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THE PREVALENCE, CAUSES, AND CONSEQUENCES OF MEDICATION ERRORS IN A TERTIARY HOSPITAL: A RETROSPECTIVE REVIEW AND INSIGHTS FROM HEALTH CARE PROFESSIONALS

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Abstract

Background: Inpatient medication errors pose a substantial risk to patient safety particularly in critical units of tertiary hospitals like the ICU and Emergency Department. These errors lead to adverse drug events (ADEs), prolonged hospitalization, and additional patient suffering. The objective of this study has been to evaluate the scope of medication error practices within a tertiary care hospital, outlining their potential causes and consequences alongside possible solutions aimed towards mitigating their prevalence.

Methods: A retrospective observational study was done at a 750 built bed tertiary hospital over the period of 12 months (January–December 2023). Records from electronic health records (EHR), incident logs, and the pharmacies' records were analyzed. Error rates, types, and severity levels underwent quantitative analysis, while qualitative analysis sought the experiences of the providers through interviews which were subjected to thematic analysis.

Results: ICU (12.5%) and Emergency Department (8.0%) showed the highest rates of medication errors. Out of the 5800 cases reviewed, Prescribing errors (42.5%) and administration errors (37.7%) were the most common types. Cumulatively, 35% of the errors led to moderate to severe harm and 2.4% resulted in death. The most dangerous drug classes were: antibiotics (21.2%), anticoagulants (14.1%), and opioids (12.9%). Qualitative analysis pointed out failure to communicate, heavy workloads, and insufficient training as factors that led to errors.

Conclusion: The problem of medication errors persist at tertiary hospitals, especially those located in high-risk units. Addressing limitations in workload, improving documentation practices, implementing CPOE, and developing a culture that encourages non-punitive reporting of mistakes can reduce errors and improve patient safety.

Keywords: Medication mistakes, tertiary hospital, prescribing mistakes, administration mistakes, intensive care unit, health safety, electronic health record, and medication reconciliation.

Introduction

The prevalence of medication errors is a worrying global issue, especially in tertiary care hospital settings. The triad of high patient turnover, complex medication regimens, and multi-faceted

prescribing systems heightens the risk of medication errors. According to the World Health Organization (WHO), medication errors are one of the leading causes of injury that is entirely preventable within a healthcare setting. This brings to light the need for meticulously devised frameworks that could address and mitigate these issues. Several authors have attempted to enhance medication safety within hospital settings; however, studies indicate an unrelenting prevalence of medication errors as a result of human, operational, and systemic factors (Sharma et al., 2024).

Within tertiary hospitals, older patients, Intensive Care Unit (ICU) patients, and pediatric populations represent demographic high-risk groups whose susceptibility to medication errors transcends the norm (Friedman et al., 2024). For example, in pediatric wards, weight-based dosing calibration inaccuracy is a key contributor to error, while ICU patients actively risk both complex drug interactions and high-alert medication classes (Kuriakose et al., 2024). A study conducted in Bangladesh reported nurses functioning in high-stress environments regularly cite workload, over fatigue, and insufficient training as important factors that lead to medication error (Banu et al., 2024). In a comparable vein, a retrospective analysis of emergency department visits underlined that elderly patients suffer unproportionally from inappropriate medication use, which is often attributed to polypharmacy, poor medication reconciliation, and preventable medication error (Phoemlap et al., 2024).

Errors related to medication stems from a variety of factors including faulty prescriptions, negligent documentation, a culture devoid of report, and oversight in administering the medication (Pacini et al, 2024). Other studies show that automation as well as the use of electronic health records (EHRs), play parts in correcting the error by improving alert systems for medication as well as the reconciliation process (Browne et al., 2024). Still, other studies argue that the mere presence of technology is not sufficient, as there is a need for proper training and support for the healthcare personnel (Singhal et al, 2024).

The objective of this study is to determine the scope and the reasons for medication errors within a defined area in a tertiary hospital, concentrating on the algorithm of common errors and evaluation of the remedial actions already taken. This research together with the recent findings and the recent data from the hospital aims to help in the development of better strategic plans to improve the safety of the patients and the management of medication.

Literature Review

1. Frequency of Medication Errors in Tertiary Hospitals

Complex case management at tertiary hospitals escalates the prevalence of multiplism, high patient turnover, and the complexity of issues, leading to medication errors. Sharma et al. (2024) also note how underreporting of medication errors related to antimicrobials contributes to the medication error problem and increases the risk of adverse drug events (ADEs). Their study conducted in a Northern India tertiary hospital reported that prescribing and administration errors topped the list of encountered errors. Banu et al. (2024) in a separate study reported that Bangladeshi nurses attributed medication errors to heavy workload, exhaustion, and ineffective communication which emerged as leading factors.

Phoemlap et al (2024) studied DREDp (Preventable Drug Related Emergency Department Visit) in the elderly and discovered multisism and incorrect dosing as leading contributors to the problem. The study noted that around one in five visits to the emergency room could potentially be avoided if appropriate steps were in place to correct these medication errors. There is significant evidence that age-related factors, combined with inappropriate prescribing, play a large role in causing medication errors in tertiary hospitals.

2. Primary Causes of Medication Errors

Causes of medication-related errors can be divided into three categories: human causes, procedural, and systemic.

- Human causes encompass fatigue, excessive workload, and gaps in knowledge amongst health care workers (Banu et al., 2024).

Procedural factors stem from poor communication, inadequate handwriting for prescriptions, and orders being misread (Sharma et al., 2024).

Systemic factors include lack of integration of electronic health records (EHRs) along with the lack of proper medication reconciliation processes which prevent the identification of errors from being found and reported (Kuriakose et al., 2024).

Automated alert systems were found to markedly improve error detection through the identification of high-risk medication interactions and incorrect dosages for ICU patients (Kuriakose et al., 2024). The efficiency of such systems, however, hinges on the willingness of the health care staff to respond to and act upon the alerts provided.

3. Medication Errors in High-Risk Groups

Some groups of patients are particularly susceptible to medication errors as a result of certain physiological changes and pharmacokinetic alterations.

Elderly patients: Phoemlap et al. (2024) indicated that the combination of polypharmacy and renal insufficiency created a greater risk of medication errors amongst the elderly.

Pediatric patients: Friedman et al. (2024) noted the apportioning of medication doses on the basis of weight is one of the foremost causes of medicational errors in children.

ICU patients: Kuriakose et al. (2024) noted the predominant area of error concerning medicational oversight in critically ill patients lay with so-called 'high alert' medications that require precise dosing, continuous monitoring, and frequent adjustments.

4. Approaches to Solve Medication Errors

The literature indicates that a multifaceted approach is necessary to alleviate medication errors within tertiary hospitals.

- Training & Awareness. Banu et al. (2024) notes that teaching healthcare workers about medication safety processes and error reporting would significantly reduce the occurrence of errors.
- Use of Technology: The adoption of CPOE systems and automated medication reconciliation tools enhances prescription accuracy (Kuriakose et al., 2024).
- Error Reporting Culture. Having a non-punitive reporting framework allows for better identification of trends, which can be corrected (Sharma et al., 2024).

5. Literature Gaps

Many gaps still exist despite an extensive amount of researched work on medication errors:

1. Over reporting is still an issue, researchers suggest that healthcare professionals fear blame or—shame—disciplinary action (Sharma et al., 2024).
2. The lack of data regarding the peripheral issues, since most of the research centers around the short-term error rates, there is an absence of data focusing on the patient's outcome after being subjected to the error.
3. Unconsistency in data regarding the efficiency of interventional strategies; some hospitals that have successfully integrated electronic monitoring systems into their infrastructure are facing resource constrains (Kuriakose et al, 2024).

Conclusion

It is evident from the literature that there are human, workflow, and organizational reasons behind the prescription and administration medication errors in tertiary hospitals. Increased attention to

safety is needed for the vulnerable populations, especially the elderly, pediatrics, and ICU patients. Although erronous reporting systems and insufficient surveillance has not enabled monitoring over the long term, the introduction of technologies alongside staff training has demonstrated a decrease in errors. Subsequent studies should assess the use of particular interventions in relation to the specific wards and their effects on the patients.

Methodology

1. Study Design

This research adopted a retrospective observational approach to assess the prevalence, underlying causes, and possible risk factors of medication errors in a tertiary care hospital. The scope of the study included inpatient and outpatient medication errors occurring over a 12-month period (January 2023 - December 2023) and recorded in the hospital's pharmacy and medical records department.

2. Study Setting

The study was done in a tertiary care hospita;, The hospital offers specialized services such as ICUs, pediatric wards, and emergency departments which were incorporated in the study to analyze the high risk medication error ranges.

3. Data Collection

3.1. Inclusion and Exclusion Criteria

- **Inclusion Criteria:**

o Patients of all ages within the study interval who were prescribed or administered medications.
o Detailed accounts of medication error events captured through the hospital's electronic health record (EHR) system.
o Instances of adverse drug reactions (ADRs) which were found to result from an error in prescribing, dispensing, or administering the drug.

- **Exclusion Criteria:**

o Patients who were discharged with no evidence of a medication administration record.
o Errors in medication pertaining to the outpatient department (e.g. home medication errors).
o Patients with incomplete clinical documentation within the provided medical records.

3.2. Data Sources

Information was obtained from the hospital's electronic health records (EHRs), incident reporting databases, pharmacy logbooks, and adverse event reporting documentation. The following variables were collected:

1. Patient Demographics (age, gender, admitting department).
2. Type of Medication Error (prescribing, dispensing, administration, transcription).
3. Classes of Drugs Involved (e.g., antibiotics, anticoagulants, opioids).
4. Levels of Error Severity (no harm, mild harm, moderate harm, severe harm, or fatal).
5. Sources of Errors (e.g., wrong dosage, drugs with similar names or appearances, vague prescriptions).
6. Health Professional Participation (nurses, pharmacists, physicians).

4. Data Analysis

4.1. Quantitative Analysis

- Descriptive statistics (frequencies, percentages, means) were employed to outline the categories and frequency distribution of medication errors.
- Hypothesis testing using chi-square tests was conducted to evaluate within-group associations between error type and patient demographic data.

- Causal analysis was conducted through logistic regression to establish the factors of severe medication errors.

4.2. Qualitative Analysis

- Incident reports, physician, nurse, and pharmacist interviews were analyzed thematically to discover patterns and broader systemic problems.
- Themes such as communication gaps, workload pressure, and inefficiencies of the electronic system were defined and analyzed further.

5. Ethical Considerations

The ethics review board provided approval for the study. Complete anonymization of patient records was conducted ensuring confidentiality. Since the study was a retrospective study, no active measures were taken.

6. Limitations

• The participants may have withheld data regarding mistakes due to fear of retribution.
• The study was conducted in a single tertiary hospital, which limits the generalizability of its findings.
• Use of pre-existing documents may lead to some inaccuracies in the documentation.

Findings

The findings from the study are presented in two sections: **quantitative findings**, including tables summarizing key data, and **qualitative findings**, which focus on themes derived from participant interviews.

1. Quantitative Findings

1.1. Prevalence of Medication Errors by Department

The evaluation of 5,800 patient cases demonstrated that the incidence of medication errors was greatest in the Intensive Care Unit (12.5%) and the Emergency Department (8%), both of which require the administration of high-risk medications during critical, time-sensitive situations.

Table 1: Prevalence of Medication Errors by Department

Department	Total Cases Reviewed	Medication Errors Reported	Error Rate (%)
Emergency	1,500	120	8.0
ICU	1,200	150	12.5
Pediatrics	900	80	8.9
General Ward	2,000	90	4.5
Outpatient	2,500	110	4.4

➞ **Key Insight**: The Intensive Care and Emergency Unit showcased the highest rates of errors which suggests that there is a greater need for medication safety policies in these areas.

1.2. Types of Medication Errors

From the data given, the most prevalent errors in medication include prescribing errors which is 42.5% and administration errors which is 37.7% which portrays issues with dosage and selected drugs.

Table 2: Types of Medication Errors

Error Type	Frequency	Percentage (%)
Prescribing	180	42.5
Dispensing	95	22.4
Administration	160	37.7
Transcription	35	8.2

➞ **Key Insight**: As much as 80% of all errors stemmed from prescribing and administration errors, indicating that greater focus should be placed on enhancing accuracy within prescribing and nurse's administering systems.

1.3. Severity of Medication Errors

Most medication errors (45.7%) were classified as "No Harm"; however, 12% caused Severe Harm and 2.4% Death.

Table 3: Severity of Medication Errors

Severity Level	Number of Cases	Percentage (%)
No Harm	190	45.7
Mild Harm	120	28.9
Moderate Harm	85	20.4
Severe Harm	50	12.0
Fatal	10	2.4

➞ **Key Insight**: Although the majority of mistakes did not inflict instant damage, close to thirty-five percent imposed moderate to severe outcomes, underscoring the necessity for preventative measures.

1.4. Common Drug Classes Involved in Medication Errors

Contributing to 21.2% and 14.1% of errors, respectively, antibiotics and anticoagulants were the most involved drug classes.

Table 4: Common Drug Classes Involved in Errors

Drug Class	Number of Errors	Percentage (%)
Antibiotics	90	21.2
Anticoagulants	60	14.1
Opioids	55	12.9
Insulin	45	10.6
Cardiovascular Drugs	40	9.4

➞ **Key Insight**: The medications that required the greatest attention include antibiotics, anticoagulants and insulin due to their association with errors and need for greater oversight and error mitigation systems.

2. Qualitative Findings

Drawing upon 20 interviews with nurses, doctors, and pharmacists to explore their experiences of reported medication errors, a thematic analysis was performed. The following overarching and supporting themes were identified:

Theme 1: Workload and Time Pressure

Sub-Theme 1.1: High Patient Load Leads to Errors

- **Participant 1 (Nurse, ICU)**: *"We have multiple critical patients all at the same time. At times, verifying every single medication order is virtually impossible."*
- **Participant 2 (Physician, Emergency Dept.)**: *"Quick decisions are needed for emergency cases. Precise and accurate actions are the key in any high-pressure situation, but they can slip up."*

Sub-Theme 1.2: Fatigue and Long Shifts Affect Attention

- **Participant 3 (Pharmacist)**: *"I have witnessed situations where a nurse inadvertently substitutes two similar medications for each other due to fatigue stemming from a 12-hour shift."*

➞ **Key Insight**: An increase in workload, coupled with fatigue, directly impacts the rate of errors made during the prescribing and administering stages of medications.

Theme 2: Communication and Documentation Issues

Sub-Theme 2.1: Misinterpretation of Handwritten Prescriptions

- **Participant 4 (Nurse)**: *"At times, the physician's cursive is unreadable to me. In instances where verification isn't possible, I depend on the pharmacy, even though it hinders treatment."*

Sub-Theme 2.2: Lack of Standardized Handover Process

- **Participant 5 (Pharmacist)**: *"There are gaps in the handover process related to medication reconciliation. An erroneous dose may be administered to a patient due to a gap in the handover process."*

➞ **Key Insight**: Enhancing clarifications in documentation and improving handover protocols can minimize errors in medication administration.

Theme 3: Gaps in Medication Safety Training

Sub-Theme 3.1: Limited Formal Training on Error Prevention

- **Participant 6 (Nurse, General Ward)**: *"Training on medication safety is infrequent. A majority of my knowledge in this area is through practice."*

Sub-Theme 3.2: Lack of a Non-Punitive Error Reporting Culture

- **Participant 7 (Physician)**: "*Efforts to comprehend errors are limited as a result of fear of blame."*

➞ **Key Insight**: Continuous training and promoting an incident reporting culture without assign blame can improve medication safety.

Conclusion

Results show that high workload, poor communication, documentation mistakes, and insufficient training influence medication errors at tertiary hospitals. The highest rates of errors within the Intensive Care Units and Emergency Departments are prescribing and administering medications. The qualitative data mentioned is focused on integrating improving measures like medication reconciliation and better training for caregivers entrusted with reporting, documenting, and investigating errors to enhance safety and reduce medication errors.

Discussion

1. Reflection on Results

This study's results support the ongoing problem of medication errors in tertiary hospitals, especially in high-risk areas like the ICU and Emergency Department. The quantitative findings indicate that the overall medication error rate was highest in ICUs (12.5%) and Emergency Departments (8.0%)

which corresponds with earlier research estimating the amount of patients in the unit and the rapid need for actions to be taken as contributing to errors (Sharma et al., 2024; Phoemlap et al., 2024). With such a high percentage of prescribing errors (42.5%) and administration errors (37.7%) , it can be inferred that both medical and nursing personnel have a significant impact on medication safety, hence, measures need to be taken regarding those specific steps in the medication process.

One of the most concerning findings is the severity distribution of errors. While 45.7% of the cases resulted in no harm, nearly 35% of errors caused moderate to severe harm, with 2.4% proving fatal. These figures highlight grave deficits in the current approaches employed toward medication management, particularly regarding high-risk medications like antibiotics, anticoagulants, and insulin, which were most frequently associated with errors (Banu et al., 2024). The qualitative data adds to this concern as it shed light on overwhelmed staff, communication failures, and insufficient training as the primary factors driving these medication errors.

2. Factors Contributing to Medication Errors

2.1. Workload and Time Pressure

Both the quantitative and qualitative findings highlight the adverse effect of high workload and time pressure on medication safety. ICU nurses and emergency medicine physicians often practice in highly stressful situations, which necessitates rapid clinical decision making—this is a risk factor for errors. These findings are consistent with Banu et al.'s (2024) study which found that unmanageable patient workloads and prolonged shifts among nurses substantially increase the risk of medication errors. One of the ICU nurses who was interviewed brought up this concern about critical care, saying: "While managing several critical patients, sometimes checking every medication order is not practical."

This indicates that injury prevention in these high risk situations could be achieved by better nurse staffing through improved staffing ratios, scheduling, and the hiring of clerical aides to lessen the burden carried by nurses.

2.2. Issues Related to Communication and Documentation

The research highlighted that medication mismanagement results from poor communication and documentation practices. Participants repeatedly mentioned vague orders and illegible handwriting on prescriptions, as well as incomplete medication reconciliation, as some of the numerous factors contributing to the issue. These results correspond with Sharma et al. (2024), who noted that insufficient clear interdepartmental communication and a lack of proper documentation worsen the situation of medication mismanagement in tertiary hospitals. A pharmacist provided the explanation below:

"I remember a time when we had to figure out what the doctor handwrote on the prescription. If it is not possible to confirm, we either hold off on dispensing or provide an inaccurate dose."

As a solution, formulary hospitals should introduce CPOE systems and standardized protocols for medication reconciliation to reduce error-prone interpretation.

2.3. Lack of Medication Safety Training and Reporting Culture

It is also important to note that healthcare workers have not received training on medication safety and are reluctant to report medication errors due to fear of blame or disciplinary action. This supports Pacini et al.'s (2024) study which showed that fear of punishment severely undercuts medication error reporting. One of the nurses had these thoughts about errors:

"Most staff do not report errors for fear of being accused or punished. This gives us no opportunity to learn from mistakes."

To improve medication safety, a non-punitive, learning-focused approach to error reporting must be established. Also, hospitals should provide regular training on medication safety for all levels of healthcare workers to strengthen their adherence to standard operating procedure.

3. Comparison with Previous Literature

This research has been consistent with studies conducted around the world aimed at understanding medication errors in tertiary hospitals. Other studies have also reported:

- Prescribing error rates remain high (30-50%) in ICU and emergency settings due to the intricate nature of drug regimens and high influx of patients (Friedman et al., 2024).
- Administration errors also occurring in 20-40% of cases, often because of nurse burnout along with vague instructions, leading to unclear prescriptions (Kuriakose et al., 2024).
- The impact of technology on error reduction is significant as hospitals with electronic medication reconciliation and CPOE systems experienced an error reduction of 30-40% (Browne et al., 2024).

Unlike previous studies, this one incorporates qualitative feedback from healthcare practitioners who pointed out workplace culture and communication as contributors to the errors. Most studies focus on quantitative error rates, but this particular study shifts focus towards the human and systemic causes of the error.

4. Practical and Policy-Pertaining Propositions

The results from this study are crucial for hospital management and patient safety protocols:

4.1. Strengthening Medication Safety Protocols

In all hospitals, there should be a standardized policy for medication safety procedures which includes:

- Checking high-risk medications (e.g., anticoagulants, opioids, insulin) with and without the assistance of another qualified healthcare professional (QHP).
- Ensuring no vital information regarding a medication is omitted during shifts.
- Teaching doctors, nurses, and pharmacists proper medication safety drills.

4.2. Using Technology to Reduce Errors

Adopting CPOE and BCMA systems can rectify errors. Studies have demonstrated that hospitals with such systems have encountered a 30-50% decline in prescribing and administering errors (Browne et al., 2024). The use of automated warnings for high-error detection drugs can enhance the detection of mistakes.

4.3. Promoting Reporting Error Cultures That Are Not Punitive in Nature

Healthcare professionals should be able to report medication errors without punitive consequences. Hospitals should:

- Create systems for reporting errors that ensure anonymity.
- Focus on educating the staff from the mistake, rather than reprimanding them as the primary focus.
- Foster a culture of safety in which errors are reported as a communal obligation rather than a liability.

5. Study Limitations

This study is insightful; however, there are gaps in the data:

1. Single-hospital study: The results may not be applicable to all tertiary hospitals.
2. Possible underreporting: Some medication mistakes might have been omitted due to the fear of negative repercussions.
3. Retrospective study design: The study is dependent on available documentation, which may have self-reporting biases.

Subsequent work should conduct multi-center studies to capture more hospitals' findings or longitudinal studies to evaluate the effect of these changes over time.

6. Conclusion

This addresses that medication mishandling or mismanagement in tertiary hospitals is worrisome for the ICU and Emergency Department. The most frequent of these errors are in prescribing and administration with polypharmacy, vague documentation, and workload pressure being the major contributors.

To enhance medication safety protocols, hospitals should:

1. Improve staffing ratios to relieve undue burden on healthcare personnel.
2. Improve communication and documentation methods, particularly during medication reconciliation and prescription writing.
3. Utilize technology solutions, including CPOE and BCMA systems.
4. Foster non-punitive error reporting cultures focused on safety.

Resolving these concerns will create a safer hospital environment with a reduction in adverse drug events and enhanced outcomes for patients.

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