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Association between Knowledge, Stress, and Medication Adherence among Hypertensive Clients in Rural Indonesia: A Cross-Sectional Study

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ABSTRACT

Hypertension is a major risk factor contributing to increased mortality and morbidity worldwide, with its prevalence increasing annually. Uncontrolled blood pressure can lead to serious complications, including stroke, retinopathy, heart failure, myocardial infarction, kidney failure, and disability. Therefore, medication adherence is crucial in preventing these complications. However, long-term and lifelong medication often presents challenges to adherence among hypertensive patients. This study aimed to analyze the association between knowledge and stress levels with medication adherence among hypertensive patients in rural areas. A cross-sectional correlational study was conducted in two villages in Kudus Regency, a hypertension-prone area, in April 2025. A total of 97 respondents were selected using purposive sampling based on predetermined inclusion and exclusion criteria. Knowledge and stress were assessed using the Hypertension Knowledge Level Scale and Perceived Stress Scale (PSS-10), while medication adherence was measured using the Hill-Bone Adherence to High Blood Pressure Therapy Scale. Data were analyzed using the chi-square test. The results showed a statistically significant relationship between knowledge and medication adherence (p=0.000), as well as between stress and medication adherence (p=0.000). These findings indicate that knowledge and stress levels significantly influence medication adherence in hypertensive patients. Therefore, community health centers are encouraged to develop targeted interventions, including structured health education and stress management programs, to improve long-term medication adherence in hypertensive populations in rural areas

KEYWORDS
Hypertension, knowledge, medication compliance, rural areas, stress

INTRODUCTION

Hypertension is one of the most serious global health problems and a major risk factor for cardiovascular and renal complications, including heart attack, heart failure, stroke, and kidney disease. Hypertension significantly contributes to morbidity, mortality, reduced quality of life, and sudden death across all age groups. Compared with normotensive individuals, hypertensive patients experience a poorer quality of life due to impaired physical, social, psychological, and sexual functioning (Makatindu et al., 2021). Beyond its clinical impact, hypertension also places a significant burden on families and communities, including emotional stress, long-term financial costs, reduced work productivity, and broader economic consequences (Marbun et al., 2024; Utari & Rochmah, 2019)

The prevalence of hypertension remains high globally and nationally. The World Health Organization reports that 33% of adults aged 30- 79 years worldwide and over 45% in Southeast Asia suffer from hypertension (WHO, 2023). In Indonesia, the 2023 Health Survey showed that the prevalence of hypertension based on blood pressure measurements reached over 29% among individuals aged ≥15 years (Kemenkes RI, 2023). Regionally, Central Java reported a hypertension prevalence of 38.2% among adults, while in Kudus Regency, 26.8% of the population aged >15 years were identified as having hypertension in 2023 (Dinas Kesehatan Kabupaten

Kudus, 2023; Dinas Kesehatan Provinsi Jawa Tengah, 2023). These data highlight hypertension as a persistent public health problem, including in rural areas.

Although hypertension is largely influenced by modifiable lifestyle factors such as excessive salt intake, smoking, alcohol consumption, and obesity, effective management relies heavily on long-term medication adherence (Mansyur & Suminar, 2022). However, adherence remains low, particularly because antihypertensive therapy must be taken lifelong. In Indonesia, medication adherence among hypertensive patients is estimated to be only around 50%, increasing the risk of serious complications and reducing quality of life (Yuliana et al., 2023).

Previous studies have identified knowledge and psychological factors as important determinants of medication adherence. Adequate knowledge has been shown to reduce the risk of non-adherence in chronic diseases, including tuberculosis and hypertension (Azmiardi et al., 2023; Iweama et al., 2021) Similarly, stress has been identified as a significant factor influencing adherence to antihypertensive medication and other chronic diseases (Abbas et al., 2020; Kosasih et al., 2023). However, most existing studies examine these factors separately or focus on urban or facility-based populations. Evidence that simultaneously analyzes knowledge and stress in rural hypertensive populations is limited.

From a theoretical perspective, this study is based on the Health Belief Model and stress-coping theory. Knowledge influences patients' perceptions of disease severity, treatment benefits, and vulnerability to complications, while stress influences coping mechanisms, motivation, and self-management behaviors. Together, these factors play a crucial role in shaping medication adherence among patients with chronic diseases.

In nursing practice, understanding these determinants is crucial. Nurses serve not only as caregivers but also as educators and assessors, identifying barriers to adherence, providing structured health education, supporting stress management, and monitoring patient treatment progress. By identifying how knowledge and stress interact with adherence behavior, nurses can design more targeted and effective interventions, particularly in resource-limited rural settings.

Therefore, this study aims to analyze the relationship between knowledge and stress with medication adherence in hypertensive patients in rural areas.

METHODS

This study used a correlational design with a cross-sectional approach. The independent variables were knowledge and stress, while the dependent variable was medication adherence in hypertensive patients. This study was conducted in two villages in Kudus Regency, Central Java, in April 2025.

A total of 97 respondents were recruited using purposive sampling techniques based on predetermined inclusion and exclusion criteria. Inclusion criteria were clients diagnosed with hypertension by a physician or other healthcare professional, or those with measured blood pressure ≥140/90 mmHg, aged ≥19 years, and able to read and write. Exclusion criteria were clients with severe or complicated comorbidities and those who did not

complete the study procedures. The sample size was determined based on feasibility and the number of eligible respondents available during the study period.

Medication adherence was measured using the Hill-Bone High Blood Pressure Therapy Adherence Scale, developed by the Johns Hopkins School of Medicine. This instrument consists of 14 items covering three domains: medication-taking behavior, appointment-keeping behavior, and salt intake behavior. Each item is scored using a four-point Likert scale (1 = all the time, 2 = most of the time, 3 = sometimes, and 4 = never). The total score ranges from 14 to 56, with scores of 14–34 categorized as non-adherent and 35–56 as adherent. The Indonesian version of the Hill-Bone questionnaire has been tested for validity (r count > r table) and reliability, with a Cronbach's alpha value of 0.719 (Fauziah, 2019; Tukan et al., 2022).

Hypertension knowledge was assessed using the Hypertension Knowledge Level Scale (HKLS), which consists of 22 items. Each correct answer is scored 1, while incorrect answers and "don't know" are scored 0. The total score is categorized as low knowledge (≤17) and high knowledge (18–22). The HKLS has demonstrated acceptable validity and reliability, with a Cronbach's alpha of 0.758 in a hypertensive population (Ernawati et al., 2020).

Stress levels were measured using the Perceived Stress Scale (PSS-10), which consists of 10 items rated on a five-point Likert scale ranging from 0 (never) to 4 (very often), with reverse scoring applied to certain items. The total score was categorized as mild stress (1–14), moderate stress (15–26), and severe stress (>26). The PSS-10 has demonstrated excellent reliability, with a Cronbach's alpha value of 0.960 (Handayani et al., 2020).

Data were analyzed using the chi-square test to examine the relationship between the categorical independent variables (knowledge level and stress category) and the dependent variable (medication adherence). This statistical test is appropriate because all study variables were measured on a categorical scale and the goal of the analysis was to identify associations, not cause-and-effect relationships.

Ethical approval for this study was obtained from the Health Research Ethics Committee of Muhammadiyah Kudus University (No. 275/Z-7/KEPK/UMKU/III/2025), issued on March 25, 2025. Prior to data collection, respondents were informed about the study's purpose, procedures, and their rights as participants. Written informed consent was obtained from all respondents, and confidentiality and anonymity were strictly maintained throughout the research process.

RESULT AND DISCUSSION

Hypertensive Clients' Characteristics

Table 1. Characteristics of Hypertensive Clients Based on Age and Length of Hypertension History (n = 97)

Variables	Mean	Median	Min	Max	SD
Age	52.29	55	19	74	12.58
Long history of illness	2.78	2	1	18	2.94

Table 1 shows that the mean age of hypertensive clients was 52.29 years (SD = 12.58), with a median age of 55 years. The youngest respondent was 19 years old and the oldest was 74 years old. The mean duration of hypertension was 2.78 years (SD = 2.94), with a median duration of 2 years, ranging from 1 to 18 years.

The findings indicate that the average age of hypertensive clients falls within the pre-elderly group. This pattern is consistent with regional epidemiological data reported in the Central Java Health Profile, which highlights hypertension as a significant health burden among adults aged 15 years and older (Dinas Kesehatan Provinsi Jawa Tengah, 2023). Similar results were reported by Susanti et al., (2024), who found that most hypertensive respondents were in their early fifties, and by Hijriyati et al., (2022), who identified individuals aged ≥45 years as the age group most frequently diagnosed with hypertension at the primary care level.

From a self-management and stress-coping perspective, the pre-elderly age group represents a critical transitional phase characterized by increased physiological vulnerability coupled with increased psychosocial demands. Age-related physiological changes, such as decreased blood vessel elasticity, declining kidney function, and the cumulative effects of long-term exposure to cardiovascular risk factors, substantially increase the risk of developing hypertension. At the same time, individuals in this age group often face conflicting responsibilities related to work, family roles, and social obligations, which can interfere with their ability to consistently adhere to long-term treatment regimens.

In rural areas, these challenges can be exacerbated by structural barriers, including limited access to healthcare facilities, low health literacy, and delayed healthcare-seeking behavior. Furthermore, traditional gender roles particularly for women in the pre-elderly age group can emphasize family and economic responsibilities over personal health management, potentially increasing the risk of non-adherence to antihypertensive therapy.

When compared with international literature, these findings align with studies from low- and middle-income countries, which report an increasing prevalence of hypertension beginning in midlife and emphasize the role of inadequate self-management and psychosocial stress in medication non-adherence. This suggests that the vulnerability observed in pre-elderly populations is not simply a local phenomenon but reflects broader global trends in chronic disease management.

Overall, the results of this study underscore that the pre-elderly age group is not only highly vulnerable to hypertension due to biological aging but also at higher risk of suboptimal medication adherence. Therefore, interventions targeting this group should prioritize strengthening self-management skills, reducing stress-related barriers, and addressing rural-specific barriers through accessible, age-appropriate, and context-sensitive health education strategies.

Table 2. Characteristics of Hypertension Clients Based on Gender, Occupation, Education, and Marital Status (n = 97)

Variables	Characteristics	f	%
Gender	Man	11	11.3
	Woman	86	88.7
Marital status	Not married yet	2	2.1
	Married	92	94.8
	Already Separated (Widow/ Widower)	3	3.1
Work	Not Working/Housewife	71	73.2
	Private Officer	1	1
	Self-employed	2	2.1
	Trader	1	1
	Laborer	12	12.4
	Teacher/Lecturer	1	1
	Civil Servants/TNI/POLRI	1	1
	Others	8	8.2
Education	No school	14	14.4
	Elementary School/Equivalent	43	44.3
	Junior High School/Equivalent	21	21.6

Variables	Characteristics	f	%
	High School/Vocational School/Equivalent	18	18.6
	Diploma (D1/D2/D3)	1	1
Total		97	100

Table 2 shows that the majority of respondents were female (88.7%), married (94.8%), and unemployed or housewives (73.2%). The highest proportion of respondents had an elementary school education or equivalent (44.3%).

Based on the research results, the majority of hypertension clients are women. This finding is consistent with various previous studies (Kusuma et al., 2024; Rhamttallah et al., 2025; Susanti et al., 2024) and data from the (Kemenkes RI, 2023), which shows a predominance of hypertension cases in women. Women's vulnerability to hypertension can be explained through biological and psychosocial approaches. Biologically, hormonal changes, particularly decreased estrogen levels in postmenopausal women, contribute to a reduced protective effect on the cardiovascular system. From a self-management perspective, women particularly in rural areas often face the burden of dual roles, such as household and social responsibilities, which can affect their ability to optimally manage chronic diseases. This is in line with the findings of Kusuma et al., (2024) and Rhamttallah et al., (2025), which show a higher tendency for medication non-adherence among women.

Occupational characteristics indicate that the majority of hypertension clients are housewives or unemployed. This finding aligns with research by Susanti et al., (2024) and Kusuma et al., (2024). Within the stress-coping framework, individuals without formal employment tend to have limited access to health information, workplace-based social support, and routines that support structured health behaviors. In rural contexts, housewives often prioritize family needs over personal health, resulting in suboptimal hypertension management. This situation suggests that employment status plays a significant role in shaping medication adherence behavior, and this group requires a more adaptive and accessible community-based intervention approach.

The study also showed that most hypertensive clients had a primary education or equivalent. This finding is consistent with research by Sundari et al., (2024) and Wijayanti et al., (2022). Low levels of education have the potential to limit an individual's ability to understand health information, medication instructions, and the long-term consequences of hypertension. From a self-management perspective, limited health literacy is a major barrier to self-care decision-making. Furthermore, among the elderly, memory loss and a lack of ongoing educational reinforcement from healthcare professionals contribute to low medication adherence.

Based on marital status, the majority of hypertension clients are married. This finding aligns with research by Adzani & Artistin, (2023) and Anggreyanti et al., (2023), which showed a predominance of marital status across various age groups of hypertension sufferers. In the context of stress-coping, marriage can provide social support, but it also has the potential to increase psychosocial stress due to economic and household responsibilities. For women, particularly in rural areas, the burden of dual roles as wife and household manager can reduce focus

on chronic disease management, thereby increasing the risk of non-adherence to therapy.

The study results showed that most clients had suffered from hypertension for a relatively long period of time. This finding aligns with research by Susanti et al., (2024) and Massa et al., (2021). Within the framework of chronic disease self-management, long disease duration is often associated with treatment burnout, especially when perceived outcomes do not meet expectations. The persistent perception that hypertension can be completely "cured" can reduce motivation for long-term treatment. In fact, blood pressure control is a form of ongoing management to reduce the risk of complications such as heart disease, kidney failure, and stroke (Kemenkes RI, 2023)

Overall, the findings of this study indicate that gender, occupation, education, marital status, and duration of hypertension interact to influence clients' ability to manage their disease and adhere to treatment. Rural-specific barriers—such as limited access to healthcare, low health literacy, and social and gender roles—need to be a primary consideration in intervention planning. A community-based approach that emphasizes strengthening self-management, social support, and ongoing health education is essential to improving medication adherence in hypertensive clients.

Hypertension Client Knowledge

Table 3. Client Knowledge of Hypertension (n = 97)

Knowledge	f	%
High	20	20.6
Low	77	79.4
Total	97	100

Table 3 shows that the majority of hypertensive clients have a low level of knowledge about hypertension (79.4%).

The findings indicate that most hypertensive clients have low levels of knowledge regarding their condition. These results are consistent with previous studies by Joni, (2021) and Devanti et al., (2024), which also reported limited knowledge among individuals with hypertension, particularly in older age groups. Low levels of knowledge remain a critical challenge in hypertension management, as understanding the disease plays a central role in shaping health behaviors.

From a self-management perspective, knowledge is a fundamental component that enables individuals to recognize symptoms, understand treatment goals, and actively engage in long-term disease management. Adequate knowledge has been shown to positively influence adherence to dietary recommendations and medication regimens, while inadequate knowledge can reduce motivation and consistency in following prescribed therapy (Ernawati & Yulita, 2022). Clients who lack an understanding of hypertension and its complications may underestimate the seriousness of the condition, increasing the risk of poor blood pressure control.

In rural contexts, low levels of knowledge can be further influenced by structural and sociocultural barriers, including limited access to health education, lower educational attainment, and limited interactions with healthcare providers. Traditional gender roles especially among women who often prioritize family responsibilities can also limit opportunities to seek health information and participate in regular health

monitoring. These factors can undermine coping strategies and reduce the ability to effectively manage hypertension.

When compared with international literature, these findings align with studies from various low- and middle-income countries, which consistently report that inadequate health literacy is associated with poor hypertension control and lower adherence to lifestyle and pharmacological interventions. International evidence emphasizes that increasing knowledge alone is insufficient unless accompanied by a supportive environment that facilitates sustained behavioral changes and self-care practices.

Therefore, knowledge about hypertension including its definition, causes, signs and symptoms, classification, complications, and prevention must be conveyed through ongoing and accessible education. Increased knowledge can positively influence attitudes toward the disease and strengthen self-efficacy in managing blood pressure, leading to more informed decision-making, regular utilization of health services, and better adherence to treatment (Farida et al., 2021). Consequently, strengthening health education interventions tailored to rural populations is crucial to improve self-management capacity and reduce the risk of hypertension-related complications.

Hypertension Client Stress

Table 4. Stress levels of Hypertensive Clients (n = 97)

Stress	f	%
Light	21	21,6
Currently	45	46,4
Heavy	31	32
Total	97	100

Table 4 shows that most respondents experienced moderate stress (46.4%), followed by severe stress (32.0%) and mild stress (21.6%)

These findings indicate that many hypertensive clients experience moderate levels of stress. These results are consistent with previous studies by Hapsari & Supratman, (2023) and Tyas & Zulfikar, (2021), which also reported moderate stress as a common condition among older individuals with hypertension. These findings suggest that stress is a common psychosocial factor accompanying hypertension, particularly in the elderly population. From a stress management and self-management perspective, stress reflects an individual's ability to adapt to chronic illness and life's demands. Hypertensive clients who have effective coping strategies tend to demonstrate greater resilience and better disease management.

Conversely, when adaptive coping mechanisms are inadequate, individuals are more vulnerable to psychosocial distress, which can negatively impact physical health and medication adherence (Saputri & Nurrahima, 2020). Persistent stress can interfere with patients' ability to maintain routine health behaviors, including medication use and lifestyle modifications. In rural contexts, stress levels may be heightened by limited access to healthcare, low levels of education, economic insecurity, and traditional gender roles that place significant responsibility on individuals especially women for household and family care.

These contextual factors can reduce opportunities for stress management, health education, and social support, thus weakening self-management capacity in hypertensive patients. Physiologically, stress activates the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system, leading to increased secretion of cortisol and

adrenaline. This hormonal response not only contributes to increased blood pressure but can also impair concentration, motivation, and decision-making related to disease management. As noted by the (Kemenkes, 2024), unmanaged stress can hinder adherence to treatment, while stress reduction strategies can support increased adherence to antihypertensive therapy.

When compared with international literature, these findings are consistent with studies from various countries highlighting psychosocial stress as a significant barrier to effective hypertension control. International evidence emphasizes that even moderate levels of stress can negatively impact self-care behaviors and blood pressure regulation, particularly among older adults managing chronic conditions. This underscores the need for an integrated approach to hypertension management that addresses both biomedical and psychosocial dimensions.

Overall, the study results suggest that moderate stress levels among hypertensive patients may contribute to poor adherence and suboptimal disease management. Therefore, hypertension interventions especially in rural areas—should incorporate stress management and coping strategies alongside pharmacological treatment to strengthen self-management and improve long-term health outcomes.

Treatment Compliance of Hypertensive Clients

Table 5. Treatment Compliance of Hypertension Clients (n = 97)

Compliance	f	%
Comply	11	11.3
Non-adherent	86	88.7
Total	97	100

Table 5 shows that the majority of respondents were classified as non-compliant with antihypertensive medication (88.7%).

Based on the study findings, the majority of hypertensive clients were categorized as non-adherent to antihypertensive medication. These results are consistent with previous studies by Kusuma et al., (2024) conducted at the Rawalele Community Health Center in Subang Regency, and by Hijriyati et al., (2022), both of which identified non-adherence as a dominant problem among individuals with hypertension. These findings indicate that poor medication adherence remains a persistent challenge across primary healthcare settings.

From a self-management and stress-coping perspective, medication adherence is a key behavioral component of chronic disease management. Poor adherence may reflect a patient's limited ability to integrate long-term medication routines into daily life, particularly when faced with stress, competing responsibilities, or low perceptions of disease severity. Patients experiencing psychological stress or lacking effective coping strategies may prioritize immediate concerns over consistent medication use, compromising blood pressure control.

In rural contexts, medication non-adherence can be further influenced by structural and sociocultural barriers, including limited access to healthcare services, irregular follow-up visits, low health literacy, and limited availability of antihypertensive medications. Furthermore, traditional gender roles especially among women who often manage household responsibilities can reduce the time and attention devoted to personal health

management, increasing the likelihood of missed doses or discontinuing treatment. When compared with international literature, these findings are consistent with studies from various low- and middle-income countries, which report high rates of non-adherence to antihypertensive therapy due to a combination of psychosocial stressors, inadequate patient education, and health system constraints. International evidence emphasizes that medication adherence is strongly influenced by patient self-efficacy, social support, and accessibility of health care resources, not just biomedical factors.

Overall, the findings suggest that non-adherence to antihypertensive medication is a multifactorial problem that goes beyond individual behavior. Therefore, interventions aimed at improving medication adherence should adopt a comprehensive approach that strengthens self-management skills, addresses stress-related barriers, and considers rural-specific challenges through ongoing education, community-based support, and improved access to primary health care services.

The Relationship Between Knowledge and Treatment Compliance of Hypertensive Clients

Table 6. Relationship between Knowledge and Treatment Compliance of Hypertension Clients (n = 97)

Knowledge	Treatment compliance				N	p-value
	Comply		Non-adherent			
	f	%	f	%		
Low	2	2	75	77.3	77	0.000
High	9	9.2	11	11.3	20	
Total	11	11.2	86	88.6	97	

Table 6 shows a statistically significant relationship between knowledge and medication adherence ($p < 0.05$). Respondents with higher levels of knowledge tended to be more adherent to medication than those with lower levels of knowledge.

The findings of this study are consistent with previous research showing a significant association between knowledge and treatment adherence. A study by Iweama et al., (2021) on non-adherence to tuberculosis treatment among patients undergoing directly observed short-term treatment (DOTS) in northwest Nigeria found that patients with adequate knowledge were less likely to be non-adherent than those with poor knowledge. Although conducted in a different disease context, this study highlights the broader principle that health literacy is a critical determinant of adherence behavior in chronic disease management.

Similarly, Azmiardi et al., (2023) reported a significant association between knowledge levels and medication adherence in hypertensive patients at primary healthcare facilities in Central Java. Their findings indicated that individuals with higher levels of knowledge demonstrated better adherence to antihypertensive therapy, reinforcing the role of cognitive understanding in shaping health behaviors. These findings support the current study, which also identified a significant association between knowledge levels and medication adherence among hypertensive patients.

From a self-management and stress coping perspective, knowledge serves as a key supporting

factor that strengthens patients' self-confidence, decision-making skills, and capacity to manage long-term therapy. Individuals with adequate knowledge are more likely to recognize the importance of consistent medication use, effectively monitor symptoms, and implement adaptive coping strategies when facing challenges related to chronic illness. Conversely, limited knowledge can reduce self-efficacy, increase stress related to disease uncertainty, and contribute to inconsistent adherence behavior.

In rural contexts, knowledge gaps can be exacerbated by structural barriers such as limited access to health information, lower education levels, and lack of exposure to ongoing health promotion activities. Traditional gender roles can also influence the acquisition of health knowledge and behaviors, particularly among women who prioritize family responsibilities over personal health management. These factors can weaken self-management capacity and contribute to poor adherence to antihypertensive therapy.

When compared with international literature, the current findings align with global evidence showing that health literacy plays a central role in medication adherence for various chronic conditions, including hypertension and tuberculosis. However, international studies also emphasize that knowledge alone is insufficient unless supported by accessible health care systems, ongoing education, and culturally appropriate interventions that foster long-term behavioral changes and self-care practices.

Therefore, knowledge about hypertension including its definition, causes, signs and symptoms, classification, complications, and treatment must be conveyed through structured and ongoing educational programs. Increased knowledge can influence attitudes, increase self-awareness, and foster better decision-making, thereby encouraging regular use of health services and consistent adherence to treatment (Farida et al., 2021). Ultimately, increased knowledge contributes to improved blood pressure management and reduces the risk of complications through improved self-management behaviors.

Overall, the results of this study reinforce the idea that knowledge is a critical factor influencing medication adherence in hypertensive patients. Strengthening patient education, particularly in rural areas, is crucial to enhance coping capacity, support ongoing self-management, and improve long-term treatment outcomes.

The Relationship Between Stress and Treatment Compliance in Hypertensive Clients

Table 7. Relationship between Stress and Treatment Compliance of Hypertension Clients (n = 97)

Stress	Treatment compliance				N	p-value
	Comply		Non-adherent			
	f	%	f	%		
Light	8	8.2	13	13.4	21	0.000
Currently	2	2	43	44.3	45	
Heavy	1	1	30	30.9	31	
Total	11	11.1	86	88.6	97	

Table 7 shows a statistically significant relationship between stress levels and medication adherence ($p < 0.05$). Higher stress levels were associated with a greater proportion of non-adherent

respondents.

The results of this study are consistent with research conducted by Abbas et al., (2020) in*"Factors Associated with Non-Adherence to Antihypertensive Medication: A Cross-Sectional Study Among Lebanese Hypertensive Adults."* The study used a cross-sectional descriptive design involving 1,497 respondents selected through random sampling, with data collected from the outpatient clinic of Rafic-Hariri University Hospital in Beirut, community pharmacies, and cardiology clinics across Lebanon. Findings showed that clients who attempted to control their stress levels were paradoxically less likely to adhere to antihypertensive medication. This statistically confirmed a significant association between stress and medication adherence, with higher stress levels increasing the likelihood of poor adherence to antihypertensive medication. These findings highlight stress as a critical risk factor for non-adherence and emphasize the importance of incorporating stress management into hypertension care, particularly within the framework of self-management and coping.

This research is also in line with previous research by Kosasih et al., (2023) entitled *"The Relationship Between Stress Levels and Treatment Compliance in Type 2 Diabetes Mellitus Patients During the Covid-19 Pandemic in the Baitussalam Community Health Center Work Area."*This study used a cross-sectional design and was conducted in the Baitussalam Community Health Center (Puskesmas) area in Aceh Besar, with 175 respondents selected through purposive sampling. Statistical analysis showed a chi-square p-value of 0.020 (<α 0.05), indicating a significant relationship between stress levels and medication adherence. Although conducted in different disease contexts, these findings strengthen the evidence that stress negatively impacts medication adherence in various chronic conditions, including hypertension.

From a physiological perspective, stress in hypertensive clients stimulates the pituitary gland to activate the endocrine system, increasing the secretion of the hormones adrenaline and hydrocortisone. This hormonal response accelerates the heart rate and increases blood pressure, thereby worsening hypertension (Budi Saputri et al., 2022). Psychologically, stress can interfere with concentration, motivation, and self-regulation, which are essential components of effective disease self-management. In this context, stress reflects patterns of attitudes and behaviors that interact and influence medication adherence. According to the (Kemenkes, 2024), effective stress reduction strategies can improve clients' ability to adhere to prescribed medication regimens, reinforcing the importance of stress management interventions in hypertension care. The results of this study show a statistically significant association between stress levels and medication adherence in hypertensive patients, with approximately half of the respondents experiencing moderate levels of stress, as presented in the Results section. This numerical finding aligns with national and international literature, which consistently reports that moderate to high stress increases the risk of non-adherence to antihypertensive medication. When interpreted through the framework of stress coping and self-management, these findings suggest that poorly

managed stress disrupts physiological stability and behavioral commitment to long-term treatment.

Furthermore, research findings must be interpreted in the context of specific barriers in rural areas. Factors such as limited education, limited access to healthcare, and traditional gender roles can influence stress levels and medication adherence among hypertensive patients in rural areas. These barriers can exacerbate stress and reduce individuals' ability to engage in effective self-care behaviors, thereby increasing the risk of non-adherence.

Despite its contributions, this study has several limitations. One limitation relates to the number of respondents. Initially, data collection was planned to coincide with Posbindu activities; however, attendance at these activities was insufficient to meet the required sample size. Consequently, the researchers adjusted their strategy by conducting door-to-door visits. While this approach ensured that the sample size met the calculated requirements and allowed for more personal interactions, it may have introduced variability in respondents' availability and willingness to participate. Another challenge was respondents' reluctance to participate in the study. To address this issue, the researchers employed a polite, communicative, and empathetic persuasive approach, accompanied by free blood pressure checks as a form of direct healthcare service and appreciation. This strategy proved effective in building trust and increasing participants' comfort and willingness to participate in the study.

Overall, these findings strengthen international and national evidence that stress is a significant determinant of medication adherence in hypertensive patients. Therefore, hypertension management programs should not only focus on pharmacological treatment but also include stress management and self-care strategies tailored to the population's social and cultural context.

Research Limitations

Based on the results of this study involving hypertensive clients, several limitations should be considered when interpreting the findings. First, the number of respondents was relatively limited. Initially, data collection was planned to coincide with Posbindu activities; however, the number of participants attending these activities did not meet the target sample size. Consequently, the researchers modified the data collection strategy.

Furthermore, this study used a cross-sectional design, collecting data at a single point in time. Consequently, a causal relationship between stress levels and medication adherence cannot be established, and the findings should be interpreted as an association rather than a causal relationship. Furthermore, the use of self-administered questionnaires to assess stress levels and medication adherence may have introduced reporting bias, as responses could be influenced by memory errors or a desire to present answers that conform to social norms.

The researchers also found reluctance among some potential respondents to participate in the study. To address this issue, a polite, communicative, and empathetic persuasive approach was implemented, accompanied by free blood pressure checks as a form of direct healthcare service and appreciation. While this strategy proved effective in increasing participation and building trust, it may have influenced respondents'

responses due to the increased interaction with the researchers.

These limitations may impact the interpretation and generalizability of the findings. The relatively small and context-specific sample size, combined with the cross-sectional design and reliance on self-reported data, limit the generalizability of the results to broader populations or different settings. Therefore, the findings should be interpreted with caution, and future studies are recommended to utilize longitudinal designs, larger sample sizes, and objective measures of medication adherence to strengthen the findings.

CONCLUSSION AND RECOMMENDATION

The results of this study indicate that knowledge and stress are significantly associated with medication adherence among hypertensive patients in the study population. Higher stress levels are associated with lower medication adherence, as moderate to high stress can interfere with concentration, motivation, and psychological disease management behaviors.

Furthermore, low knowledge levels are associated with non-adherence to antihypertensive medication, which may be due to a lack of understanding of hypertension, including its causes, symptoms, complications, and management. Adequate knowledge can foster positive attitudes and healthier behaviors, thus supporting better medication adherence and optimal blood pressure control.

Based on the findings of this study, hypertensive patients are encouraged to improve their medication adherence according to healthcare professionals' recommendations. Stress management strategies, such as relaxation techniques and light physical activity, are recommended to help reduce stress levels that can interfere with medication adherence. Furthermore, increasing knowledge about hypertension through targeted health education can support better understanding and self-management of the condition.

Community health centers, particularly those in research settings, are advised to implement structured health education programs focused on hypertension management, conduct early screening and regular blood pressure monitoring, and provide stress management counseling tailored to the local cultural context. Educational institutions in the health sector are advised to strengthen curricula related to hypertension and chronic disease management, improve student communication skills, and develop educational materials that are easily accessible and understandable to individuals with lower educational backgrounds.

For future research, it is recommended to examine additional factors that may influence medication adherence, such as family support, social support, access to healthcare, and cultural influences. Using a qualitative or mixed-methods approach could provide deeper insights into patient experiences and barriers to adherence. Further studies are also needed to develop and evaluate effective interventions aimed at improving medication adherence and encouraging regular health monitoring among hypertensive clients in similar populations.

Ethics Approval and Consent to Participate

The final stage involved analyzing the data and compiling a research report. This research has been declared to have passed the ethical review of the

health research ethics committee of Muhammadiyah Kudus University with number 275/Z-7/KEPK/UMKU/III/2025. On March 25, 2025.

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