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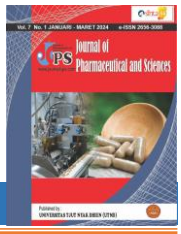

Determinants of Medication Adherence Behavior among Productive-Age Hypertensive Patients in Primary Care: A Scoping Review

Determinan Perilaku Kepatuhan Minum Obat pada Pasien Hipertensi Usia Produktif di Pelayanan Kesehatan Primer: *Scoping Review*

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Abstract

Background: Hypertension is a major global health problem and a leading risk factor for cardiovascular disease. Although effective antihypertensive medications are widely available, poor medication adherence remains a significant challenge in achieving optimal blood pressure control, particularly among productive-age patients. **Objective:** This scoping review aimed to identify and synthesize evidence on the determinants of medication adherence among productive-age hypertensive patients (aged 18–59 years) in primary care settings. **Methods:** The review followed the Joanna Briggs Institute (JBI) framework and the PRISMA Extension for Scoping Reviews (PRISMA-ScR) guidelines. A comprehensive literature search was conducted in PubMed, Scopus, ScienceDirect, and Google Scholar for articles published between 2016 and 2026. Studies involving productive-age participants (18–59 years) that examined determinants of adherence to antihypertensive medication were included. **Results:** A total of 14 studies met the inclusion criteria. The findings revealed that medication adherence among productive-age hypertensive patients was influenced by multiple factors, including sociodemographic characteristics (age, education, economic status), self-efficacy, health literacy, treatment-related factors (regimen complexity, side effects), healthcare system support (effective communication, counseling), social support, and digital health interventions (mobile applications, electronic reminders). **Conclusion:** Medication adherence among productive-age hypertensive patients is a multidimensional behavior. Comprehensive, integrated strategies are required, including patient education, enhancing self-efficacy and health literacy, simplifying treatment regimens, strengthening communication with healthcare providers, and using technology-based interventions to improve long-term adherence and blood pressure control.

Keywords: Hypertension; Medication Adherence; Determinants; Productive-Age Adults; Scoping Review

Abstrak

Latar Belakang: Hipertensi merupakan masalah kesehatan global utama dan faktor risiko penting penyakit kardiovaskular. Meskipun obat antihipertensi tersedia secara luas, kepatuhan minum obat masih menjadi tantangan utama dalam mencapai pengendalian tekanan darah yang optimal, khususnya pada pasien usia produktif. **Tujuan:** Scoping review ini bertujuan untuk mengidentifikasi dan mensintesis bukti ilmiah mengenai determinan perilaku kepatuhan minum obat pada pasien hipertensi usia produktif (18–59 tahun) di pelayanan kesehatan primer. **Metode:** Review ini mengikuti kerangka Joanna Briggs Institute (JBI) dan pedoman PRISMA-ScR. Pencarian literatur dilakukan pada basis data PubMed, Scopus, ScienceDirect, dan Google Scholar untuk artikel yang dipublikasikan pada tahun 2016–2026. Studi yang melibatkan partisipan usia produktif (18–59 tahun) dan membahas determinan kepatuhan terhadap obat antihipertensi dimasukkan ke dalam ulasan. **Hasil:** Sebanyak 14 studi memenuhi kriteria inklusi. Hasil kajian menunjukkan bahwa kepatuhan pengobatan pada pasien hipertensi usia produktif dipengaruhi oleh berbagai faktor, yaitu karakteristik sosiodemografi (usia, pendidikan, status ekonomi), efikasi diri, literasi kesehatan, faktor terkait terapi (kompleksitas regimen, efek samping), dukungan sistem pelayanan kesehatan (komunikasi efektif, konseling), dukungan sosial, serta intervensi kesehatan digital (aplikasi seluler, pengingat elektronik). **Kesimpulan:** Perilaku kepatuhan minum obat pada pasien hipertensi usia produktif bersifat multidimensional. Diperlukan strategi komprehensif dan terintegrasi yang mencakup edukasi pasien, peningkatan efikasi diri dan literasi kesehatan, penyederhanaan regimen terapi, penguatan komunikasi tenaga kesehatan, serta pemanfaatan intervensi berbasis teknologi untuk meningkatkan kepatuhan jangka panjang dan pengendalian tekanan darah.

Kata Kunci: Hipertensi; Kepatuhan Pengobatan; Determinan; Usia Produktif; Scoping Review.

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Introduction

Hypertension is one of the most prevalent chronic diseases worldwide and remains a major contributor to cardiovascular morbidity and mortality, requiring long-term pharmacological therapy and continuous patient self-management [1,2]. Effective antihypertensive medications are widely available; however, achieving optimal blood pressure control largely depends on patients' adherence to prescribed treatment regimens [2]. Poor medication adherence has been recognized as a significant barrier to successful hypertension management and contributes to increased healthcare costs, complications, and mortality. [3].

Medication adherence among productive-age adults with hypertension remains a major public health concern. In this review, productive-age adults were defined as individuals aged 18–59 years, representing the active working-age population commonly used in public health and healthcare research. This population group is particularly important because uncontrolled hypertension and poor adherence behavior during the productive age may increase the risk of long-term cardiovascular complications, reduced work productivity, and higher healthcare burdens.

Evidence from different countries indicates that medication adherence among productive-age hypertensive patients remains suboptimal. Previous studies reported that a substantial proportion of hypertensive patients demonstrated low adherence to antihypertensive therapy and inadequate blood pressure control across different healthcare settings. [4,6]. These findings suggest that poor adherence behavior remains a persistent challenge in hypertension management among adult populations.

Medication adherence is a complex behavior influenced by multiple determinants related to patient characteristics, treatment factors, and healthcare system conditions. Sociodemographic characteristics such as age, gender, education level, employment status, and socioeconomic conditions have been shown to influence adherence behaviors among hypertensive patients significantly. [7,8]. Lifestyle factors, including smoking status, physical activity, and health-seeking behaviors, are also associated with differences in adherence and blood pressure control [5]. In addition, economic conditions and family income have been identified as important predictors of adherence behavior, particularly among populations with limited access to healthcare resources. [7].

Psychological and cognitive factors also play a crucial role in determining medication adherence. Self-efficacy, knowledge about hypertension, and health beliefs significantly influence patients' ability to maintain consistent adherence to antihypertensive therapy. [2]. Health literacy has been identified as another important determinant, as patients with a better understanding of their condition are more likely to adhere to treatment recommendations and engage in effective self-management practices [8]. Similarly, patient communication skills and self-efficacy can improve adherence behavior when supported through appropriate educational interventions. [9].

Treatment-related factors are also important determinants of medication adherence. The complexity of medication regimens, the number of antihypertensive drugs prescribed, and the occurrence of adverse drug reactions have been consistently associated with lower adherence rates. [10]. Adverse drug events, including common side effects such as dyspeptic symptoms or fatigue, may discourage patients from continuing their medication as prescribed [6]. In addition, patient satisfaction with treatment has been reported to influence adherence behaviors and clinical outcomes among hypertensive patients significantly. [11].

Beyond individual patient factors, the healthcare environment and provider–patient interaction also play important roles in promoting medication adherence. Effective counseling provided by healthcare professionals has been shown to significantly improve medication adherence and reduce blood pressure levels among hypertensive patients [12]. Patient-centered care approaches that emphasize shared decision-making

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and individualized treatment planning have also demonstrated substantial improvements in adherence levels [13]. Furthermore, training healthcare providers in communication skills can enhance patients' self-efficacy and adherence, ultimately improving hypertension outcomes [9].

In recent years, technological innovations have been increasingly used to support medication adherence among patients with chronic diseases. Digital health interventions, including mobile phone reminders and smartphone applications, have been developed to assist patients in managing their medication schedules and monitoring their health status. [14]. Several studies have demonstrated that mobile health interventions can improve medication adherence and blood pressure control among hypertensive patients. [15]. However, the effectiveness of some mobile-based interventions remains inconsistent across studies and populations. [3].

Social and environmental support systems are also important determinants of medication adherence behavior. Social support from family members, peers, and healthcare providers has been shown to influence treatment adherence among hypertensive patients positively. Patients who receive stronger social support often demonstrate better disease management behaviors and higher adherence to prescribed treatment regimens. [16].

Additionally, poor medication adherence has important clinical implications for blood pressure control. Studies have demonstrated that non-adherence to antihypertensive medication is significantly associated with poorer hypertension outcomes and increased cardiovascular risk. [17]. Conversely, interventions designed to improve adherence behaviors have been shown to enhance blood pressure control and promote healthier lifestyle behaviors among hypertensive patients. [18].

Given the multifactorial nature of medication adherence, understanding the determinants that influence adherence behavior among productive-age hypertensive patients is essential for developing effective interventions and improving hypertension management outcomes. Therefore, synthesizing evidence from existing studies on the determinants of medication adherence is necessary to identify key factors that can guide clinical practice, health education strategies, and policy development to improve adherence among productive-age populations with hypertension.

Methods

Study Design

This study employed a scoping review methodology to systematically map and synthesize the existing evidence regarding determinants of medication adherence among productive-age patients with hypertension. In this review, productive age was defined as 18–59 years, based on the World Health Organization classification of the working-age population. Therefore, studies focusing exclusively on elderly populations aged ≥60 years were excluded from the final synthesis to ensure consistency with the review objective and title.

The scoping review approach was selected to explore the breadth, characteristics, and determinants of medication adherence behavior among productive-age hypertensive patients across various healthcare settings and populations. The review process followed the methodological framework proposed by the Joanna Briggs Institute (JBI) for scoping reviews. In addition, reporting of this review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines to ensure transparency and methodological rigor.

Although critical appraisal is not mandatory in scoping reviews, methodological quality assessment of the included studies was conducted to identify potential sources of bias and to strengthen the interpretation of the findings. The Joanna Briggs Institute Critical Appraisal Checklists were used according to the design of each included study, including those for cross-sectional, randomized controlled, and cohort studies.[19].

Search Strategy

A comprehensive literature search was conducted to identify studies examining determinants of medication adherence among productive-age patients with hypertension. The search was performed in four electronic databases: PubMed, Scopus, ScienceDirect, and Google Scholar. Articles published between January 2016 and March 2026 were considered eligible.

The search strategy combined Medical Subject Headings (MeSH) and free-text keywords related to hypertension, medication adherence, determinants, and productive-age populations. The main search terms included "hypertension," "high blood pressure," "antihypertensive medication," "medication adherence,"

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"treatment adherence," "medication compliance," "determinants," "predictors," "self-efficacy," "health literacy," "mobile health," "working-age adults," and "productive-age adults." Boolean operators such as AND and OR were used to refine the search process and maximize the retrieval of relevant studies.

The PubMed search strategy was structured as follows:

("Hypertension"[Mesh] OR hypertension OR "high blood pressure")
AND
("Medication Adherence"[Mesh] OR "medication compliance" OR "treatment adherence")
AND
(determinants OR predictors OR factors)
AND
("young adult"[Mesh] OR adult OR "working-age adults" OR "productive-age adults")
AND
("2016/01/01"[Date - Publication] : "2026/03/31"[Date - Publication])

Searches in PubMed, Scopus, and ScienceDirect were limited to title and abstract fields to improve relevance and reproducibility of the results. In Google Scholar, only the first 200 records, sorted by relevance, were screened due to the database's broad retrieval characteristics. Duplicate records identified across databases were removed using Mendeley reference management software. Additionally, the reference lists of eligible studies were manually searched to identify potentially relevant articles not retrieved through the database search. The search strategy was discussed and refined among the research team to improve consistency and comprehensiveness before implementation.

Eligibility Criteria

Studies were selected based on predefined inclusion and exclusion criteria to ensure consistency with the objectives of this review. Eligible studies included those investigating medication adherence among patients diagnosed with hypertension, particularly productive-age populations aged 18–59 years. The review considered studies examining determinants, predictors, or factors associated with adherence to antihypertensive medication. Quantitative, qualitative, and mixed-methods studies published in English in peer-reviewed journals between 2016 and 2026 were included.

Studies were excluded if they focused exclusively on elderly populations aged ≥60 years, were review articles, editorials, conference abstracts, or commentaries, or did not specifically evaluate adherence to antihypertensive medication. Studies that did not investigate determinants or predictors of medication adherence behavior were also excluded. In addition, studies with insufficient methodological information or unclear adherence measurement instruments, as well as articles published before 2016, were not considered eligible for inclusion. All retrieved studies were assessed according to these eligibility criteria during the title and abstract screening stage, followed by full-text review, to ensure alignment with the objectives of the review.

Study Selection

The study selection process was conducted in several stages. First, duplicate records identified from different databases were removed using Mendeley software. Subsequently, titles and abstracts were screened independently according to the predefined eligibility criteria. Articles considered potentially relevant were then retrieved in full text and assessed comprehensively for eligibility. Studies that did not meet the criteria for productive-age population, publication year, or determinant focus were excluded during the full-text review stage. Any disagreements during the screening and selection process were resolved through discussion among the reviewers.

Data Extraction

Data extraction was conducted using a standardized data-charting form developed by the research team to ensure consistency across studies. Extracted information included author names, year of publication, country, study design, sample characteristics, participant age range, sample size, adherence measurement instruments, determinants of medication adherence, and key findings. To improve reporting consistency, adherence measurement tools and determinant categories were standardized during data extraction. Studies lacking clear methods for measuring adherence were critically evaluated during quality appraisal and interpretation of findings. All extracted data were systematically organized into evidence synthesis tables to facilitate comparison across studies.

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Quality Appraisal

Methodological quality assessment was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Tools according to study design. Cross-sectional studies were assessed using the JBI Checklist for Analytical Cross-Sectional Studies, randomized controlled trials using the JBI Checklist for Randomized Controlled Trials, and cohort studies using the JBI Checklist for Cohort Studies. (22). The appraisal process evaluated methodological domains including sampling procedures, validity and reliability of outcome measurements, identification of confounding factors, completeness of follow-up, and appropriateness of statistical analysis. The quality appraisal results were not used to exclude studies; however, they were considered in interpreting the findings to identify potential risk of bias and limitations of the available evidence.

Data Analysis and Synthesis

The included studies were analyzed using descriptive and thematic synthesis approaches. Determinants of medication adherence identified across the studies were grouped into thematic categories, including sociodemographic factors, psychological and cognitive factors, treatment-related factors, healthcare system factors, social support, and technological interventions. This thematic categorization facilitated the identification of similarities, differences, and patterns across studies regarding factors influencing medication adherence among productive-age hypertensive patients. The synthesis process also considered methodological quality and potential bias identified during the critical appraisal stage to strengthen the interpretation of the findings.

Results

The literature search across PubMed, Scopus, ScienceDirect, and Google Scholar identified 422 potentially relevant records on medication adherence among productive-age patients with hypertension. After removing 193 duplicate records, 229 articles remained for title and abstract screening. During the initial screening stage, 160 articles were excluded because they did not fall within the scope of the review or were not directly related to antihypertensive medication adherence in productive-age populations. Subsequently, 69 full-text articles were assessed for eligibility, and 55 reports were excluded for reasons including not meeting the productive-age criteria, not examining determinants of medication adherence, being review articles or editorials, or lacking sufficient methodological information. Ultimately, 14 studies met all eligibility criteria and were included in the final synthesis of this scoping review. The overall process of study identification, screening, eligibility assessment, and inclusion is presented in **Figure 1.**

The included studies represented diverse geographical and healthcare settings, reflecting the global nature of hypertension management research among productive-age populations. The studies were conducted in several countries, including China, Tunisia, Nigeria, Indonesia, the United States, Spain, Pakistan, Ethiopia, Iran, and the United Kingdom. [20,21,22]. Most studies employed cross-sectional designs, while others used randomized controlled trials, quasi-experimental studies, and cohort studies to examine medication adherence behavior and its determinants. [23,24]. Sample sizes varied considerably across the studies, ranging from relatively small clinical populations to larger community-based samples. [25,26]. The detailed characteristics of the included studies are presented in Table 1.

Various measurement tools were utilized to assess medication adherence among productive-age hypertensive patients. Many studies employed standardized self-report adherence scales and validated questionnaires to evaluate medication-taking behavior. At the same time, several also incorporated clinical indicators, such as blood pressure control, to assess treatment outcomes. [10,11]. In addition, several studies examined behavioral and psychosocial constructs, including self-efficacy, treatment satisfaction, and health literacy, to understand better the mechanisms influencing adherence behavior. [21,22].

The synthesis of the included studies revealed that multiple interacting determinants influence medication adherence among productive-age hypertensive patients. Sociodemographic characteristics were frequently reported as important factors affecting adherence behavior. Variables such as age, gender, education level, employment status, and socioeconomic conditions were found to influence patients' ability to maintain consistent medication use [20,26]. Patients with higher educational attainment and greater socioeconomic resources tended to demonstrate higher adherence. In contrast, individuals with limited

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education or financial constraints were more likely to experience challenges in maintaining long-term adherence to treatment [22].

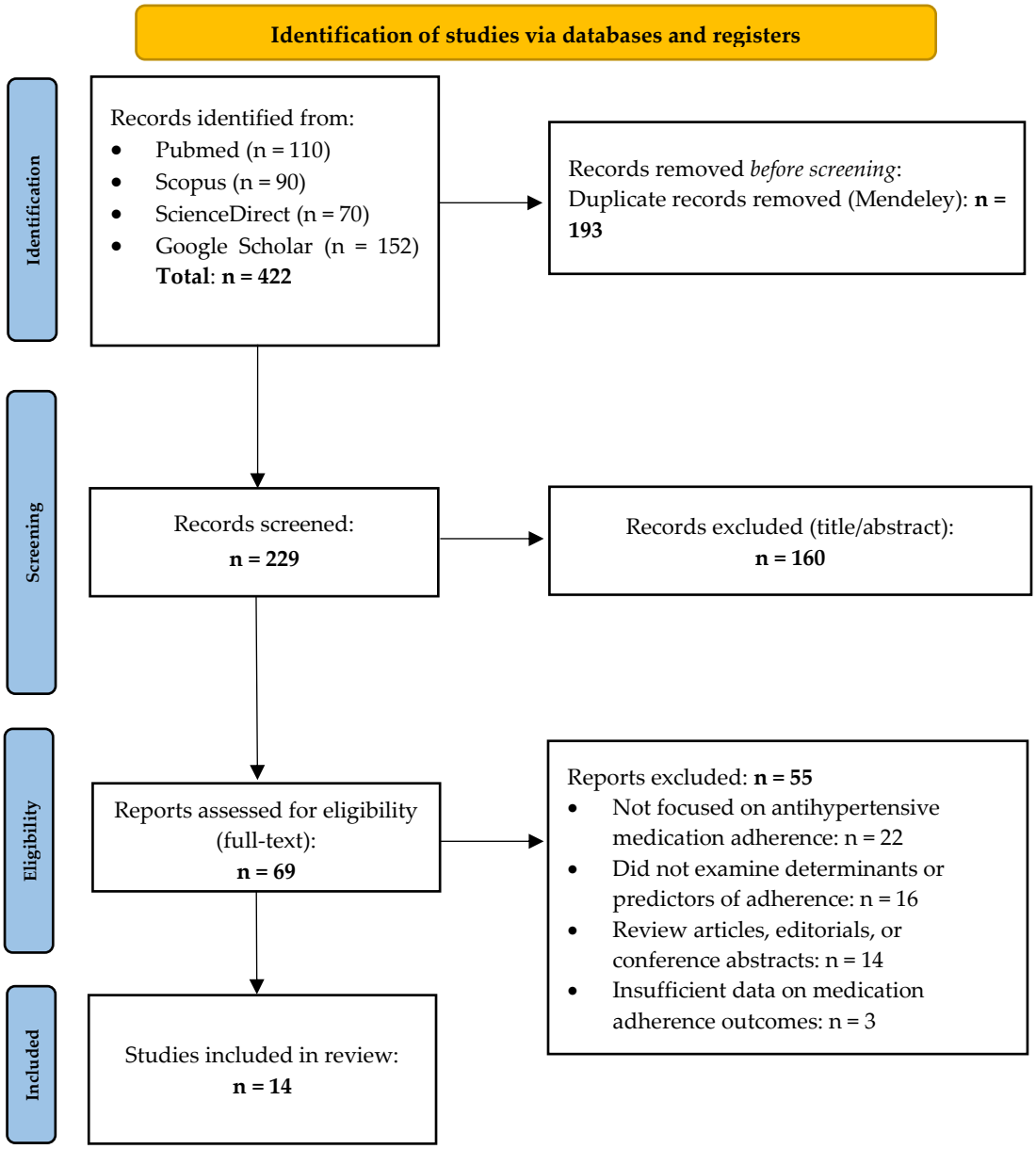

Figure 1. PRISMA flow diagram of the study selection process.

Psychological and cognitive determinants were also identified as significant contributors to medication adherence. Several studies highlighted the role of self-efficacy, health beliefs, and knowledge about hypertension in shaping adherence behavior. [21,27]. Patients with greater confidence in their ability to manage their health condition were more likely to follow prescribed treatment regimens consistently. Similarly, adequate health literacy was found to enhance patients' understanding of hypertension management and improve adherence to antihypertensive medication. [26].

Treatment-related factors were another commonly reported determinant influencing medication adherence. The complexity of medication regimens, the number of prescribed drugs, and the presence of medication side effects were frequently associated with lower adherence rates among productive-age hypertensive patients. [10,21]. Patients who experienced adverse drug reactions or who were required to take multiple medications were more likely to demonstrate inconsistent adherence behaviors, highlighting the importance of simplified treatment regimens and effective medication management strategies.

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Table 1. Characteristics and synthesis of the included studies (n = 15).

No.	Title	Author	Year	Country	Design	Sample	Adherence Measure	Determinants	Key Findings
1.	Medication Adherence, Blood Pressure Control, Knowledge, Self-care, and Self-efficacy among Tunisian Hypertensive Patients	Fatma Turki, Imen Turki, Jihen Jedidi, Houyem Said	2021	Tunisia	Cross-sectional study	750 hypertensive patients in Tunisia	The adherence measure used in the study is the 6-item GERD scale, which categorizes adherence as high, moderate, or low based on binary responses to six questions.	- Number of antihypertensive pills per day - Side effects - Uncontrolled hypertension - Insufficient self-efficacy - Insufficient self-care maintenance - Socioeconomic factors (education level, socioeconomic status) - Disease-related factors (duration of hypertension, medical antecedents) - Therapy-related factors (number of pills, side effects) - Knowledge about hypertension - Self-efficacy in managing the disease	- A low and moderate level of medication adherence was observed in 83.2% of participants. - Uncontrolled blood pressure was detected in 73.1% of cases. - Only 11.5% of participants had a good level of knowledge about hypertension. - Inadequate self-care practices were common: 48.8% for maintenance, 48.8% for monitoring, and 83.9% for management. - Weak self-efficacy for managing hypertension was found in 42.1% of participants. - Determinants of low medication adherence included: number of antihypertensive pills/day, side effects, uncontrolled hypertension, insufficient self-efficacy, and insufficient self-care maintenance.
2.	Treatment satisfaction, medication adherence, and blood pressure control among adult Nigerians with essential hypertension	G. Iloh, A. Amadi	2017	Nigeria	Descriptive study	- Sample size: 140 adult hypertensive patients - Age range: 32 to 83 years - Mean age: 52 ± 7.4 years - Gender distribution: Male: 56 (40.0%), Female: 84 (60.0%) - Setting: Primary care clinic in Nigeria	Self-reported adherence to therapy using a pretested, interviewer-administered questionnaire over the previous 30 days.	Treatment satisfaction	- Hypertension treatment satisfaction rate: 78.6% - Medication adherence rate: 42.9% - Blood pressure control rate: 35.0% - Significant association between treatment satisfaction and medication adherence (P = 0.01) - Significant association between treatment satisfaction and blood pressure control (P = 0.031)
3.	Effect of Comprehensive Health Management on Medication Adherence and Healthy Lifestyle Behavior of Patients With Hypertension	Xinyuan Lu, Jiwei Wang, Sikun Chen, Lin Lv, Jinming Yu	2025	China	Cluster randomized trial	- Age: ≥ 40 years - Number of participants: 9204 - Condition: Uncontrolled hypertension	The adherence measure is the proportion of patients with good medication adherence, expressed as the percentage of participants who meet specified criteria. The specific	Comprehensive health management measures codeveloped by healthcare organizations, village doctors, and patients; adherence to ≥ 3 healthy lifestyle components; multidimensional health management measures	- Significantly higher medication adherence in the intervention group compared to the control group, with a 5.0% absolute difference. - Adherence to ≥ 3 healthy lifestyles was achieved by 45.8% in the intervention group versus 33.7% in controls, with a 12.1% between-group difference. - Hypertension control rates differed significantly

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							criteria for "good medication adherence" are not detailed in the abstract.		between groups, with a 19.2% absolute difference. - Comprehensive health management demonstrated superior medication adherence and healthier lifestyle behaviors compared to standard care.
4.	Effect of Patient-Centered Care on Medication Adherence among Hypertensive Patients attending General Outpatient Clinic at University of Abuja Teaching Hospital, Abuja, Nigeria	G. Bwala, N. Baamlong, L. Shedul, R. A. Abdulkareem, Yalma Ramsey Msheliza, Rebecca Nanna Ripiye	2020	Nigeria	Single-blinded randomized controlled trial	64 hypertensive adults	Morisky Medication Adherence Scale (MMAS-8)	Patient-centered care (PCC)	Patient-centered care significantly improved medication adherence among adult hypertensive patients, with adherence rates increasing from 15.6% to 75.0% in the intervention group compared to 25.0% to 37.5% in the control group over 12 weeks
5.	Effectiveness Of Counseling For Hypertensive Patients On Adherence And Blood Pressure Outcome In Primary Care Providers in Indonesia	S. Kristina, Pipit Puspita Dewi, Wenny Widiastuti	2019	Indonesia	Quasi-experiment	- Sample size: 150 patients - Age: Average age was 59 years - Gender: 66.7% women - Education: 93.3% up to senior high school - Employment: 70% not employed	Morisky Green Levine Scale (MGLS)	Not mentioned (the abstract does not explicitly identify determinants of medication adherence behavior)	- Medication adherence level improved significantly in the CHP group from 3.5 to 1.6 ($p<0.001$). - Mean SBP decreased by 8 mmHg in the CHP group compared to an increase of 5.3 mmHg in controls ($p<0.001$). - The majority of patients in the CHP group were satisfied with the program. - The CHP program was effective in improving medication adherence and blood pressure outcomes.
6.	The effect of a practice-based multicomponent intervention that includes health coaching on medication adherence and blood pressure control in rural primary care	Jia-Rong Wu, D. Cummings, Quefeng Li, A. Hinderliter, H. Bosworth, J. Tillman, D. DeWalt	2018	United States	- Study Type: Secondary data analysis - Setting: Rural primary care settings - Participants: 477 patients with hypertension - Intervention: Phone health-coaching component as part of a larger quality improvement intervention - Analysis: Linear mixed effects	- Total sample size: 477 patients - Age: 18 years and older - Location: Rural primary care settings in a rural county in North Carolina - Demographics: Predominantly female and black - Income: Majority reported an annual household income of <$40,000 - Clinical characteristics:	The adherence measure used in the study is the 8-item Morisky Medication Adherence Scale (MMAS-8).	- Medication side effects: Lower adherence in patients reporting side effects. - Race: Black patients had lower adherence rates. - Baseline medication adherence: Greater improvement in low adherence groups. - Association with blood pressure control: Adherence changes associated with diastolic BP reductions. -	The key findings of the study are that a multicomponent intervention, including health coaching, improved medication adherence and reduced diastolic blood pressure over time. Changes in medication adherence were significantly associated with reductions in diastolic blood pressure, particularly among patients with low baseline adherence. This suggests that health coaching can be an effective strategy in rural primary care settings to

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					modeling to explore changes in medication adherence and blood pressure over time - Focus: Association between changes in medication adherence and blood pressure	Uncontrolled hypertension with systolic BP ≥150 mm Hg		Coaching intervention: Small effect size on adherence.	enhance medication adherence and blood pressure control.
7.	Mobile phone-based interventions for improving adherence to medication prescribed for the primary prevention of cardiovascular disease in adults.	M. Palmer, Sharmani Barnard, P. Perel, C. Free	2017	Canada, Spain, South Africa, China	Randomised controlled trials (RCTs) of parallel group design with a minimum of one-year follow-up.	- Total participants: 2429 - Recruitment settings: Community-based primary care or outpatient clinics in high-income (Canada, Spain) and upper- to middle-income countries (South Africa, China) - Demographics: Adults aged 18 years and over prescribed medication for primary prevention of CVD - Follow-up duration: Minimum of one year	- Objective measures: LDL-cholesterol for statins, blood pressure for antihypertensive drugs, heart rate for atenolol, urinary 11-dehydrothromboxane B2 for antiplatelet effects. - Indirect measures: self-report, pill counts, medication event monitoring systems (MEMS), pharmacy prescription data.	- Poor provider-patient communication - Complex or confusing advice - Poor recall of information provided in consultations - Experiences of adverse effects - Lack of social support	- Low-quality evidence regarding the effectiveness of mobile phone-delivered interventions for improving medication adherence in primary prevention of CVD. - Some trials reported small benefits, while others found no effect. - Low-quality evidence suggests these interventions do not result in harm. - Uncertainty around the effectiveness of these interventions. - Ongoing trials may provide more precise estimates in the future.
8.	Drug Side Effect Symptoms and Adherence to Antihypertensive Medication.	Y. Tedla, L. Bautista	2016	United States	Longitudinal cohort study	- Sample size: 175 hypertensive patients - Mean age: 50 years - Gender distribution: 58% women - Recruitment: Clinics at the Department of Family Medicine, UW-Madison, and the Wisconsin Research and Education Network - Inclusion criteria: Essential hypertension, starting or restarting antihypertensive treatment	Pill count adherence ratio (PCAR) = (pills taken ÷ pills prescribed) × 100 ; participants considered non-adherent if PCAR < 80%	- Drug side effects - Number of side effects above the median (4 symptoms) - Genitourinary side effects (excessive urination, decrease in sexual drive) - Antihypertensive medication class - Number of antihypertensive medications - Comorbidity - Use of medications for other diseases - Age - Sex - Race	- Antihypertensive drug side effects are associated with lower medication adherence. - Only genitourinary symptoms, specifically excessive urination and a decrease in sexual drive, significantly predict lower adherence. - Individuals with more than four side effects have lower adherence and a higher risk of non-adherence.

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9.	Development and piloting of a highly tailored digital intervention to support adherence to antihypertensive medications as an adjunct to primary care consultations	A. Kassavou, Vikki Houghton, S. Edwards, James Brimicombe, Stephen Sutton	2019	United Kingdom	- Theoretical framework: Distinguishes between intentional non-adherence (INA) and non-intentional non-adherence (NINA) - Tailoring matrix: Includes theory-based questionnaire, algorithm, schedule, and message file - Behavior change techniques (BCTs): Used to address INA and NINA determinants - Tailoring process: Informed by participant characteristics, responses, and prescription plans - Steps: Systematic development, development of delivery mode and content, prototype development, refinement	- Sample size: 20 patients initially recruited, 18 provided informed consent, 17 completed the intervention. - Eligibility criteria: Diagnosis of HBP or T2DM, prescribed relevant medications for at least 3 months, poorly controlled blood pressure or glucose levels, aged 18 or older. - Demographics: Older adults with complex medication regimens (mean=6 tablets per day, SD=4.6).	- Definition: Taking at least 80% of prescribed tablets or having medications dispensed for at least 95% of the prescribed period. - Objective Measure: Medication collection data from practice dispensary records. - Additional Measures: Telephone log files and participants' inbound calls for engagement and impact. - Future Evaluation: Objective behavioral (medication event monitoring system) and clinical (systolic blood pressure, HbA1c) outcome measurements in an RCT.	- Proximal and modifiable determinants of adherence to medication - Participant's unique characteristics (e.g., name) - Responses to a tailoring questionnaire - Prescription plan - Social and environmental consequences	- The intervention was found to be acceptable and feasible for adults with high blood pressure or comorbidities. - The pilot study showed that the intervention increased awareness about medication adherence, reinforced social support and habit formation, and reminded patients to take medications as prescribed. - Participants found the intervention easy to use and provided feedback on its features and content. - The intervention is being further evaluated in a randomized controlled trial (RCT) to assess its efficacy.
10.	Specific hypertension smartphone application to improve medication adherence in hypertension: a cluster-randomized trial	E. Márquez Contreras, S. Márquez Rivero, E. Rodríguez García, L.; López-García-Ramos, José Carlos; Pastoriza Vilas, A.; Baldonedo Suárez, Carmen; Gracia Diez, V. G. Gil Guillén, N. Martell Claros	2018	Spain	Prospective, randomized controlled trial, multicenter study with two groups: control group and intervention group using a smartphone app; three visits over 12 months.	- Total participants: 154 - Control group: 77 - Intervention group: 77 - Mean age: 57.5 years - Participants: Hypertensive patients under antihypertensive treatment who own and regularly use a mobile smartphone	Electronic monitors (MEMSs)	The use of a smartphone application (app) to promote health education and reminders is a determinant of medication adherence behavior among hypertensive patients.	- The intervention with a smartphone app improved pharmacological therapeutic adherence and blood pressure control among hypertensive patients. - Daily adherence rates were significantly higher in the intervention group (93.15% and 86.3%) compared to the control group (70.66% and 62.66%) at 6 and 12 months. - Blood pressure control was better in the intervention group (17.8%) compared to the control

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									group (38.6%) at 12 months. - The number of patients needed to treat to avoid non-adherence was 4.23.
11.	Effectiveness of a Multifaceted Mobile Health Intervention (Multi-Aid-Package) in Medication Adherence and Treatment Outcomes Among Patients With Hypertension in a Low- to Middle-Income Country: Randomized Controlled Trial	Muhammad Arshed, Aidalina Mahmud, H. Minhat, P. Lim, R. Zakar	2023	Pakistan	- Study Design: Parallel, single-blinded, superiority, randomized controlled trial - Duration: Six months - Design Features: Two-arm parallel design, 1:1 random allocation to intervention and control groups - Sampling Method: Two-stage random sample procedure - Blinding: Research team blinded to group assignments - Outcomes: Primary - change in medication adherence; Secondary - change in systolic blood pressure	- Sample size: 439 participants - Study site: Public tertiary care hospital in Lahore, Pakistan - Eligibility criteria: Aged at least 18 years, diagnosed with hypertension, poor adherence to antihypertensive therapy, access to smartphones - Sampling procedure: Two-stage random sample - Response rate: 96.3% - Demographic and health-related characteristics: Detailed in tables	- Self-Efficacy for Appropriate Medication Adherence Scale (SEAMS) - Self-reported pill-counting method: pills consumed over a certain period divided by pills prescribed for that period	- Group allocation (intervention vs. control) - Time (baseline vs. 6 months) - Age (specifically, age group 18-29)	- The median SEAMS score was significantly higher in the intervention group compared to controls at 6 months. - There was a significant increase in adherent patients in the intervention group compared to controls. - SBP was significantly reduced in the intervention group compared to controls. - The number of patients with uncontrolled hypertension decreased significantly in the intervention group. - Group allocation, time, and age significantly contributed to medication adherence. - The Multi-Aid-Package intervention had a high acceptability score.
12.	Impact of adverse drug events and treatment satisfaction on patient adherence with antihypertensive medication – a study in ambulatory patients	D. F. Berhe, K. Taxis, F. Haaijer-Ruskamp, Afework Mulugeta, Y. Mengistu, J. Burgerhof, P. Mol	2017	Ethiopia	A cross-sectional study was conducted in six public hospitals in Ethiopia using a consecutive sampling technique.	- Sample size: 925 out of 968 patients - Population: Adult ambulatory patients on antihypertensive medication - Location: Six public hospitals in Ethiopia - Demographics: Mean age 57 years, 63% female - Health status: One-third with at least one comorbid illness, 38% with controlled blood pressure - Medications: Commonly	The adherence measure used in the study is the eight-point Morisky Medication Adherence Scale (MMAS-8), which categorizes adherence into low (0-5), medium (6-7), and high (8) levels.	- Patient characteristics - Socioeconomic status - Therapy conditions - Healthcare system factors - Adverse drug events (ADEs) - Treatment satisfaction - Duration of treatment - Type of medication (e.g., calcium channel blockers) - Alcohol use	- Experiencing more ADEs reduces adherence. - Higher treatment satisfaction increases adherence. - Taking medication for more than a year decreases adherence. - Use of calcium channel blockers decreases adherence. - Alcohol use is associated with lower adherence. - Only one in five patients reported high adherence.

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						prescribed ACE inhibitors, diuretics, calcium channel blockers, beta-blockers - Adherence levels: 42% low, 37% medium, 21% high - ADEs: 21% experienced ADEs, with dyspeptic symptoms, headache, cough being common			
13.	Health providers' communication skills training affects hypertension outcomes.	S. B. Tavakoly Sany, N. Peyman, Fatemeh Behzhad, H. Esmaeily, Ali Taghipoor, G. Ferns	2017	Iran	Randomized Controlled Trial (RCT)	- Health providers: 35 - Hypertensive patients: 240 - Demographics: - Female: 77.3% - Less than high school education: 80.3% - Married: 82.3% - Low income: 82.3% - Mean age: 37 years	Not mentioned (the abstract does not specify the exact measure or tool used to assess medication adherence)	- Communication skills of health providers - Health literacy - Patient communication skills - Self-efficacy	- Significant improvement in patient communication skills - Significant improvement in self-efficacy - Significant improvement in adherence to medication - Significant improvement in hypertension outcomes
14.	Patient Health Beliefs and Characteristics Predict Longitudinal Antihypertensive Medication Adherence in Adolescents With CKD	Cyd K. Eaton, M. Eakin, S. Coburn, Cozumel S. Pruette, T. Brady, B. Fivush, S. Mendley, S. Tuchman, K. Riekert	2018	United States	Longitudinal observational study with electronic monitoring of medication adherence and surveys to assess health beliefs and demographic risk factors over 24 months.	The sample consists of 114 adolescents diagnosed with chronic kidney disease (CKD), with a mean age of 15.03 years. The majority are male, African American, and have CKD stages 1-3. The sample is diverse in terms of gender, race, and socioeconomic status.	The adherence measure used in the study is electronic monitoring via the Medication Event Monitoring System (MEMS 6) TrackCap monitors, with adherence calculated as the percentage of doses taken relative to expected doses based on the prescribed regimen.	- Demographic determinants: Older age, female gender, African American race, lower family income (<$50,000), public health insurance - Health belief determinants: Self-efficacy, positive outcome expectancies, negative outcome expectancies	- Adherence pattern: Increased and then decreased over 2 years (inverted U-shape). - Demographic factors associated with lower adherence: Older age, female gender, African American race, lower family income (<$50,000), and public health insurance. - Primary demographic predictor: Family income (≥$50,000 associated with higher adherence). - Psychological predictors: Higher self-efficacy, more positive outcome expectancies, fewer negative outcome expectancies. - Lack of longitudinal association between perceived barriers and actual adherence.

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Healthcare system factors also played an important role in shaping adherence behaviors. Studies reported that effective communication between healthcare providers and patients, along with structured counseling and follow-up care, significantly improved medication adherence among individuals with hypertension. [28,29]. Patient-centered healthcare approaches and supportive clinical environments were associated with better adherence outcomes and improved blood pressure control.

In addition to individual and healthcare-related determinants, social support was identified as a key factor influencing adherence behavior. Patients who received emotional encouragement and practical assistance from family members or community networks were more likely to adhere to their medication regimens and maintain consistent treatment practices. [16]. Social support mechanisms were found to strengthen patient motivation and reinforce positive health behaviors related to long-term hypertension management.

Technological interventions were also highlighted in several studies as emerging strategies for improving medication adherence. Digital health approaches, including mobile health applications, electronic reminders, and text message–based interventions, have demonstrated promising outcomes in supporting medication management and improving adherence. [30,24,33]. These technology-based interventions were particularly useful in facilitating self-management and providing continuous support for hypertensive patients outside traditional healthcare settings. [31].

Overall, the evidence synthesized from the included studies indicates that medication adherence among productive-age hypertensive patients is influenced by a complex interplay of sociodemographic, psychological, treatment-related, healthcare system, social, and technological factors. Understanding these determinants is essential for developing comprehensive interventions to improve adherence and optimize hypertension management outcomes across diverse populations.

Discussion

This scoping review aimed to synthesize current evidence regarding the determinants of medication adherence among productive-age patients with hypertension. The findings indicate that medication adherence is influenced by a complex interaction of several factors, including sociodemographic characteristics, psychological determinants, treatment-related factors, healthcare system support, social support, and technological interventions. These findings highlight that adherence behavior among productive-age hypertensive patients is multidimensional and cannot be explained by a single determinant alone. Similar findings have been reported in previous studies, which show that multiple behavioral, social, and clinical factors shape adherence to antihypertensive medication. [32,33].

One of the major findings of this review is the influence of sociodemographic factors on medication adherence. Variables such as age, educational level, employment status, and socioeconomic conditions were frequently associated with adherence behavior. Patients with higher educational attainment and better economic resources were more likely to adhere to antihypertensive therapy than those with limited education and financial constraints. These findings are consistent with previous studies demonstrating that socioeconomic disparities significantly influence treatment adherence among individuals with chronic diseases, including hypertension. [34,35]. Limited access to healthcare services, financial barriers, and inadequate health education may contribute to reduced adherence among disadvantaged populations.

Psychological and cognitive determinants were also identified as important contributors to medication adherence. Factors such as self-efficacy, health beliefs, and health literacy were frequently associated with adherence behavior among productive-age hypertensive patients. Patients with greater confidence in their ability to manage their health condition were more likely to follow prescribed treatment regimens consistently. Self-efficacy has been widely recognized as an important factor influencing self-management behavior in chronic disease management. [36,37]. Furthermore, adequate health literacy may improve patients' understanding of long-term medication use and the risks associated with uncontrolled hypertension. Previous studies have demonstrated that patients with higher levels of health literacy are more likely to follow medication instructions and engage in effective self-care behaviors. [38,25].

Treatment-related factors also played an important role in medication adherence. Several studies reported that complex medication regimens, polypharmacy, and adverse drug reactions were associated with lower adherence levels. Patients who were required to take multiple medications or who experienced medication side effects were more likely to demonstrate inconsistent adherence behavior. Similar findings have been reported in previous studies, indicating that treatment complexity is one of the major barriers to

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medication adherence among patients with hypertension [32]. Simplification of treatment regimens, including fixed-dose combination therapy, has been suggested as an effective strategy to improve medication adherence [35].

Healthcare system factors were also found to influence adherence behavior significantly. Effective communication between healthcare providers and patients, structured counseling, and regular follow-up care were associated with improved medication adherence. Patient-centered care approaches, including shared decision-making and individualized education, may strengthen patient motivation to adhere to prescribed treatment. Previous studies have shown that strong patient–provider relationships and effective communication improve adherence behavior and health outcomes among individuals with chronic diseases. [33].

Social support also emerged as an important determinant influencing medication adherence. Patients who received emotional encouragement and practical assistance from family members or social networks were more likely to maintain consistent medication use. Social support may encourage patients to follow treatment recommendations, attend medical appointments, and maintain positive health behaviors. Previous evidence has shown that family and community support play a significant role in improving adherence to long-term treatment in chronic disease management. [39,37].

Another important finding from this review is the growing role of technological interventions in improving medication adherence. Digital health technologies such as mobile health applications, electronic reminders, and text message–based interventions have demonstrated promising outcomes in supporting medication management and improving adherence. These interventions may help patients remember medication schedules, monitor treatment progress, and maintain communication with healthcare providers. Recent studies have highlighted the potential of mobile health interventions in improving adherence to antihypertensive medication and blood pressure control. [30,40]. Overall, the findings of this scoping review suggest that medication adherence among productive-age hypertensive patients is influenced by a complex interplay of individual, treatment-related, healthcare system, social, and technological factors. Because adherence behavior is multidimensional, effective interventions should adopt comprehensive and integrated approaches. Strategies that focus on a single determinant may not be sufficient to improve adherence outcomes. Instead, interventions that combine patient education, psychological support, simplified treatment regimens, improved healthcare communication, and digital health technologies may provide more effective solutions to enhance medication adherence.

This review also has important implications for clinical practice and healthcare policy. Healthcare professionals, particularly nurses and primary care providers, play a critical role in improving medication adherence through patient education, counseling, and self-management support. Strengthening health literacy, improving self-efficacy, and providing continuous follow-up care may improve adherence behavior and ultimately contribute to better blood pressure control among productive-age hypertensive patients.

Despite its contributions, this review has several limitations. The included studies varied in study design, sample size, adherence measurement tools, and methodological quality, which may limit direct comparisons across studies. Although methodological quality appraisal was conducted using JBI Critical Appraisal Tools, several included studies demonstrated potential risks of bias, particularly related to cross-sectional designs and self-reported adherence measures. In addition, only English-language studies were included, which may introduce language bias. Most included studies also used cross-sectional designs, limiting the ability to establish causal relationships between determinants and medication adherence. Future research should focus on longitudinal and intervention-based studies to better understand causal relationships between determinants and medication adherence. Further investigation is also needed to evaluate the long-term effectiveness of digital health interventions and integrated care models in improving medication adherence among productive-age hypertensive patients across different healthcare settings.

Conclusions and Future Directions

This scoping review highlights that multiple interacting determinants, including sociodemographic characteristics, psychological factors, treatment-related factors, healthcare system support, social support, and technological interventions, influence medication adherence among productive-age patients with hypertension. These findings confirm that medication adherence is a multidimensional behavior requiring comprehensive, integrated strategies rather than single-factor interventions. Improving medication adherence among productive-age hypertensive patients requires interventions that strengthen patient education,

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enhance health literacy and self-efficacy, simplify treatment regimens, and promote effective communication between patients and healthcare providers. In addition, digital health technologies such as mobile health applications, electronic reminders, and telehealth-based interventions offer promising opportunities to support long-term medication adherence and improve hypertension management. The findings of this review also have important implications for clinical practice and primary healthcare services. Healthcare professionals, particularly nurses and primary care providers, should implement patient-centered approaches that integrate educational, behavioral, and technological strategies to improve adherence behavior among productive-age populations. Future research should focus on longitudinal and intervention-based studies to better understand the causal relationships between determinants and medication adherence behaviors. Further investigation is also needed to evaluate the long-term effectiveness of integrated and technology-based interventions in improving medication adherence among productive-age hypertensive patients across diverse healthcare settings.

Conflict of Interest

The authors declare that there is no conflict of interest.

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