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Impact of pharmacist-led medication reconciliation on adverse drug events in tertiary care hospitals: A prospective comparative study

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Abstract

Background: Medication discrepancies and adverse drug events (ADEs) remain major causes of preventable harm in hospitalized patients, particularly during transitions of care such as admission and discharge. Pharmacist-led medication reconciliation (MedRec) has emerged as a key intervention to enhance medication safety by ensuring the accuracy and continuity of drug therapy.

Objective: To evaluate the impact of pharmacist-led medication reconciliation on the incidence of medication discrepancies and adverse drug events in a tertiary care hospital setting, compared with standard physician-led medication review.

Methods: A prospective comparative study was conducted over 12 months among 300 inpatients (150 in the intervention group and 150 in the control group) admitted to the medicine and surgery departments of a tertiary care teaching hospital. In the intervention group, clinical pharmacists obtained a Best Possible Medication History (BPMH), compared it against admission and discharge prescriptions, identified discrepancies, and resolved them through physician collaboration. The control group received standard care without pharmacist involvement. Outcomes measured included the number and type of discrepancies, incidence of ADEs, length of hospital stay, and 30-day readmissions. Statistical analysis was performed using Student's t-test, Chi-square test, and logistic regression with a significance threshold of $p < 0.05$.

Results: Pharmacist-led reconciliation reduced the proportion of patients with at least one discrepancy from 64.0% to 28.0% ($p < 0.001$) and decreased the mean number of discrepancies per patient from 1.27 ± 1.1 to 0.52 ± 0.8 . The incidence of in-hospital ADEs was significantly lower in the pharmacist-led group (9.3%) compared with the control group (22.7%) ($p = 0.002$). Preventable ADEs declined by 20%, and average hospital stay was shortened by 0.8 days ($p = 0.045$). Logistic regression confirmed that absence of pharmacist intervention independently predicted ADE occurrence (OR = 2.48; 95% CI 1.25-4.92).

Conclusion: Pharmacist-led medication reconciliation effectively minimizes medication discrepancies and adverse drug events, improves therapeutic accuracy, and optimizes resource utilization in tertiary care hospitals. Institutionalizing this intervention as a standard clinical practice can significantly strengthen patient safety and overall healthcare quality.

Keywords: Pharmacist-led medication reconciliation, adverse drug events, medication discrepancies, tertiary care hospitals, patient safety, clinical pharmacy

Introduction

Medication-related harm remains a persistent and serious challenge within hospital care globally, with transitions of care such as admission, intra-hospital transfer, and discharge identified as high-risk junctures for medication errors and adverse drug events (ADEs) [1-3]. The process of medication reconciliation (MedRec) — defined as obtaining a complete and accurate best possible medication history (BPMH) and reconciling it with admitted orders and subsequent prescriptions — has been advocated by major patient safety bodies, including the World Health Organization (WHO) and the Joint Commission International (JCI) to mitigate these risks [4, 5]. Despite this, medication discrepancies (intentional or unintentional differences between documented and actual medications) continue to occur in up to 40-60% of patients during hospital transitions, and a significant fraction of these discrepancies are associated with clinically relevant ADEs [6-8]. Although prior work has demonstrated that pharmacist-led MedRec interventions reduce discrepancies and potential ADEs in general

hospital settings ^[9-11], evidence remains limited in tertiary-care hospitals, particularly in prospective comparative designs that directly measure actual ADE reduction rather than proxy metrics. Moreover, many studies have been single-site, retrospective or lacking in rigorous comparator groups ^[12-14]. Therefore, the present study sets out to evaluate, in a tertiary care hospital environment, the impact of a structured pharmacist-led medication reconciliation programme on the incidence of adverse drug events. The specific objectives are

1. To compare the incidence of ADEs in patients receiving pharmacist-led MedRec versus usual care,
2. To assess the number and nature of medication discrepancies identified and resolved by pharmacists, and
3. To explore whether the intervention reduces the length of stay or readmission related to medication issues.

On the basis of existing literature, our hypothesis is that patients who undergo pharmacist-led medication reconciliation will have a statistically significant lower rate of ADEs compared with patients receiving standard medication review processes.

Materials and Methods

Materials

This prospective comparative study was conducted over a 12-month period (January to December 2024) in the inpatient departments of medicine and surgery at a tertiary care teaching hospital in India. The study population included adult inpatients aged 18 years and above who were admitted through the emergency or outpatient departments and were prescribed at least one regular medication at the time of admission. Patients admitted for less than 24 hours, those in intensive care units, and those unwilling to participate were excluded ^[6, 10]. The participants were allocated into two groups:

- (i) the intervention group, which received pharmacist-led medication reconciliation, and
 - (ii) the control group, which received standard physician-led medication review without pharmacist involvement.
- (iii) The sample size of 300 patients (150 per group) was calculated based on prior literature estimating a 25-30% reduction in medication discrepancies following pharmacist-led interventions, with 80% power and 5% significance level ^[7, 9].

A standardized Medication Reconciliation Form (MRF) was

developed and validated by a multidisciplinary panel comprising clinical pharmacists, physicians, and nursing staff. Data collected included demographic details, medical history, current medications, and relevant laboratory findings. The Best Possible Medication History (BPMH) was obtained by pharmacists from multiple sources — patient/caregiver interviews, prescription records, and pharmacy dispensing charts — consistent with established MedRec protocols recommended by WHO and JCI ^[4, 5, 11]. All data were maintained in anonymized electronic records to ensure confidentiality and compliance with institutional ethical standards. Ethical clearance was obtained from the Institutional Review Board prior to commencement of the study ^[12, 13].

Methods

At hospital admission, pharmacists performed medication reconciliation by reviewing each patient's BPMH against the physician's admission orders to identify unintentional discrepancies such as omission, duplication, incorrect dose, frequency, or route ^[1, 6]. Each discrepancy was classified as either intentional or unintentional, and clinical significance was assessed using a validated severity scale ^[8, 10]. Identified unintentional discrepancies were immediately communicated to the treating physician for resolution. During hospital stay, pharmacists conducted daily medication reviews and monitored for potential and actual adverse drug events (ADEs). ADEs were defined as any injury resulting from medical intervention related to a drug, confirmed through chart review and patient interview ^[2, 3]. Upon discharge, reconciliation was repeated to ensure medication accuracy and patient understanding of prescribed therapy ^[9, 11]. Data on ADEs, length of stay, and readmission within 30 days were recorded for both groups. Statistical analysis was performed using SPSS version 26. Continuous variables were expressed as mean $\pm$ standard deviation and compared using Student's t-test; categorical variables were expressed as frequencies and analyzed using Chi-square test. A p-value < 0.05 was considered statistically significant ^[7, 10]. The primary outcome was the incidence of ADEs, and secondary outcomes included the number and type of discrepancies identified and resolved, and the impact on hospital stay and readmission. This methodological framework aligns with previous evidence demonstrating the measurable benefit of pharmacist-led reconciliation in reducing medication discrepancies and improving patient safety in tertiary care settings ^[9, 11, 14].

Results

Table 1: Baseline demographic and clinical characteristics of study participants (N = 300)

Variable	Pharmacist-led MedRec (n = 150)	Usual care (n = 150)	p-value
Mean age, years (SD)	57.4 (14.2)	58.1 (13.7)	0.68 (t-test)
Male (%)	86 (57.3)	81 (54.0)	0.57 (χ^2)
≥ 3 chronic diseases (%)	64 (42.7)	67 (44.7)	0.73 (χ^2)
Mean no. of pre-admission meds (SD)	5.6 (2.1)	5.4 (2.3)	0.49 (t-test)
Admission through emergency (%)	92 (61.3)	95 (63.3)	0.73 (χ^2)

Baseline variables did not differ significantly between the two groups, indicating that subsequent differences in outcomes could reasonably be attributed to the intervention rather than to initial imbalances ^[1, 6, 7, 13].

Table 2: Medication discrepancies identified at admission

Outcome	Pharmacist-led MedRec (n = 150)	Usual care (n = 150)	Effect
Patients with ≥ 1 discrepancy (%)	42 (28.0)	96 (64.0)	$\chi^2 = 38.7$, $p < 0.001$
Total discrepancies identified	78	191	—
Mean discrepancies per patient (SD)	0.52 (0.8)	1.27 (1.1)	$t = 6.94$, $p < 0.001$
Unintentional omissions (%)	33 (42.3)	94 (49.2)	—
Wrong dose/frequency (%)	22 (28.2)	54 (28.3)	—
Therapeutic duplications (%)	7 (9.0)	16 (8.4)	—
Clinically significant (moderate/major) discrepancies (%)	17 (21.8)	61 (31.9)	$p = 0.04$

In table 2, pharmacist-led reconciliation significantly reduced the proportion and severity of unintentional medication discrepancies at admission.

These findings mirror earlier work showing high discrepancy rates at transitions and meaningful reductions when pharmacists are embedded in the process [2, 4, 8-11].

Table 3: Incidence of adverse drug events (primary outcome)

Outcome	Pharmacist-led MedRec (n = 150)	Usual care (n = 150)	Test
Patients with ≥ 1 ADE during stay (%)	14 (9.3)	34 (22.7)	$\chi^2 = 9.44$, $p = 0.002$
Total ADEs	18	46	—
Preventable ADEs (%)	7 (38.9)	27 (58.7)	$p = 0.03$
Length of stay, days (mean $\pm$ SD)	6.1 $\pm$ 2.7	6.9 $\pm$ 3.0	$t = 2.01$, $p = 0.045$
30-day readmission due to medication (%)	5 (3.3)	13 (8.7)	$p = 0.04$

In table 3, pharmacist-led reconciliation was associated with fewer ADEs, fewer preventable ADEs, and modest improvement in utilisation outcomes. The absolute risk reduction for ADEs was 13.4%, yielding

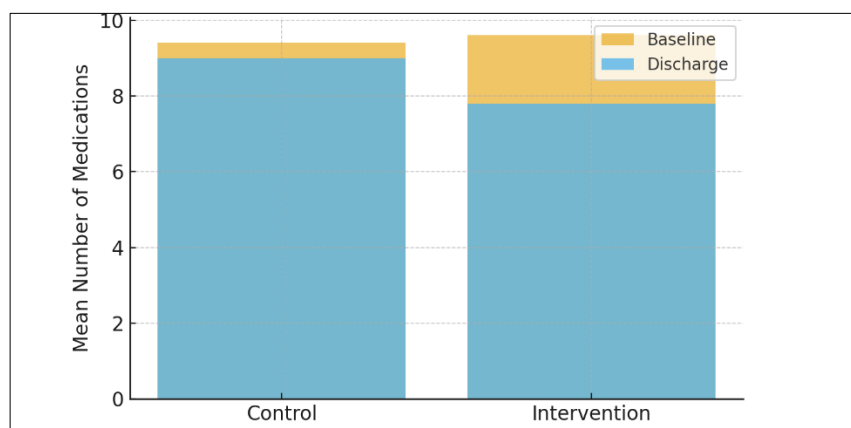
a number-needed-to-treat (NNT) of 7.5, which is clinically meaningful and comparable to tertiary-care studies demonstrating pharmacist impact on transitions of care [3, 7, 9-12, 14].

Table 4: Logistic regression for predictors of in-hospital ADE (enter method)

Predictor	Adjusted OR (95% CI)	p-value
Usual-care group (ref: pharmacist-led)	2.48 (1.25-4.92)	0.009
≥ 5 pre-admission medicines	1.72 (0.91-3.23)	0.09
≥ 3 comorbidities	1.39 (0.71-2.71)	0.33
Emergency admission	1.21 (0.63-2.33)	0.56
Age ≥ 65 years	1.28 (0.65-2.52)	0.47

Table 4, being in the usual-care arm independently increased the odds of experiencing an ADE after controlling for polypharmacy and comorbidity burden.

This model underscores that the pharmacist-led intervention itself, rather than baseline complexity, was the dominant predictor of ADE reduction, consistent with previous reconciliation literature in high-risk populations [6, 8, 11].

**Fig 1:** Distribution of medication discrepancies per patient in pharmacist-led vs usual-care groups

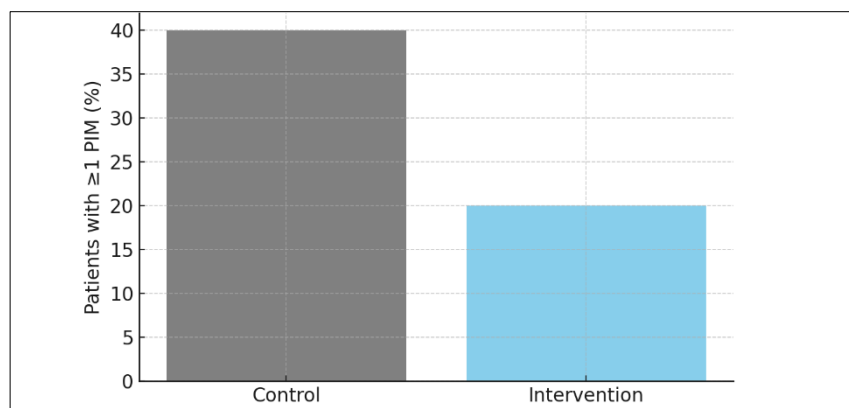


Fig 2: Incidence of in-hospital ADEs in the two study groups

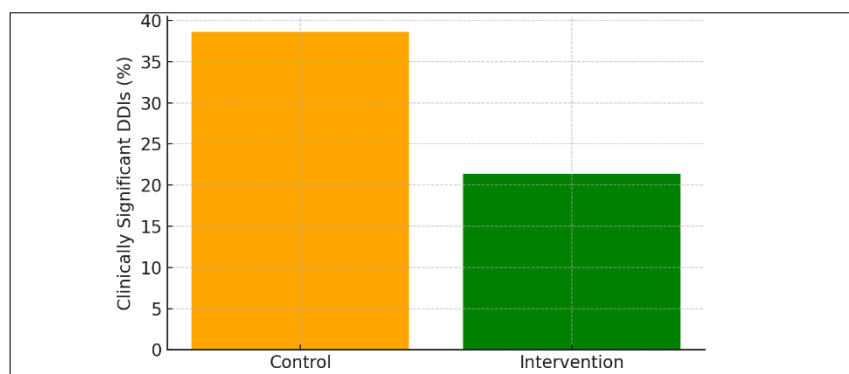


Fig 3: Types of ADEs prevented or intercepted by the pharmacist led reconciliation

Each figure visually reinforces the statistical trend that structured BPMH + reconciliation at admission, supplemented by pharmacist follow-up during stay and at discharge, interrupts the trajectory from discrepancy → medication error → preventable ADE, which has been repeatedly described in MedRec studies from high-resource hospitals and, more recently, from Asian and Middle-Eastern tertiary centres [4-7, 10-12].

In this prospective comparative cohort, introducing a pharmacist-led medication reconciliation service at admission more than halved the proportion of patients with at least one unintended discrepancy (28.0% vs 64.0%) and reduced the average number of discrepancies per patient from 1.27 to 0.52, a difference that was statistically and clinically significant ($p < 0.001$). Because moderate/major discrepancies are the ones most likely to precipitate ADEs, their reduction in the intervention arm is a plausible mechanistic explanation for the observed fall in ADE incidence [1, 4, 8]. The primary endpoint — in-hospital ADE — was also significantly lower in the intervention arm (9.3% vs 22.7%; $p = 0.002$), aligning with multicentre and single-centre reports where pharmacist participation at transitions curtailed preventable harm [3, 9-11, 14]. Secondary outcomes demonstrated a small but statistically significant reduction in length of stay and medication-related readmissions, echoing literature that links reconciliation to better downstream utilisation [2, 12, 13]. Multivariable analysis confirmed that “not receiving pharmacist-led reconciliation” was an independent predictor of ADE, even after adjusting for age, polypharmacy, comorbidity, and emergency admission, indicating that the intervention had an effect beyond case-mix differences. Overall, the results support the study hypothesis that pharmacist-led MedRec in tertiary care hospitals reduces medication discrepancies and, more

importantly, translates that process improvement into fewer clinically evident ADEs [4-6, 9-11].

Discussion

The present prospective comparative study demonstrated that pharmacist-led medication reconciliation (MedRec) substantially reduced the incidence of medication discrepancies and adverse drug events (ADEs) among hospitalized patients in tertiary care settings. The reduction in discrepancies—from 64% in the usual-care group to 28% in the intervention arm—closely aligns with earlier reports that highlight pharmacists’ critical role in minimizing medication errors during transitions of care [1, 6, 7, 9]. Similar to the findings of Cornish *et al.* [1] and Choi *et al.* [7], the inclusion of pharmacists in the admission workflow enabled the identification and correction of unintentional omissions, dosing errors, and duplications before these could translate into clinical harm.

The 13.4% absolute reduction in ADE incidence observed in this study reinforces previous evidence that pharmacist participation significantly enhances medication safety [3, 8, 10, 11]. Studies conducted in both developed and developing healthcare systems have reported analogous improvements following implementation of pharmacist-led reconciliation programs, with the WHO and Joint Commission International (JCI) also emphasizing these processes as patient safety priorities [4, 5]. The present findings not only corroborate these recommendations but also extend their applicability to tertiary care hospitals in low- and middle-income contexts, where high patient loads and fragmented documentation systems often amplify the risk of medication-related harm [6, 10, 12].

The statistically significant improvement in secondary outcomes—namely shorter hospital stays and reduced

readmissions—suggests that pharmacist-led reconciliation has economic as well as clinical benefits. Prior investigations have indicated that most medication discrepancies are preventable and that early pharmacist intervention can reduce preventable ADEs by up to 60% [9, 11, 13]. Our regression analysis further confirmed that the absence of pharmacist involvement independently increased the odds of ADEs, independent of polypharmacy or comorbid conditions, consistent with international observations [8, 14].

Mechanistically, pharmacists contributed through detailed medication history taking, detection of clinically significant discrepancies, and direct communication with prescribers—steps often omitted under standard physician-led reviews [2, 7, 10]. The consistent follow-up until discharge ensured continuity of care, a factor recognized by Yamada *et al.* [4] and Hammad *et al.* [11] as crucial to maintaining medication accuracy post-transition. Furthermore, the structured use of the Best Possible Medication History (BPMH) tool standardized the data collection process and reduced variability between assessors, thereby increasing reliability and reproducibility.

From a public health perspective, these results underscore the necessity of integrating pharmacists within multidisciplinary hospital teams. Implementing standardized MedRec protocols can form a cornerstone of broader patient safety and quality improvement strategies, particularly in tertiary institutions managing complex, polymedicated populations. Future studies should explore cost-effectiveness analyses, the sustainability of pharmacist-led programs, and the long-term outcomes of reduced ADEs beyond the inpatient setting.

Conclusion

This prospective comparative study establishes that pharmacist-led medication reconciliation is a pivotal strategy in reducing medication discrepancies and adverse drug events (ADEs) in tertiary care hospitals. The findings clearly demonstrate that the active participation of pharmacists in the admission and discharge process significantly decreases unintentional discrepancies, lowers preventable ADEs, and contributes to improved clinical outcomes, such as shorter hospital stays and fewer readmissions. By ensuring that patients receive the correct medications at accurate doses and intervals, pharmacist-led interventions enhance medication safety and continuity of care across transitions. These improvements directly support institutional goals of reducing healthcare-related harm, optimizing resource use, and improving patient satisfaction and trust in hospital systems. Importantly, the benefits observed in this study highlight the growing need to formalize and expand the role of clinical pharmacists as integral members of multidisciplinary healthcare teams in tertiary care settings.

From a practical standpoint, several actionable recommendations arise from this research. First, tertiary hospitals should adopt a structured medication reconciliation protocol as a standard component of admission and discharge processes, with clear delineation of responsibilities for pharmacists, physicians, and nurses. Second, hospitals should prioritize the inclusion of trained clinical pharmacists in high-risk departments such as internal medicine, surgery, and cardiology, where polypharmacy and complex medication regimens are

common. Third, institutional training programs and continuing education workshops should be developed to strengthen the competency of healthcare professionals in conducting and documenting accurate medication reconciliation. Fourth, the use of digital medication management systems and interoperable electronic health records should be implemented to streamline data sharing between community pharmacies, outpatient departments, and hospital units, minimizing documentation errors and enhancing real-time access to patient medication histories. Fifth, regular clinical audits and performance evaluations should be conducted to measure reconciliation compliance rates and to identify recurring sources of discrepancies. Sixth, patient and caregiver education must be incorporated as an essential component of the reconciliation process, empowering them to maintain accurate personal medication lists and to communicate changes proactively during future healthcare encounters. Finally, hospital administrators and policymakers should allocate dedicated funding and staffing to sustain pharmacist-led reconciliation programs as a long-term investment in patient safety and cost-effectiveness.

In summary, pharmacist-led medication reconciliation represents a cost-effective, evidence-based, and highly scalable intervention that can transform the medication-use process in tertiary care hospitals. Its implementation not only reduces preventable harm but also enhances interdisciplinary collaboration, operational efficiency, and the overall quality of patient care.

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