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ASSESSING NURSES KNOWLEDGE REGARDING MEDICATIONS ERRORS IN THE PEDIATRIC UNITS OF TERTIARY CARE HOSPITALS

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ABSTRACT

Aim: The aim of the study was to evaluate pediatric nurses' knowledge regarding medication errors and to identify the key factors contributing to drug administration mistakes in pediatric units.

Background: Pediatric patients are highly vulnerable to medication errors due to their unique physiological characteristics, weight variations, and developmental stages. These errors pose serious risks to patient safety, making it essential for nurses to have adequate pharmacological knowledge.

Methods: A descriptive cross-sectional study was conducted in four hospitals with a total sample of 80 nurses. Data were collected using structured questionnaires, and statistical analysis was performed using SPSS.

Results: Knowledge assessment revealed that 37.5% of nurses had fair knowledge of medication errors, 35.0% had poor knowledge, and only 27.5% had good knowledge. The most common type of error reported was incorrect dosage.

Conclusions: The results indicate that pediatric nurses have gaps in pharmacological knowledge, particularly in high-alert medication administration and dosage calculations. Targeted educational interventions, including workshops and continuous training programs, are recommended to improve medication safety in pediatric care.

KEYWORDS: Medication errors, nursing knowledge, pediatric care, drug administration, patient safety.

INTRODUCTION

Medication errors are a pervasive concern in healthcare, particularly in pediatric care, where their incidence and severity are significantly higher compared to adult populations. Studies have indicated that medication error are usually greater in pediatric units [1], [2]. This heightened vulnerability arises from children's distinct physiological development, including their increased sensitivity to drug administration on the basis of weight, which introduces multiple calculation steps prone to error [3].

Children are at a higher risk of experiencing adverse drug events (ADEs) due to factors such as the frequent need for dilution of stock solutions, underdeveloped physiological buffering systems, and their limited ability to communicate adverse effects [3]. Additionally, many medications administered in pediatric settings are either unlicensed or used off-label, increasing the complexity of safe medication administration [4]. Previous research has demonstrated that a significant proportion of pediatric medication errors occur during the administration phase, where nurses are the primary healthcare professionals responsible for it [5].

Several studies have examined factors contributing to medication errors in pediatric nursing, including system-related issues, human errors, and insufficient pharmacology knowledge among nurses [6], [7]. The ability to perform accurate drug calculations, adhere to standard dosing protocols, and recognize high-alert medications are crucial competencies for nurses working in pediatric settings. However, research has shown that gaps in these areas remain a major concern, with insufficient knowledge being one of the most frequently cited barriers to safe medication administration [8].

Given the significant implications of medication errors for pediatric patient safety, this study aimed to assess the knowledge of pediatric nurses regarding medication administration errors. By identifying knowledge gaps and contributing factors, this research seeks to inform strategies for reducing medication errors and improving patient outcomes through targeted education and policy interventions.

METHODOLOGY

STUDY DESIGN

This study employed a descriptive cross-sectional design to assess nurses' knowledge regarding medication errors in pediatric care. Data were collected at a single point in time, allowing for efficient and cost-effective analysis of participants' knowledge and contributing factors.

STUDY SETTING AND DURATION

The research was conducted in four hospitals of Mardan regions. The study took place over a four-month period.

DATA COLLECTION AND INSTRUMENT DEVELOPMENT

Data was collected using a structured questionnaire adapted from a previous study, with a content validity index of 0.88 [9]. The questionnaire comprised two sections: the first section assessed nurses' knowledge through 20 true/false questions focused on high-alert and commonly used pediatric medications, while the second section analyzed self-reported medication errors and their contributing factors. The knowledge assessment of the participants was categorized into three categories: Poor knowledge (0%–33.3%), Fair knowledge (33.3%–66.6%) and good knowledge (66.6%–100%).

SAMPLE SIZE AND SELECTION

The total number of nurses working in pediatric wards and NICUs across the four hospitals were more than (n=80). Due to staffing limitations, all the nurses were selected through census sampling technique. The sample size was calculated with a 95% confidence interval and a 5% margin of error.

DATA ANALYSIS

The collected data were analyzed using SPSS version 22. Descriptive statistics, including frequencies, and percentages, were used to interpret the results.

INCLUSION AND EXCLUSION CRITERIA

- **Inclusion Criteria:** Nurses working in pediatric wards and NICUs, as well as

- **Exclusion Criteria:** Nurses in managerial roles, those on sick leave, and those who did not voluntarily consent to participate.

ETHICAL CONSIDERATIONS

Prior to conducting the study, ethical approval was obtained from Kmu Institute of Health Sciences Islamabad ethical committee Latter No.KMU/IHS/ISB/Ethics/2025/AB/073. Formal permission was secured from hospital authorities for data collection. Participants were informed about the study's objectives, and consent was obtained before data collection. Anonymity and confidentiality of the participants were maintained throughout the study.

RESULTS

A total of 20 questions were administered, consisting of two true and eighteen false statements. Each correct answer was assigned five points, leading to a maximum possible score of 100 (5 points per question × 20 questions = 100).

A total of 80 pediatric nurses participated in the study. The overall correct answer rate varied, with 27.5% of participants scoring in the high knowledge category, 37.5% demonstrating fair knowledge, and 35.0% categorized as having poor knowledge. The highest percentage of correct responses (63.8%) was observed for questions related to aminophylline use, while the lowest correct response rate (22.5%) was noted for the appropriate use of insulin syringes, indicating significant gaps in knowledge about proper syringe selection for pediatric drug administration.

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

Among the 80 participants, 56.3% were female and 43.7% were male. The departmental distribution, 60% of participants worked in pediatric wards, while 40% were assigned to NICUs. The majority of the nurses were married (66.3%), and 33.7% were single. Regarding professional experience, 30% had 1-3 years of experience, 27.5% had 4-6 years, 20% had 7-9 years, and 22.5% had over 10 years of experience in pediatric care. In terms of educational background, 42.4% of participants held a Post-RN qualification, 33.8% had general nursing training, and 23.8% possessed a BSN degree.

Table no.1 Socio-demographic characteristics of participants n=80

S.no	Variables	Category	Frequency	Percentage
1	Gender	Male	35	43.5%
		Female	45	56.3%
3	Department	Pediatric ward	48	60%
		NICU	32	40%
4	Material statics	Single	27	33.7%
		Married	53	66.3%
5	Experiences	1-3 years	24	30%
		4-6 years	22	27.5%
		7-9 years	16	20%
		Above 10 years	18	22.5%
6	Qualification	General nursing	27	33.8%
		BSN	19	23.8%
		Post RN	34	42.4%

To assesses pediatric nurses' knowledge of medication administration using a True/False questionnaire, revealing critical gaps in their understanding of high-alert and commonly

used drugs. While 55% correctly identified that "ampule" or "vial" should be used instead of "mg" or "g" for dose expression, 45% answered incorrectly, and 47.5% failed to recognize the risk of abbreviating "unit" as "U." Knowledge of medication storage was also insufficient, with only 31.3% correctly identifying that heparin and insulin should $n_1o_7t_4$ be should be easily accessible. A major concern was syringe and administration errors, as 77.5% incorrectly assumed that insulin syringes could be replaced by 1 ml syringes, and 70% believed teaspoons were appropriate for pediatric dosing. In emergency scenarios, 61.3% correctly recognized that a fast IV push of epinephrine (1:1000) for mild allergic reactions is inappropriate, but 57.5% failed to identify the danger of rapid IV administration of 15% KCL during ventricular fibrillation. Knowledge of high-risk medications like digoxin and phenytoin was also limited, with 60% failing to recognize that Dilantin injections should be administered at a speed of less than 50 mg/min IV to prevent cardiac arrest, and 62.5% mistakenly believing that digoxin is better injected intramuscularly for prolonged effects. Similarly, 63.8% correctly identified that 10% calcium gluconate and 10% calcium chloride are not interchangeable, but 36.3% still lacked awareness of this crucial distinction.

Table No. 2 Nurse's knowledge regarding drug administration

S.No	Items questions	Answer T/F	correct	Wrong n (%)
1.	Use 'ampule' or 'vial' for the dose expression instead of 'mg' or 'g'.	T	44 (55%)	36 (45%)
2.	Use 'U' instead of 'unit' for dose expression.	T	42 (52.5%)	38 (47.5%)
3.	For convenience, heparin and insulin should be stored together in the refrigerator.	F	25 (31.3%)	54 (67.5%)
4.	15% KCL is frequently used, so it should be easily and freely accessed by nurses.	F	31 (38.8%)	49 (61.3%)
5.	Insulin syringes can be replaced by 1 ml syringes.	F	18 (22.5%)	62 (77.5%)
6.	For pediatric dose, use teaspoon as the only unit for dose expression.	F	24 (30%)	56 (70%)
7.	Fast IV push 1:1000 EPI 1 amp for a patient who has a mild allergic reaction.	F	49 (61.3%)	31 (38.8%)
8.	10% calcium gluconate and 10% calcium chloride are the same drug and interchangeable.	F	51 (63.8%)	29 (36.3%)
9.	In chemotherapy, adult dose calculation is based on BW (body weight); children's is based 'BSA' (body surface area).	T	48 (60%)	32 (40%)
10.	When an emergency such as ventricular fibrillation happens, push fast 15% KCL 10 ml into IV.	F	46 (57.5%	33 (41.3%)
11.	After the injection of aminophylline to treat neonate apnea, baby tachycardia may overdose or fast injection.	T	51 (63.8%)	29 (36.3%)
12.	When child is in acute dyspnea, administer aminophylline 250 mg through IV push.	F	37 (46.3%)	43 (53.8%)

13.	First injection of Dilantin may cause cardiac arrest. The Speed should be less than 50 mg/min IV.	T	32 (40%)	48 (60%)
14.	Diltantin could be diluted to any solution, but diluted to 5% dextrose will have a better absorbing effect.	F	20 (25%)	60 (75%)
15.	For prolonging the drug effects, 'digoxin' is better injected through IM.	F	50 (62.5%)	30 (37.5%)
16.	The usual dose of acetaminophen (Panadol) for the baby (three months, five kilogram) is about 1 cup (30 ml).	F	51 (63.8%)	29 (36.3%)
17.	The prescription for digoxin is 0.04 mg/kg; for a 20 kg child, the dosage should be 0.8-1.6 mg.	T	38 (47.5%)	42 (52.5%)
18.	Veterin 125mg (1g/vial) was prescribed; When diluted to 10 ml then 0.6 ml should be given.	T	30 (37.5%)	50 (62.5%)
19.	Tazocin 135 mg (225 mg/vial) was prescribed; when diluted to 10 ml, then 0.6 ml should be given.	F	36 (45%)	44 (55%)
20.	Direct injection of diltantin IM to major convulsive infants when no established IV route is available.	F	22(27.5%)	58 (72.5%)

DISCUSSION

This study highlights the existing knowledge gaps among pediatric nurses regarding medication errors, similar to previous research indicating that nurses often lack sufficient pharmacological knowledge. The findings demonstrate that 37.5% of nurse had fair knowledge, while 35% exhibited poor knowledge. This aligns with research conducted in Ethiopia, where nurses had an average knowledge score of 73.3% regarding pediatric medication administration. However, our study contrasts with previous study, which reported that two-thirds of nurses had poor knowledge regarding medication administration [10]. In comparison to a study, which assessed nurses' knowledge of high- alert medications and reported a correct answer rate of 56.5%, our study showed varied results, indicating both progress and persistent knowledge gaps. While general knowledge has improved, dosage miscalculations remain a major challenge. Similar study [10], our research found that knowledge of high-alert medications has increased; however, pediatric nurses continue to struggle with complex calculations, particularly for medications like digoxin and phenytoin, which pose high risks for overdosing and adverse drug events. Our study further supports findings [11], who reported a case of fatal digoxin overdose in a pediatric patient due to an incorrect dosage calculation. The lowest correct response rate (22.5%) in our study was observed in syringe selection for insulin administration, suggesting that critical knowledge gaps persist in fundamental drug administration practices. Similarly, [12] indicated that nearly half (47%) of pediatric medication errors were due to incorrect dosages, a finding that aligns closely with our study's results.

Our study reinforces the idea that work experience plays a crucial role in nurses' pharmacological knowledge. Consistent with previous studies [13], [14], we found that nurses acquire most of their pharmacology knowledge through clinical practice rather than formal education. Interestingly, our study found no significant difference in

knowledge levels between nurses with BSN degrees and those with lower educational qualifications, a result that mirrors previous research indicating that experience, rather than degree level, is a stronger determinant of pharmacological competency. High staff turnover and inadequate training contribute significantly to knowledge deficits. A study noted that new graduates are often placed in high-stress environments without proper training, increasing their susceptibility to medication errors [15]. Our findings support this, as nurses with specialized pediatric medication training performed better than their less-trained counterparts. Similar results were reported by previous study, who found that additional training significantly improved nurses' knowledge of high-alert medications [16]. Additionally, research found that nearly 8% of pediatric medication errors involved overdoses of ten times the correct dose, reinforcing the necessity of precise dosing calculations [12]. Similarly, research indicated that medication errors are most common during the daytime due to increased workload and distractions, a finding consistent with our study, where errors were predominantly reported during morning shifts [17].

Previous research has highlighted the effectiveness of computerized physician order entry (CPOE) and bar-coded medication administration (BCMA) systems in reducing errors [18]. A study found that CPOE could prevent 93% of adverse drug events [18], A study reported that clinical pharmacists could intercept up to 94% of prescribing errors [19]. Our study supports these findings, suggesting that integrating technological interventions with nurse training programs could significantly improve medication safety. Moreover, our study supports the use of double-checking procedures and pre-calculated dosage checklists, which have been shown to reduce errors in previous studies. Similar study found that 63.1% of medication errors were detected through double-checking by colleagues, further reinforcing the need for collaborative verification strategies in pediatric settings [20].

RECOMMENDATION

By implementing systematic educational programs, integrating CPOE and BCMA systems, and reinforcing collaborative medication verification practices, hospitals can significantly improve medication safety and reduce the incidence of pediatric medication errors.

CONCLUSION

Findings indicate that nurses in these hospitals have fair knowledge regarding medication errors, underscoring the necessity of ongoing education and structured training programs to enhance patient safety outcomes. These findings align with previous research that highlights the need for enhanced pharmacology training, structured clinical interventions, and technology-based solutions.

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