

Effectiveness of health promotion utilizing word puzzle games in enhancing older adults' knowledge and attitudes regarding hypertension management

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Abstract

Hypertension management plays a crucial role in influencing the health outcomes of the elderly with high blood pressure.

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Various health promotion strategies have been formulated for hypertension management. However, the result has not shown an optimal reduction in the number of hypertension sufferers. An effective health promotion, such as word puzzle games, needs to be developed. Word-based puzzle games can serve as engaging health promotion tools to improve hypertension-related health behaviors among older adults and enhance their cognitive abilities. This study aims to assess the effectiveness of a word puzzle game in enhancing the knowledge, attitudes, and practices of elderly individuals regarding hypertension management. A quasi-experimental approach with a pretest-posttest control group design was used. A total of 45 participants, both in intervention and control groups, were recruited through a purposive sampling technique. Data analysis involved descriptive techniques and inferential statistics using t-test models focusing on examining three variables: knowledge, attitudes, and behaviors. The result revealed statistically significant disparities in participants' knowledge ($p=0.000$), attitudes ($p=0.001$), and behaviors ($p=0.001$) between the experimental and control groups after implementing the word puzzle game intervention. Using word puzzle games as health promotion tools successfully enhances older adults' understanding, perspectives, and actions regarding hypertension management. These games might be employed to strengthen the ability of older individuals to control their high blood pressure.

Introduction

An older adult is defined as someone who is 60 years or older¹ and is at a higher risk of developing health problems as a result of degenerative processes. The elderly population is more vulnerable to developing complications of various illnesses,² with high blood pressure being the most common degenerative condition among this group.³ A strong link exists between hypertensive heart disease and Cardiovascular Disease (CVD), with the initial symptom being high blood pressure, leading to numerous health complications if hypertension is left untreated.⁴ This condition may lead to several chronic diseases, including heart problems and stroke.

The prevalence of hypertension in older adults rises in tandem with the global increase of the elderly population. Approximately 1.28 billion people worldwide are estimated to have hypertension.⁵ In Southeast Asian nations, around 43.2% of older adults suffer from hypertension,⁶ with 28.1% recorded in Indonesia in 2019. This figure increased to 30.29% in the same year and further rose to 31.7% by 2020.⁷

Addressing the health issues of the elderly poses considerable obstacles, primarily due to the nature of their ailments, which are often degenerative, long-lasting, and multifaceted, necessitating prolonged care and substantial financial investment.⁸ Government entities, community organizations, and educational institutions have launched various programs to reduce the occurrence of dis-

eases stemming from poorly managed hypertension. These initiatives involve updating health promotion strategies, policies, and protocols aimed at controlling high blood pressure.⁹ Health education is a key component of health promotion and disease prevention. Hypertension management in Indonesia has been carried out through the POSBINDU PTM (Integrated Non-Communicable Disease Development Post) program with basic health check activities, such as blood pressure checks and providing health education to the elderly.¹⁰ People who access POSBINDU showed a good knowledge of hypertension.^{11,12} Health education for elderly people is needed to maintain and increase knowledge about the risk factors of hypertension.^{13,14} The activity of health education aims to encourage elderly people to adopt healthy behaviors, especially taking medication,¹⁵ and changing their lifestyle to improve their overall health and life satisfaction.¹⁶

Health education interventions targeting hypertension patients can enhance older adults' ability to manage their hypertension condition, leading to better blood pressure outcomes.¹⁷ As a result, a demand for creative health education methods is needed to tailor elderly with hypertension. Using games as a means of delivering health information to older adults might be an alternative.¹⁸ Studies examining gaming interventions for the elderly have shown that games and play-based therapies, particularly in healthcare settings, produce positive outcomes for this age group.¹⁹ Extensive research on the use of games for older populations is still needed to develop alternative formats beyond stimulating cognitive function.

Despite the implementation of various health promotion interventions using different media, hypertension among the elderly remains a major public health issue. This research utilized a word search puzzle game as an educational intervention to improve older adults' knowledge, attitudes, and behaviors regarding hypertension management. The game was designed not only to provide health education but also to stimulate cognitive function and encourage social interaction among seniors. Word puzzle games have the potential to generate enthusiasm, positive emotions, and engagement while simultaneously enhancing cognitive abilities in older individuals. Moreover, the games offer an engaging technique for acquiring health-related information. This study aimed to assess the effectiveness of this word puzzle game in enhancing older adults' understanding, attitudes, and practices concerning hypertension management.

Materials and Methods

Research design

A quasi-experimental research design featuring a pretest-posttest method and a control group was utilized in this study. East Jakarta's Cakung District was selected as a study location targeting a population of elderly living in the DKI Jakarta region. The study participants were pre-elderly and elderly adults who met the following selection criteria: i) aged between 45 and 69 years; ii) able to read and write; iii) able to communicate effectively; iv) competent in performing daily activities; v) without visual or auditory impairments; vi) and willing to participate in the study.

The study was conducted for a month with four follow-up durations: one every week. Prior to intervention, respondents filled out pre-test questions about the material that would be studied while playing the word puzzle game. The material in the word puzzle game consisted of four topics: i) definition and effects of high blood pressure; ii) causes of high blood pressure; iii) signs and

symptoms of high blood pressure; and (iv) handling high blood pressure. After being explained how to play the game, respondents were asked to complete the word puzzle game for one material/topic each week. After completing all games from each material, respondents were asked to answer a post-test.

Study participants

The study employed a purposive sampling technique for recruiting participants. Sample size was determined using the Lemeshow formula, with parameters set at $\alpha=95\%$, $z=1.96$; $P=0.71$, and $d=10\%$ (α is the desired confidence level, Z is the z-score value corresponding to the desired confidence level, P is the proportion of the population estimated to have a particular characteristic, and d is the margin of error). The calculated sample of 80 was increased to 90, considering potential attrition. The final participants were 45 for each group. The study was conducted from March to October 2022.

Variables, instruments, and data collection

The study examined knowledge, attitudes, and behaviors as research variables. A researcher developed an instrument based on relevant theories, demonstrating satisfactory validity and reliability, surpassing the r-table value of 0.074 and achieving an alpha value of 0.943. Both groups underwent a pre-test to establish baseline values for assessing the word puzzle game's impact. The intervention group engaged with the word puzzle game, while the control group received a booklet. Post-intervention, both groups completed a post-test. The study compared scores before and after the intervention to evaluate its effectiveness.

Word search puzzles are linguistic challenges where words, often centered around a particular theme, are hidden within a matrix of letters. The goal is to discover and identify all the concealed words. In this particular game, focused on hypertension, approximately 20-40 terms are embedded in various orientations: left to right, top to bottom, diagonally, and in reverse. A catalog of hidden words is provided, including terminology related to the comprehension of hypertension's indicators, manifestations, origins, and consequences. As an elderly participant locates a target word, their companion asks about the participant's understanding of the term and its connection to hypertension. Once the puzzle is completed, the companion provides a summary of the identified words, and the elderly participant is asked to recollect the key points discussed by the companion.

Data analysis

A research instrument was utilized to gather primary data. The collected information underwent descriptive analysis and inferential statistical evaluation using a t-test. Descriptive analysis focused on variables related to respondent characteristics (age, gender, education, occupation, and ethnic background). To determine differences between the intervention and control groups regarding education, attitude, and behavior variables, a t-test was applied.

Ethical clearance

The study received authorization from the DKI Jakarta Health Office and successfully passed an ethical review conducted by the Jakarta III Poltekkes Kemenkes Research Ethics Committee, as evidenced by approval No.LB.02.02/KEPK/032/2022. Written informed consent was obtained from all participants in the study.

Results

Tables 1 and 2 show the characteristics of participants. Analysis shows that in the intervention group, respondents' ages ranged from 60 to 71, with an average of 64.69 years. For the control group, the age range was 60 to 76, with a mean of 67.17 years. As illustrated in Table 3, both groups were predominantly composed of female participants, individuals with elementary school education, those not currently employed, and people of Javanese ethnicity. The homogeneity test revealed no significant disparities between the intervention and control groups in terms of gender, age, occupation, education, ethnic background, knowledge, attitudes, and skills prior to the implementation of the word puzzle game intervention.

Comparative analysis of knowledge and attitude scores pre- and post-intervention with word puzzle game in intervention and control groups

The analysis presented in Table 4 shows a statistically significant disparity in knowledge between the intervention and control groups prior to and following the word puzzle game intervention ($p=0.000$). For the attitude variable, a statistically significant difference was also observed in the intervention group before and after the word puzzle game intervention ($p=0.001$). Likewise, the skill variable revealed a statistically significant change in the intervention group pre- and post-implementation of the word puzzle game ($p=0.001$).

Table 1. Respondents' characteristics based on age.

Variable	Group	N	Mean	Median	SD	Min-Max
Age of respondents	Intervention	45	64.69	63	3.059	60-71
	Control	45	67.17	67	4.896	60-76

Table 2. Classification of blood pressure in the elderly intervention group.

Blood pressure	Intervention group		Control group		Total	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Pre-hypertension SBP (mmHg) 120- 139 DBP (mmHg) 80-89	3	6.7	5	11.1	8	8.9
Stage 1 Hypertension SBP(mmHg) 140- 159 DBP (mmHg) 90-99	25	55.5	27	60	52	57.8
Stage 2 Hypertension SBP(mmHg) \geq 160 DBP (mmHg) \geq 100	17	37.8	13	28.9	30	33.3

SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 3. Distribution of participants' demographic characteristics based on gender, educational attainment, occupational status, and ethnic background.

Variable	Intervention group		Control group		Total	
	N	%	N	%	N	%
Gender						
Male	12	26.7	19	42.2	31	34
Female	33	73.3	26	57.8	59	66
Education						
Primary school	33	57.8	28	62.2	61	67
Junior high school	9	20.0	13	28.9	22	24
High school	3	6.7	4	8.9	7	9
Work						
Civil servant	1	2.2	5	11.1	6	6.7
Private sector employee	4	8.9	5	11.1	9	10
Entrepreneur	3	6.7	2	4.4	5	5.5
Labor	8	17.8	3	6.7	11	12.2
Trade	2	2.2	4	8.9	6	6.7
Not working	27	60	26	57.8	53	58.9
Ethnic origin						
Javanese	26	57.8	23	51.1	49	54
Betawi	10	22.2	10	22.2	20	22
Sundanese	8	17.8	11	24.4	19	21
Others	1	2.2	1	2.2	2	2

Variations in knowledge, attitude, and skills scores across groups

Table 5 demonstrates a statistically significant difference in respondents' knowledge ($p=0.000$), attitude ($p=0.054$), and skills ($p=0.052$) between the intervention and control groups following the implementation of the word puzzle game intervention.

Discussion

The study demonstrates the effectiveness of using word puzzle games as a novel approach to health education for older adults. This method can be particularly useful in enhancing knowledge and attitudes about hypertension management, especially among individuals who may find traditional educational methods less engaging. By using interactive and enjoyable methods like word puzzle games, it is possible to increase engagement and improve health outcomes. To engage participants in locating words within randomly arranged letters, word search puzzle games were employed.¹⁸ These puzzles typically feature square or rectangular grids where participants are tasked with identifying words horizontally, vertically, or diagonally. The game's name reflects its nature,

as predetermined words are concealed within the letter arrangement. Players must complete the puzzle by scanning from left to right (or in reverse) and searching for word beginnings (if provided), uppercase letters, and repeated letters. In cases where no word list is supplied, seniors can find words by reading right to left and top to bottom. This cognitively challenging activity is suitable for older adults, as games provide not only stimulation but also improve focus and memory retention.²⁰

The research revealed that participating in word puzzle games improved elderly individuals' knowledge, attitudes, and behaviors regarding hypertension management. A significant barrier to self-care among older hypertensive patients is an insufficient understanding of the condition and its treatment regimen.²¹ Educational initiatives for elderly individuals with hypertension cover the definition, causes, implications, symptoms, treatment options, and management approaches.^{22,23}

Health education enables individuals with hypertension to enhance their understanding, mindset, and ability to manage their diet and self-efficacy.²⁴⁻²⁶ Numerous studies have shown that health education can positively shape attitudes towards unmanaged hypertension.^{27,28} Attitudes consist of emotional and behavioral tendencies towards objects or subjects involving psychological values.²⁹ They influence actions, readiness, and the propensity to

Table 4. Analysis of knowledge, attitude, and skills scores pre- and post-intervention with word puzzle game.

Variable	Group	Mean	SD	95% CI	T	p
Knowledge	Intervention group					
	Before	8.87	2.029	-1.692-0.441	-3.436	0.001
	After	9.93	0.252			
	Difference	-1.067				
	Control group					
	Before	8.84	1.999	-0.018-0.107	1.431	0.160
After	8.80	2.018				
Difference	0.044					
Attitude	Intervention group					
	Before	26.67	3.456	-3.661-1.095	-3.735	0.001
	After	29.04	2.836			
	Difference	-2.378				
	Control group					
	Before	26.53	3.188	-0.236-0.147	0.467	0.643
After	26.58	3.354				
Difference	-0.044					
Skills	Intervention group					
	Before	28.93	3.499	-5.089-1.759	-9.957	0.000
	After	32.36	4.313			
	Difference	-3.422				
	Control group					
	Before	28.89	3.524	-0.064-0.000	0.000	0.1000
After	28.89	3.531				
Difference	0.000					

Table 5. Evaluation of knowledge, attitude, and skills scores after the word puzzle game intervention.

Variable	Group	N	Mean	SD	95% CI	F	p
Knowledge	Intervention	45	9.93	0.252	0.416-1.629	36.068	0.000
	Control	45	8.91	2.032	0.408-1.637		
Attitude	Intervention	45	29.82	2.452	1.911-4.400	3.808	0.054
	Control	45	26.67	3.411	1.909-4.402		
Skills	Intervention	45	32.36	4.313	1.740-5.016	3.897	0.052
	Control	45	28.98	3.461	1.739-5.017		

behave in specific ways towards particular items. Furthermore, the attitudes of hypertensive patients affect blood pressure management and compliance with dietary guidelines for hypertension. Patients with hypertension who possess more positive attitudes tend to exhibit better self-care practices.^{30,31}

Research has shown that evidence-based education and support for self-management in hypertensive individuals are linked to favorable health outcomes, such as lower blood pressure, improved knowledge, and enhanced self-management skills.^{32,33} A retrospective study on hypertensive patients revealed that weight increase, lack of physical activity, and high salt consumption are associated with poor blood pressure control.³⁴ Individuals with hypertension must adhere to a healthy lifestyle that includes physical activities (such as walking, jogging, strength training, and gardening), as well as monitoring and reducing salt and sodium intake.

This study examined the effectiveness of word puzzle games on elderly people in Cakung District, Indonesia. Therefore, generalization of findings to the national context needs to be done with caution. Further research is required with a larger sample size and a wider area scale. To deepen the effectiveness of word puzzle games, combining word puzzle games with other health education interventions, such as diet counseling or physical activity programs, can be done in future studies.

This study employed a word puzzle game as an interactive method to deliver health education about hypertension. The findings revealed that the intervention group demonstrated improvements in knowledge, attitudes, and behaviors compared to the control group. It's worth noting that word puzzles can also enhance cognitive abilities in elderly individuals.³⁵ Participating in mentally stimulating games can boost older adults' concentration, cognitive function, and memory.¹⁹ Games designed for seniors serve multiple purposes beyond memory training and social interaction; they also offer a means to maintain health at home during the pandemic.³⁶ Additionally, prior studies examining the impact of puzzle games on elderly individuals have shown that the process of experiential learning encompasses four cognitive stages: experiencing, reflecting, connecting, and applying. These stages work together to enhance the cognitive abilities of older adults participating in puzzle-based activities.³⁷ Research has also demonstrated that puzzle therapy can significantly improve cognitive function in the elderly population.³⁸ As a result, puzzle games and similar gaming activities may serve as effective tools for exercising cognitive abilities and potentially reducing the risk of dementia in older adults.

Conclusions

The study revealed improved knowledge, attitudes, and behaviors in the experimental group that participated in the word game puzzle intervention compared to the control group. The word puzzle game showed a statistically significant beneficial impact on elderly individuals with hypertension. Utilizing word puzzle games for health education can enhance patients' understanding of hypertension and improve their ability to manage and monitor blood pressure. Additionally, these games may boost cognitive functions in older adults and potentially reduce the likelihood of developing dementia. Future research can be designed by adding other interventions, such as hypertension diet counseling and activity programs, to increase the effectiveness of hypertension management in the elderly.

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