The Relationship of Blood Pressure on Cognitive Function in Hypertension Patients

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Abstract. WHO explains that hypertension continues to increase every year, it is estimated that in 2025 1.5 billion people with hypertension and 9.4 million people die every year due to hypertension and its complications. The prevalence of hypertension in Indonesia based on the results of Riskesdas is 34.1%. This figure is higher than the previous year which touched a prevalence rate of 25.8%. Patients with hypertension cause large blood vessels to constrict, so that the flow of blood entering through the blood vessels will decrease. If the constriction is too large there will be blockage, resulting in a decrease in oxygen levels carried by the blood to the brain. Decreased oxygen levels in the brain will cause disturbances. Cognitive function. Objective: This study aims to determine the relationship between blood pressure and cognitive function in patients with hypertension. Method: This type of research was quantitative with a cross sectional approach. The sampling technique used was random sampling (as many as 40 respondents) in the Tegaltandan and Jomblangan. The data analysis technique in this study used Kendall Tau. Results: The results revealed p value $0.000 < = 0.05$ and the correlation coefficient value was -0.653**. Conclusion: There was a relationship between blood pressure and cognitive function in hypertensive patients in the Tegaltandan and Jomblangan with a strong negative relationship. Suggestion: Hypertensive patients are expected to routinely control blood pressure to reduce problems that can cause cognitive dysfunction.

Keywords: blood pressure · cognitive function · hypertension patients

1 Introduction

As people get older, their arteries become wider and stiffer, resulting in less effective capacity and blood circulation. This causes an increase in systolic pressure and disruption of neurohormonal mechanisms that regulate blood pressure, such as the renin-angiotensin-aldosterone system, as well as an increase in peripheral plasma concentration, which causes increased vasoconstriction and vascular pressure, resulting in high blood pressure or hypertension [14].

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Furthermore, one of the causes of the rising number of hypertension cases in the community is the advancement of lifestyle [24]. Hypertension is a disease characterized by a persistent rise in blood pressure [5]. Hypertension is classified as a very serious noncommunicable disease (PTM) because hypertension often does not cause serious signs and symptoms until the complication phase [25]. Hypertension is a condition characterized by an increase in systolic and diastolic blood pressure above normal levels, which can result in morbidity and even death (mortality). Until now, hypertension has been identified as a health problem large enough to be addressed [26]. According to the World Health Organization (WHO), hypertension is on the rise and is expected to reach 1.5 billion people by 2025, with 9.4 million people dying each year as a result of hypertension and its complications.

Hypertension causes large blood vessels to constrict, reducing the flow of blood entering the blood vessels; if the constriction is too large, there will be a blockage, resulting in a reduction in oxygen carried by the blood to the brain; this will affect brain performance, which will experience disorder; one of its manifestations is a decrease in cognitive function [20].

In Law No. RI. 36 of 2009, Article 158 paragraphs 1 to 4 concerning Non-Communicable Diseases and Article 159 paragraphs 1–3 concerning Control of Non-Communicable Diseases, hypertension is listed as one of the Non-Communicable Diseases. According to Regulation of the Minister of Health of Indonesia No. 4 of 2019, Article 2 Paragraph 3 explains the types of basic services in the SPM (Minimum Service Standards) for District or City Health, one of which is Health Services for Hypertension Patients, based on standards that include blood pressure measurement and education. The service mechanism is the targeting of hypertension patients determined by the Regional Head using the Minister of Health's most recent Basic Health Research data set. Hypertension health services are defined as health services that include measuring blood pressure at least once a month in health care facilities, educating patients on lifestyle changes and/or medication adherence, and making referrals as needed.

According to the WHO, hypertension affects 22% of the world's population. Hypertensive patients account for 36% of the Southeast Asian population [23]. According to the findings of Basic Health Research, the prevalence of hypertension in Indonesia is 34.1%. This is an increase from the previous year, when the prevalence rate was 25.8%. These findings represent the prevalence of hypertension in Indonesians over the age of 18 based on blood pressure measurements.

The Special Region of Yogyakarta (DIY) is one of 14 provinces in Indonesia with a hypertension prevalence of up to 25.7%. The risk of hypertension increases by 2.18 times in the elderly aged 60–64 years, 2.45 times in the elderly aged 65–69 years, and 2.97 times in those over 70 years. The risk of developing hypertension increases with age, so that the prevalence among the elderly is quite high, reaching 40% with a mortality rate of around 50%. According to the Bantul Health Office, there will be 81,877 people with hypertension in all health centers in Bantul Regency in 2021.

According to Ministry of Health data from 2020, hypertensive patients with decreased cognitive function reached 7–9%. Furthermore, research on hypertensive patients [27] revealed that 42.5% of those who completed the MMSE (Mini Mental

State Examination) results were classified as having cognitive decline. Hypertension had a 39% prevalence on cognitive function decline in 46 samples.

The prevalence of hypertension is known to rise with age, and the prevalence is higher in people with higher levels of education. Many people are still indifferent to, if not outright dismissive of, hypertension. Currently, urban residents are more likely than rural residents to suffer from hypertension. This is because his lifestyle in cities is more dangerous, such as stress, eating fast food, smoking, and drinking. However, it is possible that rural communities will be spared. Village communities may be at risk as a result of knowledge and educational factors such as not controlling salt, micin, stress, and a lack of knowledge about hypertension itself.

Patients who have uncontrolled hypertension for more than 5 years are at risk of developing cardiovascular disease, kidney disease, and stroke. In addition to stroke, one of the complications of hypertension is in the central nervous system, which leads to decreased cognitive function and, if left untreated, it will lead to dementia (vascular cognitive impairment). Because of several factors, including hypertension, brain microvascular disorders play a role in the occurrence of vascular cognitive impairment [16]. Attention, perception, thought processes, knowledge, and memory are all examples of cognitive functions [7]. According to [16], long-term hypertension results in decreased cognitive function. According to research [9], people who have had hypertension for more than 5 years are more likely to have cognitive function decline.

According to a preliminary study conducted at the Banguntapan III Primary Health Center on January 26, 2022 through direct interviews with hypertension patients aged 20 months to more than 70 years, there were 114 hypertension patients in December 2021.

This study examines the prevalence of blood pressure in hypertensive patients and how it affects cognitive function in respondents at the Banguntapan III Public Health Center in Bantul, Yogyakarta. As a result, the researchers wanted to investigate the relationship between cognitive function and hypertension in patients. It is hoped that by understanding the relationship between hypertension and cognitive function, it will be possible to reduce or even prevent hypertensive patients in the Banguntapan area of Bantul, Yogyakarta, from experiencing a decline in cognitive function.

2 Method

This study employed quantitative research that used a formal, objective, and systemic process approach. Correlation was used in this research method to examine the relationship between the independent variable (blood pressure) and the dependent variable (decreased cognitive function). The cross-sectional design was used in this study. This study included 51 hypertensive patients from the Banguntapan III Community Health Center. This study obtained 40 respondents using a random sampling technique with random sampling and purposive sampling. The MMSE questionnaire and a digital sphygmomanometer were used in this study. The MMSE questionnaire was tested for validity and received a validity level of 0.357 with r table 0,355 declared valid because r count is greater than r table and a reliability value of 0.887. The digital sphygmomanometer has been calibrated to ensure the tool's accuracy and validity. The Kendall Tau correlation test

was used to analyze the data in this study. The Ethics Commission of UNISA Yogyakarta granted this study an ethical license, numbered 2263/KEP-UNISA/VIII/2022.

3 Result and Discussion

Table 1 shows that the age group 46–55 years has the most respondents (13 respondents (32.5%)) and the age group 56–65 years has the fewest (4 respondents (10.0%)).

Table 2 shows that there are 20 (50.0%) male and female respondents.

Table 3 depicts respondents with varying levels of education. As many as 20 (50.0%) of respondents have a senior high school education level. However, respondents with bachelor degree level are the least respondents with as many as 3 (7.5%) respondents.

Table 4 shows the respondents' various occupations. The majority of respondents, 13 (32.5%), worked as traders. Civil servants 2 (5.0%) were the fewest respondents.

Table 1. FREQUENCY DISTRIBUTION OF CHARACTERISTICS BY AGE

Age	*Frequency*	*Percentage (%)*
25–35 Years	11	27,5
36–45 Years	12	30,0
46–55 Years	13	32,5
56–65 Years	4	10,0
Total	**40**	**100,0**

Table 2. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS BY SEX

Sex	*Frequency*	*Percentage (%)*
Male	20	50,0
Female	20	50,0
Total	**40**	**100,0**

Table 3. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS ON EDUCATION

Education	*Frequency*	*Percentage (%)*
Elementary School	12	30,0
Junior High School	5	12,5
Senior High School	20	50,0
Bachelor Degree	3	7,5
Total	**40**	**100,0**

Table 4. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS BASED ON Occupation

Occupation	*Frequency*	*Percentage (%)*
Housewife	5	12,5
Household Assistant	3	7,5
Laborer	6	15,0
Privat Sector	11	27,5
Employee Trader	13	32,5
Civil Servant	2	5,0
Total	**40**	**100,0**

Table 5. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS BASED ON LENGTH OF SUFFERING FROM HYPERTENSION

Length of Suffering	*Frequency*	*Percentage (%)*
6–10 Years	18	45,0
11–20 Years	10	25,0
>21 Years	12	30,0
Total	**40**	**100,0**

Table 5 depicts respondents with varying lengths of hypertension. The majority of respondents (45.0%) had hypertension for 6–10 years. The shortest period of hypertension was 11–20 years (25.0%).

Table 6 shows the different levels of hypertension among respondents. Grade II hypertension (160-179/100-109 mmHg) has the highest prevalence of 18 (45.0%). Grade I (140-159/90-99 mmHg) has the lowest total of 5 (12.5%).

Table 7 displays the MMSE questionnaire results for various respondents. The majority of the results, 22 (55.0%), indicated probable cognitive impairment. At the very least, the standard value with total 0.

Table 6. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS BASED ON THE DEGREE OF HYPERTENSION

Hypertension Degree	*Frequency*	*Percentage (%)*
Degree I 140-159/90-99 mmHg	5	12,5
Degree II 160-179/100-109 mmHg	18	45,0
Degree III > 180/110 mmHg	17	42,5
Total	**40**	**100,0**

Table 7. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS BASED ON THE RESULT OF THE MMSE QUESTIONNAIRE

	Frequency	***Percentage (%)***
Define (<17)	1	2,5
Probable (17–23)	22	55,0
Normal (24–30)	17	42,5
Total	**40**	**100,0**

Table 8. FREQUENCY DISTRIBUTION OF RESPONDENTS CHARACTERISTICS BASED ON CROSSTABULATION OF HYPERTENSION DEGREE WITH COGNITIVE FUNTION

Hypertension		***Cognitive Function***			
		Definite (<17)	***Probable (17–23)***	***Normal (24–30)***	***Total***
Hypertension Degree	I (140-159/90-99 mmhg)	0	0	5	5
Probable (17–23)	II (160-179/100-109 mmhg)	0	7	11	18
Normal (24–30)	III (>180/110)	1	15	1	17
Total	**1**	**22**	**17**	**40**	

Table 8 shows that the more severe the hypertension, the worse the cognitive function. The highest number of respondents in cognitive disorders is 23, with definite 1 and probable 22. The majority of respondents have hypertension of grade II.

Table 9. KENDALL TAU'S TEST DISTRIBUTION

			Hypertension Degree	***CognitiveFuntion***
Kendall's Tau	Hypertension Degree	Correlation Coefficient	1.000	-.653**
		Sig. (2-tailed)	-	.000
		N	40	40
	Cognitive Function	Correlation Coefficient	-.653**	1000
		Sig. (2-tailed)	.000	-
		N	40	40

** Correlation is significant at the 0.01 level (2-tailed).

Table 9 displays the results of the Kendall Tau test, which obtained a p value of 0.000 = 0.05 and a correlation coefficient of -0.653**. This study demonstrates a relationship between high blood pressure and cognitive function. The closeness of the relationship in this study is strong, and the direction of the relationship is negative, implying that as hypertension levels rise, cognitive function suffers.

Table 1 shows the age categories chosen by four groups with a 10-year age difference. Early adulthood is defined as 25–35 years old, late adulthood as 36–45 years old, early old age as 46–55 years old, and late elderly as 56–65 years old [3]. At the age of 46–55 years (early elderly), 13 (32.5%) of respondents in the study in the Banguntapan III Primary Health Center area had hypertension. High blood pressure is most common between the ages of 30 and 55, owing to poor previous lifestyle habits and changes in the elasticity of blood vessels caused by age. As a result, capacity and blood circulation become less efficient. This causes the systolic pressure to increase. Furthermore, it disrupts neurohormonal mechanisms such as the renin-angiotensin-aldosterone system, which regulates blood pressure, as well as impaired increase in peripheral plasma concentrations, resulting in increased vasoconstriction and vascular pressure, resulting in high blood pressure or hypertension [14].

Table 2 shows that there are 20 (50.0%) male and female respondents. Men are more likely than women to develop hypertension as a result of an uncontrolled or poor lifestyle [17]. Men have higher blood pressure than women until about the age of 55, owing to poorer male lifestyle choices such as smoking and drinking alcohol. Men and women are almost equally at risk between the ages of 55 and 74, but after that, women are more at risk [10].

Women are more vulnerable after menopause, as systolic blood pressure rises sharply with age. The reason for this is that as estrogen levels fall, women will gradually lose the hormone that protects blood vessels from damage. This causes an increase in blood pressure [22].

In Table 3, as many as 20 (50.0%) of respondents have a high school education level (SMA). In Wahyuni and David's 2013 study, with the characteristics of most respondents having a high school education, namely 85 respondents with 41.06%, and the research results of p value 0.000 0.05, it can be concluded that there is a relationship between education and hypertension sufferers. According to the study, the higher a person's education, the easier it is for them to receive information, and thus the greater their knowledge of health. On the other hand, the lower the respondent's education, the less accepting of newly introduced information and values [21].

According to research conducted by [6], with p value 0.01 0.05, there is a relationship between education level and hypertension patients.

According to Table 4, the majority of respondents' occupations are traders, with 13 respondents (32.5%) being traders. The conclusion of Brian and his friends' 2015 study, with p value 0.023 0.05, is that there is a relationship between work or workload and the incidence of hypertension [1]. The conclusion of Lestari and colleagues' 2022 study, with p value 0.03 0.05, is that there is a relationship between type of work and the incidence of hypertension. The most common types of work in this study were middle to lower traders [11]. The same is true for research participants. Small traders with low yields are more likely to develop hypertension because they must constantly think about their trades and

how to trade again the next day. Then it has an effect on the risk factor for hypertension, which is stress. Stress causes an increase in sympathetic nerve activity, which gradually raises blood pressure. Furthermore, stress increases peripheral resistance and pulse rate. Organ dysfunction will occur if the stress response is excessive [9]. Stress can cause an increase in blood pressure at any time. When stressed, the adrenaline hormone rises, causing the heart to pump blood faster and raising blood pressure [5].

Table 5 shows that the most respondents (45.0%) have had hypertension for 6–10 years. The respondent's history of hypertension is divided into three categories: 6–10 years, 11–20 years, and >20 years [12]. The most hypertension age in research respondents was 45–55 years, with a maximum duration of hypertension of 6–10 years. This is consistent with the consequences when early adulthood and late adulthood have factors that cause hypertension, such as an unhealthy lifestyle, so high blood pressure or hypertension will appear in early old age. The elderly have a high risk of disease at a young age, one of which is hypertension due to a previous lifestyle [18]. According to Rahmayanti's findings, there is a relationship between the duration of hypertension and a decline in cognitive function [17]. The comparison results with the normal and impaired cognitive function groups were significantly worse in the group with hypertension duration > 20 years, according to Li and colleagues' study.

The highest degree of hypertension in Table 6 is Grade II (160–179/100–109 mmHg), which is 18 (45.0%). The respondent's degree of hypertension is degree II at the age of 45–55 years and a duration of hypertension of 6–10 years. That condition is caused by failing to implement an unhealthy lifestyle and failing to take regular medication. Several respondents stated during the study that they did not take medication on a regular basis, rarely performed health checks, one of which was checking blood pressure, and continued to have a sedentary lifestyle and poor eating habits. This has a significant impact on the level of hypertension obtained by respondents. The degree of hypertension was strongly influenced by physical activity or lifestyle in Katuuk and Masi's 2018 study [13]. According to Darmawanti and Kurniawan's research, the degree of hypertension in 2021 is heavily influenced by drug therapy and the respondent's lifestyle [2].

Table 7 shows a total of 23 (57.5%) results for cognitive disorders. In this study, respondents with hypertension grade II had the best results, while those with hypertension grade I had the worst. The cause of the large number of respondents with cognitive impairment is hypertension complications, specifically the central nervous system, which results in decreased cognitive function and, if left untreated, dementia (vascular cognitive impairments). Brain microvascular disorders contribute to the development of vascular cognitive impairment [16]. This demonstrates that the greater the degree of hypertension, the worse the respondent's cognitive function is because cognitive neuroscience states that changes in the brain can affect cognitive function and affect the brain, and the longer it will get worse [19].

In the analysis of MMSE questionnaire responses, the respondent with the lowest score was in the calculation and language section of the questionnaire, with a score of 0. This was due to the fact that many respondents disliked counting and were unable to form sentences according to the instructions on the questionnaire. The calculation on the MMSE questionnaire is very simple, consisting of only answering 100 minus 7, and so on, up to 5 times. When the calculation questions began, some respondents paused

for a moment before responding that they didn't know. There are also respondents who can answer once but are wrong and then say they don't know. There is also the direct answer, "I don't know." According to the study [8], 60.6% of respondents with a value of 0 in the calculation, and language with a value of 0 that is 51.5%, this is due to the respondent's education level being less than high school, which is 63.6%.

Table 8 shows that the more severe the hypertension, the worse the cognitive function. The most people in this study had cognitive disorders, with 16 people having hypertension grade III. After the age of 45, the artery walls thicken, causing a buildup of collagen substances in the muscle layer, causing the blood vessels to gradually narrow and stiffen. Systolic blood pressure rises until the seventh decade because the flexibility of large blood vessels decreases with age, whereas diastolic blood pressure rises until the fifth and sixth decades and then persists or tends to decrease. Because it is the result of findings of cardiac output times (HR x stroke volume) x peripheral resistance, decreased elasticity of blood vessels causes an increase in peripheral vascular resistance as a result of the final finding of increased blood pressure [15].

Table 9 displays the results of the Kendall Tau test on data with significant values or sig. (2 tailed) between the variable degree of high blood pressure or hypertension and cognitive function is 0.000 smaller with a value of = 0.05, it can be concluded that there is a "significant (significant)" relationship between the variable degree of high blood pressure or hypertension and cognitive function.

Based on the data obtained and the Kendall Tau test results, the results were found to be 0.000 smaller with a value of $\alpha = 0{,}05$, so Hα is accepted and Ho is rejected. This demonstrates significant results, implying that there is a close relationship between blood pressure in hypertensive patients and decreased cognitive function, or that there is a relationship between blood pressure in hypertensive patients and decreased cognitive function. The test results are closely related. According to Sarwono, the level of closeness or the correlation coefficient has the criteria for the level of closeness, with the criteria for the correlation coefficient value of 0.51 to 0.75 which means strong, according to the test results in table 4.8 is −0.653**, means a strong relationship. And a significant number of 0.01 with a 1% error rate.

The test results also show a negative correlation number (−0.653**), indicating a "negative" relationship between the variable degree of high blood pressure or hypertension and cognitive function. A negative relationship is called a heterogeneous relationship, which means that if the degree of hypertension is higher, cognitive function will be lower or cognitive function will decrease. The findings revealed that there was a relationship between blood pressure and cognitive function in hypertensive patients. This is due to the proliferation of smooth muscle cells in brain blood vessels. This proliferation causes the lumen to narrow and the walls of the blood vessels to thicken, disrupting the nutrients carried by the blood to the brain tissue. If not treated immediately, the neuron cells in the brain will suffer from ischemia. When there is ischemia, the ion pump that requires ATP stops working, causing sodium and calcium ions to become trapped in neuronal cells. Sodium will attract H2O into the cell, causing edema. Calcium activates glutamate, causing it to become cytotoxic to cells. The sodium and calcium will eventually cause neuron cells to die, resulting in cognitive function disorders [7].

This study is consistent with Taufik's 2014 research at Diponegoro University's Faculty of Medicine. The results from all research subjects totaled 49 respondents, with 38 having impaired cognitive function and the rest not having cognitive function disorders [20]. When measuring cognitive function in respondents with hypertension for more than 5 years, the results are very significant for impaired cognitive function.

Another study conducted by Li and his colleagues in 2014 looked at the long-standing relationship between hypertension and decreased cognitive function in hypertensive patients [12]. The duration of hypertension and cognitive decline in hypertensive patients (224 with normal blood pressure and 1,296 with uncontrolled hypertension) were described in this study. The duration of hypertension in this study was classified as 5 years, 6–10 years, 11–20 years, and >20 years. The findings revealed that cognitive function was significantly worse in the group with hypertension for more than 20 years compared to the normal group. According to the findings of a study conducted by Pandean and Surachamnto in 2016 with 45 respondents who had a history of hypertension, there was no relationship between the duration of hypertension and cognitive function ($p = 0.335$, $r = 0.065$). The findings are not statistically significant, but when measuring cognitive function with the MMSE questionnaire in patients with hypertension over the age of 5, there is a significant relationship between the duration of hypertension and impaired or decreased cognitive function [16].

Another study conducted in 2018 by Rahmayanti obtained a p-value of $0{,}035 < \alpha = 0{,}05$, indicating a significant result, indicating that there is a relationship between the duration of hypertension and cognitive decline in the Internal Medicine Polyclinic of Meuraxa Regional Hospital of Banda Aceh [17].

The findings of Titip's study in 2017 revealed a p-value of $0{,}216 > \alpha = 0{,}05$, indicating that there is no statistically significant relationship between the incidence of hypertension and impaired cognitive function, which was conducted the Sawah Lebar Integrated Health Unit in Bengkulu City [4].

4 Conclusion

Degree II was the highest level of hypertension in the Banguntapan III Primary Health Center, with 18 respondents (45.0%). In the Banguntapan III Primary Health Center, the prevalence of impaired cognitive function is 2.5% for definite impairment and 55% for probable impairment. The Kendall Tau test yielded a p value of $0{,}000 < \alpha = 0{,}05$ and a correlation coefficient of -0.653**. This study demonstrates a relationship between high blood pressure and cognitive function. The closeness of the relationship in this study is strong, and the direction of the relationship is negative, implying that as hypertension levels rise, cognitive function suffers.

References

1. Brian Sinubu, R., Rondonuwu, R., & Onibala, F. (2015). Hubungan Beban Kerja dengan Kejadian Hipertensi Di Amurang Kabupaten Minahasa Selatan. 3, 32.
2. Darmawati, I., & Kurniawan, F. A. (2021). Hubungan antara Grade Hipertensi dengan Tingkat Kemandirian Lansia dalam Activities Of Daily Living (ADLs). Faletehan Health Journal, 8(01), 31–35. https://doi.org/10.33746/fhj.v8i01.153

3. Depkes. (2018). Kategori Umur Menurut WHO & Depkes.
4. Gustami, T. E. (2017). Hubungan Hipertensi terhadap Fungsi Kognitif pada Lanjut Usia di Posyandu Sawah Lebar Kota Bengkulu. In Solid State Ionics (Vol. 2, Issue 1).
5. Ikhwan, M., PH, L., & Hermanto. (2015). Hubungan Faktor Pemicu Hipertensi Dengan Kejadian Hipertensi. 000, 1–11.
6. Intan Ayu, K. (2017). Hubungan Antara Tingkat Pendidikan Pasien Hipertensi Dengan Tingkat Kepatuhan Dalam Menjalankan Terapi Hipertensi Pada Peserta Prolanis (Program Pengelolaan Penyakit Kronis) Di Beberapa Puskesmas Kota Malang.
7. Ismaya, D. R. D., Kusumawati, R., & Murti, B. (2017). Hubungan Hipertensi dengan Gangguan Fungsi Kognitif pada Lansia di Posyandu Lansia Binaan Puskesmas Ngoresan, Surakarta. In Nexus Kedokteran Komunitas (Vol. 6, Issue 2).
8. Komala, D. W., Novitasari, D., & Awaludin, S. (2021). MIini-Mental State Examination Untuk Mengkaji Fungsi Kognitif Lansia. Keperawatan Malang, 6(2), 95–107.
9. Kusumawati, R. (2019). Hubungan Status Nutrisi terhadap Fungsi Kognitif pada pasien hipertensi diwilayah kerja Puskesmas Silo Kabupaten Jember. Skripsi.
10. Kusumawaty, J., Hidayat, N., & Ginanjar, E. (2016). Hubungan Jenis Kelamin dengan Intensitas Hipertensi pada Lansia di Wilayah Factors Related Events Sex with Hypertension in Elderly Work Area Health District Lakbok Ciamis. Jurnal Mutiara Medika, 16(2), 46–51.
11. Lestari, Y. I., & Nugroho, P. S. (2020). Hubungan Tingkat Ekonomi dan Jenis Pekerjaan dengan Kejadian Hipertensi di Wilayah Kerja Puskesmas. Borneo Student Researh, 269–273.
12. Li, T., Xiang, J., Bai, J., Wang, R., & Zhao, Z. (2014). The association of duration of hypertension and changes in cognitive function in hypertension patients.
13. Masi, G. M., & Ratulangi, U. S. (2018). Hubungan Aktivitas Fisik dengan Drajat Hipertensi Pada Pasien Rawat Jalan Di Wilayah Kerja Puskesmas Tagulandung Kabupaten Sitaro. 6, 1–6.
14. Nuraeni, E. (2019). Hubungan Usia Dan Jenis Kelamin Beresiko Dengan Kejadian Hipertensi Di Klinik X Kota Tangerang. Jurnal JKFT, 4(1), 1. https://doi.org/10.31000/jkft.v4i1.1996
15. Nuraini, B. (2015). Risk Factors of Hypertension. In J Majority (Vol. 4, Issue 5).
16. Pandean, G. V., & Surachmanto, E. E. (2016). Hubungan hipertensi dengan fungsi kognitif di Poliklinik SMF Ilmu Penyakit Dalam RSUP Prof. Dr. R. D. Kandou Manado. In e-CliniC (Vol.4,Issue1). https://doi.org/10.35790/ecl.4.1.2016.12147
17. Rahmayanti, Y. (2018). Hubungan Lama Menderita Hipertensi Dengan Penurunan Fungsi Kognitif Pada Lansia. In Jurnal Aceh Medika (Vol. 2, Issue 2).
18. Sangka, A., Basri, M., & Hanis, M. (2021). Hubungan Gaya Hidup Dengan Kejadian Hipertensi di RSUD Kota Makassar. Jurnal Ilmiah Mahasiswa & Penelitian Keperawatan, 1(2), 182–188.
19. Suwanti, & Alislami, F. Z. F. (2021). Hubungan Kejadian Hipertensi Dengan Fungsi Kognitif Pada Lansia Di Desa Jampiroso Selatan Kota Temanggung. 1(2).
20. Taufik, E., Purwoko, Y., & Muhartomo, H. (2014). Pengaruh Hipertensi Terhadap Fungsi Kognitif Pada Lanjut Usia. Jurnal Kedokteran Diponegoro.
21. Wahyuni, & Eksanoto, D. (2013). Hubungan Tingkat Pendidikan Dan Jenis Kelamin Dengan Kejadian Hipertensi Di Kelurahan Jagalan Di Wilayah Kerja Puskesmas Pucangsawit Surakarta. Jurnal Ilmu Keperawatan Indonesia, 1(1), 112–121.
22. Yunus, M., Aditya, I. W. C., & Eksa, D. R. (2021). Hubungan Usia Dan Jenis Kelamin Dengan Hipertensi Di Puskesmas Haji Penaggilan Kecamatan Anak Tuha Kabupaten Lampung Tengah. 8(September), 1–13.
23. Tirtasari, S., & Kodim, N. (2019). Prevalensi dan karakteristik hipertensi pada usia dewasa muda di Indonesia. Tarumanagara Medical Journal, 1(2), 395-402.
24. Umbas, I. M., Tuda, J., & Numansyah, M. (2019). Hubungan Antara Merokok Dengan Hipertensi Di Puskesmas Kawangkoan. Jurnal Keperawatan, 7(1).

25. Nugraha, D. P., Amalia, A., Oktafiona, E. W., Alifa, A. R., Ernawati, E., & Maurizka, I. O. (2022). PEMBERDAYAAN MASYARAKAT DENGAN MENGGUNAKAN PILL-BOX DALAM RANGKA MENINGKATKAN KEPATUHAN MINUM OBAT PASIEN HIPERTENSI DI DESA BENDILJATI WETAN KECAMATAN SUMBERGEMPOL KABUPATEN TULUNGAGUNG. Journal of Community Service (JCS), 1(2), 1-6.
26. Sumartini, N. P., Zulkifli, Z., & Adhitya, M. A. P. (2019). Pengaruh senam hipertensi lansia terhadap tekanan darah lansia dengan hipertensi di Wilayah Kerja Puskesmas Cakranegara Kelurahan Turida tahun 2019. Jurnal Keperawatan Terpadu (Integrated Nursing Journal), 1(2), 47-55.
27. Watulingas, J. F., Kembuan, M. A., & Karema, W. (2016). Gambaran fungsi kognitif pada penderita hipertensi di Kelurahan Kakaskasen III Kecamatan Tomohon Utara periode September-Oktober 2016. e-CliniC, 4(2).