Review Article

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Interventions to Improve Medication Adherence in Hypertensive Patients: A Bibliometric Analysis

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ABSTRACT

Background: Hypertension is the leading cause of cardiovascular disease, stroke, kidney disease, and global mortality. Adherence to medication is essential to control blood pressure in patients with hypertension. Therefore, effective interventions to improve medication adherence are essential. **Objective:** The purpose of this study was to identify interventions to improve hypertension treatment adherence by analysing network visualisation, overlay visualisation, and density visualisation on topics through bibliometric analysis. **Methods:** The data sources used in this study are based on online searches through dimensions. AI The literature search used stages following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. Articles published between 2022 and 2024. Field of study focuses on health science, health services, public health, nursing, and health systems. Accepted document types are articles. Research topics address interventions to improve hypertension treatment adherence, including digital technology, patient education, health literacy, psychological approaches, family participation, and health worker interventions. Articles were identified using the platform according to the main keywords: hypertension, interventions to improve, and medication adherence. Data were analysed using VOSviewer. **Results:** To improve hypertension medication adherence, healthcare providers need to improve patients' literacy and knowledge about their disease. The use of technologies such as mHealth, telemedicine, eHealth, text messaging, and WeChat has been shown to be effective in improving medication adherence. In addition, motivation and psychological services can also help improve medication adherence. Education and counselling from pharmacists, nurses, doctors, and community health workers, as well as telephone support, also play an important role. Family participation can further support the improvement of antihypertensive medication adherence. **Conclusion:** After identifying the clusters, the types of interventions that can improve hypertension treatment adherence are patient education and health literacy, use of technology, psychological approaches, health professional interventions, and family participation.

Keywords: Bibliometric; Hypertension; Interventions to Improve; Medication Adherence

INTRODUCTION

High blood pressure, or hypertension, is the leading cause of death globally and affects one in three adults. People often refer to hypertension as the "silent killer" due to its often asymptomatic nature and the fact that many people remain unaware of their condition (Babazadeh *et al*., 2024; WHO, 2023). Hypertension is a major modifiable risk factor for cardiovascular and cerebrovascular diseases (Boima *et al*., 2024; Brewer *et al*., 2023; Katz *et al*., 2024; Lobo *et al*., 2023; Martínez-Ibáñez *et al*., 2023; Persell *et al*., 2020; Yuting, Xiaodong, & Qun, 2023).

In addition to cardiovascular disease (CVD), uncontrolled hypertension can lead to kidney disease, cognitive impairment, and dementia (Boima *et al*., 2024; WHO, 2023). Other complications include stroke, cerebral infarction, cerebral haemorrhage, coronary heart disease, cardiomyopathy, peripheral vascular disease, renal failure, retinopathy, nephropathy, and neuropathy (Abegaz *et al*., 2017; Avegno *et al*., 2023;

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Babazadeh *et al*., 2024; Etminani *et al*., 2021; Kappes *et al*., 2023).

Approximately 1.28 billion people worldwide suffer from hypertension, with a prevalence of 31.1%, making it the second leading risk factor for death (Siopis *et al*., 2023; Abbas *et al*., 2024). In the past three decades, the number of adults aged 30–79 years with hypertension has doubled to an estimated 1.3 billion in 2019. Globally, 47% of women and 38% of men with hypertension are receiving treatment, but only about one in five are successfully controlling their blood pressure (WHO, 2023).

A person is diagnosed with hypertension if systolic blood pressure reaches ≥140 mmHg and/or diastolic ≥90 mmHg on two separate visits. Elevated blood pressure makes the heart pump harder, increasing the risk of damage to the brain, heart, and kidneys (WHO, 2023). Controlling blood pressure with medication can reduce the risk of premature death (Boima *et al*., 2024; Sarkar *et al*., 2024; WHO, 2023). If blood pressure is ≥160 mmHg systolic or ≥100 mmHg diastolic at two measurements in one day, antihypertensive medication should be started immediately. For blood pressure of 140-159 mmHg/90-99 mmHg, a follow-up visit 1-4 weeks later is required to confirm the diagnosis of hypertension (WHO, 2023).

A healthy diet low in sodium and potassium, along with proper medication, can prevent hypertension. Effective treatment can save lives and strengthen the healthcare system. Counselling on diet, physical activity, and other risk factors is important but should not delay pharmacological treatment. Support sodium reduction, potassium increase, alcohol and tobacco reduction, physical activity promotion, and air pollution reduction to prevent hypertension. A healthy diet, maintaining a healthy weight, and leading an active lifestyle can effectively manage hypertension and its complications.

Management of hypertension and its complications is costly and can lead to job loss, potentially leading to poverty (WHO, 2023). Adherence to medication is critical for successful treatment and health management (Abegaz *et al*., 2017; Donovan *et al*., 2022; Fallatah *et al*., 2023; Fuentes *et al*., 2022) as well as reducing risks and preventing health complications (Kassavou et al., 2020) (Gardezi *et al*., 2023). Most hypertensive patients are not adherent to antihypertensive treatment. (Z. Shen *et al.*, 2022). Non-adherence to treatment is the cause of uncontrolled blood pressure (Abegaz *et al*., 2017) thus increasing the risk of stroke due to hypertension (Desta *et al.*, 2022).

According to some literature, blood pressure treatment and control rates are low, especially in low- and middle-income countries, despite the availability of easily accessible antihypertensive drugs (Boima *et al*., 2024). Factors such as lack of health insurance, infrequent clinic visits, and treatment discontinuation when asymptomatic cause poor adherence (Pallangyo *et al.*, 2022; Tjandrarini *et al*., 2024). Non-adherence to treatment is a common problem, with an incidence rate of between 30% to 50% (Pan *et al*., 2023). Approximately 28% of new patients prescribed antihypertensive medication do not start treatment, and half of those who start quit within the first year (Dietrich *et al*., 2024).

Many patients do not adhere to the prescribed treatment regimen, which reduces its effectiveness, increases the risk of complications, and often requires additional consultations and hospitalisation. This phenomenon has been documented by Kassavou *et al*. (2020) and Pan *et al*. (2023). Poor adherence to treatment can increase the risk of cardiovascular events, renal problems, and microvascular damage, especially in patients with comorbidities. Factors such as patient condition, therapy, socioeconomic conditions, and other health conditions influence medication adherence (Kwakye *et al*., 2024).

Most hypertensive patients are asymptomatic, which may lead to reduced medication adherence. One important role for pharmacists is to address medication refusal during the dispensing process, potentially reducing unnecessary medication supply (Koya, 2024). In addition, side effects of antihypertensive drugs, such as frequent nighttime urination, may also reduce medication adherence (Dietrich *et al*., 2024). Self-management education for blood pressure control includes patient training, self-monitoring of clinical measurements, lifestyle modifications (healthy diet, physical activity, weight loss, smoking cessation, and alcohol reduction), and support for medication adherence (Boima *et al*., 2024).

Studies have shown that multidisciplinary, team-based care, including pharmacists, nurses, physicians, community health workers, counsellors, social workers, and dieticians, is effective in motivating patients to adhere to medication through counselling and education. Research has been conducted by Kwakkye *et al*. 2024

and the World Health Organization in 2023. In addition, collaborative care models involving community health workers are effective and cost-effective in improving hypertension control (WHO, 2023). Community health workers can provide education, medication administration, and blood pressure measurement and monitoring (WHO, 2023). Collaboration between pharmacists and patients reduces barriers to medication adherence, while the use of TEAM (Treatment Extension Adherence Management) tools can increase patient satisfaction with services from community pharmacists and pharmacy technicians (Svarstad, Brown & Shireman, 2022). Health coaching from a team of experts, either face-to-face or over the phone, can improve blood pressure control as well as self-care, such as medication use, low-salt diet, and weight management (Abbas *et al*., 2024).

Health literacy is an important component in managing hypertension and medication adherence (Babazadeh *et al*., 2024). Social support, including from family, positively influences medication literacy and adherence to hypertension treatment (Shen *et al.*, 2022; Guo *et al.*, 2023). Digital health technologies, such as mobile apps, have been shown to be effective in improving hypertension treatment (Lobo *et al*., 2023), especially in populations with limited access to medical care, given text messages to remind patients of medication adherence (Boima *et al*., 2024; Katz *et al*., 2024).

The use of medication reminder apps can improve patient compliance and prevent rehospitalisation (Poorcheraghi *et al*., 2023). Independent mHealth platforms are effective in improving blood pressure control, hypertension adherence, self-efficacy, and quality of life. Studies have shown that these platforms are safe and effective in improving adherence to hypertension treatment (Yuting, Xiaodong & Qun, 2023). Research on health interventions to improve hypertension treatment adherence is limited. Researchers need up-to-date information and the latest trends in this topic. Bibliometric analysis can help by providing information on subjects of interest through evaluation of published articles. No bibliometric analysis has examined publications on the combination of health interventions to improve hypertension treatment adherence. Therefore, this study aims to identify effective interventions by analysing network visualisations, overlays, and density in the topic through bibliometric analysis.

Ethical Consideration

The research method was carried out in accordance with the guidelines and regulations of the research protocol, which was approved by the health research ethics committee of the Bani Saleh College of Health Sciences, West Java, Indonesia with reference number EC.0483/KEPK/UNIV-BS/X/2024 on 1st October 2025.

METHODOLOGY

Bibliometrics, cybermetrics, informatics, scientometrics, and altmetrics are different methods of data analysis (Chellappandi & Vijayakumar, 2018). Bibliometric analysis, in particular, is effective for determining research trends by evaluating the distribution of papers, terms, and keywords (Murugesu, Khalid & Shareef, 2022). Library science also uses this method to assess research performance and evaluate the impact of research based on the number of citations received (Syros *et al*., 2022).

Data Source

The study's data sources originate from online searches conducted on dimensions.ai (Tjahjono *et al*., 2024). The search for literature review and meta-analysis (PRISMA) was conducted by Page et al. in 2021. The study adheres to the following inclusion criteria: 1) The study only includes articles that were published between the years 2022 and 2024. 2) The field of study focuses on health science, health services, public health, nursing, and health systems. 3) The accepted document types are articles. 4) Research topics address interventions to improve hypertension treatment adherence, including digital technology, patient education, health literacy, psychological approaches, family participation, and health worker interventions. The platform identified articles using the main keywords: hypertension, interventions to improve, and medication adherence. The exclusion criteria were: 1) articles published before 2022; 2) articles that are not relevant to the field of study; 3) includes non-articles such as books, technical reports, or other process documents; 4) articles dimensions.ai did not find or were irrelevant to the search keywords.

Selecting Data

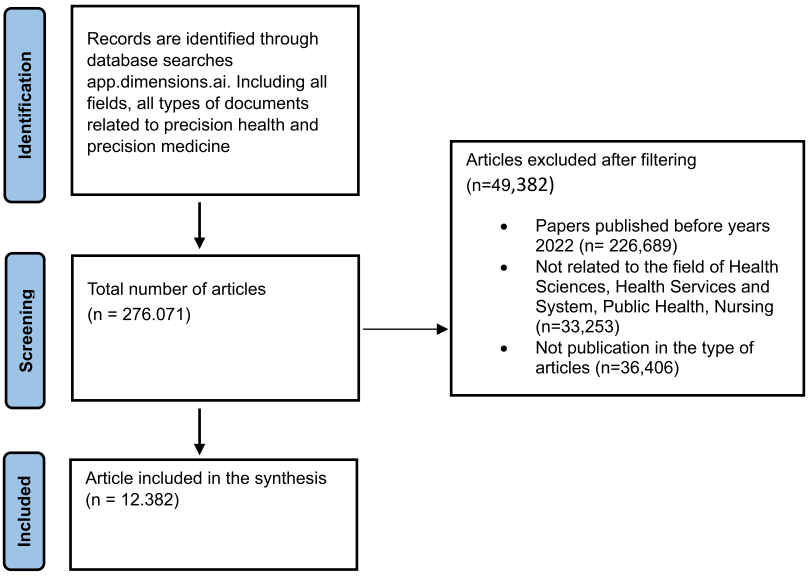
The stages in PRISMA include identification, screening, and inclusion, as shown in Figure 1. Stage 1 (identification) identified 49,382 records from dimension.ai, considering each of the primary search terms (Hypertension AND Interventions to Improve AND Medication Adherence), the "article and process document type," and all published data from 2022 to 2024. In phase 2 (refining), the "article title, abstract" option in each search term's column yielded results from the fields of Health Sciences, Health Services and System, Public Health, and Nursing. Phase 3 yielded 12,976 final papers.

Data Analysis

The data were analysed using VOSViewer. VOSviewer is a computer program for creating and viewing bibliometric maps. The type of analysis was chosen to create maps based on text data. Co-authors (Bukar *et al*., 2023) reviewed the analyses in this study.

The co-occurrence analysis procedure goes through the following steps: A data source is selected, and then the data is read from the reference manager file. Fields were selected from which titles and abstracts were extracted. The counting method chosen was full counting. A minimum number of occurrences of a term of 10 was chosen as the threshold. The number of terms selected is 133.

The counterpart analysis procedure goes through the following stages: selection of data types and creation of maps based on bibliographic data. The option to create a co-authorship map based on bibliographic data was selected. The data source is selected, and data from the reference manager file is read. The supported file type is ris. Analysis and counting type selected: the analysis type is co-authorship, and the counting method is full counting. Threshold selected: the maximum number of documents of an author is 2.



Source: (PRISMA)

Figure 1: PRISMA Flowchart

RESULTS

From the visualisation (Figure 2), 165 items were identified, which were divided into 7 clusters with a total number of links with a total link strength of 12,382. Based on the search results on VOSviewer indexed in 2022-2023, seven clusters were produced. The seven clusters are marked with the colour codes red, green, dark blue, yellow, light blue, purple, and brown. Each colour has an item that explains the keywords used in the papers referenced in the research. This makes it easier for readers to find information that is more specific and relevant to the topic they are researching, as in Figure 2.

Cluster one is marked in red and consists of twelve items, namely self-care, opportunity, information, chronic condition, mortality, literature, randomised controlled trial, control group, Medline, CINAHL, intervention group week, and adult patient. These terms indicate that improving hypertension compliance requires an approach that includes evidence-based education, self-care support, and organised interventions through randomised trials. Research using databases such as Medline and CINAHL can provide recommendations to improve the management of hypertension in adult patients.

Cluster two is marked in green colour, which consists of twelve items, namely meditation literacy, rehabilitation, breast cancer, resilience, mechanism, health literacy, quality of life (QoL), scale, social support, depression, anxiety, and stress. Hypertensive patients' adherence to medication can be improved through approaches that consider psychosocial factors, social support, and mental health. Providing effective education on health literacy and implementing techniques to manage stress, depression, and anxiety play an important role in improving adherence. Interventions that focus on improving patients' quality of life, taking into account mental resilience and social support, may result in more effective management of hypertension.

Cluster three is marked in dark blue and consists of fourteen items, namely healthcare practitioners (HCP), barrier, perception, elderly patient, hospital pharmacist, training, benefit, practice, use, theme, guideline, physician, community pharmacist, and incidence. Adherence to hypertension treatment requires an approach that includes the role of health practitioners, adequate training, and clear guidelines, along with social and medical support. Optimal hypertension management requires collaboration between doctors, nurses, hospital pharmacists, and community pharmacists, as well as a special focus on elderly patients who may face more challenges with their medication.

Cluster four is marked in yellow and consists of nine items, namely stage, polypharmacy, efficacy, baseline, sleep, predictor, clinic, hypertension, and fatigue. This cluster highlights the psychosocial aspects of health management.

Cluster five is marked in light blue and consists of eleven items, namely resident, trajectory, caregiver, dementia, program, home, multimorbidity, older adult, safety, perspective, and association. The combination of terms in the figure suggests that improving hypertension patient adherence requires a holistic approach. This involves the important role of caregivers, targeted education programs, support for patients with multimorbid conditions, and understanding the patient's views. In addition, community-based research and interventions can be an effective strategy to address barriers to adherence, especially for the elderly or patients with specific limitations.

Cluster five, which is highlighted in purple, comprises seven items: the month, the pharmacist, medication-related problems (MRP), pharmaceutical care, transition, ACS, clinical outcome, and readmission. A number of factors, including pharmaceutical interventions, MRP management, and patient education, influence the adherence to medication among hypertensive patients. Good adherence directly contributes to improved clinical outcomes, prevention of complications such as ACS, and reduced risk of readmission. Pharmacists have a crucial role in improving patient adherence through pharmacy services and managing transitions of care.

Cluster eight, which is coloured brown, comprises six items: breast cancer survivor, chronic obstructive pulmonary disease, belief, view, technology and feasibility. Although terms such as breast cancer survivorship or COPD (Chronic Obstructive Pulmonary Disease) do not have a direct link to hypertension, studies in these conditions provide valuable insights into factors that influence patient adherence to medication. Aspects such as beliefs, views, technology, and the feasibility of interventions have significant relevance for improving medication adherence in hypertensive patients. This emphasises the importance of a holistic approach that incorporates psychosocial and technological factors in the management of hypertension. After identifying the clusters, the types of interventions that improve medication adherence are digital health interventions, psychological approaches, health worker interventions, family participation, patient education, and health literacy.

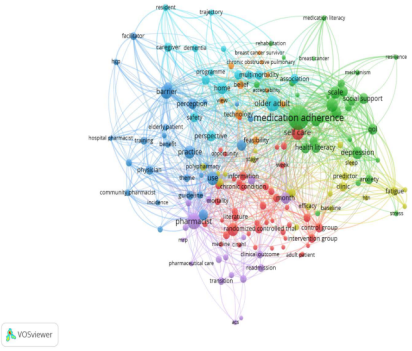


Figure 2: Network Visualisation

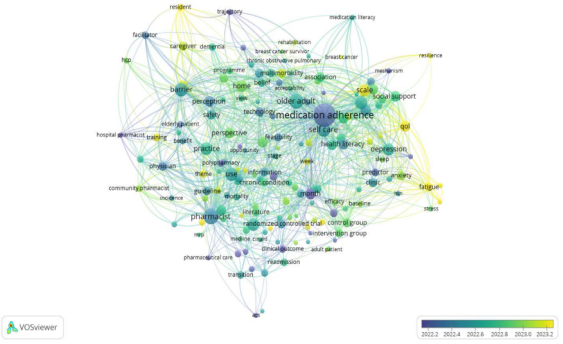


Figure 3: Visualisation of the Overlay

The overlay visualisation (Figure 3) shows that the latest topics in yellow are social support, scale, and resilience, highlighting that recent research has begun to emphasise social factors and scale measures of adherence. In addition, fatigue, stress, and quality of life (QoL) illustrate new trends in research into the influence of quality of life and mental health aspects on medication adherence. The use of technology indicates that it can support medication adherence. The old or frequently researched topics are pharmacist, guideline, and practice. Previous research has focused more on clinical aspects and the role of health professionals such as pharmacists in supporting adherence.

Early research also focused on patient barriers and perceptions of adherence. The thickness of the line indicates how often the keywords appear in each other in the same literature. For example, medication adherence is strongly linked to health literacy, social support, and self-care, showing the relationship between medication adherence and patients' ability to understand health information and social support. Pharmacists relate to guidelines and randomised controlled trials, signalling evidence-based research to improve health professional practice. Current research seems to focus more on a holistic approach, encompassing social, psychological, and quality-of-life aspects of patients.

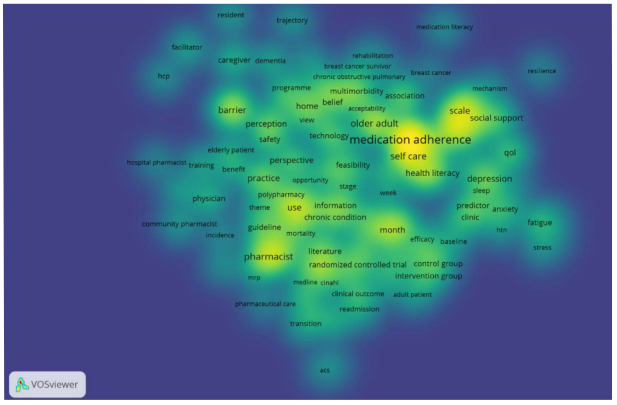


Figure 4: Density Visualisation

There is an increasing exploration of the role of technology, for example, in supporting self-care and health literacy. Factors such as resilience and scale show attention to the development of new measurement tools to evaluate medication adherence. Overall, this figure shows that research trends related to medication adherence have shifted from a focus on purely clinical approaches by healthcare professionals to a more holistic approach, encompassing technological, social, and psychological aspects. Recent studies have increasingly explored technology-based interventions and their impact on patients' quality of life.

Based on Figure 4, the main topic, the high-density barrier, focuses on factors that hinder adherence. Self-care relates to the patient's ability to manage their own health. Health literacy signifies the importance of patients' understanding of health information. Supporting topics (medium density) show that pharmacists and practice reflect the role of health workers, especially pharmacists, in supporting medication adherence. Depression, fatigue, and anxiety highlight psychological conditions that may affect medication adherence. Social support emphasises the role of family or community in helping patients.

Additional (low-density) topics, such as technology and intervention groups, show the exploration of technology-based interventions. Multimorbidity and chronic conditions indicate the clinical context, especially in patients with more than one health condition. The main focus is on factors that influence adherence (barriers, health literacy, and social support) and interventions that can improve adherence, including technology- and community- or clinically-based approaches.

DISCUSSION

This study focuses on identifying health interventions that can improve hypertension treatment adherence. Types of health interventions that can improve medication adherence include digital health interventions, patient education and health literacy, psychological approaches, health worker interventions, and family participation.

Digital Health Interventions

Digital health interventions have been shown to be effective in improving medication adherence in people with hypertension (Boima *et al*., 2024; Dietrich *et al*., 2024; Donovan *et al*., 2022; Velázquez Fuentes, Shah & Hale, 2022; Lobo *et al*., 2023; Ni *et al*., 2022). The WHO classifies these interventions as short message service (SMS), multimedia (MMS), interactive voice response, telephone calls, web-based telecare platforms, and smartphone applications (Boima *et al*., 2024). Web-based interventions utilise the internet to provide healthcare support and disseminate health information. Patient adherence to pharmacological therapy is improved by using medical devices such as alarms, electronic medication monitoring, and telehealth devices, as well as communication technologies such as computers, mobile phones, email, and text messaging (Bernardes *et al*., 2023).

The use of interactive voice response technology and two-way text messaging is effective in improving patient medication adherence (Donovan *et al*., 2022; Simon *et al.*, 2022). Although older than smartphone apps, these technologies are still useful, especially when internet access is limited. These digital communication technologies can be used to monitor medication-taking behaviour, obtain medication, conduct self-tests, and request support (Donovan *et al.*, 2022).

Two-way text messaging The Way to Health (WTH) platform uses two-way text messaging to encourage medication adherence in people with hypertension. The text message asks, "Did you take your medication today?" and prompts a response of "Yes." If answered "Yes," the system provides daily automated feedback to support adherence (Mehta *et al*., 2024). SMS messages also provide information on medication adherence and blood pressure, with 97% of people with hypertension preferring to receive these messages every three days (Nelson *et al*., 2022). In addition, mHealth apps on smartphones make it easy to monitor medication adherence with reminders and features personalised to the user (Lobo *et al*., 2023).

WeChat and Message Express mHealth interventions, which sent educational materials and medication reminders, also improved patient adherence (Li & Toh, 2023; Ni *et al.*, 2022). Research showed that at week 12, phone calls and text messages reminding hypertensive patients to take their prescribed medication improved adherence. These messages include the patient's name, drug name, dose, and time, as well as general information about hypertension, measuring, and recording blood pressure for three months (Kes & Polat, 2022). Yuting, Xiaodong and Qun (2023) found the mHealth platform to be safe and effective in improving hypertension

adherence. Mobile medication management apps with messaging, alarms, and reminder features help overcome forgetfulness, improve medication adherence, reduce side effects, and maximise disease management (Poorcheraghi *et al*., 2023).

AMoPac is an electronic adherence monitoring tool that helps detect problems, medication errors, and patient compliance by providing feedback from pharmacists, as well as reporting adherence with metrics that include clinical recommendations to general practitioners. This method measures medication-taking behaviours objectively, avoids manipulation, and helps pharmacists provide feedback to patients. Furthermore, Yilmaz *et al*. (2022) anticipate an increasing use of mobile eTansiyon in clinical practice, particularly for the treatment of hypertension, due to its effectiveness in monitoring hypertension and enhancing medication adherence.

Healthcare via telemedicine is particularly useful in remote areas with limited medical personnel and a lack of specialised care (Kappes *et al*., 2023). Technologies used in telehealth include smartphones, wireless devices, the internet, phone calls, email, and two-way video. Interventions such as fortnightly phone calls can improve hypertension treatment adherence (Avegno *et al.*, 2023). Telepharmacy, which involves the delivery of pharmaceutical services remotely by a licensed pharmacist, provides convenient access for both patients and pharmacists (Li *et al*., 2022; Mozu *et al*., 2023). Patients and healthcare workers reported that reminder cues were effective in improving medication adherence and clinic visits. To remember to take antihypertensive medication, patients often use mobile phone alarms or place a medicine box near the bed. In addition, health workers contacted patients the day before to remind them to visit the clinic (Kisigo *et al*., 2022).

Patient Education and Health Literacy

Medication adherence in patients with hypertension aims to effectively control blood pressure, improve quality of life, and reduce complications. Nurses, nurse managers, and other healthcare professionals play an important role in ensuring patients understand their health concerns (Al Ali & Telfah, 2023). Health education methods, such as educational interviews, physician advice, and mobile health content, can improve patient adherence (Kengne *et al*., 2024). Good education and counselling contribute to better adherence (Noreen *et al*., 2023).

Some patients believe that long-term use of antihypertensive drugs can be dangerous and cause side effects, leading them to opt for traditional medicine prepared by traditional healers. Lack of knowledge about the causes, symptoms, and treatment of hypertension makes patients attend the clinic less frequently and adhere to treatment. In contrast, patients who understand their disease attend the clinic more frequently and are more compliant with treatment. Three patients felt that taking medication for life was not beneficial and associated it with HIV treatment, resulting in reluctance to follow the monthly clinic schedule and medication adherence (Kisigo *et al*., 2022).

Nurses can improve hypertension treatment adherence by engaging patients in watching educational videos about stroke due to uncontrolled hypertension and the importance of regular treatment. In addition, nurses discuss culturally appropriate hypertension control strategies with patients, offering solutions to specific cultural issues. If the patient prefers herbal medicine to pharmacology, the nurse suggests strategies that combine the two and explains the benefits and how to balance the use of herbal and pharmacological medicines. The nurse also provides patients with the opportunity to ask questions and receive further explanations (Li & Toh, 2023). If healthcare providers include additional support programs in their standard of care, clinic attendance and treatment adherence will increase. Patients who successfully control their blood pressure can be an inspiration to their peers and help teach others about hypertension management (Kisigo *et al.*, 2022).

The mHealth education app can enhance health knowledge and medication adherence (Onakomaiya *et al*., 2022). This app provides educational materials on definition, classification, complications, treatment, hypertension measurement, and diet with programmed and sequential instructions and periodic evaluation. If the answer is incorrect, the material will return to the previous stage for relearning, thus improving the patient's health literacy. Five specialists, including health educators, doctors, nurses, and IT specialists, designed the materials using easy-to-understand language and visual materials like diagrams, illustrations, and charts. This educational program aims to improve the health literacy of patients with uncontrolled hypertension, thereby improving treatment adherence (Karami *et al*., 2023).

To improve medication adherence in hypertensive patients, nurses need to improve patients' health literacy and understanding of their disease (Al Ali & Telfah, 2023). Furthermore, Karami *et al*. (2023) recommend training health workers in the use of M-health to enhance individual health literacy (50).

Psychological Approach

Patients need to be reassured and motivated to form the habit of taking medication independently to improve adherence. In addition, they should actively monitor the health effects of their medication habits (Donovan *et al*., 2022). Motivational interviewing interventions, both brief and long-term, have been shown to be effective in improving medication adherence. Although results vary, this approach shows a promising positive impact on medication adherence, especially for patients with chronic diseases. Previous systematic reviews have shown that this method, which is patient-centred, can increase patient involvement in medication decision-making and help reduce fears and concerns related to medication use (Huang *et al*., 2023).

Health Worker Intervention

Interventions conducted by trained health workers, especially by health educators, community health workers (CHWs), medical assistants, and pharmacists, were found to be effective in improving medication adherence. The combination of mHealth tools and counselling by trained personnel tended to be more effective than the use of mHealth or counselling alone and had a positive impact on medication adherence and blood pressure control. Culturally and linguistically tailored interventions, such as the use of video storytelling, group presentations, and question-and-answer sessions, have also shown beneficial results (Onakomaiya *et al*., 2022).

The involvement of pharmacists is crucial in hypertension management. They analyse patients' prescriptions to identify medication problems and prescription errors and provide recommendations to improve medication adherence. Pharmacist visits to patients' homes help in assessing their medication consumption behaviour and adherence (Dietrich *et al*., 2024). Pharmacists provide clear instructions on medication management, check for adherence, and provide aids to adhere to treatment (Soubra & Elba, 2023). Educational interventions by pharmacists, both face-to-face and through mHealth technology, have been shown to be effective in improving patient adherence to antihypertensive medication. Clinical pharmacists can also play a role in supporting physicians in the treatment of hypertension (Mozu *et al*., 2023; Onakomaiya *et al*., 2022).

Nurse-led interventions were shown to be more effective in managing hypertension compared to conventional care. A reduction in systolic blood pressure (SBP) was noted within 6 months or less, while the impact on diastolic blood pressure (DBP) was not significant. The intervention was successful in improving patients' diets and physical activity, but the impact on smoking and alcohol consumption was variable. Evidence regarding its impact on patients' knowledge of hypertension and other risk factors is limited and needs further investigation. Nurse-led interventions can optimise hypertension management (Bulto et al., 2024). In addition, the majority of patients felt that specialist care improved clinic attendance and medication adherence. Adherence improvement strategies also need to involve traditional healers or educate them to support the adherence of hypertensive patients (Kisigo *et al*., 2022).

Family Participation

Previous studies have shown that lack of emotional and material support is a major barrier for hypertensive patients in attending clinics and adhering to treatment. Studies in Ethiopia and Nigeria revealed that lack of family support had a significant negative impact on adherence (Kisigo *et al*., 2022). In contrast, a study in Congo showed that patients who received family support, such as reminders to take medication, were more likely to be adherent to their antihypertensive therapy (Guo *et al*., 2023). Social support from family or caregivers, especially from spouses, including informational, emotional, financial, and care support, plays an important role in improving medication adherence in patients with hypertension (Shen *et al*., 2022).

Family, friends, colleagues, healthcare professionals, and organisations can provide significant social support, which has been shown to improve patients' quality of life and medication adherence (Al Ali & Telfah, 2023; Guo *et al*., 2023). Most patients reported that social support made it easier for them to attend clinics and adhere to medication. This support tends to be more available when patients can disclose their hypertensive condition to their family. Support from family often involves reminders to attend clinic and take medication, transport to the clinic, and financial and emotional support (Al Ali & Telfah, 2023). Patients who receive support

from friends and family tend to feel more confident and optimistic about their treatment. High social support is associated with better psychological health, which can improve medication adherence. Therefore, social support is essential to improve medication adherence in patients with hypertension (Guo *et al*., 2023).

Limitation

This article leverages dimensions.ai as its primary data source, providing valuable insights into digital technology interventions, patient education, psychological approaches, health workers, and family participation. However, future studies could benefit from incorporating additional data sources to capture a broader range of literature, particularly from resource-limited settings. Expanding the focus to include other intervention approaches and conducting field tests or practical analyses could provide more tailored insights into specific populations. Addressing implementation challenges, such as cultural, economic, and health system barriers, alongside exploring community-based and health policy interventions, offers significant opportunities for future research to enhance the applicability and impact of these findings.

CONCLUSION

Interventions that can improve hypertension treatment adherence include digital health interventions, patient education and health literacy, psychological approaches, interventions by health workers, and family participation. Future research needs to evaluate the effectiveness of interventions in rural areas or with limited health infrastructure, develop technological innovations such as AI-based applications, and assess the long-term impact of interventions to understand their sustainability and effectiveness on patient behaviour change. Multidisciplinary approaches, such as anthropology and health economics, are needed to identify contextual barriers, while customising interventions for the elderly or patients with multimorbidity may increase relevance. Social and cultural support of patients can be strengthened through community approaches, including involving community leaders. In addition, new measurement methods such as psychometric tools and sensor technology need to be developed to generate objective data, and comparisons between countries can provide greater global insight.

Conflict of Interest

The authors declare no conflict of interest in this study.

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REFERENCES

Abbas, S. M., Salama, H. M., Nour-Eldein, H., & Ahmed, H. A. S. (2024). Health coaching for hypertension control in primary care patients with uncontrolled hypertension in Egypt. *Journal of Family and Community Medicine, 31*(1), 16-24. https://doi.org/10.4103/jfcm.jfcm_174_23

Abegaz, T. M., Shehab, A., Gebreyohannes, E. A., Bhagavathula, A. S., & Elnour, A. A. (2017). Nonadherence to antihypertensive drugs: A systematic review and meta-analysis. *Medicine, 96*(4). https://doi.org/10.1097/MD.0000000000005641

Al Ali, N. M., & Telfah, R. K. (2023). The effect of health literacy in explaining medication adherence among patients with hypertension: A cross-sectional study of Syrian refugees in Jordan. *International Journal of Nursing Practice, 29*(3). https://doi.org/10.1111/ijn.13136

Avegno, K. S., Roberson, K. B., Onsomu, E. O., Edwards, M. F., Dean, E. L., & Bertoni, A. G. (2023). Evaluating a telephone and home blood pressure monitoring intervention to improve blood pressure control and self-care behaviors in adults with low-socioeconomic status. *International Journal of Environmental Research and Public Health, 20*(7). https://doi.org/10.3390/ijerph20075287

Babazadeh, T., Ranjbaran, S., Pourrazavi, S., Latifi, A., & Maleki Chollou, K. (2024). Impact of health literacy and

illness perception on medication adherence among older adults with hypertension in Iran: A cross-sectional study. *Frontiers in Public Health, 12*. https://doi.org/10.3389/fpubh.2024.1347180

Bernardes, M. L., Rosendo-Silva, B., Rosendo, I., & Monteiro-Soares, M. (2023). Web-based interventions to improve blood pressure control in patients with hypertension: a protocol for a systematic review. *BMJ Open, 13*(8). https://doi.org/10.1136/bmjopen-2022-067610

Boima, V., Doku, A., Agyekum, F., Tuglo, L. S., & Agyemang, C. (2024). Effectiveness of digital health interventions on blood pressure control, lifestyle behaviours and adherence to medication in patients with hypertension in low-income and middle-income countries: a systematic review and meta-analysis of randomised controlled trials. *EClinicalMedicine*, 69. https://doi.org/10.1016/j.eclinm.2024.102432

Brewer, L. C., Jones, C., Slusser, J. P., Pasha, M., Lalika, M., Chacon, M., Takawira, P., Shanedling, S., Erickson, P., Woods, C., Krogman, A., Ferdinand, D., Underwood, P., Cooper, L. A., Patten, C. A., & Hayes, S. N. (2023). mHealth Intervention for Promoting Hypertension Self-management Among African American Patients Receiving Care at a Community Health Center: Formative Evaluation of the FAITH! Hypertension App. *JMIR Formative Research, 7*. https://doi.org/10.2196/45061

Bukar, U. A., Sayeed, M. S., Razak, S. F. A., Yogarayan, S., Amodu, O. A., & Mahmood, R. A. R. (2023). A method for analyzing text using VOSviewer. *MethodsX, 11*. https://doi.org/10.1016/j.mex.2023.102339

Bulto, L. N., Roseleur, J., Noonan, S., Pinero de Plaza, M. A., Champion, S., Dafny, H. A., ... & Hendriks, J. M. (2024). Effectiveness of nurse-led interventions versus usual care to manage hypertension and lifestyle behaviour: Asystematic review and meta-analysis. *European Journal of Cardiovascular Nursing, 23*(1), 21-32. https://doi.org/10.1093/eurjcn/zvad040

Chellappandi, P., & Vijayakumar, C. S. (2018). Bibliometrics, Scientometrics, Webometrics/Cybermetrics, Informetrics and Altmetrics--An Emerging Field in Library and Information Science Research. *Shanlax International Journal of Education, 7*(1), 5-8. https://doi.org/http/doi.org/10.5281/zenodo.2529398

Desta, R., Blumrosen, C., Laferriere, H. E., Saluja, A., Bruce, M. A., Elasy, T. A., ... & Umeukeje, E. M. (2022). Interventions incorporating therapeutic alliance to improve medication adherence in black patients with diabetes, hypertension and kidney disease: A systematic review. *Patient Preference and Adherence, 16*, 3095-3110. https://doi.org/10.2147/ppa.s371162

Dietrich, F., Zeller, A., Hersberger, K. E., & Arnet, I. (2024). Adherence Monitoring Package (AMoPac) in patients suspected of non-response to antihypertensive treatment: Perceived usefulness by general practitioners. *BMJ Open Quality, 13*(1). https://doi.org/10.1136/bmjoq-2023-002451

Donovan, G., Hall, N., Ling, J., Smith, F., & Wilkes, S. (2022). Influencing medication taking behaviors using automated two-way digital communication: A narrative synthesis systematic review informed by the Behavior Change Wheel. *British Journal of Health Psychology, 27*(3), 861-890. https://doi.org/10.1111/bjhp.12580

Etminani, K., Göransson, C., Galozy, A., Pejner, M. N., & Nowaczyk, S. (2021). Improving medication adherence through adaptive digital interventions (imeda) in patients with hypertension: Protocol for an interrupted time series study. *JMIR Research Protocols, 10*(5). https://doi.org/10.2196/24494

Fallatah, M. S., Alghamdi, G. S., Alzahrani, A. A., Sadagah, M. M., & Alkharji, T. M. (2023). Insights Into Medication Adherence Among Patients with Chronic Diseases in Jeddah, Saudi Arabia: A Cross-Sectional Study. *Cureus, 15*(4). https://doi.org/10.7759/cureus.37592

Velázquez Fuentes, M. N., Shah, P., & Hale, G. M. (2022). Improving medication adherence in patients with hypertension through pharmacist-led telehealth services. *Journal of Telemedicine and Telecare, 28*(8), 613-617. https://doi.org/10.1177/1357633x221076719

Gardezi, S. K. M., Aitken, W. W., & Jilani, M. H. (2023). The Impact of Non-Adherence to Antihypertensive Drug

Therapy. *Healthcare, 11*(22). https://doi.org/10.3390/healthcare11222979

Guo, A., Jin, H., Mao, J., Zhu, W., Zhou, Y., Ge, X., & Yu, D. (2023). Impact of health literacy and social support on medication adherence in patients with hypertension: a cross-sectional community-based study. *BMC Cardiovascular Disorders, 23*(1), 93. https://doi.org/10.1186/s12872-023-03117-x

Huang, X., Xu, N., Wang, Y., Sun, Y., & Guo, A. (2023). The effects of motivational interviewing on hypertension management: a systematic review and meta-analysis. *Patient Education and Counseling, 112*. https://doi.org/10.1016/j.pec.2023.107760

Kappes, M., Espinoza, P., Jara, V., & Hall, A. (2023). Nurse-led telehealth intervention effectiveness on reducing hypertension: a systematic review. *BMC Nursing, 22*(1). https://doi.org/10.1186/s12912-022-01170-z

Karami, M., Ashtarian, H., Rajati, M., Hamzeh, B., & Rajati, F. (2023). The effect of health literacy intervention on adherence to medication of uncontrolled hypertensive patients using the M-health. *BMC Medical Informatics and Decision Making, 23*(1). https://doi.org/10.1186/s12911-023-02393-z

Kassavou, A., Mirzaei, V., Brimicombe, J., Edwards, S., Massou, E., Prevost, A. T., ... & Sutton, S. (2020). A highly tailored text and voice messaging intervention to improve medication adherence in patients with either or both hypertension and type 2 diabetes in a UK primary care setting: feasibility randomized controlled trial of clinical effectiveness. *Journal of Medical Internet Research, 2*2(5). https://doi.org/10.2196/16629

Katz, M. E., Mszar, R., Grimshaw, A. A., Gunderson, C. G., Onuma, O. K., Lu, Y., & Spatz, E. S. (2024). Digital health interventions for hypertension management in US populations experiencing health disparities: A systematic review and meta-analysis. *JAMA Network Open, 7*(2), 1-17. https://doi.org/10.1001/jamanetworkopen.2023.56070

Kengne, A. P., Brière, J. B., Gudiña, I. A., Jiang, X., Kodjamanova, P., Bennetts, L., & Khan, Z. M. (2024). The impact of non-pharmacological interventions on adherence to medication and persistence in dyslipidaemia and hypertension: A systematic review. *Expert Review of Pharmacoeconomics & Outcomes Research, 24*(7), 807–816. https://doi.org/10.1080/14737167.2024.2319598

Kes, D., & Polat, U. (2022). The effect of nurse-led telephone support on adherence to blood pressure control and drug treatment in individuals with primary hypertension: A randomized controlled study. *International Journal of Nursing Practice, 28*(3). https://doi.org/10.1111/ijn.12995

Kisigo, G. A., Mcharo, O. C., Robert, J. L., Peck, R. N., Sundararajan, R., & Okello, E. S. (2022). Understanding barriers and facilitators to clinic attendance and medication adherence among adults with hypertensive urgency in Tanzania. *PLOS Global Public Health, 2*(8). https://doi.org/10.1371/journal.pgph.0000919

Koya, S. N. M. M. (2024). Cardiovascular Medication Saving Activity during Dispensing Process at Specialist Clinic Pharmacy in Malaysia. *Malaysian Journal of Medical Research (MJMR), 8*(4), 9-19. https://doi.org/10.31674/mjmr.2024.v08i04.002

Kwakye, A. O., Kretchy, I. A., Peprah, P., & Mensah, K. B. (2024). Factors influencing medication adherence in co-morbid hypertension and diabetes patients: A scoping review. *Exploratory Research in Clinical and Social Pharmacy, 13*. https://doi.org/10.1016/j.rcsop.2024.100426

Li, W. W., & Toh, P. (2023). WeChat-based intervention for Chinese immigrants with hypertension: development and evaluation study. *Asian/Pacific Island Nursing Journal, 7*(1). https://doi.org/10.2196/45769

Li, X., Hu, J., Yao, Y., Zuo, C., Wang, Z., Li, X., & Lv, Q. (2022). Evaluation of pharmacist-led telemedicine medication management for hypertension established patients during COVID-19 pandemic: A pilot study. *Frontiers in Public Health, 10*. https://doi.org/10.3389/fpubh.2022.1091484

Lobo, E. H., Karmakar, C., Abdelrazek, M., Abawajy, J., Chow, C. K., Zhang, Y., ... & Islam, S. M. S. (2023). Design

and development of a smartphone app for hypertension management : An intervention mapping approach. *Frontiers in Public Health, 11*. https://doi.org/10.3389/fpubh.2023.1092755

Martínez-Ibáñez, P., Marco-Moreno, I., Peiró, S., Martínez-Ibáñez, L., Barreira-Franch, I., Bellot-Pujalte, L., ... & Sanfélix-Genovés, J. (2023). Home blood pressure self-monitoring plus self-titration of antihypertensive medication for poorly controlled hypertension in primary care: The ADAMPA randomized clinical trial. *Journal of General Internal Medicine, 38*(1), 81-89. https://doi.org/10.1007/s11606-022-07791-z

Mehta, S. J., Volpp, K. G., Troxel, A. B., Teel, J., Reitz, C. R., Purcell, A., ... & Asch, D. A. (2024). Remote Blood Pressure Monitoring with Social Support for Patients with Hypertension: A Randomized Clinical Trial. *JAMA Network Open, 7*(6). https://doi.org/10.1001/jamanetworkopen.2024.13515

Mozu, I. E., Marfo, A. F. A., Marfo, J. S., Adomako, N. O., Ayisi-Boateng, N. K., Boachie-Ansah, P., ... & Owusu-Daaku, F. T. (2023). Utilization of telepharmacy in the management of hypertension. *Exploratory Research in Clinical and Social Pharmacy, 12*. https://doi.org/10.1016/j.rcsop.2023.100381

Murugesu, G. V., Khalid, S. A., & Shareef, H. (2022). Bibliometric analysis on microbial fuel cell research trend in electronic engineering perspective. *ASEANA Science and Education Journal, 2*(2), 1-10. https://doi.org/10.53797/aseana.v2i2.1.2022

Nelson, L. A., Spieker, A. J., Kripalani, S., Rothman, R. L., Roumie, C. L., Coco, J., ... & McNaughton, C. D. (2022). User preferences for and engagement with text messages to support antihypertensive medication adherence: findings from a pilot study evaluating an emergency department-based behavioral intervention. *Patient Education and Counseling, 105*(6), 1606-1613. https://doi.org/10.1016/j.pec.2021.10.011

Ni, Z., Wu, B., Yang, Q., Yan, L. L., Liu, C., & Shaw, R. J. (2022). An mHealth intervention to improve medication adherence and health outcomes among patients with coronary heart disease: Randomized controlled trial. *Journal of Medical Internet Research, 24*(3). https://doi.org/10.2196/27202

Noreen, N., Bashir, F., Khan, A. W., Safi, M. M., Lashari, W. A., & Hering, D. (2023). Determinants of Adherence to Antihypertension Medications Among Patients at a Tertiary Care Hospital in Islamabad, Pakistan, 2019. *Preventing Chronic Disease, 20*, E42. 1–14. https://doi.org/10.5888/PCD20.220231

Onakomaiya, D., Cooper, C., Barber, A., Roberts, T., Gyamfi, J., Zanowiak, J., ... & Schoenthaler, A. (2022). Strategies to improve medication adherence and blood pressure among racial/ethnic minority populations: A scoping review of the literature from 2017 to 2021. *Current Hypertension Reports, 24*(12), 639-654. https://doi.org/10.1007/s11906-022-01224-2

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*. https://doi.org/10.1136/bmj.n71

Pallangyo, P., Komba, M., Mkojera, Z. S., Kisenge, P. R., Bhalia, S., Mayala, H., Kifai, E., Richard, M. K., Khanbhai, K., Wibonela, S., Millinga, J., Yeyeye, R., Njau, N. F., Odemary, T. K., & Janabi, M. (2022).Medication adherence and blood pressure control among hypertensive outpatients attending a tertiary cardiovascular hospital in Tanzania: A cross-sectional study. *Integrated Blood Pressure Control, 15*, 97–112. https://doi.org/10.2147/IBPC.S374674

Pan, Q., Zhang, C., Yao, L., Mai, C., Zhang, J., Zhang, Z., & Hu, J. (2023). Factors Influencing Medication Adherence in Elderly Patients with Hypertension: A Single Center Study in Western China. *Patient Preference and Adherence, 17*, 1679–1688. https://doi.org/10.2147/ppa.s418246

Persell, S. D., Peprah, Y. A., Lipiszko, D., Lee, J. Y., Li, J. J., Ciolino, J. D., ... & Sato, H. (2020). Effect of home blood pressure monitoring via a smartphone hypertension coaching application or tracking application on adults with uncontrolled hypertension: A randomized clinical trial. *JAMA Network Open, 3*(3), e200255-e200255.

https://doi.org/10.1001/jamanetworkopen.2020.0255

Poorcheraghi, H., Negarandeh, R., Pashaeypoor, S., & Jorian, J. (2023). Effect of using a mobile drug management application on medication adherence and hospital readmission among elderly patients with polypharmacy: a randomized controlled trial. *BMC Health Services Research, 23*(1), 1192. https://doi.org/10.1186/s12913-023-10177-4

Sarkar, A., Nwokocha, C., Nash, S. G., & Grigoryan, L. (2024). Empowering low-income patients with home blood pressure monitors to improve hypertension control. *The Journal of the American Board of Family Medicine, 37*(2), 187-195. https://doi.org/10.3122/jabfm.2023.230357r1

Shen, B., Guan, T., Du, X., Pei, C., Zhao, J., & Liu, Y. (2022). Medication adherence and perceived social support of hypertensive patients in China: a community-based survey study. *Patient Preference and Adherence, 16*, 1257–1268. https://doi.org/10.2147/PPA.S363148

Shen, Z., Ding, S., Shi, S., & Zhong, Z. (2022). Association between social support and medication literacy in older adults with hypertension. *Frontiers in Public Health, 10*. https://doi.org/10.3389/fpubh.2022.987526

Simon, E., Edwards, A. M., Sajatovic, M., Jain, N., Montoya, J. L., & Levin, J. B. (2022). Systematic Literature Review of Text Messaging Medication Adherence Promotion Interventions in People with Serious Mental Illness. *Psychiatric Services (Washington, DC), 73*(10). https://doi.org/10.1176/appi.ps.202100634

Siopis, G., Moschonis, G., Eweka, E., Jung, J., Kwasnicka, D., Asare, B. Y. A., ... & Bruka, L. (2023). Effectiveness, reach, uptake, and feasibility of digital health interventions for adults with hypertension: A systematic review and meta-analysis of randomised controlled trials. *The Lancet Digital Health, 5*(3). https://doi.org/10.1016/ s2589-7500(23)00002-x

Soubra, L., & Elba, G. (2023). Pharmacist role in hypertension management in the community setting: questionnaire development, validation, and application. *Patient Preference and Adherence, 17*, 351-367. https://doi.org/10.2147/PPA.S394855

Svarstad, B. L., Brown, R. L., & Shireman, T. I. (2022). A successful intervention to improve medication adherence in Black patients with hypertension: Mediation analysis of 28-site TEAM trial. *Journal of the American Pharmacists Association, 62*(3), 800-808. https://doi.org/10.1016/j.japh.2022.01.002

Syros, A., Perez, O. F., Luxenburg, D., Cohen, J. L., Swonger, R., & Huntley, S. (2022). The most influential studies concerning revision shoulder arthroplasty research. *Journal of Orthopaedics, 34*, 349-356. https://doi.org/10.1016/j.jor.2022.09.019

Tjahjono, B., Arfian, M. H., Hastuti, L., Ichwani, A., & Marini, D. (2024). Pelatihan Penggunaan Aplikasi Open-Source Dimensions AI Untuk Eksplorasi Data Literasi Reference Manager. *IKRA-ITH ABDIMAS, 8*(2), 308–315. https://doi.org/10.37817/ikra-ithabdimas.v8i2

Tjandrarini, D. H., Kristanti, D., Wurisastuti, T., Hidayangsih, P. S., Tuminah, S., Paramita, A., ... & Titaley, C. R. (2024). Pandemic Pressure: Changes in Hypertensive Management Adherence in Indonesia. *Asian Nursing Research, 18*(2), 134-140. https://doi.org/10.1016/j.anr.2024.04.005

World Health Organization. (2023). Global report on hypertension: The race against a silent killer. Geneva: World Health Organization. Retrieved from: https://www.who.int/publications/i/item/9789240081062 . Accessed on 10th January, 2024.

Yilmaz, E., Uzuner, A., Bajgora, M., Dogan, B., Altikardes, Z. A., Geris, B. K., & Akdeniz, E. (2022). Effect of eTansiyon smartphone application on hypertension control. *Primary Health Care Research & Development, 23*. https://doi.org/10.1017/s146342362100058x

Yuting, Z., Xiaodong, T., & Qun, W. (2023). Effectiveness of a mHealth intervention on hypertension control in a low-resource rural setting: A randomized clinical trial. *Frontiers in Public Health, 11*. https://doi.org/10.3389/ fpubh.2023.1049396