The Influence of Nurses' Burnout on Medication Error Knowledge in Pediatric Critical Care Unit

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Abstract: Introduction: Medication errors are defined as preventable events that lead to inappropriate medication use or patient harm, which may occur during prescription, dispensing, or administration.

Objective: To assess the influence of burnout on nurses' knowledge about medication errors in the pediatric critical care units.

Methods and Materials: A descriptive cross-sectional design was employed for this study to investigate the influence of nurses' burnout on medication errors knowledge, particularly within the realm of pediatric critical care units, from August 1st, 2023, to March 1st, 2024. The study utilized a questionnaire comprising three sections: the first to gather sociodemographic data of patients, and the second The Maslach Burnout Inventory, and third section Knowledge, Attitude and Behavior (KAB) in Medication Errors Questionnaire. A non-probability (purposive) sampling technique was employed in this study, involving 134 nurses works in paediatric critical care units. Data analysis encompassed descriptive and inferential statistics.

Results: In pediatric critical care units, up to 61.2% of nurses experienced moderate level of burnout, with a mean score of 37.79 (range 22-66). Among nurses in pediatric critical care units, 74.5% demonstrated good knowledge of medication errors. Statistical analysis revealed non-significant relationship between nurses' burnout and their knowledge of medication errors in the pediatric critical care units at $p > 0.05$.

Conclusions: More than half of the nurses in the study displayed a moderate level of burnout, with good knowledge about medication errors. According to the findings of the research, show that non-significant relationship between burnout and medication errors knowledge.

Keywords: Nurses burnout, Medication Errors, Pediatric Critical Care Unite.

Introduction: Critically ill pediatric patients in the PCCUs are at a heightened risk of medication errors due to various factors as complex prescription regimens, severity of illness, presence of comorbidities, and narrow therapeutic windows of certain medications (1). Caring for critically ill children, including neonates and preterm infants, poses significant challenges and increases vulnerability to medication errors, particularly in dosage calculation based on weight and timely administration of medications. Research by Brennan has demonstrated a significantly higher incidence of medication errors in children, up to three times more than in adults (2). Nurses in pediatric units play a crucial role in preventing the medication errors given their central role in the medication administration. Nurses caring for newborns require extensive

medication knowledge, especially with the increasing array of medications used in PCCUs. Continuing education is essential to provide nurses' understand of medication management and reduce medication errors (3). Many of factors influence safe of medication delivery, including debates on whether RNs possess sufficient information and practices for safety in medication management. Challenges include normalization of risk behaviorally, interruptions, flawed technology forms, insufficient time, lack of collaboration between medical staff, leadership, and outdated policies in critical units (4). PCCU workers health care provider operate in highly challenging environments characterized by distressing and unpredictable situations, constant exposure to emotional and psychological stress, and interaction with distressed children patients and families (5). Burnout, a consequence of ongoing workplace stress, is prevalent among staff in PCCUs due to demand and emotional taxing nature of their work (6). Burnout encompasses three dimensions: depersonalization, and reduced professional accomplishment, emotional exhaustion, leading to dissatisfaction, decreased social interaction, diminished self-esteem, and feelings of incapacity (8). The nurse burnout poses a significant concerns for the healthcare organizations, the affecting nurse turnover, performance, job satisfaction, and potentially pediatric patient safety (7). Mental challenges associated with the nursing burnout include managing patient complexities, treatments, therapies, and medication, while physical issue stem from prolonged work hours, understaffing, and resulting sleep disturbance (9). treating burnout is crucial to maintain nurses well-being and ensure the quality pediatric patient care. The demand the nature of nursing, coupled with the insufficient leisure time for the recovery and understaffing, can lead to interpersonal difficulty, contributing to burnout and psychological issue (10). Nurses staff in pediatric critical care units often experiences burnout due to job challenge, high productivity expectations, long work hours, shifts, and a lack of recognition for their efforts, which can ultimately impact pediatric patients care quality and increases the medication errors in pediatric critical care units (11). Treating burnout among nurses staff is crucial for maintaining pediatric patients care standards and decreasing medication errors. Demanding nature of nursing, coupled with insufficient leisure time for understaffing and recovery, can lead to interpersonal difficulty and psychological issues, leading to nurses' burnout (10). The nurses pediatric critical care units often experiences burnout result to job challenges, long work hours, shifts, high productivity expectations, and a reduce of recognition for their efforts, which can ultimately impact pediatric patients care quality and increasing medication errors in PCCUs. Addressing burnout among nurses is crucial for maintaining pediatric patients care standards and decreasing medication errors (11).

Methodology

Design of Study: A descriptive cross-sectional design used in this study, from August 1st, 2023, to March 1st, 2024.

Ethical Considerations: Official permissions were obtained from relevant authorities prior to data collection. Approval was first secured from the Council of the Nursing College\ University of Kerbala. The instrument used in the study was also approved by the Research Ethics Committee of the College of Nursing\ University of Kerbala under number (UOK.CON 23.015). Subsequently, permission was sought from Karbala Teaching Hospital for Children to collect the data to ensure collaboration and agreement. Ethical considerations were meticulously observed to uphold professional study conduct, ensuring the moral integrity necessary for handling participants' sensitive information and maintaining confidentiality. Nurses' participation was entirely voluntary, with the researcher informing them that their data would be kept confidential until publication, solely for scientific purposes. Participants in the study provided both written and verbal consent to the researcher.

Study Setting: The study was carried out in the field of pediatric critical care nursing in Karbala Teaching Hospital for Children.

Study Sample: A non-probability (purposive) sampling technique was employed in this study for 134 nurses works in critical care units, aim to determine the impact of workload on medication errors knowledge.

Study Instrument: The self-administered questionnaire used to gather the data from the respondents was made up of three sections:

Sociodemographic characteristics: This section contains the respondents` age, gender, marital status, educational level, years of experience, monthly income, number of years of experience in critical units, and have you participated in previous courses on medication errors. **The Maslach Burnout Inventory; a** standardized tool used to measure burnout in individuals. This questionnaire was devised by Hassan A. Hussien and consists of three domains: This domain consists of seven questions that assess emotional exhaustion. This domain consists of seven questions related to depersonalization diminish individual performance in this field consists of 8 questions. Scoring of the scale: The numerical scale used is as follows: 0 represents "Never," 1 represents "Sometimes," and 2 represents "Always." **Knowledge, Attitude And Behavior (KAB) In Medication Errors Questionnaire:** The questionnaire developed by Professor Marco Di Muzio consists of seven items. The scoring system for this questionnaire is as follows: 0: Strongly disagree, 1: Disagree, 2: Undecided, 3: Agree, and 4: Strongly agree

Results of the study

Table 1: Distribution of the participants according to their sociodemographic data Characteristics:

Demographic Characteristics	Subgroup	f.	%
Age group	22- 34 years	71	72.4
	35- 47 years	24	24.5
	48- 59 years	3	3.1
	Total	98	100.0
	Mean ± SD 30.96 ± 7.775 Min- Max 22 - 59 years		
Sex	Male	61	62.2
	Female	37	37.8
	Total	98	100.0
Marital status	Single	30	30.6
	Married	66	67.3
	Separated	2	2.0
	Total	98	100.0
Educational level	Secondary school	29	29.6
	Institute	20	20.4
	College	42	42.9
	Master's and above	7	7.1
	Total	98	100.0
Income	400-600 thousand dinars	35	35.7
	601-800 thousand dinars	38	38.8
	801 thousand dinars and more	25	25.5
	Total	98	100.0
Training course about medication error	Yes	53	54.1
	No	45	45.9
	Total	98	100.0
Years of experience in the hospital	1- 8 years	64	65.3
	9- 16 years	18	18.4
	17- 25 years	16	16.3
	Total	98	100.0

	Mean ± SD 7.62 ± 7.022 Min- Max 1 - 25 years		
Years of experience in the unit	1- 6 years	72	73.5
	7- 13 years	19	19.4
	14- 20 years	7	7.1
	Total	**98**	**100.0**
	Mean ± SD 4.78 ± 4.809 Min- Max 1 - 20 years		

%=Percentages, f= frequencies, S.D = Standard Deviation, M = Mean of score, Max= maximum and Min= minimum

Table 1 represented the demographic characteristics of (98) nurses working in PCCU. The majority (72.4%) of nurses fell within age group (22-34) years, with mean of age (30.96) years. Among the nurses, (62.2%) were male, most of them were married represented (67.3%). In terms of level of educational, only (40.8%) had completed college. Regarding income, about (38.8%) of nurses reported takings salary between (601 to 800) thousand dinars. The average years of overall hospital experience were (7.62) years, while average years of experience specifically in the pediatric critical care unit were (4.78) years. The majority of the nurses had participated in training courses related to medication errors represented (54.1%).

Table 2: The nurse's burnout at the PCCUs among the three levels:

Level	Range	f.	%.	Mean	SD
Low	22 – 36	37	37.8		
Moderate	37 – 51	60	61.2		
High	52 – 66	1	1.0		
Total	22 -66	98	100.0	37.79	5.687

%=Percentages, f= frequencies, S.D = Standard Deviation, M = Mean of score

The results in table 2 showed the nurse's burnout in the pediatric critical care units among the three levels at most (61.2%) were moderate with mean (37.79) (Min- Max 22-66).

Table 3: The medication error knowledge among nurses at PCCU:

Level	Range	f.	%.	Mean	SD
Poor	7 – 16	0	0		
Fair	17 – 25	25	25.5		
Good	26 – 35	73	74.5		
Total	7 -35	98	100.0	28.23	3.569

%=Percentages, f= frequencies, S.D = Standard Deviation, M = Mean of score

The results in table 3 showed the medication error knowledge among nurses at critical care at most (74.5%) were good with mean 28.23 (Min- Max 7-35).

Table 4: Assess the influence of burnout and workload on nurses' knowledge about medication errors at the PCCU:

N= 98	Burnout		
	Cc	p. value	Result
Nurses' knowledge	0.586	0.056	NS

P=probability value, Cc= Correlation coefficient, S: Significant at P < 0.05, HS: Highly Significant at P < 0.001, NS: Non-Significant at P > 0.05.

In table 4 the results showed there is no significant statistical correlations between burnout on nurses' knowledge about medication errors at the critical care unit at p- value P > 0.05.

Table 5: The relationship between burnout and medication errors knowledge with nurses' sociodemographic characteristics:

Demographic Characteristics	Subgroup	Burnout			knowledge		
		M	Analysis	p. value	M	Analysis	p. value
Age	22- 34 years	1.78	Cc=-.280-	.005	3.95	Cc=.314	.002
	35- 47 years	1.59			4.27		
	48- 59 years	1.53			4.10		
Sex	Male	1.68	t= -2.115-	.037	4.10	t= 1.630	.106
	Female	1.80			3.93		
Marital status	Single	1.81	F=2.094	.129	3.93	F=2.594	.080
	Married	1.69			4.06		
	Separated	1.65			4.71		
Education	Secondary school	1.68	F=.736	.482	3.90	F=2.136	.124
	Institute	1.7			4.00		
	College	1.74			4.06		
	Master's and above	1.78			4.31		
Income	400-600 thousand dinars	1.79	F=2.017	.139	3.84	F=6.691	.002
	601-800 thousand dinars	1.71			4.03		
	801 thousand dinars and more	1.66			4.30		
Experience in the hospital	1- 8 years	1.79	Cc=-.283-	.005	3.92	Cc=.238	.018
	9- 16 years	1.57			4.26		
	17- 25 years	1.64			4.23		
Experience in the unit	1- 6 years	1.76	Cc= -.300-	.003	3.97	Cc= .198	.051
	7- 13 years	1.64			4.20		
	14- 20 years	1.57			4.22		
Training course	Yes	1.71	t= -.510-	.611	4.05	t= .258	.797
	No	1.74			4.02		

P=probability value, S: Significant at P < 0.05, HS: Highly Significant at P < 0.001, NS: Non-Significant at P > 0.05.

In table 5 the results showed there were significant statistical differences among burnout with nurses sex at P < 0.05, and there were significant statistical differences among medication errors knowledge with their income at P < 0.05. Also the results shown there were significant statistical negative correlation among burnout with nurses age, years of experience in the hospital and unit at P < 0.05, and there was significant statistical positive correlation among medication errors knowledge with their age and years of experience in the hospital at P < 0.05

Discussion:

Table 1 shows that a significant majority of the 98 nurses in PCCUs were aged between 22 and 34 years represented (72.4%). This finding is agree with a study conducted by Alrabadi, (2020) on medication errors among nurses in Jordan, where 75% of respondents were within (20-34) age group. Also, a study conducted by Erdoğan et al., (2018) on nurse burnout levels found that 81.7% of nurses were within (20-30) age group. Regarding gender, the majority of nurses were male represented (62.2%). Also agree with Alrabadi's (2020) study on medication errors among nurses in Jordan, where (51.3%) of respondents were male. Conversely, Bezerra et al., (2019), in a study on pediatric patient's safety culture and burnout in pediatric hospitals, found that the majority of participants were female which represented (86.5%).

The majority of participants in the study were married represented (67.3%), this finding agree with study conducted by Hajibabaee et al., (2023), who reported that majority of nurses in Erbil hospitals were marriage represented (75.7%) . Conversely, Aljanfawi, (2022) who was found that the majority of nurses in an intensive care unit were unmarried and represented (55.42%). In

terms level of educational, most participants had completed college represented (40.8%), which agree with Elsayed's, (2020) study evaluating nurses' practical knowledge of neonatal safety and Shahin's, (2020) research on burnout among nurses in Saudi Arabia. Elsayed, (2020) reported that 67.1% of participants held a Bachelor's degree in nursing, and disagree with Shahin, (2020) who mentioned that around 80.0% of participants had a diploma in nursing sciences. According to the hospital's data on years of experience, 65.3% of nurses have between (1-8) years of experience, agree with findings from Kainat, (2023), where (49%) of nurses had (6-10) years of experience. However, Abassy's, (2021) study on pediatric nurses' knowledge of medication administration errors at PCCUs in Baghdad City found that 59.3% had less than 5 years of experience, disagree these results. In unit, inclusive training data referred to that 73.5% of nurses have accumulated (1-6) years of experience, agree with Al-Otaibi's, (2018) study on medication errors among the pediatric emergency department nurses in Saudi Arabia, where (69%) had more than 10 years of experience. This agree with Adly's, (2018) study on nurses' knowledge and skills of safety standard precautions in PCCUs, which reported that round (44.6%) of nurses had less than 5 years of experience. Present finding shows that more than half of nurses who participated in a training course on medication errors align with Alandajani's, (2022) study, which found that (62.5%) of participants had received similar training. However, Moustafa's, (2018) study on medication preparation errors among staff nurses in NICUs noted contrasting results, with (60%) of nurses having not participated in a specific training program treating medication errors. In table 2 presents results indicating that nurses in PCCUs experience moderate levels of burnout, with a mean scores of (1.72: 57.33%). The highest percentage of burnout was observing in the domain of Emotional Exhaustion, with a mean scores of (1.99; 66.33%). Conversely, the lowest level of burnout was observe in Lack of Sense of Personal Accomplishment domain, with the mean score of (1.53; 51%). Feelings Dull domain had the mean scores of (1.65; 55%). These findings are consistent with the study by Mansour, (2020) on occupational burnout among nurses in the Babylon Province, which noted a burnout rate of (57.8%) in the sample, particularly in emotional exhaustion and personal accomplishment domains. In contrast, Cishahayo's, (2017) study on nurses in PCCUs settings showed a higher prevalence's of burnout, with (61.7%) experience high levels. This included (48.3%) reported high exhaustion, 25% experience depersonalization, and 50 reporting low individual performance. Table 3 present study indicated that level of medication error knowledge among nurses in PCCUs are generally good, with a mean scores of (28.23) range (7-35). These results align with the study by Alandajani, (2022) on nurses' knowledge and attitude regarding drug mishaps, where approximately more than half of the nurses demonstrated commendable understanding of the medication errors represented (55%). Also the present study disagree with Elsayed's, (2020) study on Pediatrics safety and medication errors, which found that about half of the nurses had below-average information regarding medication administration process, majority of nurses in PCCUs in this study exhibited an average to above-average level of knowledge regarding the medication errors. Table 4 shows that there were no significant associations between burnout and nurses' knowledge of medication errors in the critical care unit, with a p>0.56. This results contrasts with research conducted by Song, (2023) in Korea, which examined the relationship between time factors, psychological burnout, and medication errors among rotating shift nurses. Song's study revealed a strong correlation between psychological burnout and medication errors, particularly emotional exhaustion (positive correlation; r= 0.49, p< 0.001). the present results disagree, another assessment by Tsiga, (2017) showed contrasting results. Tsiga analyzed the relationship between nurses' burnout and medical errors and found strong positive connections with emotional exhaustion (p=0.006) and depersonalization (p=0.005).

Table 5 clarified a significant resulting regarding the relationship between different factors and burnout among nurses. The study specified a statistically significant link between age and burnout, with a p< 0.005. This finding agree with a study by Shahin, (2020) on burnout among nurses in Saudi Arabia, which found higher burnout rates among individuals more than 35 years

of old compared to younger counterparts (p=0.041). In compare, Cishahayo's, (2017) assessment on burnout in PCCUs settings at a specific hospital in Rwanda did not find a significant relationship between age and burnout at (p>0.05). Furthermore, the study identified a significant association between sex and burnout, at p=0.037, in agreement with results from Madinah's, (2021) study on burnout among nurses in a mental health facility at (p=0.031). However, Mansour's, (2020) study on burnout among nurses in governmental hospitals found no significant difference in burnout based on sex at (p=0.706). Additionally, the study clarify a significant relationship between experience in hospital and burnout, with a p-value of 0.005. This disagree with Mansour's, (2020) study on occupational burnout among nurses in Babylon city , showing a significant relationship between burnout levels and years of experience in hospital at (p=0.003). Conversely, Cishahayo's, (2017) investigation in Rwanda did not find a significant relationship between burnout and years of experience at (p>0.05). In summary, these findings highlight significant relationship between age, sex, years of experience in hospital , and burnout among nurses, although some findings may in different studies.

The study founded a significant relationship between age and knowledge of medication errors, at p=0.002, which reinforce the results of Alandajani, (2022) regarding nurses' knowledge and attitudes toward medication errors at (p=0.001). However, this contrasts with study conducted by Ahmad's, (2023), which did not find a statistically significant relationship between age group and knowledge among registered nurses for preventing prescription errors at (p > 0.05). Regarding level of education, the study found no relationship between education level and medication error knowledge at (p=0.124), agreement with Alenezi's (2023) results at (p=0.129). In contrast, a different study noted a significant relationship at (p=0.004) between level of education and knowledge among nurses regarding medication error prevention, indicating a significant relationship between level of education and knowledge. Furthermore, the study discovered an association between experience in hospital and medication error knowledge, at p=0.018, agreement with Alandajani's, (2022) results on nurses' knowledge and attitudes toward medication errors at (p=0.001). This differs with study conducted by Ahmad's, (2023), which showed a negative association between years of experience in hospital and knowledge among registered nurses in preventing prescription errors at (p=0.602).

Conclusions: The study concludes that the most of nurses have moderate level of burnout and good knowledge about medication errors, and there is no significant correlation between burnout and medication errors knowledge, and there is significant relationship between burnout and nurse's sociodemographic characteristics, and significant relationship between medication errors knowledge and some nurse's sociodemographic characteristics.

Acknowledgment

Competing interests

None.

Abbreviations

Pediatric Critical Care Units (PCCUs).

Medication Errors (MEs).

Pediatric Emergency Department (PEDs).

Critical Care Unit (CCU).

Authors' contributions

The authors contributed to the work by participating in the design, acquisition, analysis, and interpretation of data. They drafted or critically revised important intellectual content and provided final approval of the version to be published. The authors also agreed to be accountable for all aspects of the work.

Availability of data and materials

The data utilized in this study are accessible upon request from the corresponding author.

Ethics approval and consent to participate

This study obtained approval from the Ethics Committee of the College of Nursing, University of Karbala, on August 1, 2023, under ethical approval number UOK.CON 23.015. Additionally, the administration of Karbala Teaching Hospital for Children was briefed on the study's objectives and data collection methods, and their written informed consent was obtained.

Consent for publication

We hereby give our consent for the publication of the aforementioned manuscript, along with any accompanying images or data included therein.

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