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Biopsychosocial Factors Associated with the Risk of Hypertension in Elderly in Klaten, Central Java: A Cross-Sectional Study

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ABSTRACT

Background: Hypertension is also a major preventable risk factor for cardiovascular disease, and plays a role in all causes of death worldwide, characterized by systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. The purpose of this study was to analyze the effect of biopsychosocial factors on the risk of hypertension among the elderly in Klaten Regency.
Subjects and Method: This study was cross-sectional from April-May 2024. The sample used was 200 elderly people in 25 elderly health posts and selected using random sampling techniques in Klaten Regency, Central Java. The dependent variable of this study was the incidence of hypertension. The independent variables of this study were age, gender, anxiety, stress, and income level. The data were collected using questionnaire and analyzed using path analysis run on Stata 13.
Results: Systolic blood pressure is directly affected by anxiety (b= 1.34; CI 95%= -0.13 to 2.82; p= 0.075), the existence of retirement funds (b= -0.09; CI 95%= -0.01 to -0.03; p= 0.003), and female (b= 1.22; CI 95%= -5.38 to 7.84; p= 0.716). Anxiety is influenced by stress (b= 0.38; CI 95%= 0.29 to 0.48; p<0.001), the existence of retirement funds (b= -0.01; CI 95% <0.01 to <0.01; p= 0.038), and age (b= 0.04; CI 95%= 0.07 to 0.08; p= 0.020).
Conclusion: Systolic blood pressure is directly affected by anxiety, the existence of retirement funds, and female. Anxiety is influenced by stress, the existence of retirement funds, and age.

Keywords: Age, gender, depression, stress, income, hypertension, elderly

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BACKGROUND

Hypertension is a major but manageable public health issue globally. It is a significant risk factor for cardiovascular disease, the leading cause of death in adults worldwide. Hypertension is also a major preventable risk factor for cardiovascular disease (CVD), and plays a role in all-cause mortality worldwide as indicated by systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg (Mills et al., 2020).

There are many factors that influence the occurrence of hypertension, including genetic factors, socioeconomic factors such as globalization, population distribution or population density, education, age, gender,

income level, and unhealthy behavioral factors such as consuming foods containing salt, fat or high cholesterol foods, little activity, smoking and consuming alcohol (Fadilla et al., 2019). There are two types of interventions that can be done to control hypertension, namely pharmacological and non-pharmacological. Even though pharmacological treatment or taking antihypertensive drugs is very effective, around 70% of patients who only receive antihypertensive drugs, their blood pressure cannot be controlled. This condition encourages non-pharmacological interventions to play a role in preventing and controlling hypertension. Non-pharmacological hypertension interventions can be used before starting pharmacological therapy or combined with pharmacology (Khairunissa et al., 2021).

The prevalence of hypertension in the world according to WHO (2023) is 22% of the world's total population. The African region has the highest prevalence of hypertension at 27% while the American region has the lowest prevalence of hypertension at 18%. WHO estimates that the number of people with hypertension will continue to increase along with the increasing population. Hypertension has killed 17.9 million people who died from cardiovascular disease in 2019, representing 32% of all global deaths. Of the 17 million premature deaths (under the age of 70) due to non-communicable diseases in 2019 and 38% were caused by cardiovascular disease. An estimated 46% of adults with hypertension are unaware that they have the disease. In adults, 42% of people with hypertension are diagnosed and treated, and about 1 in 5 adults, 21% with hypertension can control it. Hypertension is the leading cause of premature death worldwide. One of the global targets for non-communicable diseases is to reduce the prevalence of hypertension by 33% between 2010 and 2030 (WHO, 2023).

Based on the results of basic health research in 2018, the prevalence of the population in Central Java Province with hypertension was 37.57%. Measuring blood pressure is one of the early detection activities for risk factors for non-communicable diseases such as hypertension, stroke, heart disease, kidney dysfunction or others. This activity can be carried out at every health facility including health centers or other health clinics. It can also be carried out at integrated development posts (PTM) in the community. Cases of hypertension in Central Java in 2018 were recorded at 1,377,356 cases (Prevalence Rate 3.99%) and increased to 8,070,378 cases (Prevalence Rate 23.25%) in 2019 (Ministry of Health, 2019).

Klaten Regency as one of the regencies in Central Java has a burden of non-communicable diseases including hypertension. In 2018, there were 66,066 cases of hypertension (8.44%) in Klaten Regency, the number of hypertension sufferers was dominated by female patients of 41,944 residents (8.53%) and male patients of 24,122 residents (8.30%). The number of hypertension cases in Klaten Regency in 2019 was recorded at 134,312 cases (Prevalence Rate 10.66%) then decreased to 102,089 cases (Prevalence Rate 8.10%) in 2020. This figure is included in the five diseases that are the main health problems in Klaten Regency (Klaten Health Office, 2021).

Hypertension cases occur mostly in the age group of 35-44 years old (6.3%), age group of 45-54 years old (11.9%), and age group of 55-64 years old (17.2%) (Ministry of Health, 2017). Elderly people are divided into middle age (45-59 years old), old age (60-74 years old), elderly age (75-90 years old) and very old age (over 90 years old) according to the World Health Organization (WHO, 2018).

Biopsychosocial shows a dynamic relationship between biological, psychological and socio-economic factors that interact and influence each other. Biological theory is based on evidence that behavior is largely determined by organic and physical processes and the work of the brain. The word psycho refers to the psychological aspects of an individual, namely thoughts, feelings and behavior, while socio-economic refers to the external relationship of an individual with people and the environment around them (Kurnianingsih, 2019). Biopsychosocial shows a dynamic relationship between biological, psychological, and socio-economic factors that interact and influence each other. Biopsychosocial factors in this study include age, gender, stress anxiety, income level, and the context of the elderly health posts.

From the description above, the author is interested in conducting a study entitled "The Influence of Biopsychosocial Factors on the Risk of Hypertension in the Elderly: In Klaten Regency". From the results of the survey, the author observed the risk factors cause hypertension in the Klaten Regency. This study also supports programs for preventing non-communicable diseases and efforts related to risk factors for hypertension. Therefore, this study is important so that these risk factors can be controlled effectively.

SUBJECTS AND METHOD

1. Study Design

The type of research used is quantitative research with an analytical observational method with a cross-sectional study. This research was conducted at 25 elderly health posts in Klaten Regency. This research was conducted in April to May 2024.

2. Population and Sample

The population in this study were elderly people aged 60 years old and over who were in the elderly health post 2 in Klaten Regency. The sampling technique used was simple random sampling. A total of 200 samples were selected from 25 health posts spread across all strata and selected from each health post.

3. Study Variables

The dependent variable was Hypertension. The independent variables ewere age, gender, anxiety, stress, and income level.

4. Operational Definition of Variables

Age: Age of research subjects at the time of the research.

Gender: The gender of the research subjects is seen from their identity cards.

Anxiety Stress: A condition experienced by a person due to external demands that are considered dangerous to the body.

Income Level: The amount of pocket money received by the subject per month.

5. Study Instruments

Data on age, gender, anxiety, stress, and retirement funds were obtained through interviews and questionnaires. Hypertension data were obtained by measuring with a Tensimeter or Sphygmomanometer. Anxiety and stress data were obtained through the Depression Anxiety Stress Scale (DASS) questionnaire.

6. Data Analysis

Univariate analysis was conducted with the aim of determining the frequency distribution and percentage of each variable studied, namely Biopsychosocial including blood pressure, age, gender, and pension funds. Bivariate analysis was conducted on each variable studied, namely depression, anxiety, and stress using logistic regression. Multivariate analysis used a path analysis model with the variables studied, namely independent variables including stress, income level (retirement funds), age, and gender and dependent variables, namely anxiety and systolic blood pressure.

7. Research Ethics

Research ethics including anonymity, confidentiality, and informed consent were handled carefully throughout the research process. The research ethics permit approval letter was obtained from the Research Ethics Committee of Dr. Moewardi Hospital, Surakarta City on March 29, 2024 with the number 873/III/HREC/2024.

RESULTS

1. Sample Characteristics

Table 1 shows that 128 research subjects (64.0%) were female and 72 research subjects (36.0%) were male. Elderly people aged <70 years old were 97 research subjects (48.5%) and 103 research subjects (51.5%) were ≥70 years old. Elderly people with income levels were 31 research subjects (15.5%) who had pension funds and 169 research subjects (84.5%) who did not have pensions. For blood pressure in the elderly, 117 research subjects (58.5%) had hypertension and 83 research subjects (41.5%) did not have hypertension.

Table 2 shows the results of univariate analysis that from 200 research subjects, depression showed (Mean= 4.32; SD= 2.89) with a minimum score of 0 and a maximum score of 11. The anxiety variable showed (Mean= 3.95; SD= 2.17) with a minimum score of 0 and a maximum score of 9. The stress variable showed (Mean= 6.25; SD= 2.66) with a minimum score of 0 and a maximum score of 13. The results of the study also showed that the hypertension variable (Mean= 0.58; SD= 0.49) with a minimum score 0 and maximum score 1.

Table 1. Sample characteristics of the elderly health post 2 in the Klaten Regency (Categorical data)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Female	128	64.0
	Male	72	36.0
Age	<70 years old	97	48.5
	≥70 years old	103	51.5
Income Level	Retirement Funds	31	15.5
	No Retirement Funds	169	84.5
Blood Pressure	Hypertension	117	58.5
	Non-Hypertension	83	41.50

Table 2. Sample characteristics of the elderly health post 2 in the Klaten Regency (Continous data)

Variable	Mean	SD	Min.	Max.
Depression	4.32	2.89	0	11
Anxiety	3.95	2.17	0	9
Stress	6.25	2.66	0	13

2. Bivariate Analysis

Table 3 shows that there is a positive influence between depression and the risk of hypertension in the elderly and the relationship is not statistically significant. Every increase in one unit of depression will be followed by an increase in the risk of hypertension in the elderly by 0.81 units (OR = 0.81; 95% CI= -0.31 to 1.95; p= 0.159). With a 95% confidence level, every increase in one unit of depression will be followed by an increase in the risk of hypertension in the elderly by -0.31 to 1.95.

Based on the anxiety variable, show that there is a positive and statistically significant effect between anxiety and the risk of

hypertension in the elderly. Every increase in one unit of anxiety will be followed by an increase in the risk of hypertension in the elderly by 1.66 units (OR = 1.66; 95% CI = 0.16 to 3.17; p = 0.030). Every increase in one unit of anxiety will be followed by an increase in the risk of hypertension in the elderly by 0.16 to 3.17.

Based on the results of stress variable, show that there is a positive influence between anxiety and the risk of hypertension in the elderly, but the relationship is not statistically significant. Every increase in one unit of stress will be followed by an increase in the risk of hypertension in the elderly by 0.17 units (OR = 0.17; 95% CI = -1.07 to 1.41; p= 0.785). With a 95% confidence level, every increase in one unit of stress will be followed by an increase in the risk of hypertension in the elderly by -1.07 to 1.41.

Table 3. Results of logistic regression analysis of depression, anxiety, and stress on the risk of hypertension in the elderly

Independent Variable	OR	CI 95%		p
		Lower Limit	Upper Limit	
Depression	0.81	-0.32	1.95	0.159
Anxiety	1.66	0.16	3.17	0.030
Stress	0.17	-1.07	1.41	0.785

3. Path Analysis

This Figure 1, illustrates the structural model used in the path analysis. The model displays the relationships between the identified independent and dependent variables in this study, indicating both the direction and strength of associations based on path coefficients.

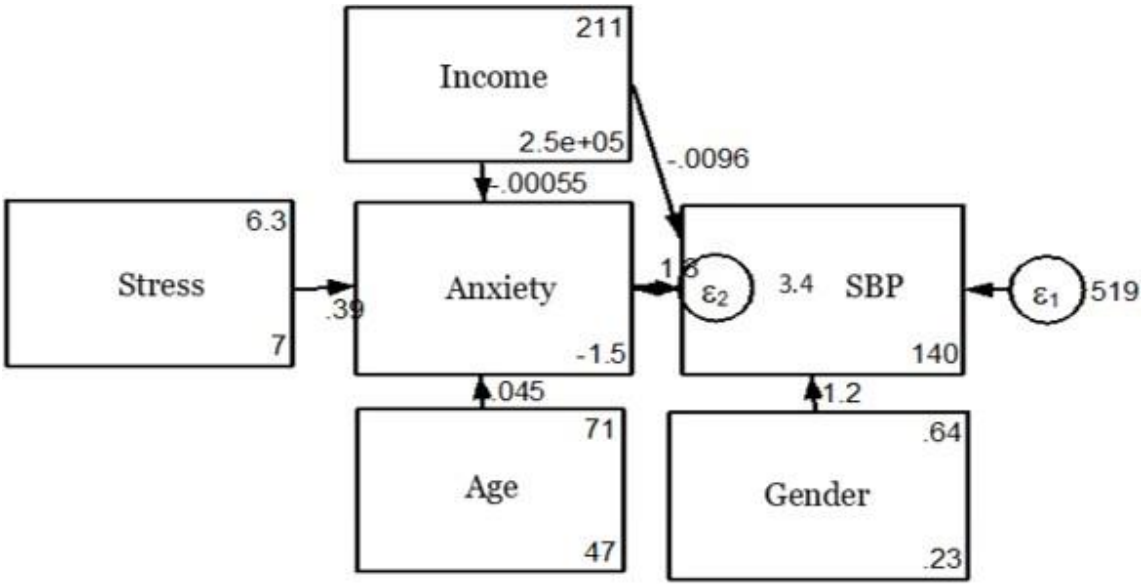

Figure 1. Structural Model of Path Analysis

Table 4 shows the results of the path analysis examining the relationships between systolic blood pressure and various predictors in the elderly, including age, gender, stress, anxiety, and retirement funds. Each coefficient indicates the strength and direction of the relationship with p-values identifying statistical significance

a. The relationship between systolic blood pressure and anxiety

Table 4 shows that there is a direct relationship between systolic blood pressure and anxiety, and the relationship is close to significant. Every increase of 1 anxiety score will be followed by an increase in systolic blood pressure of 1.34 mmHg units. (b= 1.34; CI 95%= -0.13 to 2.82; p= 0.075).

b. The relationship between systolic blood pressure and retirement funds

Table 4 shows that there is a negative relationship between systolic blood pressure and pension funds. Elderly people who have pension funds have lower systolic blood pressure on average than those without pension funds and the difference is statistically significant (b= -0.09; CI 95%= -0.01 to -0.03; p= 0.003).

c. The relationship between anxiety and stress

Table 4 shows that there is a statistically significant relationship between anxiety and stress. Every increase of 1 stress score will be followed by an increase in anxiety score of 0.38 units. (b= 0.38; CI 95%= 0.29 to 0.48; p< 0.001).

d. The relationship between systolic blood pressure and gender

Table 4 does not show any significant differences in systolic blood pressure by gender (b= 1.22; CI 95%= -5.38 to 7.84; p= 0.716).

e. The relationship between anxiety and retirement funds

Table 4 shows that there is a statistically significant relationship between anxiety and retirement funds, and the relationship is. Elderly people who have pension funds have an average lower level of anxiety than those who do not have pension funds (b= -0.01; CI 95%=-0.01 to <0.01; p= 0.038).

f. The relationship between anxiety and age

Table 4 shows that there is a positive and statistically significant relationship between anxiety and age. Every 1 year increase in age will be followed by an increase in anxiety of 0.04 units. (b= 0.04; CI 95%= 0.07 to 0.08; p= 0.020). The path analysis model shows good model fit with the following fit indicators: p= 0.819 (p>0.050); RMSEA <0.01 (RMSEA <0.08); CFI= 1.00 (CFI >0.90); TLI=1.09 (TLI>0.90); SRMR= 0.01 (SRMR <0.08); CD= 0.30.

Table 4. The results of path analysis of the relationship between systolic blood pressure and age, gender, stress, anxiety, and retirement funds in the elderly.

Dependent Variable	Independent Variable	Path coefficient (b)	CI 95%		p
			Lower limit	Upper limit	
Direct effect					
Systolic blood pressure (mmHg)	← Anxiety	1.34	-0.13	2.82	0.075
	← Retirement funds	-0.09	-0.01	-0.03	0.003
	← Gender (Female)	1.22	-5.38	7.84	0.716
Indirect effect					
Anxiety	← Stress	0.38	0.29	0.48	<0.001
	← Retirement funds	-0.01	-0.01	<0.01	0.038
	← Age (Years old)	0.04	0.07	0.08	0.020
N observation = 200					
Log likelihood = -4119.674					

DISCUSSION

a. The relationship between systolic blood pressure and anxiety

Table 4 shows that there is a direct relationship between systolic blood pressure and anxiety, and the relationship is close to significant. Every increase of 1 anxiety score will be followed by an increase in systolic blood pressure of 1.34 mmHg units. (b= 1.34; CI 95%= -0.13 to 2.82; p= 0.075).

The results of a study conducted by Istyanto et al. (2019) stated that there was a positive and direct relationship between anxiety and hypertension (b = 0.26; 95% CI = 0.02 to 0.51; p = 0.037). This study is in line with a study conducted by Hamrah et al., (2018) which showed that anxiety was significantly higher in older patients than in younger patients with a prevalence of anxiety in hypertensive patients of 42.3%.

This study stated that high levels of anxiety are associated with increased SBP. Hypertensive patients are more likely to experience anxiety and those who experience anxiety are at increased risk of developing hypertension. Anxiety may be particularly relevant to aging and cardiovascular disease. Anxiety disorders are thought to be more common in older adults than in younger adults. The incidence of hypertension is more common in the relationship between systolic blood pressure and pension funds.

Table 4 shows that there is a negative relationship between systolic blood pressure and pension funds. Elderly people who have pension funds have lower systolic blood pressure on average than those without pension funds and the difference is statistically significant. (b= -0.09; CI 95%= -0.01 to -0.03; p= 0.003).

The income level in this study is the elderly who have retirement funds and the elderly who do not have retirement funds. In this study, the elderly who do not have retirement funds are at higher risk of hypertension, possibly due to the lack of funds to check themselves regularly and psychological stress. The elderly who have retirement funds are associated with the incidence of hypertension due to their material ability and ease of access to health information through various electronic media. The study explains that low-income elderly and high blood pressure have a significant impact on all causes and cardiovascular mortality risk, the lowest-income group has a much higher mortality rate and cardiovascular incidence compared to the high-income group. The excess risk of death and cardiovascular events associated with BP is more prominent in the lowest-income group (Shin et al., 2021).

At the low-income group level, there is a higher risk of hypertension compared to the high-income group. A meta-analysis study stated that low and middle-income countries showed significant results for the occurrence of hypertension (Lestari and Nugroho, 2020).

b. The relationship between systolic blood pressure and gender

Table 4 does not show a significant difference in systolic blood pressure by gender (b = 1.22; 95% CI = -5.38 to 7.84; p = 0.716). In this study, systolic blood pressure and gender (female) did not show a significant difference. There is a relationship between age and the incidence of hypertension in women. Research done by Sudaryanto (2019) stated that there is a significant relationship between age factors and the incidence of hypertension in women aged >45 years old and over (OR=5.27; 95%CI= 1.81 to 15.28; p= 0.002).

A study states that highlighting this special consideration for women is supported by several studies in Bangladesh and other countries. This may be due to the lack of ovarian hormones during the postmenopausal period. Studies have shown that

ovarian hormones, especially estrogen, have the potential to keep blood pressure low in premenopausal women, and the lack of estrogen may be responsible for the increase blood pressure in postmenopausal women. In addition, our findings suggest that women in their later years become more socially vulnerable to hypertension. Overall, more women (56%) were identified as having hypertension than men (42%) (Hanif et al., 2021).

c. The relationship between anxiety and stress

Table 4 shows that there is a relationship between anxiety and stress, and the relationship is statistically significant. Every increase of 1 stress score will be followed by an increase in anxiety score of 0.38 units. (b= 0.38; CI 95%= 0.29 to 0.48; p< 0.001).

During stress and anxiety, the body experiences hormonal imbalance. All hormones controlled by the brain experience imbalance, one of which is increased levels of adrenaline and adrenocortical response. Stress will increase peripheral vascular resistance and cardiac output so that it will stimulate sympathetic nerve activity. Elderly people who experience stress will also increase anxiety which causes increased blood pressure. Anxiety is an unclear and widespread concern related to feelings of uncertainty and helplessness. This emotional state does not have a specific object. Anxiety is experienced subjectively and communicated interpersonally. Symptoms of anxiety experienced by the elderly are feelings of irrational worry/fear of events that will occur, difficulty sleeping, feeling tense and irritable, often complaining of mild symptoms or being afraid and worried about serious illnesses, and often imagining scary things/worrying about big problems (Setyawan, 2017).

A person in a stressful condition will stimulate the body to release adrenaline hormones so that the heart will beat faster and stronger, blood vessels narrow and eventually blood pressure will increase. Stress is prone to occur at a productive age, which is 15 to 64 years old (Cuffee et al., 2014). Mental or psychosocial stress according to Jadhav et al., (2014) is one of the main risk factors for hypertension and various other cardiovascular diseases.

d. The relationship between anxiety and retirement funds

Table 4 shows that there is a relationship between anxiety and retirement funds, and the relationship is statistically significant. Elderly people who have pension funds have an average lower level of anxiety than those who do not have retirement funds (b= -0.01; CI 95%= -0.01 to <0.01; p= 0.038).

The income level in this study is the elderly who have retirement funds and the elderly who do not have retirement funds. The study explains that the elderly who do not have retirement funds will experience anxiety. In a parallel study, a positive relationship was found between hypertension and symptoms of depression and anxiety in both high-income and low-income groups. People with hypertension who have low incomes tend not to seek treatment and do not receive medical care compared to high-income individuals (Kang and Kim, 2020).

This is stated that a low economic level can be another factor besides lifestyle of hypertension risk. Even sometimes if they already know that they have hypertension, they ignore the advice of health workers about hypertension treatment, because of the tendency of people who live alone and their memory has begun to decline. At the low-income group level, there is a higher risk of hypertension compared to the high-income group. A meta-analysis study stated that low and middle-income countries showed significant results for the occurrence of hypertension (Lestari and Nugroho, 2020).

e. The relationship between anxiety and age

Table 4 shows that there is a positive and statistically significant relationship between anxiety and age. Every 1 year increase in age will be followed by an increase in anxiety of 0.04 units (b = 0.04; 95% CI = 0.07 to 0.08; p = 0.020). This factor cannot be controlled. This study shows that as a person gets older, blood pressure increases. With increasing age, the risk of developing hypertension is greater so the prevalence among the elderly is quite high at 40% with a mortality of around 50% over the age of 60. Arteries lose elasticity or flexibility and blood pressure increases with age (Price, 1995).

Age increases with high levels of anxiety. The underlying cause may be that the number of specific 5-hydroxytryptamine (5-HT) receptors in the brain can be significantly reduced, thereby increasing the likelihood of developing anxiety. 5-HT also increases vasodilation by activating 5-HT receptors in the endothelium to promote no production. This implies that reducing 5-HT receptors may contribute to endothelial dysfunction. In addition, older people with a higher prevalence of hypertension are also more susceptible to anxiety disorders. Therefore, age is a major risk factor for the occurrence of comorbid hypertension and anxiety (Qiu et al., 2023).

High hypertension is in line with increasing age with high anxiety which is also caused by the walls of the arteries in old age experiencing thickening which results in the accumulation of collagen in the muscle layer so that the walls of large blood vessels become narrower and stiffer, as a result, there is an increase in systolic blood pressure (Currie, 2018).

The conclusion in this study is that the path analysis concludes that systolic blood pressure is directly influenced by anxiety (b= 1.34; CI 95%= -0.13 to 2.82; p= 0.075), existence of pension funds (b= -0.09; CI 95%= -0.01 to -0.03; p= 0.003), and gender (b= 1.22; CI 95%= -5.38 to 7.84; p= 0.716). Anxiety is influenced by stress (b= 0.38; CI 95%= 0.29 to 0.48; p<0.001), the existence of pension funds (b= -0.0; CI 95%= -0.01 to <0.01; p= 0.038), and age (b= 0.04; CI 95%= 0.07 to 0.08; p= 0.020). In this study, there are several limitations of the study, including: (1) The large number of questionnaire questions that must be answered by the elderly, which causes boredom or fatigue in answering questions. (2) It takes a longer duration to create a sense of mutual trust between researchers and research subjects and to build an effective communication atmosphere because the data collection technique uses interviews. (3) This study only uses the Biopsychosocial model theory. It is hoped that further researchers can research other variables using more supportive theories. (4) The selection of research variables to determine their effect on the risk of hypertension may not be able to describe the whole thing because there are many factors that can affect the risk of hypertension in other elderly people

AUTHOR CONTRIBUTION

All authors have made significant contributions to the data analysis and preparation of the final manuscript.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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