-care in hypertensive patients is a controlled blood pressure level. The self-care component in hypertensive patients is known as the Hypertension Self-Care Activity Level Effect (H-Scale), including medication adherence, low salt diet, physical activity, smoking, and alcohol (9). However, the current condition is that there is still a gap in knowledge, attitudes, and self-care behavior in hypertensive patients has implications for controlling blood pressure. According to the previous research, Murphy state that lack of knowledge and lack of positive attitude are the main factors causing the inability of hypertensive patients to do self-care (10). Therefore, self-management education interventions become a strategy that makes hypertension patients do self-care (11).

There are existing previous studies using mobile or smartphone applications for hypertension management education. First, the hypertension management app (HMA) based on Clinical Practice Guidelines (CPGs), which contains education on hypertension management and monitoring of medicine, is effective in improving medication adherence (12). Second, the mobile health application that contains information and suggestions about hypertension, remainder, and blood pressure recommendations is significant for medical compliance and blood pressure control (13). Lastly, A digital hypertension program in a smartphone application that contains a questionnaire about the management of hypertension, including dietary sodium and alcohol consumption, medical adherence, physical activity, and health literacy, is a significant improvement in blood pressure and lifestyle change (14). Although there have been many previous studies, researchers have not found a mobile apps-based hypertension education intervention that was developed based on the exploration of educational content for hypertensive patients. In addition, although there have been many studies use of modern technology is effective for hypertension education, it has not been developed, especially in the area of the Public Health Center Ngemplak I.

The study aims to develop, implement and evaluate the effectiveness of android-based hypertension self-care education to improve blood pressure control among hypertensive patients. This study will explore the content of android-based hypertension self-care education for hypertension patients, then develop the intervention and implement it, and evaluate the effectiveness of the intervention on levels of self-care knowledge. , self-care attitude, self-care behavior, and blood pressure control. The research hypothesis will determine the significant differences in levels of self-care knowledge, self-care attitude, self-care behavior, and blood pressure control after android-based hypertension self-care education implementation between and within intervention and control groups.

MATERIALS AND METHODS

Study Design

Researchers choose the Exploratory Sequential mixed design method to make comprehensively answer research questions. A three-phase exploratory sequential mixed method design in which the researcher first begins by exploring with qualitative data and analysis then builds a feature to be te sted, and test this feature in the third quantitative phase (15). The research design is seen in Fig.1. First phase is qualitative research to explore the content of android-based hypertension self-care education for hypertension patients. Then the second phase is to develop an android-based hypertension self-care education intervention. In this phase, researchers will analyze the findings of educational content in the qualitative research phase, make a design, and develop an android-based hypertension self-care education intervention by involving IT professionals. Third phase is quantitative research to test the effectiveness of android-based hypertension self-care education on level of blood pressure, self-care knowledge, self-care attitude, dan self-care behavior in hypertensive patients in the Public Health Center Ngemplak I. The quantitative research design is a Randomized Control Group Pretest – Posttest Design.

Study Setting

The research will be conducted in the Public Health Center Ngemplak I, Sleman Yogyakarta, Indonesia. The Public Health Center Ngemplak I is a primary health care unit that has a program to control various diseases, including chronic and non-communicable diseases within and outside the region. Hypertensive patients are the number I disease population. The Public Health Center Ngemplak I has a health promotion team consisting of health professionals to educate and monitor the patients with the various disease. This research will
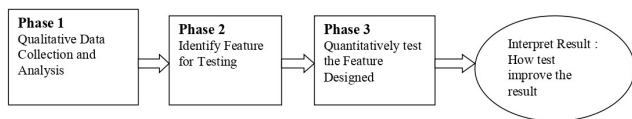
Figure 1: Exploratory Sequential Design (15)

involve health professionals and the population of hypertensive patients in the Public Health Ngemplak I area.

Eligibility Criteria
Participants in this study consist of qualitative and quantitative research participants. The researcher will take participants purposively in the qualitative research phase. The aim is to obtain information about android-based hypertension education content needed by hypertensive patients. Therefore, the eligible sample criteria are health professionals on a health promotion team who have a lot of information and experience in hypertension education programs at Public Health Center Ngemplak I.. The quantitative research population is all new patients with a medical diagnosis of primary or essential hypertension. The inclusion criteria include adults (18-55 years old), having no comorbidities or complications, and having an Android smartphone (own or with a family member who had lived in one house). The exclusion criteria are hypertensive patients who have experience hospitalization or can not follow the process to completion.

Interventions
Each participant in the intervention group will follow an android-based hypertension self-care education intervention. The Researcher will explain the procedures of intervention with a leaflet for each participant. Each participant will install a hypertension self-care education application on their respective Android smartphones. Then they will follow the education activities from the application for three months. Researchers will monitor the consistency of the intervention by visiting the participant every month. Participants in the control group will follow the hypertension education program from the Public Health Center Ngemplak I, , including health monitoring activities on non-communicable diseases every month. Then researcher will visit all participants in the intervention and control group to measure the level of self-care knowledge, self-care attitudes, self-care behavior, and blood pressure for all participants at the baseline and after three months of intervention.

Outcomes
This research has qualitative and quantitative outcomes. The qualitative study outcome is to find android-based hypertension self-care education content for hypertensive patients. In the quantitative research phase, primary outcome is the difference level blood pressure after android-based hypertension self-care education between and within the intervention and control group. Secondary outcome is the difference level in self-care knowledge, self-care attitudes, self-care behavior after android-based hypertension self-care education intervention between and within intervention and control groups.

Participants timeline
The researcher will conduct a qualitative research phase for three months, starting from sampling, collecting data, and analizing. Then, the researcher will develop an android-based self-care education intervention based on the analysis of educational content during the qualitative research phase. The quantitative research phase will conduct for five months, starting from the recruitment of participants until the assessment of research outcomes. Participant recruitment and study timeline in quantitative phase can show in Fig 2.
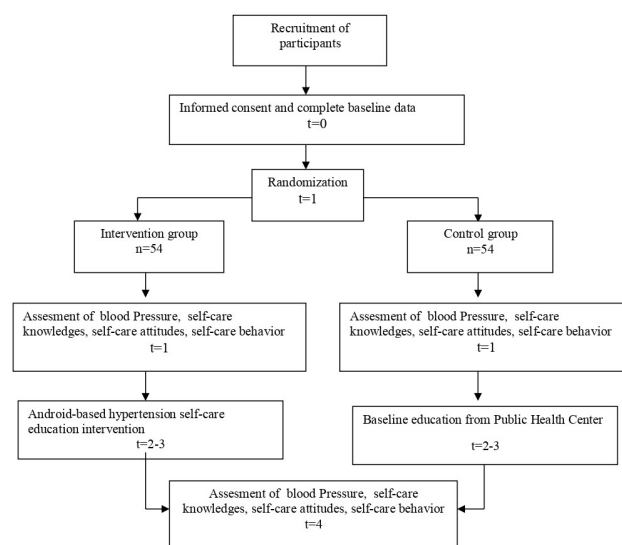

Figure 2: Participants recruitment and study timeline

Sample size
The sample of this study consisted of a sample of qualitative research and quantitative research. In qualitative research, the sample size will be determined according to the adequacy of the data or data saturation and data credibility (16). The participants will get purposively on health professional. The sample size at quantitative research will calculate with Power and Sample Size software version 3.1.9.2 with the independent t-test group formulation that based on a previous study $\alpha=0.05$, power=0.8, effect size 0,517, mean (SD) intervention group 139,15 (7,51), mean (SD) control group 143,58 (9,49) (17). The number of samples is 104 participants, then the researcher will increase the number of samples for reserve so that the final sample is 108 (54 participants, respectively).

Recruitment
Researchers will carry out various strategies to get participants according to the target. The researcher will approach the Sleman Health Office (because Public

Health Center Ngemplak I is in the area of Sleman Health Office) and the head of the Public Health Center Ngemplak I to support the research process. The researcher will disseminate the research plan to the head of Public Health Center and the health promotion team. In addition, the researcher will approach the health cadres to assist the participant recruitment process in their area. The researcher will make two groups of the participant into the intervention and the control group. Then participants will get an intervention android-based hypertension self-care education for three months. The recruitment process and time line are as shown in Fig.2.

Randomization
The randomization process will use simple random sampling in hypertensive patients who meet the sample criteria based on the Medical Record data. The randomization technique will use a closed envelope. The envelopes will be distributed to hypertensive patients who are willing to be participants when they come to the Public Health Center or by visiting the patient's home. Each hypertensive patient who meet the sample criteria will receive one envelope. Inside the envelope is written as the control, or intervention group, or blank. Blank means that the patient has not become a sample. Only researchers and patients who received envelopes will know the position as the control and intervention group

Data Collection
Researchers will collect data through in-depth interviews in the qualitative research phase. The researcher will carry out the trustworthiness of data collection through member checking from each participant and triangulation of data sources, which involves the coordinator healt promotion and the coordinator hypertension program at Public Health Center Ngemplak 1. The collection of qualitative data will use an interview guide instrument.

In quantitative research, researchers will collect demographic data and research outcomes data. The demographic data consists age, gender, level of education, and duration of hypertension. Then the researcher will collect the level of self-care knowledge, self-care attitudes, self-care practice, and blood pressure before and after the intervention. The data collection will use a questionnaire and observation sheet for documenting the level of blood pressure. The hypertension self-care knowledge questionnaire uses the Hypertension Knowledge-Level Scale (HK-LS) from Erkoc et al (2012), which has been used in the Indonesian version by Giena et al (2018) (18,19). The questionnaire consists of 18 questions with correct answer options (score 1), incorrect (score 0) and don't know (score 0).The questionnaire has been tested for the validity instrument <0.05 and the reliability of Cronbach's Alpha value of 0.91. The self-care attitude questionnaire uses the attitude questionnaire from Shrestha et al (2016) (20). The hypertension self-care attitudes questionnaire

consisted of 5 questions with assessments of strongly disagree (score 1), disagree (score 2), neutral (score 3), agree (score 4), Strongly agree (score 5). This questionnaire has been tested for the validity of <0.05 and the reliability of Cronbach's Alpha value of 0.85. The hypertension self-care behavior questionnaire uses the Hypertension Self-Care Behavior questionnaire from Han et al. (2014) (21). The questionnaire consists of 20 questions with answers always (score 5), frequent (score 4), sometimes (score 3), rarely (score 2), never (score 1). The questionnaire has been tested for the validity of <0.05 and the reliability of Cronbach's Alpha value of 0.86. Researchers will monitor all participant through the health cadres to ensure the continuity of the interventions every month.

Data analysis
Researchers will integrate mixed methods using intra methods analysis. Qualitative data analysis will use the theme analysis with strategies including preparing and organizing data, reducing data into themes through the coding process, presenting and interpreting data (23). The quantitative data will analyze with a confidence level of 95%, with a p-value < 0.05. Researchers will analyze descriptive statistical data and perform a different test. The researcher will use paired t-test to determine the difference in the effectiveness of android-based hypertension self-care management education on blood pressure control before and after the intervention. The researcher will use an independent sample t-test to determine the difference in the effectiveness of android-based hypertension self-care management education on blood pressure control between the intervention and the control group.

Ethical Consideration
This research has received a feasibility permit from Lincoln Universiti College Malaysia with letter No. LUC/MKT/IND/SP/008/001. Researchers have followed the ethical test of research feasibility applicable in Indonesia. Research ethics approval by the Health Research Ethics Committee of the University Sari Mutiara Indonesia No.625/F/Kep/Usm/I/2021. After that, this research received a feasibility permit from the Sleman District Health Office Number: 408/VIII/2020. Researchers will guarantee the freedom of participants to be involved or not involved in this research, data confidentiality, and the opportunity to access research results with informed consent. The informed consent has been approving by the Health Research Ethics Committee of the University of Sari Mutiara Indonesia Health Research Ethics Committee.

DISCUSSION

This study will illustrate that education is an essential aspect of self-care ability to control hypertension. Education is the critical link to empowering individuals for self-care (22). Thererofe, health care intervention

programs through good education will improve the self-care of hypertensive patients (23). This research will involve android-based hypertension education activities to answer the challenges of the need for hypertension information that is easier to access and financially affordable. This condition is supported by almost everyone now using technology to support their daily activities.

Existing research states that education use mobile application technology is considered to meet the aspects of convenience, feasibility, and good usability to improve the ability of hypertension management, then it is recommended to be developed (24). Then, electronic Health intervention has implications to increases self-care understanding and behavior, and clinical outcomes decrease blood pressure (25). This condition is in synergy with government programs to strengthen research and development of web-based or application-based non-communicable disease services (4). It will avoid the occurrence of potential information gaps in the community. The existence of technological advances and the widespread use of smartphones in the community, and the innovation program for controlling hypertension at Public Health Center Ngemplak I, a health promotion team consisting of health professionals with a lot of experience in hypertensive patients education are strengths in this study. Therefore, this research is a strategic step to support government programs in controlling hypertension, especially at the Ngemplak I Public Health Center

This research is very important to improve the quality of nursing care, especially in hypertensive patients who require self-management to achieve optimal health conditions through utilization. This research improves interprofessional collaboration in providing education, especially for hypertensive patients, then the education becomes more comprehensive. Results of the study will enhance the self-care of all hypertensive patients. It will increase the role of nurses, as the innovations of education comprehensively, and independent action in patients with hypertension.

CONCLUSION

Education using a modern system, easily accessible at any time, and anywhere is important to improve the self-care ability of hypertensive patients. Knowledge, attitude, behavior, and blood pressure are the primary targets in this education. Android-based Hypertension Self-care Education is a new thing that will be developed and seen its effectiveness to improve the ability of hypertensive patients to control their blood pressure. The researcher hopes that the hypertensive community will be able to manage their hypertension and achieve optimal self-care. In addition, the Public Health Center Ngemplak I will further increase the reach of education and develop educational materials in this application.

REFERENCES

1. Shah N, Shah Q, Shah AJ. The burden and high prevalence of hypertension in Pakistani adolescents: A meta-analysis of the published studies. Arch Public Heal. 2018;76(1):1–10. doi: 10.1186/s13690-018-0265-5.
2. World Health Organization. World Hypertension Day 2019 [Internet]. 2019 [cited 2021 Aug 26]. Available from: https://www.who.int/news-room/events/world-hypertension-day-2019
3. Health Research and Development Agency of the Indonesian Ministry. Basic Health Research. Jakarta: Indonesian Helth Ministry; 2018.
4. Directorate of Prevention and Control of Non-communicable Diseases DG of DP and C. P2PTM Programs and Indicators [Internet]. Indonesia Health Ministry. 2018 [cited 2021 Jan 30]. Available from: http://www.p2ptm.kemkes.go.id/profil-p2ptm/latar-belakang/program-p2ptm-dan-indikator
5. DIY Health Office. DIY Health Profile [Internet]. 2020. Available from: www.dinkes.yogyaprov.go.id
6. Sleman District Health Office. Health Profile of Sleman District [Internet]. 2019. Available from: www.dinkes.slemankab.go.id
7. Primadi O, Ma'ruf A, Indrayani YA, Wardah, Susanti MI, Pangribowo S, et al. Indonesia Health Profile. Vol. 351.077.In, Indonesia Health Ministry. Jakarta; 2021.
8. Dickson VV, Lee C, Yehle KS, Abel WM, Riegel B. Psychometric Testing of the Self-care of Hypertension Inventory: Conceptual Challenges to Collaborative Care. J Cardiovasc Nurs. 2017;32(5):431–8.doi: 10.1097/JCN.0000000000000364.
9. Zinat Motlagh SF, Chaman R, Sadeghi E, Ali Eslami A. Self-care behaviors and related factors in hypertensive patients. Iran Red Crescent Med J. 2016;18(6). doi: 10.5812/ircmj.35805.
10. Murphy K, Chuma T, Mathews C, Steyn K, Levitt N. A qualitative study of the experiences of care and motivation for effective self-management among diabetic and hypertensive patients attending public sector primary health care services in South Africa. BMC Health Serv Res. 2015;15(303):1–9. doi: 10.1186/s12913-015-0969-y.
11. Barnason S, White-williams C, Rossi LP, Centeno M, Crabbe DL, Lee KS, et al. Evidence for

Therapeutic Patient Education Interventions to Promote Cardiovascular Patient Self-Management. Circ Cardiovasc Qual Outcomes. 2017;1–23. doi: 10.1161/HCQ.0000000000000025.

12. Kang H, Park HA. A mobile app for hypertension management based on clinical practice guidelines: Development and deployment. JMIR mHealth uHealth. 2016;4(1):1–15. doi: 10.2196/mhealth.4966.

13. Gong K, Yan Y-L, Li Y, Du J, Wang J, Han Y, et al. Mobile health applications for the management of primary hypertension: A multicenter, randomized, controlled trial. Medicine (Baltimore). Medicine. 2020 Apr;99(16):e19715. doi: 10.1097/MD.0000000000019715.

14. Milani R V., Lavie CJ, Bober RM, Milani AR, Ventura HO. Improving Hypertension Control and Patient Engagement Using Digital Tools. Am J Med. 2017;130(1):14–20. doi: 10.1016/j.amjmed.2016.07.029.

15. Creswell JW, Creswell JD. Research Design Qualitative, Quantitative & Mixed Methods Approaches. Fifth Edit. Salmon H, Neve C, O'Heffernan M, Felts DC, Marks A, editors. Los Angeles: SAGE Publications; 2018. 224–226 p.

16. Utarini A. Penelitian Kualitatif dalam Pelayanan Kesehatan. Galih, editor. Yogyakarta: Gadjah Mada University Press; 2021. 229–247 p.

17. Li R, Liang N, Bu F, Hesketh T. The effectiveness of self-management of hypertension in adults using mobile health: Systematic review and meta-analysis. JMIR mHealth uHealth. 2020;8(3):1–16. doi: 10.2196/17776.

18. Erkoc SB, Isikli B, Metintas S, Kalyoncu C. Hypertension Knowledge-Level Scale (HK-LS): A Study on Development , Validity and Reliability. Int J Environ Res Public Heal. 2012;9:1018–29. doi: 10.3390/ijerph9031018.

19. Pebri V, Thongpat S, Nitirat P. Predictors of health-promoting behaviour among older adults with hypertension in Indonesia. Int J Nurs Sci. 2018;5(2):201–5. doi: 10.1016/j.ijnss.2018.04.002.

20. Shrestha S, Adhikari B, Poudel RS, Thapaliya K, Kharal T, Bhatta NK, et al. Knowledge , Attitude and Practice on Hypertension Among Antihypertensive Medication Users. J Nepal Med Assoc. 2016;55(204):86–92. PMID: 28029674.

21. Han, Hae-Ra, Lee H, Mensah, Yvonne Commodore, Kim M. Development and Validation of the Hypertension Self-Care Profile: A Practical Tool to Measure Hypertension Self-Care. J Cardiovasc Nurs. 2015;29(3):1–16. doi: 10.1097/JCN.0b013e3182a3fd46.

22. Eghbali-Babadi M, Feizi A, Khosravi A, Sarrafzadegan N. The effect of training on knowledge, attitude, and practice in patients with hypertension; the application of the expanded chronic care model: A clinical trial study. Vol. 20, Iranian Red Crescent Medical Journal. 2018;20(5): e61693. doi: 10.5812/ircmj.61693.

23. Salim H, Lee PY, Sazlina SG, Ching SM, Mawardi M, Shamsuddin NH, et al. The self-care profiles and its determinants among adults with hypertension in primary health care clinics in Selangor, Malaysia. PLoS One. 2019;14(11):1–14. doi: 10.1371/journal.pone.0224649.

24. Whitehead L, Seaton P. The effectiveness of self-management mobile phone and tablet apps in long-term condition management: A systematic review. J Med Internet Res. 2016;18(5):e97. doi: 10.2196/jmir.4883.

25. Ma Y, Cheng HY, Cheng L, Sit JWH. The effectiveness of electronic health interventions on blood pressure control, self-care behavioural outcomes and psychosocial well-being in patients with hypertension: A systematic review and meta-analysis. Int J Nurs Stud. 2019;92:27–46. doi: 10.1016/j.ijnurstu.2018.11.007.