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THE IMPACT OF TELEPHARMACY ON MEDICATION ADHERENCE IN HYPERTENSION PATIENTS: A SYSTEMATIC REVIEW

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ABSTRACT
Advances in information and communication technology have accelerated the development of digital health services, including telepharmacy. Telepharmacy has the potential to improve medication adherence, support blood pressure monitoring, and strengthen patient education, thereby reducing the burden of chronic disease and preventing cardiovascular complications. This study aimed to systematically review and synthesize evidence on the effect of pharmacist-led telepharmacy interventions on medication adherence and blood pressure control among patients with hypertension. A systematic literature review was conducted following the PRISMA 2020 guideline. Searches were performed in two electronic databases, namely Scopus and PubMed, for studies published between 2020 and 2025. A total of 1,285 articles were identified, and 11 studies met the inclusion criteria. The selected studies were appraised using the Critical Appraisal Skills Programme (CASP) tool before being included in the qualitative synthesis. The findings showed that all included studies reported improvements in treatment-related outcomes following pharmacist-led telepharmacy interventions. Overall, telepharmacy was associated with improved medication adherence and better blood pressure control in hypertensive patients compared with the control group.

Keywords: hypertension; medication adherence; telepharmacy; systematic review

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INTRODUCTION

Currently, developments in the information and communication technology sector are influencing the healthcare sector through the concept of Electronic Health (E-Health). This phenomenon has become widely recognized among the public, particularly during the Coronavirus Disease 2019 (COVID-19) pandemic. The emergence of innovations and developments in technology-based healthcare services in Indonesia and other affected countries has led to the rapid growth of these digital services, facilitating safe and effective access to healthcare services (Ministry of Health of the Republic of Indonesia, 2019). Telehealth, particularly telepharmacy, is crucial for addressing the burden of chronic diseases such as hypertension. This can be a potential solution to address issues arising in the treatment process, given the frequent issues related to long treatment intervals and polypharmacy, which can lead to decreased medication adherence and treatment failure. This contributes to the increasing number of hypertension patients, which constitutes a significant burden in various countries. According to the AHA (2025), hypertension is defined as systolic blood pressure (SBP) greater than 130 mm Hg or diastolic blood pressure (DBP) greater than 80 mm Hg, or receiving antihypertensive therapy.

Treating hypertension is one of the most important interventions to achieve target 3.4 of the Sustainable Development Goal (SDG), which aims to reduce premature deaths from major non-communicable diseases by one-third. Total Disability-Adjusted Life Years (DALYs) due to hypertension in 2019 reached 21.51 million, a substantial increase of 54.25% compared to the 13.94 million recorded in 1990. The number of hypertension patients poses a significant burden in various countries (Abbafati et al., 2020) (SDG, 2019; SDG Report, 2023). Pharmacist interventions are an element of pharmaceutical care that aims to evaluate and identify medication problems, develop

plans, and find appropriate solutions to achieve maximum effectiveness and outcomes. The role and contribution of pharmacists in pharmaceutical care are crucial for achieving the goals of hypertension treatment, namely controlling blood pressure and improving patients' quality of life (O. M. Ibrahim et al., 2022; Mozu et al., 2021; Reeves et al., 2020; Soubra & Elba, 2023).

Reviews of previous research often reveal limitations, including a lack of further study of the relationship between telemedicine/telepharmacy counseling conducted by pharmacists and improved medication adherence, thus lowering blood pressure in hypertensive patients. Therefore, this study examines the impact of telepharmacy interventions on blood pressure control in hypertensive patients, particularly in terms of their impact on medication adherence, as medication adherence contributes to blood pressure reduction in hypertensive patients. Furthermore, the purpose of this study is to review randomized controlled trials to provide comprehensive results. This is considered the most reliable scientific evidence in healthcare because it minimizes bias and involves randomizing treatment to subjects (Franklin et al., 2022). Therefore, to conduct a systematic review, randomized controlled trials were selected and this study was conducted to provide an overview of the effect of pharmacist intervention in telepharmacy practice on blood pressure control and medication adherence in hypertensive patients.

METHOD

This is a non-experimental descriptive study using a literature review design with the Scopus and PubMed electronic search engines. This study applied the Systematic Literature Review (SLR) method following the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines to systematically assess medication adherence in hypertensive patients (Palaman et al., 2021). According to PROSPERO (2016), a literature review consists of four stages:
A comprehensive Literature search, was conducted through two major electronic databases: PubMed and Scopus. The search strategy used the keywords "*telepharmacy*" OR "*telehealth*" OR "*telemedicine*" OR "*mobile health*" OR "*mhealth*" AND "*medication compliance*" OR "*medication adherence*" AND "*blood pressure control*". Study selection, this research was guided by predetermined inclusion and exclusion criteria, which included randomized controlled trials (RCTs) of interventions by pharmacists or other healthcare professionals in adults diagnosed with hypertension in inpatient, outpatient, or community settings.

Table 1.
Predetermined inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
1. Articles published within the last ten years, between 2020 and 2025, with study sites worldwide. 2. Research articles must be accessible in full text; 3. The study type must be a randomized controlled trial; 4. The study subjects were hypertensive patients aged ≥18 years, with a diagnosis of essential hypertension or currently undergoing antihypertensive treatment. 5. The intervention provided was a telemedicine intervention delivered via telecommunications technology by pharmacists for the treatment of hypertensive patients in inpatient, outpatient, or community settings, without language restrictions. The intervention included measurements of hypertension medication adherence parameters; and the intervention study design was explained in detail. 6. The study compared hypertensive patients who received telemedicine intervention delivered via telecommunications technology by pharmacists with those who did not receive any specific intervention, with no telemedicine intervention delivered via telecommunications technology by pharmacists to improve medication adherence. 7. The results of blood pressure measurements were provided at the beginning and end of the study.	1. Articles with titles that did not meet PICO criteria, 2. Articles without abstracts, 3. Articles that could not be accessed in full text, 4. Articles that did not include interventions, 5. Articles with intervention methods other than counseling, 6. Articles in which the intervention was not conducted by a pharmacist, 7. Articles in which the research was not conducted on a population of hypertensive patients, 8. Articles that were not original research, 9. Articles with research designs other than Randomized Controlled Trials (RCTs), 10. Articles that did not include a control group, 11. Articles in which the research did not examine children, 12. Articles in which the research did not examine pregnant women, 13. Articles with file types that could not be opened.

Data Extraction, was carried out systematically using a standard data extraction form. The collected

information was categorized based on the first author, year of publication, country, location, study population, objectives, main components of the pharmacist intervention, study design, sample size, follow-up time, primary outcomes, outcome measurement strategies, and key findings (Page et al., 2021). Study Quality Assessment, a methodological assessment of the studies included in this review was conducted using the Critical Appraisal Skills Programme (CASP) instrument. This assessment tool was adapted to suit the design of each study, such as randomized controlled trials (RCTs) (Long et al., 2020). Each study was scored based on a relevant checklist and then categorized as high, moderate, or low quality according to pre-established assessment criteria. The study quality categorization and assessment techniques were developed by the authors using the algorithm used by Butler et al., 2015. The findings synthesis stage involved systematic data extraction, thematic analysis to identify key patterns, and narrative synthesis to integrate findings from studies meeting the inclusion criteria, with documentation following the PRISMA flowchart.

RESULT

After going through the study selection process, primary studies were found to be subject to study quality assessment in Table 1, using the CASP tool for RCT articles on "The effect of telepharmacy on increasing compliance". Study Characteristics. The characteristics of the 11 studies included in the meta-analysis are summarized in Table 2. These 11 studies were conducted in seven countries: Australia (Chow et al., 2022), the United Kingdom (Byrne et al., 2020), China (Li et al., 2021), Ghana (Mozu et al., 2023), Egypt (Gamal et al., 2025), Nepal (Paudel et al., 2023), the United Arab Emirates (UAE) (El-Deyarbi et al., 2025; Ibrahim et al., 2022), and the United States of America (USA) (O'Connor et al., 2025; Prendergast et al., 2025; Schoenthaler et al., 2020). The 11 included studies involved adult patients, with intervention periods ranging from 3 to 48 months.

Table 1.
Study quality assessment using the CASP tool

No	Article	Criteria											Total
		1	2	3	4	5	6	7	8	9	10	11	
1	(Byrne *et al*., 2020)	1	1	1	0	1	1	0	1	0	1	1	8
2	(Chow *et al*., 2022)	1	0	1	1	1	1	1	1	1	1	1	10
3	(El-Deyarbi *et al*., 2025)	1	0	1	1	1	1	0	1	0	1	1	8
4	(Gamal *et al*., 2025)	1	0	1	1	1	1	0	1	0	1	1	8
5	(Ibrahim *et al*., 2022)	1	1	1	1	1	1	1	1	1	1	1	11
6	(Li *et al*., 2021)	1	0	1	1	1	1	0	1	1	1	1	9
7	(Mozu *et al*., 2023)	1	0	1	1	1	1	0	1	1	1	1	9
8	(O'Connor *et al*., 2025)	1	0	1	1	1	1	0	1	1	1	1	9
9	(Paudel *et al*., 2023)	1	0	1	1	1	1	0	0	1	1	1	8
10	(Prendergast *et al*., 2025)	1	0	0	1	1	1	0	1	1	1	1	8
11	(Schoenthaler *et al*., 2020)	1	0	1	0	1	1	0	1	1	1	1	8

Description of the question criretia:
1 = Does this research answer the research questions clearly?
2 = Was the assignment of participants to the intervention randomized?
3 = Were all participants who entered the study accounted for in the conclusions?
4 = Were the participants, the people who analyzed the results and the researchers blinded?
5 = Were the study groups similar at the start of the randomized controlled trial?
6 = Regardless of the experimental intervention, did each study group receive the same level of care (ie, were they treated the same)?
7 = Were the effects of the intervention reported comprehensively?
8 = Is the accuracy of the reported intervention or treatment effect estimates?
9 = Do the benefits of the experimental intervention outweigh the disadvantages and costs?
10 = Can the results be applied to your local population/in your context?
11 = Will the experimental intervention provide greater value to the people in your care than any existing intervention?

Decription of the answer score
0 = No
1 = Yes

The PRISMA flow is as follows:

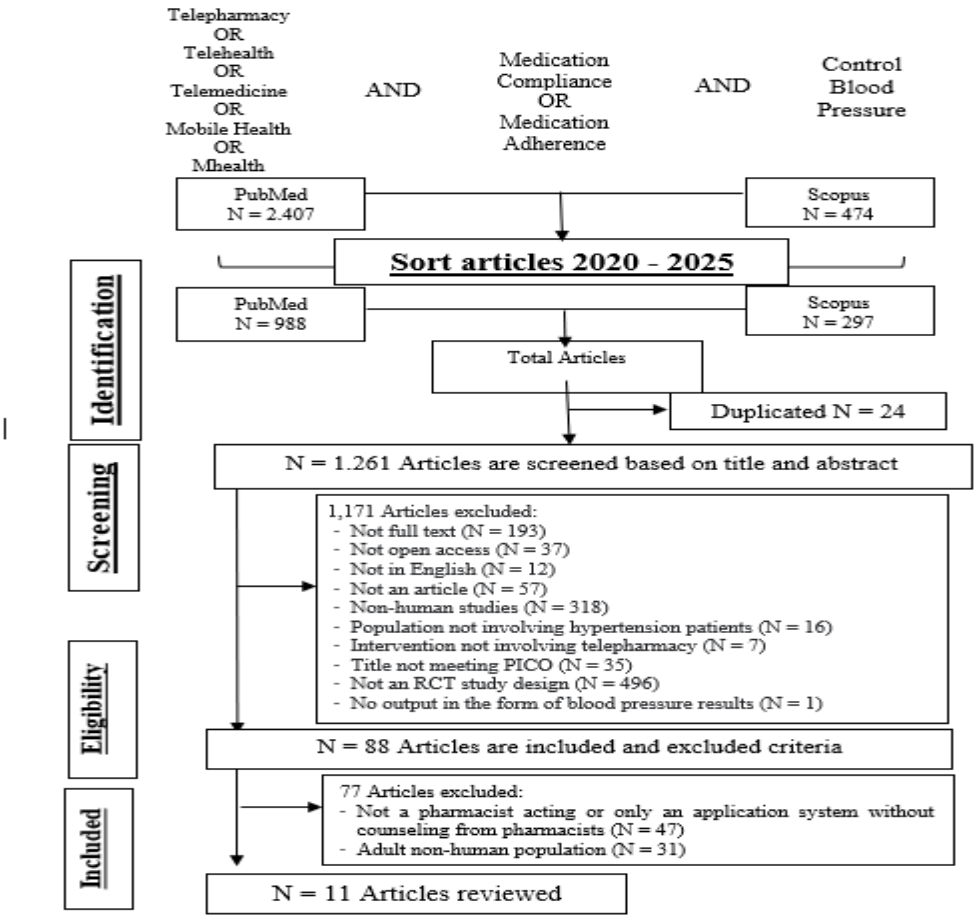


Figure 1. PRISMA Flow Diagram

Table 2.
Data characteristics

No	Author, Year of study	Country	Design Study	Interven-tion period	Outcome	
					Medication Adherence	
					Baseline (SD)	Intervention Group (SD)
1	(Byrne *et al*., 2020)	England	Pragmatic Randomised Controlled Trial	12 month	MMAS* score = 8 for high adherence (number (%)): 32 (30)	MMAS* score = 8 for high adherence (number (%)): 79 (45)
2	(Chow *et al*., 2022)	Australia	Single-blind, multicenter, randomized controlled trial	12 month	The method used was self-reported medication adherence: Measurement at month 6 (Proportion estimates (95% CI)): 0.603 (0.568; 0.641)	Measurement at month 12 (Proportion estimates (95% CI)): 0.537 (0.501; 0.576) Month 6 and/or Month 12 (Proportion estimates (95% CI)): 0.500 (0.464; 0.539)
3	(El-Deyarbi *et al*., 2025)	UAE	Randomized Clinical Trial	12 month	Baseline Tinggi = 42 (44.6) Sedang = 35 (37.2) Rendah = 17 (18.1)	Setelah 12 Bulan Tinggi = 66 (70.2) Sedang = 17 (18.1) Rendah = 11 (11.7)
4	(Gamal *et al*., 2025)	Egypt	Single-center, prospective, open-label, parallel group (1:1), randomized controlled trial (RCT)	3 month	Using the Simplified Medication Adherence Questionnaire (SMAQ). Overall Adherence SMAQ, Adherent, N (%) Baseline: 4 (9.3)	After 3 Months: 32 (74.42)
5	(Ibrahim *et*	UAE	Randomized	12 month	Mean Score Baseline	Mean Score After 12 month

No	Author, Year of study	Country	Design Study	Interven-tion period	Outcome	
					Medication Adherence	
					Baseline (SD)	Intervention Group (SD)
	al., 2022)		Clinical Trial		4.9 (2.8)	7.6 (1.8)
6	(Li *et al*., 2021)	China	Randomized Clinical Trial	6 month	Baseline Low = 63 (21.7%) Medium = 80 (27.6%) High = 147 (50.7%)	After 6 month Low = 13 (4.5%) Medium = 14 (4.8%) High = 263 (90.7%)
7	(Mozu *et al*., 2023)	Ghana	Randomized Clinical Trial	6 month	The proportion of adherent participants Baseline 85.7% intervention group (Meanbaseline = 7.1 ± 1.4)	The proportion of adherent participants 96.5% (Mean6months = 8.4 ± 0.9). There was a statistically significant difference between the mean adherence scores at baseline and after 6 months (Mean = -1.33, SD = 1.21, CI = -1.65 - -1.01, p = 0.000).
8	(O'Connor *et al*., 2025)	USA	Randomized Clinical Trial	12 month	Adherence was measured using the proportion of days covered (PDC). Patients with 1 vs. ≥2 condition-specific medication classes at baseline were assessed as having low adherence at baseline. 1 Class: 651 (67) ≥2 Classes: 317 (33)	After 12 Months Adherence to blood-control medications: 470/887 (53.0)
9	(Paudel *et al*., 2023)	Nepal	Randomized Clinical Trial	4 month	Baseline Low = 11 (45.8) Medium = 17 (58.6) High = 0	After 4 months Low = 0 Medium = 15 (46.9) High = 13 (81.3)
10	(Prender gast *et al*., 2025)	USA	Randomized Clinical Trial	12 month	Modified Morisky Scale Health Survey and Patient Activation Measure (PAM) Survey (all groups): The modified Morisky Scale is a 4-item instrument. The scale categorizes low adherence (3-4), moderate adherence (1-2), and high adherence (0) based on its criterion validity with blood pressure control. Baseline mean: 1.2	After 12 months : 1,2
11	(Schoent haler *et al*., 2020)	USA	Randomized Clinical Trial	6 month	Average Adherence Baseline 4.48 (1.41)	Average Adherence after 6 Months 6.46 (1.65)

Description of :
SD = Standard Deviation, CI = Confidence Interval, ACS = Acute Coronary Syndrome, CKD = Chronic Kidney Disease, CVD = Cardiovascular Diseases, DBP = Diastolic Blood Pressure, DM = Diabetes Mellitus, DRP = Drug Related Problem, SBP = Systolic Blood Pressure, UAE = The United Arab Emirates, USA = The United States Of America, IG = Intervention Group, CG = Control Group, MA = Medical Assistant, NA = Not Available

DISCUSSION

This systematic review of research indicates that telepharmacy is a promising strategy for improving medication adherence, particularly for chronic diseases requiring long-term therapy, such as hypertension. Implementing telepharmacy can be an important part of modern pharmaceutical

care because it supports the role of pharmacists in therapy monitoring, patient education, and optimizing treatment outcomes (Sumanth et al., 2026). Based on the results of a systematic review of 11 articles, telepharmacy interventions demonstrated improved medication adherence in the intervention group compared to the control group. These findings indicate that pharmacist involvement through remote services can help patients understand therapy, reduce barriers to medication use, and improve patient consistency in following treatment regimens. Thus, telepharmacy serves not only as a means of communication but also as an effective clinical strategy to support patient adherence in chronic diseases requiring long-term therapy (O. M. Ibrahim et al., 2022).

This increased adherence can be explained by several mechanisms, such as ongoing medication education, medication reminders, regular consultations, and more accessible therapy monitoring. In chronic diseases such as hypertension and diabetes mellitus, patients often face barriers such as forgetting to take medications, a lack of understanding of the treatment regimen, and concerns about side effects. Telepharmacy helps mitigate these barriers through more intensive pharmacist support. The consistent pattern of results across the 11 articles suggests that telepharmacy interventions positively contribute to improved medication adherence. These benefits arise because telepharmacy strengthens patient-pharmacist communication, facilitates routine follow-up, and makes patients feel more monitored throughout their therapy. The most helpful interventions are often those delivered in a repetitive and structured manner, for example, via telephone, text message, or online platforms, accompanied by medication review and reinforcement of the importance of adherence. Thus, telepharmacy is not only a communication tool but also a clinical strategy to address common causes of non-adherence such as forgetting to take medications, concerns about side effects, and a lack of understanding of the treatment regimen (Reddy et al., 2026). Overall, the findings of this systematic review support telepharmacy as a promising approach to improving patient adherence to treatment. This strategy is particularly relevant for patients requiring long-term monitoring, as it can strengthen the patient-pharmacist relationship, increase the sense of being monitored, and help achieve better therapeutic success.

CONCLUSION

Telepharmacy has been shown to have a positive impact on improving patient medication adherence, primarily by facilitating education, medication reminders, routine consultations, and ongoing therapy monitoring. A systematic review of 11 articles found that telepharmacy interventions were more effective than control groups in helping patients understand therapy, reducing barriers to medication use, and maintaining treatment consistency. Therefore, telepharmacy can be a promising and relevant strategy for implementation in modern pharmaceutical care, particularly for patients with chronic diseases requiring long-term therapy.

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