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ORIGINAL RESEARCH

Nurses and Midwives Mistakes and Errors in Pediatric Health Outcomes in Southwestern Uganda

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Background: According to the World Health Organization, nearly 1 in 10 patients suffer harm during healthcare, resulting in over 3 million deaths in low- and middle-income countries. Alarmingly, more than half of these incidents are preventable, with medication errors being the primary cause. Children are particularly vulnerable to these errors and other adverse patient events. Therefore, this study explored nurses and midwives' mistakes and errors in paediatric health outcomes in southwestern Uganda.

Methods: We adopted a phenomenological qualitative research design. Purposive and consecutive sampling methods were used to recruit nurses and midwives who had served in their respective units for at least six months and were willing to participate and signed a written informed consent form. Data collection was done using a semi-structured interview guide. All interviews were face-to-face and audio-recorded upon participants' consent. Thematic analysis was used to generate the themes.

Results: The study revealed four themes that emerged from participants' perceptions regarding the reasons for pediatric medication errors namely; work flow and work environment, work overload, limited resources and training and education need. Regarding participants' experience of pediatric medication errors, omission and commission errors was quoted and three themes emerged from interventions to medication errors, namely; sticking to rights of drug administration, education and training, and resources.

Conclusion: Results of this study indicate that although nurses demonstrated positive perceptions of strategies to improve pediatric medication safety, medication errors remain a serious challenge requiring close supervision. The primary problem identified as quoted verbatim by the participants is "…overcrowding of babies in limited clinical spaces", which created a high-risk environment for errors. The findings highlight the urgent need to incorporate the voices of nurses into policy, education, and training initiatives. Such inclusion will contribute to the development of robust healthcare systems and more effective strategies to enhance pediatric medication safety.

Plain Language Summary:

- Nurses work in overcrowded paediatric units, which compromises nurse practice environment and makes it difficult to provide safe and timely care.
- Nurses feel overwhelmed by the high number of children under their care, which leads to heavy workloads and burnout.
- Nurses lack essential resources, such as key paediatric supplies, medications, and equipment, which makes it difficult to deliver quality care to children.
- Most Nurses reported to be experiencing omission and commission errors such as missing doses, giving the wrong amount, not following the schedule, and failing to document properly.
- Nurses believe that improving drug safety means sticking to the "rights" of drug administration and training, regular supervision, and having enough resources would alleviate the drug medication errors in children.

Keywords: medication errors, pediatrics, experiences, perceptions

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Introduction

A medication error is considered as any avoidable incident that may contribute to or result in the improper use of medication.[1] The likelihood of medication errors is higher among pediatric patients, with potential adverse drug effects being three times more prevalent in this population compared to adults.[2] Pediatric dosages are often determined on an individual basis, taking into account the patient's age, weight, and body surface area in addition to their specific clinical circumstances.[3] This implies that every medication dosage is different, making them more susceptible to errors such as a missed decimal point causing a tenfold dosing error.[4]

Medication errors are a leading cause of various injuries and preventable harm in the healthcare system worldwide, accounting for approximately 10% of the overall avoidable harm experienced by hospitalized patient.[5,6] According to a report from the United Kingdom in 2018, it was estimated that approximately 237 million medication errors occurred throughout the entire process of administering medications in all age categories. The report focused on assessing the prevalence and impact of these errors.[7,8]

Individuals residing in low-income countries encounter double the number of healthy years lost due to disability resulting from medication errors compared to individuals residing in high-income countries.[9] The analysis of data on medication errors in Africa revealed that medication errors were present in approximately 13% to 76% of prescriptions for general patients.[9]

Despite numerous efforts to mitigate medication errors in pediatric settings, identifying sustainable and effective solutions for administration errors remains challenging and not readily apparent; For example, World Health Organization as a global institution has tried to address this issue by introducing a standard procedure commonly referred to as the "six rights" of medication (right patient, right drug, right dose, right route, right time, and right documentation).[10]

However, the six rights strategy has not reduced medication errors by half by 2022;[11] and the reason this strategy has not been achieved could be attributed to inadequate implementation and enforcement of the strategy, varying healthcare system capabilities globally, insufficient training and education on medication safety, and complexity of healthcare workflows.[12] Secondly, the current World Health Organization (WHO) drug administration strategies, such as "six rights" necessitate further modification and expansion to address paediatric specific challenges. Efforts to decrease medication errors should encompass a more comprehensive approach, incorporating an examination of organizational systems and procedures that promote safe administration practices.[13] Additionally, it is crucial to involve key stakeholders, including nurses, in these strategies in order to prevent pediatric medication errors.[14] The Government of Uganda, through the Ministry of Health, has already proposed a comprehensive, multi-level strategy to address this crisis. This includes the development of national policies for error reporting and the implementation of patient safety frameworks, among other initiatives.[15]

Henceforth, this study aimed at exploring the nurses and midwives' mistakes and errors in paediatric health outcomes in southwestern Uganda.

Methods and Materials

Study Design

We adopted a phenomenological qualitative research design. Given the sensitivity of the topic and potential legal implications, we opted for in-depth interviews over focus group discussions to obtain rich, detailed insights into nurses and midwives experiences and perceptions concerning pediatric medication errors.

Conceptual Framework

This study was guided by the Kalisch's missed nursing care conceptual model (2006),[16] as shown in Figure 1. Missed nursing care is a concept which was originally identified by Kalisch et al to describe implicit rationing of nursing care in general hospital units from the perspective of nurses in direct patient care.[17]

In the context of this work, Kalisch's model has been used to study the relationship between medication errors and the concepts of this theory such as the structure, processes and outcomes and the medication error. The framework is built on

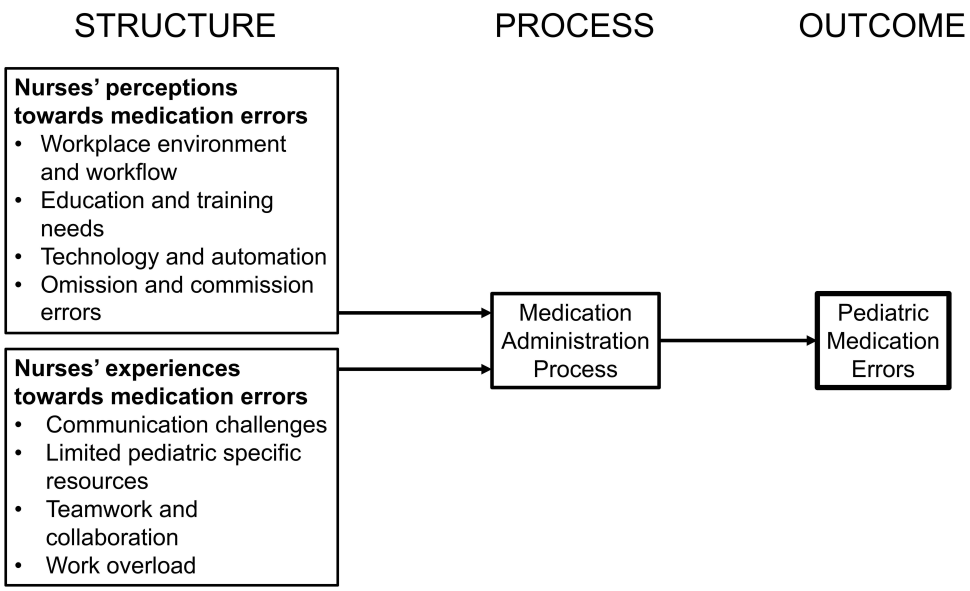


Figure 1 Conceptual Frame work. Adapted from Kalisch's Missed Nursing Care Model (2006).

an assumption that if appropriate structures are in place and there is effective teamwork and communication, adequate staffing levels, pediatric specific resources are available, the workplace environment is supportive, nursing staff are well trained, pediatric medication errors are not likely to occur. The missed nursing care model relates to patient safety and the overall quality of care, with nurses spending up to 40% of their time on drug administration.[18]

Kalisch et al in 2006 published a conceptual model that encompasses three systems, structures, processes and the outcomes. The antecedents or structure is represented by nurses' experiences and perceptions; the process is represented by the act of drug administration; the outcome medication errors.

Study Setting and Participant Recruitment Method

The study was conducted in the department of Paediatrics at Mbarara Regional Referral Hospital, a government-owned and teaching hospital affiliated to the Medical School of Mbarara University of Science and Technology. The hospital is located in Mbarara City, South western Uganda.

The Paediatrics department comprises six sub-units: the Admission Unit, Neonatal Intensive Care Unit (NICU), High Dependency and Critical Care Unit, Nutrition Unit (Tooto Ward), Acute Care Unit, and the Oncology Unit. The department is staffed by 26 permanent nurses employed by the Ministry of Health under the Ministry of Public Service. The sampling frame included all nurses working in the above-mentioned sub-units. The inclusion criteria consisted of nurses and midwives who had served in their respective units for at least six months and were willing to participate and sign a written informed consent form. The six month minimum experience requirement aligns with the Uganda Public Service guidelines for confirmation in service.[19] This is further supported by Patricia Benner's model, which indicates that nurses with at least six months of experience begin to demonstrate an advanced skill set and are capable of performing at basic levels of clinical competence.[20]

These nurses were considered to have gained sufficient experience in neonatal and pediatric drug administration and had encountered adequate experiences regarding pediatric medication safety and medication errors. Nurses who were on a study leave, working on research projects or serving as volunteers were excluded from the study.

Data Collection Tool

A semi-structured, in-depth interview guide was designed by the research team, drawing on insights from prior literature relevant to the study topic. To ensure the tool's content validity, the draft interview guide was shared via Email with

a panel of five subject matter experts: three pediatric nurses, a pharmacist with over five years of experience in drug dispensing, and a qualitative research specialist affiliated with Mbarara University of Science and Technology (MUST).

The experts were requested to evaluate each item using a three-point rating scale: "relevant and essential," "relevant but not essential," and "not relevant." They were also invited to suggest improvements regarding the clarity and appropriateness of the language used. Lawshe's method was applied to quantitatively assess the content validity of the guide.[21] Feedback revealed that all items were unanimously considered essential and relevant. Minor language adjustments were suggested by three reviewers, and an additional question item was proposed by one expert. Based on this input, the guide was revised accordingly. The final version of the interview guide received full consensus from all panel members regarding the clarity, relevance, and appropriateness of all included items.

Participant Recruitment and Data Collection

The study targeted all 26 nurses and midwives working across various pediatric units. Participants were selected using both convenience and purposive sampling techniques to ensure accessibility and relevance to the study objectives. In order to initiate the recruitment process, the principal investigator visited the paediatric ward, obtained permission from the unit in-charge, and briefed the entire nursing staff during a morning clinical meeting. During this session, the researcher explained the purpose, objectives, and ethical considerations of the study. Participants who met the inclusion criteria and willingly signed a written informed consent form were considered eligible for participation.

Interviews were conducted in a private room within the ward and were provided by the ward in-charge, ensuring a quiet and confidential environment. Only those with adequate time availability were scheduled for interviews to minimize disruption to their clinical duties. The interviews were conducted at convenient, non-working hours to allow participants to freely express their experiences without workplace pressure.

A semi-structured interview guide was used to direct the discussion. With prior permission, an audio recorder was used to capture responses for each interview that lasted approximately 45 minutes to one hour. To maintain rigor and enhance the credibility of the data, one research assistant assisted in note taking and captured the key non-verbal cues, documented participants' narratives and perceptions through bracketing, allowing for reflexivity and reducing interviewer bias. Data collection continued until data saturation was reached at the twelfth interview, at which point no new themes or insights emerged from subsequent participants. The key questions asked during the interviews were attached in supplementary material file 1.

Ethical Approval of the Study

Ethical approval for this study was obtained through a multi-level process. Initial clearance was granted by faculty members in the Department of Nursing at Mbarara University of Science and Technology (MUST). The study then received approval from the Faculty Research Committee (FRC) of MUST and an ethical clearance letter was issued by Mbarara University Research Ethics Committee (MUST-REC), under REC number: MUST-2024-1516. Subsequently, administrative permission to conduct the study at the selected site was obtained from the Hospital Director of Mbarara Regional Referral Hospital (MRRH).

Informed Consent

Each study participant was informed of the purpose, benefits and risks of the study and consented voluntarily before including them in the study and by signing a separate consent form they agreed to be audio recorded for the purposes of research study. Written informed consent was obtained from all participants and explicitly included permission for the publication of anonymized responses and direct quotations. Participants were assured that the study is voluntary and that they are free to withdraw at any time they wished without affecting their relationship with the investigator.

Privacy and Confidentiality

Privacy of the participants was observed throughout the data collection. The interviews were conducted by the researchers in designated room in the hospital which is free from noise and interruptions. After briefing participants during a morning clinical meeting on the paediatric ward, those who agreed to participate in the study and met the

eligibility criteria signed informed consent forms for both study participation and audio recording prior to the interviews. To safeguard confidentiality and privacy, only anonymized responses and direct quotes are included in the transcripts. Participant identities were kept strictly confidential, and all recordings were securely stored on a password-protected personal computer.

Data Analysis

Thematic analysis by Braun and Clarke[22] was employed, utilizing a six-phase approach for thematic analysis. These steps include: reading and re-reading the translated transcripts, generating codes, searching for themes, assessing themes, defining and labelling themes, and finally writing the results. Further information is available in supplementary material file 2.

As guided by Sibbald et al[23] the omissions of the researcher and research team were carefully considered throughout the study. We reflected on our own backgrounds, experiences, and potential biases, and how these might shape interactions with participants, data collection, and interpretation of findings. Regular discussions within the research team were conducted to examine contradictory perspectives. These reflexive practices helped ensure that our analysis remained as transparent and balanced as possible.

Rigor and Reflexivity

Research rigor was achieved by ensuring credibility, dependability, conformability and transferability according to Groenland and Dana, 2020.[24]

Credibility

To ensure achievement of this goal, prolonged engagement was implemented by allocating sufficient time during interviews and adhering to the established inclusion criteria. Each interview session lasted between 45 minutes to one hour, allowing participants to develop confidence and trust in the researcher, as well as providing ample time to thoroughly discuss their experiences and perceptions regarding pediatric medication safety and medication errors.

Transferability

This objective was accomplished by employing a thick description approach, which entails the researcher providing a detailed portrait of the research setting and/or participants. The goal was to provide readers with sufficient information to assess the relevance and applicability of the findings to different settings.

Dependability

This was accomplished through a pilot study aimed at identifying and addressing potential challenges associated with the data collection instruments. In addition, a panel of five subject matter experts reviewed the tool's content and validated it for use in the pretest phase.

Confirmability

It was achieved by including narrative quotes into the final research findings.

Results

Table 1 shows that the majority of nurses involved in pediatric care have limited or no formal training in medication safety offered to staff at Mbarara regional referral hospital as part of their in-service training, with only 3 out of 12 reporting such a training. Despite varying years of experience (3–16 years), even higher-cadre professionals such as bachelor's and master's degree holders lack specific medication safety training, indicating a critical gap that may contribute to pediatric medication errors.

Participants' Perceptions About the Causes of Medication Errors

The study revealed four themes that emerged from participants' perceptions of causes of medication errors in children as shown by Table 2.

Table 1 Demographic Characteristics of Participants

Cadre	Number	Prior Training in Medication	Working Experience
Certificate nurses	3	1	3–6 years
Certificate midwives	1	1	6 years
Diploma in Midwifery	2	0	3–6 years
Diploma in Nursing	4	1	3–16 years
Bachelor in Nursing Science	1	0	6 years
Master in Nursing Science	1	0	4 years

Table 2 Participants' Perceptions Regarding Reasons for Pediatric Medication Errors

Themes	Subthemes
Work place environment and work flow	• Overcrowding • Lack of enough storage space for emergency drugs
Work overload	• Overwhelming number of patients • Understaffing
Limited resources	• Limited supplies • Drug stock outs • Limited pediatric specific resources
Education and training needs	• Lack of training prior to working in pediatric ward • Knowledge gap

Theme One: Workplace Environment and Work Flow

This theme emerged from two subthemes, overcrowding and lack of enough storage space for emergency drugs.

Subtheme One: Overcrowding

Participants perceived that overcrowding on the ward by the patients was one of the causes of pediatric medication errors.

> "… There is overcrowding of babies in a limited space….". The environment is too small compared to the number of babies that we admit, so you find the place is squeezed but you have over seventy babies in the same place and this can contribute to medication errors (p.12)

Subtheme Two: Lack of Enough Storage Space for Emergency Medication

Participants perceived that one of the causes of pediatric medication errors was lack of storage space for emergency drugs.

> …. we would have different storages for different drugs according to what they treat. And emergency drugs stored in one place like a crush cart for example when I want adrenaline, it is not aminophylline that is close to me or it is not diazepam that is close to me. So you are sure that my emergency drugs are this side and so the other drugs for continuous treatment are also the other side…so lack of clear storage space for emergency drugs causes medication errors during emergencies (p.11)

Theme Two: Work Overload

This theme emerged from two subthemes; overwhelming number of patients and understaffing.

Subtheme One: Overwhelming Number of Patients

Participants also believed that the cause of pediatric medication errors was overwhelming number of patients.

> …the drugs are supposed to be prepared the time you are going to give, but may be due to high numbers, one person is taking care of many patients, so you end up preparing all the drugs at once…., you can end up taking a different drug at a different time, I mean administering a wrong drug, especially because the numbers are very many, workload is really high and all the drugs are in one place, you will end up holding a different drug not the one you are supposed to give at that particular time…. (p.11)

Subtheme Two: Understaffing

Participants also perceived that under staffing was among the causes of pediatric medication errors

> …here you find you are one nurse working on 60 patients, and humanly you become tired, you find the treatment that was meant for patient A is given to patient B. At times there is none to ask when you are confused or when you want clarification most especially at night…. (p.8)

Theme Three: Limited Resources

This theme emerged from three subthemes: namely, limited supplies, drug stock outs and lack of pediatric specific resources.

Subtheme One: Limited Supplies

Participants also believed that limited supplies on wards contribute to medication errors.

> …sundries are usually a problem. You find yourself in a situation where you don't have syringes, no gloves, no sterile water for injection and when caretakers don't afford to buy them, their children end up missing medication…… (p.6)

Subtheme Two: Drug Stock Out

Participants also perceived that one of the causes of medication errors was stock out of drugs. This contributed to omission and end errors of commission.

> …….some patients do miss drugs because they are not available. For instance, you find when you are to give Ampicillin to this patient and it is out of stock, so that patient misses the dose. You have to wait until the caretaker buys the drug so that you administer, and you end up giving it in a wrong hour… (p.6)

Subtheme Three: Limited Pediatric Specific Resources

Participants believed the lack of pediatric specific resources like pediatric protocols contribute to medication errors in children.

> …the nurses rarely utilize resources on the ward, like BNF for Children, like on neonatal unit, yes we have protocols like when you are stuck and want clarity you can use them. However, they are not enough…. (p.9)

Theme Four: Education and Training Needs

This theme emerged from three subthemes, namely: lack of training prior to working in pediatric ward, lack of supervision and knowledge difference in cadres.

Subtheme One: Lack of Training Prior to Working in Pediatric Ward

Participants also believed among the causes of pediatric medication errors was lack of training prior to working in pediatric ward.

…. new staffs should always get oriented if possible trained prior to working in pediatric ward about drug administration in children to avoid these errors, orient them at the beginning how to administer these drugs, how to give these dosages. So that training is always needed…. (p.1)

Subtheme Two: Knowledge Gap

Participants believed that knowledge gap in different levels of nursing cadres contributed to causing pediatric medication errors.

……Knowledge, some people are lacking the appropriate knowledge, we have enrolled nurses, nursing assistants and all these people are giving treatment, we have bachelor nurses, interns, students so part of the causes of errors are the different levels of knowledge in the cadres because not all them will be exposed to these drugs and if they are, may not know the consequences or side effects of all…. (p.9)

Participants' Experiences Regarding Pediatric Medication Errors

The study revealed one theme that emerged from what the participants experienced as the reason for medication errors as shown by Table 3.

Theme: Omission and Commission Errors

This theme emerged from four subthemes namely wrong timing, wrong reconstitution, overdose and too fast administration, and poor documentation.

Subtheme One: Wrong Timing and Missing Treatment

Participants experienced errors of commission and omission for example, wrong timing of drug administration and missing treatment mainly because of very many patients, understaffing and stock out of drugs and sundries as noted below.

…. when I am on duty and the ward is full of many patients, I usually start treatment early, earlier than the scheduled time to finish early and I realize in so doing I am violating the rights of drug administration by giving treatment in the wrong timing. But I have nothing to do about it, the workload is much…. (p.5)

Subtheme Two: Wrong Reconstitution

Wrong reconstitution was also experienced by some participants because of gap in the knowledge and lack of orientation and supervision by the senior nurses on ward as noted below.

…. another one was about meropenem. Meropenem in our neonatal unit, if it is 1 gram, we reconstitute it with 20mls of sterile water for injection and we usually target reconstitution of 50mg/mL, because some people are used to put 10mls like in ceftriaxone, someone got 10lms and put in 1gram, meanwhile, they did not label until we inquired about how they reconstituted and we found out. Already some babies had gotten much actually double the dose they were supposed to receive… (p.9)

Subtheme Three: Overdose and Too Fast Administration

Participants experienced errors of commission as in overdose and fast administration of drugs as causes of pediatric medication errors as noted below

Table 3 Participants' Experiences Regarding Pediatric Medication Errors

Theme	Subthemes
Omission and commission errors	• Wrong timing and missing treatment • Wrong reconstitution • Overdose and too fast administration • Poor documentation

….One experience I had was giving phenobarbitone IV so fast, baby was a very small preterm who had convulsions at that time, the drug was given too fast and the baby stopped breathing immediately, called for help, tried to resuscitate but the baby didn't pick, we lost the baby. (p.10)

Subtheme Four: Poor Documentation and Failure to Document

Participants also experienced poor documentation among the nursing staffs as noted below.

…. some nurses have a habit of let say sitting before mid-night and withdraw drugs and put them in patient's files as you come in the morning, you find treatment chart signed and yet the drugs were not given… (p.7)

Participants Perceptions About the Interventions to Medication Errors

The study revealed three themes that emerged from the perceptions regarding the intervention to pediatric medication errors as shown by Table 4.

Theme One: Sticking to Rights of Drug Administration

This theme emerged from three subthemes, namely; calculating the right dose, reading the patient's file, and double checking.

Subtheme One: Calculating the Right Dose, Right Route, Right Patient

Participants perceived that following rights of drug administration that is, calculating the right dosage, right route, right patient, at the right time would prevent medication errors.

…I think pediatric medication safety would consider involving all rights of drug administration, this means you are giving the correct dosage, the right drug, to the right patient, the right route, at the right time, proper documentation and also considering other allergies and contra-indications…… (p.1)

Subtheme Two: Reading the Patients' Files

Participants perceived that reading the patients' files would help the nurse to understand the prescriber's orders clearly and would prevent medication errors in children.

…. checking on the treatment form and patient's file as well because sometimes the Doctor stops the medication in the notes and forgets to update on the treatment form… (p.1)

Subtheme Three: Double Checking

Participants perceived that one of the important measures to prevent medication errors would be double checking; that is crosschecking with a fellow nurse about the drug before administering it.

Table 4 Participants' Perceptions Regarding Interventions to Pediatric Medication Errors

Themes	Subthemes
Sticking to rights of drug administration	• Calculating the right dosage, right time, right route • Reading the patients' files • Double checking
Training and supervision	• Refresher training and CMEs • Qualified health personnel • Proper orientation of new staff
Resources	• Enough staffing • Pediatric medication safety protocols • Enough supplies of drugs and sundries

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…it is important to always double check with a fellow nurse before administering medications. But in most cases, you find when you are alone on duty…. (p.6)

….it could actually be a good measure before you administer the drug to confirm with a fellow nurse the drug you are going to administer, but with the shortage of staff, we are unable… (p.9)

Theme Two: Training and Supervision

This theme emerged from three subthemes, refresher training and CMEs, Qualified health personnel, and proper orientation of new staff.

Subtheme One: Refresher Training and CMEs

Participants perceived that one of the measures to prevent pediatric medication errors would be refresher training and Continuous Medical Education.

…. trainings and then supervision, we can have the seniors supervise the junior nurses to see if they are doing the right things regarding medication and then continuous medical education regarding pediatric medication safety would also be helpful….(p.2)

Subtheme Two: Qualified Health Personnel

Participants also noticed that qualified health personnel would help in preventing pediatric medication errors.

…I think if the nurses are qualified and knowledgeable can help prevent pediatric medication errors…. (p.3)

Subtheme Three: Proper Orientation of New Staff

Participants also aired out the need to properly orient new staff as a measure to enhance pediatric medication safety.

….and orienting new people who come at our unit, remember it is a teaching hospital, we have students who change almost every day, we have interns and senior house officers rotating in the unit, proper orientation, taking them through these guidelines would help improve pediatric medication safety. (p.9)

Theme Three: Resources

This theme emerged from three subthemes, enough staffing, availability of medication safety practices and enough supplies of drugs and sundries.

Subtheme One: Enough Staffing

Participants also believed that enough staffing would help to enhance pediatric medication safety.

…. first measure I think would be increase in human resource and making sure that every nurse is given a particular number of patients to take care of…… (p.11)

Subtheme Two: Pediatric Medication Safety Protocols

Participants believed that having pediatric medication safety protocols on ward and in medication preparation areas would be of great importance to enhance pediatric medication safety.

…. having protocols and guidelines on how to give particular drugs close to the unit will also be helpful. Protocol binders are important much as people may not read them… (p.11)

Subtheme Three: Enough Supplies of Drugs and Sundries

Participants believed that availability of enough sundries like syringes, gloves, cannulas and supply of all drugs would minimize medication errors and enhance medication safety practices.

…. I think having supplies all the time helps to reduce errors of missing medication….(p.3)

Discussion

Participants' Perceptions Regarding the Reasons for Pediatric Medication Errors

Overcrowding of patients in unit significantly contributes to communication breakdown, making it a major risk factor for medication errors and a serious threat to patient safety.[25] In crowded wards, there are more disruptions and interruptions, which can affect communication among health care team members and even caretakers. This can result in miscommunication about medication orders and even patient identity during drug administration in wards where patients are not labelled.[26]

Participants also believed that lack of storage for emergency drugs was a contributing factor for pediatric medication errors. Lack of organized storage can lead to mix-ups, where the wrong drug is administered.[27] Furthermore, these findings are in agreement with Kalisch's missed nursing care model, in her concept analysis in (2009), she found out that Antecedents of missed nursing care exist within the context of the care environment, are external to nurses and create a need for them to decide what care will be provided.[17]

Some participants reported overwhelming number of patients and understaffing as the major cause of pediatric medication errors. High patient loads can limit the time available for careful medication preparation and administration, increasing the risk of mistakes. High patient turn over can lead to incomplete or hurried documentation, increasing the risk of miscommunication[28,29] Understaffing leads to delays in care, meaning that medications may not be administered on time or according to the scheduled time.[30,31] This is consistent with number of studies that have reported similar causes of pediatric medication errors. Schroers et al[32] revealed that, in the majority of studies participants communicated that understaffing and/or heavy workloads lead to multiple adverse patient events (MAEs).

Without training, nurses may not monitor effectively or respond appropriately to these adverse effects. High qualified nurses have a heightened awareness of high-risk and necessary precautions which may not be the case with low cadre nurses.[33,34] So addressing these knowledge gaps through continuous education, targeted training programs, effective supervision can help reduce pediatric medication errors and improve overall patient safety.[35] These findings are in agreement with a qualitative study by Ali and colleagues. (2021) in his study, he found out that a few nurses generally start working in hospitals without enough preparation or orientation programs. Although medication education is involved in most nursing curricula, these approaches fail to adequately prepare nurses with the required clinical skills.[30]

Participants Experiences of Pediatric Medication Errors

The study revealed one theme; omission and commission errors. Under this theme, participants experienced commission and omission errors. Commission errors involve actions that are incorrect or inappropriate. Some participants experienced administration of wrong medication and the causes of this was misreading medication labels and confusing patient identity. Some of the participants also experienced administering an incorrect doze and the major cause was miscalculation of the drug. All of them experienced wrong time of drug administration and they attributed it to understaffing, overwhelming number of patients. Both omission and commission errors can have serious consequences in pediatrics, where the margin for error is often much smaller than in adults.[36] Pediatric patients are at a higher risk of adverse outcomes due to their unique physiological characteristics, such as weight-based dosing requirements, immature organ systems, and varied responses to medications. Nurses' experiences with these errors are critical in understanding the root causes and developing strategies to improve medication safety, such as enhanced training, better communication systems, and the use of technology like electronic health records and barcoding for medication administration.

This is in line with Kalisch's model which identifies that "missed nursing care" as any aspect of necessary patient care that is omitted (in part or whole) or delayed (Kalisch and Xie, 2014),[31] and medication administration process is part of patient's care mostly provided by nurses. This finding is relatively consistent with a quantitative study done by Wondmieneh et al (2020b) which revealed that Wrong time error (58.7%) was the most frequent type of MAEs detected.[37] This finding indicates that more than half of the medications were not administered at ordered time.[30,38]

In another quantitative study by Härkänen and others (2020) revealed that administering the wrong drug and/or at the wrong frequency were amongst the more common types of incident.[39] In a systematic review done by Clapper and Ching (2020) the most commonly reported medication errors centered on miscalculated and mistaken doses, or missteps.[40]

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Participants' Perceptions Regarding the Interventions to Medication Errors

To improve pediatric medication safety, adhering to the "rights of drug administration" is a critical measure. Traditionally, the "5 Rights" include ensuring the right patient, right drug, right dose, right route, and right time. However, recent literature suggests that these foundational practices need to be expanded to include additional rights like the right to refuse, right documentation, and right response, among others.[41]

This expanded approach addresses the complexities of medication administration in pediatric settings, where the margin for error is often narrower due to factors like weight-based dosing and the developmental stages of patients. Double checking medication label against prescription and use of a "second eye" that is to say, confirming with a colleague before administering the medication would be useful most especially for look-alike and sound-alike medications to avoid confusion. Read the patient's file to understand new orders and identify them by calling the patient's name to verify patient's identity before administering medication helps to improve medication safety.

This study is partially in line with the study done by Collins (2022) which highlighted that while the "5 Rights" are essential, they are not sufficient on their own to prevent errors. He further stated that they must be supported by broader system-based strategies such as protected time for medication administration, enhanced communication among health-care teams, and the use of technologies like barcode scanning and computerized physician order entry (CPOE).[42] The study also believed that training and supervision are critical components for ensuring medication safety in pediatric healthcare settings. Providing comprehensive orientation including detailed training on pediatric medication safety during the orientation of new nursing staffs would be of help.

Ongoing education for healthcare staff on pediatric pharmacology and the unique consideration in pediatric medication administration to keep staff updated on the latest best practices and guidelines would be paramount to enhance pediatric medication safety practices. Conducting regular training sessions on the five rights and use of technology aids like infusion pumps and ensuring that all staff are proficient in using technological devices to prevent error related to technology misuse is also of great importance. In their perceptions, participants also said that it would be good for supervisors to conduct regular audits of medication administration records to identify and address potential safety issues. And furthermore, that these audits should be non- punitive in nature to cultivate a culture of medication error reporting among nurses.[43] They also noted that it would be good to pair the less experienced person and a more senior nursing staff or more qualified person and less qualified one in terms of education background. Not pairing a nursing assistant with a fellow nursing assistant during duty allocations.

These findings are relatively correlated to an integrative review done by Millichamp and Johnston (2020) where they discovered that investment in education and training-related to medication safety can significantly improve Medication administration safety.[44]

The study also revealed that resource like adequate nursing staffing is a crucial measure for improving medication safety in children. Adequate staffing ensures that nurses are not overburdened with excessive patient loads, which can lead to fatigue and increased likelihood of errors. Well-rested nurses are more vigilant and capable of accurately administering medications.[45] Adequate staffing also allows for ability to double -check medication orders and doses, a critical step in preventing errors, especially in neonates who require precise dosing.[46]

Best practices and protocols for preventing and managing medication errors should be availed on wards in order to improve medication safety practices. The availability of drugs and sundries (medical supplies) is another critical measure for improving pediatric medication safety. Consistent availability of prescribed medications prevents interruptions in treatment, which can compromise the efficacy of the medication regimen and potentially lead to adverse drug outcomes. Having an adequate supply of medical sundries such as syringes, droppers ensure that medications are administered accurately.[47]

These findings are in agreement with a meta-analysis study done by Marufu and colleagues (2022) to identify nursing intervention to reduce pediatric medication errors, he noted seven interventions which included education projects, medication information services, clinical pharmacist involvement, double checking, barriers to reduce interruptions during drug calculation and preparation, implementation of smart pumps (new technology) and improvement strategies.[11]

Strength and Limitations of the Study

Despite the above key findings, this study has limitations. To begin with, the use of a non-random sampling technique may have introduced selection bias. However, the choice of convenience sampling was considered appropriate due to the relatively small number of nurses and midwives assigned to the paediatric units of MRRH. Furthermore, the sensitive nature of the topic, medication errors raise the likelihood of social desirability bias, a well-documented concern in qualitative research, whereby participants may feel compelled to offer responses they perceive as socially acceptable. In addition, some participants expressed hesitation or fear in disclosing their personal experiences with paediatric medication errors.

Notwithstanding these limitations, the study constitutes an important initial step in generating insights into medication-related adverse events in paediatric care in Uganda. As such, it offers a valuable foundation for future research and intervention design aimed at enhancing medication safety in this vulnerable patient population.

Conclusion

The purpose of this study was to explore nurses' experiences and perceptions regarding pediatric medication errors, with the goal of identifying key factors contributing to these errors and potential interventions for improvement.

The study revealed that nurses perceived pediatric medication errors to be significantly influenced by challenges such as workflow and work environment, work overload, inadequate education and training, and limited resources. Nurses' experiences largely revolved around commission and omission errors, reflecting the complexity of pediatric care. To mitigate these errors, participants emphasized the importance of adhering to the "rights" of drug administration, providing comprehensive training and supervision, and ensuring adequate resources.

Statement of Declaration of Generative AI Use

ChatGPT (GPT-4.1 mini) was used in this manuscript solely for paraphrasing selected text to enhance clarity and coherence. No content was generated, analyzed, or interpreted by the AI beyond this function. All substantive intellectual contributions, interpretations, and conclusions are the sole work of the authors.

Abbreviations

CPOE, Computerized Physician Order Entry; MAEs, Multiple patient adverse events; MRRH, Mbarara Regional Referral Hospital; MUST-REC, Mbarara University of Science and Technology Research Ethics Committee; NICU, Neonatal Intensive Care Unit; USA, United States of America; WHO, World Health Organization.

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Disclosure

The authors report no conflict of interest in this work.

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