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Association between Health Belief Model Constructs and Blood Pressure Control among Hypertensive Patients

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Abstract

Hypertension is a major global health problem and a leading cause of cardiovascular morbidity and mortality, particularly in developing countries such as Indonesia. This study aimed to analyze the association between Health Belief Model (HBM) constructs and sociodemographic factors with blood pressure control among hypertensive patients. A cross-sectional study was conducted in November 2025 at Puskesmas Piyungan, Bantul, involving 219 hypertensive patients selected using purposive sampling. Data were collected using a validated Hypertension Belief Assessment Tool and blood pressure measurements, then analyzed using multiple regression and bivariate tests. Among HBM constructs, only perceived susceptibility was significantly associated with systolic blood pressure (SBP) in multivariate analysis, suggesting a modest inverse relationship between susceptibility beliefs and SBP levels. Sociodemographic factors including age, educational level, and occupational category also showed significant associations with SBP. No HBM constructs were significant predictors of diastolic blood pressure. These cross-sectional findings highlight perceived susceptibility and sociodemographic context as correlates of blood pressure, though the design precludes causal inference. Hypertension management programs should consider patients' belief profiles and sociodemographic characteristics when designing health promotion interventions, while longitudinal research is needed to confirm the direction and magnitude of these associations.

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1. INTRODUCTION

Hypertension is a leading cause of cardiovascular disease and premature mortality worldwide, and its prevalence is increasing rapidly in developing countries (Mills et al., 2020; Schutte et al., 2021). Hypertension is characterized by elevated systemic blood pressure. It is estimated to affect approximately 30–40% of the adult population globally (Buso et al., 2024). The burden of hypertension is substantial, significantly increasing the risk of cardiovascular morbidity and mortality (Goorani et al., 2024). Hypertension is estimated to account for nearly 50% of all deaths related to heart disease and stroke (Kuneinen et al., 2024). Furthermore, cardiovascular diseases are projected to cause approximately 23.6 million deaths annually by 2030 (Global Burden of Cardiovascular Diseases and Risks 2023 Collaborators, 2025). Therefore, hypertension management has become one of the greatest public health challenges in developing countries (Kurjogi et al., 2021).

In Indonesia, the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI) reported a hypertension prevalence of 30.8% among individuals aged >18 years based on blood pressure measurements, indicating that nearly one in three adults suffers from hypertension. Although this figure represents a decline from 34.1% in the previous year, the prevalence remains considerably high and continues to pose a serious concern for the national health system (BKPK Kemenkes RI, 2023). The Special Region of Yogyakarta (Daerah Istimewa Yogyakarta/DIY) has a relatively high burden of hypertension, with a physician-diagnosed prevalence of 13.0% among adults aged >18 years, substantially higher than the national prevalence of 8.6%. More specifically, Bantul Regency recorded the highest prevalence in DIY, with 49,306 patients (6.43%) reported in 2023 (DIY Province Health Office, 2024)

Several factors contribute to the occurrence of hypertension, and these factors may vary across countries and between urban and rural areas (Ranzani et al., 2022). The increasing prevalence of hypertension is associated with population growth, aging, and behavioral factors such as unhealthy dietary patterns, alcohol consumption, physical inactivity, overweight and obesity, as well as prolonged stress (Cherfan et al., 2020; da Silva et al., 2022; Kuneinen et al., 2024; Mills et al., 2020; Nkrumah et al., 2026).

The management of hypertensive patients requires adherence to self-care practices in order to improve their health status (Lim et al., 2024). Self-care behavior among patients with hypertension refers to patients' efforts to optimize their health by controlling and managing signs and symptoms, preventing complications, and minimizing functional impairment (Pahria et al., 2022). Self-care and self-perception are important factors in hypertension control (de Santana Silva et al., 2024). Therefore, assessing the beliefs of patients with hypertension is a crucial initial step. Beliefs regarding hypertension reflect an individual's knowledge and perceptions in understanding and managing the disease (Soleimani et al., 2024). Without an accurate understanding of patients' beliefs, interventions may be poorly targeted and less effective.

According to the Health Belief Model (HBM), hypertension control behavior is influenced by self-efficacy, perceived susceptibility, perceived severity, perceived benefits, cues to action, and perceived barriers (Andayani, 2025). This model explains that individuals' beliefs about a disease influence their willingness to adopt health behavior changes, including behaviors related to hypertension control (Komaç & Duru, 2024). Low perceptions of susceptibility and disease severity, negative perceptions regarding the benefits of treatment, and high perceived barriers may reduce patients' adherence to hypertension therapy (Burnier et al., 2025).

In other words, assessing perceived susceptibility, severity, benefits of action, barriers, and self-efficacy is essential to understanding why some patients with

hypertension succeed or fail in controlling their blood pressure. Accurate assessment of these six belief constructs is a crucial first step in determining appropriate interventions and personalizing hypertension management (Zahed et al., 2023). Without a comprehensive assessment, healthcare providers may rely solely on clinical factors such as blood pressure measurements and medication history, without considering the psychological and cognitive factors that actually play a major role in determining patient behavior. Furthermore, such assessments enable the identification of patients with high-risk belief profiles, allowing preventive interventions to be implemented at an earlier stage. In Indonesia, however, this type of assessment is still rarely conducted systematically, despite the importance of understanding hypertensive patients' belief profiles in developing effective and evidence-based hypertension control programs. Specifically, according to the HBM, perceived susceptibility motivates individuals to adopt preventive behaviors when they believe they are at risk of illness or complications; perceived severity reinforces action when consequences are viewed as serious; perceived benefits encourage adherence when patients believe treatment will be effective; and perceived barriers reflect practical or psychological obstacles that may impede self-care. Self-efficacy further determines whether patients feel capable of sustaining behavior change. These pathways suggest that each HBM dimension may independently or jointly influence blood pressure management behaviors—yet evidence examining their direct association with measured blood pressure outcomes in the Indonesian primary care context remains limited. This gap justifies the present study, which examines the association between HBM constructs and blood pressure control among hypertensive patients attending a primary health center in Bantul, Indonesia.

2. METHOD

This study employed a cross-sectional design. Data collection was conducted in November 2025 at Piyungan Primary Health Center (Puskesmas Piyungan), Bantul, Indonesia, after obtaining ethical approval from the Research Ethics Committee of Ahmad Dahlan University, Yogyakarta, Indonesia, with approval number REC-UAD/01/01/08-2025/301. All participants provided written informed consent after receiving an explanation regarding the study objectives and procedures.

The sample size was determined based on a ratio of 5–10 participants per questionnaire item, resulting in a required sample size ranging from 115 to 230 respondents. Based on this criterion, the study initially included 230 patients with hypertension recruited from Puskesmas Piyungan, Bantul, Indonesia. However, outlier data were identified in 11 respondents, and these participants were excluded from the analysis. Therefore, the final sample size analyzed in this study consisted of 219 respondents, which met the minimum sample size requirement.

The study site was selected based on the relatively high prevalence of hypertension patients at Puskesmas Piyungan, Bantul, Indonesia, which was reported at 6.76%, higher than the average prevalence of hypertension at the Bantul Regency level. A purposive sampling technique was applied. The inclusion criteria were: aged >18 years, able to communicate and hear adequately, diagnosed with hypertension, and willing to participate in the study. Participants with secondary hypertension and mental disorders were excluded. It is acknowledged that purposive sampling may introduce selection bias, as participants recruited through routine clinic visits and hypertension class activities may differ systematically from the broader hypertensive population in terms of health-seeking behavior and disease awareness. This should be considered when interpreting and generalizing the findings.

Participants were recruited through two approaches: during routine visits to the general outpatient clinic and through hypertension class activities conducted in each

hamlet within the working area of Puskesmas Piyungan. Prior to the interviews, the researcher obtained permission and assistance from nurses to identify participants who met the inclusion criteria. Subsequently, eligible participants were contacted to receive an explanation of the study objectives and to provide written informed consent.

The dependent variable in this study was hypertension control, measured using systolic blood pressure (SBP) and diastolic blood pressure (DBP). Both blood pressure measurements were assessed on a ratio scale by nurses using a digital sphygmomanometer. Measurements were taken by trained nurses following a standardized protocol: participants rested for at least five minutes prior to measurement, with readings taken on the right arm in a seated position. It is noted that the study did not systematically capture potential confounding variables including medication adherence, disease duration, comorbidities (e.g., diabetes, dyslipidemia), dietary sodium intake, and physical activity level—all of which may independently influence blood pressure and should be considered when interpreting the regression findings.

The independent variables consisted of the six constructs of the Health Belief Model (HBM), namely perceived susceptibility, perceived severity, perceived benefits, cues to action, perceived barriers, and self-efficacy related to hypertension. The instrument used in this study was adapted from the Hypertension Belief Assessment Tool (HBAT) developed in Northwest Ethiopia (Teshome et al., 2021). The HBAT consists of 23 items measured on a 5-point Likert scale ranging from “strongly disagree” to “strongly agree,” including perceived susceptibility to hypertension (items 1–4), perceived severity of hypertension (items 5–9), cues to action (items 10–13), perceived benefits (items 14–16), perceived barriers to taking action (items 17–20), and self-efficacy (items 21–23).

The original English instrument was translated into Indonesian using a forward–backward translation method (Chen et al., 2024). Two independent bilingual translators from the Language Center of Ahmad Dahlan University and the Language Center of ‘Aisyiyah University Yogyakarta were involved in translating the original instrument into Indonesian. Subsequently, a synthesis process was conducted through WhatsApp and Google Meet platforms to reconcile the translated versions and minimize potential bias. The synthesized Indonesian version was then back-translated into English by two medical doctors experienced in managing hypertension patients. The back-translation process was conducted independently without communication between translators and without access to the original instrument.

Furthermore, four experts consisting of the two forward translators and the two back translators independently evaluated and compared the original version, the back-translated versions, and the synthesized Indonesian version. To ensure that the wording modifications were consistent with expert consensus, the Indonesian version of the instrument was subsequently evaluated using the Content Validity Index (CVI). Content validity was assessed at both the item level (item-level CVI/I-CVI) and the overall scale level (scale-level CVI/S-CVI). Based on established criteria, an instrument was considered relevant if the I-CVI value was ≥ 0.78 , while an S-CVI value ranging from 0.80 to 1.00 indicated excellent content validity. In this study, the I-CVI and S-CVI values of the Indonesian version of the HBM instrument were 0.78 and 0.90, respectively, meeting the recommended standards from previous studies (Gupta et al., 2025).

Prior to data collection, the Indonesian version of the HBM instrument was pilot-tested on 20 participants to identify potential editorial errors and item inconsistencies. The reliability test yielded a Cronbach’s alpha value of 0.70, which met the acceptable reliability standard recommended in previous studies.

Data on participants’ age (in years) and sex (male/female) were collected. Educational attainment was categorized into four levels: elementary school, junior high

school, senior high school, and university or higher education. Participants' residential areas were categorized into three villages: Srimartani, Srimulyo, and Sitimulyo. Duration of hypertension was measured in years and categorized as less than 5 years and 5 years or more. Hypertension in first-degree relatives and insurance status were each categorized as "yes" or "no." Employment status was classified into six categories: unemployed, retired, laborer, government employee, farmer, and entrepreneur.

Descriptive statistics were presented as frequencies (n) and percentages (%) for categorical variables, and means with standard deviations (SD) for continuous variables. Bivariate correlations between outcome measures and HBM constructs were analyzed using Pearson's correlation coefficient. According to Schober et al. (2018), correlation coefficients were interpreted as follows: $r = 0$ (no correlation); $r = 0.10-0.29$ (weak correlation); $r = 0.30-0.49$ (moderate correlation); and $r = 0.50-1.00$ (strong correlation).

Independent t-tests were conducted to examine differences in outcome scores (SBP and DBP) across dichotomous independent variables, including age group, sex, duration of hypertension, hypertension in first-degree relatives, and insurance status. F-tests (ANOVA) were used to analyze differences in outcome scores across independent variables with more than two categories, such as education level, residential area, and employment status.

Multiple regression analysis was performed to identify predictors of hypertension control based on SBP and DBP outcomes. Statistical significance was determined at a p-value <0.05 with a 95% confidence interval (CI). All analyses were conducted using RStudio version 2024.

3. RESULTS AND DISCUSSION

Respondents' systolic blood pressure ranged from 110 to 207 mmHg, with a mean of 148.50 ± 15.13 mmHg, while diastolic blood pressure ranged from 49 to 98 mmHg, with a mean of 76.68 ± 9.20 mmHg. Table 1 also shows that the majority of participants were aged >45 years (96.80%) and female (63.50%). Most participants had completed elementary school education (62.10%) and resided in Srimulyo Village (47.00%). The duration of hypertension was <5 years in 60.30% of participants. Most participants had a family history of hypertension (65.30%) and possessed health insurance coverage (86.80%).

Table 1. Characteristics of Participants and Control of Systolic and Diastolic Blood Pressure Among Patients with Hypertension (N = 215).

Characteristics	n	(%)
Systolic blood pressure	Range: 110 - 207; $\bar{x} = 148.50$; SD = 15.13	
Diastolic blood pressure	Range: 49 - 98; $\bar{x} = 76.68$; SD = 9.20	
Age (years)		
Adults (≤ 45)	7	3.20
Elderly (>45)	212	96.80
Range: 33 – 89; $\bar{x} = 64.30$; SD = 9.03		
Sex		
Male	80	36.50
Female	139	63.50
Education		
Elementary school	136	62.10
Junior high school	23	10.50

Senior high school	43	19.60
Higher education	17	7.80
Village		
Srimartani	74	33.80
Srimulyo	103	47.00
Sitimulyo	42	19.20
Year with hypertension (years)		
<5	132	60.30
≥ 5	87	39.70
Hypertension in first-degree relative		
Yes	76	34.70
No	143	65.30
Insurance status		
Yes	190	86.80
No	29	13.20
Employment		
No employee	113	51.60
Retired employee	13	5.90
Labourer	42	19.20
Official government	13	5.90
Farmer	10	4.60
Business	28	12.80

Approximately 31.16% of participants reported high perceived barriers related to hypertension management. Meanwhile, about 28.37% of the respondents believed that hypertension prevention programs—such as early detection of hypertension, timely treatment, and maintaining blood pressure close to normal levels—provided high benefits. Another 33.95% perceived these measures as providing moderate benefits, whereas 37.67% of participants considered hypertension prevention programs to have low benefits. A total of 24.19% of participants perceived that poorly managed hypertension could lead to severe consequences. Regarding self-efficacy, approximately 26.98% of participants rated themselves as having high confidence in protecting themselves from hypertension-related complications (see Figure 1).

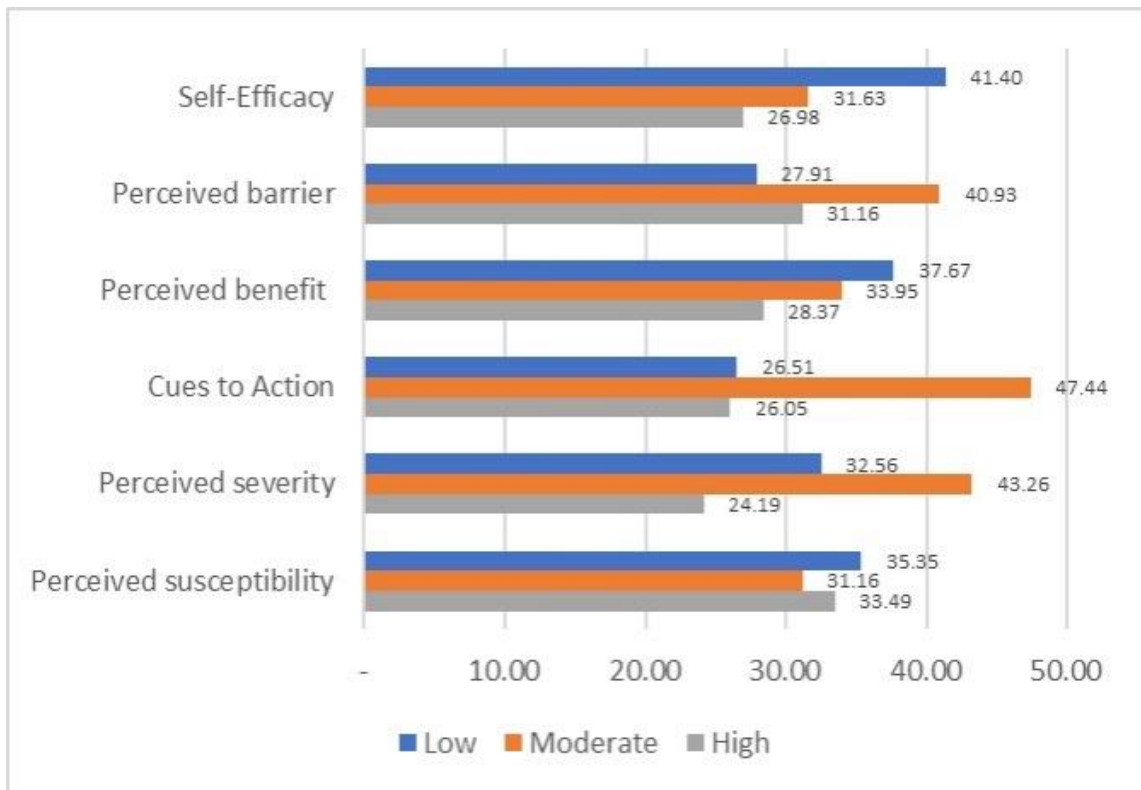


Figure 1. Percentage Distribution of Health Belief Model Construct Scores Among Patients with Hypertension.

Based on the bivariate analysis presented in Table 2, the factors associated with systolic blood pressure differed from those associated with diastolic blood pressure among patients with hypertension. Three variables showed significant associations with systolic blood pressure (SBP). First, perceived susceptibility demonstrated a significant negative correlation with SBP ($r = -0.140$; 95% CI: -0.27 to -0.01 ; p -value = 0.037). This finding indicates that higher perceived susceptibility to hypertension was associated with lower systolic blood pressure.

Second, perceived benefit also showed a significant negative correlation with SBP ($r = -0.161$; 95% CI: -0.29 to -0.03 ; p -value = 0.017), suggesting that patients with greater perceived benefits regarding hypertension control measures tended to have lower systolic blood pressure. Third, age demonstrated a significant difference between adults (≤ 45 years) and older adults (> 45 years) (t -test = 5.748; 95% CI: 20.49–41.88; p -value = 0.003), in which older adults had higher systolic blood pressure compared with younger adults.

Meanwhile, other variables including perceived severity, cues to action, perceived barriers, self-efficacy, sex, educational level, residential village, duration of hypertension, family history of hypertension, insurance status, and employment status—did not show significant associations with systolic blood pressure ($p > 0.05$). For diastolic blood pressure (DBP), only one variable demonstrated a significant association, namely hypertension history among first-degree relatives (t -test = -2.129 ; 95% CI: -5.31 to -0.21 ; p -value = 0.034). The findings indicate a significant difference in diastolic blood pressure between patients with and without a family history of hypertension. Other variables, including all six HBM constructs and additional sociodemographic factors, were not significantly associated with diastolic blood pressure ($p > 0.05$).

Table 2. Results of bivariate analysis on perceived susceptibility, perceived severity, cues to action, perceived benefit, perceived barrier, self-efficacy, socio-demography toward systolic and diastolic control.

Variable	(Category/mean \pm SD)	SBP			DBP		
		t/F/r	95% CI	p-value	t/F/r	95% CI	p-value
Perceived susceptibility	14.65 \pm 3.06	-0.140	-0.27; -0.01	0.037	-0.022	-0.11; 0.02	0.749
Perceived severity	19.20 \pm 3.64	-0.117	-0.25; 0.02	0.084	-0.073	-0.21; 0.06	0.279
Cues to action	13.78 \pm 3.54	-0.077	-0.21; 0.06	0.255	-0.073	-0.20; 0.06	0.285
Perceived benefit	12.57 \pm 2.27	-0.161	-0.29; -0.03	0.017	-0.083	-0.21; 0.05	0.218
Perceived barrier	14.51 \pm 4.13	0.002	-0.13; 0.14	0.973	0.027	-0.11; 0.16	0.694
Self-efficacy	12.39 \pm 2.19	-0.035	-0.17; 0.09	0.609	-0.036	-0.17; 0.09	0.595
Age (years) ^a	Adults (\leq 45)	5.748	20.49; 41.88	0.003	1.389	-2.05; 11.85	0.166
	Elderly (>45)						
Sex ^a	Male	-0.459	-5.16; 3.21	0.646	-0.621	-3.35; 1.74	0.535
	Female						
Education ^b	Elementary school	1.225		0.301	1.522		0.21
	Junior high school		-3.10; 10.32			-3.29; 4.85	
	Senior high school		-7.61; 2.81			0.12; 6.45	
	Higher education		-12.08; 3.23			-2.44; 6.86	
Village ^b	Srimartani						
	Srimulyo	0.002	-4.66; 4.47	0.998	1.814	-5.41; 0.09	0.166
	Sitimulyo		-5.72; 5.85			-5.09; 1.89	
Year with hypertension (years) ^a	<5	-1.019	-6.25; 1.99	0.308	-1.253	-4.09; 0.91	0.211
	\geq 5						
Hypertension in first-degree relative ^a	Yes	-1.245	-6.37; 1.44	0.214	-2.129	-5.31; -0.21	0.034
	No						
Insurance status ^a	Yes	1.789	-0.54; 11.28	0.074	-1.253	-4.09; 0.91	0.211
	No						
Employment ^b	No employee	1.017		0.409	1.598		0.162
	Retired employee		-12.29; 5.16			-1.53; 9.01	

Laborer	-2.19; 8.58	-3.53; 2.97
Official government	-11.14; 6.31	-3.30; 7.24
Farmer	-2.21; 17.45	-10.33; 1.55
Business	-5.99; 6.59	-0.56; 7.04

Note: SBP=systolic blood pressure; DBP=diastolic blood pressure; CI = confidence interval; F =F-value; t = t-value; r = coefficient correlation; Superscript letters a and b indicates analysis based on the independent t test and one way variance test.

Table 3 presents the results of the multiple linear regression analysis, indicating that among the six Health Belief Model (HBM) constructs analyzed, only perceived susceptibility showed a significant association with systolic blood pressure (SBP) ($\beta = -3.27$; 95% CI: -4.37 to -2.15; p -value < 0.001). This finding suggests that every one-unit increase in the perceived susceptibility score was associated with a 3.27 mmHg decrease in SBP after controlling for other variables. The overall SBP model explained approximately 34% of the variance in systolic blood pressure (adjusted $R^2 = 0.34$), indicating moderate explanatory power. Prior to interpretation, model assumptions were checked: residuals were approximately normally distributed, no severe multicollinearity was detected among predictors (all variance inflation factors < 5), and homoscedasticity was confirmed by visual inspection of residual plots.

A significant association was also found between age and SBP. Older adults (>45 years) had systolic blood pressure 18.99 mmHg lower than younger adults (≤ 45 years) ($\beta = -18.99$; 95% CI: -30.02 to -7.96; p -value < 0.001). In addition, educational attainment was significantly associated with SBP. Compared with participants who completed elementary school, junior high school graduates had SBP levels that were 11.26 mmHg higher ($\beta = 11.26$; 95% CI: 4.88–17.65; p -value < 0.001), while senior high school graduates had SBP levels that were 6.54 mmHg higher ($\beta = 6.54$; 95% CI: 0.28–12.80; p -value < 0.05). Participants with higher education did not show significant differences compared with elementary school graduates.

Moreover, several employment categories demonstrated significant associations with SBP. Compared with unemployed participants, laborers had SBP levels that were 15.98 mmHg higher ($\beta = 15.98$; 95% CI: 10.23–21.72; p -value < 0.001), farmers had SBP levels that were 22.40 mmHg higher ($\beta = 22.40$; 95% CI: 12.95–31.86; p -value < 0.001), and entrepreneurs had SBP levels that were 14.87 mmHg higher ($\beta = 14.87$; 95% CI: 7.72–22.02; p -value < 0.001). Retired individuals and government employees did not show significant differences in SBP. Sex, residential village, duration of hypertension, family history of hypertension, and insurance status were not significantly associated with SBP. None of the HBM constructs—including perceived susceptibility, perceived severity, cues to action, perceived benefits, perceived barriers, and self-efficacy—showed significant associations with diastolic blood pressure (DBP). Only the entrepreneur employment category demonstrated a significant association with DBP ($\beta = 5.95$; 95% CI: 0.89–11.01; p -value < 0.05).

Table 3. Multiple Linear Regression Analysis of Health Belief Model Constructs and Sociodemographic Factors Associated with Systolic and Diastolic Blood Pressure

Variable (category/r)	SBP			DBP		
	β	SE	95% CI	β	SE	95% CI
Perceived susceptibility	-3.27	0.56	-4.37; -2.15***	-0.70	0.39	-1.49; 0.07
Perceived severity	0.05	0.25	-0.43; 0.54	-0.09	0.17	-0.44; 0.25
Cues to action	-0.27	0.27	-0.80; 0.27	-0.06	0.19	-0.44; 0.31
Perceived benefit	-0.07	0.44	-0.95; 0.79	-0.01	0.31	-0.62; 0.61
Perceived barrier	-0.18	0.22	-0.62; 0.24	0.12	0.15	-0.18; 0.43
Self-efficacy	0.10	0.41	-0.71; 0.93	-0.16	0.29	-0.74; 0.41
Age (years) (ref. Adults, ≤ 45)						

Elderly (>45)	-18.99	5.59	-30.02; -7.96***	-2.71	3.95	-10.52; 5.08
Sex (ref. Male)						
Female	0.06	1.87	-3.62; 3.76	0.64	1.32	-1.96; 3.26
Education (ref. Elementary school)						
Junior high school	11.26	3.23	4.88; 17.65***	1.26	2.29	-3.25; 5.78
Senior high school	6.54	3.17	0.28; 12.80*	3.20	2.24	-1.22; 7.63
Higher education	4.62	5.12	-5.48; 14.72	1.41	3.62	-5.73; 8.56
Village (ref. Srimartani)						
Srimulyo	-0.09	2.07	-4.18; 3.99	-2.53	1.46	-5.43; 0.35
Sitimulyo	-0.53	2.59	-5.65; 4.58	-1.02	1.83	-4.65; 2.59
Year with hypertension (years) (ref. <5)						
≥ 5	1.21	1.83	-2.41; 4.83	0.72	1.30	-1.84; 3.28
Hypertension in first-degree relative (ref. No)						
Yes	0.46	1.93	-3.35; 4.28	2.46	1.37	-0.24; 5.16
Insurance status (ref. Yes)						
No	-4.69	2.67	-9.97; 0.59	0.47	1.89	-3.26; 4.21
Employment (ref. No employee)						
Retired employee	5.10	5.06	-4.88; 15.09	6.19	3.58	-0.86; 13.26
Laborer	15.98	2.91	10.23; 21.72***	2.69	2.06	-1.37; 6.75
Official government	9.36	5.11	-0.71; 19.44	3.64	3.61	-3.49; 10.77
Farmer	22.40	4.79	12.95; 31.86***	-0.85	3.39	-7.54; 5.84
Business	14.87	3.62	7.72; 22.02***	5.95	2.56	0.89; 11.01*

The majority of respondents with hypertension in the present study were female (63.5%). This finding is consistent with previous studies reporting that sex is associated with the occurrence of pre-hypertension and hypertension (Rezaianzadeh et al., 2024). However, this result contrasts with other findings found that hypertension was more prevalent among men than women, with no significant differences between rural and urban populations (Heindl et al., 2023). These findings indicate that hypertension has become a common health problem across both urban and rural communities.

Self-care behavior, self-belief, and self-perception regarding hypertension are essential components in the management of systemic arterial hypertension. In the current study, 31.16% of respondents reported high perceived barriers related to hypertension management. Patients with hypertension frequently encounter multiple barriers in maintaining blood pressure within normal ranges, involving knowledge-related, behavioral, psychological, social, and healthcare access factors. From a knowledge perspective, many patients perceive hypertension as non-dangerous because it is often asymptomatic, leading to poor understanding of the importance of regular monitoring and treatment adherence (Gyuricza et al., 2022). Medication adherence also remains a major

challenge, including forgetting to take medications, discontinuing treatment when symptoms improve, and experiencing side effects that reduce treatment motivation (Kalehoff & Oparil, 2020). Previous studies have also demonstrated that low health literacy and inadequate family support significantly contribute to poor hypertension self-management and reduced adherence to antihypertensive therapy among adults with Hypertension (Guo et al., 2023; Zhang et al., 2021). In addition, research from community-based hypertension programs reported that patients who received continuous education and behavioral counseling showed better blood pressure control and stronger self-care practices compared with those receiving standard care only (Khanal et al., 2021). These findings are consistent with the Health Belief Model, which explains that individuals are more likely to engage in preventive health behaviors when they perceive hypertension as a serious condition, recognize the benefits of treatment, and experience fewer perceived barriers (Andayani, 2025; Green et al., 2020). Furthermore, the current findings also support Self-Efficacy Theory, emphasizing that confidence in one's ability to manage medication, diet, and lifestyle plays a critical role in sustaining long-term hypertension control.

In addition, unhealthy dietary patterns, particularly high salt, fat, and processed food consumption, pose substantial challenges, compounded by difficulties in changing long-standing eating habits (Dong & Rashkova, 2024). Sedentary lifestyles and low levels of physical activity, often influenced by occupational demands or physical limitations, may further worsen blood pressure control (Badr et al., 2021; Park et al., 2020). Psychological factors such as stress, anxiety, and lack of motivation also contribute to difficulties in adopting healthy lifestyle behaviors (Lakerveld et al., 2020). Furthermore, risky behaviors including smoking, alcohol consumption, and inadequate sleep may aggravate hypertension conditions (Mirjat et al., 2020). Other barriers include limited access to healthcare services, medication availability, and insufficient social support from family and the surrounding community. Comorbid conditions such as obesity and diabetes mellitus may also complicate blood pressure management (Hill-Briggs et al., 2020). Therefore, hypertension management requires a comprehensive approach that not only focuses on medical therapy but also emphasizes behavioral modification and continuous environmental support.

Self-care behavior may be influenced by several factors, including age, sex, place of residence, ethnicity/race, educational level, marital status, availability of home blood pressure monitoring devices, monthly income, history and duration of hypertension, and family support. Among these factors, disease perception and knowledge are considered the most influential determinants of self-care behavior (Konlan & Shin, 2023). Patients with hypertension often experience financial burdens, impaired interpersonal relationships, and family-related difficulties after being diagnosed with hypertension. Consequently, many patients become dependent on support from governments, family members, and friends (Sales et al., 2025).

This study demonstrated that among the six constructs of the Health Belief Model (HBM), perceived susceptibility was significantly associated with systolic blood pressure (SBP). Each one-unit increase in perceived susceptibility score was associated with a 3.27 mmHg decrease in SBP after adjustment for other variables. This finding suggests that individuals who perceive themselves as being more vulnerable to hypertension-related complications are more likely to engage in behaviors that support blood pressure control, such as adherence to antihypertensive medication, dietary modification, regular physical activity, and routine blood pressure monitoring. According to the HBM theory, perceived susceptibility is an important determinant of preventive health behavior

because individuals who recognize their personal risk are generally more motivated to adopt healthy behaviors (Green et al., 2020).

The findings of this study are consistent with previous study that perceived susceptibility is a major predictor of health behavior change (Rountree et al., 2025). Similar findings were reported that hypertensive patients with higher perceptions of susceptibility to complications demonstrated better medication adherence and blood pressure control (Shiraly et al., 2022). In addition, perceived cardiovascular risk was associated with improved hypertension self-management behaviors (Lu et al., 2022). Therefore, increasing public awareness regarding the risks and complications of hypertension may play an important role in improving blood pressure control.

Age was also significantly associated with SBP, with participants aged >45 years showing lower systolic blood pressure compared with younger adults (≤ 45 years). This finding differs from most previous studies, which generally report that blood pressure increases with advancing age due to reduced arterial elasticity and vascular stiffness (Laurent & Boutouyrie, 2020). Other study identified older age as a major risk factor for elevated systolic blood pressure (Whelton et al., 2020). Similar findings were also reported a higher prevalence of hypertension among older populations (Oliveros et al., 2020). The contradictory finding in the present study may be explained by differences in participant characteristics. Older individuals in this study may have had better treatment adherence, greater health awareness, or more frequent health monitoring compared with younger adults. In addition, potential issues related to sample distribution or age category coding should also be considered when interpreting this result.

Educational attainment was significantly associated with SBP. Participants with junior high school and senior high school education had higher SBP levels compared with those who completed elementary school. This finding contrasts with the general assumption that higher education is associated with better health literacy and healthier lifestyles (Estrela et al., 2025; Rosário et al., 2024). However, the relationship between education and blood pressure may be influenced by occupational stress and socioeconomic conditions. The education contributes to better health outcomes through improved health literacy and access to healthcare services (Ayaz Khan et al., 2025). Lower educational attainment was associated with a higher risk of hypertension (Sun et al., 2022). The association between education and blood pressure may be influenced by occupational demands, stress levels, and lifestyle factors (Kang, 2022). Therefore, the findings of this study indicate that the effect of education on blood pressure may be complex and mediated by multiple socioeconomic factors.

Employment status was another factor significantly associated with SBP. Laborers, farmers, and business workers had significantly higher SBP levels compared with unemployed participants. In addition, the business employment category was significantly associated with diastolic blood pressure (DBP). These findings suggest that occupational conditions may influence blood pressure through mechanisms related to work stress, physical workload, and economic instability. The chronic occupational stress is associated with increased blood pressure and hypertension risk (Kang, 2022). The psychological stress at work increases the risk of cardiovascular disease and hypertension (Vaccarino & Bremner, 2024). Furthermore, the workers exposed to high physical demands and financial stress tend to have poorer blood pressure control. Among laborers and farmers, elevated blood pressure may be related to heavy physical activity, heat exposure, high-salt dietary patterns, and limited healthcare access. Meanwhile, among business workers, psychological stress and financial responsibility may contribute to increases in both SBP and DBP.

Meanwhile, sex, residential area, duration of hypertension, family history of hypertension, insurance status, and most HBM constructs (perceived severity, cues to action, perceived benefits, perceived barriers, and self-efficacy) were not significantly associated with SBP or DBP. The lack of significant associations may be explained by relatively homogeneous participant characteristics, limited sample size, or the influence of other unmeasured factors such as medication adherence, dietary intake, physical activity, and biological conditions. In addition, HBM constructs may influence blood pressure indirectly through behavioral changes rather than through direct physiological effects. Additionally, measurement limitations may have contributed to the null findings: the instrument was adapted from a context in Northwest Ethiopia and, despite translation and validation efforts, certain items may not have fully captured the nuanced health beliefs of hypertensive patients in Bantul, Indonesia. Ceiling or floor effects in construct scores, social desirability in self-report responses, and the cross-sectional nature of the design which captures belief and blood pressure at a single time point may all have attenuated the observed associations. Future studies should employ longitudinal designs to allow causal interpretation, include objective measures of medication adherence and lifestyle factors as covariates, and consider context-specific adaptations of the HBM instrument.

4. CONCLUSION

In sum, the findings of this study highlight the importance of perceived susceptibility and several sociodemographic factors, particularly age, education, and occupation, in relation to blood pressure among hypertensive patients. However, given the cross-sectional design of this study, causal inference cannot be established; the observed associations do not necessarily imply that modifying perceived susceptibility will directly improve blood pressure control. These findings nonetheless provide a basis for hypothesis generation. Hypertension control programs may consider incorporating HBM-informed health education particularly addressing awareness of personal risk and complications while tailoring approaches to patients' sociodemographic profiles. Future research using longitudinal or interventional designs is needed to establish the direction of these associations and to evaluate the effectiveness of HBM-based interventions on measurable blood pressure outcomes.

5. ACKNOWLEDGEMENT

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