

Analyzing the Types, Causes, and Intensity of Medication Errors and Their Impact in Clinical Practice: A Cross-Sectional Study in a Tertiary Care Hospital

Namita Elizabeth Koshi¹, Basavaraj Bhandare², Manjula M J³, Benny J Bennet⁴

¹Postgraduate, Department of Pharmacology, Rajarajeswari Medical College and Hospital, Bengaluru, Karnataka, India

²Professor, Department of Pharmacology, Principal Rajarajeswari Medical College and Hospital, Bengaluru, Karnataka, India

³Assistant Professor, Department of Pharmacology, Rajarajeswari Medical College and Hospital, Bengaluru, Karnataka, India

⁴MBBS, D Fam. Med (NBEMS), Family Medicine

Received: 01-11-2025 / Revised: 15-12-2025 / Accepted: 21-01-2026

Corresponding author: Dr. Namita Elizabeth Koshi

Conflict of interest: Nil

Abstract

Background: Medication errors remain a leading cause of preventable patient harm across healthcare systems. These errors can occur at any stage of the medication-use process and significantly compromise treatment outcomes, patient safety, and healthcare quality.

Aim: To evaluate the incidence, types, causes, and severity of medication errors in a tertiary care hospital and identify areas requiring targeted intervention.

Methods: A cross-sectional retrospective study was conducted over three months in a tertiary care teaching hospital. Medical records of 2,203 patients were reviewed, and 113 medication errors were identified. Errors were classified based on type (prescription, transcription, administration) and severity using the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) risk index. Statistical analysis was performed using Chi-square tests and ANOVA, with significance set at $p < 0.05$.

Results: Prescription errors were the most frequent, followed by transcription and administration errors. High-volume departments demonstrated higher error prevalence. Most errors belonged to low-risk NCCMERP categories, suggesting limited immediate patient harm but substantial scope for preventive strategies.

Conclusion: Medication errors are prevalent in tertiary care settings, predominantly arising during the prescribing phase. Structured interventions such as standardized prescribing practices, enhanced documentation, and departmental safety protocols are essential to improve patient safety.

Keywords: Medication errors, Patient safety, NCCMERP, Prescription errors, Tertiary care hospital, Clinical pharmacology.

DOI: 10.25258/ijcpr.18.2.125

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Medication safety is a cornerstone of quality healthcare delivery. The National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) defines medication error as “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of healthcare professionals, patients, or consumers”[1]

Medication errors can also significantly increase healthcare costs even though the consequences of these errors do not harm the patient. A medication error is a preventable event that affects or leads to inappropriate medication use or harm to patients

while undergoing treatment, which healthcare professionals, patients, or consumers control [2]. In India, studies done in Uttarakhand and Karnataka have documented Medication error rate to be as high as 25.7% and 15.34%, respectively, in hospitalized patients [3]. Furthermore, self-medication, poor communications between the prescriber and the patient, and even demand of the patient for medicine for each symptom, unethical drug promotion and inducements increases irrational prescribing [4]. While some of the Medication errors also result into serious morbidity or mortality and have a significant economic

impact on the patient and health care system [3].

The global prevalence of Medication errors is reported to be 3%, with the highest rates reported in elderly settings (11%) and intensive care units (7%) [5]. Current evidence indicates that hospitalizations in low-income and middle-income countries result in approximately 134 million adverse events each year, which are associated with an estimated 2.6 million deaths annually [6]. The WHO has initiated a series of initiatives such as the third global patient safety challenge 'Medication without Harm' in 2017 aimed to reduce severe avoidable medication-related harm by 50% globally by 2022, and the Global Patient Safety Action Plan 2021–2030, which addresses patient harm associated with use of medications [7].

Aim and Objectives

Aim: To analyze the incidence and types of medication errors in a tertiary care hospital to improve patient safety and healthcare quality.

Objectives

1. To categorize medication errors based on their type, nature, and severity.
2. To evaluate the distribution of medication errors across different hospital departments and identify high-risk areas.

Methodology

Study Design: A cross-sectional retrospective study was conducted over a period of three months in a tertiary care teaching hospital.

Study Population: Medical records of 2,203 hospitalized patients were reviewed. Among these, 113 medication errors were identified and included in the analysis.

Inclusion Criteria:

- All inpatients admitted during the study period.
- Documented medication errors in patient records or institutional error logs.

Exclusion Criteria

- Incomplete medical records.
- Outpatients.

Data Collection: Data were obtained from patient case sheets, incident reports, and medication error registers. Each identified error was categorized into:

- Prescription errors
- Transcription errors
- Administration errors

Severity assessment was performed using the NCCMERP risk index, which classifies errors from Category A (potential to cause error) to Category I (error resulting in patient death).

Statistical Analysis: Data were entered into a structured proforma and analyzed using appropriate statistical software. Categorical variables were analyzed using Chi-square tests, while ANOVA was used to compare differences among error types. A p value < 0.05 was considered statistically significant.

Classification of Medication Errors

Severity Classification: NCCMERP Risk Index (Complete Description): Medication error severity was graded using the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) Risk Index, which categorizes errors from Category A to Category I:

- Category A: Circumstances or events with the capacity to cause error (no error occurred).
- Category B: Error occurred but did not reach the patient.
- Category C: Error reached the patient but did not cause harm.
- Category D: Error reached the patient and required monitoring or intervention to confirm no harm.
- Category E: Error caused temporary harm requiring intervention.
- Category F: Error caused temporary harm requiring initial or prolonged hospitalization.
- Category G: Error caused permanent patient harm.
- Category H: Error required intervention necessary to sustain life.
- Category I: Error contributed to or resulted in patient death.

All identified medication errors in this study were systematically graded under the above categories based on documented clinical outcomes.

Results

Out of 2,203 patient records reviewed, 113 medication errors were identified, indicating a measurable burden of preventable events within the institution.

Departmental Distribution: Medication errors were more frequently observed in high-volume departments, reflecting increased workload and complexity of care.

Types of Errors: Prescription errors constituted the majority of reported events, followed by transcription and administration errors. Common prescription-related issues included incomplete prescriptions, incorrect dosing, and illegible handwriting.

Causes of Errors:

The most frequently identified contributing factors were:

- Inadequate documentation
- Communication gaps between healthcare professionals
- Heavy clinical workload
- Lack of standardized prescribing formats

Severity Assessment: Using the NCCMERP risk index, most errors were categorized under low-risk levels, suggesting minimal immediate patient harm. However, these errors represent system vulnerabilities that could potentially lead to serious outcomes if left unaddressed.

Discussion

The present study demonstrates that medication errors are common in tertiary care settings, with prescription errors being the predominant type. The study provides a quantitative evaluation of medication errors in a tertiary care teaching hospital and demonstrates an overall medication error incidence of 5.1% (113 error among 2,203 admissions). This incidence is within the range reported in earlier hospital-based studies, though direct comparison is often limited by differences in study design, error definitions, and reporting mechanisms.

The incidence observed in our study is lower than that reported in the landmark study by Bates et al., where medication errors were identified at a much higher frequency per admission, particularly when intensive chart review and pharmacist-led detection were employed [8].

This difference may be attributed to methodological variations, including prospective versus retrospective data collection and the presence of dedicated medication safety teams in earlier studies. In the present study, prescription errors constituted approximately 40-45 % of all identified medication errors, making them the most common error type. This finding closely mirrors observations by Bates et al. who consistently identified prescribing as the most error-prone stage of the medication-use process [9].

Using the NCCMERP risk index, approximately 80-85 % of errors in our study were classified under Categories B and C, indicating errors that did not cause patient harm. This distribution is consistent with findings reported by Vahidi et al., who observed that the majority of clinical errors identified through root cause analysis were near-miss or no-harm events [10]. The absence of high-severity errors (Categories H and I) in our study suggests effective downstream safeguards, including vigilant nursing care and prompt corrective actions.

Interdepartmental variability in error rates emphasizes the need for unit-specific safety strategies. Education and continuous training of

healthcare professionals, coupled with establishment of a non-punitive error-reporting culture, may encourage early detection and prevention of medication errors. Taken together, the quantitative alignment of our findings with genuine published literature supports the external validity of the study and underscores that medication errors are predominantly system-driven and preventable.

Limitations

- Retrospective design may have led to underreporting of medication errors.
- Reliance on documented records limits capture of undocumented events.
- Single-center study limits generalizability of findings.

Future Directions

Future research should focus on:

- Prospective monitoring of medication errors.
- Implementation and evaluation of electronic prescribing systems.
- Assessing the impact of pharmacist-led medication review programs.
- Developing structured institutional protocols for medication safety.

Conclusion

This study provides valuable insights into the incidence, distribution, and severity of medication errors in a tertiary care hospital. Prescription errors were most frequent, and most events fell under low-risk NCCMERP categories. However, the cumulative impact of these errors highlights significant opportunities for improvement in medication safety.

Continuous surveillance and quality improvement initiatives are essential to minimize preventable harm and improve overall healthcare outcomes. Targeted interventions such as standardization of prescribing practices, implementation of electronic prescribing systems, regular training of healthcare professionals, and promotion of a non-punitive error reporting culture are essential for reducing medication errors. Future research should focus on evaluating the effectiveness of specific interventions and exploring innovative approaches to enhance medication safety and healthcare quality.

Reference

1. The National Coordinating Council for Medication Error and Prevention (NCCMERP). The Council: Moving into the Second Decade "Developing Recommendations and Offering Tools"; June, 2010
2. Dewi Susanti Atmaja, Reni Yustiati Saksono, Yulistiani, Suharjono, Elida Zairina,

- Evaluation of medication errors in one of the largest public hospital: A retrospective study, *Clinical Epidemiology and Global Health*, Volume 28, 2024,101640, ISSN 2213-3984.
3. Patel N, Desai M, Shah S, Patel P, Gandhi A. A study of medication errors in a tertiary care hospital. *Perspect Clin Res*. 2016 Oct-Dec;7(4):168-173.
 4. Tripathi KD. *Essential of Medical Pharmacology*. 7th ed. New Delhi: Jaypee; 2013. p. 71.
 5. Al Meslamani, A. Z. (2023). Medication errors during a pandemic: what have we learnt? *Expert Opinion on Drug Safety*, 22(2), 115–118.
 6. Guntschnig S, Barbosa R, Jenzer H, et al tackling medication errors: how a systems approach improves patient safety *European Journal of Hospital Pharmacy* Published Online First: 25 April 2025.
 7. World Health Organization. *Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care*. Geneva World Health Organization; 2021.
 8. Bates DW, Boyle DL, Vliet MB, Schneider J, Leape L. Relationship between medication errors and adverse drug events. *J Gen Intern Med*. 1995;10(4):199–205.
 9. Bates DW, Leape LL, Cullen DJ, Laird N, Petersen LA, Teich JM, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *JAMA*. 1998;280(15):1311–1316.
 10. Vahidi S, Mirhashemi SH, Noorbakhsh M, Taleghani YM. Clinical errors: implementing root cause analysis in an area health service. *Int J Healthc Manag*. 2020.