



Medication Adherence of Older Adults with Hypertension: A Systematic Review

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Objective: Hypertension (HTN) significantly increases the risk of stroke and heart disease, which are the leading causes of death and disability globally, particularly among older adults. Antihypertensive medication is a proven treatment for blood pressure control and preventing complications. However, medication adherence rates in older adults with HTN are low. In this review, we systematically identified factors influencing medication adherence in older adults with HTN.

Methods: We applied the PRISMA guidelines and conducted systematic searches on PubMed, MEDLINE, and Google Scholar in July 2022 to identify preliminary studies reporting factors influencing medication adherence among older adults with HTN. The convergent integrated analysis framework suggested by the Joanna Briggs Institute for systematic reviews was adopted for data synthesis.

Results: Initially, 448 articles were identified, and after title and abstract screening, 16 articles qualified for full-text review. During this phase, three articles were excluded for reporting on irrelevant populations or focusing on issues beyond the review's aim, leaving thirteen studies in the final review. After data synthesis, fifteen themes were extracted from the key findings of the included studies. The most prevalent themes included the number of medications used (53.9%, n=7 studies), financial status (38.5%, n=5), sex (38.5%, n=5), age (30.1%, n=4), duration of disease (23.1%, n=3), comorbidities (23.1%, n=3), and health compliance (23.1%, n=3). Other themes, such as education, health literacy, health belief, medication belief, perception of illness, patient-physician relationship, self-efficacy, and social support, were also identified.

Conclusion: The findings of this review highlight critical areas for developing innovative, evidence-based programs to improve medication adherence in hypertensive older adults. Insights from this review can contribute to improving medication adherence and preventing future health complications.

Keywords: hypertension, medication adherence, older adults, systematic review

Introduction

Hypertension is a significant risk factor for heart disease and stroke, the leading causes of death in the United States (U.S.).¹ In 2020, approximately 670,000 deaths in the US involved hypertension as a primary cause.¹ Meanwhile, over 75% of patients with hypertension appear unable to control their blood pressure,² and the US government spends around \$131 billion annually on hypertension healthcare services.³ Among older adults, undertreated hypertension is significantly high.⁴ Arterial stiffening due to aging—an essential clinical expression of hypertension in this population—is a significant health problem that can lead to heart failure, stroke, and death.^{5,6} According to the US National Health and Nutrition Examination Survey (NHANES), about 70% of adults aged 65 or older have hypertension, and this is projected to increase yearly.⁴ Nevertheless, this population group has been underrepresented in clinical trials and other research due to concerns regarding frailty, poor physical function, cognitive impairment, or polypharmacy.⁴

Over 55 million Americans with hypertension are treated with antihypertensive medications,⁷ and consequently show an improvement in blood pressure control.⁸ A previous study shows that adherence to antihypertensives significantly lowers the risk of cardiovascular disease (CVD) occurrences among older adults.⁹ Furthermore, research shows a possible threshold effect in decreasing cardiovascular events for adherence at around 80%.⁹ Nevertheless, the adherence rate to antihypertensive medication has been reported to range from only 20 to 50%.¹⁰ Moreover, especially in older adults with hypertension, the medication adherence rate is notably low compared to other age ranges due to progressive cognitive decline or depression developing with age, amongst other factors.¹¹ Given these circumstances, there is a need to systematically review results from contemporary empirical investigations to comprehensively pinpoint factors influencing medication adherence among older adults with hypertension. The review presented here directly addresses this gap, answering the question: What factors influence medication adherence among older adults with hypertension?

Methods

Identify Relevant Studies

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)¹² were applied in this review to present the flow diagram of the literature's identification, screening, exclusion, and inclusion. Three electronic databases, PubMed, MEDLINE, and Google Scholar, were systematically searched on July 15, 2022, to identify preliminary studies published between 2019 and 2022, reporting factors influencing medication adherence among older adults living with hypertension. The researcher combined the search terms: Hypertension OR High Blood Pressure* OR Essential Hypertension AND Medication Adherence OR Medication Nonadherence OR Medication Noncompliance OR Medication Persistence OR Medication Compliance OR Medication Noncompliance AND Elderly OR Older Adult* OR Frail Elder* using Boolean phrases. In addition, reference lists of the included studies were manually searched to obtain relevant studies. All references identified were stored in EndNote.

Study Selection

The researcher screened titles and abstracts of eligible studies. Subsequently, the full text was also assessed to decide whether or not it was relevant. A third anonymous researcher was required to resolve disagreements when discrepancies occurred. Inclusion criteria were implemented to guarantee that only studies considered relevant to our objective were included. Similarly, exclusion criteria were used to eliminate literature not affiliated with the review (see [Box 1](#)).

Data Extraction

The summary of included studies ([Table 1](#)) developed for this review included the following data for each study: references, published year, settings, target population, study design, sample size, age, sex, problem and purpose,

Box 1 Inclusion and Exclusion Criteria of Included Studies

Inclusion Criteria
<ul style="list-style-type: none"> • Older adults aged ≥ 55 years • Original quantitative, qualitative, or mixed methods studies • Aimed to investigate the factors influencing medication adherence among older adults (≥ 55 years old) living with hypertension • Included participants primarily diagnosed with hypertension • All types of settings are acceptable, including inpatient, outpatient, or home • Described in the English language
Exclusion Criteria
<ul style="list-style-type: none"> • The study did not include the population of interest or concerned animal subjects • Conference proceedings, abstracts, review articles, theoretical papers, pilot studies, protocols, dissertations, letters to the editor, opinion (viewpoint), statement papers, government documents, or working papers

Table 1 A Summary of Included Studies

References, Published Year, Settings	Target Population, Study Design, Sample Size (n), age, sex	Problem & Purpose	Medication Adherence (MA) Measurement	Main outcome (Factor Influencing MA)	Themes (Factor Influencing MA)	Implications/Suggestions
2019 ¹³ 12 Sub-Saharan African countries: Benin, Cameroon, Congo (Brazzaville), Democratic Republic of the Congo, Gabon, Guinea, Côte d'Ivoire, Mauritania, Mozambique, Niger, Senegal, Togo	Hypertension Cross-sectional Study 2,198 Age, mean (SD): 58.3 (11.8) Male, n (%): 874 (39.8%) Female, n (%): 1,324 (60.2%)	- Over the past few decades, the prevalence of hypertension has dramatically increased in sub-Saharan Africa. Poor adherence has been identified as a significant cause of failure to control hypertension. - To assess medication adherence and identify socioeconomics, clinical, and treatment factors associated with low adherence among hypertensive patients in 12 sub-Saharan African countries.	The 8-item Morisky medication adherence scale (MMAS-8). ¹⁴	Lower wealth index: Patients with a lower wealth index were more likely to be less adherent to their antihypertensive medications (OR: 1.83, 95% CI [1.38–2.45], $p < 0.001$). The use of traditional medicine: The use of traditional medicine is significantly and independently associated with low medication adherence (OR: 2.28, 95% CI [1.79–2.90]).	<ul style="list-style-type: none"> • Financial status • The number of medication use 	This study revealed the high frequency of poor adherence in African patients and the associated factors. These findings should help tailor future programs to tackle hypertension in low-income countries that are better adapted to patients, with a potentially associated enhancement of their effectiveness.
2019 ¹⁵ Latvia	Hypertension Cross-sectional Study 187 Age, mean (SD): 67.73 (12.27) Male, n (%): 18 (19.6%) Female, n (%): 74 (80.4%)	- Poor adherence to pharmacological treatment among patients with hypertension is one of the particular problems in cardiology. It is known that about 50% of these patients do not use their medications as prescribed by their doctor. Patients may choose not to follow the doctor's recommendations and regularly do not control their blood pressure, owing to many factors. - To investigate therapy, knowledge about the disease and its control, and demographic differences to assess patients' adherence to hypertension.	The 8-item Morisky medication adherence scale (MMAS-8). ¹⁴	Duration of disease: The longer the patient was known to suffer from hypertension, the more adherent he or she was ($p = 0.012$, $\beta = 0.19$). Age: The adherence level correlated with the patient's age and did not depend on gender—the older the patient, the more adherent he or she is ($p = 0.001$, $\beta = 0.263$). Following up the medication prescription of their family physician: ($p = 0.001$, $\beta = 0.263$).	<ul style="list-style-type: none"> • Duration of disease • Age • Health compliance 	Medication nonadherence (NA) among patients with hypertension is high in Latvia. Further investigations are needed to understand the reasons for this better and to establish interventions for improving patient outcomes.

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Table I (Continued).

References, Published Year, Settings	Target Population, Study Design, Sample Size (n), age, sex	Problem & Purpose	Medication Adherence (MA) Measurement	Main outcome (Factor Influencing MA)	Themes (Factor Influencing MA)	Implications/Suggestions
2019 ¹⁶ Tunisia	Hypertension Cross-sectional Study 276 Age, mean (SD): 64.9 (10.2) Male, n (%) : 83 (30.1%) Female, n (%) : 193 (69.9%)	- Hypertension is a critical cardiovascular risk factor and is likely to lead to many complications. - To describe therapeutic adherence and to identify the factors associated with poor adherence among hypertensive patients.	The Girerd test. ¹⁷	Sex: Poor compliance is 2.3 times more likely in women than men ($p < 0.05$). Number of medications: Having more than three tablets a day increases the risk of poor compliance by 4.2 ($p < 0.05$). Socioeconomic level: Patients with a low socioeconomic level were seven times more likely to be poor in compliance than those with a high socioeconomic level ($p < 0.05$).	<ul style="list-style-type: none"> • Sex • Financial status • The number of medication use 	For better management of hypertensive patients we recommend that healthcare professionals should apply for some therapeutic education programs with the active involvement of patients in their therapeutic management, with good information on the benefits and risks of treatment. Self-measurement of blood pressure is also an effective way to improve adherence in these hypertensive patients.
2020 ¹⁸ Iran	(Primary) Hypertension Cross-sectional Study 300 Age, mean (SD): 56.7 (9.3) Male, n (%) : 146 (48.6%) Female, n (%) : 154 (51.33%)	- Hypertension is a significant risk factor for cardiovascular disease, which is the leading cause of morbidity and mortality. Only a few studies have examined the association of the level of health literacy with self-management goals, such as good adherence to anti-hypertension medication. This lack is more so in low-middle income populations where the health system and cultural beliefs differ. - To examine the gender-based associations of health literacy (HL) with self-reported medication adherence (MEDA) among patients with primary hypertension.	The four-item Morisky, Green, and Levine (MGL) scale. ¹⁹	Sex: The average regression estimate (\pm standard deviation) between HL and MEDA was 0.37 ± 0.09 , lower among men (0.361 ± 0.11) than women (0.396 ± 0.08), $p = 0.003$. Health Literacy: HL is significantly associated with MEDA among those with HTN.	<ul style="list-style-type: none"> • Health Literacy • Sex 	Considering gender differences, this association should be confirmed through interventional studies to help make HL a formal mitigating strategy for MEDA and other public health goals.

2020 ²⁰ Iran	<p>Hypertension Cross-sectional Study 238</p> <p>Age, mean (SD): 57.40 (15.52) Male, n (%): 77 (32.4%) Female, n (%): 161 (67.6%)</p>	<p>- Poor adherence to medication regimens leads to poor health outcomes, increased medical costs, and an increased death rate due to hypertension.</p> <p>- To evaluate baseline barriers to medication adherence among hypertensive patients in deprived rural areas.</p>	The 8-item Morisky medication adherence scale (MMAS-8). ¹⁴	<p>The variables affecting medication adherence: Sex: ($p = 0.01, \beta = -0.13$). Level of education: ($p < 0.001, \beta = 0.21$). Economic status: ($p < 0.001, \beta = 0.08$). Duration of hypertension: ($p = 0.001, \beta = 0.16$). The number of medications: ($p = 0.001, \beta = -0.20$). Concurrently with other diseases: ($p = 0.02, \beta = -0.04$).</p>	<ul style="list-style-type: none"> ● Education ● Comorbidity ● Financial status ● The number of medication use ● Duration of disease ● Sex 	Based on the present study, it can be concluded that improved knowledge about illness and treatment in rural communities enhances medical adherence. In addition, financial support along with the reduced number of prescribed drugs are also found to be the determining factors in medication adherence.
2020 ²¹ USA	<p>Hypertension Cross-sectional Study 338</p> <p>Age, mean (SD): 69.56 (9.25) Male, n (%): 125 (37%) Female, n (%): 213 (63%)</p>	<p>- For African American middle-aged and older adults with hypertension, poor adherence to medication and lifestyle recommendations is a source of disparity in hypertension outcomes, including higher stroke rates in this population relative to Whites.</p> <p>- To study demographic, social, behavioral, cognitive, and medical predictors of adherence to medication and lifestyle recommendations among underserved African American middle-aged and older adults with hypertension.</p>	The Blood Pressure Self-Care Scale ²²	<p>A higher level of adherence to antihypertensive medications was associated with the following: Sex (female): ($p = 0.003, \beta = 0.219$). Less financial strain: ($p = 0.004, \beta = -0.097$). A higher level of continuity of medical care: ($p = 0.003, \beta = 0.15$). Less negative general beliefs about medications: ($p < 0.001, \beta = -0.138$). Fewer concerns about antihypertensive medications: ($p = 0.007, \beta = -0.098$). A higher level of hypertension knowledge: ($p = 0.008, \beta = 0.232$).</p>	<ul style="list-style-type: none"> ● Medication belief ● Perception of illness ● Financial status ● Health compliance ● Sex 	There seem to be fewer demographic, social, behavioral, cognitive, and medical factors that explain adherence to lifestyle recommendations than adherence to medication in economically disadvantaged, underserved African American middle-aged and older adults with hypertension. More research is needed on factors that impact adherence to lifestyle recommendations of African American middle-aged and older adults with hypertension.

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Table 1 (Continued).

References, Published Year, Settings	Target Population, Study Design, Sample Size (n), age, sex	Problem & Purpose	Medication Adherence (MA) Measurement	Main outcome (Factor Influencing MA)	Themes (Factor Influencing MA)	Implications/Suggestions
2020 ²³ USA	Hypertension Observational Study (secondary data analysis) 2,510 Age, mean (SD): 76.4 (6.88) Male, n (%): 879 (35%) Female, n (%): 1,631 (65%)	- Measures examining the patient perception of physicians are limited, and no patient perceptions of physician measures were developed from large claims databases; a nationally representative sample of older adults was identified. In addition, no prior studies were found that examined the association between patient perceptions of physicians and medication adherence using data from a nationally representative sample of older adults and large administrative claims data. - To assess the association between patient perception of physicians and adherence to antihypertensive medication among Medicare beneficiaries.	Medication adherence with antihypertensive medications was measured using 2008 Medicare Part D administrative claims data. It was calculated as the number of days with medication on hand divided by the number of days in an interval.	Patient Perception of Physicians Scale (37 or higher): (OR: 1.341, 95% CI [1.101–1.632]). Age (80–84 years): (OR: 0.673, 95% CI [0.497–0.911]). The number of unique medications (10–15, 16–20, 21 or more): (OR: 0.355, 95% CI [0.252–0.491]). (OR: 0.237, 95% CI [0.160–0.345]). (OR: 0.111, 95% CI [0.070–0.175]).	<ul style="list-style-type: none"> • Patient-Physician relationship • The number of medication use • Age 	Older adults' perceptions of their physicians may influence their adherence to antihypertensive medications. In this study, the more favorable the provider's perception, the more adherent older adults were to their antihypertensive medications. This work provides evidence of the importance of the patient-provider relationship and its potential influence on medication adherence.

2021 ²⁴ Taiwan	Hypertension Cross-sectional Study 238 Age, mean (SD): 57.40 (15.52) Male, n (%): 77 (32.4%) Female, n (%): 161 (67.6%)	<p>- Medication nonadherence (NA) is associated with an increased risk of complications in hypertensive patients. Nevertheless, the association between demographic characteristics or lifestyle habits and medication NA has not been consistent in previous studies. Moreover, it is unknown whether specific factors are related to particular behaviors, such as forgetting to take the medication, reducing the medication dose, or discontinuing the medication.</p> <p>- To investigate behavioral factors associated with medication NA in hypertensive patients.</p>	Medication NA was evaluated by asking participants if the following behaviors occurred more than twice a week within the previous three months, with answers as "Yes" or "No": Forgetting to take medication, reducing the medication dose, and discontinuing the medication.	<p>Age: Age \geq 65 years (Adjusted odds ratio [aOR] = 0.32, 95% confidence interval [CI] = 0.15–0.69) was associated with forgetting to take medication.</p> <p>Sex (male): Male sex (aOR = 2.61, CI = 1.31–5.19) were associated with forgetting to take medication.</p> <p>Comorbidities: The presence of comorbidities (diabetes, kidney disease, or both) and insomnia (aOR = 3.97, 95% CI = 1.30–12.1) was associated with reducing the medication dose.</p> <p>The use of diet supplements: The use of diet supplements was associated with discontinuing the medication (aOR = 4.82, 95% CI = 1.50–15.5).</p> <p>Compliance with a low oil, sugar, sodium diet: Compliance with low oil, sugar, and sodium diet was a protective factor against discontinuing medication (aOR = 0.14; 95% CI = 0.03–0.75).</p>	<ul style="list-style-type: none"> • The number of medication use • Age • Health compliance • Sex • Comorbidity 	The most pervasive behavior associated with medication NA among hypertensive patients was forgetting to take medication. Age < 65 years, male sex, comorbidities, insomnia, noncompliance with diet, and the use of dietary supplements were specifically associated with medication NA.
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References, Published Year, Settings	Target Population, Study Design, Sample Size (n), age, sex	Problem & Purpose	Medication Adherence (MA) Measurement	Main outcome (Factor Influencing MA)	Themes (Factor Influencing MA)	Implications/Suggestions
2021 ²⁵ USA	Hypertension A retrospective cohort study 2,571 Age, mean (SD): 58 (14) Male, n (%): 917 (39.7%) Female, n (%): 1,654 (64.3%)	<ul style="list-style-type: none"> - The effects of patient-provider relationships on adherence to antihypertensive medication therapy were observed among Black adults but not among other racial/ethnic groups. - To assess the associations between patient-clinician relationships (communication and involvement in shared decision-making (SDM)) and adherence to antihypertensive medications. 	Verified self-reported medication refill information collected during the second year of surveys was used to calculate medication refill adherence; adherence was defined as medication refill adherence $\geq 80\%$.	<p>Patient-clinician communication: High versus low patient-clinician communication (OR, 1.38; 95% CI, 1.14–1.67) was associated with adherence to antihypertensives after adjusting for multiple covariates.</p> <p>Involvement in SDM: High versus low involvement in SDM (OR, 1.32; 95% CI, 1.08–1.61) was associated with adherence to antihypertensives after adjusting for multiple covariates.</p>	<ul style="list-style-type: none"> • Patient-Physician relationship 	Patient-clinician communication and SDM were recognized as modifiable predictors of adherence to antihypertensive medications among Black patients but not among non-Hispanic White patients, Hispanic patients, or other racial/ethnic groups. Therefore, based on the current findings, the researcher suggests that clinicians and healthcare systems consider emphasizing communication and SDM processes within patient-centered models to improve adherence to antihypertensive medications among adult Black patients with hypertension.
2021 ²⁶ Taiwan	Hypertension Cross-sectional Study 300 Age, mean (SD): 75.9 (7.4) Male, n (%): 117 (39%) Female, n (%): 183 (61%)	<ul style="list-style-type: none"> - Various individual characteristics may affect medication adherence. However, few studies have investigated the effect of interrelationships among these various individual characteristics on medication adherence. - To explore the interrelationships among risk factors for medication adherence and establish a predictive model of low medication adherence among older adults with hypertension. 	The Chinese version of the short-form Medication Adherence Self-efficacy Scale (MASES). ²⁷	<p>Health belief: poor health belief has an 86% probability of low medication adherence.</p> <p>Self-efficacy: poor self-efficacy has a 100% probability of low medication adherence.</p> <p>Duration of disease: duration of disease > 9.5 years had a higher probability of low medication adherence (83%) than those with a disease duration ≤ 9.5 years.</p> <p>Social support: poor social support has a 90% probability of low medication adherence.</p>	<ul style="list-style-type: none"> • Health belief • Self-efficacy • Social support • Duration of disease 	The proposed classification model can assist in identifying risk cases with low medication adherence. Appropriate health education programs based on these risk factors to manage and improve medication adherence for older adults with hypertension could be considered.

2021 ²⁸ Brazil	Hypertension Cross-sectional Study 485 Age, mean (SD): 62.0 (12.6) Male, n (%) : 212 (43.7%) Female, n (%) : 273 (56.3%)	<ul style="list-style-type: none"> - Nonadherence (NA) to medication significantly contributes to treatment failure in hypertensive patients. However, factors of the ecological model at family/healthcare professional, service, and system levels, are rarely evaluated as correlates of NA in hypertensive patients. - To evaluate the prevalence of NA in the implementation phase of antihypertensive medication when patients started the program and to identify multilevel factors related to NA in a secondary healthcare center. 	The four-item Morisky, Green, and Levine (MGL) scale. ¹⁹	<p>Nonadherence was associated with:</p> <p>Low health literacy: (OR 1.62, CI 1.07–2.44, $p=0.020$).</p> <p>Income \geq two reference wages: (OR 0.46, CI 0.22–0.93, $p=0.031$).</p> <p>Lack of homeownership: (OR 1.99, CI 1.13–3.51, $p=0.017$).</p> <p>The complexity of treatment (number of medications taken \geq two times/day): (OR 1.56, CI 1.01–2.41, $p=0.042$).</p>	<ul style="list-style-type: none"> • Financial status • The number of medication use • Health Literacy 	Only patient-related characteristics were associated with NA in this group of severely hypertensive patients with high cardiovascular risk. Nevertheless, the findings highlight the need for practical actions to optimize clinical outcomes in similar healthcare programs.
2021 ²⁹ Japan	Hypertension Cross-sectional Study 1,057 Age, mean (SD): Good adherence 70 [21–94], Poor adherence 74 [22–89] Male, n (%) : 641 (61%) Female, n (%) : 416 (39%)	<ul style="list-style-type: none"> - The number of medications and characteristics contributing to medication regimen complexity, such as dosage forms and dosing frequency, influence medication adherence. Nonetheless, the impact of medication regimen complexity on the therapeutic efficacy of medicines remains to be explained. - To investigate the effect of the number of medications and medication regimen complexity on medication adherence and therapeutic efficacy in patients with hypertension. 	Patients' medication adherence was defined as poor if they could not manage medications by themselves or if they required their family caregivers and/or nurses to manage their medications.	<p>Age: ≥ 71 years was extracted as a risk factor for poor medication adherence.</p> <p>The medication regimen complexity index (MRCI) score: was ≥ 19.5, but no number of oral medications was extracted as risk factors for poor medication adherence.</p>	<ul style="list-style-type: none"> • The number of medication use • Age 	The Study suggests that medication regimen complexity rather than the number of medications is closely related to medication adherence and blood pressure management. Therefore, physicians and/or pharmacists should consider the complexity of medication regimens while modifying them.

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Table I (Continued).

References, Published Year, Settings	Target Population, Study Design, Sample Size (n), age, sex	Problem & Purpose	Medication Adherence (MA) Measurement	Main outcome (Factor Influencing MA)	Themes (Factor Influencing MA)	Implications/Suggestions
2022 ³⁰ China	<p>Hypertension Cross-sectional Study 388</p> <p>Age, n (%): 88 (22.7%) individuals aged 60 to 64 years; 119 (30.7%) individuals aged 65 to 69 years; 11 (2.8%) individuals aged 70 to 74 years; 112 (28.9%) individuals aged 75 to 79 years and 58 (14.9%) individuals more than 80 years old.</p> <p>Male, n (%): 190 (49%) Female, n (%): 198 (51%)</p>	<p>- Antihypertensive drugs are still the primary choice for the treatment of hypertension. However, studies have revealed low medication adherence in people with hypertension. In order to ensure the effectiveness of the medication, it is necessary to focus on the predictors affecting medication adherence.</p> <p>- To explore the risk factors for poor medication adherence in older people with hypertension.</p>	The four-item Morisky, Green, and Levine (MGL) scale. ¹⁹	<p>People who lived with spouses and offspring: (OR = 3.004, p = 0.017) had a greater risk of poor medication adherence.</p> <p>People with high admission blood pressure: (OR = 1.910, p = 0.003) had a greater risk of poor medication adherence.</p> <p>People without hypertension complications: (OR = 0.591, p = 0.026) had a lower risk of poor medication adherence.</p>	<ul style="list-style-type: none"> • Comorbidity • Social support 	We believe that these findings contribute to the identification of high-risk people with poor adherence, allowing nurses to promptly identify patients with poor adherence and pay attention to those individuals' medication.

medication adherence (MA) measurement, main outcome (factor influencing MA), themes (factors influencing MA), and implications/suggestions.

Data Synthesis

The convergent integrated analysis framework suggested by Joanna Briggs Institute (JBI) for systematic reviews was adopted for the data synthesis of the included studies.³¹ This framework, specialized for the simultaneous analysis of qualitative and quantitative data, transforms data of different categories into the same format to facilitate data integration.³² In our review, themes were extracted from the key findings of the included studies by examining the similarities and differences between the key findings, similar to how qualitative researchers produce themes. For example, one of the key findings by Macquart de Terline et al is that “Patients with a lower wealth index were more likely to be less adherent to their antihypertensive medications (OR: 1.83, 95% CI [1.38–2.45], $p < 0.001$).” was coded as “Lower wealth index”, forming the theme, “Financial status.”¹³

Results

Search results

A total of 448 articles were initially identified and screened by title and abstract according to the inclusion and exclusion criteria (Box 1). This screening resulted in 16 articles remaining eligible for the full-text screening. During the full-text screening phase, three articles were excluded: two for reporting results exclusively for irrelevant populations, and one for reporting on a study with an aim beyond the interest of the review. Thirteen studies were included in the final review. The PRISMA¹² was applied to outline the retrieval process (see Figure 1).

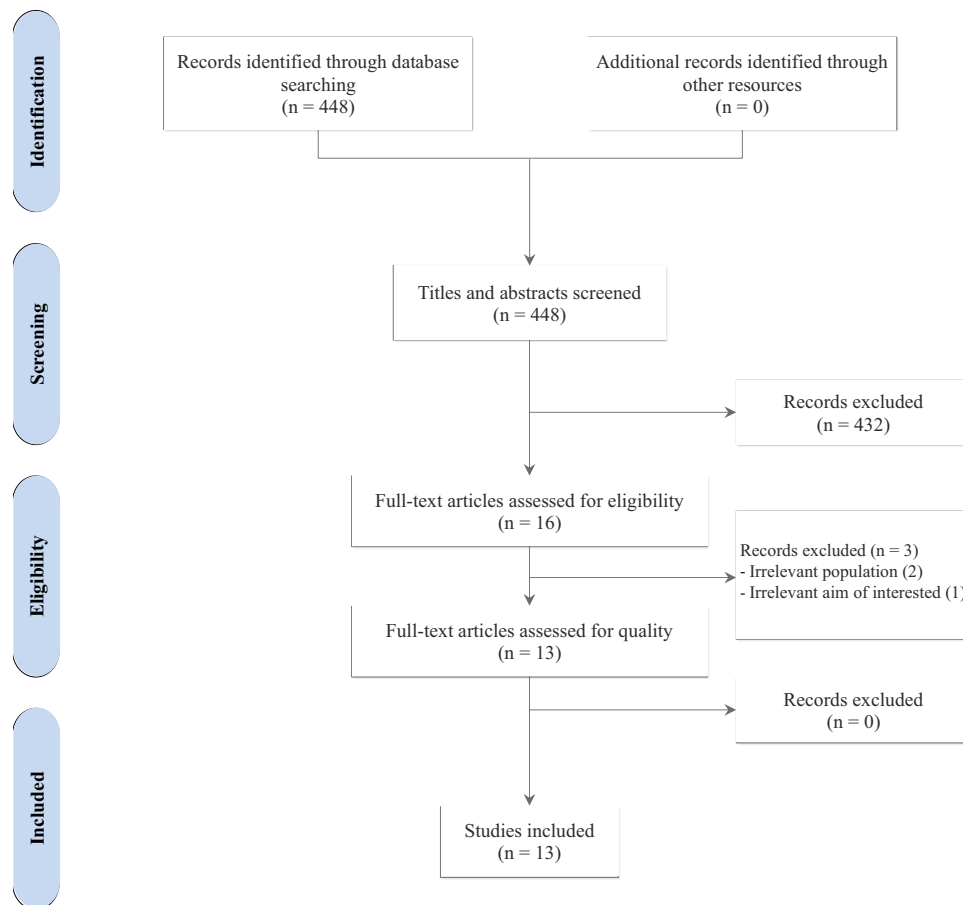


Figure 1 PRISMA flow chart.

Notes: Adapted from Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Reprint—Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine*. 2009;151(4):264–269.³³

Description of Included Studies

Table 2 shows that the included studies were published in the following years: 2019 (n = 3, 21.1%), 2020 (n = 4, 30.8%), 2021 (n = 5, 38.5%), and 2022 (n = 1, 7.7%). These studies were primarily conducted in the United States of America (USA; n = 3, 23.1%), Taiwan (n = 2, 15.4%), and Iran (n = 2, 15.4%). The research reported in the remaining five papers was conducted in China, Brazil, Japan, Tunisia, and Latvia, with one paper detailing data collection across multiple

Table 2 The Characteristics of the Included Studies

Characteristic	Number	Percentage (%)
Publication year		
2019	3	23.1%
2020	4	30.8%
2021	5	38.5%
2022	1	7.7%
Setting		
USA	3	23.1%
Taiwan	2	15.4%
Iran	2	15.4%
China	1	7.7%
Brazil	1	7.7%
Japan	1	7.7%
Tunisia	1	7.7%
Latvia	1	7.7%
Multiple setting*	1	7.7%
Study design		
Cross-sectional study	11	84.6%
Observational Study (secondary data analysis)	1	7.7%
A Retrospective Cohort Study	1	7.7%
Sample size (n)		
1–200	1	7.7%
> 200–300	5	38.5%
> 300	7	53.8%
Mean age (year)		
55–59	5	38.5%
60–69	4	30.8%
70–79	3	23.1%
80 or above	1	7.7%

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Table 2 (Continued).

Characteristic	Number	Percentage (%)
Medication adherence measurement		
The 8-item Morisky Medication Adherence Scale	3	23.1%
The four-item Morisky, Green, and Levine	3	23.1%
The Girerd test	1	7.7%
The Blood Pressure Self-Care Scale	1	7.7%
The Chinese version of the short-form Medication Adherence Self-Efficacy Scale	1	7.7%
Others**	4	30.8%

Notes: *12 sub-Saharan African countries: Benin, Cameroon, Congo (Brazzaville), Democratic Republic of the Congo, Gabon, Guinea, Côte d'Ivoire, Mauritania, Mozambique, Niger, Senegal, Togo. **Medication adherence with antihypertensive medications was measured using 2008 Medicare Part D administrative claims data. It was calculated as the number of days with medication on hand divided by the number of days in an interval.²³ Medication nonadherence was evaluated by asking participants if the following behaviors occurred more than twice a week within the previous three months with answers as "Yes" or "No": Forgetting to take medication, reducing the medication dose, and discontinuing the medication.²⁴ Verified self-reported medication refill information collected during the second year of surveys was used to calculate medication refill adherence; adherence was defined as medication refill adherence \geq 80%.²⁵ Patients' medication adherence was defined as poor if they could not manage medications by themselves or if they required their family caregivers and/or nurses to manage their medications.²⁹

settings, including 12 sub-Saharan African countries: Benin, Cameroon, Congo (Brazzaville), Democratic Republic of the Congo, Gabon, Guinea, Côte d'Ivoire, Mauritania, Mozambique, Niger, Senegal, and Togo. The most commonly reported study design was cross-sectional ($n = 11$, 84.6%), followed by observational ($n = 1$, 7.7%) and retrospective cohort studies ($n = 1$, 7.7%). The reported sample sizes varied, with 1 to 200 ($n = 1$, 7.7%), more than 200 to 300 ($n = 5$, 38.5%), and over 300 ($n = 7$, 53.8%). Five studies (38.5%) included participants aged between 55 and 59 years. Popular tools for measuring medication adherence in these studies included the 8-item Morisky Medication Adherence Scale ($n = 3$, 23.1%) and the four-item Morisky, Green, and Levine Scale ($n = 3$, 23.1%).

Description of Factors Influencing Medication Adherence Among Older Adults Living with Hypertension Themes

A summary of the findings from the included studies is provided in [Table 1](#). Fifteen themes are extracted from the key findings of the included studies ([Table 3](#)). For example, the number of medications used ($n = 7$ studies, 53.9%), financial status ($n = 5$ studies, 38.5%), sex ($n = 5$ studies, 38.5%), age ($n = 4$ studies, 30.1%), duration of disease ($n = 3$ studies, 23.1%), comorbidity ($n = 3$ studies, 23.1%), and health compliance ($n = 3$ studies, 23.1%) are among the frequent themes extracted.

Discussion

Data synthesis from the systematic review has identified fifteen key factors influencing medication adherence among older adults living with hypertension. These factors are organized into themes. The most prevalent themes include the number of medications used, financial status, sex, age, duration of the disease, comorbidities, and health compliance, and these will be the focus of our in-depth discussion.

Seven of the included studies reported a consistent trend: a higher number of prescribed hypertensive medications correlated with lower medication adherence.^{13,16,20,23,24,28,29} This aligns with robust evidence from a nationwide study conducted in the Republic of Korea, which aimed to investigate the impact of the number of medications and age on antihypertensive medication adherence. The study demonstrated a significant decline in adherence when nine or more total medications were taken, irrespective of age.³⁴ Furthermore, another study revealed that factors such as the number

Table 3 Factors Influencing Medication Adherence Among Older Adults Living with Hypertension

References	Themes (factors influencing medication adherence)														
	Age	Sex	Education	Duration of disease	Financial status	The number of medication use	Comorbidity	Health literacy	Health compliance	Health belief	Medication belief	Perception of illness	Patient-physician relationship	Self-efficacy	Social support
[13]					x	x									
[15]	x			x					x						
[16]		x			x	x									
[18]		x						x							
[20]		x	x	x	x	x	x								
[21]		x			x				x		x	x			
[23]	x					x							x		
[24]	x	x				x	x		x						
[25]													x		
[26]				x						x				x	x
[28]					x	x		x							
[29]	x					x									
[30]							x								x
Total (n, %)	4,30.1%	5,38.5%	1,7.7%	3,23.1%	5,38.5%	7,53.9%	3,23.1%	2, 15.4%	3,23.1%	1, 7.7%	1,7.7%	1,7.7%	2,15.4%	1,7.7%	2,15.4%

of medications and characteristics contributing to medication regimen complexity—such as dosage forms and dosing frequency—exert a notable influence on medication adherence, particularly among older adults.^{35–37} Consequently, healthcare professionals must adopt a more strategic approach to enhance adherence to antihypertensive medications, tailoring interventions based on the total number of prescribed medications.

Another noteworthy finding underscores the significant role of financial status in influencing medication adherence among older adults with hypertension. For instance, one study revealed that difficulties in paying monthly bills were a key determinant of medication non-adherence and poorer self-rated health, even after accounting for age, gender, race/ethnicity, education, employment status, and income.³⁸ Similarly, five studies included in our review established a substantial association between financial status and medication adherence.^{13,16,20,21,28} Specifically, a study by Macquart de Terline et al demonstrated that older hypertensive patients with a lower wealth index were more likely to exhibit lower adherence to antihypertensive medications.¹³ Likewise, Akkara et al identified that individuals with a low socioeconomic level were seven times more likely to demonstrate poor compliance with medication use compared to those with a high socioeconomic level.¹⁶ Our review illuminates the intricate connection between financial constraints and medication adherence, emphasizing the need for socio-medical interventions. These interventions could include enhancing access to affordable medications and implementing upstream social policies to promote equity. It becomes evident that further research to advance this agenda must comprehensively measure the nuanced aspects of socioeconomic status.

Hypertension, a critical cardiovascular risk factor, poses substantial complications regardless of gender. Strong evidence supports the association between gender and medication adherence among older adults with hypertension.^{39–41} However, another study in the literature reveals heterogeneity in medication adherence when comparing males and females; for instance, a cross-sectional study by Akkara et al involving 276 older adults with hypertension found that poor compliance with hypertensive medication is 2.3 times more likely in women than men.¹⁶ Conversely, three studies included in this review consistently reported that females are more likely to adhere to antihypertensive medications.^{18,21,24} The conflicting findings underscore the complexity of the relationship between gender and medication adherence, warranting further research to elucidate this association. Such investigations are essential for guiding relevant public health policies and strategies.

Our current review identifies a significant relationship between age and adherence to antihypertensive medication among older adults.^{15,23,24,29} In a study examining therapy, knowledge about the disease and its control, and demographic differences, adherence levels were found to correlate with the patient's age: the older the patient, the more likely they are to exhibit higher medication adherence.¹⁵ However, our review includes studies with contrasting results. For instance, Ward et al suggested that older adults with hypertension aged between 80–84 years are more likely to be nonadherent to their antihypertensive medication.²³ Change et al found that age ≥ 65 was associated with forgetting to take medication,²⁴ and Wakia et al identified older adults with hypertension aged ≥ 71 years as being at risk for poor medication adherence.²⁹ These divergent impacts of age on medication adherence reported in the literature may stem from the studies being conducted in different countries, featuring variations in sociodemographics, healthcare systems, and broader cultural contexts. Further research across diverse geographical settings is warranted to enhance the generalizability of findings and provide a clearer understanding of how age influences medication adherence.

Three studies included in this review investigated the influence of hypertension duration on medication adherence.^{15,20,26} For instance, a cross-sectional study conducted in Latvia with 187 older adults suffering from hypertension revealed that the longer the patient had experienced hypertension, the more adherent they were to their medication. Similarly, the study by Mamaghani et al aimed to assess baseline barriers to medication adherence among hypertensive patients in deprived rural areas and found a significant positive correlation between the duration of hypertension and medication adherence.²⁰ It is plausible that individuals with more extensive experience living with chronic diseases, particularly hypertension, have acquired skills in self-care, recognizing the positive impact of adherence on blood pressure control and complication prevention.¹⁰ However, research by Chu et al yielded a different perspective, indicating that older adults with hypertension for more than 9.5 years had a higher probability of lower medication adherence (83%) compared to those with a shorter duration of hypertension (≤ 9.5 years).²⁶ This study suggests that tailored health education programs, considering risk factors such as disease duration, could be instrumental in managing and enhancing medication adherence among older adults with hypertension.²⁶

Previous research aimed to assess the prevalence of medication adherence and associated factors among patients with multimorbidity, highlighting an association between multimorbidity and low medication adherence.⁴² Similarly, our current review reveals that older adults with hypertension experiencing comorbidities or complications due to hypertension are more likely to exhibit poor medication adherence.^{20,24,30} The study by S.M. Chang et al reported that the presence of comorbidities such as diabetes, kidney disease, or insomnia was associated with a reduction in medication dosage.²⁴ Additionally, Wan et al found that older adults with high admission blood pressure faced a greater risk of poor medication adherence, while those without hypertension complications had a lower risk of poor medication adherence.³⁰ These findings contribute to the identification of high-risk individuals with poor adherence, particularly those with comorbidities. This knowledge allows healthcare providers to promptly recognize individuals likely to show poor adherence and pay special attention to their medication regimens.

Medication literacy plays a crucial role in influencing adherence to antihypertensive drugs among patients with hypertension.^{43–45} Two studies included in our review specifically identified health literacy as a predictive factor for medication adherence among older adults with hypertension.^{18,28} First, the study by Heizomi et al explored gender-based associations of health literacy with self-reported medication adherence among patients with primary hypertension, revealing a significant correlation between health literacy and medication adherence.¹⁸ Similarly, a cross-sectional study by Pinhati et al reported that nonadherence was associated with low health literacy.²⁸ In light of these findings, it is recommended that the association between health literacy and medication adherence be further confirmed through interventional studies. Such confirmation would solidify health literacy as a formal mitigating strategy for medication adherence and other public health goals.

The studies included in our review also demonstrated a connection between medication adherence and health compliance among hypertensive patients.^{15,21,24} For instance, the study by Gavrilova et al found that older adults with hypertension who diligently follow up on their family physician's medication prescriptions are more likely to adhere to their medication.¹⁵ Similarly, Adinkrah et al highlighted that a higher level of adherence to antihypertensive medications correlated with a greater continuity of medical care.²¹ Moreover, compliance with a low oil, sugar, and sodium diet was identified as a protective factor against discontinuing medication, as discovered by S.M. Chang et al. Consequently, considering the health compliance model in future studies to improve medication adherence among older adults with hypertension is recommended. Developing interventions that leverage the compliance component could contribute to enhancing sustainable medication adherence within this population.²⁴

Limitations and Future Prospects of Research

The review has limitations that should be considered. Firstly, the review only includes studies published in English, potentially excluding relevant literature published in other languages. Additionally, the exclusion of studies beyond the review's aim might have led to the omission of important research, limiting the breadth of the review. Furthermore, the variability in study designs, settings, and population characteristics among the included studies may restrict the generalizability of the findings and pose challenges in synthesizing the results effectively.

Despite these limitations, the study offers valuable insights that can guide future research. Longitudinal studies could capture changes in medication adherence over time among older adults with hypertension, providing insights into adherence trajectories and associated factors. Furthermore, randomized controlled trials evaluating the effectiveness of tailored interventions, such as medication reminders, patient education programs, and financial assistance schemes, are needed to improve medication adherence in this population.

Adopting a comprehensive approach that considers multiple factors simultaneously, such as demographic, clinical, psychosocial, and healthcare system factors, could enhance our understanding of medication adherence behavior and inform the development of more nuanced interventions. Exploring the potential of digital health interventions, such as mobile health apps and wearable devices, in improving medication adherence among older adults with hypertension could offer personalized support and real-time monitoring opportunities.

Finally, future research should address health equity considerations by investigating disparities in medication adherence and developing strategies to promote equitable access to healthcare services and medications among vulnerable populations. Overall, addressing these limitations and pursuing these research avenues can advance our understanding of medication

adherence among older adults with hypertension and contribute to the development of more effective interventions and policies to support this population.

Conclusion

This systematic review provides crucial insights into the multifaceted factors influencing medication adherence among older adults with hypertension. The comprehensive evidence gathered here underscores the complexity of medication adherence in this population, highlighting the interplay of factors such as the number of medications, financial status, sex, age, disease duration, comorbidities, and health compliance. These findings are instrumental in guiding the development of innovative, evidence-based interventions tailored to improve medication adherence in hypertensive older adults. By addressing these key factors, such interventions promise to enhance the management of hypertension, potentially leading to better health outcomes and improved quality of life. Furthermore, the insights gleaned from this review are invaluable for policymakers and healthcare stakeholders. They offer a robust foundation for formulating policies and programs that are attuned to the unique needs of older adults living with hypertension and other chronic conditions. The implementation of these evidence-based strategies can significantly contribute to the well-being and healthcare management of the aging population.

Ethics Approval and Consent to Participate

Not applicable because this article does not contain any study with human or animal subjects.

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