

Determinants of Hypertension Self-Care Among Older Adults in Rural Central Java: A Path Analysis Study

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Abstract

Background: Consistent self-care is key for effective hypertension management, but is difficult for older adults in rural settings. Understanding how individual and contextual factors interact helps develop targeted nursing interventions. This study examined the determinants of self-care adherence among older adults with hypertension in rural Central Java by analyzing the direct and indirect links between hypertension knowledge, self-care profiles, and health care empowerment.

Methods: A quantitative study with path analysis included 60 older adults (aged >60 years) with hypertension in Getasan District, Semarang Regency, Central Java. Data were collected from August to December 2025 via validated questionnaires and analyzed using SmartPLS and IBM SPSS version 24.

Result: Health service empowerment had the strongest positive effect on self-care adherence ($\beta = 0.402$, $p < 0.001$). Hypertension knowledge did not directly influence adherence, but it did so through health care empowerment ($\beta = 0.171$, $p = 0.004$). The model explained 23% of the variance in self-care adherence ($R^2 = 0.230$).

Conclusion: Health care empowerment, rooted in patient motivation and perception, is the main factor in adherence and mediates health knowledge. Nursing interventions should shift from education to empowerment-based strategies to enhance independence in hypertension management among rural populations.

Keywords:

Hypertension, Older Adults, Self-Care Adherence

BACKGROUND

Self-care abilities among older adults remain a significant challenge in managing chronic diseases, particularly hypertension. Hypertension continues to impose a major global health burden, substantially contributing to mortality from cardiovascular events and stroke (1). It accounts for a high incidence of myocardial infarction (20%), stroke (14%), and heart failure (12%) as primary complications in the elderly population (2). Although hypertension can be managed through healthy lifestyle practices and medication, maintaining consistent self-care among older adults remains difficult (3). Generally, self-care skills in this population are low, influenced by limited knowledge and insufficient self-empowerment (4). Older adults with inadequate knowledge often lack the ability to control their blood pressure, resulting in uncontrolled hypertension (5). Furthermore, limited empowerment may hinder optimal utilization of health services, adversely affecting self-care capabilities (6). Consequently, enhancing knowledge and self-empowerment among older adults is essential for developing effective community-based self-care interventions to improve hypertension management.

Self-care among older adults is influenced by their empowerment and knowledge, particularly in understanding and applying healthy behaviors in daily life. Older adults can engage in self-care when they have adequate physical and cognitive abilities and reside in social and residential environments that promote independence (7). However, research involving older adults with chronic diseases in rural Korea indicates that low health literacy, limited social support, and restricted access to health services impede self-care practices (8). Similar barriers were identified in a qualitative study in rural China, which reported that limited knowledge, poor economic conditions, chronic diseases, and lack of social support and health facilities hinder self-care among older adults (9). These findings are corroborated by research in rural Australia, where limited healthcare personnel, difficult service access, transportation challenges, and discontinuity of care significantly obstruct optimal self-care (10). In Indonesia, integrated programs such as the CERDIK initiative, which promotes healthy living behaviors, have been implemented to enhance older adults' knowledge and self-care (11). Additionally, the Indonesian government supports self-care improvement through the Healthy Living Community Movement (GERMAS), which encourages regular physical activity and healthy lifestyle behaviors (12). The implementation of these programs aims to improve knowledge and self-care among older adults, thereby reducing the risk of hypertension-related complications. Consequently, identifying factors influencing self-care ability among rural older adults remains imperative.

Orem's Self-Care Theory posits that individuals are responsible for maintaining their health through self-care activities, with nursing support required when self-care deficits arise (13). This study operationalized Orem's theoretical framework into measurable variables. Hypertension knowledge denotes an individual's understanding of self-care requirements, which is essential for initiating appropriate health behaviors. The hypertension self-care profile represents the individual's capacity to perform self-care activities, encompassing behavior, motivation, and self-efficacy. Health care empowerment aligns with Orem's supportive-educative nursing system, in which healthcare providers facilitate patients' ability to manage their conditions through education and support (14). Self-care adherence is conceptualized as the outcome of effective self-care agency, reflecting the extent to which individuals consistently perform recommended self-care practices. Based on this framework, it is hypothesized that hypertension knowledge and health care empowerment influence self-care adherence both directly and indirectly via the hypertension self-care profile, consistent with Orem's theory (15). Orem's theory asserts that all individuals can care for themselves (16). The ability to do so depends on possessing knowledge, self-empowerment, and cognitive skills appropriate for one's age (17). Aging, particularly among older adults, involves physical changes and cognitive decline that may impair independent self-care. Therefore, health education for older adults should be tailored to their cognitive

abilities, providing information that is easy to understand and relevant to their daily lives in rural settings (18).

This study addresses a significant gap in the literature by focusing on functionally active older adults with hypertension in rural settings, a population underrepresented in prior research. Previous studies on self-care among older adults with hypertension have typically examined broader elderly populations in community and clinical contexts, often emphasizing factors such as family support, education, and health status (19). Moreover, many of these studies include older adults with functional limitations or dependency and generally rely on larger samples without specifically distinguishing those who remain independent and actively engaged in daily productive activities (20). Consequently, this study offers a more specific perspective by examining self-care adherence among hypertensive older adults who are functionally active and independent, a group that may exhibit distinct health behavior patterns. Additionally, the study aimed to identify determinants of self-care adherence among older adults with hypertension in rural Central Java by analyzing direct and indirect relationships between hypertension knowledge, self-care profiles, and health care empowerment using path analysis.

METHODS

Study Design

This study used a quantitative design with a path analysis approach to determine how different variables directly and indirectly affected self-care adherence among older adults with hypertension (21). The research was conducted from August to December 2025 in a village in the Getasan District, Semarang Regency, Central Java.

Sample/Participants

The study population consisted of all elderly individuals with a history of hypertension residing in a village in Getasan Subdistrict, Semarang Regency, Central Java. The inclusion criteria for this study included older adults aged 60 or older with a history of hypertension for more than 1 year, who were not actively participating in Posbindu activities for the past 3 months, and who were willing to participate in the entire series of research activities. The criterion of hypertension duration of more than 1 year was chosen because the length of time an individual has had hypertension can affect the adaptation process in adhering to self-care (22). The exclusion criteria included older adults with hypertension who were at risk of dementia, older adults who were partially or wholly dependent on others, and older adults with physical weaknesses or limited mobility. Respondents were identified through recommendations from health cadres and village midwives who knew older adults with a history of hypertension. The researchers coordinated with cadres and village midwives to obtain a list of potential respondents who met the inclusion criteria and attended regular cadre and Posbindu meetings to foster community involvement and ensure respondent participation. A priori power analysis was conducted using G*Power to estimate the minimum required sample size. With an effect size of 0.15, $\alpha = 0.05$, power = 0.80, and four predictors, the recommended sample size was 85 participants. However, the study setting included only 100 older adults with hypertension, of whom 60 (60%) were included. A post hoc power analysis indicated that the achieved statistical power was approximately 0.62, which is below the commonly recommended threshold of 0.80 (23), suggesting a potential risk of Type II error. Despite this limitation, Partial Least Squares Structural Equation Modeling (PLS-SEM) is appropriate for exploratory research and for studies with relatively small sample sizes and complex models. Therefore, the findings of this study should be interpreted with caution, particularly regarding statistical power and generalizability, while still providing valuable preliminary insights into self-care adherence among older adults in a population-constrained rural context.

Instruments

Data collection involved door-to-door visits to reach respondents at home. During each visit, researchers measured blood pressure with a digital sphygmomanometer to confirm hypertension status. Respondents then completed the questionnaires. The research instruments included measures of hypertension knowledge, self-care adherence, self-care profile and empowerment in health services.

First, the level of hypertension knowledge was measured using 12 questions with yes/no response options. The knowledge questionnaire was tested for validity ($p < 0.05$) and for reliability (Cronbach's $\alpha = 0.620$), indicating acceptable reliability. Second, self-care adherence was measured using 6 questions with two response options (adherent/non-adherent) on medication adherence, low-salt diet, physical activity, smoking, weight management, and alcohol consumption. The self-care adherence questionnaire was tested for validity ($p < 0.05$) and reliability (Cronbach's $\alpha = 0.733$), indicating good reliability. Third, the self-care profile was measured using the Hypertension Self-Care Profile (HBP-SCP-60), which was adapted and translated into Indonesian (24). This questionnaire has been tested for validity ($p < 0.001$) and reliability (Cronbach's $\alpha = 0.953$), indicating very high reliability. The instrument consists of three main components: behavior, motivation, and self-efficacy, measured on a 4-point Likert scale. The behavior component includes 20 items assessing the frequency of self-care practices, such as physical activity, low-salt and low-fat diet, blood pressure monitoring, medication adherence, and stress management. The motivation component consists of 20 items measuring the perceived importance of engaging in self-care, with responses ranging from "not important at all" to "very important." The self-efficacy component includes 20 items assessing respondents' confidence in performing self-care adherence. Fourth, healthcare empowerment was measured using the Health Care Empowerment Questionnaire (HCEQ-10), which was adapted and translated into Indonesian (25). The questionnaire consists of 10 items covering two aspects: perceived control over healthcare and motivation to engage in care, measured on a 4-point Likert scale. Validity testing was conducted using exploratory and confirmatory factor analyses, demonstrating a three-factor structure with good model fit indices (CFI = 0.979; NFI = 0.964; RMSEA = 0.052) and satisfactory convergent and discriminant validity. Reliability testing showed a Cronbach's α of 0.83, indicating good reliability.

Data Analysis

Questionnaire data were entered in Microsoft Excel and then analyzed with IBM SPSS 24 and SmartPLS. Preliminary analysis in SPSS included correlation, linear regression, and multiple regression to explore variable relationships and support model development (26). These analyses offered an initial understanding to inform path model specification (27). SmartPLS was then used to examine direct and indirect relationships using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is suitable for exploratory models and complex relationships and imposes fewer distributional assumptions (28).

RESULT AND DISCUSSION

RESULT

Demographic Characteristics

Table 1. Demographic Characteristic of Respondents (N=60)

Characteristic	Participants	Hypertension Knowledge	Self-Care Adherence	Self-Care Profile	Health care empowerment
		Mean (SD): 20.55(1.70)	Mean (SD): 8.80(1.26)	Mean (SD): 53.35(4.70)	Mean (SD): 26.30(7.09)
		<i>p-value</i>	<i>p-value</i>	<i>p-value</i>	<i>p-value</i>
Age (years), Mean ± SD, Min-Max	68.25 ± 6.99 (60-94)	0.824	0.950	0.335	0.081
Age group 60–69 years	34 (56.7%)				
Age group 70–79 years	21 (35%)				
Age group ≥80 years	5 (8.33%)				
Gender, <i>n</i> (%)		0.633	0.008*	0.007*	0.863
Female	46 (76.6%)				
Male	14 (23.3%)				
Education Level		0.126	0.256	0.137	0.008*
No formal education	27 (45%)				
Primary school	29 (48.3%)				
Junior secondary school	2 (3.3%)				
Senior secondary school	1 (1.7%)				
University (tertiary education)	1 (1.7%)				
Duration of Hypertension (years), Mean ± SD, Min-Max	2.2 ± 2.01 (1-10)	0.258	0.000*	0.014*	0.170
Body Mass Index (kg/m ²), Mean ± SD, Min-Max	23.06 ± 3.34 (17.33-38.46)	0.888	0.108	0.174	0.783
Systolic Blood Pressure (mmHg), Mean ± SD, Min-Max	173.3 ± 17.35 (151-250)	0.644	0.411	0.765	0.517
Diastolic Blood Pressure (mmHg), Mean ± SD, Min-Max	97.41 ± 13.13 (78-167)	0.344	0.713	0.468	0.925
Family History of Hypertension					
Yes	7 (11.7%)	0.528	0.014*	0.741	0.006*
No	53 (88.3%)				
Health Insurance		0.121	0.664	0.570	0.576
Yes	47 (78.3%)				
No	13 (21.7%)				

Note: A Spearman's rho was employed to analyze the distributions of participants' characteristics. *n* = total number of participants. % = percent, *M* = mean. *SD* = Standard deviation *significant < 0.05

Table 1 presents the demographic and clinical characteristics of 60 elderly respondents. The mean age was 68.25 ± 6.99 years, ranging from 60 to 94 years, with 56.7% aged 60–69 years. Females comprised 76.6% of the sample. Regarding education, 48.3% had elementary education, while 45% had no formal education. The mean duration of hypertension was 2.2 ± 2.01 years. The mean body mass index was 23.06 ± 3.34 kg/m², indicating a normal-to-overweight range. Mean systolic and diastolic blood pressures were 173.3 ± 17.35 mmHg and 97.41 ± 13.13 mmHg, respectively, reflecting relatively uncontrolled hypertension. Statistical analysis revealed that self-care adherence was significantly associated with gender ($p=0.008$), hypertension duration ($p=0.000$), and family history of hypertension ($p=0.014$). Self-care profile was significantly associated with gender ($p=0.007$) and hypertension duration ($p=0.014$). Health care empowerment was significantly associated with education level ($p=0.008$) and family history of hypertension ($p=0.006$). Conversely, age group, body mass index, blood pressure measures, and health insurance coverage showed no significant associations with hypertension knowledge, self-care adherence, self-care profile, or health care empowerment ($p>0.05$).

Table 2. Spearman’s rho correlation between self-care adherence and hypertension knowledge, self-care profile, and health care empowerment (n=60)

Main Variable	Hypertension Knowledge		Self-Care Profile		Health Care Empowerment	
	r	p value	r	p value	r	p value
Self-Care Adherence	0.220	0.092	0.267	0.039*	0.483	< 0.001**

Note: A Spearman’s rho correlation test was used; *= $p<0.05$; **= $p<0.01$

Table 2 shows the results of the Spearman’s rho correlation analysis. This analysis examined the relationship between self-care adherence and the study variables. The findings indicate that self-care adherence was significantly and positively correlated with health care empowerment ($r = 0.483$, $p < 0.001$). This suggests a moderate relationship. In addition, a weak but significant positive correlation was found between self-care adherence and self-care profile ($r=0.267$, $p=0.039$). No significant correlation was observed between self-care adherence and hypertension knowledge ($r = 0.220$, $p = 0.092$).

Table 3. Simple linear regression models for self-care adherence (n=60)

Variables	R ²	B	SE	β	t	p value
Hypertension Knowledge	0.027	0.121	1.977	0.163	1.257	0.214
Self-care Profile	0.056	0.063	0.034	0.236	1.850	0.069
Health Care Empowerment	0.163	0.036	1.162	0.404	3.361	0.001**

Note: R² = coefficient of determination; B = unstandardized coefficient; SE = standard error; β = standardized coefficient; *= $p<0.05$; **= $p<0.01$

Table 3 presents the results of the simple linear regression analyses that were conducted to examine the effect of each independent variable on self-care adherence. The results indicated that health care empowerment was a significant predictor of self-care adherence ($\beta=0.404$, $t=3.361$, $p=0.001$), explaining 16.3% of the variance ($R^2=0.163$). In contrast, hypertension knowledge was not significantly associated with self-care adherence ($\beta=0.163$, $t=1.257$, $p=0.214$), with a low explanatory power ($R^2=0.027$). Similarly, the self-care profile showed a positive but non-significant relationship, although

it approached statistical significance ($\beta=0.236$, $t=1.850$, $p=0.069$), accounting for 5.6% of the variance ($R^2=0.056$).

Table 4. Multiple Linear Regression Models for Self-Care Adherence (n=60)

Variables	B	SE	β	t	p value
Hypertension Knowledge	-0.062	0.102	-0.084	-0.607	0.546
Self-care Profile	0.059	0.034	0.222	1.757	0.084
Health Care Empowerment	0.074	0.023	0.416	3.177	0.002*

Note: R^2 = coefficient of determination; B = unstandardized coefficient; SE = standard error; β = standardized coefficient; *= $p<0.05$; **= $p<0.01$

Table 4 presents the results of the multiple linear regression analysis examining the predictors of self-care adherence. The findings indicate that health care empowerment was the only significant predictor of self-care adherence ($B=0.074$, $SE=0.023$, $\beta=0.416$, $t=3.177$, $p=0.002$). In contrast, hypertension knowledge was not significantly associated with self-care adherence ($B = -0.062$, $SE = 0.102$, $\beta = -0.084$, $t = -0.607$, $p = 0.546$). Similarly, the self-care profile showed a positive but non-significant relationship, although it approached statistical significance ($B=0.059$, $SE=0.034$, $\beta=0.222$, $t=1.757$, $p=0.084$).

Table 5. Summary of Regression Model FR

R	R2	Adjusted R2	F change	p value
0.455	0.207	0.163	4.866	0.004*

Note: overall R = strength of the linear relationship; R^2 = coefficient of determination; Adjusted R^2 = the proportion of variance in the dependent variable explained; F-statistic = overall model significance test; *= $p<0.05$; **= $p<0.01$

Table 5 presents the summary of the regression model fit for self-care adherence. The results indicate that the overall model was statistically significant (F change = 4.866, $p = 0.004$). The model demonstrated a moderate correlation ($R=0.455$) and explained 20.7% of the variance in self-care adherence ($R^2=0.207$), with an adjusted R^2 of 0.163, indicating that 16.3% of the variance remained explained after adjustment for the number of predictors.

Table 6. Direct and indirect relationship of self-care adherence, hypertension knowledge, self-care profile, and health service empowerment (n= 60)

Path	B	t-stat.	p value	Bootstrapping (95% CIBC)		
				Bias	Lower (2.5%)	Upper (97.5%)
Direct effect						
Health Care Empowerment → Self-Care Adherence	0.402	3.966	<0.001**	0.003	0.162	0.577
Health Care Empowerment → Self-Care Profile	-0.024	0.145	0.885	-0.001	-0.382	0.277
Hypertension Knowledge → Health Care Empowerment	0.419	4.356	<0.001**	0.003	0.195	0.578
Hypertension Knowledge → Self-Care Adherence	-0.105	1.376	0.169	0.000	-0.081	0.385
Hypertension Knowledge → Self-Care Profile	0.342	2.081	0.037*	0.008	-0.221	0.553
Self-Care Profile → Self-Care Adherence	0.282	1.489	0.137	-0.016	-0.289	0.528

Path	B	t-stat.	p value	Bootstrapping (95% CIBC)		
				Bias	Lower (2.5%)	Upper (97.5%)
Indirect effect						
Hypertension Knowledge → Health Care Empowerment → Self-Care Profile → Self-Care Adherence	-0.003	0.130	0.897	0.007	-0.056	0.032
Hypertension Knowledge → Health Care Empowerment → Self-Care Adherence	0.171	2.917	0.004*	-0.005	0.081	0.326
Hypertension Knowledge → Health Care Empowerment → Self-Care Profile	-0.010	0.138	0.890	-0.002	-0.181	0.119
Health Care Empowerment → Self-Care Profile → Self-Care Adherence	-0.007	0.137	0.891	0.017	-0.117	0.079
Hypertension Knowledge → Self-Care Profile → Self-Care Adherence	0.099	1.182	0.237	-0.017	-0.070	0.269

Note: *= $p < 0.05$; **= $p < 0.01$

Table 6 presents the path analysis results, highlighting that health care empowerment has a strong, direct, positive effect on self-care adherence ($\beta=0.402$; $p < 0.001$), making it a key driver of adherence behaviour. Hypertension knowledge also significantly boosts health care empowerment ($\beta=0.419$; $p < 0.001$) and self-care profile ($\beta=0.352$; $p=0.037$), but does not directly impact adherence. Notably, hypertension knowledge indirectly improves self-care adherence through health care empowerment ($\beta=0.171$; $p=0.004$); other indirect effects are not significant. These findings emphasise health care empowerment as the critical link between knowledge and adherence in hypertension management.

Table 7. Measurement Model Assessment

Construct	Indicator	Outer Loading	P value	AVE	Composite Reliability
Health Care Empowerment	Motivation	0.889	<0.001**	0.809	0.894
	Perception	0.910	<0.001**		
Self-Care Profile	Behavior	0.852	0.041*	0.547	0.780
	Motivation	0.597	0.2		
	Self-efficacy	0.746	0.047*		

Note: Outer loading > 0.70; AVE > 0.50; CR > 0.70; *= $p < 0.05$; **= $p < 0.01$

Table 7 presents the evaluation of the measurement model, demonstrating that most indicators achieved acceptable reliability and convergent validity. Health care empowerment showed strong indicator loadings (>0.88), high composite reliability (0.894), and an AVE (0.809), indicating excellent construct validity. The self-care profile construct also met the minimum thresholds for AVE (0.547) and composite reliability (0.780). However, one indicator (motivation) had a lower loading (0.597), suggesting a relatively weaker contribution than the other indicators, which may slightly reduce the overall measurement strength of the self-care profile. Overall, the constructs were considered reliable and valid for further structural analysis.

Table 8. Structural Model Evaluation

Path	β	t-value	p-value	f ²
Health Care Empowerment → Self-Care Adherence	0.402	3.966	<0.001**	0.179
Health Care Empowerment → Self-Care Profile	-0.024	0.145	0.885	0.001
Hypertension Knowledge → Health Care Empowerment	0.419	4.356	<0.001**	0.212
Hypertension Knowledge → Self-Care Adherence	0.163	1.376	0.169	0.011
Hypertension Knowledge → Self-Care Profile	0.342	2.081	0.037*	0.116
Self-Care Profile → Self-Care Adherence	0.282	1.489	0.137	0.091

Note: f²: 0.02 (small), 0.15 (medium), 0.35 (large); * = p < 0.05; ** = p < 0.01

Table 8 presents the results of the structural model analysis. Specifically, health care empowerment had a significant positive effect on the self-care adherence ($\beta=0.402$, $p<0.001$) with a moderate effect size. Furthermore, hypertension knowledge significantly influenced health care empowerment ($\beta=0.419$, $p<0.001$) and the self-care profile ($\beta=0.342$, $p=0.037$), underscoring its importance as a predictor. In contrast, the direct effects of hypertension knowledge on self-care adherence and of self-care profile on adherence were not statistically significant. Finally, health care empowerment did not significantly affect the self-care profile, suggesting that its influence on adherence may occur through other pathways.

Table 9. Model Fit Indices

Fit Index	Value	Recommended Threshold
SRMR	0.099	< 0.08

Table 9 presents the evaluation of the structural model’s fit indices. The results show that the Standardized Root Mean Square Residual (SRMR) value is 0.099. While this slightly exceeds the recommended threshold of < 0.08, it remains below the generally permissible upper limit of 0.10 for exploratory path analysis in complex settings. Thus, the model fit is marginal, indicating a need for future refinement.

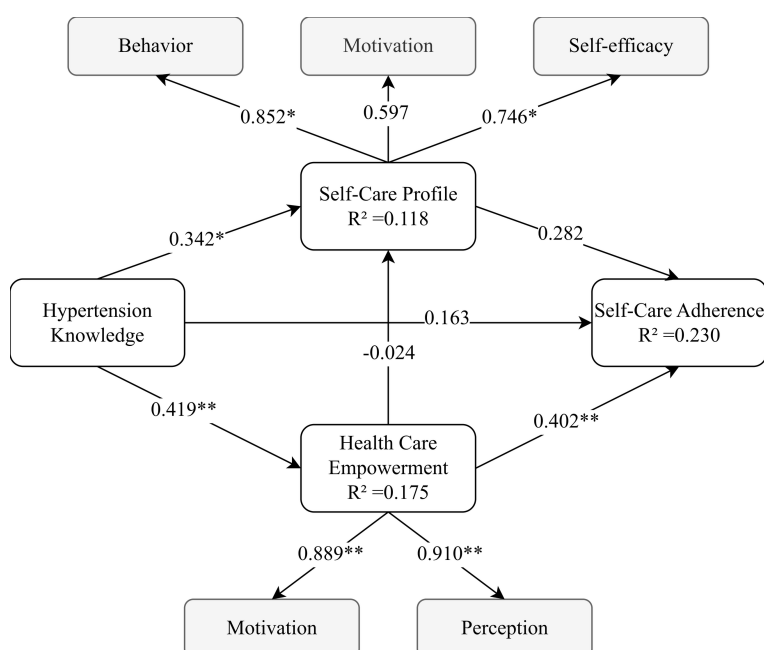


Figure 1. Path Analysis Model of hypertension self-care adherence, hypertension knowledge, and health service empowerment

Figure 1 illustrates the path analysis model. In this model, health care empowerment exerts the strongest significant influence on self-care adherence ($\beta=0.402$, $p<0.01$), supported by high factor loadings from perception ($\beta=0.910$) and motivation ($\beta=0.889$). Regarding hypertension knowledge, it had a more pronounced significant effect on health care empowerment ($\beta=0.419$, $p<0.01$) than on the self-care profile ($\beta=0.342$, $p<0.05$), with behavior serving as the primary indicator ($\beta=0.852$). However, the direct path from hypertension knowledge to self-care adherence was not statistically significant ($\beta=0.163$), suggesting that empowerment serves as a critical mediating mechanism in translating knowledge into compliant behavior. Taken together, these results indicate that the model explains 23% of the variance in self-care adherence among the study population ($R^2 = 0.230$).

DISCUSSION

Empowering older adults is the primary catalyst for enabling them to maintain their own health, rather than merely a supportive measure. Through empowerment, older adults can adopt and sustain healthy behaviors such as a low-salt, low-fat diet (including the DASH diet), regular physical activity, weight control, smoking cessation, alcohol restriction, stress management, and good sleep quality (29). These findings support Dorothea Orem's Self-Care theory, which holds that personal capability is key to health independence (30). In this study, health care empowerment was the most significant direct determinant of self-care adherence ($\beta = 0.402$, $p < 0.001$), confirming its primary role in driving behavioral change among rural geriatric populations.

The strength of empowerment in this model is primarily driven by high factor loadings in perception ($\beta=0.910$) and motivation ($\beta=0.889$). This suggests that, for older adults in rural Central Java, adherence is rooted in their perceptions of health services and their internal drive to remain healthy. Empowerment is supported by external factors such as family and a supportive social environment (31). Family-based health education has also been shown to improve independence in daily activities for elderly hypertensive patients. However, while many hypertensive patients have sufficient knowledge and good self-care adherence, expertise is not significantly associated with self-care adherence, suggesting that knowledge alone is not enough for compliance (32). When older adults feel "valued" (*diuwongke*) and perceive guidance from healthcare cadres positively, their motivation to sustain self-care increases.

The empowerment of older adults in rural areas is shaped by their health knowledge, the support from their environment, and the role of health workers and cadres. Increasing knowledge, supported by easy-to-understand materials and continuous guidance, can improve empowerment (33). External support, such as family and access to health services, also optimizes empowerment (34). Challenges include limited knowledge, declining physical and cognitive abilities, lack of family support, and insufficiently tailored health information, making self-care more difficult for many older adults (35).

Interestingly, our model shows that hypertension knowledge alone does not necessarily influence self-care adherence, as evidenced by the non-significant direct path ($\beta = 0.163$). This finding confirms that "knowing" does not automatically lead to "doing" in rural settings. Evidence from studies conducted among older adults in rural villages in Thailand indicates that, despite possessing relatively high levels of knowledge, self-care practices remain inadequate. This finding suggests that knowledge by itself is insufficient to produce behavioral change (36). Several factors contribute to this condition, including the delivery of health information that is overly abstract and the frequent use of medical terminology that older adults find difficult to comprehend, particularly in rural settings where educational attainment is generally low and many older adults have limited formal schooling (37). Consequently, the information provided is not fully understood. It may be perceived as irrelevant, leading older adults to be unaware of health problems or to regard their symptoms as a normal part of aging. This perception ultimately contributes to insufficient self-care in daily life (38). In addition,

government health programs often adopt uniform educational approaches across villages without adequately accounting for the specific conditions and needs of rural older adults.

Our findings show that empowerment is not only vital for direct adherence but also serves as the crucial link between knowledge and behavior. Hypertension knowledge predicts empowerment ($\beta=0.419$, $p<0.01$), which in turn predicts adherence—indicating that education is effective only when it also empowers. Empowerment facilitates overcoming internal barriers (e.g., physical decline, cognitive impairment) and external obstacles (e.g., education level, access, inadequate support). Health awareness and motivation—key aspects of empowerment—enable self-care. (39) External enablers such as family support, accessible health facilities, and comprehensible health programs further reinforce empowerment's pivotal role in translating knowledge into action. (40-42)

In rural communities, community nurses must prioritize empowerment as the strategy for converting knowledge into self-care. Research shows that older adults with basic hypertension knowledge often struggle with daily application, underscoring limits in empowerment. Therefore, nursing interventions should shift from simply informing to actively empowering, using relatable materials and engaging local health cadres to help older adults turn knowledge into concrete self-care behaviors. (43)

Several limitations of this study should be acknowledged. First, regarding model adequacy, the structural model achieved a marginal fit with an SRMR value of 0.099. Although this exceeds the conservative 0.08 threshold, it remains within the permissible range (<0.10) for exploratory path analysis in complex community-based settings (44), suggesting that external variables inherent to rural contexts, such as geographical access or financial constraints, might have been omitted and should be integrated into future models. Second, the achieved post hoc power was 0.62, which is below the recommended 0.80 threshold, thereby increasing the risk of Type II error. However, the use of PLS-SEM remains a robust and appropriate methodological choice, as it is specifically designed to handle complex structural relationships and provide higher statistical power in population-constrained settings with smaller sample sizes. Third, regarding generalizability, the data were collected from a single rural village in Central Java, which may not fully reflect the diverse socio-cultural dynamics of older adults in other regions. Consequently, future research should utilize larger, multi-centre cohorts and prioritise the development of culturally grounded, empowerment-oriented nursing interventions to validate and extend these preliminary findings.

CONCLUSION

This study demonstrates that health care empowerment, hypertension knowledge, and self-care profiles are significantly interrelated in determining self-care adherence among older adults in rural Central Java. The path analysis reveals that health care empowerment is the most potent direct determinant of adherence, characterized by high older adults' perceptions and motivation. Notably, hypertension knowledge does not directly translate into adherence; instead, its impact is mediated through empowerment and self-care profiles. This research suggests that while knowledge is foundational, it requires the catalyst of empowerment, specifically through strengthening patient perception and motivation, to improve self-management effectively. The resulting model provides a structural framework for understanding the complex dynamics of hypertension management in a rural geriatric context.

Community nurses should actively transition from traditional health education approaches to empowerment-based interventions by developing specific programs that build older adults' motivation and perception regarding their health services. Nursing care plans must include clear steps, such as setting individualized self-management goals, providing motivational interviewing, and involving

family support to foster sustainable self-care behaviours. Additionally, tailor these interventions to reflect the local culture in rural Central Java, ensuring that the strategies respect community values and support long-term adherence to hypertension control.

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AUTHOR'S CONTRIBUTION STATEMENT

Mrs. R contributed to the study's conceptualization, methodology, data analysis, manuscript review and editing, and overall supervision. Mrs. G was responsible for field data collection and formal data analysis. MRS N and MRS A contributed to writing the original draft of the manuscript. Mr. I contributed to the study methodology. MRS A and MRS M contributed to the conceptualization of the study. All authors reviewed and approved the final version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

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