



## An Analysis of Medication Error and Quality Improvement Measures to Reduce Medication Error in Tertiary Care Hospital

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### ABSTRACT

**Introduction:** Medication errors can occur at any stage, from prescribing and indenting to dispensing and administration. These errors have the potential to cause significant harm to patients, potentially leading to serious health complications or even death. They can also result in patient dissatisfaction and loss of trust in the healthcare system. This study was conducted to analyze medication errors in a teaching hospital, with the goal of improving processes.

**Materials and Methods:** This ongoing descriptive study focuses on reported inpatient medication errors from January 2023 to December 2023 in a 1200-bed tertiary care teaching hospital in Bangalore. During the study period, 1,918 medication errors were reported, and the total number of opportunities for medication errors was 11,137.

**Results:** Between January 2023 and January 2024, a total of 2,394 medication errors were recorded. The total number of medication orders during this period was 15,473. As shown in Figure 1, 4.7% (178) of patients with medication errors were pediatric, under the age of 18. Additionally, 48.5% (1,295) were between 19 and 64 years old, while 37.8% (1,094) were 65 years or older.

**Conclusion:** The study found that medication errors can still occur even in hospitals with established policies for safe medication handling. However, these errors can be prevented from reaching patients through well-organized strategies and multi-level checks, such as the "Swiss cheese" model, which enhances safety in medication management. Further research is recommended, particularly on near-miss incidents, to identify lapses in existing processes and develop effective interventions to improve medication safety.

**Key words:** Medication errors, Near miss, "Swiss-cheese" model, Safe medication practices

### INTRODUCTION

A medication error refers to any preventable event that could lead to inappropriate medication use or harm to a patient while the medication is under the control of a healthcare provider, patient, or consumer. These errors can stem from various aspects of professional practice, healthcare products, procedures, or systems, including compounding, distribution, administration, education, monitoring, and usage. Due to a lack of structured reporting systems, many medication errors go unnoticed until they result in patient harm, even though studies conducted in Indian hospitals have indicated that the rate of such errors ranges from 15.34% to 25.7%.

Errors can occur at any stage, from prescribing to administering the medication, potentially resulting in patient harm and increased costs for the healthcare system. These errors not only impact the patient's health but can also lead to dissatisfaction and a loss of trust in healthcare services. Common causes of medication errors include the misuse of metrics, incorrect decimal placement, improper use of zeroes, and insufficient labeling.

Multiple healthcare professionals within a hospital setting can be responsible for medication errors. The Institute for Safe Medication Practices (ISMP) defines a near miss as an event or situation that could have caused injury but did not, merely due to chance. These near misses, which do not result in harm, are valuable for reporting purposes as they highlight potential risks. By analyzing near misses, healthcare organizations can develop strategies to prevent errors. This study focuses on evaluating medication errors and implementing quality improvement measures to reduce them in tertiary care hospitals.

### AIMS & OBJECTIVES:

- To identify and analyze the root cause analysis that influence medication error in tertiary care hospital

- To evaluate and assess rational use of prescription in a tertiary care hospital.

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## MATERIALS AND METHODS

This study was conducted after receiving approval from the Institutional Ethics Committee of Saphthagiri Institute of Medical Sciences and Research Center, a 1200-bed multispecialty teaching hospital located in Bangalore. It is an ongoing descriptive study that analyzes inpatient medication errors reported between January 2023 and June 2023. The total number of medication errors reported through the hospital's incident reporting system during this period was 1,918. The total number of opportunities for medication errors during the same period was 11,137, with a sample size of 2,250 (375 samples per month) retrieved from the wards.

Descriptive statistics were employed to analyze the data collected through incident report forms. If a category of medication error reaches the Administration and Quality Control Department within 48 hours, a pre-structured incident report form is completed. This form captures detailed information about the incident that led to the medication error. The reporting department is responsible for documenting the immediate reason for the error, which is part of the error categorization process. Each medication error is subject to a root cause analysis performed by clinical pharmacists. Incident reports are used solely for process improvement, not for disciplinary purposes. According to hospital policy, the medication errors are categorized as follows:

- **Category A:** No error, but a situation that could potentially lead to one.
- **Category B:** Error occurred, but it did not reach the patient.
- **Category C:** Error reached the patient but was unlikely to cause harm (including omissions).
- **Category D:** Error reached the patient and may have required monitoring or intervention to prevent harm.
- **Category E:** Error that caused temporary harm.
- **Category F:** Error that caused temporary harm requiring initial or prolonged hospitalization.
- **Category G:** Error that could have resulted in permanent harm.
- **Category H:** Error that could have required intervention to sustain life.
- **Category I:** Error that could have led to death.

The hospital has an inpatient pharmacy dedicated to serving admitted patients, with a robust system in place to ensure safe medication practices. Documented policies are readily accessible to healthcare professionals, including doctors, pharmacists, and nurses. These policies cover various aspects of medication management, such as selection, procurement, storage, prescribing, transcribing, dispensing, preparation, and administration.

The hospital has identified high-risk medications, such as look-alike, sound-alike (LASA) medications, which are dispensed through a "High Alert" double-check system in the pharmacy. Additionally, there are clear guidelines for the safe handling and administration of chemotherapy, high-risk drugs, and medications with a narrow therapeutic index. Employees receive continuous training on these safety protocols as part of their initial onboarding and ongoing professional development. Nursing staff are trained regularly in classroom settings led by the nursing training coordinator.

The hospital's formulary, updated annually under the oversight of the Pharmacy and Therapeutic Committee (PTC), outlines safe medication practices. This committee, responsible for medication safety, reviews medication storage and handling procedures to ensure patient safety. The committee meets quarterly to review reported medication errors and implement corrective measures. Hospital policy strictly prohibits the use of medical drug samples, self-medication by patients, or medications brought from external pharmacies. A digital copy of the Hospital Drug Formulary is available at every nursing station, providing easy access to updated information on drug dosages, routes of administration, frequency, and potential side effects. High-risk emergency medications are double-checked by senior nurses before administration to ensure patient safety.

### Study design:

- Descriptive study

### Study site:

- Saphthagiri Medical College and Research Institute, Bangalore

### Sample size:

- 375 samples per month (according to NABH standards)

### Duration:

- 12 months

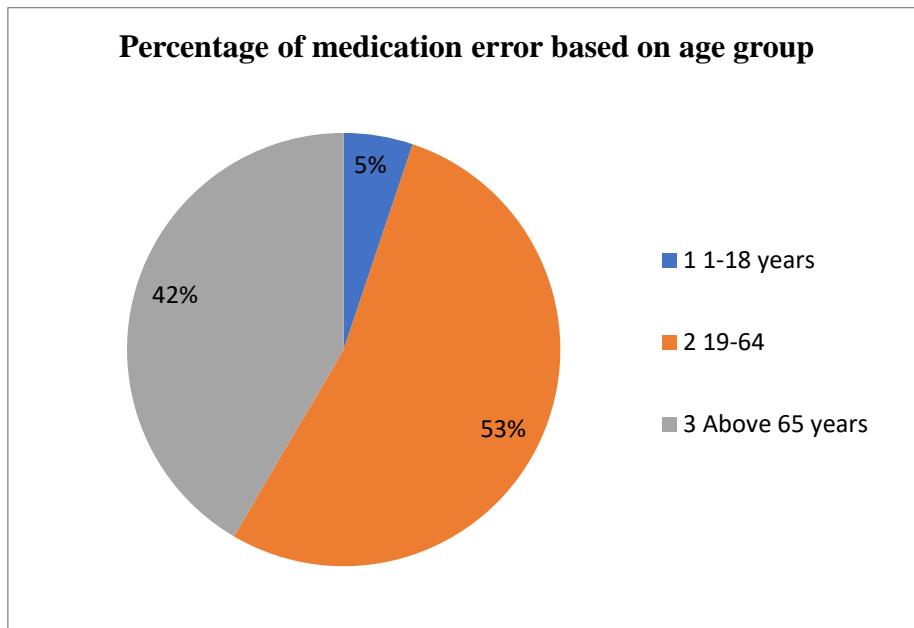
**Study criteria:**

- Inclusion criteria: In Patients from all clinical departments
- Exclusion criteria: Out Patients

**RESULTS:**

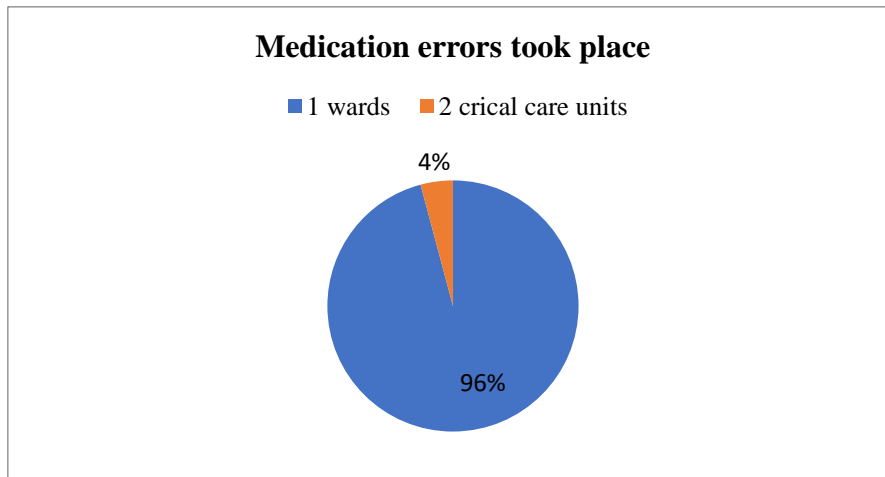
The total number of Medication Errors from January 2023 to January 2024 was 2,394. The total number of orders during the study period was 15,473. As depicted in Figure 1, 4.7% (178) of the patients who had Medication Errors belonged to the Pediatric population in the age group up to 18 years, 48.5% (1295) belonged to the age group between 19-64 years and 37.8% (1094) belonged to the age group 65 years and above.

Sl.no	Age group	Percentage of medication error (%)	N (Numbers)
1.	1-18 years	4.7%	178
2.	19-64	48.5%	1295
3.	Above 65 years	37.8%	1094



**Figure 1: Percentage of medication error based on age group**

Majority of the Medication errors about 96.8% (2131) took place in the Wards, while 4.2% (198) of the Medication Errors occurred in the Critical Care units as depicted in Figure 2.



**Figure 2: Medication errors took place**

As depicted in Figure 3, the Doctors contributed to the maximum percentage of Medication Errors 67.8%, the Pharmacists contributed to 14.04% of the Medication Errors while Nurses contributed to only 19.16% of the Medication Errors

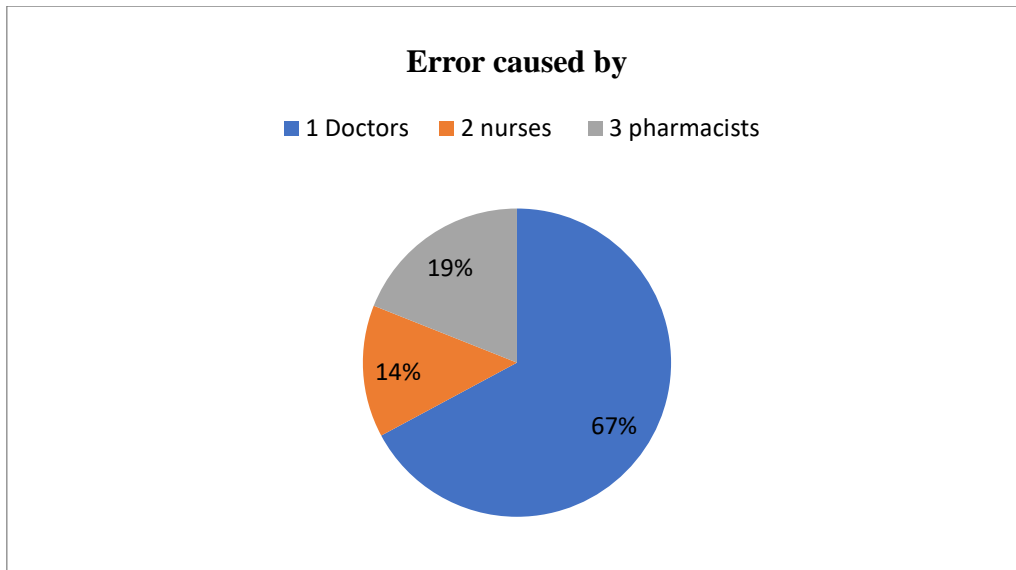


Figure 3: Error caused by

As depicted in Figure 4, 67.6% of the Medication errors were Category A, 42.3% of the Medication errors were B errors, 22.3% were Category C errors, while only 2.2% of the Medication errors were Category D. No medication errors above Category D were reported.

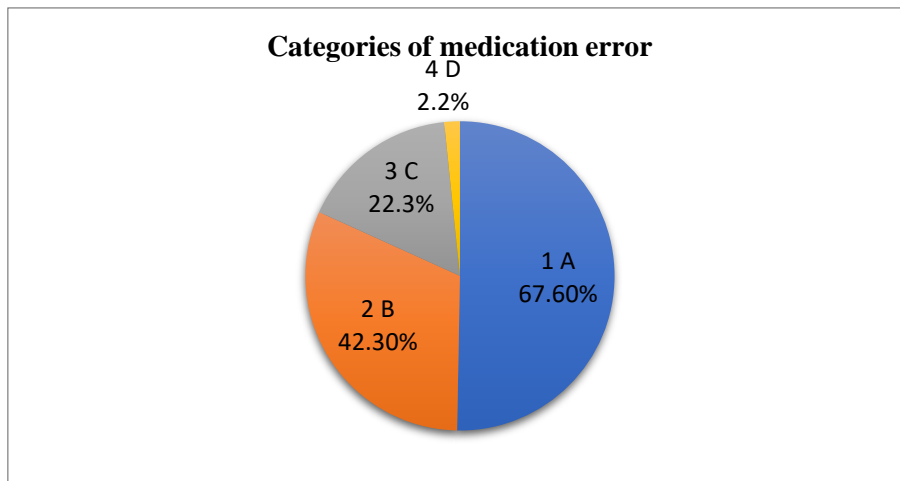


Figure 4: Categories of medication error

Medication Errors Involving different stages in medication handling and usage have been depicted in Table 1. Majority 67.8% errors were a prescription errors, transcription errors 47.3%, followed by 19.1% errors were a administration errors, 14.0% were dispensing errors.

Sl. No	Different stages of medication error	Percentage (%)
1.	Prescription errors	67.8%
2.	Transcription errors	47.3%
3.	Administration errors	19.1%
4.	Dispensing errors	14.0%

Table 1: Different stages of medication error

The major reasons for Medication Errors were errors due to use of unapproved abbreviations 66.2% (1033), Dose related error which includes wrong doses 50.43% (1014), followed by wrong medication due errors in dosage units names which constituted 17.46% (367)of the medication errors, problems with wrong route for medication administration constituted 15.73% (176)of the medication errors, errors with frequency of administration constituted 12.53% (133) of the medication errors, drug duplication constituted 2.47% (34)of the medication errors, 18.8% (149)of medication error is due to non-usage if capital letters, 5.6% (178) due to dispensing of near expiry drugs, 9.2% (169) error due to no labeling of cut strips medications during dispensing,

6.1% (159) error due to delay in dispense, 1.7% (19) is due to dispensing of expired medications, 8.3% (239) error due to no documentation of drug administration, 9.1% (251) error is due to documentation without drug administration, 11.7% (297) error due to incomplete/improper documentation by nursing staff, 2.1% (19) error is due to administration of drug in wrong time. As depicted in Table 2.

Sl. no	Reason for medication error	Percentage (%)	N (numbers)
<b>Prescription errors</b>			
1.	Unapproved drug administration	66.2%	10320
2.	dose	50.43%	7803
3.	Dosage units	17.46%	2701
4.	Route of administration	15.73%	2426
5.	frequency	12.53%	1939
6.	Drug duplication	2.47%	382
7.	Non usage of capital letters	18.8%	2909
<b>Dispensing error</b>			
8.	Near expiry drugs	5.6%	866
9.	No labeling of cut strip medication	9.2%	1423
10.	Delayed dispensing	6.1%	944
11.	Expired medications	1.7%	263
<b>Administration error</b>			
12.	Wrong time	2.1%	325
13.	No documentation of drug administration	8.3%	1284
14.	Documentation without drug administration	9.1%	1408
15.	Incomplete/Improper documentation	11.7%	1810

Table 2: Reason for medication error

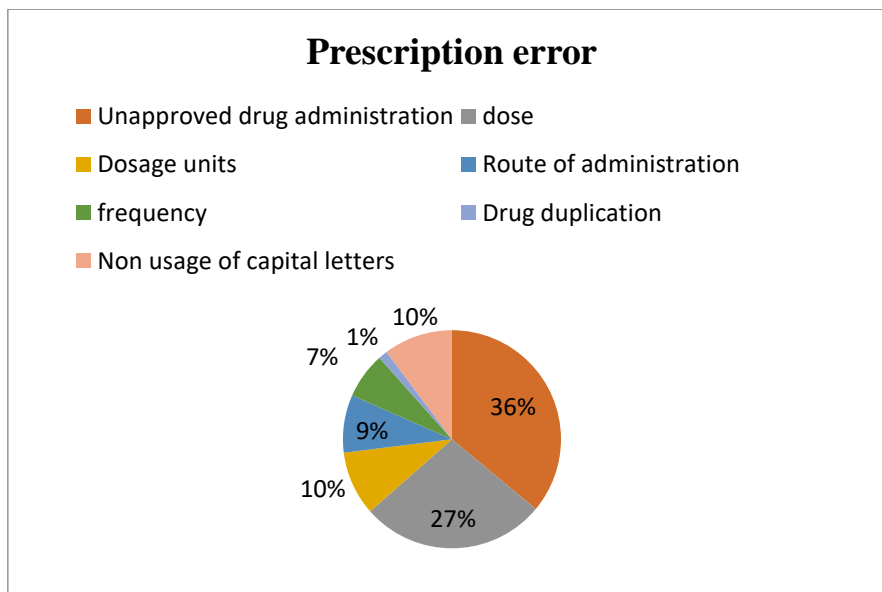


Figure 5: Prescription error

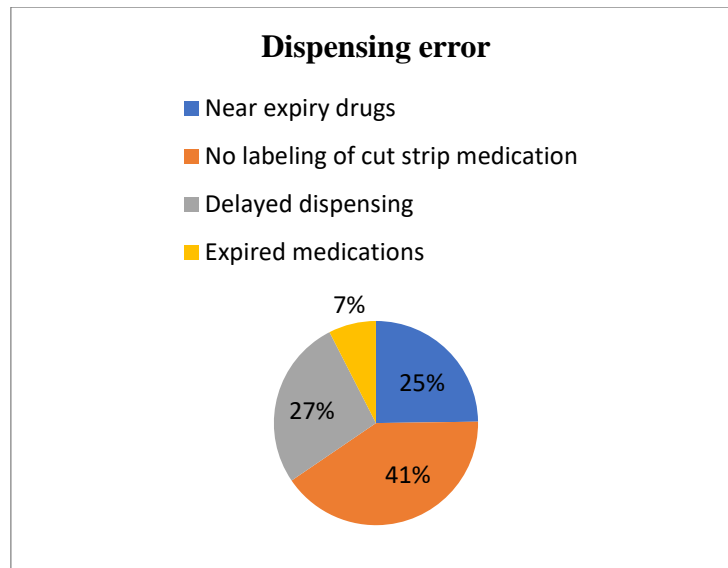


Figure 6: Dispensing error

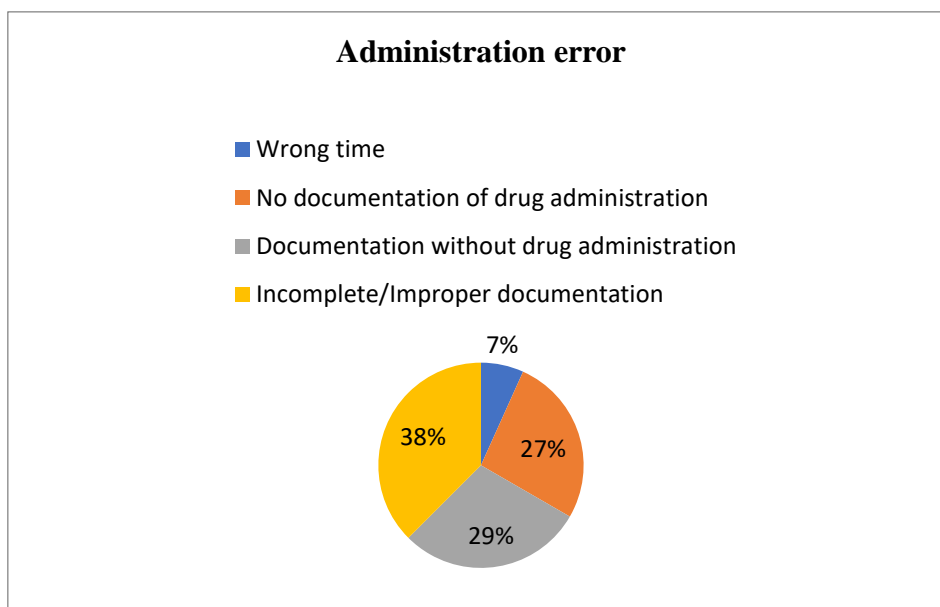


Figure 7: Administration error

## DISCUSSION

The study revealed that there were 5.27 medication errors per 100 orders, with no deaths reported. While the average number of errors was notable, the overall medication error rate observed in this study is considerably lower compared to most other Indian studies. This difference may be attributed to the well-structured processes in place at our hospital. More than half of the errors identified in our study were related to dosage, a rate higher than those reported by Kumar et al. (17.4%) and Agarwal et al. (45.5%). This discrepancy may be due to the hospital's status as a teaching institution, where medication orders are often made by students in training, potentially leading to a higher occurrence of dosage-related errors.

Our findings also indicated that most medication errors occurred among patients aged 19-64 years, consistent with the results of similar studies. In our study, the majority of errors fell under Category A (67.6%), followed by Category B (42.3%), and Category C (22.3%), with only 2.2% of errors classified as Category D. Category A errors, which represent potential errors that do not reach the patient, were the most frequently reported. This can be explained by the hospital's strong focus on medication safety, with a proactive approach to reporting even near-miss events. The hospital promotes a non-punitive environment aimed at process improvement rather than punishment, encouraging the reporting of all medication errors, including those that do not cause harm.

The organization has a comprehensive system for reporting and monitoring medication errors, and actively engages in awareness-raising initiatives among staff to ensure safe medication practices. These efforts contribute to the hospital's effective medication management and safety protocols.

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## CONCLUSION

The study concluded that medication errors can still occur even in hospital settings with established medication safety policies. However, these errors can be prevented from reaching the patient through well-designed strategies and multiple layers of checks, following the "Swiss cheese" model, which focuses on enhancing the safety of medication handling and use. Since medication errors can happen at any stage of the medication process, the "Swiss cheese" model's multi-level checks are particularly justified.

Encouraging the reporting of Category B errors, which represent near misses, is essential. These near misses are often just the tip of the iceberg and have the potential to escalate into more serious medication errors that could reach and harm patients. The study recommends further detailed research into medication errors, including near misses, as these insights could highlight gaps in current processes and help identify effective interventions for improving safety procedures.

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