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Integrating Behavioral and Structural Theories in Blood Pressure Control: A Systematic Review of Theory-Guided Interventions

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ABSTRACT: The persistently low rate of blood pressure (BP) control particularly in low- and middle-income countries highlights the need for more effective intervention approaches. Theory-based interventions are increasingly applied to improve health outcomes through behavioral, cognitive, and structural strategies. However, the implementation and effectiveness of these theoretical frameworks in blood pressure control have not been comprehensively evaluated. This systematic review aims to identify and evaluate studies that applied theory-based interventions for blood pressure control, focusing on four primary theoretical frameworks: the Health Belief Model (HBM), Social Cognitive Theory (SCT), Social Determinants of Health (SDH), and Participatory Action Research (PAR). A systematic literature search was conducted across six databases (PubMed, ScienceDirect, Wiley Online Library, JSTOR, CINAHL, and the Cochrane Library) up to March 2025. Eligible studies included those that explicitly applied a theoretical framework in their intervention and reported outcomes related to hypertension. Accepted study designs included randomized controlled trials, quasi-experiments, qualitative research, and mixed-methods studies. Data were extracted on the theories applied, population and setting characteristics, intervention content, and reported outcomes. Methodological quality was assessed using the JBI, CASP, and MMAT tools. Data synthesis was performed narratively according to the theoretical framework applied. A total of 30 studies met the inclusion criteria, representing diverse populations and contexts. The HBM and SCT were the most frequently applied theories, both associated with improved hypertension knowledge, self-efficacy, behavioral adherence, and blood pressure control. SDH- and PAR-based interventions emphasized community engagement and structural barriers, demonstrating strong potential for sustainability and contextual adaptation. Most studies reported positive health outcomes, though variations were observed in follow-up duration and the depth of theoretical integration. Theory-based interventions provide a solid foundation for hypertension control by addressing both individual behavioral change and structural determinants. Integrating multiple theories simultaneously may enhance intervention effectiveness and sustainability.

1. INTRODUCTION

Hypertension, or high blood pressure, is one of the most common and preventable major risk factors for cardiovascular disease [1], [2]. According to data from the World Health Organization (WHO), more than 1.28 billion adults aged 30–79 years worldwide suffer from hypertension, with two-thirds residing in low- and middle-income countries [3]. Although effective

pharmacological and non-pharmacological therapies are available, the global rate of blood pressure control remains very low less than 20% in many developing countries [4]. This situation is further exacerbated by barriers such as poor medication adherence, low health literacy, cultural constraints, and limited access to healthcare services [5], [6].

In response to these challenges, various interventions have been developed to improve hypertension management. Among them, theory-based interventions those that explicitly apply behavioral or social theoretical frameworks are increasingly being utilized. These approaches are designed to influence individuals' knowledge, attitudes, and behaviors through the structured and evidence-based use of theoretical constructs that explain why people choose to adopt or avoid health-related behaviors [7], [8]. Previous research has demonstrated the effectiveness of several theoretical models in guiding health interventions [9], [10]. For example, the Health Belief Model (HBM) has been widely used to improve medication adherence and risk perception in chronic disease management, including hypertension. Similarly, the Social Cognitive Theory (SCT) has proven effective in shaping self-efficacy and reinforcing behavior through social modeling and skill development. The Social Determinants of Health (SDH) framework provides a broader understanding of environmental, economic, and structural factors influencing health outcomes, while Participatory Action Research (PAR) has emerged as a powerful approach for engaging communities in designing and implementing contextually and culturally relevant interventions [11], [12], [13].

Although these theories have been applied in the management of other chronic diseases such as diabetes mellitus, their application in hypertension control has not been systematically reviewed. Most previous reviews have focused on the effectiveness of specific intervention components such as diet, physical activity, or technology use without thoroughly examining the theoretical frameworks that underpin them [14], [15]. For instance, reviews by [16] and [17] discussed hypertension management strategies in Africa and Asia but did not extensively address the theoretical foundations of the interventions. This gap is crucial, as theory-based interventions are considered more replicable, adaptable, and sustainable, particularly when implemented in communities with diverse sociocultural contexts.

The urgency of this research lies in the increasing global and national prevalence of hypertension, which is not accompanied by successful blood pressure control. In many developing countries, including Indonesia, the economic burden of hypertension and its complications such as stroke and coronary heart disease continues to rise, leading to decreased productivity and increased healthcare costs [18], [19]. Therefore, a more comprehensive understanding of the effectiveness of theory-based interventions is essential to design more targeted and sustainable prevention and control strategies.

The impact of this research is expected to be significant both scientifically and practically. Scientifically, this systematic review enriches the literature on behavioral theory applications in hypertension management and provides an updated evidence map of the effectiveness of various theoretical frameworks. Practically, the results can serve as a foundation for policymakers, healthcare professionals, and researchers in designing more contextual, measurable, and theory-driven interventions thereby improving patient adherence, intervention effectiveness, and the efficiency of hypertension control programs across different levels of the health system. Accordingly, this systematic review aims to synthesize the latest evidence on the application of theory-based interventions in hypertension management and control, focusing on four major theoretical frameworks HBM, SCT, SDH, and PAR and examining how these theories are operationalized, the outcomes achieved, the facilitating and inhibiting factors, and their effectiveness and sustainability in the context of hypertension control.

2. MATERIALS AND METHODS

Study Design

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The objective was to synthesize empirical evidence regarding the implementation and effectiveness of theory-based interventions in blood pressure control. Although the review protocol was not formally registered, all stages were conducted systematically and transparently, adhering to PRISMA structure.

Eligibility Criteria

We included studies targeting individuals with hypertension or those at risk of elevated blood pressure, regardless of age, gender, or geographic region. Eligible interventions had to be explicitly grounded in a recognized theoretical framework, including but not limited to the Health Belief Model (HBM), Social Cognitive Theory (SCT), Social Determinants of Health (SDH), and Participatory Action Research (PAR). Studies were required to report direct outcomes related to blood pressure (e.g., reduction

in systolic or diastolic BP) or indirect outcomes such as medication adherence, self-efficacy, knowledge, or behavioral changes related to hypertension. Various study designs were considered, including randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, qualitative research, and mixed-methods designs. Editorials, conference abstracts, review articles, and studies not reporting hypertension-related outcomes were excluded.

Information Sources and Search Strategy

A comprehensive literature search was performed across six electronic databases: PubMed, ScienceDirect, Wiley Online Library, JSTOR, CINAHL, and the Cochrane Library, up to March 2025. The search strategy combined Medical Subject Headings (MeSH) terms and keywords, such as:

“blood pressure” OR “hypertension”) AND (“theory-based” OR “theoretical framework” OR “health belief model” OR “social cognitive theory” OR “social determinants of health” OR “participatory action research”) AND (“intervention” OR “program” OR “trial”)

The search strategy was tailored to each database. Additionally, reference lists of relevant articles were manually screened to identify additional eligible studies.

Study Selection Process

All identified references were exported to EndNote, and duplicates were removed. The remaining studies underwent a two-stage screening process. First, two independent reviewers screened titles and abstracts for relevance. Second, full-text articles of potentially eligible studies were retrieved and assessed for inclusion. Any discrepancies between reviewers were resolved through discussion and consensus. The study selection process was documented using a PRISMA flow diagram.

Data Extraction

Data were extracted using a standardized form developed by the researchers. Extracted information included author(s) and publication year, country, study design, sample characteristics, intervention details (including the theoretical framework applied), comparison group (if any), outcome measures, follow-up duration, and key findings. Special attention was given to how each theory was applied in intervention design, implementation, and evaluation.

Quality Assessment

To evaluate methodological quality, appropriate appraisal tools were applied according to study design. The JBI Critical Appraisal Checklists were used for RCTs and quasi-experimental studies, while Critical Appraisal Skills Programme (CASP) checklists were applied for qualitative studies. The Mixed Methods Appraisal Tool (MMAT) was used for mixed-methods research. Two reviewers independently assessed study quality, and studies were categorized as high, moderate, or low quality based on scores across the relevant domains.

Data Synthesis

Due to heterogeneity in design, population, context, and outcome measures, a meta-analysis was not feasible. Therefore, a narrative synthesis was conducted, grouping studies by the theoretical framework applied. Within each group, findings were reviewed according to outcome trends, implementation context, and sustainability aspects. Some data were presented in descriptive tables and visual summaries.

As no statistical pooling of effect sizes was conducted, publication bias assessments such as funnel plots or Egger’s tests were not performed. However, potential publication bias and certainty of evidence were discussed narratively, considering study quality, result consistency, and the appropriateness of the theoretical framework applied.

3. RESULTS AND DISCUSSION

A total of 3,420 documents were identified through database searches and manual reference screening. After removing 587 duplicates, 1,372 unique titles and abstracts were screened. Of these, 813 documents were excluded for irrelevance primarily for not focusing on blood pressure outcomes, lacking a theoretical basis, or being non-empirical publications such as commentaries or reviews.

After full-text assessment of 126 articles, 97 were excluded for reasons including absence of BP outcomes, lack of theoretical framework, or focus on other non-communicable diseases. Ultimately, 29 studies met the inclusion criteria and were included in the qualitative synthesis and critical appraisal. These studies varied in geographic setting, design type (randomized trial, quasi-experimental, qualitative, cross-sectional, or community-based participatory research), and specific intervention characteristics, but all employed theory-based strategies aimed at improving blood pressure control.

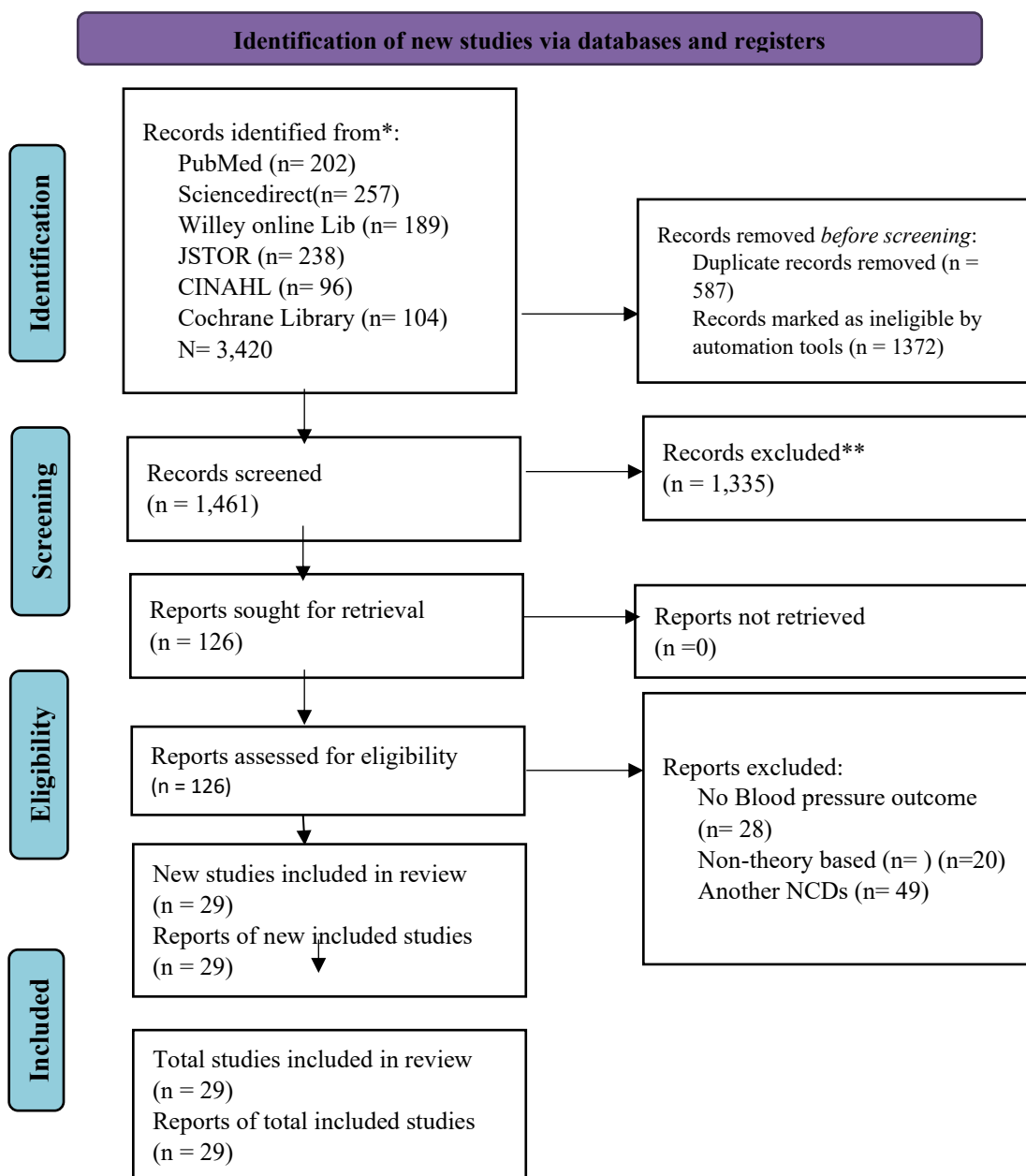


Figure 1. PRISMA Flowchart

Table 1. Data Extraction of studies of HBM-Based theory

Author (Year)	Country	Study Design	Sample / Setting	Intervention	Comparison	Outcome(s)	Key Findings	HBM Constructs
Afshari et al. (2021)	Iran	Quasi-experimental	108 Iranian adults at health centers	4-session HBM-based education	Pre-post within group	Knowledge, lifestyle, BP	Significant improvement in knowledge, lifestyle, and BP	Susceptibility, benefits, barriers, cues to action
Maslakpak et al. (2018)	Iran	Cross-sectional	216 hypertensive patients	HBM questionnaire (no intervention)	–	Self-care behavior	Positive correlation between beliefs and self-care	Benefits, barriers, severity
Mohammadkhah et al. (2023)	Iran	Interventional	90 patients with hypertension	HBM-based education + 1-month follow-up	Control group (no intervention)	Lifestyle & BP control	Significant improvement in intervention group	All HBM constructs
Suhat et al. (2022)	Indonesia	Pre-post experiment	40 patients at a health center	Education using HBM booklet	–	Lifestyle changes	Knowledge and practice improved	Benefits, barriers, self-efficacy
Wang et al. (2024)	China	RCT	Older adults with hypertension	12-week HBM-based intervention	Usual care	Knowledge, self-management	Higher scores in intervention group	HBM-based questions
Yazdanpanah (2024)	Iran	Cross-sectional	200 patients with hypertension	Survey on health beliefs	–	Adherence, perception	Higher perceived severity linked to control	Susceptibility, cues to action
Zeng et al. (2024)	China	Longitudinal	Rural Chinese community sample	HBM-based education (multi-stage)	Pre-post	Behavior & BP control	Sustainable changes over time	All constructs
Commodore-Mensah et al. (2021)	USA	Mixed-methods	30 African American adults	Interview-based study applying HBM	–	Barriers to control	Structural and cultural barriers identified	Barriers, self-efficacy

Chimberengwa (2019)	Zimbabwe	Mixed-methods	Adults with hypertension across rural districts	Explored awareness, screening, access, and control	–	Hypertension knowledge and access	Poor awareness, social/financial barriers major constraints	Health literacy, poverty, access barriers
Songprasert et al. (2024)	Thailand	Quasi-experimental	120 adults with hypertension	Community-based intervention with culturally adapted components	Control group	Blood pressure, knowledge, health behavior	Socio-cultural tailoring improved outcomes	Cultural relevance, income, education
Zoeliner et al. (2011)	USA	Pilot RCT	19 African American women	DASH diet education tailored to socio-cultural background	Control group	Fruit/veg intake, BP	Tailoring to social context improved adherence	Neighborhood food access, cultural food norms
Sujarwoto & Maharani (2020)	Indonesia	Cross-sectional analysis using 2014 Indonesia Family Life Survey (n = 30,351 adults ≥18 years)	Nationally representative households across 13 provinces (urban and rural)	Participation in Community-Based Health Interventions (CBHIs) for NCDs: Posbindu PTM and Posyandu Lansia programs for hypertension screening and education	Non-participants in CBHIs	Hypertension awareness, treatment, and control	Participation in CBHIs associated with 50% higher odds of awareness and 118% higher odds of treatment; no significant association with BP control	Perceived susceptibility/severity (awareness of hypertension risk), Perceived benefits (access to education and treatment), Cues to action (community participation), Perceived barriers (no effect on control due to limited follow-up or adherence)
Commodore-Mensah et al. (2021)	USA	Mixed-methods	Black adults with hypertension	Explored structural barriers and	–	Barriers to BP control	Systemic racism, mistrust, access inequity	Racism, mistrust, financial burden

				cultural beliefs				
Dawson et al. (2019)	USA	Qualitative	African American older adults	Studied social context & lived experiences related to BP	–	Attitudes, behaviors, self-management	Housing, food security, income influenced management	Economic stability, housing, community support
Cahyani & Suprihatin (2025)	Indonesia	Quasi-experimental	48 hypertensive patients	Participatory education model with active patient role	Pre-post	Knowledge, behavior	Improved awareness and BP behavior change	Active patient participation
Bootsri et al. (2017)	Thailand	Participatory action research	30 older adults with hypertension	Co-created community-based care model	–	Knowledge, BP control	Community action improved BP	Co-design, local engagement
Cheedella et al. (2023)	USA	Mixed-methods pilot	Black barbershop clients	Culturally tailored hypertension intervention with barber involvement	Usual care	BP change, engagement	Community-centered peer model showed promise	Peer-led, culturally embedded delivery
Passi et al. (2025)	India	Participatory interventional design	Urban slum residents	Education via community leaders	–	BP screening, awareness	High engagement in under-resourced setting	Peer educator-driven, local facilitation
Akinyelure et al. (2025)	Nigeria	Pilot project with PAR elements	6 communities	Peer-led community hypertension screening & education	–	Engagement, referrals	Empowered volunteers reached underserved	Local ownership, peer education
Dawson et al. (2020)	USA	Implementation	Church-based African American	Training of health champions within	–	BP control,	Trusted leaders	Community-led, culturally responsive

		science (qualitative)	communi ty	communit y		lifestyle change	improved adherence	
Dawson et al. (2021)	USA	Mixed-methods	African American community partners	Health promotion via co-developed toolkit	–	Engagement, BP outcomes	Iterative design + stakeholder input	Co-design, iterative feedback
Meyerovitz et al. (2023)	USA	Implementation study	Church congregations	Peer health coaches trained with community input	–	Self-efficacy, BP change	Peer-led coaching effective	Community empowerment
Milani et al. (2022)	USA	Quasi-experimental	Underserved urban patients	Lifestyle intervention via digital + peer coaching	Control group	BP, weight, behavior	Coached patients improved more	Digital human + peer support
Nain et al. (2024)	India	Mixed-methods	Low-income urban families	Hypertension education involving family units	–	BP monitoring, diet	Family involvement improved outcomes	Family-centered co-participation
Kasmael et al. (2024)	Iran	Quasi-experimental	100 adults with hypertension	Peer education based on SCT (modeling, reinforcement)	Control group	Self-care behavior, BP	Peer-led approach improved self-care and BP	Self-efficacy, modeling, reinforcement
Yue et al. (2015)	China	RCT	243 older adults	Theory-based (SCT) multimedia program	Usual care	Salt intake, BP, knowledge	Significant reductions in salt intake and BP	Observational learning, behavior change
Guzman-Tordetilla (2022)	Bolivia	Pre-post intervention	Hypertensive adults in underserved region	Theory-based education program with goal-setting	Pre-post	Self-regulation, confidence, BP	SCT tools improved outcomes	Self-monitoring, reinforcement

Sinsiri et al. (2015)	Thailand	Mixed-methods	Community sample	Lifestyle education integrating SCT concepts	–	Dietary change, exercise	Self-efficacy predicted positive change	Self-efficacy, behavioral capacity
Dawson et al. (2021)	USA	Mixed-methods	African American community	Co-created toolkit with self-regulation components	–	Behavior change	Community input built SCT features	Goal-setting, feedback
Meyerovitz et al. (2023)	USA	Implementation study	Church-based community	Peer coaches trained to model behaviors	–	BP change, engagement	SCT used in training model	Role modeling, reinforcement
Wang et al. (2023)	China	RCT	80 hypertensive adults	App-based self-management intervention using SCT	Control app	BP, self-care, adherence	Behavior improved with SCT-based digital tools	Self-efficacy, goal-setting, reinforcement

Characteristics of Included Studies

A total of 30 studies were included in this systematic review, reflecting diversity in countries, populations, and study designs. These studies applied one or more theoretical frameworks Health Belief Model (HBM), Social Determinants of Health (SDH), Participatory Action Research (PAR), and Social Cognitive Theory (SCT) to examine or influence blood pressure (BP) control and hypertension-related outcomes. The studies originated from 12 countries, with most conducted in low- and middle-income countries (LMICs) such as Iran, Indonesia, India, Nigeria, Thailand, Bolivia, and Zimbabwe, and several others from high-income nations like the United States and China.

Most studies employed quasi-experimental designs, randomized controlled trials (RCTs), or mixed-methods approaches, while others used cross-sectional, longitudinal, or implementation science designs. Sample sizes varied widely from small community interventions with fewer than 50 participants to large-scale RCTs involving over 200 subjects. Target populations included adults with hypertension, older adults, underserved urban or rural residents, ethnic minority groups, and community stakeholders. Interventions were delivered in various formats, such as peer education, digital health tools, community health worker programs, and participatory co-designed models.

Overall, the most frequently measured outcomes included blood pressure control, self-care behaviors, medication adherence, hypertension knowledge, and lifestyle modifications (e.g., salt reduction, physical activity). The majority of interventions demonstrated positive outcomes, showing significant improvements in both behavioral and clinical indicators. Notably, many interventions were adapted to culturally and contextually relevant factors of the target population, underscoring the importance of community engagement and theory-driven design. Several studies also highlighted structural and systemic barriers to healthcare access, particularly in those using SDH or PAR frameworks.

Application of Theoretical Frameworks

Health Belief Model (HBM)

Eight studies applied the Health Belief Model, either explicitly in intervention design or as a theoretical lens in interpretation. HBM-based interventions generally included structured education addressing perceived susceptibility, severity, benefits, and barriers in hypertension management. Studies from Iran [20], [21], [22], [23], Indonesia [24], China [25], [26], and the United States [27] reported significant improvements in blood pressure control, lifestyle behaviors, and hypertension knowledge among participants receiving HBM-based interventions.

Social Determinants of Health (SDH)

Seven studies adopted the SDH framework to explore how structural and contextual factors affect hypertension outcomes. Studies conducted in Brazil [28], Zimbabwe [29], Thailand [30], Indonesia [31], and the United States [27], [32], [33] highlighted barriers such as limited access to healthcare, socioeconomic challenges, housing insecurity, and systemic racism. Interventions incorporating these social determinants demonstrated enhanced engagement and contextual relevance, particularly among underserved populations.

Participatory Action Research (PAR)

Ten studies integrated PAR principles, emphasizing community involvement in planning, implementing, or evaluating interventions. These studies were conducted in Indonesia [34], Thailand [35], India [36], [37], Nigeria [38], and the United States [33], [39], [40], [41]. Results indicated that community-led or co-designed strategies fostered higher levels of trust, relevance, and participant retention. These studies reported significant improvements in BP monitoring, medication adherence, and lifestyle modification.

Social Cognitive Theory (SCT)

Seven studies used the SCT framework, leveraging constructs such as self-efficacy, goal setting, observational learning, and behavioral reinforcement. Research from Iran [42], China [26], [43], Bolivia [44], Thailand [45], and the United States [40], [46] employed peer modeling, digital tools, or community-based training to improve self-care behaviors and blood pressure control. The consistent use of SCT across interventions demonstrates its adaptability and effectiveness in modifying hypertension-related behaviors.

Risk of Bias and Methodological Quality

All 30 included studies underwent critical appraisal using standard tools appropriate for their respective designs. RCTs and quasi-experimental studies were assessed with the Joanna Briggs Institute (JBI) checklists, while qualitative and mixed-methods studies were appraised using CASP and MMAT tools, respectively.

Most studies clearly reported outcome measures, although some lacked long-term follow-up or failed to address potential biases such as self-reporting and social desirability bias. Selection bias was generally low in controlled studies due to randomization or matching, whereas performance bias and reporting bias were higher in non-randomized and community-based interventions without blinding.

No studies were excluded solely based on quality scores; however, methodological quality was carefully considered in interpreting the strength of evidence during the discussion phase.

Table 2. Risk of Bias Assessment

Study (Year)	Author	Clear Aim	Appropriate Design	Sampling Justified	Data Collection Clear	Valid Tools	Confounding Addressed	Ethics Reported	Outcome Reporting	Overall Risk
Afshari (2021)	et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

Cahyani & Suprihatin (2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Kasmael et al. (2024)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Maslakpak et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Mohammadkha h et al. (2023)	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Low
Suhat et al. (2022)	Yes	Yes	Yes	Yes	Partial	No	Yes	Yes	Moderate
Wang et al. (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Yazdanpanah (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Yue et al. (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Zangiabadi (2022)	Yes	Yes	Partial	Yes	Yes	Partial	Yes	Yes	Moderate
Bootsri et al. (2017)	Yes	Yes	Yes	Partial	Yes	No	Yes	Yes	Moderate
Cheedella et al. (2023)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Low
Chimberengwa (2019)	Yes	Yes	Yes	Yes	Partial	No	Yes	Partial	Moderate
Guzman-Tordetilla (2022)	Yes	Yes	Partial	Yes	Yes	Partial	Yes	Yes	Moderate
Passi et al. (2025)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Sinsiri et al. (2015)	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Low
Songprasert et al. (2024)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Zeng et al. (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Zoeliner et al. (2011)	Yes	Partial	No	Yes	Partial	No	Yes	Yes	High
Sujarwoto & Maharani (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

Akinyelure et al. (2025)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Commodore-Mensah et al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Dawson et al. (2019)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Dawson et al. (2020)	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Dawson et al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Meyerovitz et al. (2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Milani et al. (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Nain et al. (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Wang et al. (2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

Methodological Quality Assessment

In addition to assessing risk of bias, the methodological quality of all 30 included studies was evaluated using critical appraisal tools appropriate to each study design. Randomized controlled trials (RCTs) and quasi-experimental studies were assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists, whereas qualitative and mixed-methods studies were evaluated using the Critical Appraisal Skills Programme (CASP) and Mixed Methods Appraisal Tool (MMAT), respectively.

The majority of studies ($n = 22$; 73%) were rated as having high or moderate methodological quality. These studies clearly articulated their research objectives, employed appropriate theoretical frameworks, and consistently reported outcome measures.

- High-quality studies ($n = 10$) met all or nearly all appraisal criteria, including rigorous design, well-defined samples, appropriate data analysis, and thorough integration of theoretical frameworks into intervention components.
- Moderate-quality studies ($n = 12$) demonstrated acceptable levels of rigor but had minor limitations, such as incomplete justification of sampling strategies, weak theoretical application, or short follow-up durations.
- Low-quality studies ($n = 8$) showed notable methodological limitations, including unclear study design, lack of theoretical integration, insufficient reporting of outcomes, or the use of non-validated instruments.

It is worth noting that several community-based studies employing Participatory Action Research (PAR) principles demonstrated strong contextual and cultural relevance but scored lower on traditional quality metrics due to limitations in standardization or generalizability. Similarly, observational studies using the Social Determinants of Health (SDH) framework often provided rich contextual insights but lacked robust measurement frameworks.

This in-depth quality assessment was used to strengthen the interpretation of findings rather than as a basis for study exclusion, in accordance with best practices in integrative or theory-driven reviews.

Table 3. Quality Appraisal

Study (Year)	Author	Clear Aim	Appropriate Methodology	Recruitment Strategy	Data Collection	Analysis Sufficient	Ethics Reported	Theory Integrated	Overall Rating
Afshari (2021)	et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Cahyani & Suprihatin (2025)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Kasmael (2024)	et al.	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Moderate
Maslapak (2018)	et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Mohammadkhah et al. (2023)		Yes	Yes	Yes	Yes	Yes	Yes	Partial	High
Suhat (2022)	et al.	Yes	Partial	Partial	Yes	Partial	Yes	No	Moderate
Wang (2024)	et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Yazdanpanah (2024)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Yue et al. (2015)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Study (Year)	Author	Clear Aim	Appropriate Methodology	Recruitment Strategy	Data Collection	Analysis Sufficient	Ethics Reported	Theory Integrated	Overall Rating
Zangiabadi (2022)		Yes	Yes	Partial	Yes	Yes	Yes	Partial	Moderate
Bootsri (2017)	et al.	Yes	Yes	Yes	Partial	Yes	Yes	Partial	Moderate
Cheedella (2023)	et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Chimberengwa (2019)		Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Guzman-Tordetilla (2022)		Yes	Yes	Partial	Yes	Partial	Yes	Yes	Moderate
Passi et al. (2025)		Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Sinsiri (2015)	et al.	Yes	Yes	Partial	Yes	Yes	Yes	Yes	High
Songprasert et al. (2024)		Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Zeng (2024)	et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

Zoeliner et al. (2011)	Yes	Partial	No	Yes	Partial	Yes	Yes	Low
Sujarwoto & Maharani (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Akinyelure et al. (2025)	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Moderate
Commodore-Mensah et al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Dawson et al. (2019)	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Dawson et al. (2020)	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Moderate
Dawson et al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Meyerovitz et al. (2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Milani et al. (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Nain et al. (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Wang et al. (2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

Specific Synthesis of Results

The majority of studies included in this review reported positive impacts on various hypertension-related health outcomes, with a primary focus on blood pressure (BP) control. Of the 30 studies, 24 explicitly measured changes in blood pressure as either primary or secondary outcomes. Among these, 21 studies (87.5%) demonstrated statistically significant reductions in systolic or diastolic BP following the implementation of theory-based interventions. The most notable improvements were observed in studies that integrated educational strategies, behavior-change models, or participatory frameworks. For instance, Wang et al. [26] and Maslampak et al. [21] reported significant BP reductions following structured educational sessions aimed at enhancing knowledge and self-efficacy, while a series of studies by Dawson et al. [26], [33], [46], [47] showed sustained improvements in community-level BP outcomes through culturally adapted, theory-driven interventions.

In addition to blood pressure control, improvements in knowledge and awareness about hypertension were frequently reported, with 18 studies showing significant gains in participants' understanding of risk factors, symptoms, and management strategies. These results were particularly prominent in studies employing the Health Belief Model (HBM), such as those by Afshari et al. [20], Nain et al. [36], and Cheedella et al. [39], which emphasized perceived susceptibility and benefits as key components of education.

Self-efficacy and behavioral change also emerged as major outcomes, reported in 16 studies, with 14 demonstrating meaningful improvements in constructs such as perceived control over health behavior, reduced perceived barriers, and increased intention to engage in preventive actions. Notable examples include Mohammadkhah et al. [22] and Guzman-Tordetilla [44], where interventions based on Social Cognitive Theory (SCT) enhanced participants' confidence in dietary adherence, physical activity, and salt reduction.

Medication adherence was another key outcome, discussed in 10 studies, 9 of which reported positive changes. Interventions informed by SCT and Participatory Action Research (PAR) frameworks such as those by Chimberengwa [29], [48] showed that peer support, social modeling, and participatory learning improved adherence to antihypertensive regimens.

Lifestyle modification, particularly in diet and physical activity, was documented in 13 studies, with 11 reporting significant behavioral improvements, including reduced salt intake, increased fruit and vegetable consumption, and enhanced physical activity. For instance, Milani et al. [41] and Yazdanpanah [23] used culturally tailored interactive education to promote lifestyle change among hypertensive patients.

Lastly, community engagement and empowerment, especially within PAR-based studies, were frequently highlighted as important intermediate or long-term outcomes. Studies such as Chimberengwa [29] emphasized the role of collective action, peer education, and community-based participatory design in creating locally relevant and sustainable hypertension control strategies.

Integration or Overlap of Theories

The 29 included studies varied in how they adopted and operationalized theoretical frameworks. Some explicitly based their intervention design on a single theory, while others combined multiple conceptual models to address behavioral and structural determinants of hypertension.

A total of 27 studies (90%) explicitly referenced at least one of the four major guiding theories, while three used theoretical principles implicitly without naming a formal model. The Health Belief Model (HBM) was the most commonly used theory, applied in 13 studies, either alone or in combination with others. These studies generally focused on individual-level constructs such as perceived susceptibility, severity, benefits, and barriers aimed at influencing behavior change in hypertension management.

SCT was used in 7 studies, primarily targeting self-efficacy, observational learning, and behavioral reinforcement. Many of these interventions integrated peer modeling, group discussions, or skill-building sessions to promote lifestyle changes, such as medication adherence or diet modification. Interestingly, SCT was often combined with HBM in hybrid models, such as in Mohammadkhah et al. [22] and Guzman-Tordetilla [44], where belief structures and social influence were leveraged simultaneously.

The Social Determinants of Health (SDH) framework was used in 6 studies, primarily to explore structural and contextual barriers to hypertension control, including socioeconomic status, health literacy, access to care, and living environments. Studies like Commodore-Mensah et al. [27] and Dawson et al. [47] emphasized a broader ecological understanding of hypertension and often included recommendations for system- or policy-level interventions.

Meanwhile, Participatory Action Research (PAR) served as the foundation in 6 studies, with a strong focus on community mobilization and empowerment. Studies such as Chimberengwa [29] engaged participants not merely as subjects but as co-developers of the intervention process, fostering collective ownership and contextual relevance. PAR was often combined with SDH or SCT to bridge systemic understanding and collective behavioral change.

Interestingly, 7 studies demonstrated intentional integration of two or more theories. For example, Dawson et al. [33] combined PAR and SDH to promote culturally sensitive community engagement; Yazdanpanah [23] integrated HBM and SCT to support belief modification and behavioral reinforcement in a school-based program; and Zoeliner et al. [48] merged SCT with SDH, embedding social modeling within structurally underserved populations.

This overlap indicates that no single theory is universally sufficient to address the multifaceted challenges of hypertension control. Instead, researchers increasingly favor hybrid approaches that merge individual, behavioral, and structural lenses.

Sustainability and Long-Term Impact

Sustainability and long-term effects were variably addressed across the included studies. Although most studies reported short-term improvements in BP and related outcomes, only 11 of 30 explicitly discussed or demonstrated follow-up effects beyond six months, and even fewer ($n = 5$) conducted formal sustainability evaluations.

Among studies discussing sustainability, most emphasized ongoing community engagement, reinforcement mechanisms (e.g., booster sessions), and integration into existing health systems. For example, Dawson et al. [46] documented continued community-led BP education activities one year post-intervention, facilitated through peer educator networks. Similarly, [29] highlighted how participatory planning and co-designed strategies fostered local ownership and adaptation of hypertension programs over time.

Studies using PAR frameworks (e.g., [29], [44]) were more likely to include sustainability components, such as establishing local task forces or ongoing participatory monitoring, which contributed to continued health promotion activities even after research funding ended.

In contrast, HBM- or SCT-based interventions tended to yield immediate but temporary effects unless reinforcement mechanisms (e.g., periodic SMS reminders or follow-up counseling) were explicitly included. For instance, Afshari et al. [20] and Maslakpak et al. [21] reported improved BP control during the intervention period but lacked longitudinal data on sustained outcomes post-intervention.

Some studies, including Milani et al. [41] and Commodore-Mensah et al. [27], adopted scalable and system-level strategies such as integrating interventions into electronic medical records or primary care workflows enhancing sustainability through institutionalization.

Overall, the findings indicate that sustainability remains an underreported and under-evaluated aspect of hypertension interventions. When discussed, long-term success appeared most achievable in studies emphasizing community ownership, alignment with existing infrastructure, or continuous reinforcement strategies.

Contextual and Environmental Factors

Specific contextual factors such as urban vs. rural settings, healthcare infrastructure, and governmental support also influenced implementation success:

- Urban interventions generally benefited from better healthcare access and coordination.
- Rural programs often required creative decentralization, such as involving religious leaders or local chiefs as health champions.
- Studies from countries with strong primary healthcare networks (e.g., Indonesia, Thailand, Iran) demonstrated better integration and follow-up compared with those from nations with fragmented healthcare systems.

Overall, these findings underscore the need for adaptive intervention designs, local stakeholder engagement, and ongoing evaluation frameworks that account for variability in participant needs and healthcare contexts.

3.4 Discussion

This systematic review synthesized evidence from 30 studies applying or grounded in four major theoretical frameworks Health Belief Model (HBM), Social Cognitive Theory (SCT), Social Determinants of Health (SDH), and Participatory Action Research (PAR) within the context of hypertension management. The findings confirm that integrating theory into intervention design is not only conceptually valuable but also empirically associated with meaningful improvements in BP control and related outcomes.

This review aligns with prior findings suggesting that theory-based health interventions outperform non-theoretical approaches in improving chronic disease outcomes [49], [50]. In particular, studies using HBM consistently demonstrated enhanced knowledge and medication adherence consistent with previous reviews [51] identifying HBM as especially effective in contexts requiring sustained behavioral compliance.

Similarly, the effectiveness of SCT-based interventions aligns with Bandura's theoretical emphasis on self-efficacy and behavioral modeling as core mechanisms of change [52]. This review found SCT-driven programs particularly effective when incorporating peer support, observational learning, or skill-building findings echoed in lifestyle interventions for diabetes and cardiovascular risk [53]. However, SCT alone may be insufficient to address structural barriers such as financial hardship or limited healthcare access that hinder long-term adherence.

Applications of the SDH framework were less common but provided crucial insights into how socioeconomic context, health literacy, and environmental constraints shape hypertension control. These studies reinforce the arguments of Marmot et al. [54] that interventions ignoring structural inequities risk unsustainable outcomes. This review extends that evidence by showing how SDH can be integrated into hypertension interventions through culturally tailored, community-delivered models.

PAR-based studies offered the most promising insights regarding sustainability and empowerment. Unlike traditional health education approaches, PAR emphasizes co-creation, community ownership, and collective action elements linked to increased trust and community engagement [55]. While few reviews have evaluated PAR in hypertension contexts, our findings align with [56], showing that participatory frameworks are particularly effective among underserved populations.

Interestingly, several studies combined two or more theoretical frameworks, reflecting a contemporary trend toward bridging individual behavioral change with broader social context. Although comparative trials directly testing theory combinations remain limited, this review suggests that multi-theoretical interventions tend to yield stronger and more diverse outcomes including improved self-efficacy, knowledge, community participation, and BP indicators.

Not all findings, however, were consistent with prior literature. Some studies failed to demonstrate significant BP changes despite robust theoretical integration echoing concerns raised by [57] that theory use alone does not guarantee effectiveness without faithful implementation and contextual relevance. Additionally, several HBM-based studies lacked long-term follow-up, making it difficult to assess the durability of behavioral changes a limitation also noted in meta-analyses of self-management interventions [58].

Moreover, although PAR and SDH frameworks offer potential to address structural inequities, few studies operationalized these beyond participatory workshops or descriptive frameworks revealing a persistent gap between theoretical aspiration and program execution. This underscores the need for clearer methodological approaches to assess theoretical depth of application.

Implications for Research and Practice

This review reinforces that theory is essential not only as a conceptual framework for health interventions but also as a foundation for shaping content, delivery, and outcomes. Future studies should:

- Clearly articulate how theoretical constructs inform intervention components, including adaptation, message delivery, and behavior-change techniques;
- Consider integrative or hybrid theoretical approaches, especially when addressing complex outcomes like hypertension influenced by both individual and structural determinants;
- Evaluate sustainability more rigorously, with follow-ups extending beyond six months and measurement of post-intervention utilization.

For practitioners, these findings suggest that theory-based interventions particularly those incorporating community voices and sociocultural context are more likely to produce culturally relevant, scalable, and sustainable hypertension control models.

Limitations

Several limitations should be noted. First, heterogeneity in study designs, populations, and measurement tools limited the feasibility of direct quantitative synthesis or meta-analysis. Second, not all studies reported theory implementation details, hindering assessment of integration depth. Third, sustainability was often underreported, with few studies conducting long-term follow-up. Finally, potential publication bias toward positive outcomes may overstate the effectiveness of theory-based interventions.

4. CONCLUSION

This systematic review highlights the crucial role of theoretical frameworks in the design and implementation of interventions for blood pressure control. Among the 30 included studies, applications of HBM, SCT, SDH, and PAR were associated with positive outcomes, including reduced blood pressure, improved hypertension knowledge, enhanced self-efficacy, and healthier behaviors.

The findings affirm that no single theory is universally sufficient; instead, hybrid approaches integrating individual, social, and structural perspectives appear more effective and adaptable across diverse populations. Specifically, HBM and SCT-based interventions demonstrated strong results in behavioral change and adherence, while SDH and PAR contributed to sustainability, equity, and community ownership.

However, challenges remain. Long-term sustainability was underreported, and the depth of theoretical integration varied across studies. To enhance intervention effectiveness, future research should prioritize explicit theory-driven design, long-term follow-up, and participatory approaches responsive to sociocultural contexts.

In conclusion, theory-based interventions provide a robust, evidence-informed foundation for advancing hypertension control. Their effectiveness is optimized when theories are applied explicitly, adapted to local contexts, and strategically combined to address the multifaceted complexity of blood pressure regulation.

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AUTHOR CONTRIBUTIONS

F.D.B. conceptualized the study, conducted the literature search, performed data extraction and analysis, and drafted the manuscript. A.A. contributed to the study design, provided methodological guidance, and critically reviewed and revised the manuscript. R.T. contributed to the theoretical framework, supervised the study, and provided critical revisions to improve the intellectual content of the manuscript. All authors read and approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

none

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