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A PROSPECTIVE OBSERVATIONAL STUDY OF FACTORS INFLUENCING MEDICATION ERROR IN NICU

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ABSTRACT

Medication errors are a significant challenge in Neonatal Intensive Care Units (NICUs) because neonates are highly vulnerable due to physiological immaturity, rapid changes in body weight, and the need for precise weight-based drug dosing. This prospective observational study was conducted in India from August 2025 to February 2026 to evaluate the factors influencing medication errors in the NICU and to identify their incidence and types. A total of 150 prescriptions were analyzed, among which 55 medication errors were identified, resulting in an overall error rate of 36.7%. Prescribing errors were the most frequently reported errors, accounting for 50.9% of all medication errors, followed by medication preparation errors (27.3%), dispensing errors (16.4%), and administration errors (5.5%). Within prescribing errors, wrong dose calculation was the most common type, while incorrect dilution was the leading medication preparation error. The study identified several factors contributing to medication errors, including complex dose calculations, polypharmacy, prolonged hospital stay, unclear prescriptions, inadequate communication among healthcare professionals, heavy workload, staff fatigue, and lack of technological support systems. Multivariate analysis demonstrated that prolonged hospital stay (>7 days) and polypharmacy (>5 drugs per prescription) were significant predictors of medication errors. The findings emphasize that medication errors remain highly prevalent in NICUs and highlight the importance of strengthening clinical pharmacy services, improving staff training, promoting effective communication, and implementing standardized medication safety protocols. A multidisciplinary and system-focused approach is essential to reduce medication errors and improve neonatal patient outcomes.

KEYWORDS: Medication error, NICU, Prescription, Polypharmacy.

INTRODUCTION

The term “medication error” refers to any avoidable incident that could cause or result in improper use of medication or harm to the patient while the medication is under the control of healthcare professionals, patients, or consumers.[1]

These incidents can be linked to professional practise, healthcare products, processes, and systems, including prescription writing, communication of medication orders, labelling and packaging of products, medication preparation, distribution, administration, education, monitoring, and utilisation.[2]

Types of medication errors

A prescribing error occurs when there is a mistake in selecting or writing a medication order. This may include wrong drug selection, incorrect dose, wrong dosage form, frequency, route, or failure to consider allergies and drug interactions.(1)In NICU, prescribing errors are common because neonatal doses require precise calculations based on body weight and gestational age.A

transcribing error happens when medication orders are copied incorrectly from one document to another. These errors may occur due to illegible handwriting, incorrect interpretation of abbreviations, or omission of important information while entering prescriptions into records or charts.[2] Dispensing errors occur during the preparation and supply of medications by the pharmacy. Examples include giving the wrong drug, incorrect strength, wrong labelling, or incorrect quantity. In NICU, dispensing errors can seriously affect neonates because even small dosage variations may lead to toxicity.[1] Administration errors happen when the medication is given incorrectly to the patient. These include wrong dose, wrong patient, wrong route, wrong time, or omission of a dose.

Administration errors are one of the most common medication errors in NICU due to the complexity of neonatal drug administration and dilution procedures.[3] Monitoring errors occur when the healthcare team fails to properly observe and assess the patient's response to medication. This includes failure to monitor drug levels, vital signs, laboratory values, or adverse drug reactions. In neonates, inadequate monitoring can lead to delayed identification of toxicity or therapeutic failure.Knowledge-based mistakes occur because of insufficient knowledge or lack of information about the drug, disease condition, or patient factors. For example, a healthcare professional may prescribe a contraindicated medication due to lack of awareness.Rule-based mistakes occur when established guidelines or protocols are incorrectly applied or ignored.[2] This may happen when healthcare workers follow the wrong procedure or apply a correct rule in an inappropriate situation.Action-based slips are errors that occur during the execution of a task despite having correct knowledge and intention. These are usually caused by distraction, fatigue, or inattention. Examples include selecting the wrong medication vial or pressing the wrong infusion pump setting.Memory-based lapses occur when a healthcare professional forgets to perform an action or forgets important information. Examples include forgetting to administer a dose or missing a scheduled monitoring parameter. These errors are often associated with heavy workload and stress in NICU settings.[1]

Table 1: Types of medication error.

Classification Types	**Category**
Stage-based	Prescribing
	Dispensing
	Administration
	Monitoring
Classification Types	**Category**
Physiological	Knowledge-based Mistakes
	Rule-based mistake
	Action-based slips
	Memory-based lapses

Medication errors in NICU

A medication error (ME) in the Neonatal Intensive Care Unit is defined as any preventable event arising from the inappropriate use of a drug that causes or has the potential to cause harm to the neonate, regardless of whether an injury actually occurred. These incidents are particularly common in the NICU because neonates are a vulnerable group due to their physiological immaturity, rapidly changing weight, and the frequent need for complex calculations to adapt adult drug dosages into minute volumes.[4]

Types of Medication errors in NICU

Errors occurring while prescribing the medicine, such as wrong drug selection, incorrect dose, frequency, or illegible handwriting. In NICU, these errors are common because neonatal doses require precise weight-based calculations. Mistakes made while copying medication orders from one document to another or into electronic records.

This may include incorrect drug name, dose, or timing. Errors occurring in the pharmacy during preparation or supply of medications, such as dispensing the wrong medicine, wrong concentration, or incorrect labeling. Errors that happen while giving the medication to the neonate.[4] Examples include giving the wrong dose, wrong drug, wrong route, or administering at the wrong time. Failure to properly observe and assess the neonate after medication administration.

This may lead to unnoticed adverse drug reactions or ineffective therapy. Administration of a higher or lower dose than prescribed. Even small dose variations can seriously affect neonates due to their low body weight and immature organs. Medication or IV fluids administered too fast or too slow, especially during infusion therapy, causing complications like fluid overload or toxicity. Medication not administered at the prescribed time interval, which may reduce therapeutic effectiveness or increase adverse effects. Failure to administer a scheduled medication dose, either accidentally or due to miscommunication. Incorrect dilution, mixing, or reconstitution of medications before administration, leading to improper drug concentration. Medication administered through an incorrect route, such as giving an IV medication orally or vice versa. Medication administered to the wrong neonate due to patient identification mistakes. Administration of a medication that was not prescribed.[5]

Table 2: Types of Medication errors in NICU.

CATEGORY	ERROR TYPE
Process based stage	Prescribing
	Transcribing
	Dispensing
	Administration
	Monitoring
CATEGORY	**ERROR TYPE**
Dose & Delivery	Wrong dose
	Wrong route
	Wrong time
	Omission
CATEGORY	**ERROR TYPE**
Technical & Methods	Wrong Preparation
	Wrong route
CATEGORY	**ERROR TYPE**
Other critical errors	Wrong patient
	Unauthorized drug

Classification of Medication Errors

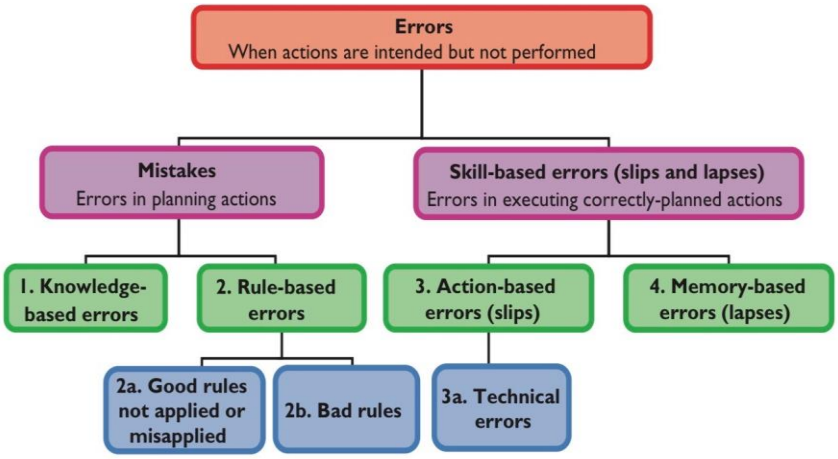

Fig. 1: Classification of med error based on psychological approach.

Factors influenced by medication errors

The primary factors influencing medication errors are categorized into systemic, human, and environmental determinants.Factors Influencing Medication Errors.Medication errors are mainly caused by systemic, human, and environmental factors. These factors affect the safety and accuracy of medication administration in healthcare settings.Healthcare professionals may make medication errors when they do not receive adequate training about drug therapy, dosage calculation, or proper administration techniques.[6] Lack of updated knowledge can increase the risk of mistakes.Inexperienced healthcare workers may have limited understanding of medications, drug interactions, side effects, and safe dosage ranges. This can lead to prescribing or administration errors. Medication errors may occur when healthcare professionals do not have complete information about the patient's medical history, allergies, weight, or current medications. Incomplete patient assessment can affect treatment safety.Some healthcare professionals may underestimate the seriousness of medication-related risks. Poor attention to safety precautions and failure to double-check medications can result in errors.[5]

Table 3: Factors influenced by medication errors.

The factors that are linked to healthcare professionals are:
Insufficient training in therapy
Lack of experience and knowledge of drugs
Limited knowledge of the patient
Insufficient risk perception

Factors influenced by medications errors in NICU

Medication errors in the Neonatal Intensive Care Unit (NICU) are a critical concern because neonates are up to eight times more likely to experience a medication error

compared to adults. The factors involves Physician,Pharmacists & Nurse.[6] Neonates have low birth weight, prematurity, organ immaturity, and rapid changes in body weight and gestational age.[7]

These conditions make drug dosing very complex and increase the risk of medication errors.Complex dose calculations, multiple drug therapy (polypharmacy), similar drug names, and narrow therapeutic index drugs can increase the chances of prescribing and administration errors in NICU patients.Incomplete prescriptions, unclear handwriting, incorrect dose calculations, and failure to verify medication orders may lead to serious medication errors during patient care.[8] Lack of electronic prescribing systems, absence of clinical decision support systems, and dependence on manual documentation can contribute to medication mistakes in NICU settings.Heavy workload, staff shortages, fatigue, stress, and interruptions during medication administration can reduce concentration and increase the possibility of errors.Poor communication between doctors, pharmacists, and nurses during patient transfer or treatment processes may result in incorrect medication administration. Inadequate documentation and lack of coordination also contribute to errors.[9]

Table 4: Factors influenced by medication errors in NICU.

Category of factors	
Patient-Related factors	Low birth weight, prematurity, organ immaturity, variability in weight and gestational age
Medication-Related factors	Complex dosing calculations, multiple drug therapy (polypharmacy), similar drug names, narrow therapeutic index drugs
Task-Related factors	Incomplete prescriptions, unclear handwriting, incorrect dose calculations, failure to verify medication orders
Computerised information system factories	Lack of electronic prescribing systems, absence of clinical decision support, manual documentation errors
Work environmental Factors	High workload, staff shortage, fatigue, stress, interruptions during medication administration
Interprofessional / Communication factors	Poor communication during patient transfer, inadequate documentation, lack of coordination between healthcare providers

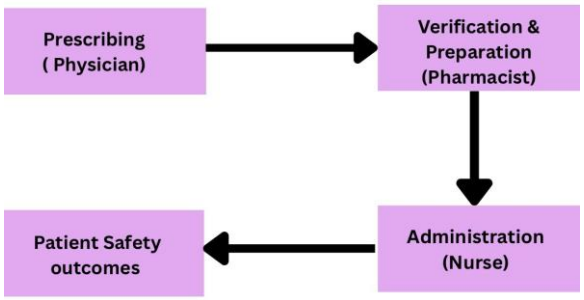

Fig 2: Factors influenced by medication errors in NICU.

Physician-Related Factors

The physician's role is primarily centered on clinical judgment and the initial order. Errors here often stem from the transition of clinical thought to written instructions.

Calculation Errors: In NICU, drug doses are calculated according to the neonate's weight and age. Any mistake in calculation can lead to overdose or underdose, affecting patient safety.

Legibility Issues: Poor handwriting or unclear verbal orders from physicians may create confusion among healthcare professionals and increase the chance of giving the wrong medication or dose.

Lack of Knowledge: Insufficient knowledge about neonatal pharmacotherapy and drug dosing can result in inappropriate prescribing and medication errors.[9]

Table 5: Physician-Related Factors.

Factors	**Key Impact**
Calculation	Dosing based on weight/age
Legibility	Unclear or verbal orders
Knowledge	Lack of neonatal drug expertise

Pharmacist-Related Factors

The pharmacist serves as the critical "checkpoint." Factors here involve the physical preparation of the medication and the oversight of the prescribing physician.

Dilution Errors: Neonatal medicines often require small doses and complex dilution methods. Mistakes during preparation may produce incorrect drug concentrations.

Labelling Errors: Missing, incomplete, or unclear labels on medications can lead to confusion and incorrect drug administration.

Inadequate Monitoring: Failure to properly review prescriptions and monitor medication use may allow prescribing and dispensing errors to go unnoticed.[6]

Table 6: Pharmacist-Related Factors.

FACTORS	**KEY IMPACT**
Dilution	Complex micro-preparation
Labelling	Confusion or missing labels
Monitoring	Lack of prescription auditing

Nurse-Related Factors

Nurses manage the final step of the process. Their factors are often "system-based," influenced by the physical environment and patient volume.

Heavy Workload: High patient load and inadequate staffing can reduce the nurse's attention during medication administration, increasing the risk of errors.

Distractions and Interruptions: Interruptions during medication preparation or administration may cause nurses to forget or administer the wrong dose.

Fatigue: Long working hours and physical stress can decrease concentration, decision-making ability, and accuracy during patient care.[8]

Table 7: Nutse-Related factors.

FACTORS	KEY IMPACT
Workload	High nurse-to-infant ratios
Distraction	Interruption during bedside care
Fatigue	Long shifts and physical stress

AIM

To evaluate the factors influencing medication errors in NICU in prospective observational study methods.

OBJECTIVE

1. To analyse the incidence of medication errors in the Neonatal Intensive Care Unit (NICU).
2. To categorize the types of medication errors present in the NICU.
3. To identify the factors influencing medication errors, including patient-related, drug-related, healthcare provider–related, and system-related factors.

MATERIALS AND METHODS

Study design

This is a study that was conducted in India between August 2025 to February 2026. The research was designed as a prospective observational study to identify and characterize the specific factors contributing to medication errors in a high-stakes clinical environment.

Study setting and population

The study population included physicians who prescribed medications, pharmacists who prepared or dispensed them, and nurses who administered them. We looked at the prescriptions found in all patient files from the hospital records department.Admitting neonates to the NICU increases their risk of medication errors. This vulnerability stems from the high volume of medications and essential, life-saving procedures required for their care.Although health care professionals are professionally accountable for the safe proscribing, dispensing and administration of drugs, medication errors continue to be a significant and recurring issue in NICU.

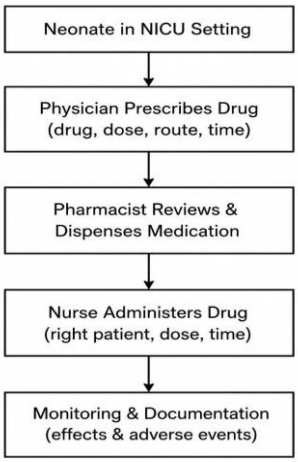

Fig 3: Study settings and population in NICU.

Data collection tools and Instruments

We designed a questionnaire to assess medication safety and error rates in the NICU.Medication errors occur most frequently during the prescribing, dispensing, administration, and monitoring stages.This review examines the definition of medication errors and explores their underlying causes. These factors are identified based on documented error reports.

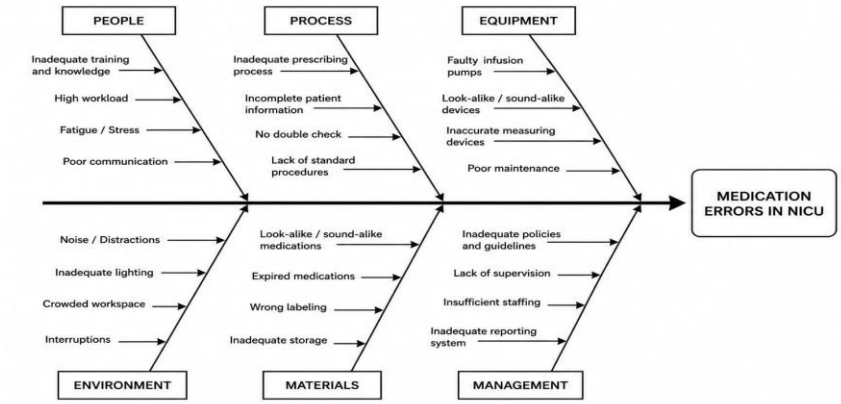

Fig 4: Data collection tools and Instruments.

Data analysis and procedural methodology

Medication errors were identified in the NICU, where out of 150 prescriptions analyzed, 55 prescriptions were found to have errors, indicating a high occurrence of medication errors. A total of 150 prescriptions were analyzed, and 55(36.7%) errors were detected. The error rate was found to be 0.5 (19/38) and 0.29 (11/38) per patient. This study underscores the need for targeted interventions, such as improved dosing protocols, training for less experienced staffs and strategies. The definition used should facilitate interpretation and comparison of a wide range of research reports.

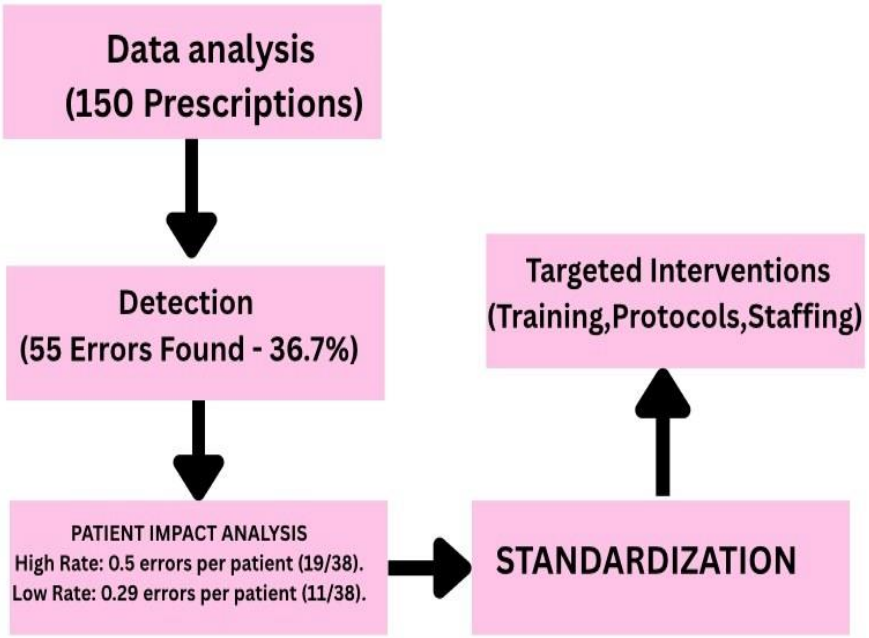

Fig 5: Data analysis and procedural methodology.

RESULTS AND DISCUSSION

The prospective observational study, conducted between August 2025 and February 2026, yielded comprehensive data regarding medication errors (MEs) within the neonatal setting.

Incidence and prevalence of medications errors

Table 8: Incidence and prevalence of medication errors.

PARAMETER	VALUE
TOTAL PRESCRIPTION ANALYZED	150
TOTAL ERROR IDENTIFIED	55
OVERALL ERROR RATE	36.7%
INCIDENCE RATE (Per 1000 hospital days)	22
INCIDENCE RATE (Per 100 Patients)	110
SERIOUS REPERCUSSIONS RATE (Per 1000 days)	1.2

A total of 150 prescriptions were analyzed in the NICU, among which 55 medication errors were identified, resulting in an overall error rate of 36.7%, indicating a high occurrence of medication errors. The incidence rate was calculated as 22 per 1000 hospital days and 110 per 100 patients. The rate of serious medication errors was found to be 1.2 per 1000 hospital days. These incidence rates were derived based on 2500 hospital days, 50 patients, and 3 serious medication errors. The findings highlight the need for targeted interventions such as improved dosing protocols, training for less experienced staff, and implementation of effective medication safety strategies.

Categorization of Errors

The errors were classified according to the phase of the medication-use process:

- Prescribing Errors: These were the most frequent, accounting for 50.9% (28 cases) of all reported incidents.
- Medication Preparation Errors: Represented 27.3% (15 cases) of the findings, highlighting risksduring drug reconstitution or dilution.
- Dispensing Errors: Accounted for 18.2% (9 cases) of the total errors.
- Administration Errors: Administration errors accounted for 5.5% of the total medication errors identified.

Distribution of different kinds of medication errors at NICU

Table 9: Distributions of different kinds of medications errors in NICU.

Most medication error occurs at which stage of the medication process	Frequencies	Percentage
Prescribing error	28	50.9%
Medication preparation errors	15	27.3%
Dispensing errors	9	16.4%
Administration errors	3	5.5%

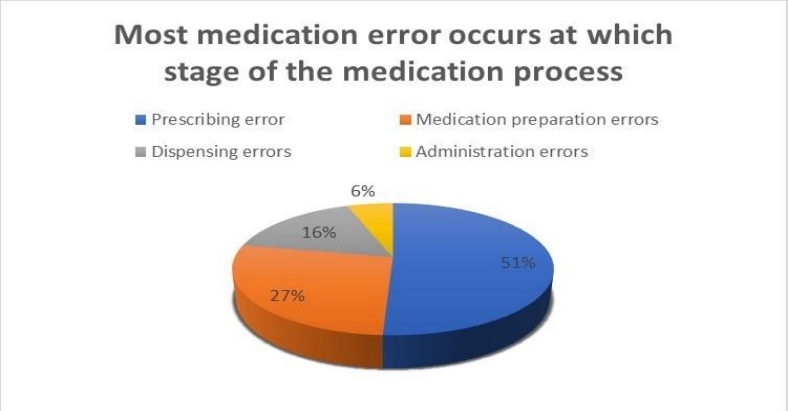

Fig 6: Medication errors.

Among the 55 medication errors identified in the NICU, prescribing errors were the most common category, accounting for 28 cases (50.9%). Within prescribing errors, wrong dose calculation was the most frequently observed type, contributing to 10 cases (18.2%), followed by incorrect frequency and illegible handwriting with 5 cases each (9.1%). Wrong drug selection accounted for 4 cases (7.3%), while wrong route prescribed and failure to consider allergies or drug interactions each contributed to 2 cases (3.6%). These errors mainly occurred due to the complexity of neonatal dose calculations and incomplete prescription review.Medication preparation errors accounted for 15 cases (27.3%). Among these, incorrect dilution was the most common preparation-related error, observed in 6 cases (10.9%).

Wrong drug concentration contributed to 4 cases (7.3%), while improper reconstitution accounted for 3 cases (5.5%).

Labeling mistakes during preparation were identified in 2 cases (3.6%). These errors occurred mainly because neonatal medications require precise dilution and preparation techniques.Dispensing errors represented 9 cases (16.4%) of the total medication errors. Wrong medication dispensing was the most common dispensing error, accounting for 3 cases (5.5%). Incorrect labeling and wrong strength dispensing contributed to 2 cases each (3.6%). Incorrect quantity supplied and dispensing of expired medication each accounted for 1 case (1.8%). These errors were associated with pharmacy handling and labeling problems.Administration errors were the least common category, accounting for 3 cases (5.5%). Wrong time administration, omission of dose, and wrong route administration each contributed to 1 case (1.8%). These errors mainly occurred due to workload, interruptions, and communication gaps during medication administration in the NICU.

The sub classification of medication errors on NICU medication error

Table 10: Prescribing errors on NICU medication errors.

Medication Error category	Types of error	Frequency (n=28)	Percentage
Prescribing errors	Wrong dose calculation	10	35.71%
	Incorrect frequency	5	17.86%
	Wrong drug selection	4	14.29%
	Illegible handwriting	5	17.86%
	Wrong route prescribed	2	7.14%
	Allergy/drug interaction overlooked	2	7.14%
	Subtotal	28	100%

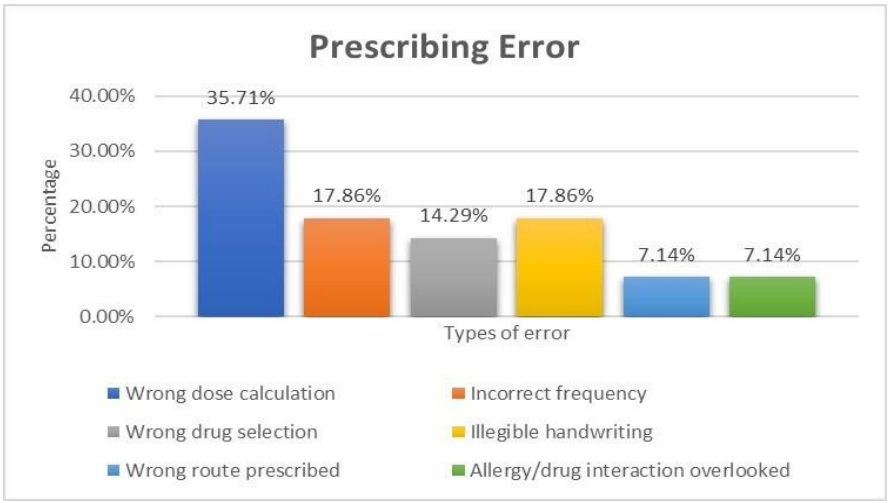

Fig 7: Prescribing errors on NICU medication errors.

Among the 28 prescribing errors identified, wrong dose calculation was the most common error accounting for 35.71% (n=10), followed by incorrect frequency and illegible handwriting, each contributing 17.86% (n=5). Wrong drug selection accounted for 14.29% (n=4), while wrong route prescribed and allergy/drug interaction overlooked each represented 7.14% (n=2) of the total prescribing errors. Overall, these errors constituted 100% (n=28) of the prescribing error category.

Table 11: Medication preparation errors on NICU medications errors.

ɛdication Error category	Types of error	Frequency (n=15)	Percentage
Medication preparation errors	Incorrect dilution	6	40%
	Wrong drug concentration	4	33.3%
	Improper reconstitution	3	26.6%
	Lebeling mistake during preparation	2	13.3%
	Subtotal	15	100%

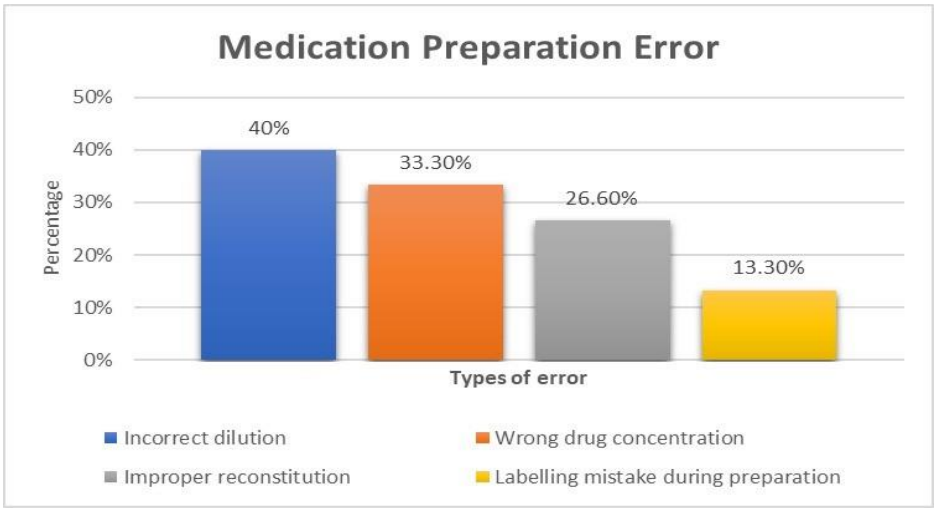

Fig 8: Medication preparation errors.

Medication preparation errors identified in the NICU. A total of 15 preparation errors were reported. Among these, incorrect dilution was the most frequently observed error, accounting for 6 cases (40%). This was followed by wrong drug concentration, which occurred in 4 cases (33.3%). Improper reconstitution was reported in 3 cases (26.6%), while labeling mistakes during preparation were observed in 2 cases (13.3%). The findings indicate that errors related to medication dilution and concentration were the most common preparation-related issues, emphasizing the need for careful adherence to preparation protocols and verification procedures to ensure medication safety in neonatal patients.

Table 12: Dispensing errors on NICU medication errors.

Medication Error category	Types of error	Frequency (n=9)	Percentage
Dispensing errors	Wrong medication dispensed	3	33.3%
	Incorrect labeling	2	22.2%
	Wrong strength dispensed	2	22.2%
	Incorrect quantity supplied	1	11.1%
	Expired medication supplied	1	11.1%
	Subtotal	9	100%

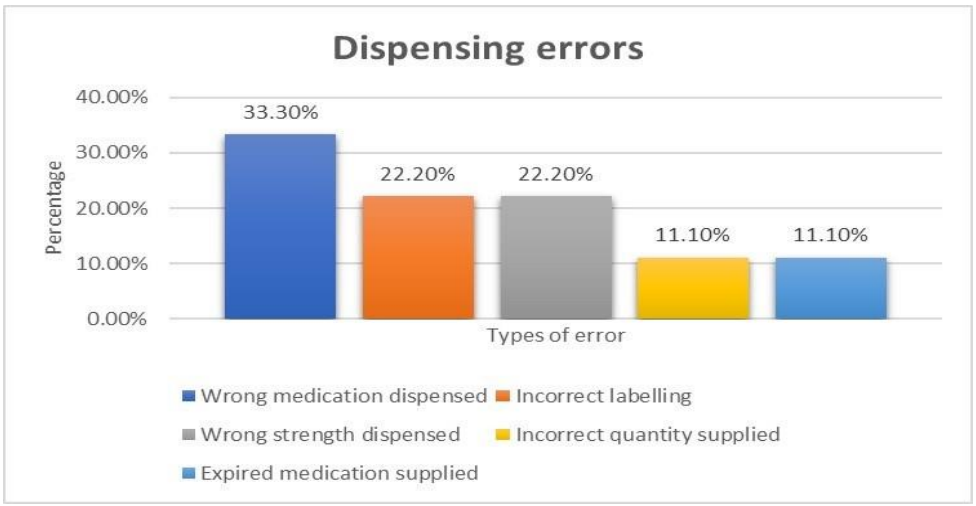

Fig 9: Dispensing errors.

Dispensing errors identified in the NICU, with a total of 9 dispensing errors recorded. Wrong medication dispensed was the most common dispensing error, accounting for 3 cases (33.3%). Incorrect labeling and wrong strength dispensed were each reported in 2 cases (22.2%). In addition, incorrect quantity supplied and expired medication supplied were observed in 1 case each (11.1%). These results suggest that medication selection and labeling errors were significant contributors to dispensing-related incidents, highlighting the importance of pharmacist review, accurate labeling, and strict dispensing practices to minimize medication errors in the NICU setting.

Table 13: Administration Errors on NICU medication errors.

dication Error category	Types of error	Frequency (n=3)	Percentage
Administration errors	Wrong time administration	1	33.3%
	Omission of dose	1	33.3%
	Wrong route administration	1	33.3%
	Subtotal	3	100%

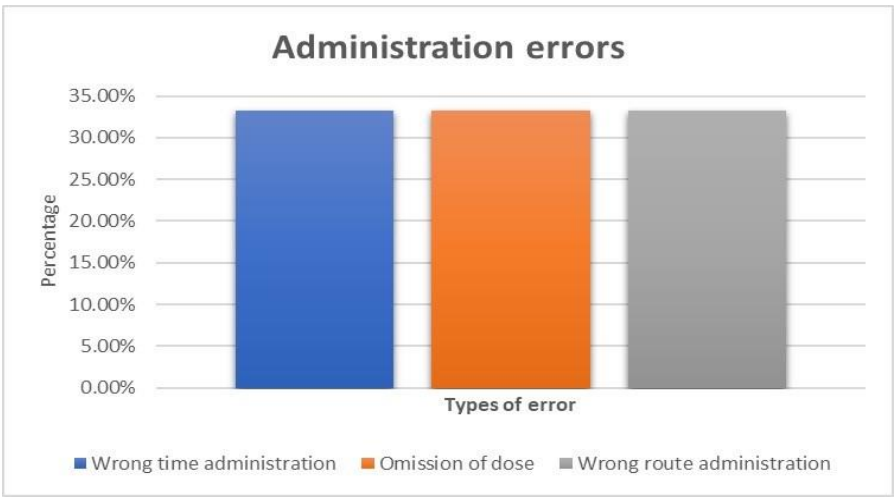

Fig 10: Administration errors.

Administration errors reported in the NICU. A total of 3 administration errors were identified. Wrong time administration, omission of dose, and wrong route administration each occurred once, representing 33.3% of the administration errors. Since all three error types occurred with equal frequency, no single administration error predominated. These findings emphasize the importance of following the prescribed medication schedule, ensuring all doses are administered, and verifying the correct route of administration to enhance medication safety and improve patient outcomes in neonatal intensive care units.

Demographic and general characteristics of the study population

Table 14: Demographic and general characteristics of the study populations.

Demographic variables	Frequency in entire sample(%) n=150	Frequency in ME- affected neonates (%), n=59
Gender		
Male	85(56.7%)	30(54.5%)
Female	65(43.3%)	25(45.5%)
Size of GA		
Small for GA	25(16.7%)	10(18.2%)
Appropriate for GA	115(76.7%)	40(70.7%)
Large for GA	10(6.6%)	5(9.1%)
Birth weight		
<2.5	60(40.0%)	25(45.5%)
2.5-3.99	85(56.7%)	28(50.9%)
>4.0	5(3.3%)	2(3.6%)
Duration of stay		
1-7	90(60.0%)	15(27.3%)
8-21	50(33.3%)	30(54.5%)
>21	10(6.7%)	10(18.2%)
Total no of drugs prescribed per baby		
1-5	55(36.7%)	15(27.3%)
>5	95(63.3%)	40(72.7%)

GA=Gestational age, ME=Medication Error

A total of 150 prescriptions were analyzed in the present study, among which 55 medication errors were identified. With respect to gender distribution, 56.7% were males and 43.3% were females. Among the medication error–affected group, 54.5% were males and 45.5% were females.Based on size for gestational age, the majority of neonates (76.7%) were appropriate for gestational age, followed by 16.7% who were small for gestational age and 6.6% who were large for gestational age. Among those with medication errors, 72.7% were appropriate for gestational age, 18.2% were small for gestational age, and 9.1% were large for gestational age.Regarding birth weight, 40.0% of neonates had a birth weight of less than 2.5 kg, 56.7% had a birth weight between 2.5–3.99 kg, and 3.3% had a birth weight greater than 4.0 kg.

Among the medication error–affected group, 45.5% weighed less than 2.5 kg, 50.9% weighed between 2.5–3.99 kg, and 3.6% weighed more than 4.0 kg.In terms of duration of hospital stay, 60.0% of neonates stayed for 1–7 days, 33.3% stayed for 8–21 days, and 6.7% had a stay longer than 21 days. Among those with medication errors, 27.3% stayed for 1–7 days, 54.5% stayed for 8–21 days, and 18.2% stayed for more than 21 days.With regard to the total number of drugs prescribed per prescription, 36.7% received 1–5 drugs, while 63.3% received more than five drugs. Among the medication error–affected group, 27.3% received 1–5 drugs and 72.7% received more than five drugs.

Determinants of medication errors in Neonatal intensive care unit

Table 15: Determinants of medication errors in NICU.

Variable	Univariate analysis	Multivariate analysis*
	Unadjusted	Adjusted
Gender	0.91	-
Birth weight	1.26	1.05(0.50-1.90)
Inborn/Outborn	1.80	2.10(0.98-4.30)
Duration of stay(>7 days)	3.17	2.80(1.50-5.20)
Polypharmacy(>5 drugs/ prescription	3.30	2.90(1.50-5.60)

The determinants of medication errors were analyzed using multivariate analysis among 150 prescriptions. Prolonged duration of hospital stay (>7 days) and polypharmacy (>5 drugs per prescription) were identified as significant predictors of medication errors. Neonates with a hospital stay longer than 7 days had higher odds of experiencing medication errors (adjusted OR: 2.80). Similarly, prescriptions involving more than five drugs were associated with increased odds of medication errors (adjusted OR: 2.90). In addition, outborn neonates showed higher odds of medication errors compared to inborn neonates (adjusted OR: 2.10). However, variables such as gender and birth weight did not show a significant association with medication errors.

The Role of Clinical Pharmacy

One of the most actionable insights from this research is the potential for clinical pharmacy services to act as a safeguard. The integration of pharmacists into the NICU multidisciplinary team has been shown to effectively reduce medication errors. By reviewing prescriptions for dosing accuracy and checking against established protocols, clinical pharmacists can intervene before the error reaches the patient.

Limitations and Future Directions

While this study provides a robust snapshot of ME incidence and contributing factors, it is important to acknowledge that the cross-sectional survey design captures a specific timeframe. Future longitudinal research is required to evaluate the long-term efficacy of interventions such as the introduction of smart infusion pumps and specialized training for junior staff. Furthermore, shifting toward a culture of safety where errors are viewed as learning opportunities rather than punitive events is paramount to improving neonatal outcomes.

CONCLUSION

This study demonstrates a high incidence of medication errors (36.7%) in the NICU, with prescribing errors being the most frequent.Key contributing factors include polypharmacy, prolonged hospital stay, complex dosing calculations, and healthcare provider–related limitations.The findings highlight that neonates are particularly vulnerable due to physiological immaturity and the need for precise drug dosing.System-related issues such as workload, communication gaps, and lack of technological support further increase error risk.Strengthening clinical pharmacy services, staff training, and standardized protocols can significantly reduce medication errors. Overall, a multidisciplinary and system-focused approach is essential to improve medication safety and neonatal outcomes.

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