

Impact of Clinical Pharmacist Interventions on Medication Reconciliation at Discharge in an Indian Tertiary Care Hospital

Idris Dawaiwala^{1,*}, Monika Fuse¹, Manisha Katyari¹, Shrikant Raut¹, Sharook Shaji¹, Satyajit Singh Gill², Vivek Patwardhan³

¹Department of Clinical Pharmacy, Jehangir Hospital, Pune, Maharashtra, INDIA.

²Department of Medical Admin, Jehangir Hospital, Pune, Maharashtra, INDIA.

³Research Scientist, Hirabai Cowasji Jehangir Medical Research Institute, Pune, Maharashtra, INDIA.

ABSTRACT

Objectives: Unintentional medication-related discrepancies at discharge are linked to serious Medication Errors (MEs), adverse drug events, and increased healthcare utilization. Given the developmental stage of clinical pharmacy services in India, our study seeks to assess the impact of Clinical Pharmacist (CP) interventions in preventing MEs at discharge within the Indian healthcare setting. **Materials and Methods:** Conducted at a 350-bed academic Indian tertiary care hospital, this single-centre quasi-experimental study included two phases: a pre-intervention phase (January 2023 to April 2023) and an intervention phase (May 2023 to August 2023). During the pre-intervention period, clinicians alone managed the discharge medication reconciliation process. In the intervention phase, CPs collaborated with doctors. Discharge summaries were reviewed for parameters such as appropriate dosage, weight, creatinine clearance, frequency, administration route, drug timings, duplications, omissions, duration, contraindications, and drug-drug interactions. **Results:** In the pre-intervention phase, 126 patients (5.6%) had discrepancies, compared to 167 patients (7.7%) in the intervention phase ($p=0.6$). During the pre-intervention period, only 3 discrepancies (2.3%) were resolved before discharge, while CPs resolved 166 discrepancies (99.4%, $p<0.001$) during the intervention period, leaving only one discrepancy unresolved. Drug omissions were the most common type of discrepancy in both pre- (97, 66.4%) and intervention (207, 82.8%) groups. The average number of drugs in the discharge summary for patients with discrepancies versus without discrepancy was 8.6 versus 7.5 in the pre-intervention period and 7.6 versus 5.9 ($p=0.52$) in the intervention period, respectively. Additionally, during the intervention period, the average number of medical specialities involved in patient care for those without discrepancies was 1.5, compared to 2.1 for those with discrepancies ($p=0.52$). **Conclusion:** Integrating CPs into the discharge medication reconciliation process significantly reduced drug-related discrepancies. This study highlights the potential of CPs in improving medication and patient safety within the Indian healthcare system.

Keywords: Medication reconciliation, Medication error, Medication safety, Discharge reconciliation, Clinical pharmacy.

Correspondence:

Dr. Idris Dawaiwala

Department of Clinical Pharmacy,
Jehangir Hospital, 32 Sasoon Rd, Near
Sourab Hall, Pune-411001, Maharashtra,
INDIA.

Email: idrisd52@gmail.com

ORCID: 0000-0002-1769-2758

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INTRODUCTION

Medication reconciliation is a systemic process where patients' current medication list is accurately documented on admission, and verified at transition of care, and at discharge to avoid any drug-related discrepancies.¹ This comprehensive approach is designed to mitigate the risk of medication errors, which

pose significant safety concerns within the healthcare setting, particularly during transitions of care.² Notably, inadequacies in medication reconciliation contribute to over 40% of medication errors, with 20% resulting in harm.³ Unintentional medication discrepancies manifest prominently during critical junctures, with 54% occurring at admission,⁴ 62% during intra-hospital transfers,⁵ and 71% at discharge.⁶ Furthermore, medication-related discrepancies at discharge have not only resulted in Adverse Drug Events (ADEs) but are also associated with increased healthcare utilization and hospital readmissions.^{7,8} Recognizing the gravity of this issue, prominent healthcare entities such as the National Patient Safety Goal (NPSG) outlined by the Joint Commission and the World Health Organization (WHO) and its collaborators



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have identified medication reconciliation as a paramount patient safety concern.⁹

Studies have demonstrated the positive impact of Clinical Pharmacists (CPs) in ensuring the accuracy and completeness of medication lists during discharge medication reconciliation.^{10,11} Specifically, a research finding revealed that the most prevalent discrepancy during discharge reconciliation was related to drug-drug interactions, constituting 49.3% of cases, followed by drug omission at 21.5%.¹¹ Moreover, a study has shown a correlation between the involvement of CPs in the reconciliation process and a reduction in ADEs at discharge.¹⁰ Other studies have highlighted the role of CPs in medication review, patient counselling, and telephonic follow-ups, which have led to the identification of more medication errors and lower rates of preventable ADEs 30 days after hospital discharge.¹³⁻¹⁵

These findings collectively emphasize the significant and multifaceted contributions of CPs in minimizing medication discrepancies and fostering improved patient care outcomes during critical transitions in healthcare. In India, the CP profession is still in its early developmental stages, with many hospitals lacking quality accreditations and awareness of clinical pharmacy services. As a result, the potential contribution of CPs in the discharge reconciliation process remains largely unexplored. Therefore, our study aims to address this significant knowledge gap by investigating the implementation of the discharge reconciliation process and the type of CP interventions in an Indian tertiary care setting.

MATERIALS AND METHODS

Setting

This single-centre quasi-experimental study took place at an academic tertiary care hospital with a total of 350 in-patient beds.

Patients

The inclusion criteria for this study comprised individuals aged 18 and above of any gender who were discharged on weekdays (Monday to Saturday) between January 1, 2023, and August 31, 2023. Participants who had at least admission duration of 24 hr and were prescribed two or more medications upon discharge were included. Individuals admitted for one-day chemotherapy, as well as those discharged from paediatric and intensive care units, were excluded due to resource constraints.

Pre-intervention and intervention period

The study was divided into two phases: the pre-intervention phase spanning from January 1, 2023, to April 30, 2023 (4 months), and the subsequent intervention phase, conducted from May 1, 2023, to August 31, 2023 (4 months). In the pre-intervention phase, resident doctors from respective specialty departments conducted the discharge summary reconciliation process and prepared the discharge summary online in the hospital management system.

This discharge summary was verified by the primary consultants, and the final discharge summary was printed and given to the patients. No CPs were involved in the discharge summary reconciliation process during this phase.

In the intervention phase, after the preparation of the discharge summary by the doctors, it was verified by the attending CPs. In case of medication-related discrepancies, the concerned resident doctor was informed about the error, and the discrepancy was resolved. It was mandated that patients could only be discharged after the CPs' review during this period. Additionally, discharge medication counselling was provided to the patients. A wallet-sized card was also handed over to the patient, containing the patient's name, food and medicine allergy information, date of birth, emergency contact mobile number, any medical conditions the patient is suffering from, and the patient's current and complete medication list (Figure 1). Patients were instructed to keep this card with them at all times in case of any emergency. The summary of the discharge reconciliation process in the pre-intervention and intervention periods is depicted in Figure 2.

Medication reconciliation by CPs at discharge

Four CPs were allotted on respective floors that were responsible for verifying discharge medications once it is prepared, and verified by the primary consultants. CPs reviewed discharge medications for appropriate medication dosage as per guidelines, weight and creatinine clearances, frequency, route of administration, drug timings, drug-duplications, omissions, drug durations, and brand spellings. They carefully reviewed the discharge instructions, treatment plan, and cross verified it with the patient's diagnosis, patient's medications during hospitalization, and patient's admission reconciliation sheet. If any discrepancies or errors are identified during the CP's review, it was informed and discussed with resident doctors and corrections are made on system, the document is printed, and reviewed again to confirm that all changes have been accurately incorporated and that the information is now complete and correct.

Data collection

Retrospective cohort data for the pre-intervention period were extracted from the hospital's online health management system and the medical records department. Discrepancies from the pre-intervention period were identified by reviewing scanned copies of discharge summaries and patient medical record files. Patient demographics and clinical characteristics, including age, gender, date of admission, length of stay, number of medications at discharge, therapeutic class of drugs, patients' diagnoses, number of medical specialties involved in patient care, and the number of discrepancies on discharge medication list, were collected. The number of interventions performed by CPs on discharge summaries was recorded in an Excel database during the intervention period, along with details of discrepancies. Bias was prevented by involving only those CPs who did not participate

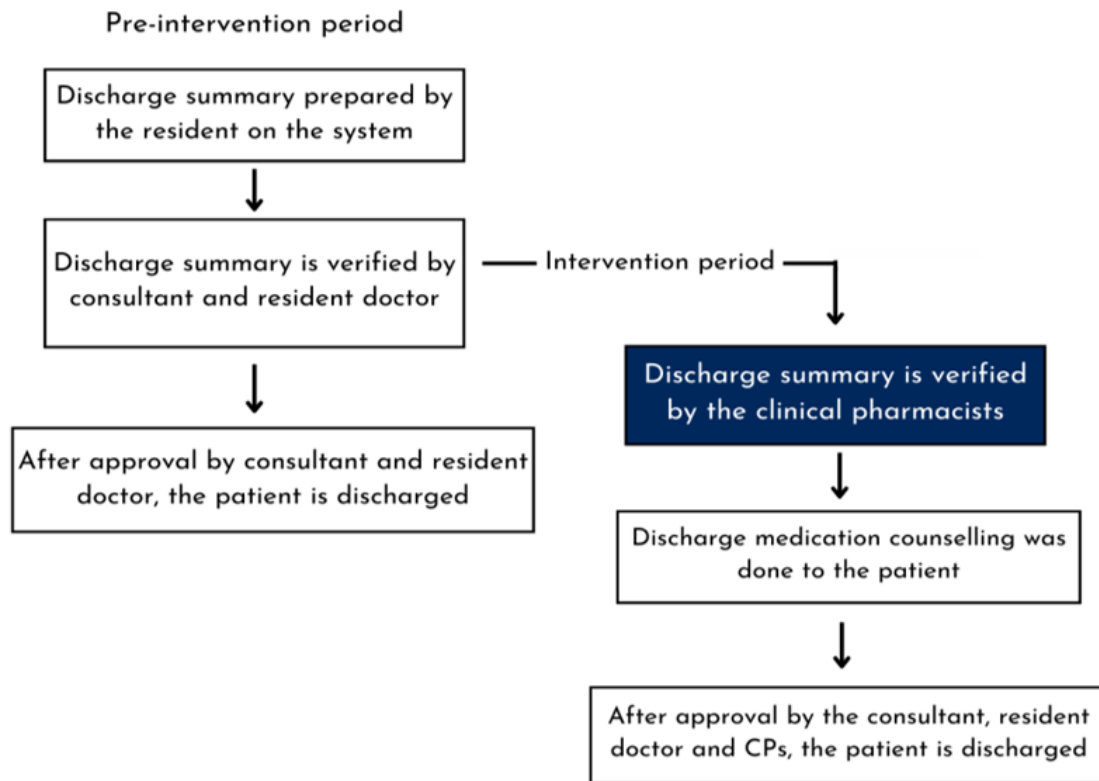


Figure 2: The process of discharge medication reconciliation in pre-and intervention periods.

Drug omission was the most common type of discrepancy in both the pre-intervention 97 (66.4%) and intervention 207 (82.8%) groups. Incorrect duration was the second most common type of discrepancy in the pre-intervention group 18 (12.3%), while incorrect dose was the second most common in the intervention group 17 (6.8%). Anti-hypertensive agents emerged as the most frequent drug class associated with discrepancies in both periods, representing 36 (24.6%) in the pre-intervention period and 76 (30.4%) in the intervention period. The various types of discrepancies observed in both groups are summarized in Table 2, while the different classes of drugs involved are detailed in Table 3.

DISCUSSION

Our study analysed the role of CPs in optimizing medications and minimizing medication-related discrepancies at patient discharge in an Indian tertiary care setting. We observed a significant reduction (-99.4%, $p < 0.001$) in patients with medication-related discrepancies in the post-intervention period, with the majority of discrepancies being resolved before patient discharge. In contrast, the pre-intervention period showed only a 0.02% resolution rate of patient-related discrepancies. These findings are consistent with other studies and meta-analyses that have also demonstrated a significant reduction in discrepancies with CPs involvement in medication reconciliation process at discharge.^{16,17}

Our study also revealed that a higher number of medications at discharge had greater likelihood of medication-related discrepancies, a pattern consistently observed in both the pre- and post-intervention periods respectively (8.6 vs 7.5 and 7.6 vs 5.9, $p = 0.52$). Patients with poly-pharmacy often have multiple co-morbid conditions, requiring heightened vigilance and caution. Involving CPs at this stage can provide an additional layer of safety, helping to avoid medication errors at discharge in a timely manner and ultimately enhancing patient safety.

Another crucial observation in our study was the higher number of discrepancies observed when multiple specialties were involved in a patient's care (1.5 vs 2.1, $p = 0.52$). The involvement of multiple specialties increases the number of medications, the risk of drug duplications, and the engagement of multiple healthcare professionals in the patient's treatment. These factors can elevate the risk of medication errors at discharge. Conducting a thorough evaluation of discharge summaries involving all concerned individuals can help mitigate such errors. Further research in this area is crucial to identify additional gaps and enhance systems and quality of care, particularly in the context of Indian healthcare settings.

Our study showed that drug omission was the most common discrepancy observed in both periods, the similar observation have also been reported by other studies.^{18,19} This discrepancy often occurs due to the withholding of certain medications, such

Table 1: Patient demographics and clinical characteristics.

Parameter	Pre-Intervention phase	Intervention phase	p-value
No.of patients	2243	2150	0.16
Age	49.6	50.7	
Female	1085	1128	0.8
Admitted speciality			
General medicine	576	486	0.005
Neurology	290	207	<0.001
Obstetrics and Gynaecology	244	263	0.39
Orthopaedics	152	207	0.003
Urology	98	99	0.94
Cardiology	261	233	0.24
Pulmonology	101	46	<0.001
General surgery	156	224	<0.001
Haematology	11	12	0.83
Oncology	76	104	0.03
Gastroenterology	179	171	0.66
Nephrology	99	98	0.94
Total no patients with discrepancy	126	167	0.32
No of drugs associated with discrepancy	146	250	0.06
1 Drug	112	117	0.003
2 Drugs	9	30	0.03
3 Drugs	2	12	0.05
4 Drugs	0	5	0.08
5 Drugs	2	1	0.57
6 Drugs	0	2	0.52
Average length of stay (days)	6.6	5.6	
Average no of drugs in discharge summary in patients with Discrepancy.	8.6	7.6	
Average no of drugs in discharge summary of patients without discrepancy.	7.5	5.9	
Average no of drugs in discharge summary for total patients.	7.6	6.5	

as anti-hypertensive and hypoglycaemic agents, upon admission due to the patient's unstable condition. Unfortunately, these medications are sometimes overlooked and not restarted when the patient stabilizes and is discharged. This finding is supported by another aspect of our study, where anti-hypertensive medication emerged as the most common drug class associated with medication-related discrepancies. We also noted instances where patients were transitioned from oral hypoglycaemic agents to insulin upon admission, but this change was not reverted back to oral agents upon discharge. These observations underscore significant gaps in medication therapy management among healthcare professionals, highlighting the need for personnel

with a focused approach to medications at all levels to prevent such errors.

Our study demonstrates crucial role of CPs in improving patient care through focused medication management, as evident from our findings. Healthcare accreditations such as those by the Joint Commission International and the National Accreditation Board for Hospitals and Healthcare Providers in India mandate medication reconciliation during transitions of care within and between settings. Incorporating CPs into Indian healthcare settings, particularly in the medication reconciliation process, can serve as a valuable tool for enhancing the quality of care by promoting patient and medication safety.

Table 2: Type of medication discrepancy at discharge.

Types of Error	Pre-Intervention	Intervention
Dispensing error	0	1
Drug duplication	14	11
Incorrect dose	12	17
Incorrect duration	18	9
Medication without Indication	3	9
Drug omission	97	201
Wrong route	0	3
Dose Tapering not done	2	0

Table 3: Classes of drugs with discrepancies at discharge.

Type of medication	Pre-intervention	Intervention
Alpha-blockers	5	10
Anticoagulants	0	2
Antihypertensive	36	76
Antimicrobials	20	18
Anxiolytics and anti-depressant	5	11
Bronchodilators	2	0
Combination of antiplatelet and statins	12	20
Corticosteroids	2	1
H2 Blockers and PPIs	1	8
Hypothyroid	15	14
Insulin	6	0
Oral hypoglycaemic agents	17	48
Potassium channel activators	2	5
Statins	1	10
Vitamin or mineral supplements	10	12
Others	11	15

PPIs: Proton pump inhibitors.

LIMITATIONS

While our study provides valuable insights, it is important to acknowledge certain limitations. Firstly, our research was conducted at a single centre, potentially constraining the generalizability of our findings to other healthcare settings. Nevertheless, we sought to mitigate this limitation by increasing the sample size. Additionally, our study excluded discharges from paediatric and ICU wards, suggesting a potential area for future research. Furthermore, we did not analyse healthcare utilization in the 30 days' post-discharge in both groups, which is an important parameter. However, due to the initial stages of process implementation at our facility, this could be pursued as a future research endeavour.

CONCLUSION

The integration of clinical pharmacists into the medication reconciliation process at discharge was associated with a significant reduction in drug-related discrepancies. The inclusion of CPs in the Indian healthcare system can be instrumental in promoting safe medication use and enhancing patient safety.

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ETHICAL APPROVAL

Ethics approval for this study was exempted, as the research involved a quality improvement initiative focused on enhancing patient safety through medication reconciliation, which posed minimal risk to participants and did not involve any experimental interventions.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

ADEs: Adverse Drug Events; **NPSG:** National Patient Safety Goals; **WHO:** World Health Organization; **CPs:** Clinical Pharmacists.

AUTHOR CONTRIBUTION

Idris Dawaiwala: Conceptualization, data collection, writing, and reviewing the manuscript. **Monika Fuse:** Methodology, data analysis, and drafting the manuscript. **Manisha Katyari:** Data curation and statistical analysis. **Shrikant Raut:** Investigation and validation. **Sharook Shaji:** Supervision and project administration. **Satyajit S. Gill:** Reviewing and editing the manuscript, ethical oversight. **Vivek Patwardhan:** Overall guidance, manuscript reviewing, and final approval of the version to be published.

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