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Tertiary Prevention Behavior among Elderly with Hypertension Based on the Information Motivation Behavioral Skill Model

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ABSTRACT

Background: Hypertension among the elderly is a prevalent health problem with a high risk of serious complications, including stroke and renal failure. However, tertiary prevention behaviors, such as treatment adherence and lifestyle management, remain suboptimal. The Information Motivation Behavioral Skill (IMB) model suggests that health behavior is influenced by information, motivation, and behavioral skills. This study aimed to analyze tertiary prevention behavior among elderly patients with hypertension based on the IMB model.

Subjects and Method: This was an analytic observational study with a cross-sectional design. A total of 252 older people with hypertension were selected using simple random sampling at Gambirsari and Sibela Primary Health Centers in Surakarta, Central Java, Indonesia. Variables independent were information, motivation, behavioral skills, and the dependent was tertiary prevention behavior. Data were collected using questionnaires and analyzed using path analysis run on STATA 13.

Results: Information (b=4.32; 95% CI=2.2 to 6.43; p<0.001), motivation (b=3.15; 95% CI=1.77 to 4.54; p<0.001), and behavioral skills (b=3.33; 95% CI=2.09–4.57; p<0.001) had significant direct effects on tertiary prevention behavior. Indirect effects through behavioral skills were also observed for information (b=0.81; 95% CI=0.19 to 1.42; p=0.010) and motivation (b=1.49; 95% CI= 0.88 to 1.11; p<0.001), with AIC = 401.34, BIC = 426.05.

Conclusion: Information, motivation, and behavioral skills directly influence tertiary prevention behavior among elderly patients with hypertension. In addition, information and motivation also have indirect effects through behavioral skills.

Keywords: hypertension, information motivation behavioral model, tertiary prevention behavior, older people

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BACKGROUND

Hypertension is defined as a condition characterized by elevated blood pressure with systolic values ≥140 mmHg and/or diastolic values ≥90 mmHg, including individuals undergoing antihypertensive treatment. This disease is a major risk factor for various non-communicable diseases, such as cardiovascular disease, stroke, kidney failure, and ischemic heart disease (WHO, 2023). Older adults are more vulnerable to hypertension due to the physiological aging process, which leads to decreased vascular elasticity and increased aortic stiffness, thereby increasing the incidence of isolated systolic hypertension in the elderly population (Jones et al., 2025).

Globally, hypertension remains a significant health problem, affecting approximately 1.28 billion adults aged 30–79 years, most of whom live in low- and middle-income countries. More than 40% of individuals with hypertension are unaware of their condition, and less than one-third of those receiving treatment achieve optimal blood pressure control. This condition indicates that hypertension is not only a clinical problem but also a challenge in public health behavior (WHO, 2023).

In Southeast Asia, hypertension is a significant cause of mortality, contributing to more than 1.5 million deaths annually and affecting approximately one in three older adults (WHO, 2021). In Indonesia, the prevalence of hypertension among adults is around 31.2% and is higher in the elderly population (Ministry of Health of the Republic of Indonesia, 2024b). Among individuals aged ≥60 years, the prevalence exceeds 60% and increases with age (Oktamianti et al., 2022). Data from the Indonesian Health Survey also show that the prevalence of hypertension among older adults reaches 65.8%, with higher distribution in several regions, including Central Java (Ministry of Health of the Republic of Indonesia, 2024a).

In Surakarta, Indonesia, hypertension is one of the non-communicable diseases with a high prevalence among older adults. Data from the Surakarta City Health Office in 2025 showed that the number of elderly patients with hypertension reached 6,525 at Gambirsari community health center (*puskesmas*) and 5,930 at Sibela community health center. The number of hypertension cases among older adults in both primary health centers remains high and continues to increase each year (Surakarta City Health Office, 2024). This condition indicates that hypertension is still a priority health problem, particularly in efforts to prevent complications among the elderly.

Tertiary prevention is an important effort in hypertension control to prevent further complications. The interventions include medication adherence, dietary management, physical activity, and regular blood pressure monitoring (Zahro et al, 2025). However, several studies have shown that tertiary prevention behaviors among older adults remain low, particularly in medication adherence and lifestyle management (Hua et al., 2024).

Low tertiary prevention behavior is influenced by limited knowledge, motivation, and skills in disease management (Hariyadi et al., 2024). Limited health literacy, cognitive decline, and lack of social support also become barriers among older adults (Estiko et al., 2025). Previous studies showed that non-adherence to antihypertensive therapy reached 30–50% and increased the risk of complications (Burnier and Egan, 2019).

Health education through printed media and counseling has not been optimal in changing elderly behavior due to the gap between knowledge and the application of health behaviors. Studies show that infor-

mation alone is insufficient without adequate motivation and skills (Giguère et al., 2020). Low health literacy also contributes to non-adherence to treatment and hypertension management among older adults (Ruksakulpiwat, et al., 2024). Therefore, the Information Motivation Behavioral Skill (IMB) approach is important to identify the determinants of tertiary prevention behavior in order to provide more effective interventions (Fisher and Fisher, 2023).

The Information Motivation Behavioral Skill (IMB) model explains that health behavior is influenced by information, motivation, and behavioral skills (Fisher and Fisher, 2023). Information and motivation encourage behavioral change, while behavioral skills play a role in the consistent implementation of health behaviors (Giguère et al., 2020). Behavioral skills also act as a mediator between information, motivation, and health behavior (Rikmasari et al., 2025). This study aimed to analyze tertiary prevention behavior among older adults with hypertension based on the IMB model.

SUBJECTS AND METHOD

1. Study Design

This was a cross-sectional study conducted in Surakarta, Central Java, Indonesia, from January to February 2026.

2. Population and Sample

The population in this study consisted of all older adults with hypertension in the working areas of Gambirsari and Sibela Community Health Centers. The sample included 252 respondents selected using a simple random sampling technique, with inclusion criteria of older adults aged 60–74 years, diagnosed with hypertension, able to communicate clearly, and willing to participate as respondents.

3. Study Variables

The variables in this study consisted of information, motivation, and behavioral skills as independent variables, while tertiary prevention behavior was the dependent variable.

4. Operational Definition of Variables

Information was measured based on the level of specific knowledge regarding health actions, including hypertension, its causes, prevention, and complications.

Motivation refers to the internal and external drive of older adults to prevent hypertension complications, including self-confidence and social support.

Behavioral skills were measured based on the individual's ability or capacity to perform, achieve goals, and overcome barriers in carrying out tertiary prevention behaviors for hypertension.

Tertiary prevention behavior Actual behavior or real actions and healthy lifestyles aimed at reducing or delaying complications caused by hypertension.

5. Study Instruments

The research instrument used in this study was a self-developed questionnaire consisting of 10 items for each variable. The independent variables included information, motivation, and behavioral skills, while the dependent variable was tertiary prevention behavior. The questionnaire was developed by the researchers and had undergone validity and reliability testing prior to data collection.

6. Data analysis

Univariate analysis was conducted to obtain the frequency distribution and percentage characteristics of the study subjects. Bivariate analysis was performed to examine the association between independent and dependent variables using simple binary logistic regression. Multivariate analysis was conducted using path analysis with the Generalized Structural Equation

Modeling (GSEM) approach in Stata version 13 to identify the direct and indirect effects of independent variables on the dependent variable.

7. Research Ethics

Research ethical issues including informed consent, anonymity, and confidentiality, were addressed carefully during the study process. The research received ethical approval from the Health Research Ethics Committee of Universitas Kusuma Husada Surakarta with ethical clearance number 3108/UKH.L02/EC/I/2026, on January 06, 2026.

RESULTS

1. Sample Characteristics

Table 1 show the characteristics of 252 respondents with categorical data. Most respondents were female, totaling 173 individuals (68.65%). The highest educational level was elementary school, with 88 respondents (34.92%). Most respondents were unemployed, categorized as others, totaling 214 individuals (84.92%). The majority had no income (Rp0), accounting for 218 respondents (86.51%). Regarding family history of hypertension, most respondents had a hereditary history of hypertension, totaling 167 individuals (66.27%). Most respondents had no comorbid diseases other than hypertension, totaling 214 individuals (84.92%). In the information variable, the majority had good information, with 132 respondents (52.38%). Furthermore, 146 respondents (57.94%) had high motivation, 146 respondents (57.94%) had good behavioral skills, and 199 respondents (78.97%) had good tertiary prevention behavior.

Table 1. Sample characteristics (categorical data)

Characteristics	Category	Frequency	Percentage
Gender	Male	79	31.35
	Female	173	68.65
Education	No Formal Education	40	15.87
	Elementary School	88	34.92
	Junior High School	65	25.79
	Senior High School	49	19.44
	Higher Education	10	3.97
Occupation	Unemployed	214	84.92
	Laborer	22	8.73
	Private Employee	1	0.40
	Entrepreneur	15	5.95
Income	Low (<minimum regional wage)	238	94.44
	High (>minimum regional wage)	14	5.56
Family History	No	85	33.73
	Yes	167	66.27
Comorbidities	None	214	84.92
	Diabetes mellitus	22	8.73
	Heart disease	1	0.40
	Gastric acid disease	15	5.95
	Gout	1	0.40
	Asthma	1	0.40
	Neurological Disease	1	0.40
Information	Poor	120	47.62
	Good	132	52.38
Motivation	Low	106	42.06
	High	146	57.94

Characteristics	Category	Frequency	Percentage
Behavioral Skills	Poor	106	42.06
	Good	146	57.94
Tertiary Prevention	Poor	53	21.03
Behavior	Good	199	78.97

2. Univariate Analysis

Table 2 show the results of the univariate analysis showed that the mean score of information was 30.04 (SD= 2.96), motivation was 30.36 (SD= 3.56), behavioral skills was 29.30 (SD= 2.40), tertiary preventive behavior was 31.81 (SD=3.77).

Table 2. Results of the univariate analysis of research subjects (continuous data)

Variabels	N	Median	SD	Min.	Max.
Information	252	31	2.96	21	36
Motivation	252	31	3,56	20	37
Behavioral skills	252	30	2.40	22	39
Tertiary prevention behavior	252	32	3.77	22	38

3. Bivariate Analysis

Based on the results of the bivariate analysis, information had a significant influence on tertiary prevention behavior (OR=100.18; 95% CI=13.55 to 740.42; p<0.001). This finding indicates that older adults with good information were 100.18 times more likely to perform tertiary prevention behavior compared to those with poor information. These results suggest that better information received by older adults increases the likelihood of performing tertiary prevention behaviors for hypertension.

Motivation had a significant influence on tertiary prevention behavior (OR=45.55; 95% CI=12.75–142.05; p<0.001). This finding indicates that older adults with high motivation were 45.55 times more likely to perform tertiary prevention behavior compared to those with low motivation. These results suggest that higher self-motivation and support from the surrounding environment increase the likelihood of older adults performing tertiary prevention behaviors for hypertension.

Behavioral skills had a significant influence on tertiary prevention behavior (OR= 30.51; 95% CI= 10.52–88.48; p <0.001). These findings indicate that older adults with good behavioral skills were 30.51 times more likely to perform tertiary prevention behavior compared to those with poor behavioral skills. This result suggests that better behavioral skills increase the likelihood of older adults performing tertiary prevention behaviors for hypertension.

Table 3. Bivariate analysis of variabels influencingtertiary preventive behavior

Variables	OR	95% CI		p
		Lower limit	Upper limit	
Information	100.18	13.55	740.42	<0.001
Motivation	45.55	12.75	142.05	<0.001
Behavioral skills	30.51	10.52	88.48	<0.001

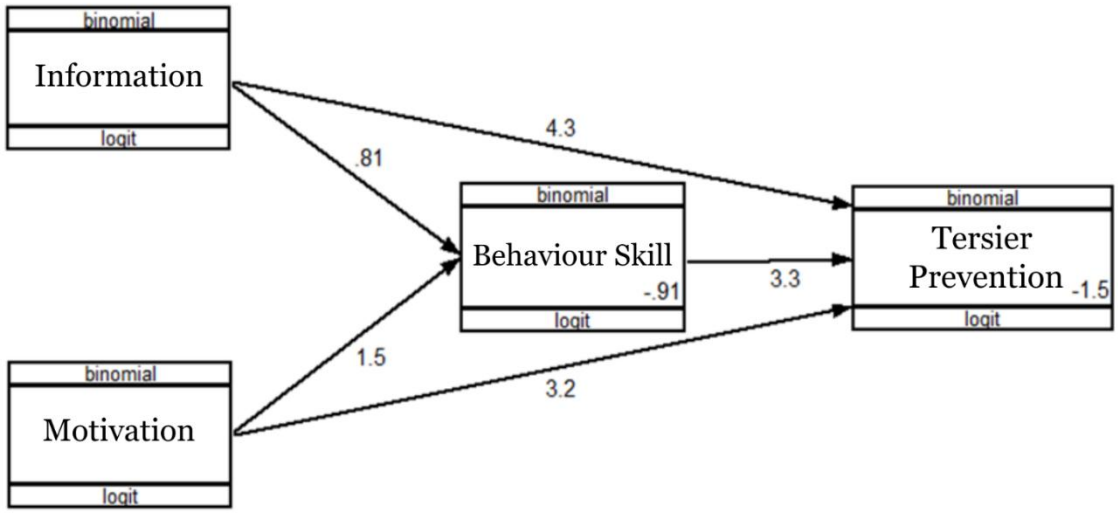

Figure 1. Path analysis model with estimation

4. Multivariate Analysis

Figure 1 presents the results of the (GSEM) analysis, illustrating the effects of the (IMB) theory constructs on tertiary prevention behaviors among older adults with hypertension.

Table 4 shows the results of the multivariate analysis using path analysis, which revealed Information has a direct effect on tertiary prevention behavior. Patients with adequate information are 4.32 units more likely to engage in tertiary prevention behavior than patients with insufficient information (b= 4.32; 95% CI= 2.20 to 6.43; p <0.001).

Motivation has a direct effect on tertiary prevention behavior. Patients with high motivation are 3.15 units more likely to engage in tertiary prevention behavior than patients with low motivation (b = 3.15; 95% CI = 1.77 to 4.54; p<0.001)

There is a direct effect of behavioral skills on tertiary prevention behaviors. Patients with good behavioral skills are 3.33 units more likely to engage in tertiary prevention behaviors than patients with poor behavioral skills (b = 3.33; 95% CI = 2.09 to 4.57; p<0.001)

Patients with good information are 0.81 units more likely to acquire good behavioral skills than patients with insufficient information (b = 0.81; 95% CI = 0.19 to 1.42; p = 0.010).

Patients with high motivation are 1.49 units more likely to acquire behavioral skills than patients with insufficient information (b = 1.49; 95% CI = 0.88 to 1.11; p<0.001).

Table 4. Results of the path analysis of the theory of information, motivation, and behavioral skills on tertiary prevention behavior

Dependent Variables		Independent Variables	b	95% CI		p
				Lower Limit	Upper Limit	
Direct effect						
Tertiary prevention behavior	←	Information	4.32	2.20	6.43	<0.001
	←	Motivation	3.15	1.77	4.54	<0.001
	←	Behavioral skills	3.33	2.09	4.57	<0.001

Dependent Variables		Independent Variables	b	95% CI		p
				Lower Limit	Upper Limit	
Indirect effect						
Behavioral skills	←	Information	0.81	0.19	1.42	0.010
	←	Motivation	1.49	0.88	1.11	<0.001
N observation= 252						
Log likelihood= -193.67418						
AIC = 401.3484						
BIC = 426.0544						

DISCUSSION

The direct effect of information on tertiary prevention behavior

Path analysis results indicate that information has a direct and significant effect on tertiary prevention behavior among older adults with hypertension. Older adults with good information are 4.32 units more likely to engage in tertiary prevention behaviors than those with insufficient information.

Based on the IMB framework, information can predict behavior both directly and indirectly through behavioral skills. Information is a key determinant in the implementation of health behaviors because it provides relevant data for an individual's health actions (Fisher and Fisher, 2023).

These findings align with the study by Dinita and Maliya (2024), which showed that information influences the increase in behaviors to prevent hypertension complications (p=0.001). Wahyudi (2020) study also demonstrated that information influences behaviors to prevent hypertension complications. This condition is likely influenced by an individual's level of awareness regarding their condition as well as their knowledge in implementing appropriate preventive measures (Oktavia et al., 2023).

These findings are consistent with the results of Fajarsari (2021) study, which showed that increased access to and understanding of information regarding hypertension play a role in encouraging individuals to adopt healthier behaviors to keep their blood pressure within normal limits. Furthermore, research conducted by Limbong (2020) indicates that a good level of knowledge regarding hypertension influences individual behavior in efforts to prevent complications resulting from hypertension.

According to the Information Motivation Behavioral Skills (IMB) framework, information is a key determinant of health behavior that influences behavior both directly and through behavioral skills. Adequate knowledge of hypertension increases disease awareness, supports informed decision-making, and promotes effective self-management. Therefore, older adults with higher levels of hypertension-related information are more likely to adhere to treatment and adopt behaviors that prevent complications (Fisher and Fisher, 2023).

The direct effect of motivation on tertiary prevention behavior

The results of the path analysis indicate that motivation has a direct and significant effect on tertiary prevention behavior among older adults with hypertension. This indicates that older adults with high motivation are more likely to engage in tertiary prevention behaviors compared to those with low motivation.

These findings are supported by the study by Mariyanti et al. (2024), which states that there is a relationship between

family support and hypertension prevention behaviors: when family support is good, prevention behaviors or self-care behaviors are also good. The support provided includes emotional, informational, appreciative, and instrumental support, which motivates patients to engage in self-care behaviors (Mariyani et al., 2021).

These findings are supported by Susanti et al. (2022) who reported a significant association between social support and preventive behaviors among patients with hypertension. Individuals receiving adequate social support were more likely to demonstrate better self-management skills than those with limited support.

Rusminingsih et al. (2021) found that motivation was significantly associated with self-care behavior and tertiary prevention among hypertensive patients. Patients with higher motivation were more likely to engage in effective tertiary preventive behaviors ($p = 0.003$), highlighting the important role of motivation and social support in hypertension management. Based on the odds ratio (OR) analysis, patients with high motivation levels were 7.667 times more likely to demonstrate good tertiary prevention behaviors.

Within the Information Motivation Behavioral Skills (IMB) framework, motivation is a key factor influencing health behavior. Strong motivation, supported by family and healthcare providers, can improve treatment adherence, lifestyle modification, and regular health monitoring. Therefore, social support plays an important role in enhancing motivation and promoting tertiary preventive behaviors among older adults with hypertension.

The direct effect of behavioral skills on tertiary prevention behaviors

The results of the path analysis indicate that behavioral skills have a direct and significant effect on tertiary prevention behaviors among older adults with hypertension ($b = 3.33$; 95% CI = 2.09–4.57; $p < 0.001$). This indicates that older adults with good behavioral skills are more likely to engage in tertiary prevention behaviors compared to those with low skills. Behavioral skills in this study include the ability to monitor blood pressure, manage lifestyle, adhere to medication, manage stress, and communicate with healthcare providers (Sulaeman, 2025).

These findings are supported by Betriza *et al.* (2025) study, which showed that older adults with high self-efficacy regarding their ability to implement tertiary prevention behaviors were more likely to adopt tertiary prevention behaviors for hypertension ($b = 0.14$; 95% CI = 0.01 to 0.27; $p = 0.036$). This aligns with the findings of Yue *et al.*, (2015) which indicate that behavioral competence has a significant correlation with adherence to self-care among hypertensive patients.

Within the Information Motivation Behavioral Skills (IMB) framework, behavioral skills enable individuals to translate information and motivation into effective health actions. Older adults with stronger behavioral skills are more likely to perform self-management behaviors, including maintaining a healthy diet, engaging in physical activity, monitoring blood pressure, and adhering to treatment. Therefore, enhancing behavioral skills through education and support from healthcare providers and family members is essential for promoting tertiary prevention of hypertension among older adults.

The indirect effect of information on tertiary prevention behavior through behavioral skills

Path analysis results indicate that information has a significant indirect effect on tertiary prevention behavior through behavioral skills among older adults with

hypertension. This indicates that the better the information older adults possess, the better their behavioral skills, thereby increasing the likelihood of implementing tertiary prevention behaviors (Sulaeman, 2025).

These findings are consistent with Harahap et al. (2020) who reported a significant association between information level and the ability to manage hypertension independently. Adequate knowledge of hypertension, including its causes, complications, and prevention, supports the development of behavioral skills and effective self-management. Better understanding encourages treatment adherence, regular blood pressure monitoring, and healthy lifestyle practices, whereas limited information may hinder self-management (Fisher and Fisher, 2023). Therefore, accurate information and continuous health education are essential for strengthening behavioral skills and supporting the tertiary prevention of hypertension among older adults (Efriani et al, 2023).

The indirect effect of motivation on tertiary prevention behavior through behavioral skills

Path analysis results indicate that motivation has an indirect effect on tertiary prevention behavior in elderly hypertensive patients through behavioral skills, and this effect is statistically significant. Patients with high motivation are more likely to possess good behavioral skills, thereby increasing the likelihood of engaging in effective tertiary prevention behaviors. Patients with high motivation are 1.49 units more likely to acquire good behavioral skills than those with low motivation. Motivational indicators among respondents in this study included motivation originating from within the patient (personal motivation) and motivation originating from external sources or others (social motivation) (Sulaeman, 2025).

The study conducted by Siahaan et al. (2022) reported that motivation significantly influences self-care efficacy among patients with hypertension. These findings indicate that older adults with higher motivation are more likely to possess the confidence and ability to perform self-care behaviors that support the tertiary prevention of hypertension.Similarly Fay (2020) states that motivation influences tertiary prevention behavior through behavioral skills.

Within the Information Motivation Behavioral Skills (IMB) framework, motivation plays an important role in strengthening behavioral skills. High levels of motivation, supported by family and social support, can enhance older adults' confidence and readiness to engage in self-care behaviors, including treatment adherence, blood pressure monitoring, and healthy lifestyle practices. Therefore, motivation is a key factor in developing behavioral skills and promoting successful tertiary prevention of hypertension among older adults (Sulaeman, 2025).

AUTHOR CONTRIBUTION

DL is the principal investigator of this study and was responsible for determining the research topic, conducting the study, and collecting the data. AG and ISS reviewed the first draft of the manuscript and provided academic guidance throughout the research process. EBC and HS contributed to the scientific evaluation and critical review of the research content and provided valuable feedback for the improvement of the manuscript.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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