International Journal of Health Sciences and Research
Vol.13; Issue: 5; May 2023
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

A Retrospective Observational Study on Impact of Medication Errors and Its Severity in a Tertiary Care Teaching Hospital in India

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DOI: https://doi.org/10.52403/ijhsr.20230516

ABSTRACT

To explore and estimate the frequency of medication error, a study conducted in a tertiary care teaching hospital of East India. 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. Identifying and evaluating the failures of medication errors and its severity analysis in a Tertiary care teaching hospital, Kolkata and suggesting 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 was taken from Medication Error reporting form and 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, Medication Safety, Adverse drug reaction, Dispensing Error, Prescription Error

INTRODUCTION

A medicine is a product that combines a drug with excipients or additives that has been shown to have therapeutic or biological effects. Drugs are active substances with therapeutic effects.[1,2]

A medication error is any avoidable incident that may result in improper pharmaceutical usage or patient injury. Common causes of drug mistakes include inadequate patient education, inaccurate diagnosis, improper prescription, dosage calculation problems, and inappropriate administration. Other factors, such as stress from the workplace or inadequate training, may also have an influence on drug errors.[3,4]

It is crucial to recognize and address pharmaceutical errors where they may result in therapeutic failure or serious patient harm. Medication errors can be prevented

by increasing the rationality of medication prescriptions. It is also possible to prevent drug administration errors by giving patients the right patient counselling and distributing medications in the right dose and dosage form.[5,6]

A prescriber's sensitivity to error can be due in part to the underlying variables that make them more likely to make mistakes, slip up, or lapse. Depression, tiredness, and a lack of focus on the job are all consequences of having employees work overtime outside of normal business hours. When doctors initially start working at hospitals, they often make mistakes due to their lack of experience and unfamiliarity with the local prescription charts. The likelihood of mistakes should decrease as a result of enhanced training and working conditions, including more effective induction procedures.[7]

"A failure in the treatment process that results in harm to the patient, or has the potential to lead to it," is how the term "medication error" is defined. Failure is a term used to describe a process that has not met an acceptable standard. The term "treatment process" refers to any action taken to address symptoms, their underlying causes, or to diagnose, treat, or prevent a disease or physiological condition.[8]

Together with therapeutic drugs, it also includes the aforementioned substances. A drug's production or compounding, prescription, transcription (if necessary), distribution, administration, and following effects monitoring are all included in this process. In the description, the word "harm" also suggests "lack of benefit," which is a form of therapy failure. It is not specified who commits the error—it could be a doctor, nurse, chemist, caretaker, or someone else—nor who is in charge of preventing errors.[9,10]

Drug mistakes have been defined in a variety of ways, as should be the case with all technical definitions. In this instance, it was done by creating situations and figuring out which ones would qualify as errors under each category. The sole definition that categorized all mistake circumstances and only error scenarios was the description above, slightly changed.[11,12]

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 retrospective 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 and 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.

NO ERROR	NO HARM
Category A	Circumstances or events have the capacity to cause error.
ERROR	NO HARM
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.
ERROR	HARM
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.
ERROR	DEATH
Category I	Error occurred that may have contributed to, or resulted in, patient death.

Table 1: Categorization of Medication Error based on the harm score

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. All statistical analysis was carried out using Microsoft Excel.

7. Data Collection:

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

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%).

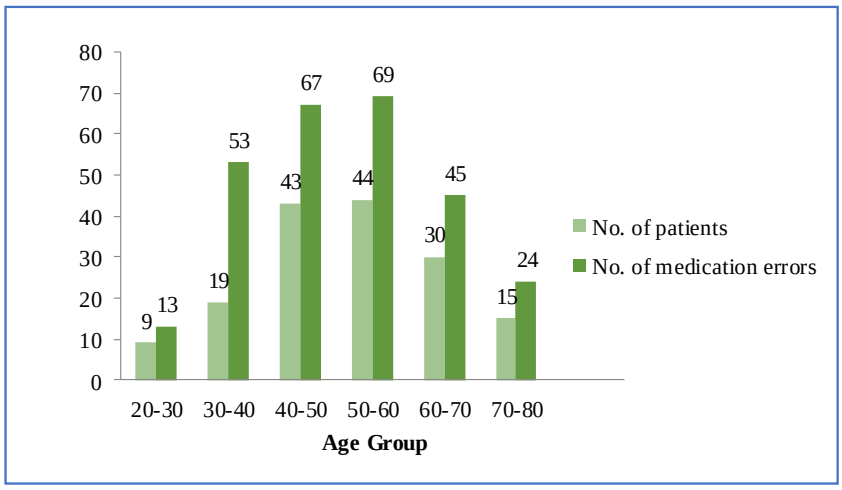
1. Age distribution of patients with medication errors:

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 1.: 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:

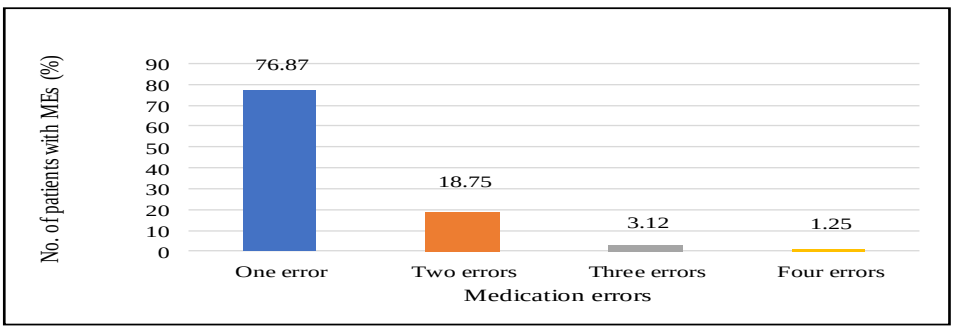
$$\text{Frequency of ME} = \frac{\text{No. of errors identified}}{\text{Total no. of opportunities}} \times 100$$

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

Table 2: 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 2: 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 3: 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%). Some major instances are explained below.

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.

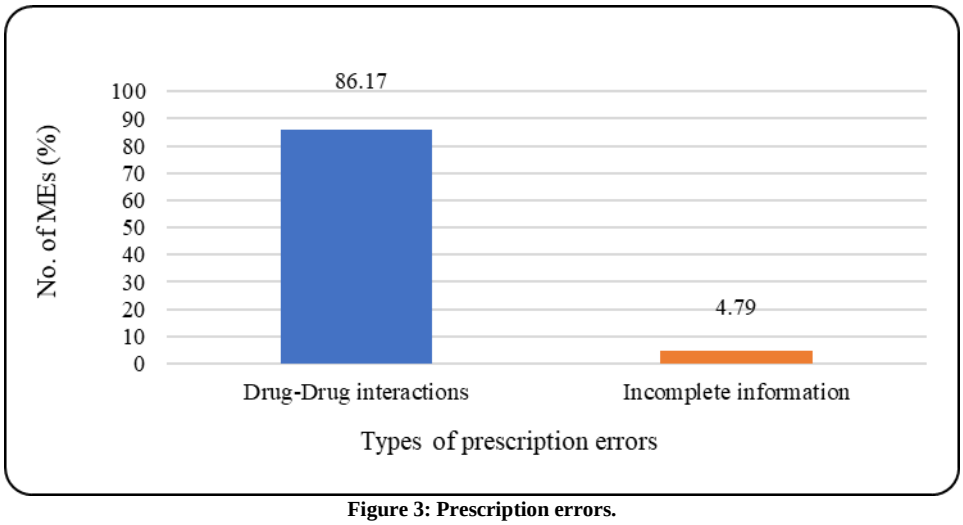


Figure 3: Prescription errors.

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.

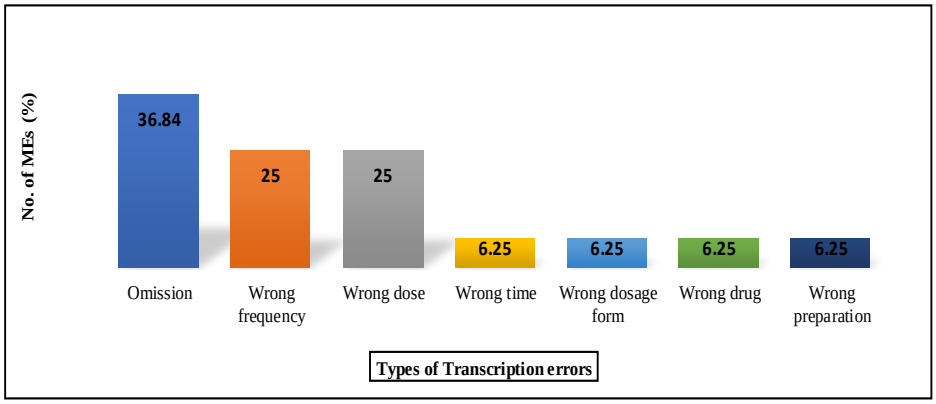
Out of 16 transcription errors, omission error contributes the highest transcription errors 7 (36.84%), followed by wrong frequency and wrong dose 4 (25%), wrong drug, wrong dosage form, and wrong preparation, wrong time 1 (6.25%) were found same. Some major instances are elaborated below.

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 4: 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

Figure 4: 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 5: 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

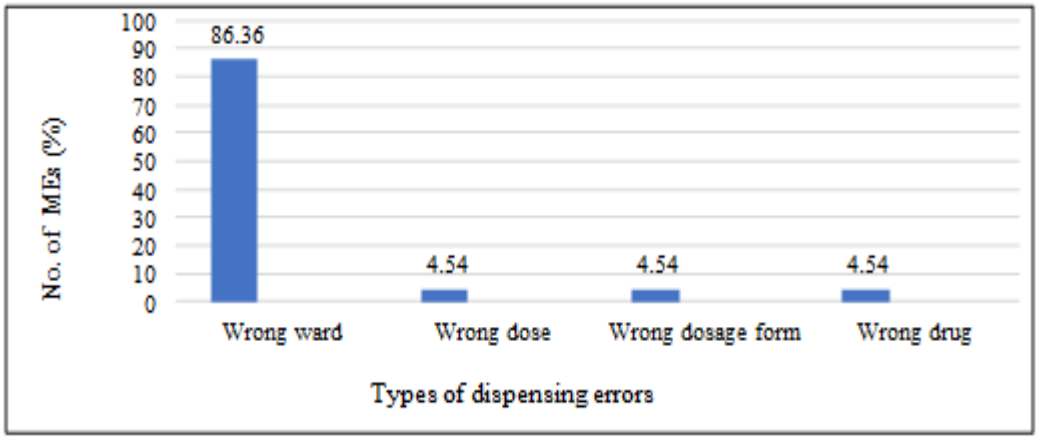


Figure 5: Dispensing errors.

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 major instance is elaborated below.

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 6: 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

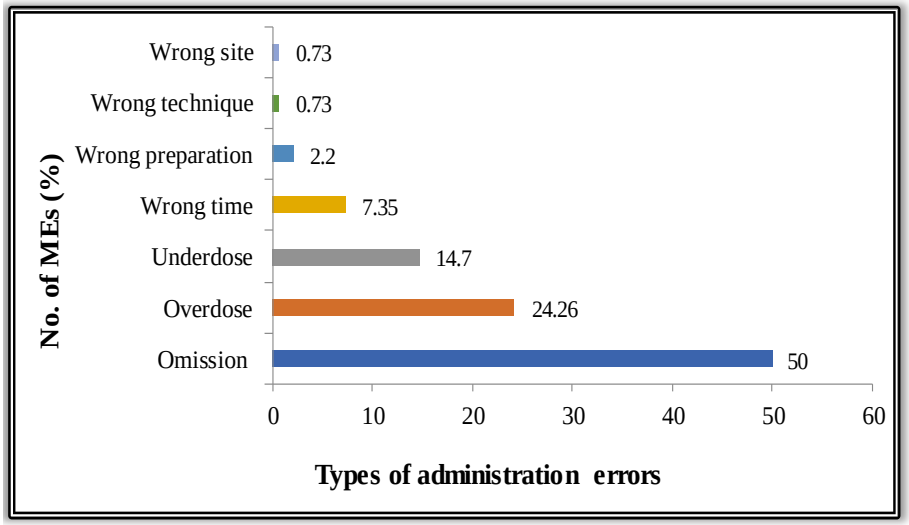


Figure 6: Administration errors.

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 time10 (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.

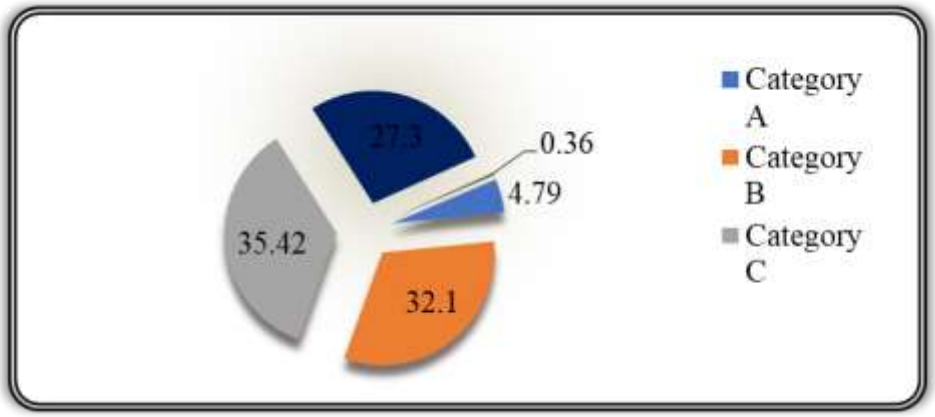
7. NCCMERP categorization of medication errors

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

Table 7: 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

Figure 7: 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%).

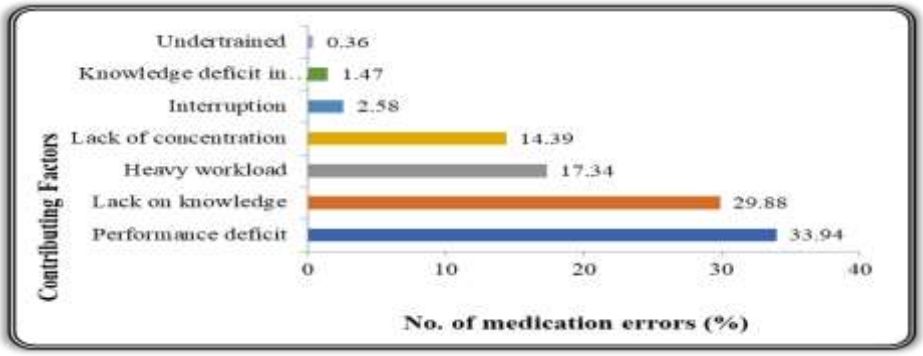
8. Contributing or risk factors for medication errors

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

Table 8: 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

Figure 8: 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, administrating the drugs and persons involved in this process have been identified and assessed.

Table 9: 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%).

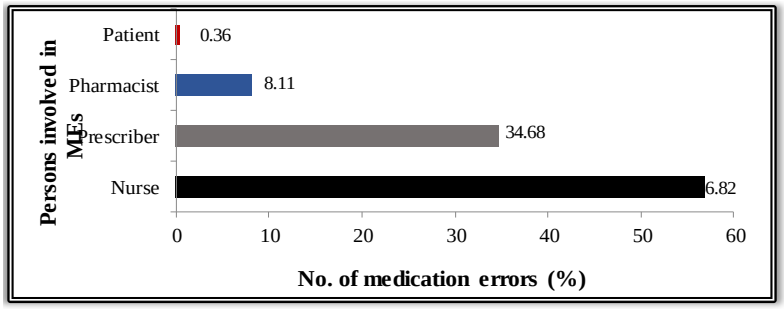


Figure 9: Personnel involved in medication errors

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 10: 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

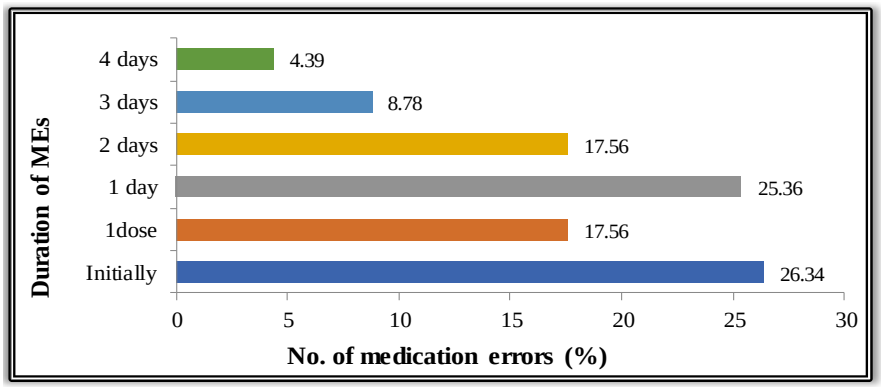


Figure 10: Duration of medication errors.

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, Antiplatlets, Antibiotics, Anti-inflammatory drugs, Antifungal, GI drugs, Bronchodilators, Corticosteroids, Antineoplastic, Vitamins, CNS agents, Diuretics, Antidiabetic, Miscellaneous drugs.

Table 11: 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	Antiplatlets	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

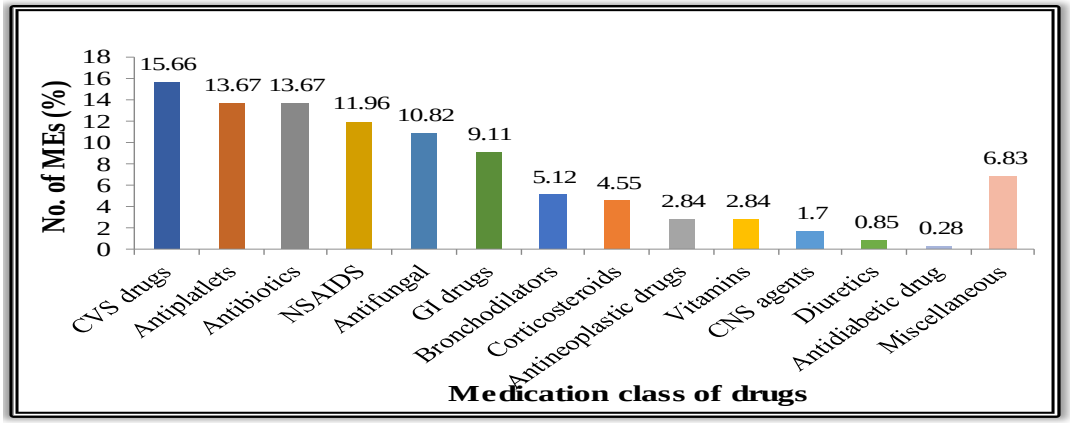


Figure11: Medication class (es) involved in medication errors.

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%).

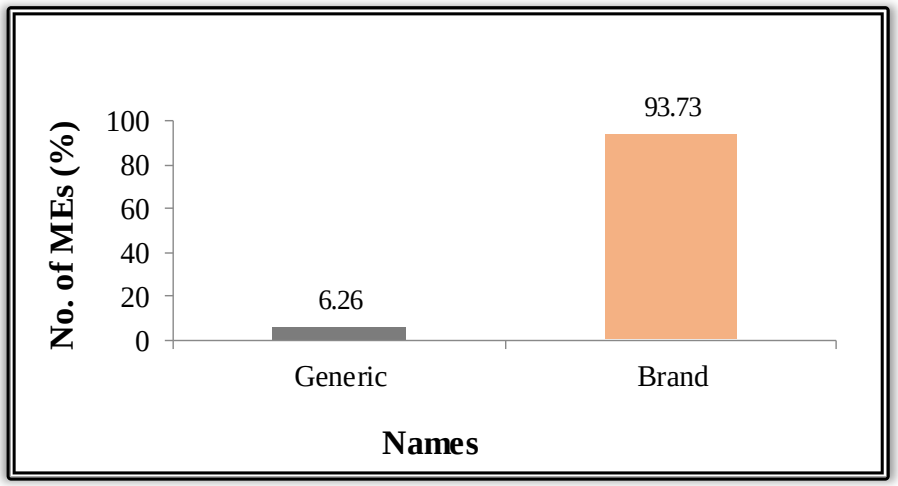
Generic vs. brand

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

Table 12: Details of Generic Vs Brand

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

Figure 12: Generic Vs Brand



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

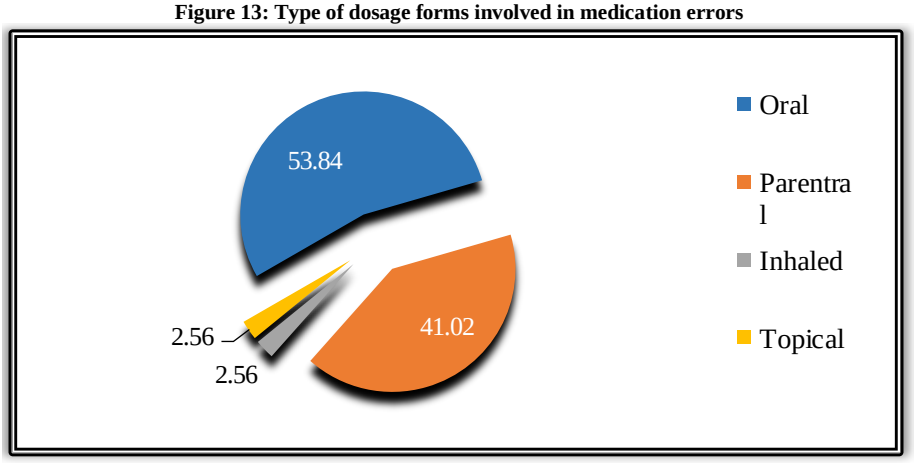
Types of dosage forms involved in medication errors

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

Table 13: 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

Figure 13: 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 drugs144 (41.02%) followed by inhaled drugs 9 (2.56%), topical 9 (2.56%).

DISCUSSION

The typical causes of pharmaceutical mistakes Vital patient information were missing (allergies, age, weight, pregnancy, etc.) Insufficient computer screening, outdated references, and other crucial drug-related data were absent. Medication order misunderstanding (illegible, incomplete, misheard, etc.) Issues with the medicine's name, label, and packaging (look-alikes, incorrect drug identification) Drug delivery device issues as well as distribution or storage issues with drugs (bad device design, intravenous injection of syringe contents, etc.) Workflow, personnel, and environmental factors (lighting, noise, workload, interruptions etc.) Inadequate patient education and staff training (Lack on

patient consultation, non-compliance) A lack of independent pharmacy or quality control methods A lack of medical comprehension (when a new medicine replaces one or more older ones, a combination drug may imply that a person takes it once a week rather than daily).[13,14]
The majority of errors and defects are preventable. The necessary authorities were given the proper information, guidance, and counselling as part of this research's rigorous examination of pharmaceutical errors. Medication errors were immediately corrected by analysing the issue and its underlying cause. Careful evaluation of the underlying issue was necessary for controlling the medication error. Knowing the level and type of mistake can assist to reduce the rate of medication error at that particular level, leading to an overall more positive outcome, since there are several degrees of pharmaceutical error, as has already been stated. Health institutions must focus on a number of aspects to accomplish with a low medication error rate. Education should be the main focus of the rehabilitation, and the patient's damage can be reduced by creating a safe and stimulating work environment. Interventions are designed to help with complexity reduction, training, and knowledge improvement.[15,16]

CONCLUSION

The results of present study revealed that the hydroalcoholic extract of leaves of cestrum nocturnum generally shown immune stimulatory effect on the humoral immune function and cell mediated immunity in Wistar rats. Further, Studies are required to gain more insights into the possible mechanism of action.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Abhijit Sasmal Pankaj Arora, Arpan Dutta Roy et.al. A retrospective observational study on impact of medication errors and its severity in a tertiary care teaching hospital in India. *Int J Health Sci Res.* 2023; 13(5):143-155.
DOI: *https://doi.org/10.52403/ijhsr.20230516*

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