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The Influence of the Health Belief Model on Tertiary Prevention Behaviors among Older Adults with Hypertension in Cirebon Regency, West Java, Indonesia

Afiah Cahya Anggrahini[1)], Argyo Demartoto[2)], Bhisma Murti[1)], Sri Mulyani[3)], Endang Sutisna Sulaeman[3)]

[1)]Master's Program in Public Health, Universitas Sebelas maret
[2)]Faculty of Social and Political Sciences, Universitas Sebelas Maret
[3)]Study Program of Anesthesiology Nursing, Vocational School, Universitas Sebelas Maret
[4)]Faculty of Medicine, Universitas Sebelas Maret

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ABSTRACT

Background: Hypertension is one of the most prevalent non-communicable diseases among older adults and contributes substantially to the development of complications and a decline in quality of life. Tertiary prevention is therefore crucial to slow disease progression. This study aimed to analyze the influence of Health Belief Model (HBM) constructs on tertiary prevention behaviors among older adults with hypertension.
Subjects and Method: This quantitative study employed a cross-sectional design. The respondents consisted of 200 older adults with hypertension in Cirebon Regency, selected using a multistage random sampling technique. Data were collected using a standardized questionnaire that had been tested for validity and reliability. Multivariate data analysis was conducted using path analysis to identify both direct and indirect effects among variables.
Results: Perceived benefits were found to have a direct effect on tertiary prevention behaviors among older adults with hypertension (b= 0.17; 95% CI= 0.13 to 0.30; p= 0.023), as was self-efficacy (b= 0.14; 95% CI= 0.01 to 0.27; p= 0.036). In contrast, perceived susceptibility, perceived severity, perceived barriers, and cues to action influenced tertiary prevention behaviors indirectly. The resulting path model demonstrated a good level of model fit.
Conclusion: Health Belief Model constructs can be utilized as a behavioral approach to enhance adherence to tertiary prevention behaviors among older adults with hypertension. HBM-based interventions that consider individual perceptions and social support are recommended as effective strategies in geriatric health care services.

Keywords: hypertension, elderly, Health Belief Model, tertiary prevention behavior

Correspondence:
Argyo Demartoto. Department of Sociology, Faculty of Social and Political Sciences, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta, Central Java 57126, Indonesia. Email: argyo-demartoto_fisip@staff.uns.ac.id.

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BACKGROUND

Since its launch in 2016, the achievement of several Sustainable Development Goals (SDGs) indicators has experienced delays, particularly due to the impact of the COVID-19 pandemic. One of the SDGs,

namely Good Health and Well-being, aims to reduce premature mortality from non-communicable diseases (NCDs) by one-third by 2030 through prevention and treatment efforts. This target places NCDs as a major health policy priority, particularly hypertension, which represents one of the highest disease burdens in Indonesia (Bappenas, 2023).

According to the World Health Organization (WHO, 2019), the prevalence of hypertension varies across regions, with the highest rates observed in Africa (27 %) and the lowest in the Americas (18 %). Globally, the number of individuals with hypertension increased from 594 million in 1975 to 1.13 billion in 2015, with the greatest increase occurring in low- and middle-income countries (World Health Organization, 2019). In Indonesia, Ministry of Health data (2018) indicate the highest prevalence in South Kalimantan (44.13 %), followed by West Java (39.60 %) and East Kalimantan (39.30 %). As part of West Java Province, Cirebon Regency recorded 88,047 individuals with hypertension (Cirebon Regency Health Office, 2023).

Hypertension is diagnosed when systolic blood pressure is ≥140 mmHg and/or diastolic blood pressure is ≥90 mmHg on repeated measurements, with systolic pressure considered the primary indicator (Mancia et al., 2023). This chronic non-communicable condition is commonly experienced by older adults and is often referred to as a "silent killer" because it may be asymptomatic while carrying a high risk of serious complications, including kidney failure, cardiovascular disease, myocardial infarction, stroke, and retinopathy. When inadequately controlled, hypertension affects not only physical health but also quality of life and psychological well-being (Mohi et al., 2023).

In older adults, increased blood pressure occurs as a result of vascular thickening and reduced arterial elasticity associated with aging (Ekasari et al., 2021). A study conducted in Palembang reported that age is a major risk factor for hypertension, with an odds ratio of 6.138 (Sartik et al., 2017). Data from the Indonesian Basic Health Research Survey also indicate that the prevalence of hypertension and diabetes mellitus increases with advancing age, with hypertension being the most prevalent NCD among older adults at 32.5 percent (Center for Data and Information, Ministry of Health, 2022). The WHO classifies older age into several categories: middle age (45–59 years), elderly (60–74 years), old (75–90 years), and very old (>90 years) (Intarti and Khoriah, 2018).

Demographic transitions toward an aging population structure, characterized by declining fertility and mortality rates, increasing life expectancy, and a lower dependency ratio, are no longer limited to developed countries but are also occurring in developing nations such as Indonesia (Center for Data and Information, Ministry of Health, 2022). United Nations data (2020) indicate that Indonesia ranks 108th out of 196 countries in terms of its older adult population (≥60 years). However, by 2050, Indonesia is projected to enter the top ten countries with the largest older adult populations, reaching approximately 10 million individuals. This trend highlights a significant demographic shift that requires careful management, particularly given the high vulnerability of older adults to chronic conditions such as hypertension.

Despite this growing burden, many older adults still have limited understanding of hypertension and its prevention and management. Therefore, promotive and preventive interventions must be prioritized, with the expectation that improved

health literacy can reduce hypertension-related morbidity and mortality (Maulana, 2022). Tertiary prevention is particularly important to maintain the quality of life of individuals with hypertension through early detection, treatment adherence, and long-term disease management. Regular medication use and timely care are essential to control blood pressure and prevent serious complications such as stroke, kidney failure, and cardiovascular disease (Hajri, 2021).

Hypertension control can be enhanced through health education that improves individuals' understanding of the disease, associated risks, and management strategies, thereby encouraging behavioral change toward better self-management (Arindari and Suswitha, 2020). One widely used health education approach is the Health Belief Model (HBM), which is applied to understand and predict preventive and treatment-related behaviors. This model emphasizes demographic factors, knowledge, and individual perceptions, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and motivation, all of which influence health beliefs and behaviors. Through the HBM framework, patients are encouraged to adopt preventive behaviors and effectively manage disease complications (Hermanto and Katmini, 2021).

Health education interventions based on the HBM have been shown to improve knowledge, perceptions, and behaviors related to hypertension management. A quasi experimental pre-post study conducted in Iran demonstrated the effectiveness of HBM based education in promoting hypertension prevention behaviors. However, that study included participants aged 36 to 65 years and did not specifically focus on older adults, despite this group having the highest prevalence of hypertension and a greater risk of complications (Azadi et al., 2021). Therefore, this study aims to analyze the influence of Health Belief Model constructs on tertiary prevention behaviors among older adults with hypertension.

SUBJECTS AND METHOD

1. Study Design

This study employed an analytic observational design with a cross sectional approach. Data collection was conducted from June to July 2025 in Cirebon Regency, West Java, Indonesia.

2. Population and Sample

The target population consisted of older adults diagnosed with hypertension in Cirebon Regency, West Java, Indonesia. The study sample included 200 older adults with hypertension recruited from five primary health centers (Karangsari, Kedawung, Gunungjati, Suranenggala, and Kedaton) in Cirebon Regency. Purposive sampling was used to select the study locations, while proportionate stratified random sampling was applied for participant selection.

3. Study Variables

The independent variables in this study were perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self efficacy. The dependent variable was tertiary prevention behavior for hypertension.

4. Operational Definition of Variables

Perceived susceptibility refers to an individual's subjective assessment of the risk of developing a disease or experiencing adverse health outcomes, as well as the extent to which personal behaviors may influence disease occurrence.

Perceived severity refers to an individual's perception of the seriousness of a disease if left untreated, including medical and clinical consequences such as complications and disability, as well as social impacts affecting daily activities, quality of

life, and roles within the family and community.

Perceived benefits represent an individual's belief that engaging in healthy behaviors or preventive actions will provide greater advantages than the risks associated with the disease, thereby motivating proactive health behaviors.

Perceived barriers refer to obstacles perceived by individuals that hinder the adoption of health behaviors, including financial costs, time constraints, side effects, or discomfort.

Cues to action are factors that trigger health related behaviors, either external cues such as advice from health care providers or health campaigns, or internal cues such as physical symptoms including dizziness or palpitations.

Self efficacy is defined as an individual's confidence in their ability to perform specific actions, including the capacity to regulate motivation, behavior, and environmental influences.

Tertiary prevention behavior refers to individual efforts to prevent complications of hypertension, such as regularly monitoring blood pressure, engaging in routine physical activity, and adopting a healthy lifestyle.

5. Study Instruments

Data were collected using a structured questionnaire with a Likert scale consisting of 38 items. The questionnaire included 5 items each for perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self efficacy, as well as eight items assessing tertiary prevention behaviors.

6. Data analysis

Univariate analysis was conducted to describe the parameters of each study variable. Bivariate analysis using simple linear regression. Multivariate analysis using path analysis. All analyses were conducted using STATA version 13.

7. Research Ethics

Ethical aspects of the study, including informed consent, anonymity, and confidentiality, were carefully addressed throughout the research process. Ethical approval was obtained from the Health Research Ethics Committee of Dr. Moewardi Regional General Hospital, Surakarta, Central Java, Indonesia (Approval No. 1.053/V/HREC/2025), dated May 20, 2025.

RESULTS

1. Sample Characteristics

Table 1 presents the characteristics of the 200 study respondents. The majority of respondents were aged between 60 and 69 years, accounting for 145 individuals (72.5 percent). In terms of sex, female respondents predominated, with a total of 116 participants (58%).

Table 1. Sample characteristics

Characteristics	N	%
Age		
60 – 69 years old	145	72.50
≥70 years old	55	27.50
Sex		
Male	84	42.00
Female	116	58.00

Based on Table 2, tertiary prevention behaviors among older adults with hypertension show a mean score of 11.31 (SD= 2.62), indicating a relatively good level of preventive behavior. Perceived susceptibility (mean= 7.18; SD= 2.55) and perceived

severity (mean= 7.09; SD= 2.05) reflect respondents' awareness of risk and their understanding of the seriousness of hypertension. Perceived benefits are relatively high (mean= 6.97; SD= 1.77), although perceived barriers remain present (mean= 4.90; SD= 2.09), which may influence preventive behaviors. Meanwhile, cues to action (mean= 7.09; SD= 2.12) appear to play a meaningful role, and self efficacy shows the highest mean score (mean= 9.31; SD= 1.21), indicating strong confidence among respondents in their ability to manage hypertension.

Table 2. Results of Univariate Analysis of Continuous Variables

Variables	Mean	SD	Minimum	Maximum
Tertiary prevention behavior	11.31	2.62	6	16
Perceived susceptibility	7.18	2.55	0	10
Perceived seriousness	7.09	2.05	2	10
Perceived benefit	6.97	1.77	1	10
Perceived barrier	4.90	2.09	0	8
Cues to action	7.09	2.12	1	10
Self-efficacy	9.31	1.21	4	10

2. Bivariate Analysis

Based on Table 3, the bivariate analysis indicates that several Health Belief Model constructs are significantly associated with tertiary prevention behaviors among older adults with hypertension. Perceived susceptibility shows a positive and statistically significant relationship with tertiary prevention behaviors. A one unit increase in the perceived susceptibility score is associated with a 0.19 unit increase in the tertiary prevention behavior score (b = 0.19; 95% CI= 0.05 to 0.33; p = 0.008). Perceived severity is also positively and significantly associated with tertiary prevention behaviors, with a one unit increase in perceived severity corresponding to a 0.22 unit increase in tertiary prevention behavior scores (b = 0.22; 95% CI= 0.04 to 0.40; p = 0.012).

Perceived benefits demonstrate a positive and statistically significant association with tertiary prevention behaviors. Each one unit increase in perceived benefits is followed by a 0.25 unit increase in tertiary prevention behavior scores (b= 0.25; 95%CI = 0.05 to 0.45; p= 0.015). Self efficacy also shows a positive and statistically significant relationship with tertiary prevention behaviors, whereby a one unit increase in self efficacy is associated with a 0.31 unit increase in tertiary prevention behavior scores (b= 0.31; 95%CI = 0.01 to 0.61; p = 0.040).

In contrast, perceived barriers, although positively related, do not show a statistically significant association with tertiary prevention behaviors. A one unit increase in perceived barriers is associated with a 0.07 unit increase in tertiary prevention behavior scores (b= 0.07; 95% CI = −0.10 to 0.24; p= 0.409). Similarly, cues to action show a positive but statistically non significant relationship, with a one unit increase in cues to action corresponding to a 0.16 unit increase in tertiary prevention behavior scores (b= 0.16; 95% CI= −0.05 to 0.33; p = 0.058). These findings suggest that perceived difficulties and external prompts alone may not be sufficiently strong to directly influence tertiary prevention behaviors among older adults with hypertension.

Table 3. Results of Simple Linear Regression Analysis of Factors Influencing Tertiary Prevention Behaviors among Older Adults with Hypertension

Independent Variables	b	95% CI		p
		Lower limit	Upper limit	
Perceived susceptibility	0.19	0.05	0.33	0.008
Perceived seriousness	0.22	0.04	0.40	0.012
Perceived benefit	0.25	0.05	0.45	0.015
Perceived barrier	0.07	-0.10	0.24	0.409
Cues to action	0.16	-0.05	0.33	0.058
Self-efficacy	0.31	0.01	0.61	0.040

3. Path Analysis

The proposed model consisted of seven observed variables, including three exogenous variables and four endogenous variables, with a total of fourteen estimated parameters. Based on these specifications, the degree of freedom (df) was five, indicating that the model was identifiable and appropriate for path analysis. The results showed that the model demonstrated an excellent goodness of fit (Chi Square = 0.376; RMSEA = 0.019; CFI= 0.977; TLI = 0.963; SRMR = 0.047; CD = 0.100).

Table 4 indicates that perceived benefits have a positive and statistically significant effect on tertiary prevention behavior (b= 0.17; 95% CI = 0.13 to 0.30; p= 0.023). Self-efficacy has a positive and statistically significant effect on tertiary prevention behavior (b= 0.14; 95% CI= 0.01 to 0.27; p= 0.036). Perceived barriers have a negative and statistically significant effect on perceived benefits (b= −0.16; 95% CI= −0.29 to −0.03; p= 0.014). Cues to action have a positive and statistically significant effect on perceived benefits (b = 0.21; 95% CI = 0.08 to 0.34; p= 0.002). Perceived severity has a positive and statistically significant effect on perceived benefits (b = 0.14; 95% CI = 0.01 to 0.27; p= 0.037). Perceived susceptibility has a positive and statistically significant effect on perceived barriers (b= 0.19; 95% CI= 0.06 to 0.32; p= 0.004). Perceived susceptibility also has a positive and statistically significant effect on cues to action (b = 0.25; 95% CI = 0.05 to 0.44; p = 0.014).

Overall, the findings demonstrate that tertiary prevention behavior is directly influenced by perceived benefits and self-efficacy, while other Health Belief Model constructs exert indirect effects through perceived benefits, perceived barriers, and cues to action.

Table 4. Results of Path Analysis of the Health Belief Model for Tertiary Prevention Behaviors among Older Adults with Hypertension

Study Variables			Path Coef. (b)	95% CI		p
				Lower limit	Upper limit	
Tertiary prevention behavior	→	Perceived benefit	0.17	0.13	0.30	0.023
	→	Self-efficacy	0.14	0.01	0.27	0.036
Perceived benefit	→	Perceived barrier	-0.16	-0.29	-0.03	0.014
	→	Cues to action	0.21	0.08	0.34	0.002
	→	Perceived seriousness	0.14	0.01	0.27	0.037

Study Variables			Path Coef. (b)	95% CI		p
				Lower limit	Upper limit	
Perceived barrier	→	Perceived susceptibility	0.19	0.06	0.32	0.004
Cues to action	→	Perceived susceptibility	0.25	0.05	0.44	0.014
N Observation = 200						
Log likelihood = -2915.07						
Chi Square (p)= 0.376 (>0.05)						
RMSEA=0.02 (≤0.05), CFI=0.98 (≥0.95).						
TLI=0.96 (≥0.95); SRMR=0.05 (≤0.08); CD=0.10						

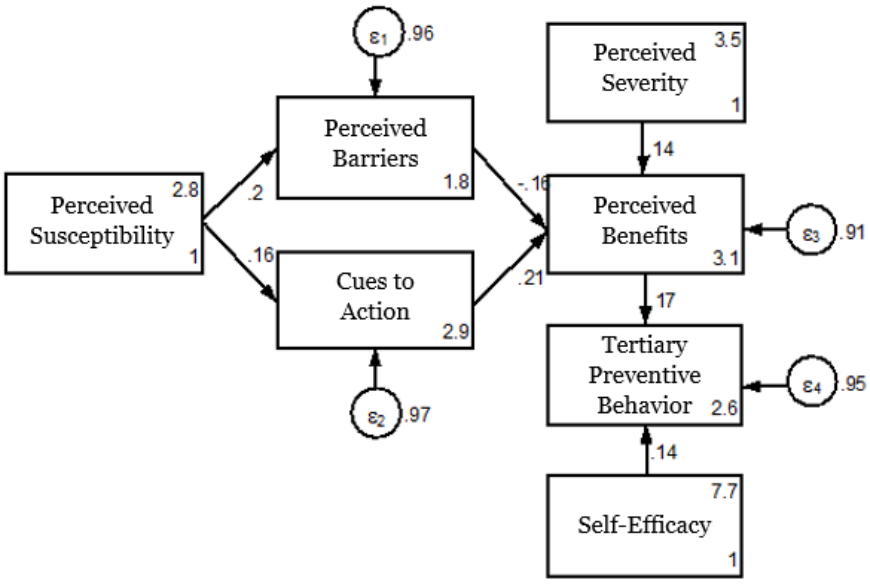

Figure 2. Path Diagram of Health Belief Model Constructs and Tertiary Prevention Behaviors among Older Adults with Hypertension

DISCUSSION

1. Association between perceived benefit and tertiary prevention behavior

Path analysis indicates that tertiary prevention behaviors among older adults with hypertension are directly and significantly influenced by perceived benefits (b= 0.17; 95 % CI= 0.13 to 0.30; p= 0.023). The stronger the older adults' belief in the benefits of preventive actions, the more likely they are to engage in these behaviors actively and consistently. This finding is consistent with a study conducted in Iran, which showed that older adults with greater awareness of the benefits of self care were more motivated to adopt preventive behaviors, and that Health Belief Model based educational interventions were effective in enhancing perceived benefits (Khorsand et al., 2017).

Research conducted in western China demonstrated a positive association between perceived benefits and adherence to antihypertensive medication among older adults, whereby patients who experienced tangible benefits, such as blood pressure reduction and prevention of complications, were more compliant with their treatment regimens (Pan et al., 2023). However, another study involving a larger population found that although perceived benefits remained a significant factor, the strength of its correlation with adherence was

relatively weak, with an adherence rate of 74 percent (Yue et al., 2015).

Studies conducted in other settings have also confirmed a positive relationship between perceived benefits and hypertension prevention behaviors, reinforcing the notion that stronger beliefs in the benefits of prevention are associated with a greater likelihood of engaging in healthy behaviors (Haryani et al., 2016).

2. Association between self-efficacy and tertiary prevention behavior

The results of the path analysis indicate that tertiary prevention behaviors among older adults with hypertension are directly and significantly influenced by self efficacy. Older adults with higher confidence in their ability to manage their condition are more likely to engage in tertiary prevention behaviors. This finding is consistent with the study by Zhao Yue et al. (2015), which reported a significant association between self efficacy and adherence to hypertension treatment.

A study conducted in the United States demonstrated that patients with hypertension who had high self efficacy were 1.23 times more likely to adhere to medication compared with those with lower self efficacy. Higher self efficacy was also significantly associated with greater adherence to a low salt diet (64 percent), physical activity (27 percent), smoking cessation (10 percent), and weight management (63 percent) (Findlow et al., 2022). Evidence from Iran further supports these findings, showing that self efficacy scores increased by 5.53 times in the group receiving Health Belief Model based educational interventions, compared with a 1.06 fold increase in the control group (Nematzad et al., 2022).

Overall, self efficacy plays a crucial role in promoting tertiary prevention behaviors among older adults with hypertension. Enhancing self efficacy, particularly through Health Belief Model based interventions, has been shown to effectively strengthen medication adherence, self care practices, and the adoption of healthy lifestyles.

3. Association between perceived barrier and tertiary prevention behavior

The path analysis results indicate that perceived barriers have a statistically significant indirect and negative effect on tertiary prevention behaviors through perceived benefits. This finding is supported by a study conducted in Iran, which reported that perceived barriers were negatively associated with hypertension control, whereas perceived benefits and self efficacy were positively associated (Solhi et al., 2023). Barriers such as financial constraints, medication side effects, and limited access to health services reduce older adults' confidence in the benefits of preventive actions, thereby decreasing adherence to antihypertensive treatment. Efforts to minimize perceived barriers and strengthen perceived benefits are therefore essential to enhance tertiary prevention behaviors (Pan et al., 2023). In addition to medication adherence, health education plays an important role in tertiary prevention of hypertension. Health Belief Model based interventions have been shown to be effective, with an increase in perceived benefits scores by 5.4 percent and a reduction in perceived barriers scores by 9.5 percent. These results indicate that HBM based education can improve individual perceptions and promote more favorable preventive behaviors (Khorsandi et al., 2017).

This study underscores the important role of perceived barriers and perceived benefits in shaping tertiary prevention behaviors among older adults with hypertension. High perceived barriers may weaken perceived benefits and reduce adhe-

rence, whereas a better understanding of benefits encourages consistent preventive behaviors. Therefore, structured educational interventions grounded in the Health Belief Model represent a relevant and effective strategy for hypertension control among older adults.

4. Association between cues to action and tertiary prevention behavior

The path analysis indicates that cues to action have a statistically significant indirect effect on tertiary prevention behaviors through perceived benefits. This finding suggests that external prompts, such as advice from health care providers, media information, or encouragement from family members, can enhance older adults' perceptions of the benefits of preventive actions. Within the Health Belief Model framework, cues to action function as triggers for health behaviors, either internal, such as the onset of physical symptoms, or external, such as support from family members and health professionals (Ricinta et al., 2024).

Cues to action play an important role in increasing older adults' awareness of hypertension risk and in promoting preventive behaviors. For example, physician advice or personal experiences can trigger lifestyle changes when individuals understand the associated benefits (Ricinta et al., 2024). A study conducted in China also demonstrated that cues to action were significantly correlated with adherence to antihypertensive medication, underscoring the importance of external factors in shaping health behaviors (Yue et al., 2015).

The effectiveness of these cues is enhanced when they strengthen positive perceptions of the benefits of health actions. Therefore, cues to action are not only initial triggers but also represent a key strategy in promotive and preventive interventions for older adults with hypertension.

5. Association between perceived seriousness and tertiary prevention behavior

The results of the path analysis indicate that perceived severity has a statistically significant indirect effect on tertiary prevention behaviors through perceived benefits. Older adults who perceive hypertension as a serious disease are more likely to value preventive measures and treatment as beneficial. This finding is consistent with a study conducted in Ethiopia, which reported that perceived severity was significantly associated with medication adherence, and that perceptions of disease consequences further enhanced adherence (Tsadik et al., 2020).

Previous study found that perceived severity had an indirect effect on hypertension prevention behaviors, as awareness of serious health threats encouraged the development of positive perceptions regarding the benefits of prevention (Puspita et al., 2017). Other studies have also demonstrated that Health Belief Model based educational interventions are effective in increasing perceived severity and perceived benefits (Azadi et al., 2021). These findings underscore that greater awareness among older adults of the dangers of hypertension increases their tendency to view preventive actions as beneficial, thereby promoting more consistent and sustainable health behaviors.

6. Association between perceived susceptibility and tertiary prevention behavior

The path analysis results indicate that perceived susceptibility has a statistically significant indirect effect on tertiary prevention behaviors through perceived barriers and perceived benefits. Older adults who perceive themselves as vulnerable to hypertension complications tend to experience greater barriers, such as financial

constraints, advanced age, medication side effects, and the long duration of treatment, which in turn reduce their perception of treatment benefits. This condition contributes to low adherence levels (Yue et al., 2015). Perceived susceptibility reflects an individual's assessment of the likelihood of experiencing future health problems. Individuals who perceive themselves to be at low risk are less likely to engage in preventive behaviors, whereas those who perceive a high risk tend to be more proactive in preventive actions (Ricinta et al., 2024).

A study conducted in Tanzania also demonstrated that patients with high perceived susceptibility showed higher medication adherence at 57.4 percent, with a statistically significant difference (p= 0.012), while perceived barriers were negatively associated with adherence (Joho, 2021). However, individuals who feel vulnerable are also more sensitive to perceived barriers, and without adequate health education, perceived benefits may be weakened. Health Belief Model based interventions have been shown to improve self care behaviors, although they do not substantially reduce perceived barriers (Nematzad et al., 2022). These findings highlight the need for promotive strategies that explicitly address perceived barriers so that risk awareness can be translated into sustained adherence and preventive practices.

In addition, path analysis revealed that perceived susceptibility has an indirect effect on tertiary prevention behaviors through cues to action and perceived benefits. Educational efforts and external encouragement have been shown to enhance older adults' awareness of the risk of hypertension complications, thereby motivating engagement in preventive behaviors. Evidence from Tanzania supports this finding, showing that cues to action are positively associated with adherence, while perceived susceptibility and perceived benefits also contribute significantly (Joho, 2021).

Increased risk awareness has been shown to strengthen other Health Belief Model constructs, particularly perceived benefits, which promote tertiary prevention behaviors such as medication adherence and lifestyle modification (Setiyaningsih et al., 2016). A study in Aceh reported that a greater number of cues to action, including health information, medical consultations, and family discussions, were associated with better medication adherence among older adults, with perceived susceptibility playing an important role (Ricinta et al., 2024). Health Belief Model based educational interventions have also been found to improve scores for cues to action, perceived benefits, and perceived susceptibility, thereby effectively enhancing self care behaviors among older adults with hypertension (Nematzad et al., 2022). These findings underscore that cues to action function as a key trigger in strengthening perceived benefits and shaping motivation among older adults to adhere more consistently to hypertension prevention practices.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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