ORIGINAL ARTICLE

Effectiveness of Pharmacist-Led Interventions for Blood Pressure Control in Hospital and Hospital-Linked Settings: A Systematic Review and Meta-analysis

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ABSTRACT

Hypertension remains a major contributor to cardiovascular morbidity and mortality, while evidence on pharmacist-led care in hospital and hospital-linked settings is fragmented. This systematic review and meta-analysis evaluated the effects of clinical pharmacist-led interventions on blood pressure and related outcomes in adults with hypertension. PubMed and Scopus were searched through 23 November 2025. Five studies were included: three randomized controlled trials, one quasi-randomized controlled trial, and one nonrandomized before-after study. Interventions comprised structured education, medication review and optimization, medication therapy management, home blood pressure monitoring, and follow-up. Narrative findings generally favored pharmacist-led care for blood pressure, medication adherence, hypertension knowledge, and resolution of drug-related problems. Two controlled trials, one randomized and one quasi-randomized, contributed to the exploratory meta-analysis. Pharmacist-led interventions reduced systolic blood pressure by a pooled mean difference of -5.27 mmHg (95% CI -7.23 to -3.31; I^2 = 0%). The pooled diastolic blood pressure effect favored intervention but was not statistically significant (mean difference -4.21 mmHg; 95% CI -9.80 to 1.38; I^2 = 85.1%). Interpretation is limited by the small number of pooled studies, heterogeneous interventions, attrition, and risk of bias. Pharmacist-led interventions may improve systolic blood pressure and medication-management outcomes, but additional rigorously designed trials with standardized interventions and outcome reporting are needed.

Keywords: Hypertension; Clinical pharmacist; Pharmacist-led intervention; Blood pressure control; Medication therapy management

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Introduction

Hypertension remains a major global health burden and is a leading preventable risk factor for cardiovascular disease and all-cause mortality [1]. Blood pressure control remains suboptimal, particularly among patients with multimorbidity, chronic kidney disease, polypharmacy, limited disease knowledge, and poor medication adherence [2-5]. These factors increase the likelihood of drug-related problems, treatment failure, avoidable healthcare use, and higher costs.

Pharmacist-led interventions may address several modifiable barriers to blood pressure control. Pharmaceutical care and medication therapy management combine individualized education, medication reconciliation and review, identification and resolution of drug-related problems, adherence support, monitoring, and collaboration with prescribers [2,3,6]. Previous systematic reviews have reported reductions in systolic and, less consistently, diastolic blood pressure with pharmacist involvement, although the interventions, care settings, and patient populations were heterogeneous [7-12].

Most previous evidence syntheses have focused on community, general-practice, or broadly ambulatory populations. Evidence from hospital outpatient clinics, specialty clinics, inpatient-to-discharge programs, and other hospital-linked services is less clearly characterized. These settings may involve greater comorbidity, polypharmacy, and

transitions of care, while the intensity and authority of pharmacist interventions vary substantially. A focused synthesis of hospital and hospital-linked care is therefore needed.

This systematic review aimed to evaluate the effects of pharmacist-led interventions on systolic and diastolic blood pressure in adults with hypertension receiving care in hospital or hospital-linked settings. Secondary objectives were to summarize effects on medication adherence, hypertension knowledge, drug-related problems, quality of life, healthcare utilization, laboratory outcomes, and medication-related costs.

METHODS

Study Design

This systematic review and meta-analysis was reported in accordance with the PRISMA 2020 statement [13]. The protocol was not prospectively registered; this lack of prospective registration is acknowledged as a limitation.

Review Question and PICO

The review question was: among adults with hypertension receiving care in hospital or hospital-linked settings (Population), do clinical pharmacist-led or pharmacist-co-led interventions such as pharmaceutical care, medication therapy management, medication review, education, adherence support, or blood pressure monitoring (Intervention), compared with usual care, no structured pharmacist intervention, or the pre-intervention period (Comparator), improve systolic and/or diastolic blood pressure (primary Outcomes) and medication adherence, disease knowledge, quality of life, drug-related problems, healthcare utilization, laboratory measures, or medication-related costs (secondary Outcomes)?

Search Strategy

PubMed and Scopus were searched, with the last search conducted on 23 November 2025. Reports published from January 2010 through 23 November 2025 were considered to focus on contemporary clinical pharmacy practice, including medication therapy management, team-based care, and technology-assisted blood pressure monitoring. The PubMed search was: ((pharmacist[Title/Abstract] OR "pharmacist intervention"[Title/Abstract] OR "clinical pharmacy"[Title/Abstract] OR "medication review"[Title/Abstract] OR "pharmaceutical care"[Title/Abstract] OR "drug therapy management"[Title/Abstract]) AND (hypertension[MeSH Terms] OR hypertensive[Title/Abstract] OR "high blood pressure"[Title/Abstract]) AND (hospital*[Title/Abstract] OR inpatient*[Title/Abstract] OR ward[Title/Abstract])). The PubMed search was restricted to publications from 2010 onward and retrieved 34 records. The core Boolean expression documented for Scopus was: TITLE-ABS-KEY(clinical pharmacy OR pharmacist intervention OR pharmaceutical care AND hypertension OR high blood pressure AND hospital OR inpatient OR in-hospital). The saved Scopus export contained 201 records. The core expression is reported without platform-generated filter syntax. Because the expression was broader than a fully grouped three-concept strategy, all retrieved records were screened against the eligibility criteria. A publication-year restriction was not applied at the database level in Scopus; the predefined date criterion was therefore enforced during title and abstract screening. Reference lists of included studies and relevant reviews were examined, but no additional studies were included through citation searching.

Eligibility Criteria

Studies were eligible if they enrolled adults aged 18 years or older with diagnosed hypertension; evaluated an intervention led or co-led by a clinical or hospital pharmacist; were conducted in an inpatient unit, hospital outpatient clinic, hospital specialty clinic, or hospital-initiated transitional-care program; included usual care, no structured pharmacist intervention, or a pre-intervention comparator; reported systolic and/or diastolic blood pressure; used a randomized controlled, quasi-experimental, cohort, controlled before-after, or single-group before-after design; and were published in English. Studies conducted solely in community pharmacies or primary health-care units without a defined hospital linkage were excluded, as were reviews, protocols, editorials, case reports, and

conference abstracts without sufficient outcome data.

Study Selection

The searches identified 235 records: 34 from PubMed and 201 from Scopus. After removal of 36 duplicates, 199 unique records were screened by title and abstract, and 151 were excluded. Forty-eight full-text reports were assessed for eligibility; 43 were excluded because they lacked a pharmacist-led intervention (n = 2), were conducted in an ineligible setting (n = 25), were not published in English (n = 1), or were not focused on hypertension (n = 15). Five studies were included in the qualitative synthesis, and two contributed data to the meta-analysis (**Figure 1**). Screening and eligibility assessment were performed by a single reviewer; independent duplicate screening was not undertaken.

Data Extraction

A standardized form was used to extract study design, country and setting, participant characteristics, sample size, intervention and comparator components, follow-up duration, blood pressure outcomes, medication adherence, hypertension knowledge, quality of life, drug-related problems, healthcare utilization, laboratory outcomes, and cost outcomes. Extracted data were checked against the source reports by the same reviewer. Independent duplicate extraction was not performed.

Statistical Analysis

Two controlled trials, one randomized and one quasi-randomized, provided sufficiently comparable change-score data for quantitative synthesis. Mean differences were calculated as the change from baseline in the intervention group minus the change from

Table 6. Risk-of-bias assessment for the blood pressure outcome

Study	Design/tool	Key concerns	Overall judgment	Rationale
Okoro et al. (2022)	RCT / RoB 2	Allocation concealment and prespecified analysis insufficiently reported; baseline sex imbalance	Some concerns	Randomized double-blind design, but reporting is insufficient to rule out bias in randomization and selective reporting
Huynh et al. (2024)	Quasi-randomized / ROBINS-I	Predictable odd/even allocation; complete-case analysis after 18.4% attrition; no prespecified analysis plan identified	Serious risk	Foreknowledge of assignment could influence enrollment, and exclusion of participants lost to follow-up may bias the effect estimate
Paudel et al. (2023)	RCT / RoB 2	Open-label, small single-center trial; allocation concealment not described; no publicly available analysis plan identified	Some concerns	Blinded outcome assessment reduces measurement bias, but randomization and reporting details are limited
Li et al. (2023)	RCT / RoB 2	Trial registered after recruitment; complete-case analysis after 15.8% attrition; intervention pharmacists measured BP	High risk	Post hoc registration, missing outcome data, and non-independent outcome measurement may bias estimates
Migliozzi et al. (2015)	Nonrandomized / ROBINS-I	Single-group implementation study; selected patients with readings and one-year follow-up; no concurrent control	Serious risk	No concurrent control and selection based on available home-BP readings and one-year follow-up create serious confounding, selection, and regression-to-the-mean concerns.

Judgments were based on information available in the published reports. RoB 2, Cochrane Risk of Bias 2 tool; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions.

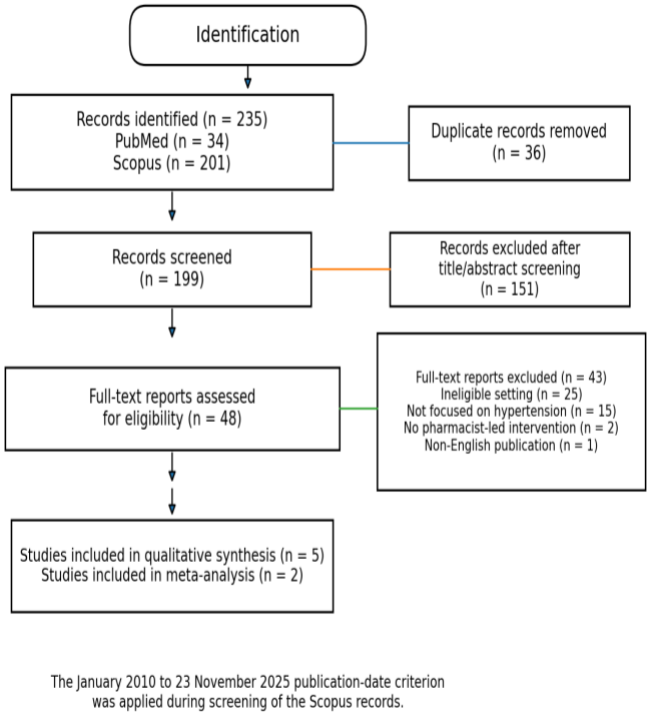

Figure 1. PRISMA flow diagram of study selection

baseline in the comparator group, so negative values favored pharmacist-led intervention. For Huynh et al., the standard deviations of within-group change were reported directly and were used without modification. For Li et al., only baseline and 12-month standard deviations were available; the standard deviation of change was therefore imputed as $SD_{change} = \sqrt{(SD_{pre}^2 + SD_{post}^2 - 2r \times SD_{pre} \times SD_{post})}$, where r is the pre-post correlation, assumed to be 0.5 (Cochrane Handbook section 6.5.2.8) [14]. Because the correlation was not reported, sensitivity analyses varied r from 0.3 to 0.9. Study-level standard errors were then calculated as $SE = \sqrt{(s_1^2/n_1 + s_2^2/n_2)}$, where s and n denote the standard deviation of change and the sample size in the intervention (1) and comparator (2) groups. Random-effects models using the DerSimonian-Laird estimator were fitted with the metafor package in R. Statistical heterogeneity was evaluated using Cochran's Q, τ^2, and I^2. Because only two studies were pooled, heterogeneity estimates were interpreted cautiously; subgroup analysis, meta-regression, funnel plots, and formal tests for small-study effects were not performed.

Risk of Bias Assessment

Risk of bias was assessed separately from statistical heterogeneity and for the blood pressure outcome. The three randomized trials were evaluated using t he Cochrane Risk of Bias 2 (RoB 2) tool across the domains of randomization, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting [15]. The quasi-randomized controlled trial and the nonrandomized before-after study were evaluated using ROBINS-I, with attention to confounding, par ticipant selection, intervention classification, deviations, missing data, outcome measurement, and selective reporting [16]. Judgments were based on information available in the published reports and are summarized in **Table 6**. Risk-of-bias appraisal was conducted by a single reviewer without independent duplicate assessment.

RESULT AND DISCUSSION

Study Characteristics and Intervention Models

Five studies were included: three randomized controlled trials, one quasi-randomized controlled trial, and one single-group nonrandomized before-after study (**Table 1**). Studies were conducted in Nigeria, Vietnam, Nepal, the United States, and China. Participants were treated in hospital outpatient or specialty-clinic programs, or were enrolled during hospitalization and followed after discharge.

Populations ranged from adults with primary hypertension to clinically complex groups with chronic kidney disease, renal transplantation, multimorbidity, and polypharmacy. Follow-up ranged from 12 weeks to 12 months. This clinical diversity broadens applicability but limits direct comparison of effect sizes across studies.

Interventions varied from education-focused programs to comprehensive medication therapy management (**Table 2**). Components included face-to-face counseling, printed or smartphone-based education, telephone or text-message reminders, medication reconciliation and review, drug-related problem resolution, home blood pressure monitoring, and collaborative medication adjustment [1-3,6,17]. The intensity, duration, and pharmacist authority differed substantially, which may influence the magnitude and sustainability of effects.

Table 2. Components of pharmacist-led interventions in the included studies

Study	Core pharmacist intervention	Technology/monitoring	Patient education	Medication optimization	Contact frequency
Okoro et al. (2022)	Individualized prescription review; adherence support; team-based care	Home BP monitor, BP logbook, telephone access, text reminders	CKD, hypertension, diet, self-management, medication adherence, and BP self-measurement	Drug-related interventions and prescription review	Baseline education; biweekly text reminders; assessments at 6 and 12 months
Huynh et al. (2024)	Structured educational intervention	Smartphone educational videos and telephone follow-up	30-minute initial counseling plus printed materials and videos	No protocolized pharmacist prescribing or medication adjustment reported	Initial session; 15-minute calls at weeks 6, 8, and 10
Paudel et al. (2023)	P-DIPS: individualized counseling plus usual care	Weekly telephone reminders	Hypertension, risk factors, medication use/adverse effects, and lifestyle modification; local-language leaflet	No direct pharmacist medication adjustment reported	15-minute initial session; weekly calls; face-to-face follow-up at 2 and 4 months
Migliozzi et al. (2015)	Pharmacist-provided MTM under collaborative practice agreement	Computer-enabled home BP monitor and online portal	Comprehensive disease and BP education	Pharmacist could add, discontinue, or adjust medicines under collaborative agreement	BP reviewed at 30, 90, 180, and 360 days
Li et al. (2023)	Five core MTM elements, medication reconciliation, action plan, documentation, and follow-up	Electronic BP measurement; telephone and face-to-face follow-up	Medication education and treatment consultation	Medication reconciliation and drug-related problem resolution	At admission and 1, 3, 6, and 12 months after discharge

This table presents MTM elements, BP monitoring methods, technology use, patient education, medication optimization, and contact frequency.

Risk of Bias Across Included Studies

No study was judged to be at uniformly low risk of bias for the blood pressure outcome (**Table 6**). The main concerns across the controlled trials were predictable or insufficiently concealed allocation, lack of blinding where relevant, complete-case or per-protocol analysis after attrition, outcome measurement by intervention personnel in one trial, and limited evidence of prespecified analysis plans. The quasi-randomized trial used a deterministic odd/even allocation rule that permitted foreknowledge of assignment. The uncontrolled before-after study had serious risk of confounding and regression to the mean because it lacked a concurrent control group. These limitations reduce confidence in the apparent consistency of direction across studies.

Blood Pressure Outcomes and Clinical Interpretation

All five studies reported a reduction in blood pressure over time or a result favoring pharmacist-led care, but the strength of evidence varied (**Table 3**). In the randomized CKD trial by Okoro et al., systolic blood pressure decreased by 7.12 mmHg more in the intervention group than with usual care ($p = 0.020$), whereas between-group differences in the proportion achieving blood pressure control were not statistically significant [3]. Huynh et al. reported a 12-week between-group difference in change of -5.17 mmHg for systolic and -1.66 mmHg for diastolic blood pressure [1]. Paudel et al. found lower median systolic and diastolic blood pressure at four months in the intervention group, although change-score dispersion was not available for

pooling [17].

Li et al. reported larger 12-month reductions in the intervention group than in the control group for both systolic and diastolic blood pressure [2]. Migliozzi et al. reported sustained within-group improvements at 30, 90, 180, and 360 days [6], but the study had no concurrent control. Secular trends, co-interventions, regression to the mean, and selective follow-up therefore cannot be excluded; this finding supports feasibility rather than a definitive comparative effect.

The comparative findings should be interpreted as effects of multicomponent pharmacist-led programs rather than of a single intervention component. Education, monitoring, adherence support, and medication optimization were usually delivered together, preventing attribution of the observed effect to any one component.

Meta-Analysis Findings

The exploratory meta-analysis of two controlled trials, one randomized and one quasi-randomized, found a pooled mean difference in systolic blood pressure change of -5.27 mmHg (95% CI -7.23 to -3.31; z = -5.27; $p < 0.0001$) (**Table 4**; **Figure 2**). No statistical heterogeneity was detected ($Q = 0.057$, $df = 1$, $p = 0.811$; $\tau^2 = 0$; $I^2 = 0\%$). A reduction of this magnitude may be clinically relevant at the population level [18], but the estimate is based on only two studies, one of which used quasi-random allocation, and should not be interpreted as definitive evidence across all hospital-linked settings.

For diastolic blood pressure, the pooled mean difference was -4.21 mmHg (95% CI -9.80 to 1.38; z = -

Table 3. Blood pressure outcomes reported in the included studies

Study	Baseline BP	Follow-up BP	Intervention effect	Comparator effect	Between-group interpretation	p value/notes	Meta-analysis
Okoro et al. (2022)	Reported as comparable except sex imbalance	6 and 12 months	SBP reduction 7.12 mmHg greater than usual care	BP-control proportions increased but were not statistically different	Favored intervention for mean SBP	p=0.020 for SBP difference	Not pooled; complete dispersion data not reported in review file
Huynh et al. (2024)	I: 140.58/82.33; C: 138.20/81.21 mmHg	I: 134.33/79.75; C: 137.22/80.29 mmHg at 12 weeks	Change: -6.15/-2.58 mmHg	Change: -0.98/-0.92 mmHg	Difference in change: -5.17/-1.66 mmHg	p<0.001 reported for both outcomes	Pooled
Paudel et al. (2023)	No significant baseline difference; numerical values not fully reported in review table	Median at 4 months: I 125/80; C 130/90 mmHg	Lower final median BP	Usual care	Favored intervention	SBP p=0.008; DBP p=0.012	Not pooled because change-score variance was unavailable
Migliozzi et al. (2015)	Baseline values not provided in review table	Significant reductions at 30, 90, 180, and 360 days	Sustained within-group reduction	No concurrent control	Uncontrolled improvement	p<0.05	Not pooled
Li et al. (2023)	Measured at hospital admission	12 months after discharge	Change: -9.47/-11.10 mmHg	Change: -3.64/-3.70 mmHg	Greater reduction: 5.83 mmHg SBP and 7.40 mmHg DBP	SBP p=0.023; DBP p<0.001 at 12 months*	Pooled

*Source-reported p values were not used to validate the imputed change-score variance.

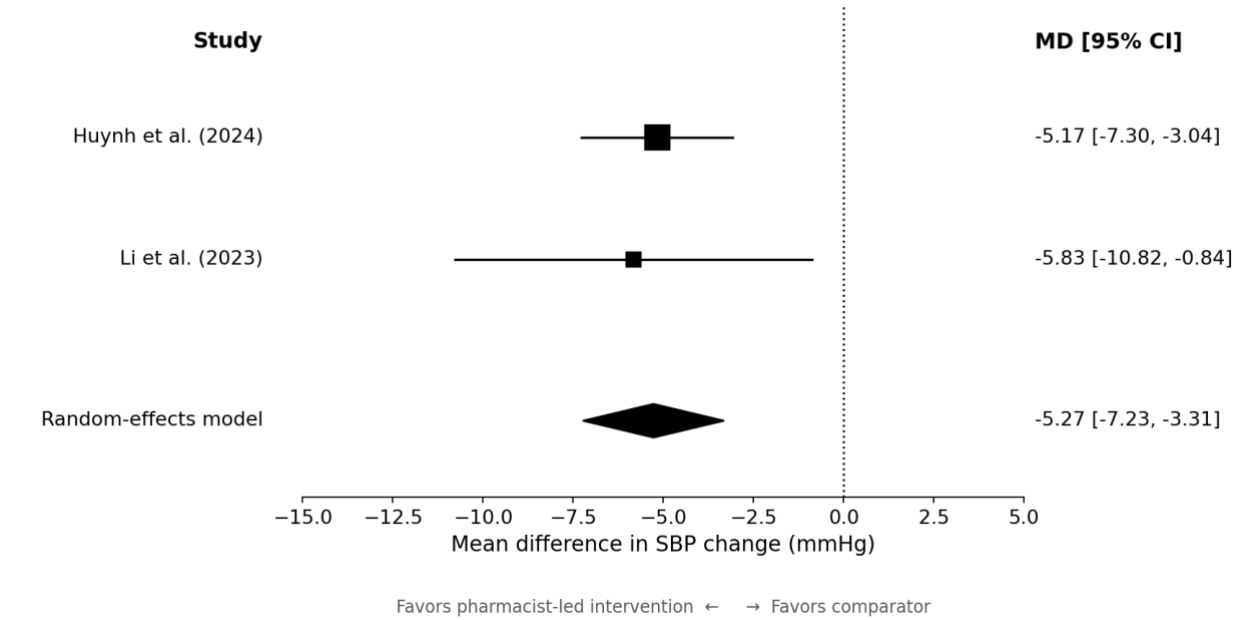

Figure 2. Forest plot of systolic blood pressure change

Exploratory random-effects meta-analysis of two controlled trials (one randomized and one quasi-randomized). Negative values favor pharmacist-led intervention.

Table 4. Exploratory pooled analysis of systolic and diastolic blood pressure change

Outcome (k)	MD	SE	95% CI	z	p	τ^2	I^2
SBP (2)	-5.27	1.00	-7.23 to -3.31	-5.27	<0.0001	0.00	0%
DBP (2)	-4.21	2.85	-9.80 to 1.38	-1.48	0.140	14.02	85.1%

Pooled mean differences represent intervention minus comparator change scores; negative values favor pharmacist-led intervention. CI, confidence interval; DBP, diastolic blood pressure; I^2, proportion of variability attributed to heterogeneity; MD, mean difference; SBP, systolic blood pressure; SE, standard error; τ^2, between-study variance.

1.48; p = 0.140) (**Table 4**; **Figure 3**). Substantial heterogeneity was observed (Q = 6.716, df = 1, p = 0.010; τ^2 = 14.02; I^2 = 85.1%). The wide confidence interval and divergent study-specific effects indicate uncertainty. With only two studies, heterogeneity estimates are imprecise and potential sources cannot be explored reliably. A sensitivity analysis across assumed pre-post correlations of r = 0.3 to 0.9 did not alter the direction, statistical significance, or approximate magnitude of either pooled estimate (**Supplementary Table S1**).

Mechanisms of Effect: Adherence, Knowledge, and Optimization

Medication adherence and hypertension knowledge improved in the education-focused controlled trials [1,17] (**Table 5**). Counseling was reinforced with printed materials, videos, telephone follow-up, or reminders, suggesting that repeated, multimodal contact may be more effective than a single educational encounter [19]. A cluster randomised trial of a pharmacist-led adherence intervention conducted outside the hospital setting similarly reported improved adherence and lower diastolic blood pressure [20]. However, adherence was generally self-reported and may be susceptible to social-desirability and recall bias.

Medication optimization and resolution of drug-related problems were prominent in the more intensive medication therapy management models. Li et al. reported that 75.3% of baseline drug-related problems in the intervention group were resolved by 12 months [2], while Migliozzi et al. reported that medication-related problems accounted for 46% of documented pharmacist

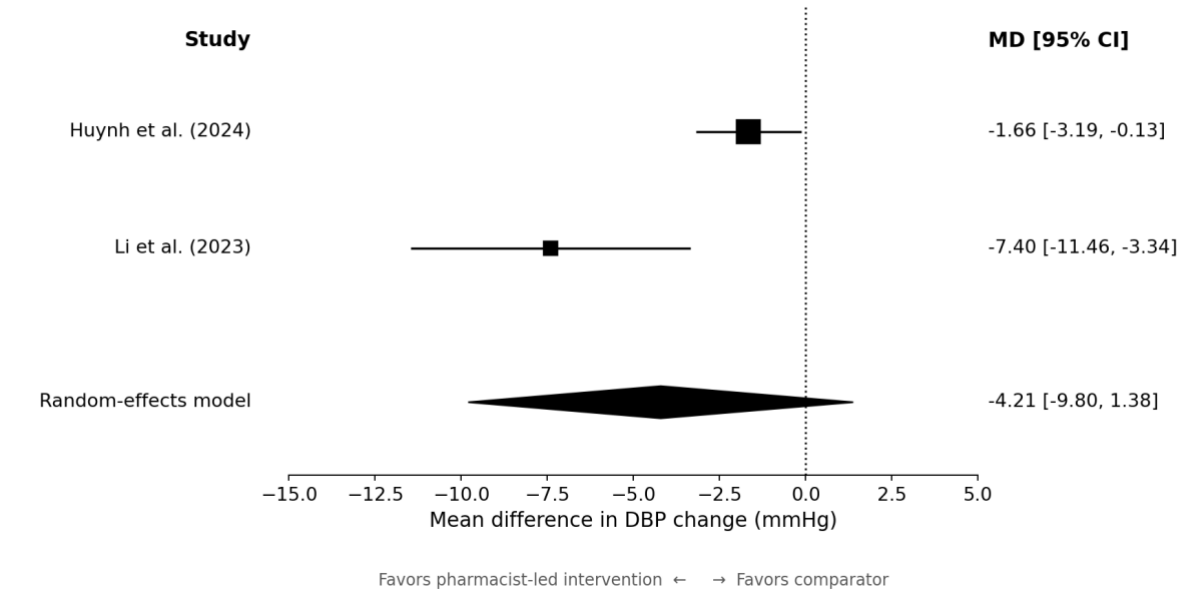

Figure 3. Forest plot of diastolic blood pressure change

Exploratory random-effects meta-analysis of two controlled trials (one randomized and one quasi-randomized). Negative values favor pharmacist-led intervention.

interventions [6]. These process outcomes provide a plausible pathway to improved blood pressure, although mediation was not formally tested.

Secondary Outcomes and Health System Implications

Paudel et al. reported improvements in physical and mental health-related quality-of-life scores at four months [17], whereas Li et al. found no significant between-group difference in EQ-5D utility at 12 months [2] (**Table 5**). The difference may reflect study population, follow-up, intervention content, and measurement sensitivity rather than a consistent effect of pharmacist care on quality of life.

Evidence for health-service and economic outcomes was limited. Li et al. reported a lower average daily medication therapy cost at 12 months, but the readmission rate did not differ significantly between groups [2]. A scoping review of pharmacist-led interventions delivered at hospital discharge has reported reductions in readmission rates, although the interventions varied widely across studies [21]. Because these outcomes were reported by a single trial, this review cannot establish cost-effectiveness or a consistent effect on healthcare utilization.

Sustainability and Evidence Strength

Several studies reported benefits at follow-up periods of up to 12 months [2,3,6], but durability cannot be separated from ongoing follow-up, medication changes, or other co-interventions. Longer follow-up alone does not establish sustainability when attrition is substantial or the comparison is uncontrolled.

The direction of findings is generally favorable, but consistency across randomized and nonrandomized designs should not be interpreted as strong certainty because several studies shared important risks of bias. The most defensible conclusion is that pharmacist-led interventions are promising, especially when they combine education, monitoring, and medication optimization, while the comparative evidence remains limited.

Limitation and Future Direction

This review has several limitations. Only PubMed and Scopus were searched, the search was restricted to English-language studies published from 2010 onward, and the protocol was not prospectively registered. The Scopus core Boolean expression was broad, was not date restricted at the database level, and was not independently peer reviewed; the year criterion was

Supplementary Table S1. Sensitivity of the pooled estimates to the assumed pre-post correlation

Assumed r	SBP: MD (95% CI)	SBP: p	SBP: I^2	DBP: MD (95% CI)	DBP: p	DBP: I^2
0.3	−5.25 (−7.25 to −3.25)	< 0.0001	0%	−4.08 (−9.64 to 1.47)	0.150	80.7%
0.4	−5.26 (−7.24 to −3.27)	< 0.0001	0%	−4.15 (−9.72 to 1.43)	0.145	82.9%
0.5	−5.27 (−7.23 to −3.31)	< 0.0001	0%	−4.21 (−9.80 to 1.38)	0.140	85.1%
0.6	−5.29 (−7.22 to −3.36)	< 0.0001	0%	−4.27 (−9.87 to 1.33)	0.135	87.3%
0.7	−5.32 (−7.20 to −3.43)	< 0.0001	0%	−4.33 (−9.95 to 1.28)	0.130	89.5%
0.8	−5.36 (−7.16 to −3.55)	< 0.0001	0%	−4.40 (−10.02 to 1.22)	0.125	91.7%
0.9	−5.43 (−7.10 to −3.76)	< 0.0001	0%	−4.46 (−10.09 to 1.16)	0.120	93.9%

Pooled mean differences in blood pressure change across assumed pre-post correlations for the imputed study-level variance (Li et al. 2023). Huynh et al. 2024 contributed reported change-score standard deviations at all values of r. The row for r = 0.5 is the primary analysis. CI, confidence interval; DBP, diastolic blood pressure; I^2, proportion of variability attributed to heterogeneity; MD, mean difference; SBP, systolic blood pressure.

applied during screening. The review may therefore have missed eligible studies indexed with alternative terminology despite screening all retrieved records. Screening, data extraction, and risk-of-bias appraisal were undertaken by one reviewer rather than independently in duplicate; this may increase the risk of errors in study selection and data extraction and of subjective judgment in risk-of-bias ratings, and it represents a departure from recommended systematic review practice. Only two studies were sufficiently comparable for meta-analysis, one of which used predictable quasi-random allocation. This precluded meaningful subgroup analysis or assessment of publication bias, and the DerSimonian-Laird random-effects estimates and heterogeneity statistics are unstable with only two studies. For one pooled trial, the standard deviation of change was not reported and had to be imputed under an assumed pre-post correlation. Although sensitivity analyses across plausible correlation values did not alter the direction, significance, or approximate magnitude of either pooled estimate, this reliance on imputation is an additional source of uncertainty. Risk of bias was important, clinical and intervention heterogeneity was considerable, and certainty of evidence was not formally graded.

Future research should use concealed randomization, intention-to-treat analysis, blinded or independent blood pressure measurement, standardized intervention descriptions, consistent blood pressure measurement protocols, and complete reporting of change-score variances. Trials should also report intervention fidelity, medication changes, adverse events, patient-centered outcomes, healthcare utilization, and costs. Prospective registration of both trials and systematic-review protocols would improve transparency and reduce selective reporting.

CONCLUSION

This systematic review suggests that pharmacist-led interventions may improve systolic blood pressure and several medication-management outcomes in adults with hypertension receiving care in hospital or hospital-linked settings. In an exploratory meta-analysis of two controlled trials, one randomized and one quasi-randomized, systolic blood pressure

Table 5. Secondary outcomes reported in the included studies

Study	Adherence/knowledge	Quality of life	Drug-related problems/medication optimization	Healthcare utilization	Laboratory outcomes	Cost outcomes
Okoro et al. (2022)	Adherence counseling; adherence outcome reported in source study	Not reported	Individualized prescription review and drug-related interventions	Not reported	Serum creatinine assessed	Not reported
Huynh et al. (2024)	MGL 3.76+/-0.52 vs 3.20+/-0.87; higher hypertension-knowledge score; p<0.001	Not reported	Not reported	Not reported	Not reported	Not reported
Paudel et al. (2023)	MGL improved at 2 and 4 months; p<0.001	Physical 45.0 vs 40.3 (p=0.046); mental 47.1 vs 38.8 (p=0.003) at 4 months	Not reported	Not reported	Not reported	Not reported
Migliozzi et al. (2015)	Barriers to adherence assessed and addressed	Not reported	Medication-related problems represented 46% of pharmacist interventions	Not reported	Not reported	Not reported
Li et al. (2023)	Adherence addressed through MTM; no dedicated adherence scale reported	No significant EQ-5D difference	75.3% of baseline DRPs resolved in intervention group at 12 months	Readmission lower numerically but not statistically significant	Not a principal reported outcome	Average daily medication therapy cost lower at 12 months; p=0.049

decreased by approximately 5 mmHg relative to usual care. The pooled diastolic blood pressure effect was uncertain and heterogeneous.

The evidence does not support a definitive conclusion that all pharmacist-led models are effective across settings. The small evidence base, variable interventions, attrition, quasi-random allocation in one pooled trial, one uncontrolled before-after study, and risk of bias limit confidence and generalizability. Pharmacist integration is promising when it includes repeated education, monitoring, and medication optimization, but implementation decisions should account for local scope of practice and available resources.

Further multicenter randomized trials with concealed allocation, intention-to-treat analysis, standardized blood pressure measurement, clearly defined pharmacist activities, and comprehensive clinical and economic outcome reporting are needed before firm estimates of effectiveness and cost-effectiveness can be established.

CONFLICT OF INTEREST

The authors have no conflicts of interest regarding this investigation.

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