Predictors of Medication Adherence Among Older Adults With Uncontrolled Hypertension

Xiaoping Xiang, M.N.S.[1], Pornpat Hengudomsub, PhD[2]*, Panicha Ponpinij, PhD[3]

Abstract

This predictive correlational study aimed to examine medication adherence and its influencing factors among Chinese older adults with uncontrolled hypertension. Using simple random sampling, 137 patients aged 60 years and above were recruited from the Department of Cardiology at the Second Affiliated Hospital of Wenzhou Medical University. Data were collected through validated instruments, including the Morisky Medication Adherence Scale (MMAS-8), the Chinese Medication Literacy Scale (C-MLSHP), the Medication Self-Efficacy Scale (MASES-R), and the Multidimensional Social Support Scale (MSPSS). Descriptive statistics and multiple linear regression analyses were conducted.

The results indicated a low mean medication adherence score (M = 5.59, SD = 0.98). Medication self-efficacy, medication literacy, and social support combinedly explained 30.8% of the variance in medication adherence (Adjusted R^2 = 0.308, $F_{(3,133)}$ = 21.185, $p < .001$). Medication self-efficacy emerged as the strongest predictor (β = 0.431, $p < .001$), followed by medication literacy (β = 0.240, $p < .05$). However, social support did not has a significant effect on medication adherence (β = 0.015, $p > 0.05$).

These findings underscore the critical role of medication self-efficacy and literacy in promoting medication adherence among older adults with uncontrolled hypertension and highlight the need for targeted nursing interventions aimed at enhancing these factors to improve health outcomes.

Key words: Uncontrolled hypertension, Medication adherence, Medication self-efficacy, Medication literacy, Social support

[1] Student of Master degree of Adult Nursing, Faculty of Nursing, Burapha University

[2] Associate Professor, Faculty of Nursing, Burapha University

[3] Assistant Professor, Faculty of Nursing, Burapha University

* Corresponding author e-mail: pornpath@buu.ac.th

Received 21/04/2025 Revised 29/06/2025 Accepted 29/06/2025

Significance of the study

Hypertension is a prevalent chronic disease among the aging population and a major global health concern. It is the leading preventable risk factor for cardiovascular disease (CVD) and all-cause mortality worldwide (Mills, Stefanescu, & He, 2020). The prevalence of hypertension increases markedly with age. In China, over half of older adults have hypertension, and the prevalence rises to nearly 90% among those aged 80 years and above. Importantly, uncontrolled hypertension remains widespread in this demographic, with recent studies indicating that nearly 50% of older adults with hypertension in Chinese communities do not achieve blood pressure targets despite treatment (Gao et al., 2022). This uncontrolled hypertension contributes substantially to morbidity and mortality from cardiovascular and cerebrovascular diseases, kidney disease, and all-cause death (Kokubo & Iwashima, 2015). According to the China Cardiovascular Disease Health and Disease Report 2020, over 245 million individuals in China suffer from hypertension (Ma et al., 2020), yet awareness, treatment, and control rates remain low at 55.7%, 46.5%, and 20.3%, respectively (Wei, Mi, Li, Xin, & Wang, 2021), highlighting a significant public health challenge.

Effective hypertension management includes both non-pharmacological and pharmacological interventions (Benetos, Petrovic, & Strandberg, 2019); however, this study specifically focuses on medication adherence because it is fundamental to successful blood pressure control. Medication adherence—defined by the World Health Organization as the extent to which a patient's behavior aligns with healthcare recommendations, including medication intake, diet, and lifestyle changes—is especially critical for older adults who face multiple barriers to pharmacotherapy, such as polypharmacy, cognitive decline, and side effects (Thuy, Monkong, Pookboonmee, Leelacharas, & Viwatwongkasem, 2020). Despite the availability of effective treatments, medication non-adherence is a pervasive global problem, with rates exceeding 50% in developed countries and even higher in developing regions (Al-Ramahi, 2015). In China, nearly 60% of elderly hypertensive patients fail to achieve adequate blood pressure control, underscoring the urgent need to improve adherence in this population (The Writing Committee of the Annual Report on Cardiovascular Health and Diseases in China. (2022).

A growing body of evidence from systematic reviews and meta-analyses focusing on older adults indicates that medication adherence is influenced by multiple factors, notably medication self-efficacy, medication literacy, and social support. Medication self-efficacy—the confidence individuals have in their ability to correctly follow medication regimens—is strongly associated with improved adherence and effective hypertension self-management (Locke, 1997; Schoenthaler, Ogedegbe, Allegrante, & Behavior, 2009). Medication literacy, defined as the capacity to obtain, understand, and use medication-related information, positively affects adherence by enhancing correct medication use, problem-solving skills, and communication with healthcare providers (Neiva Pantuzza et al., 2022). Additionally, adequate social support, particularly from family caregivers, has been shown to improve adherence by fostering treatment engagement and reducing social isolation in older adults (Turan, Aksoy, & Çiftçi, 2019). Although some studies have explored medication

adherence in patients with hypertension, few studies have focused specifically on the unique interplay of self-efficacy, medication literacy, and social support among older Chinese adults with uncontrolled hypertension. Therefore, understanding these factors is essential for developing effective interventions, especially by nurses. Understanding factors influencing medication adherence in this population is essential for designing effective strategies to improve hypertension control and ultimately enhance health outcomes and quality of life for older adults.

Objectives of the study

1. To describe medication adherence among older adults with uncontrolled hypertension.
2. To examine the influence of medication self-efficacy, medication literacy, and social support on medication adherence among older adults with uncontrolled hypertension.

Conceptual Framework

The conceptual framework used in this study is grounded in the medication adherence concept as postulated by the World Health Organization and supported by relevant literature reviews. Medication adherence, a critical aspect in managing chronic diseases such as hypertension, is defined as the extent to which patients follow their prescribed medication regimens. Factors influencing medication adherence can be broadly categorized into patient-related and environmental factors (Burnier & Egan, 2019). In this study, medication self-efficacy and medication literacy are classified as patient-related factors, while social support is considered an environmental factor. Medication self-efficacy was based on Bandura's Self-Efficacy theory (Bandura, 1997). In this context, it reflects an individual's confidence in managing medication-related tasks, which directly enhances adherence behaviors. Older adults with higher medication self-efficacy, better medication literacy, and stronger perceived social support are more likely to demonstrate good medication adherence. Figure 1 illustrates the conceptual framework guiding this study, highlighting the interrelationships among these key influencing factors and their impact on medication adherence.

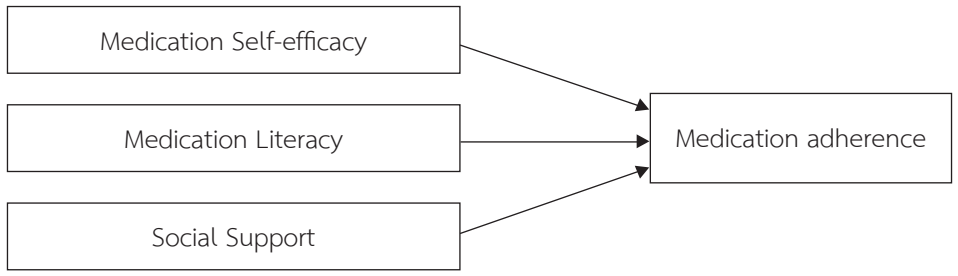

Figure 1 Conceptual framework

Methods

Research Design

This study is a predictive correlational design aimed at describing medication adherence and examine whether medication self-efficacy, medication literacy, and social support could predict medication adherence among the older adults with uncontrolled hypertension.

Population

The study targeted older adults diagnosed with hypertension in the cardiology department of the Second Affiliated Hospital of Wenzhou Medical University, with approximately 5,000 such individuals receiving follow-up care annually.

Sample and sample size

The sample consisted of outpatients aged 60 years and older with essential hypertension. These patients were randomly selected from the target population and met the following inclusion criteria: (1) age 60 years or older; (2) uncontrolled hypertension, defined as having a systolic blood pressure (SBP) and diastolic blood pressure (DBP) greater than 140/90 mmHg despite being on antihypertensive medications; (3) fluency in the Chinese language for listening, speaking, and writing; (4) No cognitive impairment, as determined by a culturally adapted Chinese version of the Mini-Mental State Examination (MMSE) with a score of 24-30 indicating normal cognitive function (as one of the most widely used tools for dementia screening, MMSE was compiled with a score of $\leq$ 24 as the screening cutoff(Gao, Yang, Kuang, and Qiu (2015); and (5) voluntary agreement to participate in the study and sign the informed consent. Patients were excluded if they had psychiatric disorders or serious medical conditions such as dementia, cancer, or kidney failure.

The sample size for this study was calculated using the G*Power 3.1 program. Linear multiple regression was chosen as the statistical test, with an alpha level of 0.05, a test power of 0.90, a medium effect size of 0.13 (Laerkner, Egerod, & Hansen, 2015), and three independent variables. This calculation resulted in a required sample size of 114 participants. To account for incomplete data, an additional 20% was added, leading to the recruitment of 23 more participants. Thus, a total of 137 participants were recruited in this study.

Research instruments

Instruments for data collection included general information questionnaires and the other 4 scales including the Morisky Medication Adherence Scale-8 (MMAS-8) in Chinese version, Chinese Medication Literacy Scale for Hypertensive Patients (C-MLSHP), Self-Rated Abilities for Health Practices Scale (SRAHPS), and the Multidimensional Scale of Perceived Social Support (MSPSS). Details are as follows:

1. Mental status exam

A Chinese version of the Mini-Mental State Examination was used to screen for cognitive impairment. The Mini-Mental State Examination (MMSE) is the most commonly used methods in cognitive impairment detection in both clinical and research fields (Hawkins et al., 2014). The MMSE is a 30-point questionnaire used extensively in clinical and research settings to measure cognitive

impairment (Folstein, Folstein, & McHugh, 1975). MMSE has good sensitivity and specificity for detecting dementia. Creavin et al. reported that in the community, a pooled sensitivity of 0.85 and specificity of 0.90 at a cut point of 24, and sensitivity of 0.87 and specificity of 0.82 at a cut point of 25 (Creavin et al., 2016). Pooled estimates of 15 studies showed a sensitivity of 0.89 and specificity of 0.89 at a cut point of 23 or less or 24 or less (Patnode et al., 2020).

2. Demographic Information

Demographic questionnaire was developed by the researcher in order to obtain information on socio-demographic variables such as gender, age, level of education, annual income, marital status, occupational status, registered family residence, type of medical insurance, family history of hypertension, complications of hypertension (comorbid conditions), number of antihypertensive drugs prescribed, living conditions, and the number of persons in each patient household.

3. Medication Adherence

MMAS-8 in Chinese version was used to assess medication adherence. Originally, the MMAS-8 was developed by Morisky and their research team (Morisky, Ang, Krousel-Wood, & Ward, 2008). The eight-item medication adherence scale yielded good reliability and validity for assessing medication adherence in patients with hypertension, with a Cronbach's alpha coefficient of 0.83. In this scale, the response format is a five-point Likert scale response. These items provide information about the barriers to medication adherence, such as forgetting to take medication, not taking medication when one feels worse, and having difficulties in complying with a treatment regimen. The scores for the eight items were then summed to create an overall adherence score ranging from 0 to 8, in which the higher scores indicating better adherence. The recommended cutoff point of 6 will be used, to indicate having medication adherence. The MMAS-8 with the scores < 6 indicated low adherence, scores 8 was considered high adherence. Whereas the scores between ≥ 6 and < 8 indicated moderate medication adherence. A Chinese version of the MMAS-8 (Yang et al., 2014), namely "C-MMAS-8" was used in this study. This scale was already validated in a group of Chinese myocardial infarction patients. It yielded acceptable values for both the reliability and validity (Cronbach's α was 0.77, and pretest and post-test correlation coefficient were 0.88). In the previous study conducted with Chinese older persons with hypertension, the Cronbach's α coefficient obtained was 0.71 and in this study was .762.

4. Medication Literacy

Medication literacy was administered to the older participants by using Chinese Medication Literacy Scale for Hypertensive Patients (C-MLSHP). This is a validated scale for examining the medication Literacy for patients with hypertension. This scale was developed by Zhong (Zhong, Wang, & Nicholas, 2020). There are four dimensions which included knowledge, attitude, skills, and behaviors, The scale contained 37 items. The knowledge dimension covered 9 items, the attitude dimension included 8 items, the skill dimension included 7 items, and the behavior dimension comprised 13 items. The Cronbach's α coefficient was 0.849 for the full scale and ranged from 0.744 to 0.783 for the dimensions. The scores for the 37 items will be summed to create an overall medication literacy

score ranging from 0 to 37, with higher scores indicating a higher level of medication literacy. The Cronbach's alpha obtained in this study was .772.

5. Medication Self-Efficacy

Medication Adherence Self-Efficacy Scale-Revision MASES-R was used to examine medication this particularly, self-efficacy among older persons with hypertension in this study. It is a self-administered scale with a single domain including 13 items. It was originally adapted for using with hypertensive African Americans (Fernandez, Chaplin, Schoenthaler, & Ogedegbe, 2008). It aims to measure medication adherence self-efficacy for hypertensive patients. All the items in this scale cover the perceived confidence toward medication adherence in the circumstances in which patients with hypertension may encounter during the process of their everyday medication administration. Each item has a 4-point Likert response format (0 = not sure at all, 1 = a little sure, 3 = pretty sure, 4 = fully sure). The total score for this scale is calculated as the average score of all the items, ranging from 1 to 4. A higher score indicates higher medication adherence self-efficacy. Shen was authorized by the owner of this scale to translate the MASES-R into Chinese version and test its reliability and validity in 445 Chinese hypertensive patients, the results yielded acceptable reliability and validity (Shen, Shi, Ding, & Zhong, 2020). The Cronbach's alpha obtained in this study was .742.

6. Social support

The Multidimensional Scale of Perceived Social Support (MSPSS) developed by Zimet (Zimet, Dahlem, Zimet, & Farley, 1988), Presently, there is in a Chinese version (Huang, Jiang, & Ren, 1996), was used for examining social support in this study. The MSPSS consists of 12 questions to assess some aspects of perceived social support, including support from family, friends and significant others. The study participants will be asked to rate each item on a 7-point Likert type scale ranging from 1 (very strongly disagree) to 7 (very strongly agree). The total score ranged from 12 to 84, with higher scores indicating more social support. The Chinese version of MSPSS yielded an acceptable reliability Cronbach alpha of .94. The Cronbach's alpha obtained in this study was .821

Ethical considerations

The study proposal was submitted to Burapha University Ethics Committee on Human Research (BUU EC) and Institution Review Board (IRB) of BUU and the Ethics Committee of the Second Affiliated Hospital of Wenzhou Medical University for obtaining ethical approval, the IRB approval code number from BUU and WMU were G-HS050/2565 and 2022-K-123-01.

Participants were explained about the purpose, procedures, and benefits of the study. Informed consent was reviewed and signed by each participant before data collection. Participants were informed about their right to refuse to participate or withdraw without adverse effects at any time. We had guaranteed the anonymity and confidentiality of participants and had not disclosed personal information to anyone else. All data are stored in the secure servers of the Second Affiliated Hospital of Wenzhou Medical University, which are equipped with access control and encryption protection, and are only used for research purposes. The data will be destroyed one year after the study is published.

Data analysis

All data had been analyzed using the IBM SPSS version 23.0 for mac system. The significant level is set at less than 0.05. Plan for data analyses are as follows:

1. Demographic data and all variables were analyzed using descriptive statistics, including frequency, percentage, range, mean, and standard deviation.

2. For testing the influence of selected predictors on medication adherence, a standard multiple linear regression analysis was conducted. Before performing the regression, five assumptions were checked: 1) Linear relationship, 2) No multicollinearity, 3) Independence, 4) Homoscedasticity, and 5) Multivariate normality. All assumptions were met.

Results

The research results were presented in five parts as follows:

Part 1 Demographic characteristics of older adults with uncontrolled hypertension

Table 1 showed that the numbers of male and female participants in the study with male representing 54.7 % and female 45.3%. The mean age of participants was 71.5 (SD = 7.65) Among the participants, 50.4% were aged 60-70 years. About 65.7% of all participants had attended junior middle school, and 56.2% were retired. About 73.7% were married, and 43.8% reported an annual income between RMB 30,000 and 49,999. Additionally, 58.4% lived in urban areas, while 41.6% resided in rural areas. Most participants (67.9%) lived with 2 to 4 other persons. Regarding medical information, 73.7% had complications related to hypertension, and 73.7% reported a family history of hypertension. More than half (52.6%) took one antihypertensive drug, 39.4% took two to three drugs, and only 8% took four or more. The duration of hypertension was less than 3 years for 7.3% of participants, 3-4 years for 21.9%, 5-9 years for 35%, and 10 years or more for 35.8%.

Table 1. Characteristics of the participants (n = 137)

Variables	Number (n)	Percentage (%)
Age		
60-70	69	50.4
71-80	51	37.2
> 81	17	12.4
Mean = 71.05; SD = 7.65		
Gender		
Male	75	54.7
Female	62	45.3
Occupational status		
Employed	38	27.7
Retired	77	56.2
Unemployed	22	16.1

Table 1. Cont.

Variables	Number (n)	Percentage (%)
Educational level		
Primary school and below	31	22.6
Junior middle school	90	65.7
High school	7	5.1
Junior College	7	5.1
College degree and above	2	1.5
Annual Household income Chinese RMB (¥)		
< 10000/year	18	13.1
10000-29999/year	22	16.1
30000-49999/year	60	43.8
50000-99999/year	27	19.7
≥100000/year	10	7.3
Marital status		
Married	101	73.7
Divorced or widowed	36	26.3
Registered residence		
Urban	80	58.4
Countryside	57	41.6
Hypertension complication		
Yes	101	73.3
No	36	26.3
Number of co-lived person		
One or none	7	5.1
2-4	93	67.9
5-7	35	25.5
8 or more	2	1.5
Duration of hypertension		
< 3 years	10	7.3
3-4 years	30	21.9
5-9 years	48	35
≥ 10 years	49	35.8
Family history of hypertension		
yes	103	75.2
no	34	24.8
Number of prescribed antihypertensive drugs		
one	72	52.6
2-3	54	39.4
4 or more	11	8

Part 2 Descriptive information of medication adherence

In this study population, 67.2% of the patients exhibited a moderate level of low adherence. As shown in Table 2 The mean score for medication adherence in this study was 5.59 (SD= .981) which can be classified in the low level of medication adherence.

Table 2. Description of Medication Adherence (n = 137)

Medication Adherence	Mean (SD)	Score range	Number (n)	Percentage (%)
Total	5.59(.98),		137	
Low adherence		<6	92	67.2
Moderate adherence		6-7	44	32.1
High adherence		8	1	0.7

Part 3 Factors related to medication adherence

This study investigated four factors associated with medication adherence, medication self-efficacy, medication literacy, and social support. The findings indicated that the mean score for medication literacy was 27.07 (SD = 3.03), While the mean score for Self-Efficacy was 2.53 (SD = .67). Additionally, social support received a mean score of 53.56 (SD = 9.35) As shown in Table 3.

Table 3. Mean and Standard Deviation (SD) of the factors related to Medication Adherence (n = 137)

Variables	Possible range	Actual range	Mean	S.D.
Medication Literacy	0-37	20.-35	27.07	3.03
Medication Self-Efficacy	1-4	1-3.76	2.53	.67
Social support	12-84	20-75	53.56	9.35

Part 4 Factors influencing medication adherence

Prior to the analysis, the assumption testing for the use of multiple regression was conducted, and this assumption was met. The study first used Pearson correlation test to examine the associations among medication self-efficacy, medication literacy, social support and medication adherence. The results of the correlation matrix (Table 4) showed that medication self-efficacy ($r = 0.520$, $p < 0.01$), medication literacy ($r = 0.399$, $p < 0.01$) and social support ($r = 0.217$, $p < 0.01$) were all significantly positively correlated with medication adherence, and all tested correlation coefficients did not exceed 0.8, indicating no multicollinearity among variables.

The multiple regression analysis showed that medication self-efficacy, medication literacy and social support combinedly explained 30.8% of the variance in medication adherence (adjusted $R^2 = 0.308$, $F_{(3,133)} = 21.185$, $p < 0.001$). Among them, medication self-efficacy ($\beta = 0.431$, $p < 0.001$) was the strongest predictor, followed by medication literacy ($\beta = 0.240$, $p < 0.05$), and these two

predictors had significant positive effects on patients' medication adherence. Contrary to expectations, social support (β = 0.015, p > 0.05) was not a significant predictor of medication adherence. The analysis results are shown in Table 5.

Table 4. Correlation between predictors and Medication Adherence (n = 137)

Variables	1	2	3	4
1. Medication Adherence	1			
2. Medication Literacy	.399**	1		
3. Medication Self-efficacy	.520**	.355**	1	
4. Social support	.217*	.414**	.239**	1

**p < .01, *p < .05

Table 5. The influence of factors predicting medication adherence

Predicting factors	B	SE	β	t	p-value
- Medication Literacy	.078	.026	.240	2.928	.004
- Medication Self-Efficacy	.628	.112	.431	5.623	<.001
- Social support	.002	.008	.015	.192	.848
Constant = 1.740, p < .05, R = .569[a], R^2 = .323, R^2 adjust = .308, $F_{(3,133)}$ = 21.185, p < .001					

Discussion

1. Medication adherence in older patients with uncontrolled hypertension

The average medication adherence score among older adults with uncontrolled hypertension in this study was low (M = 5.59, SD = 0.981), indicating suboptimal adherence. This finding aligns with previous research indicating generally poor adherence rates in elderly hypertensive populations (Abegaz, Shehab, Gebreyohannes, Bhagavathula, & Elnour, 2017). Possible explanations towards this low adherence are as follows:

Firstly, the asymptomatic nature of hypertension often leads to underestimation of the disease severity by patients, reducing the perceived urgency to adhere strictly to medication regimens. Older adults may not feel "ill," so they deprioritize medication, which contributes to inconsistent intake (Hamrahian, 2020). Secondly, the complexity of managing multiple antihypertensive drugs—common in this study where 39.4% took two or more medications—poses practical challenges, including confusion about dosing schedules and increased risk of side effects, which can discourage adherence (Cross, Elliott, Petrie, Kuruvilla, & George, 2020). Thirdly, side effects associated with antihypertensive medications may further reduce motivation to continue treatment (Burnier & Egan, 2019). Lastly, lower educational attainment, observed in 65.7% of participants who only completed junior middle school, may hinder understanding of treatment importance and proper medication use, leading to

poorer adherence (Uchmanowicz, Chudiak, Uchmanowicz, Rosińczuk, & Froelicher, 2018).

In sum, low medication adherence in this population is likely multifactorial, involving disease perception, regimen complexity, side effect burden, and limited health literacy. These intrinsic and extrinsic challenges warrant targeted interventions to improve adherence in older adults with hypertension.

2. Factors predicting medication adherence

The second objective of this study is to examine the predictive factors of medication adherence. The standard multiple linear regression method was employed, with all factors entered simultaneously. Medication self-efficacy, medication literacy, and social support significantly explained 30.8% of the variance in medication adherence ($F_{(3,133)}$ = 21.185, $p < .001$). The best predictor is medication self-efficacy (β = .431, $p < .001$), followed by medication literacy (β = .240, $p < .005$), whereas social support (β = .015, $p > 0.05$) is not a significant predictor of medication adherence.

Medication self-efficacy was the best predictor of medication adherence in uncontrolled hypertension. It refers to an individual's belief in their ability to manage and adhere to their prescribed medication regimen. This belief positively influences medication adherence in various ways such as increased confidence. The older patients with better confidence are more likely to follow treatment plans regularly and correctly, as found in the study conducted by Martos – Méndez (2015). It also helps promote better self-management. Medication self-efficacy, defined as an individual's confidence in managing their medication regimen, encourages active engagement in healthcare and promotes consistent medication adherence (Ruppar, Conn, & Russell, 2008). It enhances motivation and commitment, enabling older adults to maintain their medication routines despite challenges such as side effects or complex schedules (Horne et al., 2013). Moreover, higher medication self-efficacy improves problem-solving skills, helping individuals overcome barriers like timely medication intake and adverse effects, which supports sustained adherence (Yu, Wang, & Pan, 2024). Additionally, strong medication self-efficacy fosters positive health beliefs by increasing understanding of the importance of adherence and its impact on long-term health, thus motivating consistent treatment (Remm, Halcomb, Hatcher, Frost, & Peters, 2023). Therefore, medication self-efficacy in older adults is essential for staying motivated and adhering to regimens, even when facing challenges.

Medication literacy, identified as the second strongest predictor of adherence in this study, influences adherence through multiple mechanisms. It improves patients' understanding of medication instructions by ensuring comprehension of labels, dosages, and regimen requirements, which enhances correct medication-taking behaviors and consistency. Additionally, medication literacy increases confidence in managing medications, schedules, and side effects (Zhang, Terry, & McHorney, 2014), boosts problem-solving skills, and facilitates effective communication with healthcare providers. It also enables early recognition of side effects, appropriate guidance-seeking, and regimen adjustments, thereby reducing barriers to adherence (Taufek, 2025). Overall, medication literacy supports better understanding, confidence, problem-solving, and communication, all of which promote improved medication adherence.

In this study, social support did not significantly impact medication adherence. There are several possible reasons for this. Firstly, although social support is generally beneficial, its effectiveness in promoting adherence may rely more on the quality rather than the quantity of the support received. For instance, if the support lacks relevant knowledge, such as an understanding of the importance of a medication regimen, it may fail to lead to better adherence. Moreover, the type of social support also matters. Emotional or informational support might be more effective than instrumental support (like help with remembering to take medications), and emotional support alone may not directly influence adherence behaviors. Secondly, the patient's perception of support is essential. Even if family, friends, or caregivers provide support, patients who do not perceive this involvement or concern may lack motivation to adhere to their medication regimen. Scheurer, Choudhry, Swanton, Matlin, and Shrank (2012) emphasized that patients may not adhere if they do not view their social network as actively engaged with their treatment. In this study, participants reported low perceived social support, highlighting a potential barrier to adherence. Thirdly, personal beliefs and attitudes also influence adherence; patients resistant to medication or doubtful of its necessity may not follow the regimen despite strong social support. Krousel-Wood et al. (2011) found that patients' beliefs about medication necessity significantly affect adherence. In addition, there are other barriers to adherence, such as medication complexity, side effects, or financial constraints, which may not be addressed by social support alone. DiMatteo, Haskard, and Williams emphasized that factors like these can pose significant challenges, making social support insufficient on its own(DiMatteo, Haskard, & Williams, 2007). These reasons suggest that while social support is valuable, it should be combined with other interventions to effectively promote adherence.

Limitations in this study

The cross-sectional design of this study limits the ability to infer causality or monitor changes in medication adherence over time. Longitudinal research is recommended to gain a better understanding for the dynamics of medication adherence. Furthermore, collecting data from a single hospital in Wenzhou, China, restricts the generalizability of the findings to other regions or healthcare settings.

Implication of the findings

The findings obtained from this study can be applied for clinical practice, and nursing education as follows:

The results of this study provide nurses with a deeper understanding of medication adherence among older adults with uncontrolled hypertension. The low levels of medication adherence in this population highlight the need for nurses to implement nursing interventions to enhance medication adherence. It is essential for nurses to take into account the significant predictors such as medication self-efficacy and medication literacy, when developing these strategies.

The findings of this study identified key predictors of medication adherence among older adults with uncontrolled hypertension. As a result, educating nursing students about these predictors and effective strategies to enhance them would be beneficial.

Recommendation for future research

Future studies should explore tailored interventions for cognitive decline and complex medication regimens in older adults with uncontrolled hypertension, examine the role of technology in supporting adherence, conduct longitudinal research to track adherence changes, and investigate socioeconomic factors to optimize policies and health outcomes.

In light of the research findings indicating that cognitive decline, complex medication regimens, and limited technological support significantly impede medication adherence among older adults with uncontrolled hypertension, the following targeted recommendations are proposed:

First, future studies should focus on developing and testing tailored interventions addressing cognitive decline and complex medication regimens. Given that this study revealed older patients often struggle to remember doses due to cognitive impairment and are overwhelmed by multiple medications, interventions could include simplified pill packaging, visual reminder systems, or cognitive - training programs integrated with medication management.

Second, considering the growing potential of technology in healthcare, researchers should explore how digital tools can enhance medication adherence. As this study highlighted the lack of technological support among participants, future research could assess the effectiveness of smartphone apps with automated reminders, telemonitoring systems, or virtual health coaching platforms in improving adherence among the elderly.

Finally, since socioeconomic factors such as income and access to healthcare were found to have an underlying influence on medication adherence in this study, longitudinal research is needed to track how these factors interact with adherence over time. Such studies can provide insights into the long - term impact of socioeconomic disparities on health outcomes and inform the development of targeted policies aimed at improving medication adherence and overall hypertension management in older adults.

Conflict of Interests:

The authors declare no conflict of interest.

References

Abegaz, T. M., Shehab, A., Gebreyohannes, E. A., Bhagavathula, A. S., & Elnour, A. A. (2017). Nonadherence to antihypertensive drugs: A systematic review and meta-analysis. *Medicine, 96*(4), e5641.

Al-Ramahi, R. (2015). Adherence to medications and associated factors: A cross-sectional study among Palestinian hypertensive patients. *Journal of Epidemiology and Global Health, 5*(2), 125-132.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company.

Benetos, A., Petrovic, M., & Strandberg, T. J. C. r. (2019). Hypertension management in older and frail older patients. *Circulation Research, 124*(7), 1045-1060.

Burnier, M., & Egan, B. M. (2019). Adherence in hypertension: A review of prevalence, risk factors, impact, and management. *Circulation Research, 124*(7), 1124-1140.

Creavin, S. T., Wisniewski, S., Noel-Storr, A. H., Trevelyan, C. M., Hampton, T., Rayment, D., Thom, V. M., Nash, K. J., Elhamoui, H., Milligan, R., Patel, A. S., Tsivos, D. V., Wing, T., Phillips, E., Kellman, S. M., Shackleton, H. L., Singleton, G. F., Neale, B. E., Watton, M. E., & Cullum, S. (2016). Mini-Mental State Examination (MMSE) for the detection of dementia in clinically unevaluated people aged 65 and over in community and primary care populations. *The Cochrane Database of Systematic Reviews, 2016*(1), CD011145. https://doi.org/10.1002/14651858.CD011145.pub2

Cross, A. J., Elliott, R. A., Petrie, K., Kuruvilla, L., & George, J. (2020). Interventions for improving medication-taking ability and adherence in older adults prescribed multiple medications. *The Cochrane Database of Systematic Reviews, 5*(5), CD012419. https://doi.org/10.1002/14651858.CD012419.pub2

DiMatteo, M. R., Haskard, K. B., & Williams, S. L. J. M. c. (2007). Health beliefs, disease severity, and patient adherence: A meta-analysis. *Medical Care, 45*(6), 521-528.

Fernandez, S., Chaplin, W., Schoenthaler, A. M., & Ogedegbe, G. J. J. o. b. m. (2008). Revision and validation of the medication adherence self-efficacy scale (MASES) in hypertensive African Americans. *Journal of Behavioral Medicine, 31*, 453-462.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. J. J. o. p. r. (1975). "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189-198.

Gao, M. Y., Yang, M., Kuang, W. H., & Qiu, P. Y. (2015). Factors and validity analysis of mini-mental state examination in Chinese elderly people. *Beijing da xue xue bao. Yi xue ban= Journal of Peking University. Health Sciences, 47*(3), 443-449.

Gao, Z., Chen, S., Huang, X., Ye, J., Liu, J., Huang, Z., Chen, J., Li, L., Liu, Y., & Lin, S. (2022). Risk prediction model for uncontrolled hypertension in Chinese community. *Frontiers in Cardiovascular Medicine, 8*, 808071. https://doi.org/10.3389/fcvm.2021.808071

Hamrahian, S. M. (2020). Medication non-adherence: A major cause of resistant hypertension. *Current Cardiology Reports, 22*(11), 133.

Hawkins, M. A., Gathright, E. C., Gunstad, J., Dolansky, M. A., Redle, J. D., Josephson, R., Moore, S. M., & Hughes, J. W. (2014). The MoCA and MMSE as screeners for cognitive impairment in a heart failure population: A study with comprehensive neuropsychological testing. *Heart & Lung, 43*(5), 462-468. https://doi.org/10.1016/j.hrtlng.2014.05.011

Horne, R., Chapman, S. C., Parham, R., Freemantle, N., Forbes, A., & Cooper, V. J. P. o. (2013). Understanding patients' adherence-related beliefs about medicines prescribed for long-term conditions: a meta-analytic review of the Necessity-Concerns Framework. *PloS one, 8*(12), e80633.

Huang, L., Jiang, Q., & Ren, W. (1996). Correlation between coping styles, social support and psychosomatic symptoms in cancer patients. *Chinese Mental Health Journal, 4*, 160-161.

Kokubo, Y., & Iwashima, Y. J. H. (2015). Higher blood pressure as a risk factor for diseases other than stroke and ischemic heart disease. *Hypertension, 66*(2), 254-259.

Krousel-Wood, M., Joyce, C., Holt, E., Muntner, P., Webber, L. S., Morisky, D. E., Frohlich, E. D., & Re, R. N. (2011). Predictors of decline in medication adherence: Results from the cohort study of medication adherence among older adults. *Hypertension, 58*(5), 804-810.

Laerkner, E., Egerod, I., & Hansen, H. P. (2015). Nurses' experiences of caring for critically ill, non-sedated, mechanically ventilated patients in the Intensive Care Unit: A qualitative study. *Intensive and Critical Care Nursing, 31*(4), 196-204.

Locke, E. A. J. P. p. (1997). Self-efficacy: The exercise of control. *Personnel Psychology, 50*(3), 801.

Ma, L. Y., Chen, W. W., Gao, R. L., Liu, L. S., Zhu, M. L., Wang, Y. J., Wu, Z. S., Li, H. J., Gu, D. F., Yang, Y. J., Zheng, Z., & Hu, S. S. (2020). China cardiovascular diseases report 2018: An updated summary. *Journal of Geriatric Cardiology: JGC, 17*(1), 1-8. https://doi.org/10.11909/j.issn.1671-5411.2020.01.001

Martos – Méndez, M. J. (2015). Self-efficacy and adherence to treatment: The mediating effects of social support. *Journal of Behavior, Health & Social Issues, 7*(2), 19-29.

Mills, K. T., Stefanescu, A., & He, J. (2020). The global epidemiology of hypertension. *Nature reviews. Nephrology, 16*(4), 223-237. https://doi.org/10.1038/s41581-019-0244-2

Morisky, D., Ang, A., Krousel-Wood, M., & Ward, H. (2008). Predictive validity of a medication adherence measure in an outpatient setting. *The Journal of Clinical Hypertension, 10*(5), 348-354.

Neiva Pantuzza, L. L., Nascimento, E. D., Crepalde-Ribeiro, K., Botelho, S. F., Parreiras Martins, M. A., Camila de Souza Groia Veloso, R., Gonzaga do Nascimento, M. M., Vieira, L. B., & Moreira Reis, A. M. (2022). Medication literacy: A conceptual model. *Research in Social & Administrative Pharmacy : RSAP, 18*(4), 2675-2682. https://doi.org/10.1016/j.sapharm.2021.06.003

Patnode, C. D., Perdue, L. A., Rossom, R. C., Rushkin, M. C., Redmond, N., Thomas, R. G., & Lin, J. S. (2020). Screening for cognitive impairment in older adults: Updated evidence report and systematic review for the US preventive services task force. *JAMA, 323*(8), 764-785. https://doi.org/10.1001/jama.2019.22258

Remm, S., Halcomb, E., Hatcher, D., Frost, S. A., & Peters, K. J. J. o. c. n. (2023). Understanding relationships between general self-efficacy and the healthy ageing of older people: *An Integrative re Journal of Clinical Nursing, 32*(9-10), 1587-1598.

Ruppar, T. M., Conn, V. S., & Russell, C. L. (2008). Medication adherence interventions for older adults: Literature review. *Research and Theory for Nursing Practice, 22*(2), 114-147.

Scheurer, D., Choudhry, N., Swanton, K. A., Matlin, O., & Shrank, W. J. T. A. j. o. m. c. (2012). Association between different types of social support and medication adherence. *The American Journal of Managed Care, 18*(12), e461-467.

Schoenthaler, A., Ogedegbe, G., Allegrante, J. P. J. H. E., & Behavior. (2009). Self-efficacy mediates the relationship between depressive symptoms and medication adherence among hypertensive African Americans. *Health Education & Behavior, 36*(1), 127-137.

Schoenthaler, A., Ogedegbe, G., & Allegrante, J. P. (2009). Self-efficacy mediates the relationship between depressive symptoms and medication adherence among hypertensive African Americans. *Health Education & Behavior: The Official Publication of the Society for Public Health Education, 36*(1), 127-137. https://doi.org/10.1177/1090198107309459

Shen, Z., Shi, S., Ding, S., & Zhong, Z. (2020). Mediating effect of self-efficacy on the relationship between medication literacy and medication adherence among patients with hypertension. *Frontiers in Pharmacology, 11*, 569092.

Taufek, N. H. M. (2025). Global initiatives for improving health and medication literacy. *In Health literacy in medicines use and pharmacy* (pp. 289-305). Massachusetts: Academic press, Elsevier.

The Writing Committee of the Annual Report on Cardiovascular Health and Diseases in China. (2022). Interpretation of the annual report on cardiovascular health and diseases in China 2020. *Cardiology Discovery, 2*(4), 269-285.

Thuy, L. T., Monkong, S., Pookboonmee, R., Leelacharas, S., & Viwatwongkasem, C. (2020). Factors explaining medication adherence of older adults with hypertension: A cross-sectional study. *Pacific Rim International Journal of Nursing Research, 24*(3), 306-320.

Turan, G. B., Aksoy, M., & Çiftçi, B. J. J. o. V. N. (2019). Effect of social support on the treatment adherence of hypertension patients. *Journal of Vascular Nursing, 37*(1), 46-51.

Uchmanowicz, B., Chudiak, A., Uchmanowicz, I., Rosińczuk, J., & Froelicher, E. S. (2018). Factors influencing adherence to treatment in older adults with hypertension. Clinical Interventions in Aging, 13, 2425-2441. https://doi.org/10.2147/CIA.S182881

Wei, J., Mi, Y., Li, Y., Xin, B., & Wang, Y. J. B. P. H. (2021). Factors associated with awareness, treatment and control of hypertension among 3579 hypertensive adults in China: Data from the China Health and Nutrition Survey. *BMC Public Health, 21*, 1-11.

Wei, J., Mi, Y., Li, Y., Xin, B., & Wang, Y. (2021). Factors associated with awareness, treatment and control of hypertension among 3579 hypertensive adults in China: Data from the China Health and Nutrition Survey. *BMC Public Health, 21*(1), 423. https://doi.org/10.1186/s12889-021-10417-4

Yang, A., Wang, B., Zhu, G., Jiao, Z., Fang, Y., Tang, F., Ma, C., Zhao, Y., Cheng, C., & Zhong, M. (2014). Validation of Chinese version of the Morisky medication adherence scale in patients with epilepsy. *Seizure, 23*(4), 295-299. https://doi.org/10.1016/j.seizure.2014.01.003

Yu, H. M., Wang, L., & Pan, C. Z. (2024). The impact of cognitive behavioural therapy-based psychological intervention on emotional improvement in elderly patients with extensive burns. *International Wound Journal, 21*(2), e14594. https://doi.org/10.1111/iwj.14594

Zhang, N. J., Terry, A., & McHorney, C. A. (2014). Impact of health literacy on medication adherence: A systematic review and meta-analysis. *The Annals of Pharmacotherapy, 48*(6), 741-751. https://doi.org/10.1177/1060028014526562

Zhong, Y., Wang, J., & Nicholas, S. (2020). Social support and depressive symptoms among family caregivers of older people with disabilities in four provinces of urban China: The mediating role of caregiver burden. *BMC Geriatrics, 20*(1), 3. https://doi.org/10.1186/s12877-019-1403-9

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. J. J. o. p. a. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment, 52*(1), 30-41.