Original Article

DOI: 10.7860/JCDR/2026/81341.23243

Pharmacology Section

Prevalence of Medication Errors in the Medicine Department of a Tertiary Care Teaching Hospital: A Cross-sectional Study

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ABSTRACT

Introduction: Medication Errors (ME) pose a major global threat to patient safety, causing adverse drug effects, increased morbidity and mortality, and higher healthcare costs while eroding patient trust. In the Medicine Department of a tertiary care teaching hospital in Eastern India, the prevalence of MEs lacks comprehensive documentation, thereby hindering targeted interventions.

Aim: To evaluate the prevalence and characteristics of MEs within the Medicine Department of a tertiary care teaching hospital.

Materials and Methods: This Institution-based cross-sectional observational study was conducted in the Departments of General Medicine and Pharmacology of a tertiary care teaching hospital of MGM Medical College and LSK Hospital, Kishanganj, Bihar, India, from March 2024 to February 2025. Data from 3,056 patient cases were collected through direct observation, covering prescribing, administration, transcription, and dispensing errors. Severity was classified using the National Coordinating Council for ME Reporting and Prevention's (NCCMERP) Index. Data were analysed using descriptive statistics and subgroup analyses with SPSS version 21.0 and Microsoft Excel, with $p<0.05$ considered statistically significant.

Results: Overall ME prevalence was 9.26% (283/3,056 cases), highest in the 51-60 years age group (31.8%). Prescribing errors dominated 131 cases (46.3%), followed by administration 63 (22.3%), transcription (50, 17.7%), and dispensation (38, 13.6%) errors- all highly significant ($p<0.001$). Key prescribing factors: error-prone abbreviations (14%) and illegible handwriting (12%). Most errors 164 cases, (58%) were categorised as "Error, No Harm" (Categories B–D) according to the NCC MERP index. Antibiotics (15%), Nonsteroidal Anti-inflammatory Drugs (NSAIDs) (12%),and multivitamins (11%) were most frequently associated with medication errors.

Conclusion: Prescription errors are prevalent in this setting, especially among middle-aged patients. Targeted interventions-improving prescription legibility, abbreviation use, transcription, and administration- are crucial. Collaborative efforts focusing on antibiotics and analgesics will enhance safety and reduce adverse outcomes.

Keywords: Medication errors, Prescribing errors, NCCMERP index

INTRODUCTION

Medication errors (MEs) increase adverse drug effects, morbidity, mortality, and treatment costs. Furthermore, they can erode patients' trust in healthcare providers and increase public healthcare expenditure. [1,2]. A ME is defined as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the Healthcare Professional (HCP), patient, or consumer" [3,4]. Such events can be related to professional practice, healthcare products, procedures, and systems, encompassing prescribing, order communication, product labelling, packaging and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use [5].

MEs and Adverse Drug Reactions (ADRs) significantly contribute to hospital adverse events, causing disability or death in up to 6.5% of admissions. While global studies on prescription errors exist, research in low- and middle-income countries remains limited despite growing medication use [6,7]. This study employs the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) index to categorise error severity and highlights the need for accurate reporting, analysis, and reporter protection to enhance prevention systems [4,8].

MEs are a significant threat to patient safety and continue to be a persistent issue in healthcare settings despite advancements in medical knowledge and technology. These errors can lead to adverse outcomes, increased healthcare costs, and reduced patient trust [9]. The medicine department of a tertiary care teaching hospital is also affected by this problem; however, there is a lack of comprehensive data on its prevalence in this specific setting. Without a clear understanding of the magnitude and nature of MEs, it becomes difficult to implement targeted interventions strategies to prevent them and enhance patient safety.

The present study aimed to evaluate the manifestation of MEs in the medicine department of a tertiary care teaching hospital. The objectives include estimating the frequency and types of MEs, assessing their severity, and identifying contributing factors. Additionally, the study seeks to identify critical points where MEs commonly occur and develop preventive strategies to reduce the occurrence of such errors.

MATERIALS AND METHODS

This Institution-based cross-sectional observational study conducted at the Department of General Medicine and Pharmacology of a tertiary care teaching hospital in the MGM Medical College and LSK Hospital, Kishanganj, Bihar, India, spanning from March 2024 to February 2025, allowing comprehensive data collection.Ethical clearance was obtained from the Institutional Ethics Committee (MGM/IEC-24/2024). Informed consent was secured from the participants, ensuring understanding of the study.

Study Population

The study population included all patients attending the Department of General Medicine of a tertiary care teaching hospital (MGM Medical College and LSK Hospital, Kishanganj, Bihar) based on specific inclusion and exclusion criteria.

Inclusion criteria: Patients aged 18 years and above, of both genders, who received prescribed medications during their hospital stay and had complete medical records accessible during the study period.

Exclusion criteria: Patients referred to other departments, those with incomplete medical records, and individuals receiving palliative care were excluded to ensure accurate data collection and focus on the intended study group.

Sample size calculation: The sample size calculation was done using the following formula:

$n=Z^2*P*(1-P)/d^2=(1.96^2*0.146*(1-0.146))/0.05^2=191.5944\approx192$

where:

- n=the sample size
- Z=the z-score corresponding to the desired confidence level (usually 1.96 for a 95% confidence interval)
- P=the estimated prevalence of MEs (in this case, a conservative estimate of 14.6% was used
- d=the desired precision (usually 0.05 for a 5% margin of error)

Therefore, the minimum sample size required for this study was 192 ME cases. The sample size was calculated based on the study conducted by Parthasarathi A et al., [3].

Study Procedure

The data collection process primarily involved the direct observation of random cases in the Medicine Department. A total of 3,056 patient cases were observed.

Data collection also incorporated existing incident reporting systems and retrospective medical record reviews to obtain relevant details, including error types, contributing factors, and severity by using the NCCMERP ME Index [4,8].

Relevant information about MEs such as the type of MEs (Prescribing Error, Transcription Error, Administration Error, Dispensing Error), contributing factors, and severity of harm (No Error: Category A; Error, No Harm: Category B, C and D; Error, Harm: Category E, F and G; Error, Death: Category H and I) were recorded and further analysed.

STATISTICAL ANALYSIS

The collected data were analysed using descriptive statistics, subgroup analyses, and qualitative thematic analysis to identify patterns and factors associated with MEs. Statistical analyses (Z test) were performed using SPSS version 21.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel.

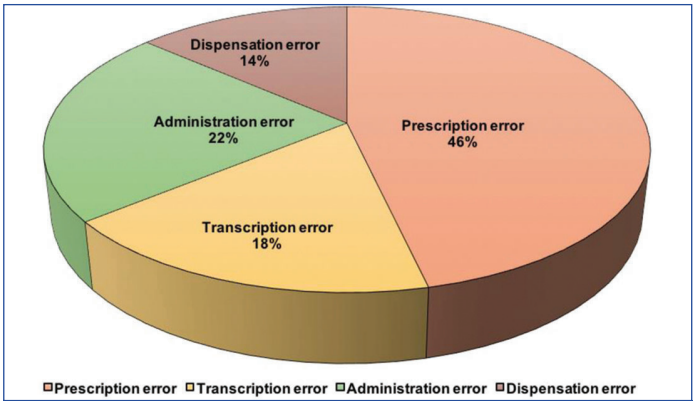
RESULTS

The present study reviewed 3,056 cases and identified 283 MEs, resulting in an overall prevalence of 9.26%.The highest percentage of MEs occurred in patients aged (51-60) years 90 cases (31.8%). In contrast, the lowest percentage was in patients over 80 years 4 cases (1.4%), possibly due to simpler medication regimens and closer clinical supervision. MEs were slightly more frequent in males 163 (57.6%) than in females 120 (42.4%) [Table/Fig-1].

Prescribing errors were most common 131 cases (46.3%), followed by administration errors 63 cases (22.3%), transcription errors 50 cases, (17.7%), and dispensing errors 38 cases (13.6%). with statistically significant results for most error types. Within the prescribing errors, the predominant factors were error-prone abbreviations 39 cases (14%) and illegible prescriptions 33 cases, (12%), with no nurse involvement observed. Administration errors were mostly omissions 23 cases (8%) and wrong frequency of medication 15 cases (5%), attributed to nurses. Transcription errors involved wrong documentation of medication names (18 cases, 6.2%) and doses (14 cases, 4.8%), with nurses more involved than doctors. Dispensation errors primarily included wrong medications dispensed 22 cases (8%) and wrong dose of medication dispensed 10 cases (4%), attributed to pharmacists [Table/Fig- 2,3].

Age groups (years)	Numbers of participants with a Medication Error (ME) (N=283)		
	Male n (%)	Female n (%)	Total N (%)
18-30	13 (4.6)	11 (3.9)	24 (8.5)
31-40	25 (8.8)	13 (4.6)	38 (13.4)
41-50	43 (15.2)	34 (12.0)	77 (27.2)
51-60	52 (18.4)	38 (13.4)	90 (31.8)
61-70	26 (9.2)	17 (6.0)	43 (15.2)
71-80	3 (1.1)	4 (1.4)	7 (2.5)
>80	1 (0.4)	3 (1.1)	4 (1.4)
Total	163 (57.6)	120 (42.4)	283 (100)

[Table/Fig-1]: Demographic distribution of participants with ME.



[Table/Fig-2]: Frequency of different types of Medication Errors (ME) (N=283).

Prevalence among 3056 cases was 4.30% for prescription errors, 2.07%for administration, 1.64% for transcription, and 1.26% for dispensation, all statistically significant (p-value <0.0001) [Table/Fig-4].

Most errors were categorised as "Error, No Harm" 164 cases, (58%), with a decrease in errors over time, suggesting improvements in patient safety efforts. The impact of MEs varied, with 63 cases (22%) categorised as Category D errors, indicating errors that reached the patient but resulted in no harm according to the NCCMERP classification [Table/Fig-5]. The findings emphasise the need for enhanced medication management strategies, such as clearer prescriptions, better adherence monitoring, and interdisciplinary communication.

Among drug categories, antibiotics (15%), NSAIDs (12%), and multivitamins (11%) were most frequently involved in errors, raising concerns due to their high potential for adverse effects [Table/Fig-6].

Overall, MEs were most prevalent among middle-aged patients, with prescription mistakes being the most frequent. Targeted interventions- such as simplifying regimens, improving documentation, and enhancing healthcare-provider collaboration- are essential in minimising errors and ensuring patient safety.

DISCUSSION

The one-year cross-sectional study revealed a 9.26% prevalence of MEs in the Medicine department. Prescribing errors were the most frequent (46.4%), followed by administration (22%), transcription (18%), and dispensing errors (14%). The 51-60 age group was most affected (31.8%), while those over 80 years had the lowest incidence (1.5%). Most errors were classified as Category D ("Error, no harm") (58%). Antibiotics (15%) and analgesics (12%) were the most commonly implicated drug categories, which may reflect the

S. No.	Prescribing error factors	Healthcare Professional (HCP) involved (n=131)		Frequency of ME (N=283) %	Total prescribing error
		Doctors n (%)	Nurses n (%)		
1	Illegible prescription	33 (25)	0	33 (12)	131, 46.3% Z=21.3876 p<0.001 significant
2	Incomplete prescription	28 (21)	0	28 (10)	
3	Wrong dose of the medication	21 (16)	0	21 (7)	
4	Error-prone abbreviation	39 (30)	0	39 (14)	
5	Wrong dosage form of the medication	10 (8)	0	10 (4)	
S. No.	Transcription error factors	Healthcare Professional (HCP) involved (n=50)		Frequency of ME (N=283) %	Total transcription error
		Doctors n (%)	Nurses n (%)		
1	Wrong documentation of the name of the medication	7 (14)	11 (21)	18 (6.2)	50,17.7% Z=4.7769 p<0.001 significant
2	No signature in the treatment chart after administration of the medication	0	6 (12)	6 (2.1)	
3	Wrong documentation of the dose of the medication	5 (9)	9 (18)	14 (4.8)	
4	The name of the medication was not mentioned in the treatment chart	0	13 (26)	13 (4.6)	
S. No.	Administration error factors	Healthcare Professional (HCP) involved (n=63)		Frequency of ME (N=283) %	Total administration error
		Doctors n (%)	Nurses n (%)		
1	Omission	0	23 (37)	23 (8)	63, 22.3% Z=7.44 p<0.001 significant
2	Extended use of medication	0	11 (18)	11 (4)	
3	Wrong frequency of medication	0	15 (24)	15 (5)	
4	Wrong dose of medication	0	8 (12)	8 (3)	
5	Wrong medication	0	6 (9)	6 (2)	
S. No.	Dispensing error factors	Healthcare Professional (HCP) involved (n=38)		N	Total dispensing error
		Nurses n (%)	Pharmacists n (%)		
1	Wrong medication dispensed	0	22 (57)	22 (8)	38, 13.6% Z=2.3161 p=0.02055 Significant at p<0.05
2	The wrong dosage form of medication dispensed	0	7 (18)	7 (2)	
3	Wrong dose of medication dispensed	0	10 (25)	10 (4)	

[Table/Fig-3]: Analysis of Medication Errors (ME) by category and the factors involved along with Healthcare Professional (HCP) Involvement.
ME: Medication error, n=number of cases, p-value is Significant at p<0.05

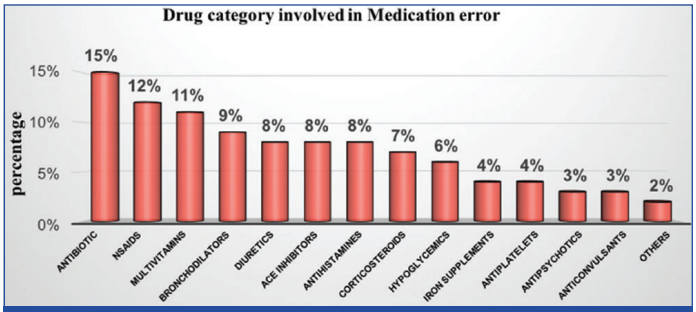
Types of Medication Error (ME)	Prevalence of Medication Errors (ME) (n=3056)	p-value
Prescription error	4.30	Z=-16.250 p<0.001 Highly significant
Transcription error	1.64	Z=-20.6335 p<0.001 Highly significant
Administration error	2.07	Z=-20.0057 p<0.001 Highly significant
Dispensation error	1.26	Z=-21.2722 p<0.001 Highly significant
Total	9.26	

[Table/Fig-4]: Prevalence and significance of different types of Medication Errors (ME).

Effect of ME	Category	Frequency of ME n (%)	Total N (%)	
No error	Category A	36 (13)	36	13
Error, no harm	Category B	56 (20)	164	58
	Category C	45 (16)		
	Category D	63 (22)		
Error, harm	Category E	32 (11)	83	29
	Category F	24 (8)		
	Category G	27 (10)		
Error, death	Category H	0	0	0
	Category I	0		

[Table/Fig-5]: National Coordinating Council for Medication Error (ME) reporting and prevention's index for categorising ME [4].

complexity of prescribing in patients with chronic conditions and multiple medications [10].



[Table/Fig-6]: Drug categories involved in ME.

The present study findings emphasise the critical need for robust risk mitigation. Recommendations include implementing electronic prescribing systems, standardised protocols, improved interdisciplinary communication, age-specific medication strategies, targeted monitoring of high-risk drugs, and fostering a non punitive error reporting culture. Further research is needed to explore seasonal error patterns and intervention outcomes.

In India, Patel N et al., (Dehradun) found dispensing errors (48%) to be the most frequent, while Mitra M and Basu M (Bihar) reported a 9.6% prevalence, with prescribing errors (5.4%) being the most common [11,12]. Arun MS et al., (Hill state) noted an 8.14% incidence, mainly prescribing (4.08%) and administration (3.06%) errors [13]. In Iran, Hodkinson A et al., reported preventable medication harm at 3%, highest in the elderly (11%) and intensive care (7%), while Vaziri S et al., found a 44.5% error prevalence, mostly in administration (52.4%) [14,15]. Shitu Z et al., (Malaysia) identified a 30.5% error rate in emergency departments, mainly wrong-time errors (46.9%), caused by knowledge gaps and communication failures [16]. In outpatient settings, Naseralallah L et al., reported error rates between 23%-92%, with prescribing errors (up to 91%) being the most common

[17]. Alharbi W et al., (8.75%) found errors highest in patients aged 41-50, mainly involving cardiovascular and psychotropic drugs [18]. Kuitunen S et al., (10.15%) reported the highest errors in those aged 61-70, often linked to anticoagulants and antidiabetics [19]. Zipre KG et al., (9.8%) saw most cases in patients aged 71-80, with cardiovascular and antimicrobial drugs implicated [20]. Dalmolin GR et al., analysed 3,800 cases, mainly involving analgesics and antidiabetics [21].

A surprising U-shaped trend was found in MEs: the 51-60 years age group had the highest error rate, while those over 80 years had the lowest. This challenges the common assumption that elderly patients experience the highest risk of medication errors likely due to simpler regimens and better oversight in the oldest group. Further multicentre research is required to explore these patterns.

For the healthcare system, MEs result in legal consequences, compromised quality of care, provider burnout, tarnished reputations, and a need for increased focus on quality improvement and patient safety culture. Addressing these errors through prevention and management is essential to improving patient outcomes and healthcare delivery, with the prevalence of prescription errors (46.4%) highlighting the importance of accuracy in initial medication stages.

Strengths of the study: The study's one-year duration offers a comprehensive view of MEs, with detailed categorisation by type, severity, professional involvement, and drug category. The inclusion of a substantial number of patient records enhances statistical power.

Limitation(s)

The study's findings are limited by its single-hospital setting, reliance on potentially underreported data sources and cross-sectional design, which overlooks long-term trends. Subjectivity in error severity assessment and a focus solely on the medicine department further restricts the generalisability of the findings.

CONCLUSION(S)

The present study highlights the need to reduce medication errors among middle-aged patients through improvements in prescribing, transcription, and administration practices. It emphasises collaboration among HCPs and the need for targeted interventions in specific drug categories. Future research should explore the underlying causes of these errors and evaluate targeted preventive interventions.

Acknowledgement

Authors' would like to acknowledge the contribution of Prof. (Dr.) Susanta Kumar Bordoloi, for his constant support, advice, and feedback. Also thankful to Dr. Piyali Dutta Chowdhury, the statistician, for her assistance with the data analysis and interpretation.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 19, 2025
- Manual Googling: Dec 22, 2025
- iThenticate Software: Dec 24, 2025 (6%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 16, 2025**
Date of Peer Review: **Oct 11, 2025**
Date of Acceptance: **Dec 26, 2025**
Date of Publishing: **May 01, 2026**