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The Relationship Between Age and the Severity of Hypertension at the Imbanagara Community Health Center, Ciamis, in 2022

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ABSTRACT

Background: Hypertension is a non-communicable disease that continues to increase in prevalence both in Indonesia and worldwide. It is defined as a systolic blood pressure greater than 140 mmHg and/or a diastolic blood pressure greater than 90 mmHg. The causes of hypertension include non-modifiable factors such as genetics, age, and sex, as well as modifiable factors such as physical inactivity, obesity, smoking, excessive salt intake, and stress. Age is a non-modifiable risk factor associated with the aging process, which results in decreased vascular elasticity and increased blood pressure. This study aimed to analyze the relationship between age and the severity of hypertension among patients at Imbanagara Community Health Center, Ciamis, West Java, in 2022.

Methods: This cross-sectional study was conducted among 90 patients with hypertension. Data were collected using a structured questionnaire covering age, sex, educational background, occupation, source of health information, adherence to antihypertensive medication, and blood pressure measurements. Data were analyzed using univariate and bivariate analyses, and the Chi-square test was applied to determine the association between age and hypertension severity.

Results: Most patients with hypertension were female, had completed elementary school, and were housewives. The primary source of information was health care professionals. The majority of respondents had grade II hypertension (50 patients; 55.5%) and were between 40 and 55 years of age. The Chi-square test showed a p-value of less than 0.05, indicating a statistically significant relationship between age and the severity of hypertension. Conclusion: There is a significant association between age and the severity of hypertension among patients at Imbanagara Community Health Center in 2022. These findings highlight the importance of early detection and age-specific management strategies to prevent the progression of hypertension severity. These findings provide context-specific evidence from a primary healthcare setting in West Java, highlighting the need for age-targeted screening and intervention strategies to reduce the burden of uncontrolled hypertension in similar low-resource settings.

Keyword: Risk factors, hypertension, age.

Introduction

Hypertension remains a major and persistent global public health challenge, contributing substantially to the growing burden of non-communicable diseases (NCDs) despite decades of preventive efforts and clinical advancements.[1] The World Health Organization (WHO) reports that NCDs including cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases accounted for approximately 43 million deaths in 2021, representing nearly 75% of all non-pandemic deaths globally.[1] These conditions continue to impose a substantial burden on healthcare systems and national economies, particularly in low- and middle-income countries (LMICs), where healthcare resources remain limited and unevenly distributed.[2] Among these conditions, hypertension stands out as a leading modifiable risk factor contributing significantly to cardiovascular morbidity and mortality worldwide.[2] Notably, elevated blood pressure alone is responsible for approximately 25% of global NCD-related deaths, underscoring its critical role in the global disease burden.[1]

The magnitude of the problem is further reflected in its widespread prevalence. Globally, more than 1.28 billion adults aged 30–79 years are affected by hypertension, with nearly two-thirds of cases occurring in LMICs.[3] Despite the availability of effective treatment strategies, only about one-fifth of individuals with hypertension achieve adequate blood pressure control.[4] This persistent gap highlights systemic challenges, including inadequate screening programs, limited access to healthcare services, and suboptimal long-term disease management.[3] In Indonesia, national survey data (Riskesdas) demonstrate a concerning upward trend in hypertension prevalence, increasing from 25.8% in 2013 to 34.1% in 2018.[5] More recent estimates indicate that prevalence remains persistently high, ranging between 29% and 34%, accompanied by low treatment and control rates.[6] Without targeted and context-specific interventions, hypertension will continue to contribute significantly to premature mortality and long-term disability.

From a clinical perspective, hypertension is defined as a sustained systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg.[7] Blood pressure levels below 120/80 mmHg are considered normal, while intermediate levels (SBP 120–139 mmHg or DBP 80–89 mmHg) are categorized as prehypertension or elevated blood pressure.[7] Clinical guidelines such as JNC 7 and JNC 8 further classify hypertension into Stage 1 (140–159/90–99 mmHg) and Stage 2 (≥160/100 mmHg).[8] Importantly, hypertension is often referred to as a "silent killer" due to its asymptomatic progression, which frequently delays diagnosis and treatment. Persistent uncontrolled hypertension leads to progressive vascular damage and increases the risk of severe complications, including heart failure, ischemic heart disease, stroke, kidney failure, and retinopathy.[7] Consequently, hypertension is recognized as one of the leading preventable causes of disability and premature death worldwide.[9]

The development and progression of hypertension are influenced by multiple interrelated factors, broadly categorized into non-modifiable and modifiable determinants. Non-modifiable factors include age, genetic predisposition, and sex.[10] In contrast, modifiable factors primarily involve lifestyle and environmental influences such as high salt intake, obesity, physical inactivity, alcohol consumption, and tobacco use.[9] Additionally, psychological stress and poor dietary patterns further exacerbate hypertension risk and progression.[10] While these risk factors are well established, their interaction within specific population contexts remains complex and not fully understood, particularly in relation to disease severity.

Among these determinants, age plays a particularly critical role in shaping both the prevalence and severity of hypertension. Vascular aging, characterized by reduced arterial elasticity and impaired endothelial function, contributes to a progressive increase in systolic blood pressure over time.[11] Epidemiological evidence indicates a strong association between advancing age and hypertension prevalence; for example, approximately 80% of adults aged ≥75 years in the United States are affected.[20] Furthermore, findings from the Global Burden of Disease study identify high blood pressure as the leading risk factor for global mortality, with a disproportionately greater impact in older populations.[12] Age-related physiological mechanisms, including oxidative stress and endothelial senescence, further contribute to increased hypertension severity.[13] These findings suggest that age is not only a determinant of hypertension occurrence but also a key factor influencing its clinical progression.

However, empirical evidence examining the relationship between age and hypertension severity at the primary healthcare level remains limited, particularly in Indonesia. Existing studies tend to focus on broader epidemiological patterns without adequately addressing local variations in demographic characteristics, healthcare access, and patient behavior. This gap is especially critical in region-specific contexts such as West Java, where hypertension prevalence is among the highest in the country.

At the local level, Puskesmas Imbanagara in Ciamis, West Java, represents a primary healthcare facility facing a substantial burden of hypertension cases. Based on 2022 health reports, hypertension ranks among the top three most prevalent diseases in this setting. Despite ongoing efforts in hypertension management, challenges related to disease control and patient outcomes persist. The absence of context-specific evidence examining how age influences hypertension severity in this population limits the ability of healthcare providers to implement targeted and effective interventions.

Despite extensive global evidence on hypertension, studies examining the relationship between age and hypertension severity at the primary healthcare level remain limited, particularly in Indonesia. Most existing studies focus on prevalence rather than severity classification, and often lack context-specific analysis at the community health center level. Therefore, this study offers a novel contribution by providing localized evidence from a primary healthcare setting in West Java, where demographic, behavioral, and healthcare access factors may differ from national and global patterns.

Therefore, this study aims to analyze the relationship between age and hypertension severity among patients at Puskesmas Imbanagara, Ciamis, in 2022. By addressing this critical evidence gap, the study seeks to provide contextually relevant insights that can inform early detection strategies and improve hypertension management at the primary healthcare level. Ultimately, these findings are expected to contribute to reducing hypertension-related complications and strengthening public health responses in similar settings.

Methods

This study employed an analytic correlational design with a cross-sectional approach. Data were collected at a single point in time to examine the correlation between the independent variable (age) and the dependent variable (severity of hypertension).

The study was conducted among patients with hypertension in the working area of Imbanagara Community Health Center, Ciamis, in 2022. Sampling was performed using a total sampling technique, in which all members of the population who met the inclusion criteria were included as

study participants.

The required sample size was calculated using the following formula:

$$n = \left\{ \frac{Z_{1-\frac{\alpha}{2}}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}}{(P_1-P_2)^2} \right\}^2$$

$$n = \left[\frac{[1.96x\sqrt{2x0,345x(1-0,345)} + 0.84x\sqrt{0,35x(1-0,35)+0,34x(1-0,34)}]}{(0,35-0,34)} \right]^2$$

The minimum required sample size was 35.431, which was rounded to 35 participants.

Where:

n = sample size

$Z_{1-\alpha/2}$ = Z value for a 95% confidence level (1.96)

$Z_{1-\alpha/2}$ = Z value for 80% statistical power (0.84)

P_1 = proportion of patients with regular adherence to antihypertensive medication (0.35)

P_2 = proportion of patients with irregular adherence to antihypertensive medication (0.34)

P = $\frac{P1+P2}{2} = \frac{0.35+0.34}{2} = 0.345$

Primary data were collected using a structured questionnaire distributed to 90 hypertensive patients in Sukapura Village between March and May 2023. The data analyzed in this study were originally collected as part of an undergraduate research project conducted in 2022. The interval between the completion of data collection and manuscript submission occurred because the dataset required additional verification, data cleaning, and adaptation from the thesis format into a scientific manuscript suitable for journal publication. This process was necessary to ensure data validity, consistency, and compliance with scientific publication standards.

The questionnaire included variables such as sex, education level, occupation, source of health information, age, medication adherence, and blood pressure measurements.

Data analysis was conducted using univariate analysis to describe respondents' characteristics, including sex, education level, occupation, source of information, age, and blood pressure classification. Bivariate analysis was then performed to assess the relationship between age and the severity of hypertension using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

This study aimed to analyze the relationship between age and the severity of hypertension among patients at Imbanagara Community Health Center, Ciamis, in 2022. A total of 90 hypertensive patients met the inclusion criteria and were included in the analysis. The results are presented in two sections: univariate analysis describing respondent characteristics and bivariate analysis examining the association between age and hypertension severity.

UNIVARIATE ANALYSIS

a. Sex Distribution

The distribution of respondents based on sex is presented in Table 1.

Table 1. Distribution of Patients by Sex (n = 90)

Sex	Frequency (n)	Percentage (%)
Male	22	24.4
Female	68	75.6
Total	90	100

As presented in Table 1, the majority of hypertensive patients were female (75.6%), while male patients accounted for 24.4% of the total sample. This indicates a marked predominance of female patients within the study population. The proportion of female patients was more than three times higher than that of male patients, suggesting a notable imbalance in sex distribution among respondents.

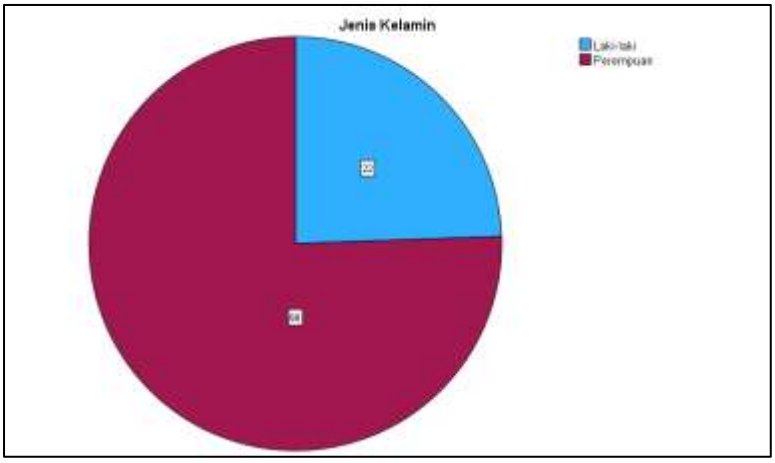

Figure 1. Distribution of Patients by Sex

This distribution is further illustrated in Figure 1, which clearly shows the higher proportion of female patients compared to males. The consistency between the tabulated data and graphical representation strengthens the observation that hypertension cases recorded at the Imbanagara Community Health Center during the study period were predominantly observed among women.

b. Educational Level

Table 2 presents the educational background of the respondents.

Table 2. Distribution of Patients by Educational Level (n = 90)

Education Level	Frequency (n)	Percentage (%)
Elementary School	37	41.1
Junior High School	28	31.1
Senior High School	20	22.2
Diploma	4	4.4
Bachelor's Degree	1	1.2
Total	90	100

As presented in Table 2, the largest proportion of respondents had completed elementary school (41.1%), followed by junior high school (31.1%) and senior high school (22.2%). Only a small proportion of respondents had higher education, including diploma (4.4%) and bachelor's degree (1.2%). Overall, more than two-thirds of the respondents had an educational level below senior high school, indicating a predominance of lower educational attainment within the study population.

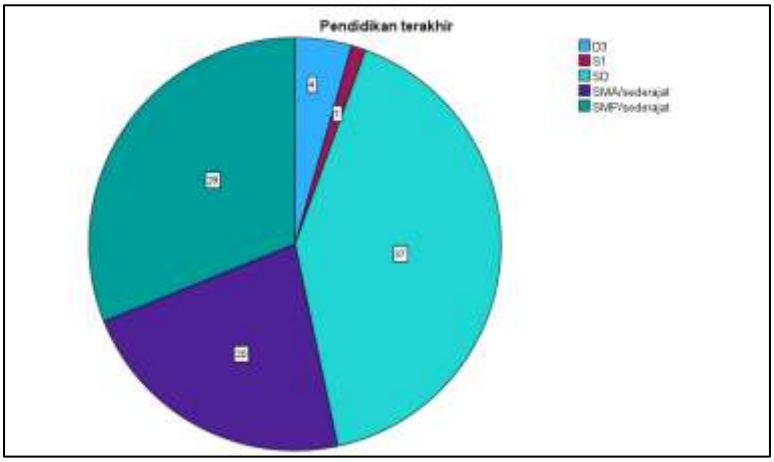

Figure 2. Distribution of Patients by Educational Level

This distribution is further illustrated in Figure 2, which clearly shows that respondents with elementary and junior high school education constitute the largest proportion compared to other educational levels. The consistency between the tabulated data and graphical representation strengthens the observation that most hypertensive patients recorded at the Imbanagara Community Health Center during the study period had relatively low levels of formal education.

c. Occupation

The occupational characteristics of respondents are presented in Table 3.

Table 3. Distribution of Patients by Occupation (n = 90)

Occupation	Frequency (n)	Percentage (%)
Housewife	29	32.3
Farmer/Laborer	24	26.7
Civil Servant	3	3.3
Police/Military	1	1.1
Entrepreneur	5	5.5
Retired	1	1.1
Unemployed	27	30.0
Total	90	100

As presented in Table 3, the largest occupational group was housewives (32.3%), followed by unemployed individuals (30.0%) and farmers/laborers (26.7%). Together, these three groups accounted for the majority of respondents. In contrast, occupations requiring formal employment status, such as civil servants (3.3%) and police/military personnel (1.1%), were minimally represented in the study population.

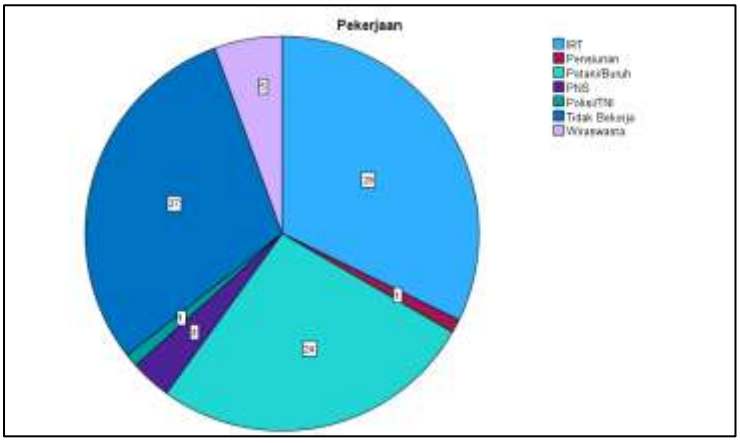

Figure 3. Distribution of Patients by Occupation

This distribution is further illustrated in Figure 3, which clearly shows the predominance of housewives, unemployed individuals, and farmers/laborers compared to other occupational groups. The consistency between the tabulated data and graphical representation strengthens the observation that the majority of hypertensive patients in this setting were concentrated in non-formal or economically inactive occupational categories.

d. Source of Information

The sources from which patients obtained information about hypertension are summarized in Table 4.

Table 4. Distribution of Patients by Source of Information (n = 90)

Source of Information	Frequency (n)	Percentage (%)
Family/Friends	1	1.1
Media	9	9.9
Health Care Professionals	79	87.9
No Information	1	1.1
Total	90	100

As presented in Table 4, the vast majority of respondents obtained information regarding hypertension from health care professionals (87.9%). A smaller proportion reported receiving information from media sources (9.9%), while only a minimal proportion relied on family or friends (1.1%) or reported having no information (1.1%). These findings indicate a strong predominance of formal healthcare channels as the primary source of hypertension-related information among respondents.

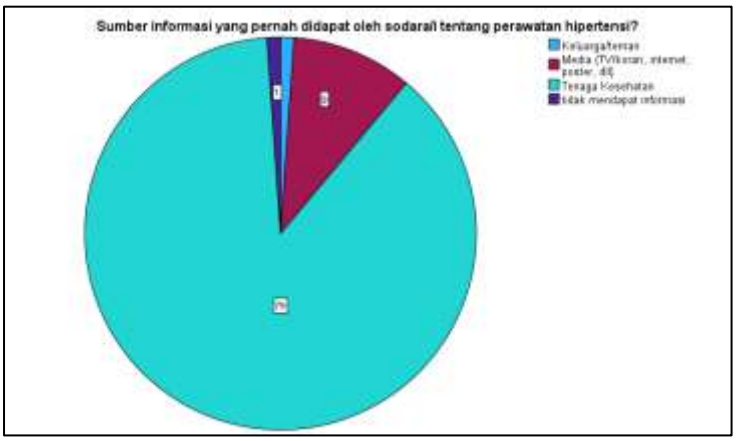

Figure 4. Distribution of Patients by Source of Information

This distribution is further illustrated in Figure 4, which clearly shows the dominance of health care professionals compared to other sources of information. The consistency between the tabulated data and graphical representation strengthens the observation that healthcare providers play a central role in disseminating hypertension-related information in this setting.

e. Blood Pressure Classification

The distribution of blood pressure categories is shown in Table 5.

Table 5. Distribution of Blood Pressure Classification (n = 90)

Blood Pressure Category	Frequency (n)	Percentage (%)
Normal	8	8.9
Prehypertension	5	5.6
Grade I Hypertension	4	4.5
Grade II Hypertension	50	55.5
Hypertensive Crisis	23	25.5
Total	90	100

As presented in Table 5, more than half of the patients were classified as having Grade II hypertension (55.5%), followed by hypertensive crisis (25.5%). In contrast, only a small proportion of patients were categorized as Grade I hypertension (4.5%), prehypertension (5.6%), and normal blood pressure (8.9%). These findings indicate that a substantial proportion of patients presented with moderate to severe hypertension.

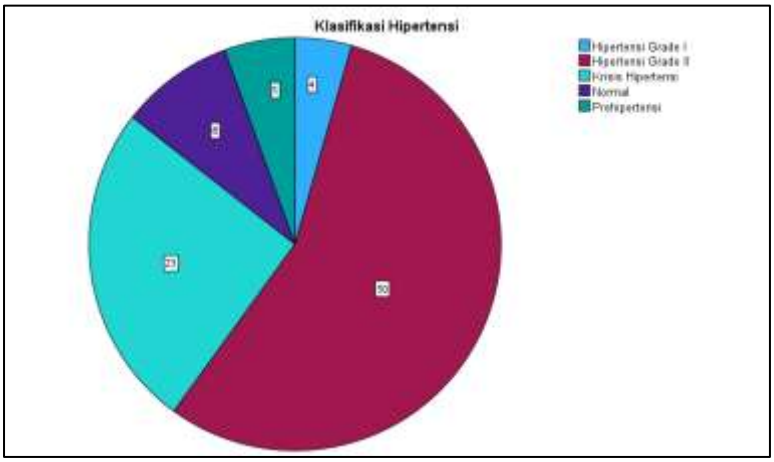

Figure 5. Distribution of Blood Pressure Classification

This distribution is further illustrated in Figure 5, which clearly shows the predominance of Grade II hypertension and hypertensive crisis compared to other categories. The consistency between the tabulated data and graphical representation strengthens the observation that most hypertensive patients in this setting were classified within higher severity levels of blood pressure.

f. Age Distribution

The age distribution of respondents is presented in Table 6.

Table 6. Distribution of Patients by Age Group (n = 90)

Age Group (Years)	Frequency (n)	Percentage (%)
<25	3	3.3
26–35	4	4.4
36–45	18	20.0
46–55	35	38.9
56–65	22	24.5
>65	8	8.9
Total	90	100

As shown in Table 6, the largest age group was 46–55 years (38.9%), followed by 56–65 years (24.5%). Together, these two age groups accounted for more than 60% of the total respondents. Younger age groups (<35 years) represented less than 8% of the sample, indicating that hypertension in this setting was predominantly observed among middle-aged and older adults.

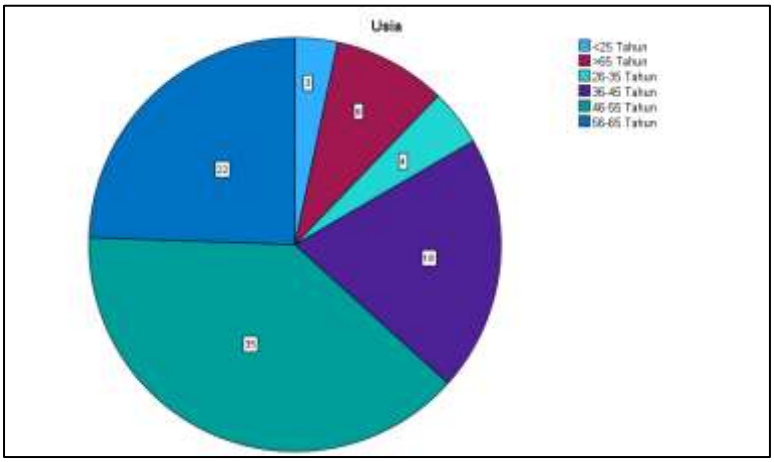

Figure 6. Distribution of Patients by Age Group

This distribution is further illustrated in Figure 6, which clearly shows the predominance of respondents in the 46–55 and 56–65 year age groups compared to other age categories. The consistency between the tabulated data and graphical representation strengthens the observation that hypertension was more commonly observed in middle-aged and older populations in this study.

BIVARIATE ANALYSIS

To determine whether age was associated with the severity of hypertension, a Chi-square test was performed. The cross-tabulation results are presented in Table 7.

Table 7. Relationship Between Age and Blood Pressure Classification (n = 90)

Blood Pressure Category	<25	26–35	36–45	46–55	56–65	>65	Total
Normal	2	0	1	3	1	1	8
Prehypertension	0	1	1	2	1	0	5
Grade I Hypertension	1	3	0	1	3	0	4
Grade II Hypertension	0	0	9	25	10	2	50
Hypertensive Crisis	0	0	7	4	7	5	23
Total	3	4	18	35	22	8	90

Chi-square test result: p = 0.00 (p < 0.05)

Table 7 demonstrates a clear pattern in which more severe hypertension categories were concentrated in older age groups. Grade II hypertension was most frequently observed in patients aged 46–55 years (25 cases), followed by those aged 56–65 years (10 cases). Hypertensive crisis cases were notably present among individuals aged 36–45 years (7 cases), 56–65 years (7 cases), and over 65 years (5 cases).

The Chi-square analysis yielded a p-value of 0.00, which is less than the significance level of 0.05. This indicates a statistically significant association between age and hypertension severity. Therefore, age is significantly related to the distribution of blood pressure categories among hypertensive patients in this study population.

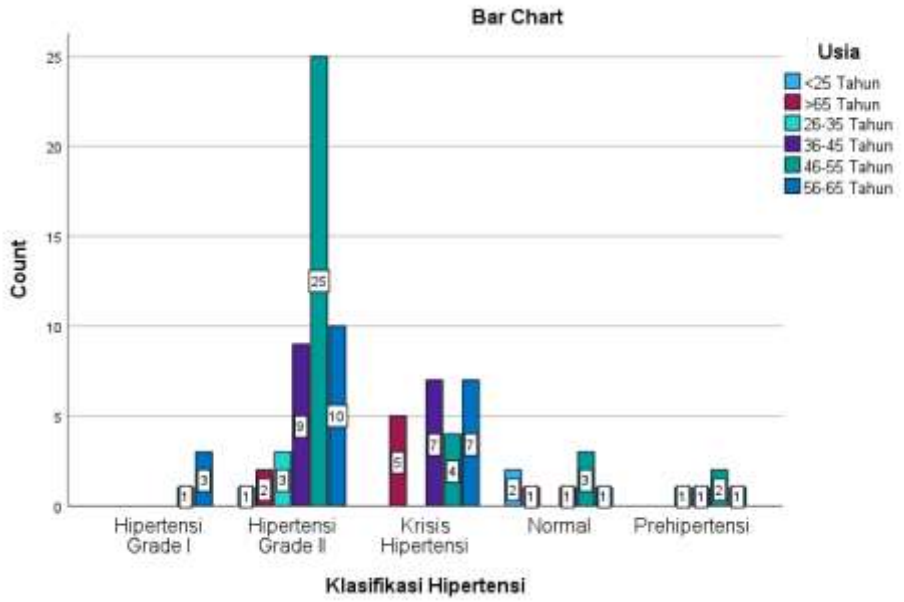

Figure 7. Association between Age Group and Blood Pressure Classification

This pattern is further illustrated in Figure 7, which shows that Grade II hypertension is most frequently observed in the 46–55 year age group, followed by the 56–65 year group. Hypertensive crisis cases are distributed across several older age groups, with notable frequencies in the 36–45, 56–65, and >65 year categories. In contrast, lower blood pressure categories, including normal and prehypertension,

are observed in smaller proportions across all age groups.

The graphical distribution highlights that higher severity of hypertension tends to be more common in middle-aged and older individuals, while younger age groups contribute minimally to severe hypertension categories.

Discussion

Based on the findings of this study, hypertension was more prevalent among female patients, accounting for 68 respondents (75.6%). This finding is consistent with epidemiological evidence demonstrating sex-related differences in hypertension prevalence.[14]Premenopausal women tend to have a lower incidence of hypertension compared to men of the same age due to the cardioprotective effects of estrogen.[15] Estrogen regulates vascular homeostasis through endothelial nitric oxide production, modulation of the renin–angiotensin–aldosterone system (RAAS), and improvement of lipid profiles, particularly by increasing high-density lipoprotein (HDL) and reducing low-density lipoprotein (LDL). Furthermore, estradiol levels decline by more than 60% during menopause, leading to increased arterial stiffness, endothelial dysfunction, and elevated blood pressure, which explains the higher prevalence of hypertension among older women.[16]

In this study, hypertension was most frequently observed among respondents with elementary school education (41.1%). This finding is consistent with previous studies indicating that low educational attainment is strongly associated with hypertension prevalence.[17] At the global level, ecological analysis across 138 low- and middle-income countries reported that hypertension prevalence ranges from 13.7% to 33.4%, with higher rates observed in populations with lower literacy and socioeconomic status.[18] In Indonesia, limited health literacy is also associated with poor hypertension awareness and treatment, where only 41.8% of individuals are aware of their condition and approximately 6.6% receive treatment.[19] These findings suggest that inadequate education may impair an individual's ability to understand health information, adopt preventive behaviors, and adhere to long-term treatment.

Regarding occupation, the largest proportion of hypertensive patients in this study were housewives (32.3%). This finding is consistent with previous studies indicating that non-formal occupational groups are associated with increased cardiovascular.[20] Occupational status influences behavioral risk factors such as physical inactivity, dietary patterns, and psychosocial stress.[21] Sedentary lifestyle is strongly associated with obesity, which increases the risk of hypertension by up to 2–3 times due to increased cardiac workload and peripheral vascular resistance.[22] These mechanisms contribute to sustained elevation of blood pressure over time.

In terms of health information exposure, most respondents (87.9%) reported receiving information from health care professionals. This finding aligns with previous studies showing that structured health education improves hypertension awareness and control.[23] In low- and middle-income countries, poor awareness and control remain major challenges, with hypertension contributing to millions of deaths annually.[1] Community-based interventions such as POSBINDU programs have been shown to improve knowledge and treatment uptake, although gaps remain in behavioral implementation. [19]

With regard to blood pressure classification, most patients in this study were categorized as having Grade II hypertension (55.5%), indicating a high burden of moderate-to-severe hypertension. This finding is consistent with global evidence showing that uncontrolled hypertension remains highly prevalent despite treatment availability. A recent systematic review involving 200 studies reported a

pooled global prevalence of uncontrolled hypertension of 54.6% (95% CI: 52.1–57.1).[24] Uncontrolled hypertension significantly increases the risk of cardiovascular complications, including stroke, coronary artery disease, and kidney failure, due to progressive vascular remodeling and endothelial damage.[25]

Previous studies have demonstrated that age is a major determinant of hypertension severity. Individuals aged above 35 years have a significantly higher risk of developing Grade II hypertension due to cumulative exposure to risk factors and progressive vascular degeneration.[26] Aging is associated with reduced arterial elasticity, increased collagen deposition, and impaired vasodilation, which lead to elevated systolic blood pressure.[13] Lifestyle-related factors such as high salt intake (>6 g/day), high-fat diets, and physical inactivity further accelerate this process by promoting fluid retention and atherosclerosis (National Heart, Lung, and Blood Institute, 2024). Additionally, long-term use of oral contraceptives has been associated with up to a 5.38-fold increase in hypertension risk due to hormonal imbalance.[26]

In this study, hypertension was most common among respondents aged 46–55 years (38.9%). This finding is consistent with epidemiological evidence indicating that hypertension prevalence increases significantly with age, particularly among individuals aged 40–60 years.[27] Age-related vascular changes, including arterial stiffening and endothelial dysfunction, reduce the ability of blood vessels to regulate blood pressure effectively.

The findings of this study have important implications for clinical practice and public health strategies. The predominance of Grade II hypertension among middle-aged adults suggests delayed diagnosis and suboptimal blood pressure control at the primary care level. This highlights the urgent need for early screening programs, routine blood pressure monitoring, and targeted lifestyle interventions, particularly among individuals aged ≥40 years. In addition, strengthening health education programs may improve awareness and treatment adherence, thereby reducing the risk of cardiovascular complications.

Bivariate analysis showed that respondents aged 46–55 years most frequently experienced Grade II hypertension (25 patients), with a statistically significant association between age and hypertension severity ($p = 0.00$; $p < 0.05$). This finding supports previous studies demonstrating that hypertension severity increases with age and is more pronounced in middle-aged and older populations.[28,29] The progression of hypertension is influenced by cumulative exposure to behavioral and metabolic risk factors, as well as physiological changes such as vascular aging. In addition, psychosocial stress may activate neuroendocrine pathways, including the sympathetic nervous system and RAAS, contributing to sustained increases in blood pressure.

Conclusion

This study demonstrates that age is a significant determinant of hypertension severity, with a higher concentration of Grade II hypertension observed among middle-aged individuals. Beyond confirming statistical association, these findings emphasize the presence of delayed detection and suboptimal hypertension control at the primary healthcare level. This study provides context-specific evidence from a community health center in West Java, contributing to the limited literature on hypertension severity in primary care settings in Indonesia. Strengthening early detection strategies, age-targeted interventions, and community-based health education programs is essential to reduce the progression of hypertension and prevent long-term cardiovascular complications.

Conflicts of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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