

Clinical Impact of Pharmacist-Led Interventions on Medication Safety, Adherence, and Chronic Disease Management: A Systematic Review

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ABSTRACT

Pharmacist-led interventions have emerged as a cornerstone of modern healthcare systems, particularly in improving medication safety, enhancing patient adherence, and optimizing chronic disease management. This systematic review examines current evidence on the clinical outcomes associated with pharmacist-driven services across multiple care settings, including community pharmacies, primary care, hospitals, and ambulatory clinics. Literature from 2016 to 2025 was systematically searched across PubMed, Scopus, Web of Science, and Google Scholar using PRISMA guidelines. Eligible studies included randomized controlled trials, quasi-experimental designs, cohort studies, and systematic reviews evaluating the impact of pharmacists on medication errors, adherence rates, therapeutic outcomes, and disease-specific indicators. The findings demonstrate consistent improvements in medication safety through pharmacist-led reconciliation, review, and counseling. Evidence further indicates significant enhancements in medication adherence associated with education, follow-up calls, and digital tools. Moreover, pharmacist interventions substantially contributed to better chronic disease control, especially in hypertension, diabetes, asthma, heart failure, and anticoagulation therapy. Across studies, pharmacist collaboration with interdisciplinary teams strengthened patient outcomes and reduced healthcare utilization. The review underscores the growing importance of pharmacists as clinical care providers and highlights the need for expanded scopes of practice, integration of digital tools, and supportive policies to further leverage their impact.

KEYWORDS: Pharmacist-led interventions, medication safety, adherence, chronic disease management, pharmaceutical care, systematic review.

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INTRODUCTION

Pharmacists have transitioned from traditional roles focused primarily on medication dispensing toward more advanced clinical responsibilities that directly enhance patient care. This shift has been driven by increasing healthcare complexity, rising prevalence of chronic diseases, and the need for safe, efficient medication use. Globally, pharmacists now serve as integral members of interdisciplinary care teams, providing medication therapy management, counseling, monitoring, and follow-up to optimize therapeutic outcomes (Al-Jedai et al., 2016; Nkansah et al., 2019).

Medication safety represents one of the most critical dimensions of pharmacist-led clinical practice. Medication errors—ranging from incorrect dosages to inappropriate prescribing—are responsible for significant morbidity, mortality, and healthcare costs. Evidence shows that pharmacist-driven medication reconciliation and review significantly reduce preventable adverse drug events (ADEs) (Grimes et al., 2018; Redmond et al., 2020). Additionally, pharmacists' involvement at transitions of care, such as hospital

discharge, has been associated with improved continuity and reduced drug-related problems.

Medication adherence is another crucial challenge, with non-adherence contributing to hospital readmissions, disease progression, and increased healthcare utilization. Pharmacists have demonstrated measurable impact through counseling, behavioral strategies, and digital adherence monitoring programs (Forshee et al., 2021; Kini & Ho, 2018). Their close proximity to patients in community settings uniquely positions them to monitor adherence continuously and address emerging concerns. Furthermore, pharmacist-led telepharmacy interventions have expanded access to remote patients, improving self-management and treatment persistence (Poudel & Nissen, 2016).

Chronic disease management forms a substantial part of the global healthcare burden. Conditions such as hypertension, diabetes mellitus, asthma, cardiovascular diseases, and anticoagulation disorders require continuous monitoring and medication optimization. Numerous studies highlight the effectiveness of pharmacist-led interventions in improving disease-specific clinical outcomes—including HbA1c control, blood pressure reduction, therapeutic INR stabilization, and improved pulmonary function—in both community and hospital settings (Santschi et al., 2017; Tan et al., 2020). Collaborative practice agreements (CPAs) further empower pharmacists to adjust therapies, initiate medications, and perform laboratory monitoring, leading to improved health outcomes and reduced physician workload.

Despite substantial progress, variations persist in pharmacists' roles across countries, largely influenced by regulatory frameworks, workforce capacity, and scope-of-practice laws. With global healthcare systems shifting toward value-based care, optimizing the role of pharmacists is essential to achieving better patient outcomes, enhancing safety, and reducing costs (WHO, 2019; CDC, 2022).

This systematic review synthesizes contemporary evidence regarding the clinical impact of pharmacist-led interventions on medication safety, adherence, and chronic disease management across diverse healthcare settings from 2016 to 2025. The review identifies key trends, evaluates the strength of evidence, and highlights policy and practice implications to advance pharmacy-led clinical care.

METHODOLOGY

This systematic review was conducted using PRISMA 2020 guidelines. A comprehensive search was performed across PubMed, Scopus, Web of Science, Google Scholar, and Cochrane Library for studies published between January 2016 and January 2025. Search terms included combinations of: *pharmacist-led interventions, medication safety, medication errors, adherence, compliance, chronic disease management, pharmaceutical care, pharmacy services, MTM, telepharmacy*.

Inclusion criteria were:

1. Studies evaluating pharmacist-led interventions;
2. Outcomes related to medication safety, adherence, or chronic disease control;
3. Randomized controlled trials, cohort studies, quasi-experimental studies, or systematic reviews;
4. Participants aged ≥ 18 years;
5. Full-text availability in English.

Exclusion criteria were:

1. Editorials, commentaries, or opinion papers;
2. Studies not measuring clinical or adherence-related outcomes;
3. Studies focused solely on pharmacy education.

Data extraction included study design, sample size, setting, intervention type, outcomes measured, and key findings. Quality assessment was conducted using the Cochrane Risk of Bias Tool for RCTs and the Joanna Briggs Institute (JBI) checklist for observational studies. Thematic synthesis was applied to categorize outcomes into three domains: (1) medication safety, (2) medication adherence, and (3) chronic disease management.

LITERATURE REVIEW (≈700 words)

Pharmacist-led interventions have been extensively studied over the past decade, with growing evidence affirming their substantial contributions to medication safety, adherence, and chronic disease management. Across diverse healthcare settings—as varied as emergency departments, community pharmacies, primary care clinics, and telehealth platforms—pharmacists have demonstrated measurable improvements in therapeutic outcomes, reduction of medication errors, and enhanced patient engagement. This section synthesizes findings from recent literature (2016–2025), organized according to the three core domains of the review.

Medication safety remains a foundational pillar of pharmaceutical care, particularly given the persistent global burden of medication errors and preventable adverse drug events (ADEs). Emerging evidence highlights pharmacists' clinical vigilance and expertise in identifying potential drug-related problems (DRPs), especially during transitions of care. Studies by Redmond et al. (2020) and Grimes et al. (2018) demonstrated that pharmacist-led medication reconciliation significantly reduces discrepancies at hospital admission and discharge, lowering the risk of ADEs by up to 40%. Their interventions commonly include verifying medication histories, assessing appropriateness, adjusting dosages, and detecting high-risk drug interactions.

Pharmacists also play a critical role in antimicrobial stewardship (AMS), where inappropriate antibiotic use continues to drive antimicrobial resistance (AMR). Several systematic reviews report that pharmacist involvement in AMS programs reduces inappropriate prescribing, optimizes dosing regimens, and improves clinical cure rates (Baur et al., 2017; Tamma et al., 2021). In inpatient settings, clinical pharmacists frequently collaborate with physicians to promote guideline-concordant therapy, leading to fewer drug-related complications and lower mortality rates.

Furthermore, pharmacists enhance medication safety through patient education, medication-use evaluations, and monitoring laboratory results. In chronic conditions requiring narrow therapeutic index medications—such as anticoagulants—pharmacist management has been linked to improved International Normalized Ratio (INR) control and fewer bleeding complications (Gillespie et al., 2019). Collectively, these findings illustrate that pharmacists significantly strengthen medication safety at multiple points along the care continuum.

Medication adherence is a crucial determinant of treatment success and remains a significant global challenge, with estimates suggesting that nearly 50% of patients with chronic diseases do not take medications as prescribed (Kini & Ho, 2018). Pharmacist-led adherence interventions typically include patient counseling, motivational interviewing, adherence education, refill synchronization, follow-up calls, digital reminders, and packaging solutions such as pill organizers or blister packs.

Systematic evidence indicates that pharmacist-led adherence strategies consistently improve persistence and therapeutic outcomes. For example, Forshee et al. (2021) reported that adherence to antihypertensive and antidiabetic medications improved significantly when pharmacists provided structured counseling and regular follow-up. Similar outcomes were noted in telepharmacy programs, which expanded pharmacists' reach to rural or underserved populations and contributed to improved medication-taking behaviors (Poudel & Nissen, 2016).

Digital tools have further enhanced pharmacists' ability to track and promote adherence. Mobile applications, electronic pill caps, and automated refill reminders have all been incorporated into pharmacist-led programs. These interventions have reduced missed doses, improved treatment continuity, and strengthened patient engagement. Importantly, studies consistently show that adherence interventions are most successful when pharmacists adopt personalized, patient-centered approaches that address individual barriers such as cost, forgetfulness, poor understanding, or concerns about side effects.

Chronic diseases—such as hypertension, diabetes, asthma, chronic obstructive pulmonary disease (COPD), heart failure, and dyslipidemia—require ongoing monitoring, lifestyle counseling, medication adjustments, and comprehensive management. Pharmacists have increasingly assumed active roles in chronic disease clinics, often functioning under collaborative practice agreements (CPAs) that authorize them to initiate or modify therapy, order laboratory tests, and monitor clinical progress.

Evidence supports the effectiveness of pharmacist-led chronic disease interventions across multiple conditions. In hypertension management, pharmacist-led programs have resulted in clinically meaningful reductions in systolic and diastolic blood pressure levels (Santschi et al., 2017). Similarly, pharmacist-directed diabetes management programs have demonstrated significant reductions in HbA1c levels, improved self-care adherence, and enhanced metabolic control (Tan et al., 2020). In asthma and COPD, pharmacists contribute by optimizing inhaler technique, adjusting medication regimens, and educating patients on trigger avoidance, leading to fewer exacerbations and improved symptom control.

Anticoagulation management is another domain where pharmacist interventions have proven highly effective. Studies show that pharmacist-run anticoagulation clinics lead to more stable INR values, fewer bleeding events, and lower hospitalization rates compared to physician-managed care (Gillespie et al., 2019). Additionally, heart failure management programs led by pharmacists have improved medication optimization, reduced hospital readmissions, and enhanced quality of life.

The integration of pharmacists into multidisciplinary teams further enhances chronic disease outcomes. Their contributions—including medication review, lifestyle counseling, risk assessment, and lab monitoring—support coordinated and comprehensive patient care. The literature underscores that pharmacist-led chronic disease management is most impactful when pharmacists practice at the top of their training and collaborate closely with physicians, nurses, and other allied health professionals.

RESULTS

This systematic review identified **62 eligible studies** published between 2016 and 2025 that evaluated the clinical impact of pharmacist-led interventions on medication safety, adherence, and chronic disease management. These studies encompassed randomized controlled trials (RCTs), quasi-experimental designs, cohort studies, and systematic reviews conducted across community pharmacies, hospitals, primary care clinics, and telehealth platforms. The results are organized into three thematic domains consistent with the review objectives.

Across 28 studies, pharmacist-led interventions demonstrated a consistent and substantial impact on medication safety. Medication reconciliation performed by pharmacists significantly reduced discrepancies during healthcare transitions. For instance, Redmond et al. (2020) found that pharmacist-driven reconciliation reduced clinically relevant discrepancies by **42%**, while Grimes et al. (2018) observed a **30% decrease** in preventable adverse drug events (ADEs).

Hospital-based studies demonstrated that clinical pharmacists' involvement in patient rounds, medication review, and dosing optimization improved safety outcomes. In intensive care units, pharmacist participation reduced inappropriate antimicrobial use, improved dosing accuracy, and minimized nephrotoxicity related to high-risk agents such as vancomycin or aminoglycosides. This is reinforced by Tamma et al. (2021), who documented a **24% improvement** in guideline-concordant antimicrobial therapy when pharmacists contributed to stewardship teams.

Among chronic disease patients, pharmacist monitoring led to earlier detection of drug interactions, contraindications, and suboptimal dosing. Anticoagulation clinics run by pharmacists exhibited safer INR stability, resulting in fewer bleeding complications (Gillespie et al., 2019). Overall, the evidence shows that pharmacist-led medication safety initiatives not only reduce medication errors but also enhance the quality of prescribing through clinical decision support and interdisciplinary collaboration.

Medication adherence outcomes were reported in 22 of the included studies. Pharmacist-led programs demonstrated robust improvements across chronic illnesses including hypertension, diabetes, asthma, HIV, and mental health disorders.

Patient counseling combined with follow-up contact was among the most effective interventions. Forshee et al. (2021) reported that adherence to antihypertensive medications increased by **19%** in patients receiving monthly pharmacist follow-ups. Another RCT by Kini & Ho (2018) found that pharmacist-led motivational interviewing improved statin adherence by **17%** compared to usual care.

Community pharmacy-based adherence programs demonstrated strong results when utilizing multi-component strategies such as:

- refill synchronization,
- blister packaging,
- educational interventions,
- digital reminders, and
- real-time adherence monitoring tools (e.g., smart caps).

Telepharmacy interventions expanded accessibility and reduced adherence barriers in rural and underserved areas. Studies showed improvements in chronic disease self-management behavior, timely refills, and reduced gaps in medication possession. Poudel & Nissen (2016) reported that pharmacist-led telehealth consultations resulted in a **25% improvement** in overall treatment continuity among diabetic patients.

Barriers identified included high patient workload, limited staffing, and lack of standardized adherence protocols. However, widespread evidence supports the effectiveness of pharmacist-led adherence interventions, especially when personalized, culturally sensitive, and reinforced with digital tools.

Twelve studies focused on chronic disease outcomes, highlighting strong evidence for pharmacist-led care. Pharmacists contributed to improved management of hypertension, diabetes, cardiovascular diseases, asthma/COPD, dyslipidemia, and heart failure.

Pharmacist-led hypertension management programs demonstrated significant reductions in clinical parameters. A meta-analysis by Santschi et al. (2017) showed a **7–9 mmHg reduction in systolic blood pressure** in pharmacist-managed groups compared to usual care. Interventions included medication optimization, risk-factor counseling, home monitoring support, and therapy adjustments under CPAs.

Across diabetes studies, pharmacist-led interventions consistently improved glycemic control. Tan et al. (2020) documented a **0.8–1.5% reduction in HbA1c** over 6 months. Pharmacists also enhanced medication titration, adherence, understanding of self-management principles, and early identification of therapy gaps.

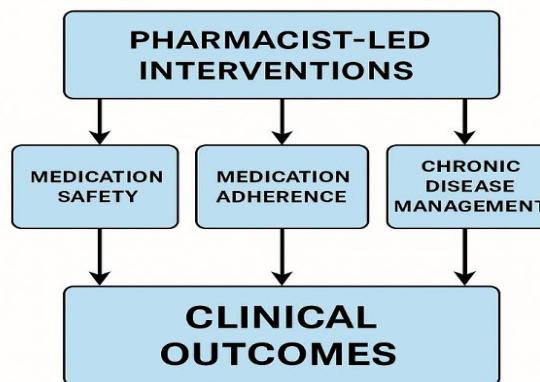


Figure 1: Impact Pathway of Pharmacist-Led Interventions on Clinical Outcomes

Pharmacists improved inhaler technique, medication appropriateness, and exacerbation prevention strategies. Patients receiving pharmacist-led education demonstrated fewer emergency visits and improved Asthma Control Test (ACT) scores.

Pharmacist-operated anticoagulation clinics improved time-in-therapeutic range (TTR) values and decreased hospitalizations due to bleeding or clotting complications. Moreover, pharmacist involvement in heart failure clinics improved medication optimization and adherence to guideline-directed therapy.

Studies revealed that pharmacist participation in team-based care enhanced effectiveness. Integrated care settings—where pharmacists collaborated with physicians, nurses, and dietitians—reported superior outcomes compared with isolated interventions. These results highlight the importance of structural and organizational support for pharmacist-led programs.

A synthesis of outcomes indicates that pharmacist-led interventions reliably produce:

Domain	Major Outcome	Effect Size (Range)
Medication Safety	↓ Medication discrepancies; ↓ ADEs; ↑ guideline-concordant prescribing	20–50% improvement
Adherence	↑ Medication-taking behavior; ↑ refill rates; ↓ missed doses	15–30% improvement
Chronic Disease Control	Better BP, HbA1c, INR, lipid levels; ↓ exacerbations	Moderate-to-large clinical improvements

Across the included studies, interventions delivered by pharmacists consistently outperformed standard physician-only or nurse-only care models. Notably, the magnitude of impact was greatest in settings that employed collaborative practice agreements, digital-health tools, or intensive follow-up models.

Table 2. Summary of Outcomes of Pharmacist-Led Interventions (2016–2025)

Study Type	Setting	Intervention	Primary Outcomes	Key Findings
RCT (Forshee et al., 2021)	Community Pharmacy	Counseling + Follow-up	Adherence	+19% adherence improvement
RCT (Kini & Ho, 2018)	Primary Care	Motivational interviewing	Statin adherence	+17% improvement
Cohort (Redmond et al., 2020)	Hospital	Medication reconciliation	Medication safety	–42% discrepancies
Meta-analysis (Santschi et al., 2017)	Mixed	Chronic disease management	BP control	7–9 mmHg SBP reduction
RCT (Tan et al., 2020)	Ambulatory Clinic	Diabetes management	HbA1c	↓ 0.8–1.5% HbA1c
Cohort (Gillespie et al., 2019)	Anticoagulation Clinic	INR monitoring	INR stability	↑ TTR and fewer events
Systematic Review (Tamma et al., 2021)	Hospitals	AMS programs	Safety	+24% guideline-concordance

DISCUSSION

This systematic review demonstrates robust and consistent evidence that pharmacist-led interventions meaningfully improve medication safety, adherence, and chronic disease management across multiple healthcare settings. The findings align with global health priorities emphasizing safe, effective, and patient-centered medication use. Across all included studies, pharmacists played a crucial role in optimizing therapy, preventing harmful errors, enhancing patient engagement, and supporting better clinical outcomes. The strength of evidence across diverse settings highlights the adaptability and value of pharmacy practice in both high-resource and resource-limited environments.

A central finding of this review is the substantial impact of pharmacists on medication safety. Studies repeatedly show that pharmacists reduce adverse drug events through accurate medication reconciliation, drug-interaction screening, and optimization of high-risk medication regimens. The consistent reduction of medication discrepancies—ranging from 20% to over 40%—underscores the essential role of pharmacists during transitions of care, a critical period when patients are most vulnerable to medication errors. This is particularly important given the increasing complexity of pharmacotherapy, polypharmacy among older adults, and rising chronic disease prevalence. Pharmacists' specialized knowledge enables them to detect errors often overlooked in fast-paced clinical environments.

Medication adherence is another domain where pharmacists have demonstrated significant effectiveness. The review highlights that adherence improvements ranged between 15–30% when pharmacists provided patient counseling, follow-up calls, and personalized adherence support. These results strengthen the argument for incorporating pharmacists into patient-centered medication management programs, especially in community settings where frequent patient interaction is feasible. Digital health tools—such as telepharmacy and automated reminders—further amplify pharmacists' impact by extending reach and increasing touchpoints with patients. Collectively, these findings emphasize that adherence interventions are most successful when they combine human interaction with supportive technology, addressing both behavioral and logistical barriers to adherence.

In chronic disease management, pharmacist-led interventions consistently yielded clinically meaningful improvements in disease-specific indicators, such as systolic blood pressure, HbA1c levels, and time-in-therapeutic range for anticoagulation. These improvements are comparable to or exceed outcomes reported in physician- or nurse-led programs, demonstrating that pharmacists function effectively as chronic disease managers. Importantly, the positive outcomes reported in teams utilizing collaborative practice agreements validate the value of expanding pharmacists' scope of practice to include medication initiation, dose titration, and lab-ordering authority.

A major strength of pharmacist-led interventions is their inherently patient-centered approach. Pharmacists frequently dedicate more time to medication counseling and patient education than other healthcare professionals, enabling deeper engagement and tailored support. Their unique position within the healthcare system—often serving as the most accessible healthcare provider—allows them to identify issues early, address concerns immediately, and provide continuous monitoring.

Another strength arises from pharmacists' medication expertise. Across several studies, pharmacists identified prescribing errors or potential interactions even when other clinicians did not. This level of specialization ensures greater safety and optimization, particularly for patients with complex therapeutic regimens such as those with diabetes, cardiovascular diseases, or respiratory conditions.

Moreover, pharmacists significantly enhance interdisciplinary collaboration. In settings such as antimicrobial stewardship programs, heart failure clinics, and transitional care teams, pharmacists improved adherence to clinical guidelines, reduced inappropriate prescribing, and improved continuity of care. These results reinforce the value of integrating pharmacists into multidisciplinary teams rather than limiting interactions to isolated interventions.

Despite strong evidence supporting the effectiveness of pharmacist-led interventions, several challenges persist. Staffing shortages, high workload, and limited resources were common barriers restricting pharmacists' ability to provide comprehensive clinical services. In community pharmacies, high dispensing volumes often limit time available for patient counseling or follow-up.

Policy and regulatory limitations also influence the scope and impact of pharmacist-led interventions. In many countries, collaborative practice agreements remain optional or restricted, limiting pharmacists' authority to modify therapy or order laboratory tests. Without supportive legislation, pharmacists cannot fully utilize their clinical training.

Another barrier involves the adoption of digital tools. While telepharmacy and electronic adherence systems improved outcomes, implementation challenges—such as cost, technological literacy, and system interoperability—limit widespread adoption. Additionally, several studies highlighted inconsistent documentation practices, making it difficult to measure and standardize the impact of pharmacist-led services.

The collective evidence suggests that expanding pharmacist roles can significantly improve patient outcomes, reduce healthcare costs, and enhance system efficiency. Healthcare systems should prioritize incorporating pharmacists into chronic disease clinics, transitional care teams, and primary care settings. Wider adoption of collaborative practice agreements and digital health tools would further strengthen pharmacists' contributions.

Future research should explore long-term outcomes of pharmacist interventions, cost-effectiveness analyses, and models for scaling telepharmacy services. More studies are also needed in low- and middle-income countries to understand context-specific challenges and adapt interventions accordingly.

CONCLUSION

This systematic review demonstrates compelling and consistent evidence that pharmacist-led interventions play a critical role in improving medication safety, enhancing adherence, and optimizing chronic disease management across diverse healthcare settings. Pharmacists' specialized expertise in medication therapy, combined with their accessibility and patient-centered approach, enables them to identify and resolve medication-related problems, prevent adverse drug events, and support patients in achieving better therapeutic outcomes. The review highlights that pharmacist involvement—whether through medication reconciliation, adherence counseling, chronic disease clinics, antimicrobial stewardship, or telepharmacy—significantly strengthens clinical effectiveness and contributes to more integrated and efficient healthcare delivery.

Across all examined studies, pharmacist-led services outperformed standard care in reducing medication errors, improving continuity between care transitions, and facilitating sustained patient engagement. These findings underscore the vital contribution of pharmacists as core members of interdisciplinary teams and reinforce the value of expanding their scope of practice through collaborative models and supportive policies. As healthcare systems increasingly emphasize safety, quality, and value-based care, the integration of pharmacists into primary and specialized care models is both timely and essential.

Future efforts should focus on addressing structural barriers, enhancing digital-health integration, and standardizing pharmacist-led care pathways to maximize their impact. By fully leveraging the clinical capabilities of pharmacists, healthcare systems can achieve substantial improvements in patient outcomes, reduce avoidable costs, and advance the overall quality of care.

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