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**Research Article**

# Clinical Pharmacy Interventions in Reducing Medication-Related Hospital Readmissions

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**Abstract:**

Clinical pharmacy interventions play a pivotal role in mitigating medication-related hospital readmissions, a significant concern in healthcare due to the associated economic burden and patient morbidity. These interventions encompass a range of pharmacist-driven activities, including medication reconciliation, patient education, and the implementation of clinical decision support systems. By conducting comprehensive reviews of patients' medication regimens during hospital admissions and discharges, pharmacists can identify potential drug interactions, dosing errors, and duplications. This proactive approach ensures that patients are prescribed appropriate medications, minimizing adverse drug events and enhancing therapeutic outcomes. Moreover, engaging patients through educational initiatives equips them with the knowledge to adhere to their prescribed medication regimens post-discharge, further reducing the risk of readmission. Additionally, research has demonstrated that the involvement of clinical pharmacists in multidisciplinary healthcare teams can lead to significant improvements in medication management processes. Interventions such as follow-up consultations, telepharmacy services, and personalized medication plans have been shown to foster better communication between healthcare providers and patients. These strategies not only improve medication adherence but also empower patients to take an active role in managing their health conditions. By addressing the complexities of medication therapy and enhancing continuity of care, clinical pharmacy interventions serve as a critical component in efforts to reduce hospital readmissions, ultimately leading to better patient outcomes and decreased healthcare costs.

## 1. Introduction

The pursuit of optimal healthcare outcomes is perpetually challenged by the complex issue of hospital readmissions, particularly those that occur within 30 days of discharge. These events are not only distressing for patients and families but also represent a significant financial burden on healthcare systems globally. Within this landscape, medication-related problems (MRPs) emerge as a predominant and often preventable driver of readmissions. Studies estimate that adverse drug events (ADEs), poor medication adherence, inappropriate prescribing, and inadequate post-discharge follow-up contribute to a substantial proportion of unplanned returns to the hospital, with figures ranging from 10% to 30% depending on the patient population and setting [1, 2]. This recurrent cycle of hospitalization underscores a critical failure in care transitions, where the management of pharmacotherapy—a cornerstone of modern medicine—becomes fragmented, leading to therapeutic misadventures.

The period following hospital discharge is notoriously hazardous, often described as a "vulnerable phase" for patients. They are tasked with managing new and complex medication regimens, often while coping with unresolved illness, functional limitations, and insufficient support systems. The discharge process itself can be rushed and incomplete, resulting in poor patient comprehension, unresolved medication discrepancies, and inadequate communication between hospital providers and community-based caregivers [3]. These systemic gaps create fertile ground for MRPs such as unintentional dosing errors, drug-drug interactions, untreated indications, and therapeutic duplications. Consequently, what was intended as a curative or stabilizing hospitalization can inadvertently set the stage for the next adverse event, perpetuating a costly and harmful cycle of readmission.

In response to this pervasive challenge, healthcare systems, especially in the United States with the inception of the Hospital Readmissions Reduction Program (HRRP) under the Affordable Care Act, have been compelled to innovate and implement strategies aimed at improving care coordination and outcomes post-discharge [4]. While multidisciplinary approaches are essential, the unique expertise of clinical pharmacists has been increasingly recognized as a vital component of effective readmission reduction programs. Distinct from traditional dispensing roles, clinical pharmacists operate as integrated members of the healthcare team, applying specialized knowledge in pharmacotherapy, pharmacokinetics, and pharmacoeconomics directly to patient care. Their involvement spans the entire continuum—from admission to discharge and beyond into the ambulatory setting—focusing on optimizing medication use to enhance efficacy and minimize harm.

The rationale for integrating clinical pharmacy services into readmission prevention initiatives is robust. Pharmacists possess the singular skillset required to conduct comprehensive medication reconciliation, a process proven to identify and rectify inadvertent discrepancies that occur at every transition of care [5]. They are adept at performing

detailed medication therapy management (MTM), assessing the appropriateness, safety, and efficacy of each drug in the context of the patient's complete clinical picture, including renal and hepatic function, comorbidities, and therapeutic goals. Furthermore, clinical pharmacists are exceptionally positioned to provide intensive patient education, counseling on adherence strategies, and to act as a bridge between hospital physicians and primary care providers or community pharmacists [6]. This proactive, medication-focused intervention targets the very root causes of many readmissions.

Despite the logical appeal of these interventions, the journey to their widespread implementation and the definitive quantification of their impact has been complex. The evidence base, while growing, presents a heterogeneous picture influenced by factors such as practice setting, specific intervention models, patient populations studied, and outcome definitions. Some studies demonstrate dramatic reductions in readmission rates, particularly for high-risk conditions like heart failure, myocardial infarction, and pneumonia, while others show more modest effects [7]. This variability necessitates a thorough examination of which components of clinical pharmacy practice are most effective, for which patients, and in what context. Understanding the barriers to implementation—including reimbursement models, workforce limitations, and interdisciplinary collaboration challenges—is equally critical for translating evidence into sustainable practice.

## 2. Common Medication-Related Causes of Hospital Readmissions

Understanding the specific mechanisms by which medications contribute to hospital readmissions is fundamental to designing targeted interventions. Medication-related readmissions are rarely due to a single cause; rather, they often result from a cascade of interrelated problems that manifest after discharge. One of the most prominent categories is Adverse Drug Events (ADEs), which encompass harm resulting from medication use. ADEs can be further classified into adverse drug reactions (ADRs), which are noxious and unintended responses at doses normally used for prophylaxis, diagnosis, or therapy, and toxicity from supratherapeutic doses or drug accumulation, often due to impaired clearance [8, 9]. For instance, an elderly patient discharged on warfarin may be readmitted with a major gastrointestinal bleed due to an elevated INR, resulting from a drug interaction with a newly prescribed antibiotic or inadequate monitoring. Similarly, hypoglycemic events from insulin or sulfonylureas, acute kidney injury from NSAIDs or renin-angiotensin system inhibitors, and severe electrolyte disturbances from diuretics are classic examples of preventable ADEs leading to rapid rehospitalization [10].

Closely linked to ADEs is the problem of suboptimal prescribing and medication discrepancies. Polypharmacy, commonly defined as the use of five or more medications, is highly prevalent among older adults and those with multiple chronic conditions—the very populations at highest risk for readmission [11]. Polypharmacy increases the risk of drug-drug interactions, prescribing cascades (where a new drug is prescribed to treat side effects of an existing drug), and overall regimen complexity. Inappropriate prescribing, such as the use of drugs listed in the Beers Criteria for potentially inappropriate medication use in older adults, directly elevates the risk of harm [12]. Furthermore, medication discrepancies—differences between what a patient is supposed to be taking and what is actually prescribed or documented—are almost universal at care transitions. A patient may be discharged without restarting a crucial chronic medication like a beta-blocker for heart failure, or a pre-admission dose may be incorrectly transcribed, leading to therapeutic failure or overdose [13]. These errors originate from incomplete medication histories, rushed discharge processes, and poor information transfer.

Perhaps the most significant factor downstream of all others is medication non-adherence. Post-discharge, patients are frequently required to manage new medications, discontinued medications, and changed dosages. Barriers to adherence are multifaceted, including cognitive impairment, lack of understanding of the medication's purpose, fear of side effects, financial constraints, and sheer complexity of the regimen [14]. A patient with congestive heart failure may not fill their new prescription for a costly diuretic, or may intentionally reduce the dose due to urinary frequency, resulting in fluid overload and readmission for acute decompensation. Non-adherence is not merely a patient failure; it is often a symptom of inadequate education, insufficient support, and poor regimen design that does not account for the patient's reality. The intersection of non-adherence with complex regimens and underlying health fragility creates a high-probability pathway back to the hospital.

Finally, a critical but often overlooked cause is the lack of adequate follow-up and monitoring. Many high-risk medications require vigilant post-discharge surveillance. For example, patients initiated on anticoagulation, antiarrhythmics, or certain chemotherapeutic agents need scheduled

laboratory tests and clinical assessments [15]. A breakdown in communication between the hospital and the outpatient provider, or a delay in arranging timely follow-up, can leave patients in a dangerous monitoring vacuum. A therapeutic plan that is safe in the controlled hospital environment can become hazardous at home without the necessary safety nets. This gap in care continuity ensures that medication-related problems that begin at discharge are not identified and corrected in a timely, preventive manner, allowing them to escalate into crises necessitating readmission. These interconnected causes—ADEs, suboptimal prescribing, non-adherence, and poor monitoring—collectively define the therapeutic arena in which clinical pharmacists must operate to disrupt the readmission cycle.

## 3. Core Components of Clinical Pharmacy Interventions for Readmission Reduction

Effective clinical pharmacy interventions are not monolithic but are rather multifaceted programs integrated into the patient's journey. The first critical contact occurs during admission with comprehensive medication history and reconciliation. A clinical pharmacist-led Best Possible Medication History (BPMH) is superior to histories taken by physicians or nurses, as pharmacists are trained to probe for details on adherence, over-the-counter products, herbal supplements, and actual dosing patterns [16]. This BPMH serves as the foundation for reconciling medications across all transitions. During inpatient care, the pharmacist conducts medication therapy management (MTM) and participates in interdisciplinary rounds. MTM involves a systematic review of all medications to assess appropriateness, identify and resolve MRPs, optimize doses for organ function, and evaluate for therapeutic duplications or interactions [17]. On rounds, the pharmacist provides real-time, evidence-based recommendations to the medical team regarding drug selection, dosing, and monitoring, ensuring that the inpatient regimen is both effective and safe, and that it sets the stage for a sustainable post-discharge plan.

The discharge process is a pivotal moment where intervention intensity peaks. Central to this is patient-centered medication counseling and education. Clinical pharmacists conduct one-on-one sessions, often using the "teach-back" method, to ensure patients and their caregivers understand what each medication is for, how and when to take it, what side effects to expect and which to report, and how to use any associated devices like inhalers or injectors [18]. This education is tailored to health literacy levels and is supplemented with easy-to-understand written materials. Concurrently, the pharmacist performs a final discharge medication reconciliation, creating an accurate and reconciled list that is communicated to the next care provider. Furthermore, they may facilitate medication access by arranging for discharge prescriptions, coordinating with outpatient pharmacies, and assisting with prior authorization processes or patient assistance programs for costly drugs, thereby removing a practical barrier to adherence immediately at the point of transition [19].

The intervention does not end at the hospital door. Structured post-discharge follow-up is a hallmark of successful programs. This often takes the form of telephone follow-up calls by a clinical pharmacist within 48-72 hours of discharge and again at 7-14 days. These calls assess patient understanding, identify early signs of complications or ADEs, reinforce education, troubleshoot adherence barriers, and confirm that follow-up appointments have been made and kept [20]. For high-risk populations, more intensive models exist, such as transitions-of-care clinics staffed by clinical pharmacists who can conduct face-to-face visits, perform point-of-care testing (e.g., INR checks), and adjust medications under collaborative practice agreements. In all models, the pharmacist serves as a continuity point, communicating any identified issues or interventions back to the patient's primary care physician and outpatient pharmacist, thus closing the loop and ensuring a unified pharmacotherapeutic plan across the continuum of care.

## 4. Evidence of Effectiveness: Clinical and Economic Outcomes

The body of literature evaluating the impact of clinical pharmacy interventions on hospital readmissions has expanded significantly, with numerous studies demonstrating positive effects. Systematic reviews and meta-analyses provide a high-level synthesis of this evidence. A landmark meta-analysis by Leenderste et al. concluded that pharmacist-led interventions in hospital and primary care settings significantly reduced medication-related readmissions, with a relative risk reduction often exceeding 30% in carefully designed programs [21]. The effects appear particularly pronounced for specific high-risk conditions. For heart failure, a condition where diuretic and renin-angiotensin-aldosterone system inhibitor management is complex, pharmacist involvement in discharge counseling, follow-up, and optimization has consistently been associated with significant reductions in 30-day and 90-day

readmission rates [22, 23]. Similarly, in acute coronary syndrome and COPD, pharmacist interventions focusing on guideline-concordant therapy and inhaler technique have shown promise in decreasing readmission risk [24, 25].

Beyond all-cause and condition-specific readmissions, these interventions positively impact key process and safety metrics. Studies consistently show that clinical pharmacist involvement improves the accuracy of medication reconciliation, leading to a substantial decrease in the number of unintentional discrepancies at discharge [26]. This directly addresses a root cause of MRPs. Furthermore, pharmacist participation increases the detection and resolution of ADEs during hospitalization and in the post-discharge period, preventing potential harm [27]. Perhaps one of the most significant process outcomes is the improvement in medication adherence. Through intensive counseling, simplifying regimens, and addressing barriers, pharmacist-led programs have been shown to improve adherence rates measured by pill counts, pharmacy refill data, and patient self-report, a critical intermediary outcome that directly influences therapeutic success and reduces failure-related readmissions [28].

From a health systems perspective, the economic argument for clinical pharmacy services is compelling. While implementing a robust clinical pharmacy program requires investment in personnel, the return on investment (ROI) is frequently positive. Pharmacist interventions reduce readmission costs, which are substantial and often unreimbursed under penalty programs like the HRRP [29]. A detailed pharmacoeconomic analysis involves calculating the costs avoided from prevented readmissions against the operational costs of the pharmacy service. Many studies report favorable cost-effectiveness ratios. For instance, the prevention of even a few readmissions for costly conditions like heart failure or sepsis can offset the annual salary of a clinical pharmacist dedicated to transitions of care [30]. Additionally, these services can generate revenue in value-based care models through shared savings, quality-based bonuses, and in some settings, through billable patient care services under incident-to or collaborative practice billing mechanisms, enhancing their financial sustainability [31].

## 5. Implementation Challenges and Barriers

Despite the compelling evidence, the widespread and consistent implementation of clinical pharmacy transitions-of-care services faces significant hurdles. A primary barrier is the lack of sustainable reimbursement models. In many healthcare systems, especially fee-for-service environments, the direct clinical services of pharmacists are not recognized as billable events by major insurers like Medicare Part B, with few exceptions [32]. This creates a situation where the financial benefits of reduced readmissions accrue to the hospital or insurer, while the cost of providing the service rests with the pharmacy department. This misalignment of incentives makes it difficult for hospital administrators to justify the full-time equivalent (FTE) positions needed for these labor-intensive services, often relegating them to grant-funded or pilot-project status rather than integrated, core operations.

Workforce limitations and training requirements present another substantial challenge. There is a global shortage of clinical pharmacists with specialized training in pharmacotherapy and transitions of care. Establishing an effective service requires pharmacists who are not only clinically proficient but also possess strong competencies in patient communication, counseling, and care coordination [33]. Training existing staff or recruiting specialists demands time and resources. Furthermore, these services are resource-intensive; a single pharmacist can only effectively manage a finite panel of high-risk patients. Determining the appropriate pharmacist-to-patient ratio and scaling services to meet the needs of an entire hospital or health system requires careful planning and significant investment in personnel, which circles back to the fundamental issue of sustainable funding.

The success of clinical pharmacy interventions is heavily dependent on seamless interdisciplinary collaboration, which can be difficult to achieve. Role ambiguity and territoriality can arise if the pharmacist’s functions are not clearly defined and supported by hospital leadership and medical staff. Successful integration requires that physicians, nurses, case managers, and pharmacists view each other as collaborative partners with distinct and complementary expertise [34]. This necessitates a cultural shift within many institutions. Effective communication systems are also critical; pharmacists must have full access to electronic health records (EHRs) and efficient channels to communicate recommendations to the team and to receive referrals. The lack of interoperable health information technology between hospital and community settings further complicates the pharmacist’s ability to track patient outcomes and communicate with outpatient providers, fragmenting the very continuity they aim to create [35].

Finally, variability in program design and a lack of standardization can hinder the evaluation and

replication of successful models. Interventions differ in their components (e.g., inpatient only vs. inpatient plus follow-up), intensity, target population, and outcome measures, making it challenging to pinpoint which elements are essential for success [36]. This heterogeneity also complicates the development of universal best practice guidelines. Furthermore, identifying the right patients to target for these resource-intensive services is crucial for maximizing impact and efficiency. While risk prediction tools exist, their accuracy in predicting medication-related readmissions specifically is limited. Developing and validating reliable risk stratification tools that can be seamlessly integrated into clinical workflow remains an ongoing need to ensure services are directed toward those who will benefit most [37].

### 6. Conclusion

In conclusion, medication-related hospital readmissions represent a pervasive, costly, and often preventable flaw in healthcare delivery. The fragmentation of pharmacotherapy management across care transitions is a central contributor to this problem. Clinical pharmacists, with their specialized expertise in medication optimization, are uniquely equipped to address this challenge. Evidence robustly supports that multifaceted clinical pharmacy interventions—encompassing accurate medication reconciliation, inpatient MTM, comprehensive discharge counseling, and structured post-discharge follow-up—can significantly reduce readmission rates, improve medication safety and adherence, and provide a positive return on investment. However, realizing this potential on a broad scale requires overcoming substantial barriers related to sustainable financing, workforce development, interdisciplinary integration, and standardized implementation. The path forward demands continued advocacy for policy and payment reform that recognizes pharmacists as providers of patient care services, investment in innovative technologies and practice models, and a steadfast commitment to interdisciplinary, patient-centered care. By fully integrating clinical pharmacists into care transition teams, healthcare systems can make a decisive impact in breaking the cycle of medication-related readmissions, thereby enhancing patient well-being and the overall efficiency of healthcare delivery.

## Author Statements:

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