Reducing Medication Errors And Enhancing Therapeutic Outcomes: A Systematic Review Of Nursing–Pharmacy Collaborative Models In Healthcare Systems

Amani Ali Mohammed[1], Amani Mohammed Oudah Al-Atwi[2], Wedad Ahmed Alzubi[3], Naif Jaber Albaqami[4], Mansour Mohammed Buhairy Algarny[5], Aliaa Basheer Abdullah Albalawi[6], Mona Ali Abdulwahed[7], Taghreed Hamad Alharbi[8], Amani Yousef Alluqmani[9], Fatimah Ali Mohammed Aljbani[10]

1. Female Medical Ward Staff, Aseer Health Cluster, Saudi Arabia
2. Eradah Mental Health Complex – Tabuk, Saudi Arabia
3. Muhayil General Hospital, Aseer Health Cluster, Saudi Arabia
4. East Jeddah hospital, first Jeddah health cluster, Saudi Arabia
5. King Saud medical city, Riyadh first health cluster, Saudi Arabia
6. Tabuk Health cluster, Primary health care Aljaw, Saudi Arabia
7. Female Medical Ward, Aseer Health Cluster, Saudi Arabia
8. -Al-Shumaisi Medical Complex in Makkah, Makkah Health Cluster, Saudi Arabia
9. Primary Health Care Center – South Taiba Health Center, Jeddah, Saudi Arabia
10. Aseer Health Cluster, Saudi Arabia

Abstract

The increasing complexity of medication regimens across healthcare settings has intensified the risk of medication errors and suboptimal therapeutic outcomes. Interprofessional collaboration between nursing and pharmacy professionals has emerged as a critical strategy to improve medication safety, optimize therapy, and enhance patient-centered care. This systematic review aims to synthesize current evidence on nursing–pharmacy collaborative models and their impact on medication error reduction, therapeutic effectiveness, and healthcare quality outcomes. Following PRISMA guidelines, a comprehensive search of major databases was conducted to identify peer-reviewed studies examining structured or informal nursing–pharmacy collaboration across acute, chronic, and transitional care settings. Included studies were analyzed regarding collaboration mechanisms, clinical and organizational outcomes, and enabling factors. The findings indicate that integrated nursing–pharmacy collaboration significantly reduces medication errors, improves adherence to evidence-based prescribing, enhances therapeutic monitoring, and positively influences patient satisfaction and safety outcomes. Additionally, system-level benefits such as workflow efficiency, interprofessional communication, and organizational learning were identified. This review underscores the importance of embedding structured nursing–pharmacy collaboration within healthcare systems and supports its role as a cornerstone of medication safety and therapeutic excellence.

Keywords: Nursing–pharmacy collaboration; medication safety; medication errors; therapeutic outcomes; interprofessional care; systematic review.

INTRODUCTION AND BACKGROUND

Medication errors continue to represent a significant and preventable threat to patient safety worldwide, contributing to avoidable morbidity, mortality, and escalating healthcare costs. Errors can occur at any stage of the medication-use process—prescribing, transcribing, dispensing, administering, and monitoring—and are often driven by system complexity, fragmented workflows, and breakdowns in interprofessional communication. The World Health Organization has repeatedly emphasized medication safety as a global priority, highlighting the need for coordinated, system-wide strategies to reduce preventable harm associated with medicines (WHO, 2017).

Within healthcare systems, nurses and pharmacists play central and complementary roles in medication management. Nurses are primarily responsible for medication administration, patient monitoring, and frontline detection of adverse drug events, while pharmacists contribute specialized expertise in pharmacotherapy, medication reconciliation, dosage optimization, and drug–drug interaction management. Despite this interdependence, traditional practice models in many settings have positioned nursing and pharmacy functions in parallel rather than in an integrated manner, increasing the likelihood of communication gaps and duplicated or omitted safety checks. Growing evidence indicates that poor coordination between nurses and pharmacists is a major contributor to medication-related adverse events, particularly in high-risk environments such as intensive care units, emergency departments, and during transitions of care. Studies have shown that ineffective communication and unclear professional boundaries can undermine the safe use of medications, leading to prescribing discrepancies, administration errors, and inadequate monitoring of therapeutic responses (Manias et al., 2020; Keers et al., 2019).

In response, healthcare systems internationally have increasingly adopted interprofessional collaboration models as a core patient safety strategy. Nursing–pharmacy collaboration refers to structured and informal practices that promote shared responsibility, bidirectional communication, and joint decision-making throughout the medication-use process. Such collaboration may include joint medication reconciliation at admission and discharge, pharmacist participation in nursing rounds, collaborative therapeutic drug monitoring, and coordinated patient education aimed at improving adherence and understanding of treatment regimens.

Evidence suggests that collaborative nursing–pharmacy models are associated with meaningful reductions in medication errors, improved adherence to evidence-based prescribing guidelines, and enhanced therapeutic outcomes, particularly for patients with complex or chronic conditions (Patterson et al., 2021; Mekonnen et al., 2021). Beyond clinical outcomes, these models also contribute to organizational benefits, including improved safety culture, more efficient workflows, and strengthened interprofessional trust.

Despite growing interest, the implementation and effectiveness of nursing–pharmacy collaboration vary widely across healthcare systems and care settings. Differences in organizational culture, staffing structures, digital infrastructure, and regulatory frameworks influence how collaboration is operationalized and sustained. Consequently, a systematic synthesis of the evidence is essential to clarify which collaborative models are most effective, under what conditions they succeed, and how they contribute to reducing medication errors while enhancing therapeutic outcomes. This review addresses this need

by critically examining the current literature on nursing–pharmacy collaborative models within healthcare systems.

REVIEW OBJECTIVES AND RESEARCH QUESTIONS

Medication safety and therapeutic effectiveness are increasingly recognized as outcomes of coordinated, system-level practices rather than isolated professional actions. Given the central roles of nurses and pharmacists across the medication-use continuum, there is a growing need to clarify how collaborative practice between these two professions influences clinical and organizational outcomes. This systematic review is designed to address existing gaps in the literature by providing a structured synthesis of evidence related to nursing–pharmacy collaborative models and their impact on medication safety and therapeutic outcomes across healthcare systems.

Review Objectives

The primary objectives of this systematic review are to:

1. Identify and categorize nursing–pharmacy collaborative models implemented across different healthcare settings;
2. Examine the effect of nursing–pharmacy collaboration on medication error reduction and adverse drug event prevention;
3. Evaluate the influence of collaborative practice on therapeutic outcomes, including treatment optimization, monitoring effectiveness, and patient adherence;
4. Explore organizational, professional, and technological factors that enable or hinder successful nursing–pharmacy collaboration; and
5. Synthesize evidence to inform best-practice recommendations and future research directions.

Research Questions

To achieve these objectives, the review addresses the following research questions:

1. What types of nursing–pharmacy collaborative models are reported in healthcare systems?
2. How does nursing–pharmacy collaboration affect medication error rates and patient safety outcomes?
3. What therapeutic and clinical outcomes are associated with nursing–pharmacy collaborative practices?
4. What barriers and facilitators influence the implementation and sustainability of effective nursing–pharmacy collaboration?

Together, these objectives and questions provide a focused framework for systematically evaluating the contribution of nursing–pharmacy collaboration to medication safety and therapeutic excellence.

METHODOLOGY

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, methodological rigor, and reproducibility. A comprehensive and structured search strategy was developed to identify relevant peer-reviewed literature examining nursing–

pharmacy collaboration and its impact on medication safety and therapeutic outcomes within healthcare systems.

Electronic database searches were performed across PubMed/MEDLINE, Scopus, Web of Science, and CINAHL. Search terms were developed using a combination of Medical Subject Headings (MeSH) and free-text keywords related to nursing, pharmacy, interprofessional collaboration, medication errors, medication safety, and therapeutic outcomes. Boolean operators and truncations were applied to optimize search sensitivity. Reference lists of included articles were also manually screened to identify additional relevant studies.

Studies were eligible for inclusion if they: (1) examined structured or informal collaboration between nurses and pharmacists; (2) reported outcomes related to medication errors, adverse drug events, therapeutic effectiveness, or patient safety; (3) were conducted in healthcare settings such as hospitals, primary care, or transitional care; and (4) employed quantitative, qualitative, or mixed-methods designs. Reviews, editorials, opinion pieces, and studies focusing on a single professional group without collaborative elements were excluded.

Following duplicate removal, titles and abstracts were independently screened by reviewers to assess eligibility. Full-text articles meeting inclusion criteria were retrieved and reviewed in detail. A standardized data extraction form was used to capture study characteristics, collaboration models, outcome measures, and key findings.

Methodological quality was assessed using validated appraisal tools appropriate to study design. Given heterogeneity in interventions and outcome measures, findings were synthesized narratively, supported by structured tables to highlight patterns, consistencies, and gaps in the evidence.

Nursing–Pharmacy Collaborative Models in Medication Management

Nursing–pharmacy collaboration has evolved from informal, ad hoc communication into structured, system-level models designed to enhance medication safety and therapeutic effectiveness. These collaborative models span the entire medication-use process and are implemented across diverse healthcare settings, including acute care hospitals, intensive care units, primary care clinics, and transitional care environments. The literature identifies several dominant models through which nursing and pharmacy professionals jointly contribute to medication management.

One of the most frequently reported models is the **integrated ward-based collaboration model**, in which pharmacists are embedded within clinical units and actively participate in daily nursing rounds. In this model, nurses and pharmacists engage in real-time communication regarding medication orders, administration schedules, and patient responses to therapy. Studies indicate that this approach improves early identification of prescribing discrepancies, enhances dose optimization, and reduces administration errors, particularly for high-risk medications such as anticoagulants, insulin, and antimicrobials (Keers et al., 2019; Manias et al., 2020). The physical and professional proximity fostered by ward-based integration also strengthens interprofessional trust and shared accountability.

Another prominent model is **collaborative medication reconciliation**, particularly during transitions of care. Nurses often collect medication histories at admission and discharge, while pharmacists verify accuracy, identify discrepancies, and recommend adjustments. Collaborative reconciliation has been shown to significantly reduce

unintentional medication discrepancies and prevent adverse drug events following hospital discharge (Mekonnen et al., 2021). This model is especially valuable for older adults and patients with polypharmacy, where medication complexity increases the risk of error.

Shared therapeutic drug monitoring (TDM) represents a further collaborative approach, commonly applied in critical care and chronic disease management. Nurses monitor clinical parameters and patient responses, while pharmacists provide expertise in pharmacokinetics, dose adjustments, and drug–drug interaction management. Evidence suggests that joint TDM improves therapeutic target attainment and minimizes toxicity, particularly for narrow therapeutic index medications (Patterson et al., 2021).

In many healthcare systems, **interprofessional medication education and counseling** has emerged as an effective collaborative model. Nurses and pharmacists jointly educate patients and caregivers on medication purpose, administration techniques, potential side effects, and adherence strategies. This shared approach enhances patient understanding, promotes adherence, and reduces preventable medication-related hospital readmissions (Manias et al., 2020).

More recently, **technology-enabled collaborative models** have gained prominence. Electronic medication administration records, clinical decision support systems, and shared electronic health records facilitate timely communication between nurses and pharmacists. Digital tools support collaborative review of medication orders, flag potential errors, and enable coordinated monitoring of therapeutic outcomes. While technology alone does not replace professional collaboration, it serves as a critical enabler of effective nursing–pharmacy interaction (World Health Organization, 2017).

Table 1. Nursing–Pharmacy Collaborative Models in Medication Management

Collaborative Model	Key Collaborative Activities	Care Setting	Reported Outcomes
Integrated ward-based model	Joint rounds, medication review, real-time communication	Acute care, ICU	Reduced medication errors, improved dosing accuracy
Collaborative medication reconciliation	Admission/discharge review, discrepancy resolution	Transitional care	Fewer medication discrepancies, safer transitions
Shared therapeutic drug monitoring	Monitoring, dose adjustment, toxicity prevention	ICU, chronic care	Improved therapeutic control, reduced adverse effects
Interprofessional patient education	Joint counseling, adherence support	Inpatient, outpatient	Improved adherence, patient satisfaction
Technology-enabled collaboration	EHRs, decision support, eMAR	System-wide	Enhanced communication, early error detection

Collectively, these models demonstrate that effective nursing–pharmacy collaboration is multifaceted, context-dependent, and influenced by organizational culture and system

design. Structured collaboration consistently aligns nursing and pharmacy expertise, reduces fragmentation, and enhances medication safety and therapeutic outcomes.

Impact on Medication Errors and Patient Safety

Medication errors constitute a major patient safety challenge across healthcare systems, with significant clinical, ethical, and economic consequences. Evidence consistently demonstrates that fragmented medication workflows and poor interprofessional communication are among the leading contributors to preventable medication-related harm. Within this context, nursing–pharmacy collaboration has emerged as a critical safety intervention, directly addressing vulnerabilities across the medication-use process.

Multiple studies indicate that structured collaboration between nurses and pharmacists significantly reduces medication errors at the prescribing, dispensing, and administration stages. Pharmacist involvement in clinical units, combined with continuous nurse–pharmacist communication, enables early identification and correction of prescribing errors such as inappropriate drug selection, incorrect dosing, and overlooked contraindications (Keers et al., 2019). Nurses, as frontline medication administrators, play a complementary role by providing real-time patient data and clinical observations, allowing pharmacists to tailor recommendations and prevent downstream errors.

Collaborative models are particularly effective in reducing **medication administration errors**, which remain one of the most common error types in hospital settings. Studies report that joint medication review processes, double-check mechanisms, and shared accountability between nurses and pharmacists reduce wrong-dose, wrong-time, and wrong-route errors (Manias et al., 2020). These improvements are most pronounced in high-risk environments such as intensive care units and emergency departments, where medication regimens are complex and time-sensitive.

Nursing–pharmacy collaboration also plays a vital role in **adverse drug event (ADE) prevention**. Pharmacists contribute pharmacovigilance expertise, while nurses monitor patient responses and adverse symptoms during and after medication administration. When integrated effectively, this collaboration improves early detection of ADEs and facilitates timely intervention, thereby reducing patient harm and length of hospital stay (Mekonnen et al., 2021).

Transitions of care represent another critical safety gap where collaboration demonstrates strong impact. Medication discrepancies frequently occur during hospital admission, discharge, and transfer between care settings. Collaborative medication reconciliation—where nurses collect medication histories and pharmacists verify and reconcile orders—has been shown to significantly reduce unintentional discrepancies and prevent post-discharge medication-related adverse events (Patterson et al., 2021). This is particularly relevant for older adults and patients with polypharmacy, who are at heightened risk of harm.

Beyond measurable error rates, nursing–pharmacy collaboration contributes to broader **patient safety culture**. Interprofessional teamwork fosters open communication, shared responsibility, and a non-punitive approach to error reporting. These cultural shifts encourage early reporting of near-misses and learning from errors, aligning with international patient safety priorities promoted by the World Health Organization. Studies suggest that units with strong nurse–pharmacist collaboration demonstrate higher compliance with medication safety protocols and improved staff perceptions of safety climate (WHO, 2017).

Table 1. Impact of Nursing–Pharmacy Collaboration on Medication Errors and Patient Safety

Patient Safety Domain	Mechanism of Collaboration	Reported Impact
Prescribing errors	Joint medication review, pharmacist consultation	Reduced inappropriate drug selection and dosing
Administration errors	Double-check systems, real-time communication	Fewer wrong-dose and wrong-time errors
Adverse drug events	Shared monitoring and early detection	Reduced ADE incidence and severity
Care transitions	Collaborative medication reconciliation	Fewer discrepancies and readmissions
Safety culture	Interprofessional teamwork and reporting	Improved safety climate and compliance

Overall, the evidence indicates that nursing–pharmacy collaboration is not a single intervention but a systemic safety strategy. By integrating professional expertise, improving communication, and strengthening safety culture, collaborative models significantly reduce medication errors and enhance patient safety outcomes across healthcare settings.

Impact on Therapeutic and Clinical Outcomes

Beyond reducing medication errors, nursing–pharmacy collaboration has a measurable and meaningful impact on **therapeutic effectiveness and broader clinical outcomes**. Effective medication therapy depends not only on accurate prescribing and administration, but also on continuous monitoring, dose optimization, patient engagement, and timely adjustment of treatment regimens. Collaborative practice between nurses and pharmacists directly strengthens these interconnected processes.

One of the most consistently reported therapeutic benefits of nursing–pharmacy collaboration is **improved medication appropriateness and dosing accuracy**. Pharmacists contribute specialized pharmacological knowledge to support individualized therapy, while nurses provide real-time clinical assessments of patient response, vital signs, and tolerance. This synergy is particularly valuable for medications with narrow therapeutic indices, such as anticoagulants, antimicrobials, insulin, and cardiovascular agents. Studies demonstrate that collaborative dose adjustment and monitoring significantly improve target therapeutic ranges and reduce treatment-related complications (Mekonnen et al., 2021; Patterson et al., 2021).

Nursing–pharmacy collaboration also enhances **therapeutic monitoring and response to treatment**. Nurses' continuous bedside presence enables early detection of suboptimal treatment response or emerging adverse effects, which can be promptly communicated to pharmacists for intervention. This bidirectional feedback loop supports timely medication modification and prevents prolonged exposure to ineffective or harmful therapy. Evidence indicates that such collaborative monitoring improves disease control outcomes in chronic conditions, including diabetes, hypertension, and anticoagulation management (Manias et al., 2020).

Another important clinical outcome associated with collaboration is **improved patient adherence and understanding of treatment plans**. Joint nurse–pharmacist patient

education initiatives combine practical administration guidance with pharmacological counseling, resulting in clearer communication about medication purpose, dosing schedules, and potential side effects. Patients receiving coordinated education demonstrate higher adherence rates, improved self-management skills, and greater satisfaction with care, all of which contribute to better therapeutic outcomes and reduced hospital readmissions (Keers et al., 2019).

In inpatient and transitional care settings, nursing–pharmacy collaboration has been linked to **shorter lengths of stay and reduced readmission rates**. Optimized medication therapy, early resolution of drug-related problems, and improved discharge medication reconciliation reduce preventable complications following discharge. Collaborative discharge planning ensures continuity of therapy and minimizes post-discharge medication changes that could compromise treatment effectiveness (Mekonnen et al., 2021).

At a systems level, these clinical improvements translate into **enhanced overall care quality and efficiency**. Effective collaboration reduces therapeutic duplication, inappropriate polypharmacy, and unnecessary medication escalation. This is particularly relevant for older adults and patients with multimorbidity, where medication complexity is associated with poorer outcomes. By aligning nursing and pharmacy expertise, healthcare systems achieve more rational prescribing, safer deprescribing practices, and improved long-term clinical stability (Patterson et al., 2021).

Collectively, the evidence suggests that nursing–pharmacy collaboration functions as a therapeutic optimization strategy rather than solely a safety intervention. By integrating continuous clinical assessment with pharmacological expertise, collaborative models improve treatment effectiveness, patient experience, and long-term clinical outcomes. These findings support the inclusion of structured nursing–pharmacy collaboration as a core component of high-quality, patient-centered medication management systems.

Organizational, Workforce, and Digital Enablers

Effective nursing–pharmacy collaboration does not occur in isolation; rather, it is shaped by **organizational structures, workforce capabilities, and digital infrastructure** that enable or constrain interprofessional practice. The literature consistently highlights that sustained collaboration requires deliberate system-level design rather than reliance on individual professional initiative.

Organizational leadership and governance play a central role in embedding nursing–pharmacy collaboration into routine medication management. Clear policies that define shared accountability, standardized medication workflows, and interprofessional communication protocols strengthen collaboration and reduce role ambiguity. Leadership commitment to patient safety—reflected through supportive policies, resource allocation, and performance indicators—has been associated with higher levels of nurse–pharmacist engagement and better medication safety outcomes (Manias et al., 2020).

Interprofessional governance structures, such as medication safety committees and quality-improvement teams, provide formal platforms for joint decision-making and learning. These structures promote shared ownership of medication safety goals, encourage reporting and analysis of medication-related incidents, and support continuous improvement. Alignment with international patient safety initiatives, such as those promoted by the World Health Organization, further reinforces organizational commitment to collaborative medication safety frameworks (WHO, 2017).

From a workforce perspective, **interprofessional education and competency development** are among the most influential enablers of effective nursing–pharmacy collaboration. Training programs that emphasize shared clinical reasoning, communication skills, and mutual role understanding foster professional trust and teamwork. Studies indicate that nurses and pharmacists who receive joint education are more likely to engage in proactive collaboration, seek shared input, and intervene early in medication-related problems (Keers et al., 2019).

Adequate staffing levels and workload balance are equally critical. High workload pressure and staffing shortages limit opportunities for meaningful interaction, particularly in high-acuity settings. Conversely, protected time for interdisciplinary rounds, case discussions, and collaborative medication reviews enhances the depth and quality of collaboration. Clear role delineation—while maintaining flexibility for shared responsibilities—helps minimize professional tension and supports efficient teamwork.

Digital health technologies increasingly serve as foundational enablers of nursing–pharmacy collaboration. Electronic health records (EHRs), electronic medication administration records (eMAR), and computerized physician order entry systems provide shared access to medication information, enabling real-time communication and coordinated decision-making. When effectively integrated, these systems support collaborative review of medication orders, flag potential interactions or dosing errors, and facilitate ongoing therapeutic monitoring (Mekonnen et al., 2021).

Clinical decision support systems further enhance collaborative practice by providing evidence-based alerts and recommendations accessible to both nurses and pharmacists. However, the literature cautions that technology alone is insufficient; digital tools must be embedded within collaborative workflows and supported by adequate training to avoid alert fatigue and underutilization.

Telepharmacy and remote consultation platforms have also expanded collaborative possibilities, particularly in resource-limited or geographically dispersed settings. These innovations enable pharmacists to support nursing teams in real time, extending collaborative medication management beyond traditional hospital environments.

In summary, organizational leadership, workforce preparedness, and digital infrastructure function as **interdependent enablers** of nursing–pharmacy collaboration. Healthcare systems that align governance, education, staffing, and technology around shared medication safety goals are more likely to achieve sustained improvements in therapeutic outcomes and patient safety.

DISCUSSION

This systematic review demonstrates that **nursing–pharmacy collaboration is a pivotal determinant of both medication safety and therapeutic effectiveness** across healthcare systems. The synthesized evidence confirms that collaboration between nurses and pharmacists extends beyond error prevention, functioning as a multidimensional mechanism that enhances clinical decision-making, optimizes therapeutic outcomes, and strengthens organizational safety culture.

A key finding across the reviewed studies is that **medication errors are not solely individual failures but system-level phenomena**, often arising from fragmented workflows and inadequate interprofessional communication. Nursing–pharmacy collaborative models directly address these vulnerabilities by integrating pharmacological

expertise with continuous clinical monitoring. Consistent with prior safety research, collaborative practices were most effective when embedded into routine workflows—such as ward-based rounds, medication reconciliation, and therapeutic drug monitoring—rather than implemented as standalone interventions.

Importantly, the review highlights that **collaboration yields the greatest impact in high-risk contexts**, including intensive care, emergency care, and transitions of care. These settings are characterized by complex medication regimens, time pressure, and heightened risk of adverse drug events. In such environments, real-time nurse–pharmacist communication enables rapid identification of discrepancies, prompt therapy adjustments, and early detection of treatment failure or toxicity. This reinforces the notion that interprofessional collaboration is not optional but essential in complex clinical systems.

Beyond safety outcomes, the findings illustrate that **therapeutic effectiveness improves when nurses and pharmacists share responsibility for medication optimization**. Collaborative dose adjustment, monitoring of patient response, and coordinated patient education were associated with improved disease control, enhanced adherence, and reduced readmissions—particularly among patients with chronic conditions or polypharmacy. These findings support a shift from task-based medication management toward **collaborative therapeutic stewardship**, aligning with patient-centered care principles.

At the organizational level, the review underscores the importance of **leadership, governance, and workforce development** in sustaining collaboration. Healthcare organizations that formalize nurse–pharmacist collaboration through policies, interprofessional committees, and performance indicators achieve more consistent and durable outcomes. Conversely, settings characterized by staffing shortages, role ambiguity, or limited interprofessional training report weaker collaboration and diminished impact. These findings align with systems theory, emphasizing that collaboration thrives in environments designed to support it.

Digital health technologies emerge as critical enablers but not substitutes for collaboration. Electronic medication systems and decision support tools enhance information sharing and error detection; however, their effectiveness depends on integration into collaborative workflows and adequate training. This reinforces evidence that **technology amplifies—but does not replace—human collaboration**.

From a policy perspective, the review supports international patient safety priorities advocated by the World Health Organization, particularly the need for system-wide approaches to medication safety. Embedding nursing–pharmacy collaboration within national quality frameworks, accreditation standards, and workforce policies may accelerate progress toward safer medication practices.

For practice, healthcare leaders should prioritize structured nurse–pharmacist collaboration in medication management pathways. For research, future studies should adopt standardized outcome measures and longitudinal designs to better quantify causal impact. For policy, integrating collaborative practice requirements into safety regulations and professional standards may drive sustainable improvement.

In summary, this review positions nursing–pharmacy collaboration as a **core pillar of safe, effective, and resilient medication management systems**, with relevance across clinical, organizational, and policy domains.

CONCLUSION

This systematic review provides compelling evidence that **nursing–pharmacy collaboration is a fundamental driver of medication safety and therapeutic effectiveness within modern healthcare systems**. Across diverse clinical settings, collaborative models consistently demonstrate their ability to reduce medication errors, prevent adverse drug events, and optimize therapeutic outcomes. By integrating nurses' continuous clinical assessment with pharmacists' pharmacological expertise, healthcare organizations can mitigate system-level vulnerabilities inherent in complex medication-use processes.

The findings indicate that the greatest benefits of collaboration are achieved when nurse–pharmacist interactions are **formally embedded within organizational structures**, rather than relying on informal or ad hoc communication. Models such as integrated ward-based collaboration, shared medication reconciliation, and joint therapeutic monitoring consistently improve patient safety outcomes and enhance care continuity, particularly in high-risk and transitional care environments.

Beyond safety metrics, this review highlights the broader **clinical and system-level value** of nursing–pharmacy collaboration. Improved treatment effectiveness, higher patient adherence, reduced readmissions, and strengthened safety culture reflect the multifaceted impact of collaborative practice. Importantly, organizational leadership, workforce preparedness, and digital infrastructure emerge as critical enablers, underscoring the need for a holistic approach to implementation.

From a strategic perspective, embedding nursing–pharmacy collaboration aligns with global patient safety priorities and quality improvement initiatives, including those advocated by the World Health Organization. Healthcare policymakers and leaders should therefore recognize nurse–pharmacist collaboration as an essential component of safe medication management and invest in governance, education, and technology to support it.

In conclusion, strengthening nursing–pharmacy collaboration represents a sustainable, evidence-based pathway toward reducing preventable medication harm and enhancing therapeutic outcomes. Future healthcare systems that institutionalize collaborative medication management will be better positioned to deliver high-quality, patient-centered, and resilient care.

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