Original Article

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Medication Reconciliation: A Step Towards Patient Safety – An Interventional Approach in Geriatrics

Shamna Palliyalil Madathodiyil, M.Pharm[1], Dilip Chandrasekhar, Ph.D.[2], Fathima Thahseen Pulaya Kalathil, M.Pharm[1], Shareefa Komban, M.Pharm[1], Sradha Gopikrishnan, PharmD[1]

[1]Department of Pharmacy Practice, Al Shifa College of Pharmacy, Malappuram, Kerala 679325, India.

[2]Principal, Al Shifa College of Pharmacy, Malappuram, Kerala 679325, India.

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Abstract:

Objective: To evaluate the effect of pharmacist-led medication reconciliation in geriatrics.

Material and Methods: A prospective interventional study was conducted in the inpatient units of KIMS Al-Shifa Hospital from June 2022 to June 2023. The study focused on geriatric patients admitted to the General Medicine, Pulmonology, Gastroenterology, and Nephrology departments. Patient demographics and medication histories were collected at various stages of hospitalization. A standardized questionnaire was used to assess the knowledge and perceptions of healthcare professionals regarding pharmacist-led medication reconciliation.

Results: A total of 73 healthcare professionals participated, including 31 pharmacists (43.0%), 30 nurses (41.0%), and 12 physicians (16.0%). Among the 165 patients studied, 1,697 medication discrepancies were identified, of which 95.0% (n=1,611) were intentional and 5.0% (n=86) were unintentional. The most common overall discrepancy was the addition of an order (56.0%), followed by the omission of an order (31.0%). Among unintentional discrepancies, the omission of an order was the most frequent (55.0%), especially during admission (46.0%). On average, each prescription contained four discrepancies. Pharmacists performed 86 interventions, and 66.0% were accepted by physicians (p-value<0.001). Discrepancies most often involved antimicrobials (25.0%) and drugs for acid-related disorders (11.0%).

Conclusion: Unintentional discrepancies, particularly omissions, were the most frequent errors during admission. Pharmacist-led medication reconciliation significantly reduced medication discrepancies, highlighting the importance of pharmacist involvement in improving medication safety among geriatric patients.

Keywords: Geriatrics, medication discrepancies, medication reconciliation

Contact: Dr. Dilip Chandrasekhar, Ph.D.
Principal, Al Shifa College of Pharmacy, Malappuram, Kerala 679325, India.
E-mail: dilipc@alshifacollegeofpharmacy.ac.in
Contact: Dr. Sradha Gopikrishnan, PharmD
Department of Pharmacy Practice, Al Shifa College of Pharmacy, Malappuram, Kerala 679325, India.
E-mail: sradha@alshifacollegeofpharmacy.ac.in

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Introduction

In clinical practice, having an accurate and complete record of a patient's medication history is vital to ensure safe and effective care. Documentation of this information in medical records supports informed decision-making and helps reduce the risk of medication-related errors. Research has consistently demonstrated that maintaining an up-to-date and accurate medication list significantly decreases the likelihood of medication errors, particularly in older adults. Despite its importance, compiling a correct list of a patient's current medications is often challenging. Among the most effective strategies for reducing such errors is medication reconciliation[1]. This process plays an essential role in the continuity of care and is ideally conducted by clinical pharmacists, who possess specialized knowledge in pharmacotherapy and medication safety[2].

Medication errors commonly occur during transitions in care, including hospital admissions, transfers between units, and patient discharge. These moments are particularly vulnerable to communication failures, where incorrect or incomplete medication information may be conveyed to patients or between healthcare providers. It is estimated that between 25.0% and 50.0% of medication errors during transitions are due to information gaps or omissions in patients' medication histories[3]. Such discrepancies are a major source of patient harm[4]. Older adults are especially at risk; they often deal with multiple health conditions and are prescribed numerous medications, increasing the chance of adverse drug events due to age-related changes in pharmacokinetics and pharmacodynamics[5-6].

According to the World Health Organization, medication errors contribute to at least one death per day and cause harm to approximately 1.3 million individuals each year in the United States. In low- and middle-income countries, while the frequency of medication-related adverse events is comparable to that in high-income settings, the burden measured in years of healthy life lost is nearly twice as great. Given the magnitude of this issue, the World Health Organization has prioritized medication reconciliation as one of the top five high-risk areas for safety standardization[7]. When discrepancies—especially unintentional ones—are left unresolved, they can result in preventable medication errors, adverse outcomes, and added clinical burden.

Globally, medication reconciliation is recognized as a key process in enhancing patient safety across healthcare systems[8]. Its core principle involves collecting comprehensive and accurate information about a patient's medications by engaging with the patient, their family, and all involved healthcare providers during transitions of care. In this regard, nurses and physicians also play an important complementary role, ensuring continuity and clinical oversight alongside pharmacists. With the rise of telemedicine and the expansion of roles among non-physician prescribers, the process faces both challenges (such as difficulty in verifying medication histories remotely) and opportunities (such as improved communication and access to records), highlighting the need for stronger integration of telemedicine into reconciliation practices. Accurate medication histories and timely reconciliation are essential during hospital admissions, intra-hospital transfers, and discharge to ensure continuity and safety in medication use[9]. Errors in medication reconciliation have the potential to cause serious harm to patients if not addressed properly[10].

To implement an effective reconciliation process, healthcare providers must develop, maintain, and share a complete and verified medication list throughout the patient's journey in the healthcare system. Pharmacists are instrumental in this process. They help identify discrepancies, ensure medications are appropriate, and communicate verified medication lists clearly to all the involved parties, ensuring that the patient receives the right medication at the correct dose and time[11].

The process of medication reconciliation consists of three primary steps: firstly, creating the Best Possible

Medication History (BPMH); secondly, comparing this BPMH with medications prescribed at various stages—admission, transfer, or discharge; and finally, identifying and resolving any discrepancies. These discrepancies are categorized as either intentional or unintentional, and appropriate action is taken and documented accordingly. The BPMH includes comprehensive information on all medications the patient is using, including prescribed drugs, over-the-counter medicines, vitamins, supplements, and herbal remedies. Information should ideally be gathered through direct interviews with patients and their caregivers, then verified through multiple sources such as other healthcare providers, pharmacists, medication containers, official medication lists, or electronic health records. Research shows that one-third of prescribing errors in hospitals are due to inaccurate medication histories at admission[15].

Although clinical pharmacists are best positioned to carry out medication reconciliation, nurses and physicians may also contribute meaningfully by gathering information, validating medication histories, and reinforcing safe prescribing decisions, particularly in settings where pharmacists are not available. However, workload pressures and time limitations often reduce the effectiveness of non-pharmacist-led reconciliation[12]. Despite being a mandated safety practice, medication reconciliation is implemented inconsistently across hospitals[13]. Challenges to successful implementation include resource constraints, lack of provider engagement, and limitations in electronic health record systems[14].

The BPMH plays a central role in guiding new prescriptions, especially at critical transition points such as admission, discharge, or handoffs between different care providers. It allows clinicians to detect and address potentially harmful duplications, omissions, or dosing errors. Assembling this history requires teamwork. The responsibility for medication reconciliation is shared among pharmacists, nurses, physicians, patients, and their families, underlining the collaborative nature of this process. Timing is another crucial factor, as delays in reconciliation can lead to missed discrepancies and potential harm[16]. Discharge medication reconciliation is particularly important since many changes in drug therapy may have occurred during the hospital stay due to new diagnoses, drug interactions, or formulary restrictions[17]. The aim is to reconcile medications prescribed before admission with those introduced or adjusted during the hospital stay, ensuring clarity and safety as the patient transitions back to outpatient care[18].

Pharmacists are vital in ensuring patient safety through meticulous medication reconciliation, particularly in older patients who are most vulnerable to adverse drug events. They help prevent discrepancies at admission, during transfers, and at discharge by verifying histories, identifying risks, and providing patient education[19]. Routine reconciliation and prescribing initiatives can mitigate the medication risks in elderly patients; however, challenges, such as a lack of training among clinicians and poor integration of pharmacists into care teams, still persist[20].

Older patients represent a significant proportion of hospital admissions and are often affected by chronic conditions requiring multiple medications. The central aim of this study was to evaluate the impact of pharmacist-led medication reconciliation in a clinical setting by identifying discrepancies at various care transitions—admission, transfer, and discharge—and to counsel patients on its importance. Additionally, this study sought to assess healthcare professionals' understanding and application of medication reconciliation practices

Material and Methods

This study was conducted at a National Accreditation Board for Hospitals and Healthcare Providers (NABH) accredited tertiary care hospital in Perinthalmanna, Malappuram District, Kerala, over a period of one year, from June 2022 to June 2023. This was a prospective

interventional study involving geriatric inpatients from the departments of General Medicine, Nephrology, Pulmonology, and Gastroenterology. Ethical clearance for the study was obtained from the Institutional Ethics Committee (IEC) under approval letter no: KAS:ADM:IEC:0174B:22. Informed consent was obtained from all study participants before enrolment.

Patients aged 65 years and above, of all genders, admitted to the specified departments were included based on pre-defined inclusion and exclusion criteria. Patients were excluded if they had no dispensed medication within the past two years, had no knowledge of their home medications, were discharged without any discharge medication, were unable to communicate, or lacked a caregiver who could provide medication history. A total of 165 patients were reconciled during the study period. The sample size was determined based on the patient admission flow to the selected departments during the study period and the feasibility of data collection, while 100 questionnaires were distributed to ensure adequate representation of different healthcare professionals.

The study began with a comprehensive review of the international and national literature on medication reconciliation. Findings from this review, along with insights from the study site, were used to develop a structured data collection form, a standardized questionnaire, and a detailed protocol. The questionnaire was content-validated through expert review by senior clinicians and pharmacists, and a pilot test was conducted with a small group of healthcare professionals to ensure clarity and reliability before full-scale use. It aimed to assess the level of knowledge and perception of healthcare professionals—including physicians, pharmacists, and nurses—regarding medication reconciliation. It consisted of 16 questions, divided into four sections: Section 1 captured demographic and professional background; Section 2 assessed familiarity with the medication reconciliation process; Section 3 evaluated perceptions regarding the role of pharmacists; and Section 4 collected suggestions for improving the process. A total of 73.0% of the distributed questionnaires were completed and returned.

The data collection form recorded patient demographics, past medical history, medication history, current admission medications, transfer medications (if any), discharge medications, and types of medication discrepancies. Eligible patients were enrolled during ward rounds, and informed consent was obtained. The Best Possible Medication History (BPMH) was collected within 24 to 72 hours of admission and compared with the prescribed admission medications to identify any discrepancies. Patients were counselled regarding the importance of medication reconciliation. For transfer cases, data were collected within 24 hours of intra-hospital transfer, and discharge data were collected at the time of preparing discharge summaries.

Identified discrepancies were classified into intentional and unintentional categories. Types of discrepancies included additions, dose changes, frequency changes, drug substitutions, and therapeutic duplications. Unintentional discrepancies were discussed with the treating physicians and other healthcare professionals, and appropriate pharmacist-led interventions were made. Physician acceptance of interventions was defined as any recommendation made by the pharmacist that was fully or partially incorporated into the patient's treatment plan.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS), version 16.0. Quantitative variables were expressed as mean and S.D., while qualitative variables were presented as frequency and percentage. Associations between categorical variables were analysed using the Chi-square test. Results were interpreted using the p-value, with statistical significance set at $p\text{-value}<0.05$.

Results

A total of 165 patients were included in the study, and 378 prescriptions were reconciled. Participant demographics, comorbidities, medication counts, and baseline clinical characteristics are summarized in Table 1.

To assess the knowledge and practice of medication reconciliation among healthcare professionals, a standardized questionnaire was utilized. Of the 100 questionnaires distributed, 73 were completed (73.0%), comprising responses from 31 pharmacists (43.0%), 30 nurses (41.0%), and 12 physicians (16.0%).

Across all patients, 1,697 medication discrepancies were identified. Of these, 1,611 (95.0%) were intentional and 86 (5.0%) were unintentional—the latter classified as potential medication errors (Figure 1).

Among all discrepancies, the most frequent was the addition of an order (56.0%, n=952), followed by the omission of an order (31.0%, n=529). Other discrepancy types included dose change (5.0%, n=84), drug change (4.0%, n=61), frequency change (3.0%, n=45), and therapeutic duplication (1.0%, n=26) (Figure 2).

Focusing on unintentional discrepancies, the omission of an order accounted for 55.0% (n=47), followed by therapeutic duplication (29.0%, n=25). Other types included drug change (9.0%, n=8), frequency change (4.0%, n=3), dose change (2.0%, n=2), and the addition of an order (1.0%, n=1) (Figure 3).

The distribution of discrepancies across transitions of care showed that 46.0% occurred at admission, 34.0% at discharge, and 20.0% at transfer. Statistical analysis showed no significant association between the transition phase and the discrepancy occurrence (p-value=0.690) (Figure 4).

Table 1 Number of medication discrepancies per prescription

Parameter	Admission	Transfer	Discharge
Number of prescriptions	165	48	165

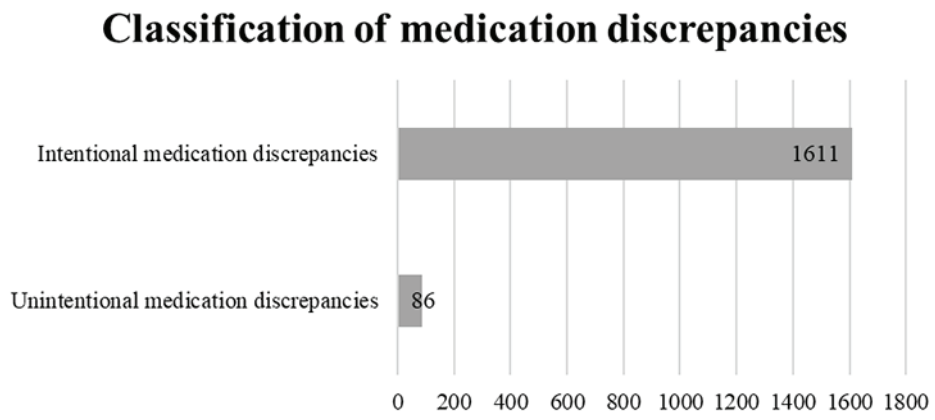

Figure 1 Classification of medication discrepancies

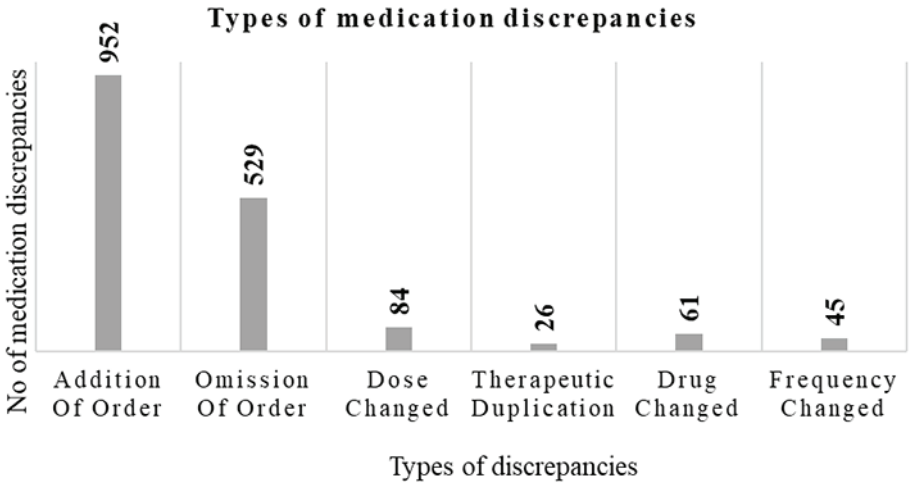

Figure 2 Types of medication discrepancies

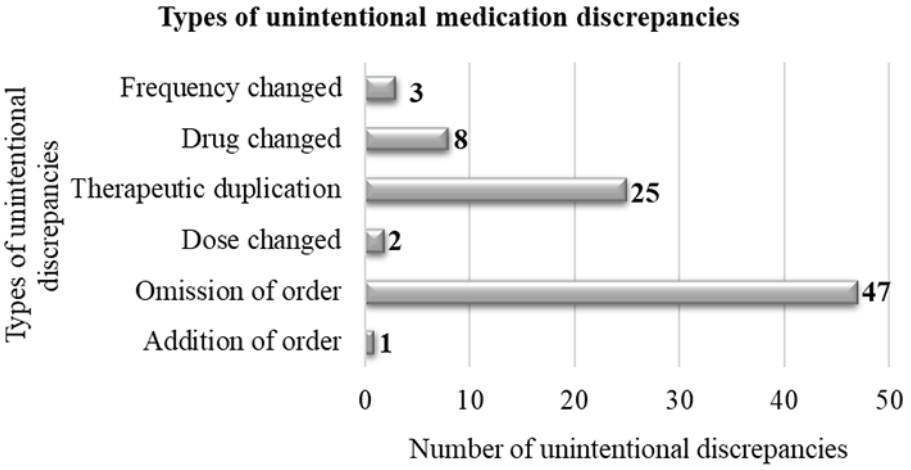

Figure 3 Types of unintentional medication discrepancies

On average, each prescription contained four discrepancies. Pharmacists conducted 86 interventions, of which 66.0% (n=57) were accepted by physicians, while 34.0% (n=29) were not. There was a significant association between pharmacist interventions and physician acceptance (p-value<0.001) (Figure 5).

The potential clinical harm of unintentional discrepancies was categorized as mild, moderate, or severe. Most were classified as mild to moderate, with a smaller proportion deemed severe.

Grouping discrepancies by drug category (Table 2) showed that antimicrobials accounted for 25.0% (n=435),

followed by drugs for acid-related disorders (11.0%, n=182) and drugs for obstructive airway diseases (9.0%, n=159). Fewer discrepancies were linked to antineoplastic agents (n=2) and ophthalmological drugs (n=3). A significant association was observed between drug category and discrepancy occurrence (p-value<0.001).

Analysis by comorbidity profile (Table 3) revealed that 14.0% (n=229) of discrepancies occurred in patients with diabetes mellitus and hypertension, while 11.0% (n=186) occurred in patients with diabetes mellitus, hypertension, and other comorbidities. For unintentional discrepancies, 16.0% (n=14) were seen in patients with hypertension and other conditions, followed by 15.0% (n=13) in those with diabetes mellitus and hypertension. The Chi-square test showed a significant association between comorbidities and the number of discrepancies (p-value=0.010).

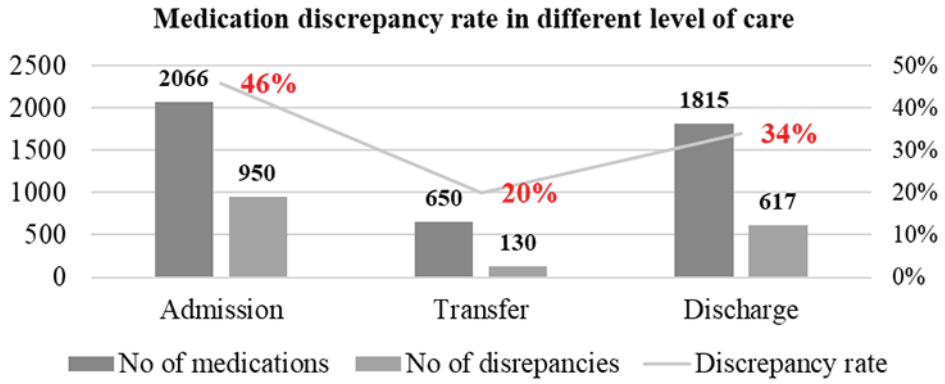

Figure 4 Medication discrepancy rate in different levels of care

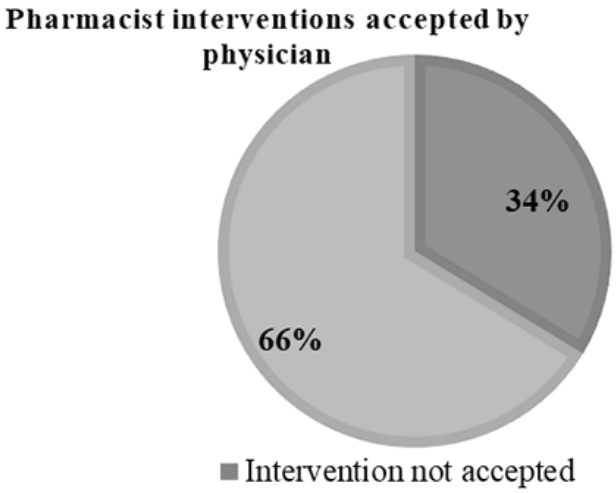

Figure 5 Pharmacist interventions accepted by physicians

Table 2 Distribution of discrepancies in medicine

Serial number	Medicine category	Number of medication discrepancies
1	Antimicrobials	435
2	Drugs for acid related disorders	182
3	Drugs for obstructive air way disease	159
4	Analgesics	128
5	Mineral supplement	107
6	Corticosteroids	99
7	Drugs used in diabetes	78
8	Cardiac therapy	74
9	Psycholeptics and Psychoanaleptics	72
10	Others	65
11	Drugs for constipation	52
12	Diuretics	43
13	Vitamins	42
14	Antithrombotic agents	24
15	Drugs for diarrhoea	23
16	Antifungal	19
17	Antitussives	18
18	Anti epileptics	15
19	Drugs for BPH	14
20	Antianemia preparations	13
21	Agents acting on renin angiotensin system	8
22	Anti-inflammatory and anti-rheumatic	7
23	Lipid modifying agents	6
24	Muscle relaxants	5
25	Nasal preparations	4
26	Ophthalmological	3
27	Antineoplastics	2

Table 3 Past medical history and medication discrepancies

Serial number	Past medical history	Number of medication discrepancies	Number of unintentional medication discrepancies
1	DM+HTN	229	13
2	DM+HTN+OTHERS	186	9
3	HTN+OTHERS	168	14
4	DM+CKD+HTN	120	10
5	HTN	103	0
6	DM+OTHERS	101	4
7	OTHERS	95	3
8	DM+HTN+ASTHMA+OTHERS	82	5
9	COPD+OTHERS	71	2
10	DM	67	1
11	ASTHMA + OTHERS	54	2
12	DM+CKD+HTN+OTHERS	48	1
13	DM+HTN+IHD+OTHERS	43	3

Table 3 (continued)

Serial number	Past medical history	Number of medication discrepancies	Number of unintentional medication discrepancies
14	DM+CIRRHOSIS	42	3
15	DM+CKD	42	1
16	CKD+HTN+OTHERS	35	2
17	COPD+CVA+OTHERS	32	3
18	CLD+OTHERS	32	1
19	COPD	27	0
20	DM+CIRRHOSIS+OTHERS	23	5
21	CKD+OTHERS	20	2
22	CLD	17	0
23	BPH+OTHERS	17	0
24	HTN+CKD	13	1
25	COPD+CVA	9	1
26	CIRRHOSIS	8	0
27	BPH	8	0
28	CIRRHOSIS+OTHERS	5	0
Total		1697	86

DM=diabetes mellitus, HTN=hypertension, CKD=chronic kidney disease, IHD=ischemic heart disease, COPD=chronic obstructive pulmonary disease, CVA=cerebrovascular accident, CLD=chronic liver disease, BPH=benign prostatic hyperplasia

Discussion

This prospective interventional study focused on geriatric inpatients from the departments of General Medicine, Nephrology, Pulmonology, and Gastroenterology in a tertiary care hospital. It aimed to assess the impact of pharmacist-led medication reconciliation over a one-year period, with data collected from 165 patients based on clearly defined inclusion and exclusion criteria.

To evaluate the knowledge and practices of healthcare professionals—namely physicians, pharmacists, and nurses—a standardized 16-question survey was adapted from the study by Jacinthe Lemay et al.[21] Of the 100 questionnaires distributed, 73.0% were returned, including responses from 12 physicians, 30 nurses, and 31 pharmacists. The distribution comprised 43.0% pharmacists, 41.0% nurses, and 16.0% physicians, differing from the study by Lemay et al.[21], possibly due to limited awareness or time constraints among physicians.

Although 92.0% of respondents were familiar with the term "medication reconciliation," 8.0% were not—potentially due to gaps in academic training or limited clinical emphasis on reconciliation. Only 58.0% had been introduced to the concept during formal education, while just 51.0% received workplace training; these findings are consistent with Lemay et al.[21]. The lack of training may be attributed to evolving clinical practices, minimal curriculum coverage, and resource limitations.

Regarding perceptions of responsibility, 50.0% of physicians, 53.0% of nurses, and 47.0% of pharmacists believed pharmacists should be responsible for reconciliation. Chi-square analysis revealed a significant association (p-value=0.000) between profession and perceptions about the pharmacist's role. Surprisingly, pharmacists showed relatively less awareness despite being the most directly involved in the process. This may reflect inadequate training opportunities, high workload, or the fragmented integration

of pharmacists into care teams. These findings underscore the importance of interprofessional education and targeted workshops to enhance pharmacist engagement. Similar trends have been observed by Al-Hashar et al.[22], Lee et al.[23], and Vogelsmeier et al.[24].

Of the 1,697 identified medication discrepancies, 25.0% were associated with antimicrobials, 11.0% with drugs for acid-related disorders, and 9.0% with medications for obstructive airway diseases. These findings are consistent with Tamiru et al.[32] but contrast with the results reported by Zheng et al.[25]. Pharmacists performed 86 interventions targeting unintentional discrepancies, of which 66.0% were accepted by physicians—a figure that differs from the lower acceptance rates in Gallagher et al.[26]. Variability in physician acceptance may be due to differences in clinical judgment, physician workload, or hesitation to alter established prescribing patterns. This highlights the need for stronger interdisciplinary communication and trust-building measures.

All patients had at least one comorbidity, with diabetes mellitus and hypertension being the most common combination. Eighteen patients had multiple comorbid conditions, such as coronary artery disease, hypothyroidism, and chronic obstructive pulmonary disease. These results align with findings by Chiarelli et al.[21], though they differ from those reported by Welk et al.[27].

Among the total discrepancies, 95.0% were intentional and 5.0% unintentional, in agreement with Chiarelli et al.[20]. The high proportion of intentional discrepancies likely reflects necessary clinical decisions such as drug substitutions, dose adjustments, or formulary restrictions. In contrast, unintentional discrepancies—though fewer in number—represent true medication errors and therefore carry greater clinical significance. The most common discrepancy was "addition of order" (56.0%), followed by omission (31.0%), dose change (5.0%), drug change (4.0%), frequency change (3.0%), and therapeutic duplication (1.0%). This pattern diverges from the findings of DEEP et al.[28] but corresponds with omission-related issues observed in studies by Andersen et al.[29] and Alanazi et al.[19]. Importantly, among the 86 unintentional discrepancies, 58.0% (n=50) were classified as mild, 33.0% (n=28) as moderate, and 9.0% (n=8) as severe in terms of potential clinical harm. This highlights the potential for adverse events even when the absolute numbers of unintentional errors are small.

Discrepancies occurred most frequently during the admission phase, accounting for 46.0% of total discrepancies, followed by discharge (34.0%) and transfer (20.0%). This distribution mirrors findings by Kreckman et al.[30]. Admission discrepancies are often due to incomplete medication histories, multiple prescribers, or inaccessible records. Comprehensive medication reconciliation at the point of admission is therefore critical.

Out of the 86 unintentional discrepancies, 41.0% occurred in patients aged 65–70 years, followed by 22.0% in the 76–80 age group. This may be explained by the higher rates of polypharmacy and poor medication recall in younger elderly patients. Regarding gender distribution, 52.0% of unintentional discrepancies were found in males and 48.0% in females. While some literature suggests that females may be more vulnerable due to a longer life expectancy, greater medication use, and health-seeking behaviors, our findings indicate nearly equal distribution. This reinforces the importance of systematic medication review and patient education regardless of gender. Integrating counselling for patients and caregivers into the reconciliation process is particularly vital in geriatric populations, as it can reduce errors, improve adherence, and empower patients in their care.

A total of 378 prescriptions—covering admission, transfer, and discharge—were reconciled. On average, each prescription contained four discrepancies, consistent

with Accomando et al.[31]. Factors contributing to these discrepancies include complex medication regimens, inadequate documentation, and communication gaps.

Antineoplastic drugs (3.0%) and ophthalmological agents had the fewest discrepancies, whereas antimicrobials were the most frequently involved. This may be due to complex dosing, rapid changes in guidelines, and the need for careful monitoring. In geriatric patients, these factors are compounded by cognitive decline and multiple comorbidities. Targeted interventions, such as clinical pharmacist involvement, routine medication review, and close collaboration with caregivers, can reduce these risks.

This study had several limitations. It included only four hospital departments, potentially missing discrepancies in other clinical areas. The sample size was limited, and patients admitted during public holidays were excluded. Due to resource constraints, the study could not evaluate the impact of patient counselling, a potentially significant factor in medication adherence and error prevention. Future studies should therefore incorporate structured counselling interventions, evaluate their impact on adherence, and explore digital or telemedicine-based approaches for continuity of care.

Despite these constraints, this study's strengths lie in its comprehensive evaluation of medication reconciliation across care transitions. Pharmacist-led reconciliation significantly reduced unintentional discrepancies and improved overall medication safety. Additionally, the study enhanced healthcare professionals' awareness of the process, fostering a more proactive patient safety culture. The findings emphasize that reconciliation should not only be a corrective step but also a preventive strategy, integrating patient counselling and interprofessional collaboration into routine practice.

For meaningful improvement, healthcare institutions should implement reconciliation across all care settings, including inpatient, outpatient, emergency, and perioperative units. Strengthening pharmacist involvement is essential, especially considering their lower engagement levels. Hiring additional clinical pharmacists will address manpower shortages and improve reconciliation efficiency. Integrating electronic documentation systems will streamline communication and minimize ambiguity.

Institutional policies should enforce structured reconciliation programs that emphasize pharmacist-led interventions and interdisciplinary collaboration. Policymakers should allocate resources for workforce expansion, digital infrastructure, and ongoing professional education to sustain and advance medication safety practices.

Conclusion

Reducing medication discrepancies in geriatric patients is crucial due to their comorbidities and polypharmacy. This study highlights the knowledge, practices, and impact of medication reconciliation among healthcare professionals, revealing significant gaps in both formal education and workplace training. Medication discrepancies were prevalent, with intentional discrepancies being more frequent, particularly during the admission phase. The most common discrepancies involved the addition (56.0%) and the omission (31.0%) of orders.

Pharmacists played a vital role in medication reconciliation; however, perceptions of their responsibilities varied among healthcare professionals. Pharmacist-led interventions significantly reduced medication discrepancies, with 66.0% of the interventions being accepted by physicians. Discrepancies were most frequently associated with antimicrobial agents (25.0%), acid-related disorder medications (11.0%), and drugs for obstructive airway diseases (9.0%).

Enhancing interprofessional collaboration, implementing targeted education, and establishing

standardized medication reconciliation protocols are necessary to strengthen patient safety practices. Additionally, raising awareness among patients and caregivers about the importance of disclosing complete and accurate medication histories is essential to ensure reliable documentation and improved quality of care.

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