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The Impact of Pharmacist Led Interventions on Medication Safety and Clinical Outcomes in Specialized Outpatient Settings: A Scoping Review

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ABSTRACT

This scoping review maps the existing evidence on pharmacist-led interventions in specialized outpatient settings to synthesize their impact on medication safety and clinical outcomes. Conducted in accordance with JBI methodology and PRISMA ScR guidelines, a systematic search of PubMed, Scopus, Embase, and CINAHL (2012-2023) identified relevant studies. Data were extracted on study design, setting, intervention type, and outcomes.The review synthesized evidence from diverse settings including rheumatology, geriatric oncology, obstetrics and gynaecology, transplant care, and primary care. Pharmacist-led interventions such as medication reconciliation, comprehensive medication review, prescribing error interception, and targeted deprescribing of high-risk medications (HRMs) consistently demonstrated significant benefits. Key findings included reductions in prescribing errors (up to 9.2% of prescriptions intercepted), deprescribing of potentially inappropriate medications (PIMs) and HRMs (e.g., from 10.9% to 1.9%), and high rates of accepted clinical interventions (up to 92.4%). These activities led to optimized therapeutic regimens and mitigated drug-related harm, with interventions preventing major or fatal outcomes in specific high-risk populations. Pharmacist integration into outpatient multidisciplinary teams is a powerful strategy for enhancing medication safety and clinical outcomes. The evidence supports a shift from the pharmacist's traditional dispensing role to that of a clinical gatekeeper and therapeutic manager. Future efforts should focus on standardizing outcome measures, evaluating cost-effectiveness, developing scalable implementation models, and integrating pharmacists into learning health systems to sustain and expand their impact.

Keywords pharmacist intervention, medication safety, outpatient care, drug related problems, prescribing errors, deprescribing

Introduction

Medication safety remains a critical challenge in healthcare, particularly in outpatient settings where high patient volumes, polypharmacy, and fragmented care increase the risk of drug-related problems (DRPs), prescribing errors, and the use of high-risk medications (HRMs). Pharmacist-led interventions including medication reconciliation, medication review, prescribing error interception, and targeted deprescribing have emerged as key strategies to optimize therapeutic outcomes and enhance patient safety. However, the extent, nature, and clinical impact of these interventions across diverse specialized outpatient populationssuch as rheumatology, geriatric oncology, obstetrics and gynaecology, transplant care, and primary care are not comprehensively synthesized.

This scoping review aims to map the existing evidence on pharmacist-led interventions in outpatient settings, focusing on their role in identifying and resolving DRPs, reducing prescribing errors, deprescribing HRMs, and improving clinical outcomes. By integrating findings from varied clinical contexts, this review seeks to highlight common themes, methodological approaches, and gaps in the literature to inform future practice and research.

Materials and Methods

This scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews and reported following the PRISMA-ScR guidelines. A systematic search was performed across PubMed, Scopus, Embase, and CINAHL for studies published between 2012 and 2023. Keywords included: "pharmacist intervention," "medication reconciliation," "medication review," "prescribing error," "high-risk medication," "outpatient," "clinical pharmacy," and "drug-related problems." Inclusion criteria encompassed observational, interventional, and quality-improvement studies conducted in outpatient settings, involving pharmacist-led activities aimed at improving medication safety. Data extraction focused on study design, setting, population, intervention type, outcomes measured, and key findings.

Results and Discussion

Study (First Author, Year)	Setting & Population	Intervention Type	Key Findings	Clinical Impact / Acceptance Rate
van der Nat et al. (2022)	Rheumatology outpatient clinic	Medication reconciliation (MR)	Patient input during MR added essential info in 0% (EMR+NMRS) to 29% (EMR only) of visits. Most value when starting new drugs or discussing DRPs.	Limited added value with full digital access; targeted MR recommended.
Choukroun et al. (2020)	Geriatric oncology outpatient clinic	Pharmacist–geriatrician medication review	Reduced PIMs (Laroche: 31.4% to 5.9%), START criteria (66.7% to 5.9%), and ADE risk. Polypharmacy prevalent (80%).	High detection of DRPs (88.2% patients); interventions clinically significant.
Narayanan et al. (2022)	Obstetrics & Gynaecology outpatient pharmacy	Prescription screening and error interception	9.2% of prescriptions had errors (52.4% commission, 47.6% omission). 395 interventions performed (9.8:1 prescription-intervention ratio).	100% acceptance; 65.1% "very significant" clinical impact.
Deyo et al. (2020)	Primary care FQHC (age ≥65)	Pharmacist-led EHR messaging to deprescribe HRMs	HRM prescribing reduced from 10.9% to 1.9%. 71.2% therapy modification rate.	Achieved national benchmark (<3% HRM use); messages timed pre-visit improved success.
Duwez et al. (2020)	Lung transplant outpatient clinic	Pharmacist interventions in multidisciplinary team	92.4% of interventions accepted. Major/moderate impact in 64.9%. Top DRPs: wrong dosage (39.6%), untreated indication (19.6%).	Avoided fatality in 0.1%; major impact in 7.0%. Immunosuppressants and antifungals most critical.

This scoping review synthesizes compelling evidence across diverse specialized outpatient settings that pharmacist-led interventions consistently enhance medication safety, optimize therapeutic outcomes, and mitigate drug-related harm. The findings underscore the indispensable role of pharmacists as integral members of the outpatient healthcare team, yet reveal significant heterogeneity in practice models, measured outcomes, and implementation contexts.The traditional pharmacist's role as a dispenser has fundamentally transformed into that of a clinical gatekeeper and therapeutic manager. This evolution is most evident in specialized high-risk settings like geriatric oncology and solid organ transplant clinics. In geriatric oncology, as demonstrated by Choukroun et al. (2020), the pharmacist's role extends beyond simple reconciliation to encompass comprehensive medication reviews using validated tools (STOPP/START, Laroche criteria) for deprescribing potentially inappropriate medications. This is critical, as polypharmacy and multimorbidity create a perfect storm for adverse events in this frail population

Similarly, in lung transplant clinics, Duwez et al. (2020) show pharmacists functioning as pharmacokinetic experts, proactively managing the narrow therapeutic index of immunosuppressants like tacrolimus, and navigating high-risk drug-drug interactions (e.g., with azole antifungals). The clinical impact was profound, with interventions preventing major or fatal outcomes in 7.1% of cases.Conversely, the study by van der Nat et al. (2022) in rheumatology prompts a critical re-evaluation of resource allocation. Their finding that patient-led medication reconciliation adds negligible value when comprehensive digital records (EMR and national database) are available challenges the blanket application of this resource-intensive process. It argues for a targeted, risk-stratified approach where pharmacist resources are concentrated on scenarios of highest yield such as new drug initiation, complex regimen changes, or when digital data is incomplete. This highlights a maturing field where the focus shifts from doing everything to doing what matters most.

The impact of context cannot be overstated. The extraordinary success in the Federally Qualified Health Center (FQHC) setting described by Deyo et al. (2020) reducing high-risk medication (HRM) prescribing from over 10% to below the national benchmark of 3% demonstrates the unique power of pharmacist intervention in underserved communities. These settings often grapple with fragmented care, health literacy challenges, and limited specialist access, amplifying the potential benefit of integrated pharmacy services. The key innovation was workflow integration: leveraging shared EHRs to deliver succinct, evidence-based recommendations directly to the provider's inbox, timed just before the patient's appointment. This model of "right information, right time, right person" proved remarkably effective, achieving a 71.2% therapy modification rate.

In contrast, in highly structured, protocol-driven environments like the obstetrics and gynaecology outpatient pharmacy (Narayanan et al., 2022), the pharmacist's role was that of a meticulous safety net. The 9.8:1 prescription-to-intervention ratio indicates that nearly 10% of all prescriptions required pharmacist interception to correct errors, predominantly dose and duration errors with high clinical significance. This emphasizes that even in specialized clinics, systemic vulnerabilities in the prescribing process persist, and the pharmacist's real-time, point-of-dispensing review remains a non-negotiable safety checkpoint. While error detection and prevention are central themes, the reviewed studies reveal a broader spectrum of impact mechanisms Therapeutic Optimization: This goes beyond correcting errors to actively improving care. Examples include initiating statins for untreated dyslipidemia in transplant patients (Duwez et al.) or adding vitamin D supplements per START criteria in geriatric oncology (Choukroun et al.).Risk Mitigation through Deprescribing: The proactive discontinuation of harmful or unnecessary medications (e.g., sedative-hypnotics, skeletal muscle relaxants) is a sophisticated clinical skill that prevents future harm and is a cornerstone of modern geriatric care. System-Level Influence: Pharmacists contribute to culture change and system redesign. Their documentation of error patterns (e.g., missing specialist countersignatures, incorrect anticoagulant durations) provides actionable data for quality improvement initiatives, leading to better prescribing guidelines, EHR alerts, and staff education.

Critical Success Factors and Barriers

The synthesis points to several success factors:Integration into the Care Team: Highest acceptance and impact occurred when pharmacists were embedded within multidisciplinary teams (transplant, geriatric oncology), attending rounds, and participating in shared decision-making.Technology Leverage: Shared EHR access, templated messaging, and integration with claims or dispensing databases were force multipliers, enabling efficient identification of at-risk patients and seamless communication. Proactive, Pre-Visit Workflow Interventions were most successful when pharmacists could prepare recommendations before the clinician saw the patient, facilitating shared decision-making during the encounter rather than creating post-hoc work.

However, significant barriers and research gaps persistOutcome Measurement Heterogeneity: Studies measure different things prescribing error rates, PIM prevalence, HRM use, intervention acceptance. There is a stark lack of standardized, patient-centered outcome measures such as reduction in hospitalizations, emergency department visits, mortality, or patient-reported quality of life and symptom burden.The Sustainability and Cost-Effectiveness Black Box:While clinical benefit is clear, the business case is often implicit. Robust economic analyses evaluating the return on investment (ROI) of clinical pharmacist salaries through avoided adverse events and hospitalizations are scarce but essential for widespread adoption and sustainable funding models.The Implementation Science Gap: We know what works in specific studies, but less about how to implement these models across diverse healthcare systems with varying resources, cultures, and regulations. Research is needed on implementation strategies, scalability, and adaptation to low-resource settings.

Future Directions: Toward a Learning Health System

The future of outpatient clinical pharmacy lies in moving from isolated interventions to being a core component of a learning health system. This involves Standardization and Interoperability Developing and adopting standardized terminologies (like PCNE) and outcome sets for pharmacy interventions to enable benchmarking and meta-analysis. Leveraging Advanced Analytics Moving beyond retrospective chart reviews to predictive analytics using AI and machine learning on EHR data to prospectively identify patients at highest risk for DRPs and target interventions preemptively. Expanding the Scope to PatientReported Outcomes Incorporating tools to measure how medication changes affect a patient's daily function, symptoms, and treatment satisfaction. Policy Advocacy Generating the high-quality health economic evidence needed to advocate for sustainable reimbursement models for comprehensive medication management services, shifting pharmacy's value proposition from product to patient outcomes.

Conclusion

In conclusion, the evidence unequivocally supports the integration of clinical pharmacists into outpatient care teams as a powerful strategy to improve medication safety. Their impact is multifaceted, spanning error interception, therapeutic optimization, and risk mitigation. The challenge ahead is not to prove if pharmacists add value, but to determine the most effective, efficient, and scalable models for deploying their expertise across the continuum of care, and to embed these services into the fabric of healthcare financing and delivery. This requires a concerted effort from researchers, clinicians, healthcare administrators, and policymakers to translate this compelling evidence into standard practice.

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