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The Relationship Between Age and Gender and the Incidence of Hypertension at the 05.09.01 Ngawi Health Clinic

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Abstract

Hypertension remains one of the major noncommunicable diseases and continues to be a significant public health concern due to its contribution to increased morbidity and mortality associated with cardiovascular diseases. Identifying nonmodifiable risk factors, such as age and sex, is essential to support hypertension screening and early detection efforts. This study aimed to analyze the association between age, sex, and the incidence of hypertension among patients at the Health Polyclinic 05.09.01 Ngawi. This study employed an analytical observational design with a cross-sectional approach. A total of 100 patients were selected using a purposive sampling technique based on medical record data. Data were analyzed using univariate analysis, the Chi-square test for bivariate analysis, and binary logistic regression for multivariate analysis with a significance level of 5%. Bivariate analysis revealed that age was significantly associated with hypertension incidence ($p < 0.001$), whereas sex was not significantly associated with hypertension ($p = 0.478$). Multivariate analysis demonstrated that the logistic regression model was statistically significant ($\chi^2 = 16.037$; $p < 0.001$). Age remained a significant predictor of hypertension after controlling for sex ($p < 0.001$). Patients aged ≥35 years had 5.743 times higher odds of developing hypertension compared with those aged <35 years (OR = 5.743; 95% CI = 2.286–14.430). In contrast, sex was not significantly associated with hypertension ($p = 0.514$; OR = 1.470; 95% CI = 0.582–3.717). Age was significantly associated with and influenced the incidence of hypertension, whereas sex showed no significant association with hypertension incidence.

INTRODUCTION

Hypertension is one of the major public health problems and remains a significant challenge in controlling noncommunicable diseases in various countries. Hypertension contributes to increased morbidity and mortality due to cardiovascular diseases, including coronary heart disease, heart failure, stroke, and chronic kidney disease. The American Heart Association (2025) defines hypertension as a condition of persistently elevated arterial blood pressure characterized by systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥80 mmHg. Changes in diagnostic thresholds indicate that the population potentially identified as having hypertension has increased, making early detection and prevention efforts increasingly important.

Hypertension continues to demonstrate a high prevalence globally and in Indonesia. It has been reported that 33% of the global population aged 30–79 years is living with hypertension. However, nearly half (44%) of individuals with hypertension are unaware of their condition. Low public awareness regarding blood pressure status causes many hypertension cases to remain undetected in the early stages and only become recognized after complications occur. In Indonesia, the prevalence of hypertension based on blood pressure

measurements reaches 29.2%, whereas hypertension based on physician diagnosis is approximately 8% (World Health Organization, 2025; Ministry of Health of the Republic of Indonesia, 2024). The discrepancy between measurement-based prevalence and diagnosed cases indicates that a substantial number of hypertension cases remain unidentified within the community.

The burden of hypertension is also a concern in East Java Province. Based on the 2023 Indonesian Health Survey, East Java is among the ten provinces with the highest prevalence of diagnosed hypertension in Indonesia, with a prevalence of 8%, and ranks third highest for hypertension based on blood pressure measurements, with a prevalence of 32.8%. In addition, the Health Profile of East Java Province reported an increase in hypertension cases of 3.55% during the 2023–2024 period. Hypertension is also among the ten most common diseases reported in outpatient and inpatient services at healthcare facilities in East Java. These conditions indicate that hypertension remains a critical health problem requiring serious attention through prevention, early detection, and control strategies for noncommunicable diseases at the regional level (Ministry of Health of the Republic of Indonesia, 2024; East Java Provincial Health Office, 2025).

The high prevalence of hypertension accompanied by a low diagnosis rate represents a major challenge in controlling noncommunicable diseases. Undiagnosed hypertension may progress into cardiovascular complications, including stroke, coronary heart disease, and chronic kidney disease, which can increase morbidity, mortality, and healthcare costs. Previous findings suggest that nearly half of the global hypertensive population is unaware of their condition because it remains undiagnosed, resulting in delayed treatment and poorer clinical outcomes. Furthermore, public awareness of hypertension remains low, with awareness rates reported at only 17.5% (Cissé et al., 2021; Zhou et al., 2021).

Various strategies have been developed to control hypertension, including promotive and preventive approaches focusing on risk factor identification. Preventive strategies involving early hypertension screening have been demonstrated as effective and sustainable approaches for reducing hypertension prevalence before progression to chronic complications, particularly in areas with limited healthcare access (Estiko et al., 2025). Risk factors for hypertension can generally be categorized into modifiable and nonmodifiable factors. Modifiable factors include unhealthy dietary patterns, excessive salt intake, smoking, alcohol consumption, obesity, stress, and insufficient physical activity, whereas nonmodifiable factors include age, sex, and genetic predisposition (Mohammed Nawi et al., 2021; Sood et al., 2024). Although these factors cannot be altered, they are valuable in screening processes because they help identify populations at higher risk of developing hypertension. Age and sex are among the most commonly used demographic characteristics for identifying risk groups because they are easily obtained from healthcare records and have been associated with variations in blood pressure and hypertension incidence across different populations (Connelly et al., 2022; Drury et al., 2024; Meinert et al., 2023; Sood et al., 2024).

Age is one of the most consistent risk factors associated with hypertension. Aging is accompanied by structural and functional changes in the cardiovascular system, including reduced vascular elasticity, increased arterial stiffness, thickening of blood vessel walls, and impaired endothelial function. These changes contribute to increased peripheral vascular resistance, which ultimately leads to elevated blood pressure. Various studies have

demonstrated that hypertension prevalence increases significantly among older adults compared with younger populations (Connelly et al., 2022; Meinert et al., 2023). Therefore, age is an important indicator for determining priority groups in hypertension screening and early detection programs (Ma et al., 2022).

In addition to age, sex is also closely associated with hypertension incidence. Biological and hormonal differences between men and women contribute to variations in hypertension risk across different age groups. During young adulthood, men generally demonstrate a higher prevalence of hypertension than women. However, after menopause, women's risk of hypertension increases due to decreased estrogen levels, which play an important role in vascular function and blood pressure regulation. In addition to biological mechanisms, sex differences are also associated with disease awareness, healthcare-seeking behavior, and the effectiveness of blood pressure control among individuals with hypertension (Defianna et al., 2021; Meinert et al., 2023; Drury et al., 2024; Visniauskas et al., 2022; Khoiry et al., 2022).

Although the relationship between age, sex, and hypertension has been extensively studied, most previous studies have used national surveys or general population datasets to describe hypertension conditions at the community level. However, patients accessing specific healthcare facilities may have different characteristics influenced by demographic factors, healthcare accessibility, socioeconomic conditions, and regional contexts. Oktamianti et al. (2023) reported that the prevalence of diagnosed hypertension was higher in urban communities (22.6%) than in rural communities. These findings demonstrate variations in hypertension incidence according to regional characteristics and healthcare access. Therefore, population-level studies may not fully represent the characteristics of patients in specific healthcare facilities. Research conducted at the local healthcare facility level remains necessary to provide contextual evidence supporting hypertension control program planning.

The 05.09.01 Ngawi Health Clinic serves as a primary healthcare facility with an important role in early detection, monitoring, and management of hypertension within its service area. Despite its importance in local hypertension management, no previous research has specifically evaluated the relationship between age, sex, and hypertension incidence among patients visiting this facility. This research gap has resulted in limited local empirical evidence for identifying priority groups in hypertension screening and prevention programs at this healthcare facility. The novelty of this study lies in providing local epidemiological evidence regarding the relationship between age, sex, and hypertension incidence among patients at the 05.09.01 Ngawi Health Clinic. Understanding these associations at the healthcare facility level is essential for developing evidence-based and contextually appropriate screening strategies, optimizing resource allocation, and improving early detection among high-risk groups. Therefore, this study aimed to analyze the relationship between age, sex, and hypertension incidence, thereby addressing the identified knowledge gap and contributing to improved hypertension control efforts at the primary healthcare level.

METHOD

This study employed an analytical observational design with a cross-sectional approach. The research was conducted at the 05.09.01 Ngawi Health Polyclinic from April to May 2026. Ethical approval was obtained from the Health Research Ethics Committee (No. B/FIK/S.SP/III/2026), and research permission was obtained from the 05.09.01 Ngawi Health

Polyclinic. The cross-sectional design was used to analyze the relationship between age, sex, and hypertension incidence among respondents at a single observation period. The study population consisted of all patients who visited the 05.09.01 Ngawi Health Polyclinic during the study period. A total of 100 respondents were selected using purposive sampling. The inclusion criteria were patients aged ≥18 years with complete data on age, sex, systolic blood pressure, and diastolic blood pressure. Patients with incomplete medical records or unidentifiable hypertension status were excluded.

The dependent variable was hypertension incidence, while the independent variables were age and sex. Age was categorized into <35 years and ≥35 years based on the mean age of respondents, whereas sex was categorized as male and female. Hypertension status was determined based on recorded systolic and diastolic blood pressure measurements according to the American Heart Association guidelines, with systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥80 mmHg classified as hypertension (American Heart Association, 2025). Data collected included respondent characteristics, age, sex, education level, occupation, history of chronic disease, smoking history, family history of hypertension, and hypertension status.

Data analysis was performed using univariate, bivariate, and multivariate analyses. Univariate analysis was conducted to describe the frequency distribution and percentage of respondent characteristics. Bivariate analysis was performed using the Chi-square test to determine the association between age, sex, and hypertension incidence. Multivariate analysis was conducted using binary logistic regression to evaluate the simultaneous association of age and sex with hypertension incidence and to estimate the odds ratio (OR) with a 95% confidence interval (CI). Statistical significance was determined at a p-value <0.05. The suitability of the regression model was assessed using the Hosmer–Lemeshow test, which showed p = 0.982, indicating good model fit, with a Nagelkerke R^2 value of 0.204.

RESULTS AND DISCUSSION

A. Respondent Characteristics

This study involved 100 respondents who visited the Health Polyclinic 05.09.01 Ngawi. Based on age characteristics, most of the respondents were 52 years old ≥35 years old (52%), while the respondents were <35 years old as many as 48 people (48%). Based on gender, the majority of respondents were women as many as 61 people (61%) and men as many as 39 people (39%). Most of the respondents had a secondary education level of 83 people (83%), worked as private employees as many as 28 people (28%), 88 people had no history of chronic diseases (88%), 72 people had no history of smoking (72%), and 87 people did not have a history of hypertension in the elderly (87%).

A total of 65 respondents (65%) had hypertension and 35 respondents (35%) did not have hypertension. The high proportion of hypertension in this study shows that hypertension is still a fairly dominant health problem in patients who visit the 05.09.01 Ngawi Health Polyclinic. These findings are in line with the Indonesian Health Survey report which shows that hypertension is still one of the non-communicable diseases with a high prevalence in the Indonesian adult population and tends to increase with age. (Ministry of Health of the Republic of Indonesia, 2024)

The characteristics of the respondents in this study showed the dominance of the adult age group and women. Similar findings were reported by those who showed that hypertension was more prevalent in the adult and older age groups than in the younger age group. The study also reports that the distribution of hypertension in the adult population is influenced by demographic characteristics, especially age and gender. In addition, cohort studies have shown that the prevalence of hypertension is higher in older age groups than in younger age groups. These characteristics illustrate that the respondents in this study are dominated by groups that have a greater susceptibility to the occurrence of hypertension.(Alfaqeeh et al., 2023)(Defianna et al., 2021)(Dorter et al., 2026)

Table 1. Respondent Characteristics

Respondent Characteristics		n	%
Age	< 35 years old	48	48
	≥ 35 years old	52	52
Gender	Male	39	39
	Women	61	61
Final Education	Elementary School	2	2
	High School	83	83
	College	15	15
Jobs	Civil Servant	15	15
	Private Employees	28	28
	Self-employed / Farmer / Driver	24	24
	Housewives	24	24
	Not Working	9	9
History of Chronic Disease	Ya	12	12
	No	88	88
Riwayat Merokok	Ya	28	28
	No	72	72
History of Hypertension (Elderly)	Ya	13	13
	No	87	87
Incidence of Hypertension	Ya	65	65
	No	35	35

B. Relationship between Age and Hypertension Incidence

Table 2. Relationship of Age and Sex to Hypertension Incidence (N = 100)

Variabel		Incidence of Hypertension				Total		p-value
		Hypertension		No Hypertension				
		N	%	N	%	N	%	
Age	< 35 years old	22	45,8	26	54,2	48	100	0.000
	≥ 35 years old	43	82,7	9	17,3	52	100	
Gender	Male	27	69,2	12	30,7	39	100	0.478
	Women	38	62,3	23	37,7	61	100	

The results of bivariate analysis using the Chi-Square test showed that there was a significant relationship between age and the incidence of hypertension (p=0.000). In the age group <35 years), there were 22 respondents (45.8%) who had hypertension and 26 respondents (54.2%) who did not have hypertension. Meanwhile, in the age group ≥35 years, there were 43 respondents (82.7%) who had hypertension and only 9 respondents (17.3%) who did not have hypertension.

The results of this study show that the older a person gets, the higher the risk of developing hypertension. Physiologically, changes in the structure and function of the heart occur with age. Changes such as hardening of blood vessels, decreased elasticity and widening of the aorta in older age lead to a gradual increase in systolic and diastolic blood pressure. (Hinkle et al., 2021; Ma et al., 2022) In addition to changes in blood vessels, the aging process also affects neurohormonal regulation that plays a role in blood pressure control. The activity of the renin-angiotensin-aldosterone (RAAS) system, increased oxidative stress, and chronic activation of the sympathetic nervous system can lead to sodium retention and increased vascular tone. This condition results in the heart having to work harder to pump blood so that systolic and diastolic blood pressure tends to increase. As we age, kidney function also decreases, which is characterized by a reduced filtration rate of glomerulars and tubules in reabsorption, urine concentration and sodium excretion ability, thus increasing the risk of hypertension (Chen et al., 2025; Cosardereliogl u & Abadir, 2025)(Chen et al., 2025; Hinkle et al., 2021)

These changes explain why the prevalence of hypertension increases significantly in older age groups. Research shows that age is the strongest risk factor for hypertension in the Indonesian population. The results of the study also found that older age groups are more likely to experience hypertension than younger age groups. Globally, the analysis also showed that the prevalence of hypertension increases consistently with age due to the accumulation of biological changes in the cardiovascular and metabolic systems.(Hustrini et al., 2023)(Alfaqeeh et al., 2023)(Zhou et al., 2021)

The results of the multivariate analysis (Table 3) reinforce the findings of the bivariate analysis which shows that age is a factor that affects the incidence of hypertension (Table 3). After being controlled with sex variables, respondents aged ≥35 years had a 5.743-year chance of developing hypertension compared to respondents aged <35 years (OR=5.743; 95% CI=2.286–14.430; p<0.001). The results of the analysis also showed that increasing age contributed substantially to the occurrence of hypertension in the study population and the age group of ≥35 years still showed a higher risk than the younger age group. A significant association between age and hypertension suggests that the aging process has an important role in increasing an individual's susceptibility to impaired blood pressure regulation.

Table 3. Results of Multivariate Analysis of Binary Logistic Regression on Hypertension Incidence (N=100)

Variabel	B	SE	Uji Forest	P-value	OR	95% C.I.for EXP(B)	
						Lower	Upper
Gender							
Male (ref)	-	-	-	-	1.00		
Women	0.385	0473	0.663	0.415	1.470	.582	3.717
Age Group							
< 35 years old (ref)	-	-	-	-	1.00		
≥ 35 years old	1.748	0.470	13.829	<0.001*	5.743	2.286	14.430
Konstan	**-0.32**	**0.348**	**0.852**	**0.356**	**0.726**		

Omnibus Test = 16,037, df= 2, p=0.000; B = Regression Coefficient; SE = Standard Error; OR = Odds Ratio; CI = Confidence Interval; Ref = Reference category; Nagelkerke R2 = 0.204.

Although age is a significant outcome for hypertension, the increase in blood pressure in older age groups is not only caused by the biological process of aging. This can also be seen from the Nagelkerke R2 value of 0.204 which shows that the variables age and sex are able to explain 20.4% of the variation in the incidence of hypertension and there are 79.6% variations in the incidence of hypertension that may be influenced by other factors outside the research model Various studies show that the incidence of hypertension is the result of a complex interaction between biological, behavioral, and environmental factors. As they age, individuals tend to experience lifestyle changes such as decreased physical activity, weight gain, dietary changes, and accumulated exposure to cardiovascular risk factors that last for a long time. This condition can accelerate the occurrence of vascular dysfunction and disorders of blood pressure regulation, thereby increasing the risk of hypertension.(Gianfredi et al., 2025; Hinkle et al., 2021; Khasanah , 2022)(Mills et al., 2020)

In addition, overnutrition and obesity more often found in the adult and elderly age groups also contribute to increased blood pressure through activation of the sympathetic nervous system, increased activity of the renin-angiotensin-aldosterone (RAAS) system, insulin resistance, and chronic inflammatory processes at low levels. The mechanism leads to increased peripheral resistance and sodium retention which ultimately increases. On the other hand, smoking behavior, excessive salt consumption, lack of physical activity, as well as long-term psychosocial stress can also worsen endothelial function and accelerate the process of arterial stiffness that has occurred due to aging (Chen et al., 2025; Cosardereliogl u & Abadir, 2025; Hinkle et al., 2021; Peng et al., 2025)(Valenzuela et al., 2021).

Socioeconomic factors also play a role in determining the risk of hypertension in older age groups. Individuals with low levels of education, limited access to health services, and poor economic conditions tend to have a higher risk of developing hypertension due to low health literacy, limited access to routine health checkups, and low ability to implement a healthy lifestyle. Research shows that socioeconomic inequality is still one of the important determinants of hypertension incidence in various developing countries. Therefore, the high proportion of hypertension in the ≥35-year-old age group in this study is likely influenced not only by the physiological aging process, but also by the accumulation of various risk factors that work simultaneously throughout the individual's life.(Mashuri et al., 2022)(Gianfredi et al., 2025; McMaughan et al., 2020)

C. Sex Relationship with Hypertension Incidence

The results showed that there was no significant relationship between sex and the incidence of hypertension (p=0.478). Although the proportional prevalence of hypertension in men (69.2%) is higher than in women (62.3%), the difference is not large enough to show a statistically significant relationship. These findings indicate that in the study population, gender was not the main factor influencing the occurrence of hypertension. On the other hand, the incidence of hypertension is likely to be more influenced by other factors such as age, health status, lifestyle, and metabolic factors that were not analyzed in depth in this study. The results of this study are in line with a study that analyzed Indonesian Family Life Survey (IFLS) data and found that factors of age, obesity, and health status have a stronger influence on hypertension than gender. After controlling for various sociodemographic and health variables, gender is no longer the dominant predictor of hypertension incidence. Alfaqeeh et al., (2023)

The difference in the risk of hypertension between men and women is closely related to hormonal and physiological mechanisms that change throughout the life cycle. In young adulthood, males generally have higher blood pressure than females due to the influence of androgen hormones that increase sympathetic nervous system activity, sodium retention, and peripheral vascular resistance. On the other hand, women of reproductive age obtain the protective effects of the hormone estrogen which plays a role in improving the endothelial function of blood vessels, stimulating nitric oxide production, and suppressing the activity of the renin-angiotensin-aldosterone system which contributes to increased blood pressure (Hinkle et al., 2021)(Drury et al., 2024)(Drury et al., 2024; Visniauskas et al., 2022)

However, the protective effect of estrogen will decrease as you age and enter menopause. Decreased estrogen levels lead to reduced vasodilation of blood vessels, increased arterial stiffness, and increased activity of the renin-angiotensin system so that the risk of hypertension in women increases significantly after menopause. Therefore, the difference in the prevalence of hypertension between men and women tends to shrink in older age groups, even in some populations the prevalence of hypertension in women can exceed that of men(Hinkle et al., 2021)(Connelly et al., 2022; Darvish et al., 2026; Morimoto & Ichihara, 2023)

These conditions can explain the results of this study. Based on the characteristics of the respondents, most of the respondents were in the age group ≥35 years (52%) (Table 1). In this age group, the influence of the aging process on increasing blood pressure tends to be more dominant than the biological influence of gender. As we age, there are structural and functional changes in the cardiovascular system in the form of decreased elasticity of blood vessels, increased arterial stiffness, endothelial dysfunction, and decreased sensitivity of barrereceptors that contribute to increased blood pressure in both men and women. As a result, the difference in the risk of hypertension by gender becomes increasingly invisible.

The findings of this study are also supported by studies that state that the prevalence of hypertension is indeed higher in men at a young age, but women experience a faster increase in blood pressure since the third decade of life so that the prevalence of hypertension increases sharply at a later age. In addition to biological factors, behavioral and environmental factors may also contribute to the absence of a significant association between sex and hypertension in this study. Studies have shown that a diet high in sodium, lack of physical activity, obesity, stress, and smoking habits have a greater contribution to increased blood pressure than sex differences.Connelly et al., (2022)(Alfaqeeh et al., 2023; Khasanah, 2022; Valenzuela et al., 2021; Wahidin et al., 2025)

The results of the multivariate analysis showed that gender had no significant effect on the incidence of hypertension after being controlled with age variables (OR=1.470; p=0.415; 95% CI=0.582–3.717). An odds ratio value greater than one indicates a tendency for women to have a 1.47 times greater chance of hypertension than men. However, p-values that exceed the significance limit (0.05) as well as the confidence interval range that crosses the number one suggest that the relationship is not statistically strong enough to be considered an independent risk factor. Thus, these results further emphasize that the variation in hypertension incidence in respondents cannot be explained by gender differences alone, but rather by other factors that have a greater contribution to the increase in blood pressure.

Implications

The results of this study show that age is a significant determinant of the incidence of hypertension. Age is a factor that needs to receive major attention in efforts to prevent and control hypertension at the primary health service level. Respondents aged ≥35 years had a much higher risk of hypertension than younger age groups. These results can be the basis for the 05.09.01 Ngawi Health Polyclinic in strengthening the hypertension screening program based on risk factors, especially in the adult and elderly age groups. In addition to early detection, promotive and preventive interventions through health education regarding healthy lifestyle modifications, weight control, increased physical activity, sodium consumption restrictions, smoking cessation, and stress management need to be implemented on an ongoing basis to reduce the risk of hypertension in vulnerable groups.

In addition, nurses have a strategic role in assessing risk factors, early identification of increased blood pressure, providing health education, counseling for behavior changes, and assisting patients in implementing healthy living behaviors. A nursing approach that is oriented towards the prevention and management of risk factors from adulthood is expected to increase the effectiveness of hypertension control and reduce the burden of non-communicable diseases in the community.

The results of the study confirm that age has a more dominant influence than gender in explaining the incidence of hypertension in the study population. These findings can be the basis for future research to develop a more comprehensive hypertension prediction model by incorporating biological, behavioral, environmental, and socioeconomic factors so that a more comprehensive understanding of the determinants of hypertension in the community can be obtained.

Limitations

This study has several limitations that need to be considered in interpreting the research results. The limited time of the study so that the use of cross-sectional design caused the associations found to be only associative and therefore could not explain the cause-and-effect relationship between age, sex, and hypertension events. The study only involved two main independent variables, namely age and gender. Meanwhile, hypertension is a multifactorial condition that is also influenced by various other factors such as body mass index, central obesity, salt consumption, physical activity, diet, stress, family history, alcohol consumption, and comorbidities that were not analyzed in this study. This is reflected in the Nagelkerke R^2 value of 0.204 which shows that most of the variation in hypertension incidence is still influenced by other factors outside the research model. Further research is recommended to use a larger sample count, involving several health facilities, and include more comprehensive hypertension risk factors in order to provide a more comprehensive picture of the determinants of hypertension incidence in the community.

CONCLUSION

This study demonstrated that age was significantly associated with hypertension incidence among patients visiting the 05.09.01 Ngawi Health Clinic. Respondents aged ≥35 years had 5.743 times higher odds of hypertension compared with respondents aged <35 years. The strong association between age and hypertension highlights the importance of age-based screening strategies in primary healthcare settings to support early detection and timely

intervention. In contrast, sex was not significantly associated with hypertension incidence after controlling for age, indicating that sex differences did not independently influence hypertension risk in the study population. The absence of a significant association between sex and hypertension suggests that age-related physiological changes and accumulated risk factors may have a greater influence on hypertension risk among adults receiving care at this healthcare facility. These findings provide valuable local epidemiological evidence that can support the development of targeted hypertension screening and prevention programs at the 05.09.01 Ngawi Health Clinic, allowing healthcare providers to prioritize resources for high-risk age groups.

Future research should involve larger sample sizes and multiple healthcare facilities to produce more comprehensive and generalizable evidence regarding hypertension determinants in the broader population. Further investigations incorporating additional risk factors, including body mass index, central obesity, dietary patterns, salt intake, physical activity levels, stress, family history, alcohol consumption, and comorbidities, are recommended to provide a more comprehensive understanding of factors associated with hypertension. Longitudinal studies using prospective designs are also needed to better examine temporal relationships between risk factors and hypertension development by monitoring blood pressure changes over time. Furthermore, studies evaluating the effectiveness of age-based screening strategies and targeted prevention programs would provide valuable evidence for improving policy development and resource allocation for hypertension control in primary healthcare settings. Qualitative studies exploring barriers and facilitators related to hypertension screening and management from both patient and healthcare provider perspectives may also contribute to the development of more effective interventions. Addressing these research gaps will support the development of comprehensive, evidence-based strategies for hypertension prevention, early detection, and management at the primary healthcare level, ultimately contributing to reducing the burden of cardiovascular disease in Indonesian communities.

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