Media of Health Research

Vol. 4 No. 2, May 2026, pages: 247-262

e-ISSN 2987-7784

DOI: https://doi.org/10.70716/mohr.v4i2.530

Effectiveness of Digital Health Interventions on Clinical and Behavioral Outcomes in Hypertension Patients: A Systematic Review

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Article History

Manuscript submitted:
30 April 2026
Manuscript revised:
15 May 2026
Accepted for publication:
21 May 2026
Manuscript published:
28 May 2026

Keywords

blood pressure control;
mobile health;
telemedicine;
medication adherence;
quality of life

Abstract

Hypertension is a major risk factor for cardiovascular disease, yet blood pressure control remains suboptimal, especially in low- and middle-income countries. Digital health interventions (DHI) have been implemented to support hypertension management, although their effectiveness varies. This systematic review evaluated the effects of DHI on clinical and behavioral outcomes in adults with hypertension and identified the most effective type of intervention. Randomized controlled trials (RCTs) published between 2015 and 2025 were searched in PubMed, Scopus, and Google Scholar. Study selection followed the PRISMA guideline, and methodological quality was assessed using the Joanna Briggs Institute (JBI) tool. Fifteen RCTs met the inclusion criteria. Mobile-based interventions were the most frequently studied (8/15; 53.3%) and showed the most consistent benefits, including improved blood pressure control (80%), reductions in systolic (85.7%) and diastolic blood pressure (62.5%), and improvements in medication adherence (100%), self-care behavior (75%), and quality of life (100%). Telephone-based interventions (3/15; 20%) improved target blood pressure attainment and patient satisfaction, whereas web-based interventions (4/15; 26.7%) were generally less effective unless combined with telemedicine or clinical support. Overall, mobile-based DHI demonstrated the most consistent improvements in hypertension outcomes.

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How to Cite: Anggraini, T. D., Karuniawati, H., & Sulaiman, S. A. S. (2026). Effectiveness of Digital Health Interventions on Clinical and Behavioral Outcomes in Hypertension Patients: A Systematic Review. *Media of Health Research, 4*(2), 247-262. https://doi.org/10.70716/mohr.v4i2.530

Introduction

Hypertension, or high blood pressure, is one of the most prevalent public health problems worldwide. According to a recent World Health Organization (WHO) report, approximately 1.4 billion people aged 30–79 years live with hypertension, accounting for nearly one-third of the global population in this age group. Most individuals with hypertension live in low- and middle-income

countries, and around 600 million people are unaware of their condition because hypertension is often asymptomatic and therefore known as a “silent killer” (WHO, 2025b). The prevalence of hypertension in Indonesia continues to increase. According to the 2023 Indonesian Health Survey (SKI), hypertension affects 34.11% of the Indonesian population, making it one of the country’s most common chronic diseases (Kemenkes RI, 2023). High systolic blood pressure is estimated to account for around 69% of cardiovascular disease-related deaths, making hypertension a major risk factor for cardiovascular disease. According to the 2023 World Health Organization (WHO) hypertension profile for Indonesia, the prevalence of hypertension among individuals aged 30–79 years reached 40%, which is higher than the global prevalence of 32%. There are an estimated 51.3 million people with hypertension in Indonesia, and only 4% have controlled blood pressure. The report also indicates an increasing prevalence of uncontrolled hypertension in both men and women. WHO further projects that 1.3 million hypertension-related deaths could be prevented by 2040 through improved blood pressure control (WHO, 2023).

Poor adherence to antihypertensive therapy is a major contributor to inadequate blood pressure control. A study conducted in Surakarta showed that patient adherence was associated with successful blood pressure control (Mutmainah & Rahmawati, 2010). Several studies conducted in Indonesia have also shown that adherence to antihypertensive medication remains suboptimal in healthcare practice. Similar findings were reported among hypertensive outpatients in Karawang, where most patients were classified as having moderate (65.7%) and poor (29.2%) adherence (Mura et al., 2023). A systematic review by Yulianti et al. (2025) also found that interventions developed using a behavioral theory framework could improve medication adherence among patients with hypertension in primary care and community settings. However, the number of high-quality studies remains limited. These findings indicate that behavioral intervention strategies have the potential to improve outcomes in hypertension management. Therefore, innovative approaches are needed to improve medication adherence and patient engagement in long-term hypertension care (Yulianti et al., 2025).

With the rapid development of digital technology and the widespread use of telecommunication devices, digital health interventions (DHI) have emerged as a promising approach to support hypertension management. DHI includes various technologies such as mobile applications, text messaging, telemedicine, educational web-based platforms, and remote monitoring, all of which may improve patient participation in disease management (WHO, 2025a). Alfian and Wardati (2016) reported that simple digital technologies, such as SMS reminders and digital pillbox applications, can help improve medication adherence among patients with hypertension (Alfian & Wardati, 2016). The World Health Organization (WHO) has also acknowledged the important role of digital technologies in strengthening health systems and has issued recommendations for their implementation in healthcare settings (WHO, 2019). Several studies have suggested that digital health interventions may improve medication adherence, blood pressure monitoring, and health-related behavior change among patients with hypertension. However, their effectiveness varies depending on the type of technology and the implementation context (Xiong et al., 2023). Boima et al. (2024) further reported that digital interventions may reduce blood pressure, improve medication adherence, and support positive health behavior changes. Increased access to digital technology and mobile devices creates opportunities for greater patient engagement, continuous monitoring outside healthcare facilities, and more personalized disease management. However, there is limited evidence comparing the effectiveness of different types of DHI, such as mobile-, telephone-, and web-based interventions, because most existing studies evaluate only one type of digital intervention. This highlights the need for a systematic review to synthesize the available evidence. This systematic review aims to synthesize current evidence on the effects of different types of digital health interventions (DHIs) on blood pressure control and behavioral outcomes related to hypertension management in adults. It

also seeks to identify intervention characteristics associated with better outcomes in order to support the development of more effective hypertension management strategies in the digital health era.

Materials and Methods

Article Searching Strategies

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. To identify relevant studies, the search strategy combined keywords from article titles and abstracts. Literature searches were conducted in three electronic databases, namely PubMed, Scopus, and Google Scholar, for articles published between 2015 and 2025. Keywords were used to identify articles related to hypertension, digital health interventions, and clinical and behavioral outcomes. The search strategies used in each database are presented below:

Keyword Pubmed

> (((((Hypertension[Title]) OR (High Blood Pressure[Title])) OR (Essential hypertension[Title])) OR (arterial hypertension[Title])) OR (blood pressure elevation[Title])) AND ((((((((((((Digital Application[Title]) OR (Mobile Applications[Title])) OR (Digital Technology[Title])) OR (Internet-based intervention[Title])) OR (Telemedicine[Title])) OR (mHealth[Title])) OR (mobile health[Title])) OR (eHealth[Title])) OR (telecare[Title])) OR (digital health intervention[Title])) OR (mobile-based intervention[Title])) OR (web-based intervention[Title])) OR (telephone-based intervention[Title])) OR (telemonitoring[Title]))

Keyword Scopus

> (TITLE(Hypertension) AND TITLE(Digital Health Intervention) OR TITLE(Mobile based intervention) OR TITLE(web based intervention) OR TITLE(telephone based intervention))

Keyword Google Scholar

> "hypertension" AND "digital health intervention" AND "clinical outcome"

Article Criteria

Articles were included in this systematic review if they met the following criteria: (1) written in English or Indonesian; (2) evaluated digital health interventions; (3) used a randomized controlled trial (RCT) design; (4) reported measurable therapeutic outcomes; and (5) involved adults with hypertension without major comorbidities that could affect outcome assessment. Articles published between 2015 and 2025 were included in the selection process.

Studies Selection Process

The researchers screened the titles and abstracts of articles identified through the keyword search. The next stage involved data extraction using Microsoft Excel, based on the study design, type of digital health intervention, number of participants, intervention duration, analytical methods, and outcomes reported in both the intervention and control groups. Each article was then reviewed in full text before the final selection of studies included in this review was determined.

Assessing the Quality of Articles

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Randomized Controlled Trials (Tufanaru et al., 2020).

Results and Discussions

Literature Search and Selection Process

Figure 1 illustrates the study selection process using a PRISMA flow diagram. A total of 381 records were identified through PubMed, Scopus, and Google Scholar. After duplicates were removed, the remaining records were screened by title and abstract. A total of 216 full-text articles were assessed for eligibility. Finally, 15 studies met the inclusion criteria and were included in the final analysis after 201 full-text articles were excluded.

Characteristics of the Studies

Table I summarizes the characteristics of the 15 studies included in this review. Most studies were conducted in China (n = 5) (Gong et al., 2020; F. Liu et al., 2023; Wang et al., 2023; Yuting et al., 2023; H. Zhou et al., 2022), followed by the United States (n = 2) (Margolis et al., 2020; Prendergast et al., 2025) and Japan (n = 2) (Nishizaki et al., 2023; Yatabe et al., 2021). The remaining studies were conducted in Indonesia (n = 1) (Widyastuti et al., 2025), Pakistan (n = 1) (Arshed et al., 2024), Bangladesh (n = 1) (Jahan et al., 2020), Sweden (n = 1) (Hermansson-Borrebaeck et al., 2025), Spain (n = 1) (Múzquiz-Barberá et al., 2023), and Finland (n = 1) (Lisón et al., 2020). Sample sizes ranged from 64 to 4118 participants. The identified digital health interventions included mobile-based (n = 8; 53.33%), web-based (n = 4; 26.67%), and telephone-based (n = 3; 20%). Intervention duration ranged from 3 to 12 months. Physicians were the most common providers of the interventions (n = 6; 40%), followed by collaborative care involving pharmacists with physicians or nurses (n = 2; 13.33%), while pharmacist-led interventions were reported in one study (6.67%). Blood pressure outcomes, including blood pressure control rate, systolic blood pressure, and diastolic blood pressure, were the most frequently assessed outcomes and were reported in 14 studies, except for one study (Margolis et al., 2020). In addition, 26 other outcome types were reported across the included studies. The most frequently reported were quality of life (including psychological outcomes) (n = 7), self-care (including patient adherence and knowledge) (n = 7), body composition (n = 5), self-efficacy (n = 3), medication adherence (n = 2), and cardiovascular risk (n = 1). Tables I and II present a detailed summary of the characteristics, intervention components, follow-up periods, and main findings of the included studies.

Type of Digital Health Intervention (DHI)

This review found that digital health interventions (DHIs) improved hypertension management, with the most consistent effects observed in mobile-based interventions. Clinical outcomes, particularly blood pressure-related measures, improved more consistently than behavioral and psychosocial outcomes, although the latter also showed meaningful benefits in several studies.

Among the three main DHI categories, mobile-based interventions were the most consistent in improving hypertension outcomes. These interventions were associated with achieving blood pressure targets (80%), reductions in systolic (85.7%) and diastolic blood pressure (62.5%), improved medication adherence (100%), enhanced self-care behaviors (75%), and improved quality of life (100%). Common features of mobile-based interventions included medication reminders (Arshed et al., 2024; Gong et al., 2020; Jahan et al., 2020; F. Liu et al., 2023; Prendergast et al., 2025; Yuting et al., 2023), self-monitoring of blood pressure (Arshed et al., 2024; F. Liu et al., 2023; Prendergast et al., 2025; Wang et al., 2023; Widyastuti et al., 2025), digital education on antihypertensive therapy and lifestyle management (Arshed et al., 2024; Gong et al., 2020; Jahan et al., 2020; F. Liu et al., 2023; Prendergast et al., 2025; Wang et al., 2023; Widyastuti et al., 2025; Yuting et al., 2023), and motivational or psychological support (Jahan et al., 2020; Prendergast et al., 2025; Wang et al., 2023; Yuting et al., 2023). This pattern suggests that mobile-based interventions are

effective not only because they are digital, but also because they combine several self-management functions within a single platform.

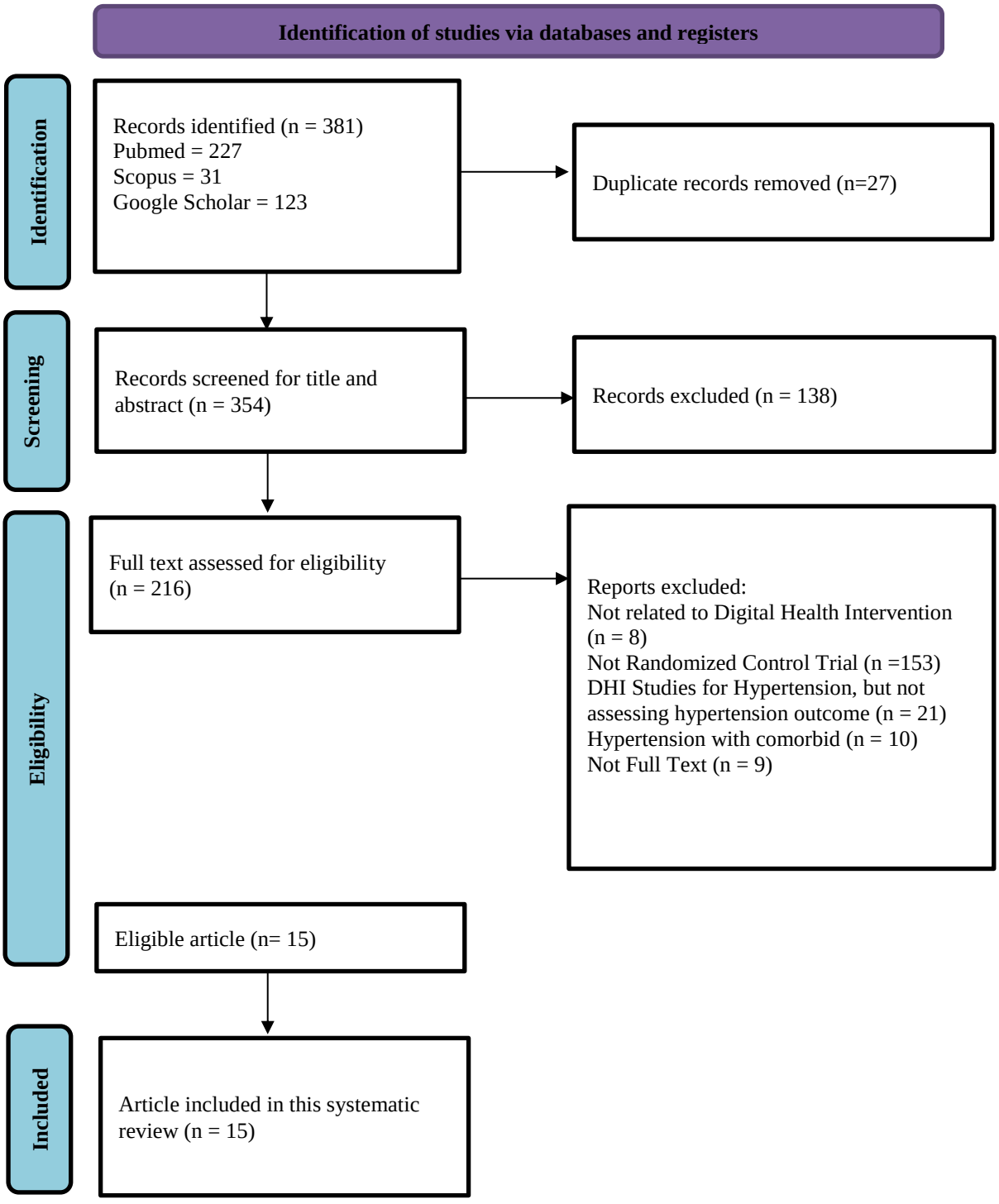

Figure 1. PRISMA flow diagram of the study selection process

Table 1
General Characteristics of the Studies

No	Author (Year)	Setting	Country	Participants	Design	Outcomes
1	Jahan et al. (2020)	Tertiary hospital	Bangladesh	Adults ≥35 years; rural/community; low education; phone access; eligible for follow-up	RCT	BP (SBP/DBP), behavior change, urinary salt, QoL
2	Margolis et al. (2020)	16 primary care clinics	USA	Adults with uncontrolled hypertension (standardized automated BP)	Cluster RCT	Cardiovascular events; costs
3	Nishizaki et al. (2023)	8 clinics	Japan	Adults with essential hypertension receiving/starting outpatient telemedicine, stable treatment.	Cluster RCT	SBP/DBP, continuation rate, patient satisfaction, QoL, direct/indirect/societal costs
4	Zhou H. et al. (2022)	66 community health centers	China	Adults with hypertension (SBP/DBP ≥140/90 or on antihypertensives); consented.	Cluster RCT	BP control rate, SBP, DBP
5	Arshed et al. (2024)	Hospital	Pakistan	Adults with hypertension and poor medication adherence	RCT	SBP/DBP reduction, BP control rate, medication adherence (SEAMS; pill count)
6	Yuting et al. (2023)	6 primary care centers	China	Adults >40 years with hypertension; cognitively intact; able to communicate	RCT	BP, waist/hip circumference, hypertension compliance, self-efficacy, QoL
7	Widyastuti et al. (2025)	1 hospital + 2 health centers	Indonesia	Adults 18–60 years with hypertension; smartphone users; BP ≥140/90	2-arm RCT	SBP/DBP, self-care, self-efficacy, motivation, knowledge

8	J et al. (2021)	University clinic + private clinics	Japan	Adults >20 years with elevated BP; able to self-measure home BP; telemedicine care	RCT	Home SBP/DBP, BP control rate, BMI
9	Wang et al. (2023)	Hospital	China	Adults 20–80 years, newly diagnosed essential hypertension; smartphone users	RCT	Office & home SBP/DBP, BP control rate, QoL (SAS/SDS/PSQI)
10	Liu F. et al. (2023)	Hospital	China	Adults 18–80 years with primary hypertension; on antihypertensives >1 month; smartphone users	RCT	BP control rate, SBP/DBP, knowledge, lifestyle score, BMI
11	Prendergast et al. (2025)	Hospital (ED)	USA (Chicago)	Adults 18–75 years; elevated ED BP; English/Spanish speakers; ED discharge	2-arm RCT	SBP/DBP, BP control rate, follow-up completion
12	Lisón et al. (2020)	Hospital	Finland	Adults 18–65 years with hypertension and overweight/obesity	RCT	SBP/DBP change, physical activity, functional capacity, BMI, body fat mass, glucose
13	Gong et al. (2020)	Hospital	China	Adults 18–79 years with primary hypertension; smartphone users; adequate literacy	RCT	SBP/DBP, BP control rate, medication adherence
14	Hermansson-Borrebaeck et al. (2025)	31 primary health care sites	Sweden	Adults with hypertension on ≥1 antihypertensive; Swedish-speaking	RCT	Self-efficacy (GSE)
15	Múzquiz-Barberá et al. (2023)	Hospital	Spain	Adults 18–75 years with hypertension and overweight/obesity; specialist care	RCT	SBP/DBP, BMI, physical activity level, QoL

Table 2

Main Findings of the Studies

No	Author (Year)	DHI type	Feature codes	I / C (n; mean age; % female)	Provider	Follow-up	Statistical analysis	Main findings
1	Jahan et al. (2020)	Mobile (SMS)	E+R+PS	I: 209; 46.4; 88% / C: 211; 47.8; 83.9%	CHWs	5 mo	χ^2; ANOVA	SBP↓ (p=0.04), DBP↓ (p=0.02); behavior change↑ (salt intake p=0.04; PA p=0.03); urinary salt↓ (p=0.01); QoL↑ (p<0.001).
2	Margolis et al. (2020)	Telephone (telemonitoring)	SM+FB+TC+MM	I: 228; 62; 45.2% / C: 222; 60.2; 44.1%	Pharmacist (TI); PCP (UC)	12 mo	Logistic regression	CV events↓ vs UC (15 vs 26); ~51% lower CV event likelihood; cost lower in TI ($2,772 vs $5,721 per patient).
3	Nishizaki et al. (2023)	Telephone (video telemedicine)	SM+TC+MM	I: 31; 51.5; 54.8% / C: 33; 57.2; 66.7%	Physicians	6 mo	LMM; t-test	SBP non-inferior (Δ 1.18 mmHg; 90% CI −3.68 to 6.04); DBP target attainment better (p<0.001); satisfaction↑ (p=0.01; p=0.04); QoL ↔; costs ↔.
4	Zhou H. et al. (2022)	Web + telemedicine	E+SM+FB+TC+MM	I: 2985; 61.6; 55.4% / C: 1133; 61.6; 53.8%	PCP	12 mo	Mixed-effects logit	BP control↑ (47.4% vs 30.2%; OR 1.18; 95% CI 1.13–1.24; p<0.001); SBP/DBP improved (p<0.001).
5	Arshed et al. (2024)	Mobile (multicomponent)	E+R+SM	I: 220; NA; 41.4% / C: 219; NA; 36.5%	Physicians	6 mo	Mann–Whitney; χ^2	SBP↓ more in I vs C (14.01 vs 4.75 mmHg; p<0.001); DBP↓ (p=0.001); BP control↑ (p<0.001); adherence↑ (SEAMS p<0.001; pill count p<0.001).

6	Yuting et al. (2023)	Mobile (app)	E+R+SM+FB+TC +PS	I: 66; 61.37; 31.82% / C: 68; 62.09; 44.12%	Pharmacist	12 wk	Univariate linear regression	SBP improved (p=0.012), DBP ↔; waist circumference improved (p<0.01); compliance↑ (p<0.01); self-efficacy↑ (p<0.01); QoL↑ (p<0.01).
7	Widyastuti et al. (2025)	Mobile (MaRiTensi)	E+R+SM+PS	I: 50; 46.98; 66% / C: 49; 48.98; 75.5%	Research team	6 & 12 wk	MW; t-test	6 wk: SBP/DBP↓ (p=0.039/0.009); self-care↑ (p=0.005); self-efficacy↑ (p=0.011); motivation↑ (p=0.026). 12 wk: self-care↑ (p=0.024); SBP/DBP ↔.
8	Yatabe et al. (2021)	Telephone (telemedicine)	SM+TC+MM	I: 49; 53; 57% / C: 48; 53; 63%	Physicians	12 mo	t-test	Home SBP↓ (p=0.02); home DBP ↔; BP control↑ (85.4% vs 70%; p=0.01); BMI ↔.
9	Wang et al. (2023)	Mobile (WeChat)	E+R+SM+FB+GS +PS	I: 88; 50.90; 46.6% / C: 87; 50.70; 46%	Cardiologists	6 mo	t-test; χ^2; MW	Office & home BP↓ (p≤0.008); BP control↑ (p=0.007–0.008); QoL scores improved (p<0.001).
10	Liu F. et al. (2023)	Mobile (mHealth app) ± provider portal	E+R+SM+FB+TC	I: 148; 48.58; 47.3% / C: 149; 50.64; 53%	Nurse	6 mo	χ^2; t-test	BP control↑ (p<0.001); SBP↓ (p<0.001); DBP↓ (p=0.01); knowledge↑ (p<0.001); BMI↓ (p=0.002); lifestyle score ↔.
11	Prendergast et al. (2025)	Mobile	E+R+SM	I: 289; 50.3; 55.7% / C: 285; 51.9; 56.8%	Clinical pharmacist; APN	6 mo	Linear regression; χ^2	SBP↓ (p=0.02); DBP ↔; BP control ↔; follow-up completion ↔.

12	Lisón et al. (2020)	Web (internet-based)	E+SM+FB	I: 55; 54.9; NA / C: 50; 51.4; NA	Univ. eHealth/psych team	12 mo	t-test; Wilcoxon	SBP ↔; DBP ↔ (trend p=0.05); DBP reduction from baseline significant (p=0.03); BMI↓ (p=0.005); body fat mass↓ (p<0.001); glucose↓ (p=0.04); PA ↔.
13	Gong et al. (2020)	Mobile (app)	E+R+SM	I: 225; 58.20; 44% / C: 218; 59.27; 47%	Trained investigators	6 mo	t-test; χ^2	SBP/DBP improved (p≈0.00); BP control↑ (p=0.011); adherence improved in low-adherence subgroup (p=0.004).
14	Hermansson-Borrebaeck et al. (2025)	Web (eHealth self-management)	E+PS	I: 442; 62.60; 42.2% / C: 420; 62.80; 44%	Physician; nurse	8 wk & 12 mo	Paired t-test	Self-efficacy↑ at 8 wk (p=0.042); no difference at 12 mo (p=0.171); control group ↔.
15	Múzquiz-Barberá et al. (2023)	Web (lifestyle)	E+SM+PS+FB	I: 70; 56.2; 45.71% / C: 62; 57.7; 45.16%	Physicians	12 wk	Mixed-ANCOVA	SBP/DBP ↔; BMI ↔; PA ↔; QoL ↔ (all p>0.10).

Abbreviations: BP=blood pressure; SBP=systolic BP; DBP=diastolic BP; QoL=quality of life; PA=physical activity; CHWs=community health workers; PCP=primary care physician; MW=Mann–Whitney.

Feature codes:

E = education; **R** = reminders; **SM** = self-monitoring (blood pressure); **FB** = clinical feedback; **TC** = teleconsultation (phone/video); **MM** = medication management/titration; **PS** = motivational/psychological support; **GS** = group support/chat group.

Table 3
Assessment of the quality of articles included in the systematic review

Study	Design	JBI Score	Quality
(Jahan et al., 2020)	RCT	10/13	High
(Margolis et al., 2020)	RCT	11/13	High
(Nishizaki et al., 2023)	RCT	8/13	Moderate
(H. Zhou et al., 2022)	RCT	7/13	Moderate
(Arshed et al., 2024)	RCT	12/13	High
(Yuting et al., 2023)	RCT	12/13	High
(Widyastuti et al., 2025)	RCT	10/13	High
(Yatabe et al., 2021)	RCT	8/13	Moderate
(Wang et al., 2023)	RCT	8/13	Moderate
(F. Liu et al., 2023)	RCT	10/13	High
(Prendergast et al., 2025)	RCT	10/13	High
(Lisón et al., 2020)	RCT	12/13	High
(Gong et al., 2020)	RCT	8/13	Moderate
(Hermansson-Borrebaeck et al., 2025)	RCT	9/13	Moderate
(Múzquiz-Barberá et al., 2023)	RCT	12/13	High

Note: High quality = score 10–13; moderate quality = score 7–9; low quality = score ≤6

The high effectiveness of mobile-based interventions is consistent with evidence showing that they commonly integrate key self-management components such as education, reminders, self-monitoring, and motivational support (Arshed et al., 2024; F. Liu et al., 2023; Wang et al., 2023; Yuting et al., 2023). These findings align with Cao et al. (2022), who reported that the success of mobile application-based interventions depends on engagement, interactivity, and the adaptation of features to users' needs. Applications that include reminders, self-monitoring, accessible digital education, and motivational or feedback features may increase patient engagement and support more stable behavior change. Thus, the effectiveness of mobile-based interventions appears to be influenced by the diversity and intensity of the features provided within the platform (Cao et al., 2022).

These findings are also supported by evidence from Indonesian primary care settings, where pharmacist-led education and counseling interventions have been shown to improve medication adherence and blood pressure control among patients with hypertension (Sabiti et al., 2023). More broadly, these results are in line with Zhou Y. et al. (2024), who reported that comprehensive interventions combining antihypertensive therapy with lifestyle modification are considered a standard approach in hypertension management. Their study also suggested that mobile applications targeting multiple physiological and behavioral risk factors were more effective in reducing systolic blood pressure than applications with fewer features (Y. Zhou et al., 2024). Similarly, Katz et al. (2024) found that multicomponent digital health interventions significantly lowered blood pressure,

especially among populations experiencing health disparities (Katz et al., 2024). The study by Bandeira et al. (2024) also showed that mobile applications consistently reduced SBP and DBP, particularly when they integrated multiple behavior change techniques (BCTs). Y. Liu et al. (2025) further reported that mobile-based interventions promoted positive lifestyle changes, including increased physical activity and self-monitoring. These findings support the results of the present review, which indicate that multicomponent mobile-based interventions are associated with more consistent improvements in both clinical and behavioral outcomes (Bandeira et al., 2024; Y. Liu et al., 2025)

Telephone-based interventions also demonstrated significant benefits, particularly in achieving target blood pressure and patient satisfaction. These interventions generally involved consultation, counseling, follow-up, and medication adjustment through direct communication with healthcare providers (Margolis et al., 2020; Nishizaki et al., 2023; Yatabe et al., 2021). Telephone-based interventions may improve patient satisfaction by facilitating direct communication with healthcare providers, enabling timely assessment of patient data, medication adjustments, and personalized clinical counseling. Margolis et al. (2022) reported that a telehealth model involving medication review, scheduled consultations, and clinical follow-up significantly reduced blood pressure and produced outcomes that were comparable to or better than usual clinic-based care (Margolis et al., 2022).

However, telephone-based interventions appeared less effective for outcomes that depend on sustained daily support, such as physical activity, dietary modification, and quality of life. This interpretation is in line with previous reviews showing that telephone-based interventions improve continuity of care and provider–patient communication but are less consistent in producing long-term behavioral change (Ali et al., 2024; Hayavi-Haghighi et al., 2024; Omboni et al., 2020). The absence of features such as daily reminders and intensive lifestyle education, which are commonly found in mobile-based interventions (F. Liu et al., 2023; Wang et al., 2023; Yuting et al., 2023), may explain why telephone-based interventions tend to be less effective in improving SBP, DBP, and quality of life. Therefore, this type of intervention may be more appropriate as a consultation support tool between patients and healthcare providers.

In this review, web-based interventions showed the lowest effectiveness. Most studies in this category mainly provided educational content and had limited interactivity. Without features such as automated reminders, real-time monitoring, or direct clinical feedback, their ability to maintain patient engagement appeared limited. This finding is consistent with Boima et al. (2024), who reported that web-only interventions rarely produced substantial improvements in blood pressure unless they were combined with telemedicine or professional feedback. Similar evidence was reported by Alzahrani et al. (2022), who concluded that low platform use, limited personalization, and lack of behavioral incentives contributed to the poor effectiveness of website-based interventions.

Additionally, a meta-analysis by Yang et al. (2024) showed that telemedicine delivered through web-based systems with clinical connectivity, such as real-time blood pressure monitoring and physician access, was more effective than static web-based education. In this review, the study by H. Zhou et al. (2022), which combined website-based intervention with telemedicine, was the only study in this category to show consistent effectiveness. This finding further suggests that passive web-based interventions are unlikely to achieve meaningful clinical benefits unless they are integrated with interactive features or clinical support (Alzahrani et al., 2022; Boima et al., 2024; Yang et al., 2024; H. Zhou et al., 2022)

Overall, this review's findings indicate that DHI's effectiveness in hypertension management depends on feature diversity, patient–provider interaction, and the availability of clinical support within the intervention platform. Mobile-based interventions appear to be the most effective because

they provide continuous, interactive, and multimodal support. Telephone-based interventions are useful for clinical consultation but less effective for sustained behavior change. In contrast, web-based interventions are generally less effective unless combined with interactive features such as telemedicine. These findings suggest that future digital interventions for hypertension should prioritize integrated features, sustained engagement, and connection with healthcare providers in order to achieve better therapeutic outcomes.

Conclusion

This systematic review demonstrates that digital health interventions (DHI) can improve both clinical and behavioral outcomes in patients with hypertension, particularly in relation to blood pressure control. Among the intervention types, mobile-based interventions showed the most consistent effectiveness in reducing systolic and diastolic blood pressure and in improving medication adherence, self-care, self-efficacy, and quality of life. Their effectiveness appears to be related to the multimodal, interactive, and sustained nature of the intervention, which commonly includes self-monitoring, reminders, educational components, and motivational support. Telephone-based interventions were particularly useful for clinical consultations and patient satisfaction, though less effective at promoting long-term behavior change. Web-based interventions generally showed limited clinical benefit, especially when they relied solely on passive educational content without interactive features or professional support. Overall, the effectiveness of DHI in hypertension management depends on feature intensity, interactivity, and integration with clinical services.

Acknowledgments

We express our gratitude to Universitas Muhammadiyah Surakarta for providing financial assistance and to everyone involved in the development of this systematic review.

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