Investigating the Factors Contributing to Medication Reconciliation Errors in an Indian Tertiary Care Teaching Hospital

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Abstract

Medication errors represent a critical challenge in healthcare, posing risks to patient safety and well-being. This article explores the diverse spectrum of medication errors, aiming to shed light on their complexities and implications for clinical practice. Pharmaceutical omission accounted for 43.51% of all pharmaceutical errors and occurred nearly three times as often as the second most common form of mistake. During the study period, Pharmacist has reported highest medication errors [648 (48.04%)] followed by nursing staff and Doctors [461 (34.17%)] and [240 (17.79%)] respectively. The majority of medication order errors happened during hospital admission (60.12%), which is twice as high as the error rate during the hospital stay (23.8%). Medication omission (43.51%), dosage mistakes (13.79%), and data entry errors (12.08%) were the three most common kinds of errors across all ward specialties. Medication errors pose significant challenges to patient safety and healthcare quality. By understanding the various types of medication errors, identifying their root causes, and implementing proactive prevention strategies, healthcare providers can mitigate risks and improve medication safety for all patients.

Introduction

Medication error reporting platforms are an internationally recognised and very promising method for healthcare practitioners to report significant pharmaceutical errors that happen in healthcare settings.

When medications are not provided correctly, whether they are prescribed individually or in combination for various ailments, medication errors may occur, potentially increasing the risk of a therapy. [1].

The two concepts coexist: toxicities, or possible damage to the patient, along with effectiveness, or the extent to which the medication aids the patient. Medical errors may be prevented by thoroughly assessing their use. If an activity does not produce the expected result or is unintended, it is considered an error in Leape's medicine.

Evidence from throughout the world shows that between 9 and 12 percent of people in observational studies make a mistake with their medication [2].

Although Indian patients have been getting palliative care for more than 20 years, there has been little research on tools to reduce pharmaceutical errors. [3,4]

Types of Medical Errors:

a) **Diagnostic errors:** Incorrect or delayed diagnoses leading to patient harm or suboptimal outcomes.

b) **Treatment errors:** Mistakes in prescribing, administering, or monitoring treatments, including medication errors, surgical errors, and procedural complications.

c) **Preventive errors:** Failures in preventive care, such as missed vaccinations, screenings, or follow-up appointments.

d) **Communication errors:** Breakdowns in communication among healthcare providers, patients, and caregivers leading to misunderstandings or mistakes in care delivery.

e) **Systemic errors:** Failures in healthcare systems, processes, or policies contributing to medical errors.[5,6,7]

Methodology

The study designs: The study was a cross-sectional observational audit of pharmacist interventions over a specific period. Pharmacists checked and signed off inpatient medication orders, ensuring clarity, eligibility, completeness, and

appropriateness. Discharge orders were also checked before dispensing. Pharmacists visited wards daily, spending 2-3 hours, but not all wards were visited daily. Any order discrepancies or errors were intercepted, and interventions were based on personal knowledge and clinical judgment. Errors were recorded and classified based on severity. Interventions were stored in the hospital's electronic system and reviewed regularly to ensure consistency and quality.[8,9]

Data extraction: Data were sourced from hospital and medical records, including inpatient case sheets from the Medicine department. Pharmacist interventions related to inpatient medication order errors were retrieved from the Pharmacy Information and Communication System (PICS) and compiled into an Excel spreadsheet. The dataset included patient descriptive data (admission and discharge dates), ward information, intervention timestamps, and intervention descriptions. Confidentiality was ensured by removing personal patient and prescriber data. The study facilitator extracted the data securely, maintaining strict confidentiality. All data were stored on a password-protected computer. [10]

Interventions validation to assess the incidence and nature of medication errors: The analysis of the interventions was conducted by the principal investigator (FA). In the vast majority of cases, the pharmacist interventions provided sufficient information to facilitate a clear judgment regarding errors. When there were ambiguous interventions, the principal investigator contacted the study site facilitator to provide further clarification.[11]

Inclusion and exclusion: A prospective observational study on medication errors was conducted over several months at the Medicine department of a hospital in India, with prior approval from the Institutional Ethics Committee. Randomly selected prescriptions or those followed until patient discharge were analyzed. Inpatient case records, including case history, diagnosis, physician medication orders, nurse administration records, and diagnostic reports, were reviewed.

Any identified medication errors were transferred to a medication error reporting form. Each prescription underwent two checks for errors, using the CIMS website and validated by additional references such as MICROMEDEX, drug handbooks, and Drug Digest website. Data were represented as percentages.

Data Statistical Analysis: Data were analyzed using SPSS for Windows. Descriptive analysis characterized interventions, assessing erroneous medication orders across wards, severity, medical class, and hospitalization stage. Error rate calculation utilized total medication orders as the denominator, with overall error rate derived from total errors divided by total orders. Proportion of patients exposed to potential prescribing errors was computed by dividing detected errors by total admitted patients. Error rates per ward were calculated by dividing identified errors by total orders per ward. Chi-squared tests examined associations between erroneous medication orders and ward type (p < 0.05 considered significant). [12,13]

Ethical Approval: Ethical approval was gained from Hospital. This retrospective data analysis did not require ethical approval as it was considered as an audit. The extracted data excluded any personal information or confidential patient data. [14]

Results and Discussion

Types of medication errors detected: Pharmaceutical omission accounted for 43.51% of all pharmaceutical errors and occurred nearly three times as often as the second most common form of mistake. According to table 1 the second most prevalent form of mistake was dosage errors, which accounted for 13.79% of all errors, followed by data input errors, which accounted for 12.08% of all errors.

Table 1: Types of medication errors detected

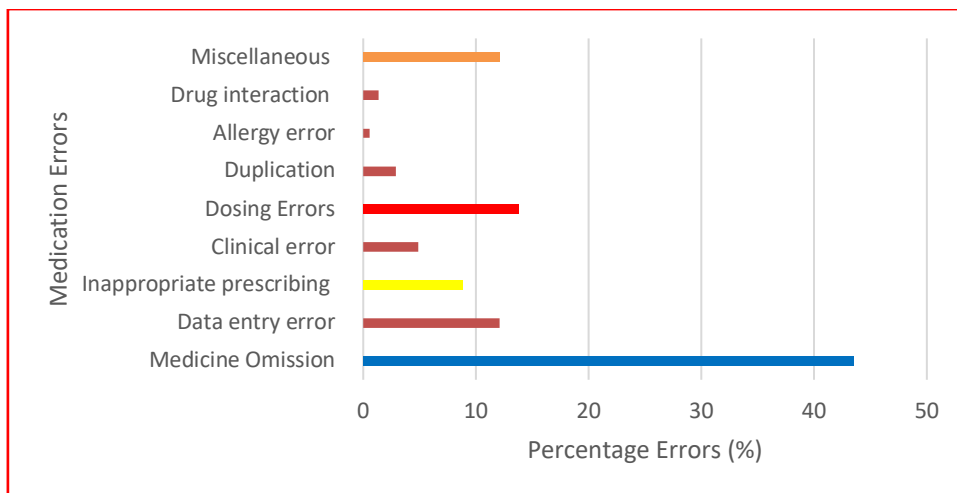| Medication Error	Numbers(n)	Percentage Errors (%)
Medicine Omission	587	43.51
Data entry error	163	12.08
Inappropriate medication	119	8.82
Clinical error	66	4.89
Dosing Errors	186	13.79
Duplication	39	2.89
Allergy error	8	0.59
Drug interaction	18	1.33
Miscellaneous	163	12.08
Total	**1349**	**100.00**

Figure 1: Types of medication errors detected

Distribution of the medication errors identified and reported by HCPs: During the study period, Pharmacist has reported highest medication errors [648 (48.04%)] followed by nursing staff and Doctors [461 (34.17%)] and [240 (17.79%)] respectively. The details of distribution of medication errors, as reported by the HCPs across selected specialities where the system was implemented are presented in table 2.

Table 2: Distribution of the medication errors identified and reported by HCPs

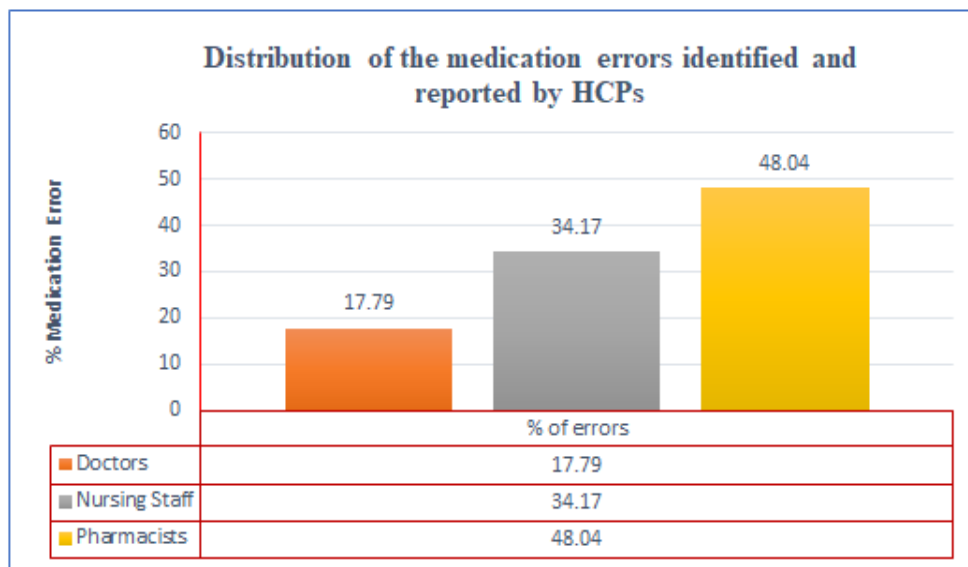| Category of Health Care Professionals	Number of Errors Reported					% of errors
	2020	**2021**	**2022**	**2023**	**Total Numbers of error**	
Doctors	47	65	85	43	240	17.79
Nursing Staff	99	138	106	118	461	34.17
Pharmacists	101	246	167	134	648	48.04
Total	247	449	358	295	1349	100

Figure 2: Distribution of the medication errors identified and reported by HCPs

Table 3 shows the medication errors broken down by stage of hospital stay. The majority of medication order errors happened during hospital admission (60.12%), which is twice as high as the error rate during the hospital stay (23.8%). The error rate for medication orders given at discharge (16.09%) is comparatively lower.

Table 3: Medication errors according to hospitalization stage

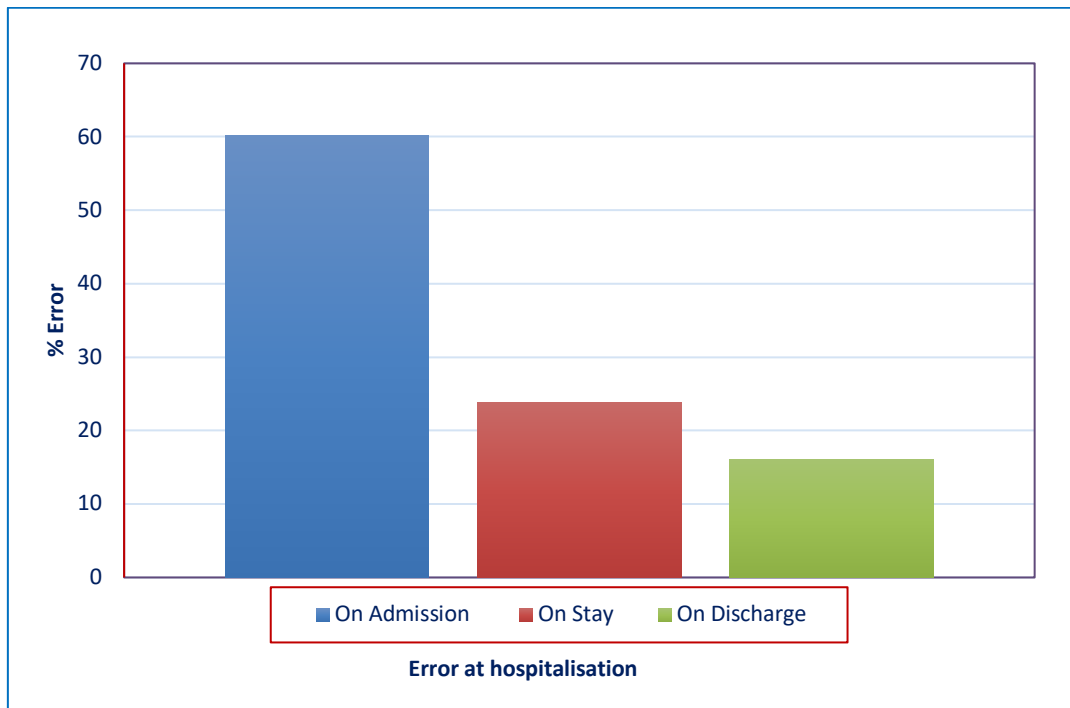| Error at Hospitalization	On Admission	On Stay	On Discharge	Total
Numbers	811	321	217	1349
% Error	60.12	23.8	16.09	100

Figure 3: Medication errors according to hospitalization stage

Medication error frequency by medical specialty: Various specialty' wards showed a great deal of variation in the mistake rates that were recorded (Table 4). After general medicine (42.03%), the most common specialty were linked with incorrect drug prescriptions were gastroenterology (18.16%), urology (11.71%), otolaryngology (6.89%), and paediatrics (5.11%). With a rate of 0.37% and 0.30%, respectively, the maxillofacial surgery as well as cardiology wards had the fewest mistakes.

Table 4: Medication errors by medical specialty

| Ward	Number of Errors	% Errors
General Medicine	567	42.03
Trauma & Orthopaedics	55	4.08
Paediatrics	69	5.11
General Surgery	33	2.45
Cardiothoracic Surgery	9	0.67
Maxillofacial Surgery	5	0.37
Gastroenterology	245	18.16
Critical Care	7	0.52
Urology	158	11.71
Ear, nose & throat	93	6.89
Oncology	23	1.70
Cardiology	4	0.30
Gynecology	34	2.52
Renal	9	0.67
Neurosciences	22	1.63
Clinical Haematology	16	1.19
Total	**1349**	**100.00**
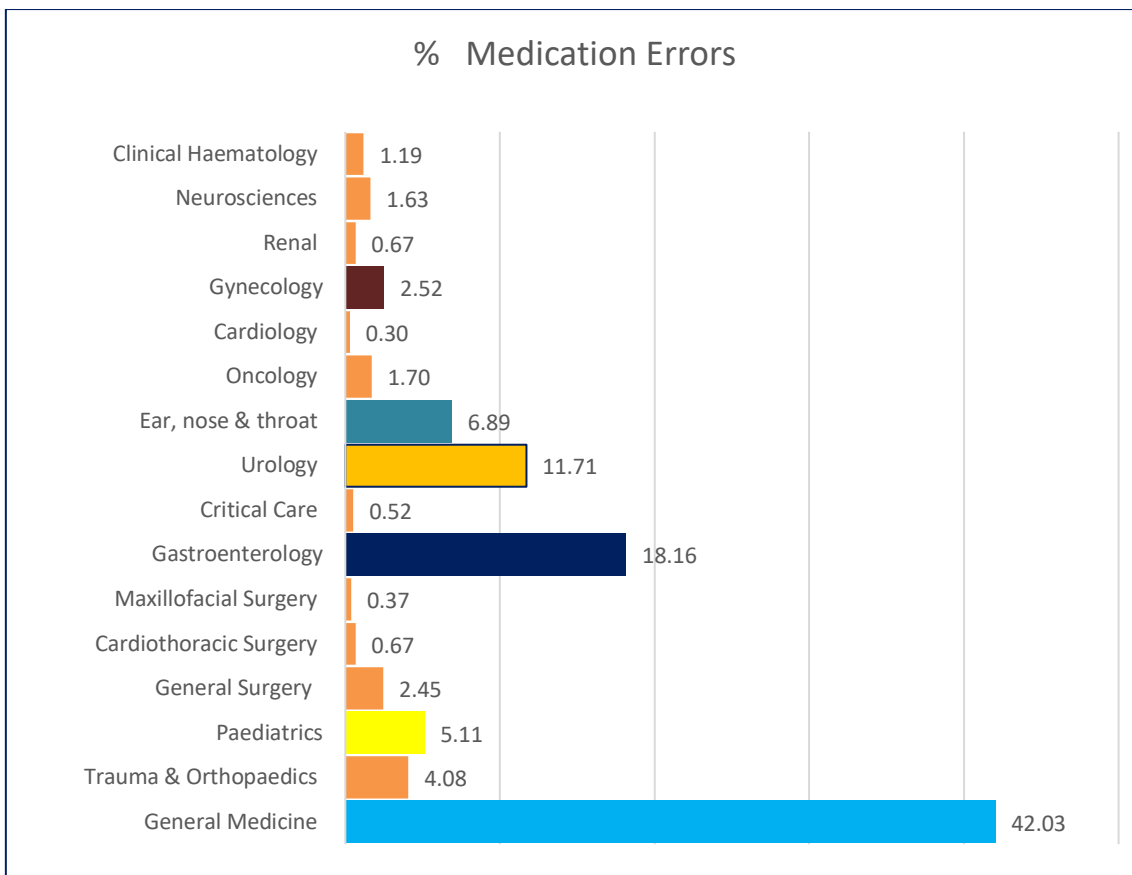
Figure 4: Medication errors by medical specialty

Medications involved with medication errors

Table 5: Medical class of the drug involved with medication errors

Medical Class	Years wise errors numbers				Total Numbers	% Error
	2020	**2021**	**2022**	**2023**		
Central Nervous system	55	116	85	63	319	23.65
Cardiovascular	22	34	42	40	138	10.23
Infectious	34	30	72	50	186	13.79
Antibiotics	46	88	37	32	203	15.05
Gastrointestinal	11	74	45	30	160	11.86
Respiratory	11	32	11	11	65	4.82
Endocrine	11	9	12	10	42	3.11
NSAIDS	14	30	11	14	69	5.11
Steroids	13	11	9	6	39	2.89
Antidiabetic	10	8	10	9	37	2.74
Musculoskeletal and joint	5	5	7	11	28	2.08
Diuretics	12	7	11	11	41	3.04
Anticoagulants	3	5	6	8	22	1.63
Total	**247**	**449**	**358**	**295**	**1349**	**100**

The drug orders linked to medication mistakes are categorised by therapeutic areas in Table 5. When broken down by therapeutic category, the most frequent prescription order mistakes were the central nervous system (23.65%), infectious diseases (13.79%), antibiotics (15.05%) and the gastrointestinal system (11.86%).
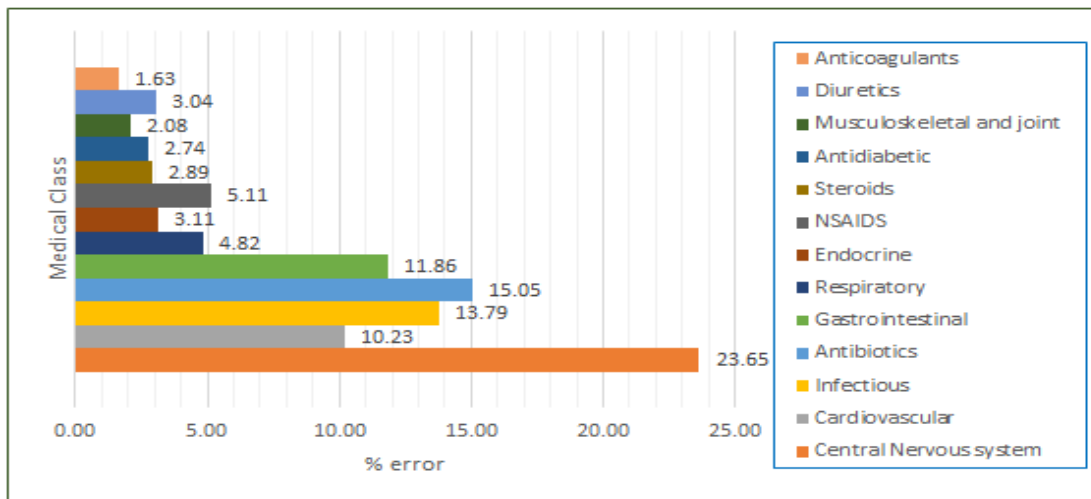
Figure 5: Medical class of the drug involved with medication errors

Severity of erroneous medication orders

Table 6: Level of severity year wise Numbers of medication errors

Year	Medication Error Level				Total numbers of Error
	Minor	Significant	Serious	Potentially lethal	
2020	66	167	14	0	247
2021	134	283	31	1	449
2022	66	283	9	0	358
2023	21	263	11	0	295
Total	287	996	65	1	1349

Mistakes involving incorrect prescription orders were mostly classified as either small (21.28%) or possibly significant (73.83%). According to Table 7, the frequency of potentially critical mistakes was much lower at 4.82%, and the frequency of possibly fatal errors was even lower at 0.07%.

Table 7: Level of severity Number of medication errors

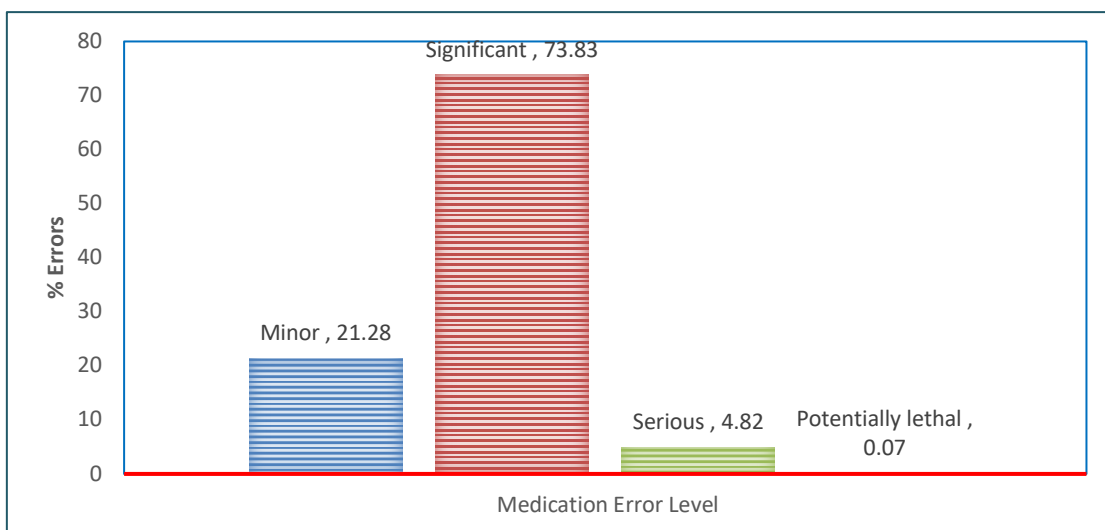| Medication Error Level	Numbers of Errors	% Errors
Minor	287	21.28
Significant	996	73.83
Serious	65	4.82
Potentially lethal	1	0.07
Total	1349	100

Figure 6: Level of severity Number of medication errors

The types of error and the wards summary: You may get a summary of the error types found in each ward site in table 8. Medication omission (43.51%), dosage mistakes (13.79%), and data entry errors (12.08%) were the three most common kinds of errors across all ward specialties. During the research period, a total of 8 mistakes (0.59%) were recorded as allergy errors; out of these, 2 were found on the general medicine wards.

Table 8: The types of errors and the wards summary

Ward	Medicine Omission	Data entry error	Inappropriate prescribing	Clinical error	Dosing Errors	Duplication	Allergy error	Drug interaction	Miscellaneous	Total	%
General Medicine	367	24	44	15	89	4	2	3	19	567	42.03
Trauma & Orthopaedics	6	4	0	0	4	2	1	2	36	55	4.08
Paediatrics	13	9	6	1	1	4	1	0	34	69	5.11
General Surgery	7	3	3	6	7	4	0	1	2	33	2.45
Cardiothoracic Surgery	3	1	0	0	3	1	0	0	1	9	0.67
Maxillofacial Surgery	1	1	1	0	0	0	0	1	1	5	0.37
Gastroenterology	79	43	22	12	36	11	1	3	38	245	18.16
Critical Care	3	2	0	1	1	0	0	0	0	7	0.52
Urology	45	33	23	13	23	4	1	2	14	158	11.71
Ear, nose & throat	22	19	9	11	15	3	0	3	11	93	6.89
Oncology	9	4	3	2	1	2	0	0	2	23	1.70
Cardiology	2	1	0	0	1	0	0	0	0	4	0.30
Gynecology	15	11	2	2	1	1	0	1	1	34	2.52
Renal	2	2	0	0	1	0	1	2	1	9	0.67
Neurosciences	8	3	3	2	2	2	0	0	2	22	1.63
Clinical Haematology	5	3	3	1	1	1	1	0	1	16	1.19
Total	587	163	119	66	186	39	8	18	163	1349	100
%	43.51	12.08	8.82	4.89	13.79	2.89	0.59	1.33	12.08	100	

Summary and Conclusion

Medical errors remain a pervasive challenge in healthcare, threatening patient safety and quality of care. During the study period, Pharmacist has reported highest medication errors [648 (48.04%)] followed by nursing staff and Doctors [461 (34.17%)] and [240 (17.79%)] respectively. Maximum percentage medication error was found in general medicine ward 36.37% and minimum error was found in Cardiothoracic Surgery, Maxillofacial Surgery ward 0.12%.

The majority of Medication errors reported were minor and significant (21.28% and 73.83% respectively), with only 4.82 % classified as serious and 0.07 % potentially lethal.

The highest rate of medication order errors occurred during hospital admission (60.12%), doubling the error rate during the hospital stay (23.8%). Conversely, the error rate for medication orders at discharge (16.09%) was notably lower.

The highest rates of incorrect drug prescriptions were observed in general medicine (42.03%), followed by gastroenterology (18.16%), urology (11.71%), otolaryngology (6.89%), and pediatrics (5.11%). Maxillofacial surgery and cardiology wards had the lowest rates at 0.37% and 0.30%, respectively. The study highlights the need for improvement in transferring patient data between primary and secondary care and emphasizes the importance of prescriber vigilance when using prescribing systems. Pharmacists play a crucial role in identifying and preventing medication errors, advocating for their expanded integration within medical teams to enhance collaborative patient care.

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