



## A retrospective observational study on impact of medication errors and its severity in a tertiary care teaching hospital in India

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### Abstract

To explore and estimate the frequency of medication error, a study conducted in a Ruby General Hospital, Kolkata. The medication error can be divided into Prescribing errors, Dispatching Error, Drug Administration Errors, and Indenting Errors. The purpose of this study is to determine the prevalence and nature of medication errors; to explore the causes and to study corrective actions for such medication error. Identify and evaluate the failures of medication errors and its severity analysis in a Ruby General Hospital, Kolkata and suggest solutions on reducing medication errors. It is a prospective study of patients receiving medication during treatment. The techniques that were used to identify the medication errors the study was carried out in a Tertiary Care 320 bedded Teaching hospital at Kolkata. Data taken from Medication Error reporting form and Photocopy of medicine card of patients. Proper monitoring and capturing of medication error data has been initiated. Staff has been counselled and sensitized regarding safe medication practices and proper reporting of medication errors. Regular training on medication error has been conducted by Clinical Pharmacy Department, which improve the knowledge of monitoring, capturing, reporting and prevention of medication errors by the physicians, nurses, and clinical pharmacist.

**Keywords:** Medication errors, Administration errors, Safety, Patients, Adverse drug reaction, Dispensing, Prescribing

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### Introduction

In the dynamic landscape of healthcare, the safe and effective administration of medications plays a pivotal role in patient care. Medication errors, defined as any preventable event that may cause or lead to inappropriate medication use or patient harm, pose a significant challenge to healthcare providers worldwide. Understanding the impact of these errors, along with their severity, is crucial for developing strategies to enhance patient safety and the quality of healthcare delivery. This retrospective observational study aims to investigate the prevalence, types, and severity of medication errors in a tertiary care hospital setting. Tertiary care hospitals, with their specialized medical services and complex patient cases, are particularly susceptible to medication errors due to the intricate nature of treatment regimens and the involvement of multiple healthcare professionals in patient care. The study will delve into the electronic health records (EHRs) and incident reports over a specified time period, providing a comprehensive analysis of medication errors within the chosen tertiary care hospital. The primary objectives are to identify the common types of medication errors, explore their root causes, and assess the severity of their impact on patient outcomes.

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By examining the various stages of medication use – from prescription and dispensing to administration – the study aims to highlight critical points in the medication process where errors are more likely to occur. Additionally, the severity of each error will be categorized to distinguish between minor incidents with negligible consequences and those that result in serious harm or complications for the patient. The findings of this study will not only contribute to the existing body of knowledge on medication safety but also serve as a foundation for developing targeted interventions and improvement initiatives. Identifying modifiable risk factors and implementing evidence-based strategies can help mitigate the occurrence of medication errors, ultimately enhancing patient safety and promoting a culture of continuous quality improvement within the healthcare system. As healthcare providers continually strive for excellence in patient care, understanding the landscape of medication errors and their impact is imperative. This study seeks to shed light on the challenges faced by healthcare professionals in a tertiary care setting, with the ultimate goal of fostering a safer and more effective medication management system.

### Aims and Objectives

Identify and evaluate the failures of medication errors and its severity analysis in a Tertiary Care Hospital in Kolkata and suggest solutions on reducing medication errors.

### Study criteria

The study was considering with some criteria. The following criterion was:

- Inclusion Criteria - Medication error case sheet of patients admitted to the hospital.
- Exclusion criteria- OPD patient were not included for this research and dialysis patients were omitted for this research.

### Methodology

#### 1. Study Design

It is a prospective study of patients receiving medication during treatment. The techniques that were used to identify the medication errors are listed below:

- Direct Observation
- Daily review of medicine card by clinical Pharmacist.
- Daily audit of prescription.
- Medication administration record

#### 2. Source of Data

The study was carried out in a Tertiary Care 320 bedded Teaching hospital at Kolkata, West Bengal, India.

#### 3. Study Material

Medication Error reporting form Photocopy of medicine card of patients

### 4. Medication Error Categorization based on harm scoring

The medication errors were then classified by type: Prescribing, dispatching, drug administration and indenting. As per the declaration of National Coordinating Council, the medication errors were categorized as per the importance of the errors.

**Table 1:** Categorization of Medication Error based on the harm score [54]

<b>No error</b>	<b>No Harm</b>
Category A	Circumstances or events have the capacity to cause error.
<b>ERROR</b>	<b>No Harm</b>
Category B	Error occurred but it did not reach patient
Category C	Error occurred that reached the patient, but did not cause harm (includes errors of omission)
Category D	Error occurred that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to prevent harm.
<b>Error</b>	<b>Harm</b>
Category E	Error occurred that may have contributed to, or resulted in, temporary harm to the patient and required intervention.
Category F	Error occurred that may have contributed to, or resulted in, temporary harm to the patient and required initial or prolonged hospitalization.
Category G	Error occurred that may have contributed to, or resulted in, permanent harm to patient
Category H	Error occurred that required intervention necessary to sustain life.
<b>Error</b>	<b>Death</b>
Category I	Error occurred that may have contributed to, or resulted in, patient death.

### 5. Study procedure

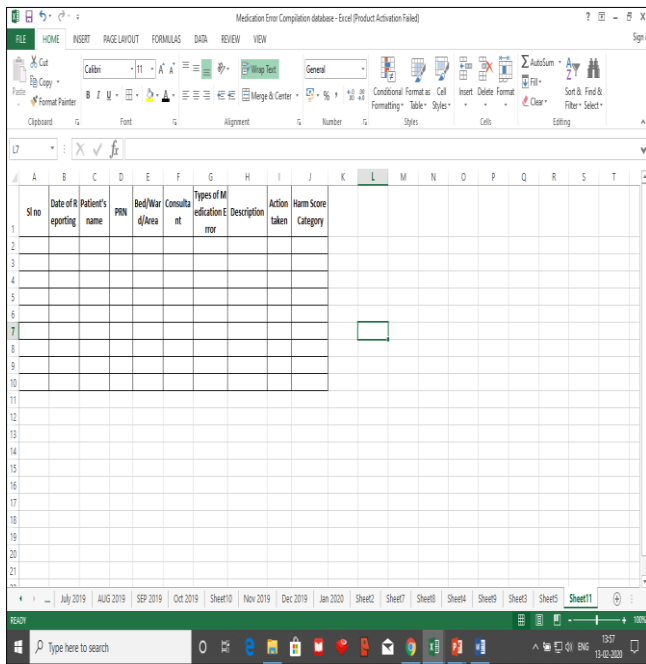
The medication errors were analyzed through a prospective observational study conducted over a period of nearly one year in Tertiary Care Hospital of Kolkata, India. The data for the present study was collected from medication error form, reported, and updated daily by the authorized people's mainly clinical pharmacists. The clinical pharmacists are well trained in types of medication error and the process of reporting it.

### 6. Analytical Methods

A prospective cohort study was conducted by using the direct observational method. Errors were expressed as actual numbers or in percentages. Data were structured in qualitative form. So, continuing with the descriptive analysis with help of median to find the number of differences in error rates between last one year's errors<sup>2</sup>. All statistical analysis was carried out using Microsoft Excel.

**7. Data Collection**

Data were collected in Data collection form/ Case reporting form (Medication error form) and raw data were transferred to electronic database for further detail analysis.



**Fig 1:** Electronic database template.

**Results**

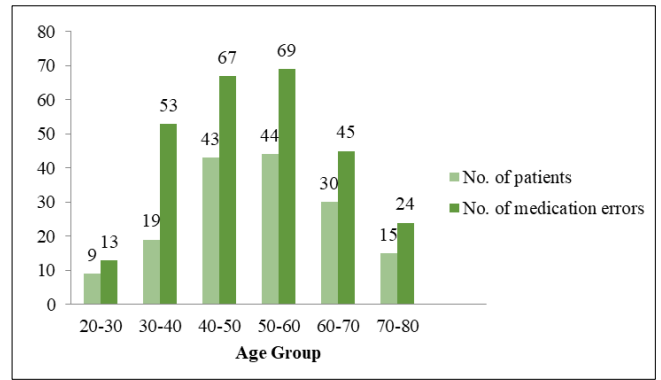
During the study period, total 600 patients were reviewed in all wards in super multi-specialty hospital. Out of 600 patients, 160 patients were identified with medication errors. Among them 271 medication errors were identified in 160 patients. Based upon data collected from 160 patients 97 (60.62%) patients were male and 39 (24.37%) patients were female. In the study most of the errors occurred at the age group of 50-60 (25.46%), 40-50 (24.72%).

**1. Age distribution of patients with medication errors:**

160 patients with medication error were distributed according to their age and also number of errors in that particular age group was distributed. Highest number of medication errors was found in 50-60 age group patients and 44 (27.50%) patients belong to this age group with 69 (25.46%) errors then followed by 40-50 age group patients and 43 (26.87%) patients belongs to this age group with 67 (24.72%) errors. The results are shown in below table 1 and fig 1.

**Table 1:** Distribution of patients with medication errors according to age group.

Sl.No.	Age group	No. of patients (%)	No. of medication errors (%)
1	20-30	9 (5)	13 (3.69)
2	30-40	19 (11.87)	53 (7.01)
3	40-50	43 (26.87)	67 (24.72)
4	50-60	44 (27.50)	69 (25.46)
5	60-70	30 (18.75)	45 (16.60)
6	70-80	15 (9.37)	24 (8.85)



**Fig 2:** Age group distribution.

**2. Number of medication errors in each patient**

More than one error in each patient was also found. Patients with any one error out of all types of error i.e. it may be prescription error, transcription error, dispensing error, administration error were considered as one error and were also one error which leads to another error was assessed as two errors and all types of errors contribute to the patient who's having with three, four errors.

Out of 160 patients, patients with one error were found to be 123 (76.87%), followed by patients with two errors 30 (18.75%) and patients with three errors 5 (3.12%), four errors 2 (1.25%) were very less compared with the patients with two errors.

A total 9152 medication doses were observed in 160 patients and number of errors in doses was found to be 381.

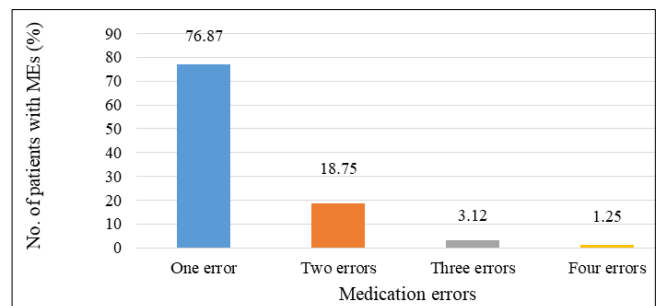
The frequency of medication errors was identified by using the following formula: [37]

$$\text{Frequency of ME} = \frac{\text{No. of errors in doses}}{\text{Total no. of doses in patients with Medication errors}} \times 100$$

**The error frequency rate was found in our study as: 381/9152x100 = 4.16**

**Table 3:** Details of number of errors in each patient.

Sl.No.	Medication errors	No. of patients with errors (n=160)	Percentage (%)
1	One error	123	76.87
2	Two errors	30	18.75
3	Three errors	5	3.12
4	Four errors	2	1.25



**Fig 3:** Medication errors in each patient.

### 3. Distribution of medication errors

Total number of medication errors was found to be 271 and all these errors were assessed and classified according to types of errors.

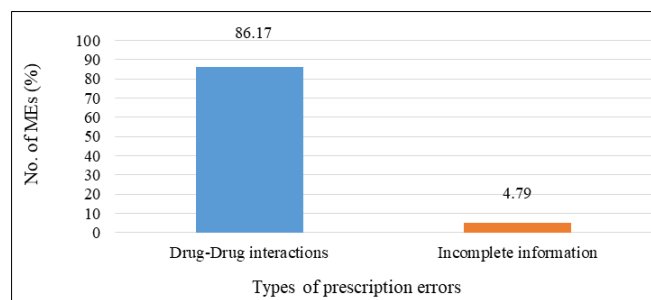
Administration error were noted 136 (50.18%) making it the top most medication errors and followed by prescription error 94 (34.68%) transcription error 19 (7.01%), dispensing error 22 (8.11%).

**Table 4:** Details of prescription errors.

Sl.No.	Types of prescription error	No. of errors (n=94)	Percentage (%)
1	Drug-Drug interaction	81	86.17
2	Incomplete information	13	4.79

Drug-Drug interaction was found to be 81 (86.17%) which contributes the highest and followed by incomplete information 13 (4.79%).

A 69 years old male patient was admitted to the hospital for coronary artery bypass surgery. Patient’s medication administration chart was reviewed for medication errors and found medication administration chart with these drugs aspirin and ketorolac, atorvastatin and amiodarone on the same day and assessed as drug-drug interactions which has to modify the drug therapy and also to avoid the combinations.



**Fig 4:** Prescription errors.

### 4. Distribution of transcription errors to their subtypes

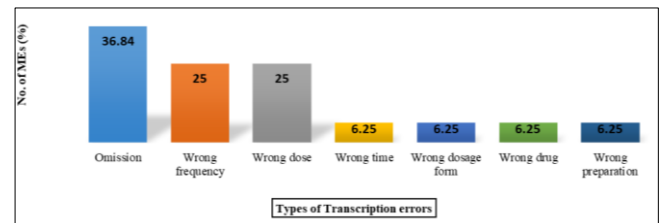
Out of 271 medication error, transcription errors were found to be 19 and these prescription errors were assessed and classified into wrong dose, wrong time, wrong dosage form, wrong preparation, wrong frequency, and wrong drug.

Out of 16 transcription errors, omission error contributes the highest transcription errors 7 (36.84%), followed by wrong frequency and wrong dose 4 (25%), wrong drug, wrong dosage form, and wrong preparation, wrong time 1 (6.25%) were found same.

A 74 years old male patient was admitted to the hospital and detected with space occupying lesion right liver. And doctors diagnosed as multifocal hepatocellular carcinoma and prescribed Tab. Udiliv 300mg TID in physician notes. After reviewing the patient case sheet, it found that nurse haven’t transcribed the drugs into medication administration record and drug was not been administered since from two days.

**Table 5:** Details of transcription errors.

Sl.No.	Type of transcription errors	No. of errors (n=19)	Percentage (%)
1	Omission	7	36.84
2	Wrong frequency	4	25
3	Wrong dose	4	25
4	Wrong time	1	6.25
5	Wrong dosage form	1	6.25
6	Wrong preparation	1	6.25
7	Wrong drug	1	6.25



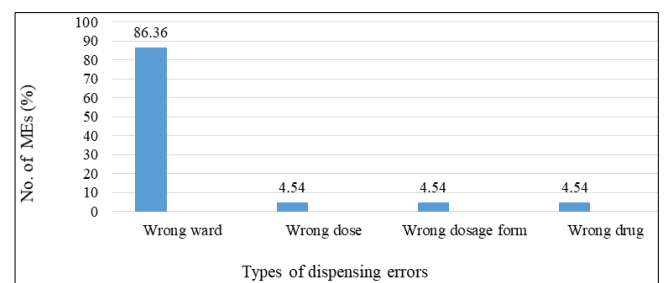
**Fig 5:** Transcription errors.

### 5. Distribution of dispensing errors to their subtypes

Out of 271 medication error, dispensing errors were found to be 22 and these dispensing errors were assessed and classified into wrong dose, wrong ward, wrong dosage form, wrong drug.

**Table 6:** Details of dispensing errors.

Sl.No.	Types of dispensing errors	No. of errors (n=22)	Percentage (%)
1	Wrong ward	19	86.36
2	Wrong dose	1	4.54
3	Wrong dosage form	1	4.54
4	Wrong drug	1	4.54



**Fig 6:** Dispensing errors.

Out of 22 dispensing errors, wrong ward were noted 19 (86.36%) making it the top most medication dispensing error followed by wrong dose 1 (4.54%), wrong dosage form 1 (4.54%), and wrong drug 1 (4.54%).

A 52 years old male patient was admitted to the hospital he is known case of chronic kidney disease stage 5 on maintenance hem dialysis. For dressing nurses indent powder. MgSo4 but pharmacist dispensed injection MgSo4.

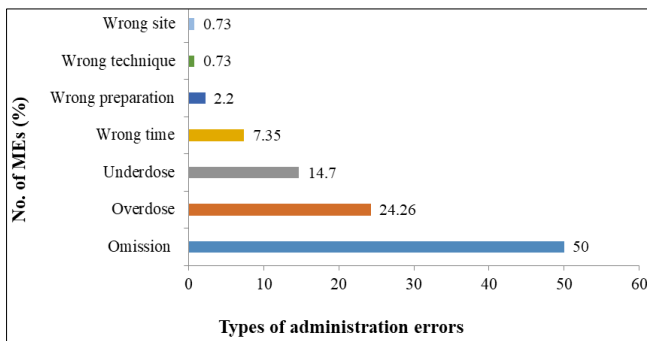


**6. Distribution of administration errors into their subtype**

Out of 271 medication error, administration errors were found to be 136 and administration these errors were assessed and classified into omission, overdose, under dose, wrong preparation, wrong time, wrong technique, and wrong site.

**Table 7:** Details of administration errors.

S.No.	Types of medication administration errors	No. of errors (n=136)	Percentage (%)
1	Omission error	68	50
2	Overdose	33	24.26
3	Under dose	20	14.70
4	Wrong time	10	7.35
5	Wrong preparation	3	2.20
6	Wrong technique	1	0.73
7	Wrong site	1	0.73



**Fig 7:** Administration errors.

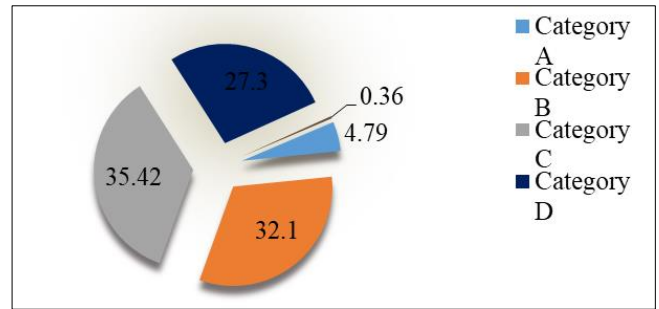
Out of 129 medication administration errors omission errors found to be more than half of medication administration errors 68 (50%), followed by overdose 33 (24.26%) under dose 20 (14.70%), wrong time 10 (7.35%), wrong preparation and 3 (2.32%), wrong technique and wrong time 1 (0.73%). E.g. A 39 yrs. old male patient admitted to the hospital with chief complaints of decreased frequency of urine output since from 10 days and diagnosed as acute renal failure. Doctor prescribed injection vancomycin 1.5 gm once daily at 2 pm but nurse failed to administer 1.5 gm and instead of 1.5 gm, 500 mg vancomycin has been given. This leads to under dose after knowing that still 1000 mg has to give to make 1.5 gm nurse administer that leftover 1000 mg on the next day morning which leads to over dose for that day.

**7. NCCMERP categorization of medication errors**

Patients were reviewed on daily basis for medication error then the medication error were analysed by using NCCMERP taxonomy and categorized into following.

**Table 8:** Details of NCCMERP categorization of medication errors.

S.No.	Category	No. of errors (n=271)	Percentage (%)
1	A	13	4.79
2	B	87	32.10
3	C	96	35.42
4	D	74	27.30
5	E	1	0.36



**Fig 8:** NCCMERP categorization

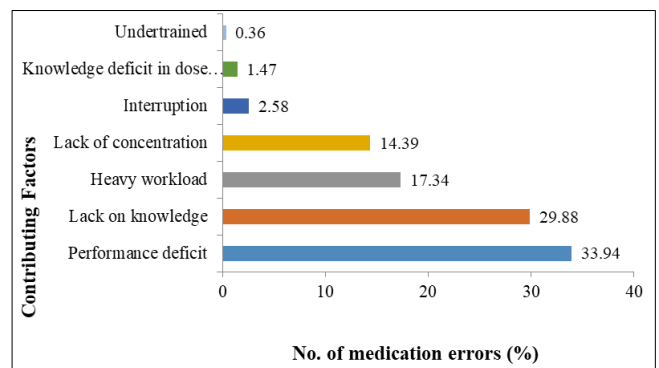
Total 271 errors were found and most of the errors belongs to Category C 96 (35.42%) followed by Category B 87 (32.10%), Category D 74 (27.30%), Category A 13 (4.79%), Category E 1 (0.36%).

**8. Contributing or risk factors for medication errors**

After multidisciplinary reviews of medication errors, which help to identify underlying causes or factors that may have contributed to the event were assessed into Performance deficit, Lack of information /knowledge, Heavy work load, Lack of concentration, Interruption, Knowledge deficit in dose calculation, Undertrained.

**Table 9:** Details of contributing/risk Factors for medication errors.

S.No.	Risk factors	No. of errors (n=271)	Percentage (%)
1	Performance deficit	92	33.94
2	Lack of information /knowledge	81	29.88
3	Heavy work load	47	17.34
4	Lack of concentration	39	14.39
5	Interruption	7	2.58
6	Knowledge deficit in dose calculation	4	1.47
7	Undertrained	1	0.36



**Fig 9:** Contributing/risk Factors

Out of all risk factors, performance deficit 92 (33.94%) contribute the highest which lead to medication errors followed by lack of knowledge 81 (29.88%), heavy workload 47 (17.34%), lack of concentration 39 (14.39%), interruption 7 (2.58%), knowledge deficit in dose calculation 4 (1.47%), undertrained 1 (0.36%).

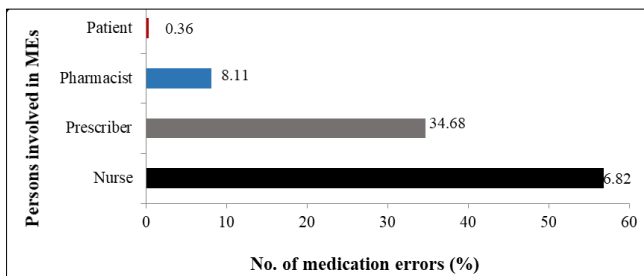
**Personnel involved in medication errors**

Medication errors may occur at any stage i.e. while prescribing, dispensing, administering the drugs and persons involved in this process have been identified and assessed.

**Table 10:** Details of personnel involved in medication errors.

S.No.	Personnel Involved	No. of errors (n=271)	Percentage (%)
1	Prescriber	94	34.68
2	Pharmacist	22	8.11
3	Nurse	154	56.82
4	Patient	1	0.36

In most of the medication errors nurses were involved 154 (56.82%) followed by prescriber 94 (34.68%), pharmacist (8.11%), patient (0.36%).



**Fig 10:** Personnel involved in medication errors

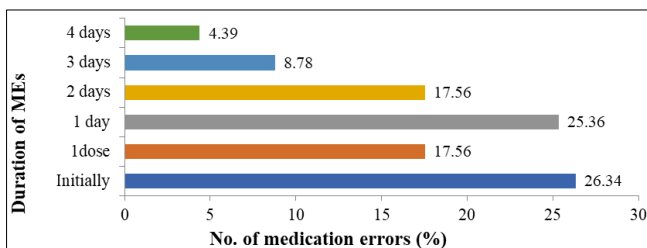
**Distribution of medication class involved in medication error**

**Duration of medication errors**

Duration of medication errors indicates that at what stage medication errors has been identified and stopped and also to prevent the further errors which may occur due to the previous errors that occurred.

**Table 11:** Details of duration of medication errors.

S.No.	Duration	No. of errors (n=205)	Percentage (%)
1	Initially	54	26.34
2	1 dose	36	17.56
3	1 day	52	25.36
4	2 days	36	17.56
5	3 days	18	8.78
6	4 days	9	4.39



**Fig 11:** Duration of medication errors.

Out of 271 medication errors ,most of the errors were identified and stopped initially 54 (26.34%), then followed by 1 day 52 (25.36%), 1 dose 36 (17.56%), then errors

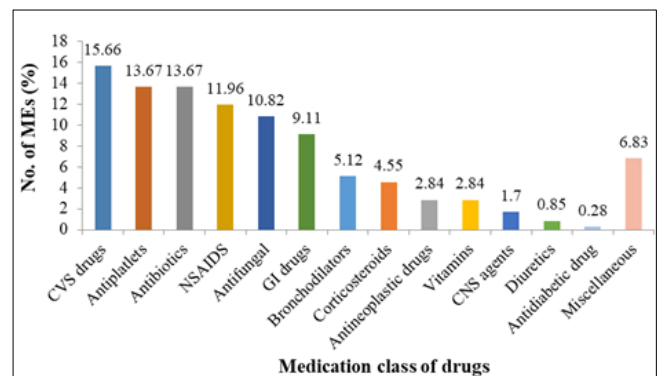
continued for 2 days 36 (17.56%), 3 days 18 (8.7%), 4 days 9 (4.39%).

**Distribution of medication class involved in medication error**

In 271 medication errors many drugs are involved. These drugs have been classified into their therapeutic class after assessing they were found to be CVS drugs, Antiplatelets, Antibiotics, Anti-inflammatory drugs, Antifungal, GI drugs, Bronchodilators, Corticosteroids, Antineoplastic, Vitamins, CNS agents, Diuretics, Antidiabetic, Miscellaneous drugs.

**Table 12:** Details of distribution of medication class (es) involved in medication errors

S.No.	Class of drugs	No. of errors (n= 351)	Percentage (%)
1	CVS drugs	55	15.66
2	Antiplatelets	48	13.67
3	Antibiotics	48	13.67
4	Anti-inflammatory drugs	42	11.96
5	Antifungal	38	10.82
6	GI drugs	32	9.11
7	Bronchodilators	18	5.12
8	Corticosteroids	16	4.55
9	Antineoplastic	10	2.84
10	Vitamins	10	2.84
11	CNS agents	6	1.70
12	Diuretics	3	0.85
13	Antidiabetic	1	0.28
14	Miscellaneous	24	6.83



**Fig 12:** Medication class (es) involved in medication errors.

The study of involvement of a particular medication class to the medication errors showed that the CVS drugs 55 (15.66%) contributing maximum, which was followed by Antiplatelets 48 (13.67%), Antibiotics 48 (13.67%).

**Generic vs. brand**

All the drugs involved in medication errors were distributed into brand and generic names.

**Table 13:** Details of Generic Vs Brand

S.No.	Names	No. of errors (n=351)	Percentage (%)
1	Generic	22	6.26
2	Brand	329	93.73

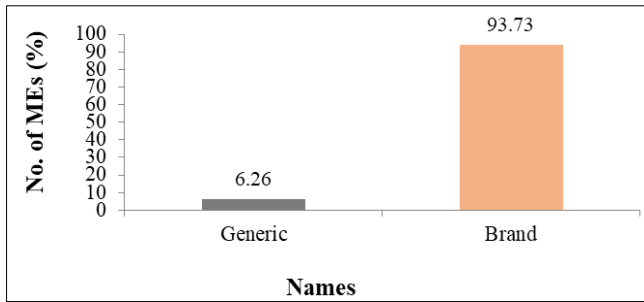


Fig 13: Generic Vs Brand

Most of the drugs in medication errors were with brand names 329 (93.73%), and generic 22(6.26%).

**Types of dosage forms involved in medication errors**

Out of 271 medication errors many drugs dosage forms were involved.

**Table 14:** Details of type of dosage forms involved in medication errors.

S.No.	Dosage Form	No. of errors (N=351)	Percentage (%)
1	Oral	189	53.84
2	Parenteral	144	41.02
3	Inhaled	9	2.56
4	Topical	9	2.56

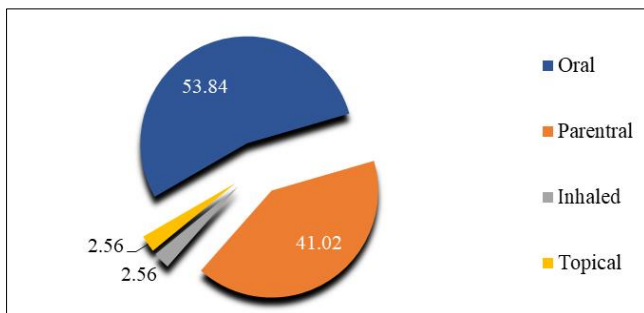


Fig 14: Type of dosage forms involved in medication errors

The dosage forms which were involved in most medication errors include oral drugs 189 (53.84%), and inject able drugs 144 (41.02%) followed by inhaled drugs 9 (2.56%), topical 9 (2.56%).

**Conclusion**

This study had presented a pattern of findings of medication errors. Most of the medication errors were at administration phase (50.18%) where omission errors were maximum of all Administration errors followed by Prescription errors (34.68%), Dispensing errors (8.11%), Transcription errors (7.01%). Severity of each error were assessed by using NCCMERP taxonomy and categorized them into either one of the categories (A,B,C,D,E,F,G,H and I) most of the errors belongs to Category C (35.42%), followed by Category B (32.10%), Category D (27.20%), Category A (4.79%), Category E (0.36%). Contributing factors which lead to medication errors has to identify which is important to prevent the medication errors. Performance deficit found to be the highest contributing factor among all to lead medication errors. Every health care system should encourage medication errors reporting and prevention so as to increase patient quality of life. The role of a clinical

pharmacist in this situation appears to be a strong intervention; the clinical pharmacist initially could only confine to identification of the medication errors. Proper monitoring and capturing of medication error data has been initiated. Staff has been counselled and sensitized regarding safe medication practices and proper reporting of medication errors. From last few months the rate of error show decline trend compared to previous months. Regular training on medication error has been conducted by Clinical Pharmacy Department, which improve the knowledge of monitoring, capturing, reporting and prevention of medication errors by the physicians, nurses and clinical pharmacist.

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