Arab American University

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The Effect of Educational Sessions on Knowledge and Perception of Medication Administration Errors Among Palestinian Neonatal and Pediatric ICU Nurses: Quasi-Experimental Study

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Thesis Approval

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Declaration

I attest that this research submitted for the degree of Master is the result of my own research, and that this thesis (or any of its parts) has not been submitted from any other previous works to any other university or institution.

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Signature:

Date: /1 /2024

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الإهداء

بسم الله الرحمن الرحيم

﴿يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ)

إلى من قاد قلوب البشرية وعقولهم، إلى مرفأ الأمان، معلم البشرية (سيدنا محمد صل الله عليه وسلم)

إلى رمش عين أمي وكد يد أبي، إلى من زين اسمي بأجمل الألقاب، من دعمني بلا حدود وأعطاني بلا مقابل، إلى فخري واعتزازي (والدي)

إلى من سهلت لي الشدائد بدعائها، واحتضنني قلبها قبل يدها إلى سر قوتي ونجاحي(والدتي)

إلى من كان ظلي حين يلفحني التعب، إلى رفيق الدرب وصديق الأيام جميعاً بحلوها ومرها (زوجي)

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أهدي إنجازي العظيم هذا إلى فلسطين الحبيبة عامة والى شهدائنا الابرار واسرانا ومسرانا فك الله قيدهم.

Dedication

I give this Achievement to the Almighty Allah for preserving my life I dedicate this work to the great father who devoted this life for us.

To my dear love mother that gave me the path of my success.

To my husband, brothers and sisters

To the Palestinian people especially for martyrs who sacrificed their lives for Palestine and Al-Aqsa.

To every person help me to finish this work.

Finally, I dedicate this work to myself to achieve my dreams.

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Abstract

Introduction: Medication errors (MEs) are among the most common consequences of medication preparation and administration in the pediatric and neonatal intensive care units, in which nurses are the most involved healthcare providers (HCPs). Therefore, several studies tested the impact of educational sessions on the level of knowledge and practice of NICU and PICU nurses towards MEs, which is the aim of the current study, alongside the investigation of the most common corresponding demographic and professional factors.

Methodology: A pretest-posttest, quasi-experimental study was conducted on NICU and PICU nurses of Palestine Medical Complex – Palestine using a total population sampling method, and was investigated using a self-administered questionnaire that was disseminated before and after and educational session that was provided by an experienced nurse. Data were analyzed SPSS using proper descriptive and inferential statistics.

Results: Among the nurses, 62.5% were males, 87.5% with bachelor's degree, 52.1% working in PICU, and 56.3% with < 5 years of experience. Overall, improvement in all aspects of MEs were insignificant in terms of knowledge and perception (4.438 ± 0.943 to 4.750 ± 0.758 out of 5, p-value = 0.077), reporting (6.438 ± 1.486 to 6.896 ± 1.533 out of 9, p-value = 0.140), opinion and recommendation (2.563 ± 0.649 to 2.729 ± 0.676 out of 3, p-value = 0.221) and

causes (8.063 ± 2.096 to 7.583 ± 2.938 out of 11, p-value = 0.424) from pretest to posttest phases, respectively.

Conclusion: The mean scores of the four domains were high in both pretest and posttest phases, and therefore no significant improvement was noticed. It is recommended to conduct the study on larger sample sizes and compare between several departments and hospitals to help generalizing the results.

Keywords: Medication errors, neonatal ICU, pediatric ICU, nurses, education, educational sessions.

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Table of abbreviations

Abbreviation	Full term
ME(s)	Medication Error(s)
HCP	Healthcare Provider
NICU	Neonatal Intensive Care Unit
PICU	Pediatric Intensive Care Unit
ICU	Intensive Care Unit
ADE	Adverse Drug Events
ADR	Adverse Drug Reaction
NCC-MERP	The National Coordinating Council for Medication Error Reporting and Prevention
LOS	Length of Stay
RCT	Randomized Controlled Trial
AHFS	American Hospital Formulary Service
RDS	Respiratory Distress Syndrome
OS	Operating System
ANOVA	Analysis of Variance
SPSS	Statistical Package for Social Sciences
SD	Standard Deviation
X^2	Chi-Square test
Annex(es)	Appendix(ces)

Chapter 1

Introduction

1.1 Background

When it comes to the nursing involvement in the area of medication administration, there are nine essential skills that are considered the backbone of effective and safe medication administration, including the process of ensuring safe ordering, handling, storing and discarding, as well as medication preparation, medication administration to the patient, documentation, medication-related events' assessment and evaluation, interprofessional cooperation in medication administration, alongside the cooperation with the patient, and medication information reporting (Luokkamäki et al.,2021). The nurses are in charge of every step of the medicine prescription, documentation, dispensing, administration, and monitoring processes, with the exception of prescription, which is the responsibility of a medical professional. Because of this significant responsibility, nurses are the ones who guarantee the proper administration of medications, making them more susceptible to medication errors (ME), also known as "near-misses," which are defined as "preventable events that may cause patient harm as a result of actions performed by healthcare professionals."[1] It can be recognized before harming the patient. (Marletta et al., 2022).

Worldwide, MEs are responsible for 2 – 5% of the overall hospital patient admissions (Latimer, Hewitt, Stanbrough, & McAndrew, 2017), while reviews found that the estimated prevalence of MEs ranges between 2% and 94%, with inappropriate prescription being the most common cause, followed by multiple storage locations, as well as therapeutic duplications, resulting in an estimated prevalence of preventable Adverse Drug Events (ADE) as 15/1000 person-years (Assiri et al., 2018). In England, more than 230 million of annual MEs are estimated, with more than 60% of them occurring at non-primary healthcare settings, and while 72% are

considered with no significant harm more than 60 million MEs of them are potentially clinically significant, accounting for more than 34% of MEs, alongside the economic burden that is represented in more than £98 million per year, causing more than 1000 yearly deaths (Elliott, Camacho, Jankovic, Sculpher, & Faria, 2021). More specifically, a review stated that the mean cost of MEs ranged between €2.58 to more than €111,000 (Walsh et al., 2017).

The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) has initiated the taxonomy for medication errors in 1998, and according to the patient's outcome, the council classified MEs into four major subcategories, where the first category (no error, Category A) is concerned with events that have the capacity to cause error, while the second category is concerned with errors that cause no harm, either temporary or permanent, physical, emotional or psychological, and is classified to three subcategories, where Category B is for the error that did not reach the patient, Category C is for the error that reached the patient without causing the harm, and Category D is for the error that caused the harm to be monitored to ensure it did not reach the patient. (NCC-MERP, 2001).

Descriptive studies were concerned in focusing of the areas of pharmaceutical intervention of which MEs occur the most, and found that all phases are involved, resulting in MEs types related to prescribing (37.3%), documentation (28%), administration (19.6%) and dispensing (15.1%), divided on the overall MEs reports (Parthasarathi, Puvvada, Patel, Bhandari, & Nagpal, 2021). On the other hand, when focusing on pediatric and neonatal departments, the most common classified MEs were assigned to incorrect doses (26.4%), omission of medications (14.7%), incorrect time (10.3%), absence of documentation (9.7%), incorrect frequency (14.5%) and inadequate preparation (10.2%), while others included mislabeling and incorrect duration of medication administration (Truter, Schellack, & Meyer, 2017).

Several causes have been studies and found to be related to the incidence of MEs, especially inside intensive care units (ICUs), which include low attention of healthcare providers (HCPs), like nurses, physicians and pharmaceutical technicians to medication safety protocols, as well as lack of professional communication and collaboration, including the interprofessional interaction between physicians themselves, physicians and nurses, and between HCPs and patient and family. Also, environmental determinants are involved, which focuses of ICU's nature of patients and its structure and equipment, while management determinants include the insufficient management staff and lack of clinical pharmacists in the ICUs (Farzi, Irajpour, Saghaei, & Ravaghi, 2017).

When focusing on the neonatal intensive care units (NICUs), higher frequency of MEs was related to several risk factors, including female infant gender, preterm delivery, low birth weight, shorter hospital length of stay (LOS) and younger age at admission (Eslami, Aletayeb, Kouti, & Hardani, 2019). Moreover, Daher et al. (2020) stated some specific causes for MEs inside NICUs, including MEs related to inaccurate documentation of neonatal identification, birth weight and gestational age.

In order to prevent MEs in NICUs and other departments, some preventive measures have been suggested, such as the use of computerized physician order entries and other technologies that make the process of medication administration easier, as well as the pharmacists' daily review of medication orders (Chedoe et al., 2007). Since then, educational sessions and programs have demonstrated a significant impact on ICU nurses' knowledge, awareness, attitude, and practice toward MEs. They have also demonstrated the beneficial effects of interprofessional education (i.e., HCPs educating peers and colleagues), which enhances interprofessional collaboration and patient care. (Irajpour et al., 2022).

There is a need for such studies to be conducted in Palestine, where Palestinian studies concentrate on the investigation of HCP awareness of MEs (Damin Abukhalil, Amer, Musallam, & Al-Shami, 2022) or the impact of medication safety education programs on the prevalence of MEs in ICUs in general (Abukhader , 2020). Therefore, the current study aims to investigate, using a quasi-experimental design, the impact of educational programs on the level of knowledge and perception about MEs among Palestinian pediatric intensive care units (PICU) and NICU nurses, as well as the investigation of the most prevalent corresponding factors that are related to the educational session impact.

1.2 Problem Statement

Medication administration skills are among the most essential areas in the nursing profession that need special attention, as well as development, especially in phases of preparation and administration. Moreover, although majority of ADEs are not clinically important, there is a significant uncertainty regarding the estimates and assumptions of avoidable ADEs that correspond to MEs, which are related to lack of long-term high-quality data (Elliott et al., 2021). Studies also contain considerable variety in their coverage of the potential effects and associations of MEs to health outcomes and burden, which is related to varieties in patients, settings and errors' characteristics (Walsh et al., 2017).

There is a dearth of studies in Palestine that deal with the topic of MEs, and even though there aren't many of them, the ones that do focus on the lack of regulatory systems for monitoring, controlling, and educating medications that focus on MEs, as well as the lack of studies on the level of awareness of HCPs in relation to MEs (Damin Abukhalil et al., 2022).

1.3 Significance of the Study

The current study will help in identifying the most common areas, associated risk factors, how to prevent the event on MEs and how educational sessions can help in increasing awareness and decreasing the vulnerability to MEs inside NICUs. This topic focuses on a crucial phase of MEs inside NICUs, which is the administration phase held by nurses, which accounts for the majority of causes if MEs, which results in enhanced medication practice among nurses and improved neonatal outcomes.

1.4 Objectives of the Study

The current study will try to achieve the following objectives:

1. Determine the level of knowledge and perception among Palestinian pediatric and neonatal ICU nurses regarding the process of medication administration and medication errors (MEs).
2. Investigate the level of knowledge and perception that is impacted by the conduction of an educational program related to MEs among Palestinian PICU and NICU nurses.
3. Determine the most common corresponding sociodemographic and professional factors that affect the change in the knowledge and perception of Palestinian PICU and NICU nurses regarding MEs.

1.5 Questions of the Study

The current study will try to answer the following questions:

1. What is the level of knowledge and perception among Palestinian pediatric and neonatal ICU nurses regarding the process of medication administration and medication errors (MEs)?

2. what is the effect of educational program on a level of knowledge and perception are related to MEs among Palestinian PICU and NICU nurses?

3. What are most common corresponding sociodemographic and professional factors that affect the change in the knowledge and perception of Palestinian PICU and NICU nurses regarding MEs?

1.6 Study Hypotheses

The current study will try to test the following hypotheses:

H_0: There is no significant difference in the level of knowledge and perception among Palestinian PICU and NICU nurses before and after the conduction of the educational program about MEs at a significance level of 0.05.

H_0: There is no significant difference in the impact of educational sessions about MEs according to the sociodemographic factors (age, gender, educational level, residency, … etc.) of the Palestinian PICU and NICU nurses at a significance level of 0.05.

H_0: There is no significant difference in the impact of educational sessions about MEs according to the professional factors (experience, PICU vs NICU, receiving of related courses, … etc.) of the Palestinian PICU and NICU nurses at a significance level of 0.05.

Chapter 2

Literature Review

2.1 Introduction

This chapter is concerned with the review of the latest and most related literature in the area of neonatology and nursing regarding the incidence and risk factors of medication errors (MEs), as well as the level of knowledge and attitude about MEs among NICU nurses, and how targeted educational sessions affected the level of knowledge and attitude. This review includes English published articles with a focus on the comparison between national and international studies, as well as prioritizing studies with rigorous methodological approaches, like randomized controlled trials (RCTs) and systematic reviews, which are published in the last 5 – 10 years, and were searched for inside well-known libraries of PubMed, Google Scholar and ScienceDirect, using the following keywords: medication errors, neonatal intensive care unit, nursing, knowledge, attitude, education, educational sessions.

2.2 Description and analysis of MEs inside the PICU and NICU

Several studies were concerned with the description of MEs inside NICUs as a part of their clinical audit, which aims to focus on the quality assurance and quality improvement in the medical and nursing practice (Godény, 2012), which helps in developing practice evaluation and enhancement guidelines for continuous improvement of the provided healthcare (Ashmore & Ruthven, 2008).

One of the studies related this scheme is the Qatari retrospective study that was conducted on a total 201 MEs that were reported by pharmacists in NICUs, which aimed to describe the nature and settings of such errors. Results showed that out of the 201 errors, 198 (98.5%) were reported during the prescription phase, while the rest occurred during the dispensing,

administration and transcribing phases by nurses (1 event each). Also, the study showed that 51.2% of the errors occurred among male infants, with 27.4% of the errors occurred among infants with age of 0 – 1 day, compared to 24.9% for age of 8 – 29 days and 23.4% for age of 1 – 2 months, resulting in a length of stay (LOS) inside NICU of 1 – 4 weeks in 33.8% of the cases.The researchers claimed that this is the first study to prescribe such aims in the Middle East Region, as well as the emphasis on the importance to conduct further studies on other HCPs and settings, and to focus on educational programs to enhance the awareness and reduce MEs as much as possible (Pawluk et al., 2017).

It is also important to try to analyze the possible causes and associated factors with different types and stages of MEs inside NICUs and PICUs, and this what Elmeneza, Habib, and Elsalam (2018) aimed to conduct in their study among a sample of 649 neonates in two educational hospitals in Egypt, with a mean gestational age of 35.55 ± 3.50 weeks, mean LOS of 6.47 ± 7.47 days, and a mean weight of 2.51 ± 0.91 Kg, which showed that one or more MEs occurred in 265 (40.8%) of the neonates. During the medication administration process, 624 MEs were recorded, which accounted for 96.1/100 NICU patient admissions, with 87.5% near-misses, compared to 8.2% ADEs. Analytical results showed that the most common MEs occur during prescription/ordering phase (n = 254), followed by transcription/verification phase (n = 227), administration phase (n = 111), dispensing phase (n = 25), and monitoring phase (n = 7).The researchers recommended the improvement of nurse/ and doctor/patient ratios, with the enhancement in working hour, as well as the involvement of pharmacists in the process of medication administration, like reviewing medication orders and participate in patient care rounds.

Similar approach was applied in Palestine, as in the study of Al-Ramahi et al. (2017), who aimed to investigate of MEs in pediatric inpatients younger than 16 years old. Although the study

is conducted among non-PICU patients, results found that 22.4% of the prescribed medications were out of range of recommended dosage, as well as that 40.4% of the patients were found to have at least one inappropriately prescribed medication dosage. Also, significantly higher percentages of inappropriate dosing were found among patients with lower weight, having higher number of inpatient medications number and who had longer period of stay in hospital.

Esqué Ruiz et al. (2016), the incidence of MEs in the targeted NICU was 32.2 per 1000 hospital days, which represented 20 per 100 patients, with 68.1% of them are related to administration errors, followed by 39.5% for prescription errors. Although 89.4% of the errors were harmless, nurses were the most common reporting HCPs for MEs (65.4%). The study investigated for non-drug related errors, including IV fluid (8.4%) and nutrition products (5.4%), with distraction being the most common cause for MEs (59.9%), followed by training shortage (19.2%), organizational factors (18.8%) and professional factors (17.8%). The study did not test for the differences and their significance according to the demographic or professional factors of the HCPs, which indicates a limitation in the mentioned study.

Tracking the trend of MEs can be achieved using several research types, and rather than the cross-sectional approaches, Manias et al. (2019) conducted a 5-year retrospective follow up of MEs errors, with the investigation of personal, environmental and communication factors' impact. The sample included 3340 MEs that corresponded to 5.73 MEs per 1000 bed days, in which NICUs corresponded to 10.8% of them. Mostly (48.8%), errors reached the patient with a harm that required monitoring. When inspecting for the causes related to communication process, the causes were mostly related to medical record documentation (17.9%), clinical handover (14.2%), informal bedside communication (13.5%) and misinterpretation of the order (12.9%), among others, while caused related to human factors were mostly related to performance deficit (21.5%), policies and

procedures (24.2%) and knowledge deficit (7.5%). Results also showed that family involvement was significantly associated with a decrease in MEs and increase in their detection. The knowledge deficit factor emphasizes on the importance of educational sessions and continuous education in the prevention and minimization of MEs among nurses in general, and nurses of sensitive and critical care departments.

In addition the quantitative approach, qualitative research has successfully tried to explore the actual and potential practices that nurses in NICUs do to prevent the incidence of MEs, such as the content analysis that was conducted on a focus group of NICU nurses in Denmark. The analysis emerged in that the main current interventions that are taken to prevent the occurrence of MEs include the focus on technological advancement and involvement, procedures guidelines and clarification, educational sessions in a recurrent manner to keep knowledge up to date among nurses, which will be reflected on the improvement of psychomotor skills related to medication preparation and administration, as well as the involvement of hospital pharmacy services (Rishoej et al., 2018). Similarly, a survey-based study was conducted by Matti, Nguyen, Mosel, and Grzeskowiak (2018) in order to investigate the impact of specific preventive measurements in the prevention of MEs in sampled Australian and New Zealand NICUs, which showed that the most commonly used evidence-based technologies were smart pumps (90%), followed by the presence of ward-based clinical pharmacists (85%), as well as continuous improvement of nurses' medication calculation skills.

The qualitative method was also used in a Palestinian study that involved semi-structured in-depth interviews with 4 specialist doctors and 11 NICU nurses. The interview lasted a total of 282 minutes and was conducted in several centers. Results divided the errors under examination

into three groups. These categories included mistakes made when preparing or storing pharmaceuticals, such as calculation and dilution errors, as well as mistakes made when using the improper diluent or solvent. The second class of errors relates to the phase of prescribing and administering medications, such as inappropriate prescribing for a neonatal patient, unintentionally using the incorrect administration technique or dose, while the third class relates to errors that may occur after the administration, which focuses on the failure to monitor the patient in accordance with recommended guidelines. (Shawahna, Jaber, Said, Mohammad, & Aker, 2022).

The process of medication preparation and administration is very sensitive and requires a lot of concentration by the nurse and other HCPs who are involved in the process, and therefore, minimizing interruptions is important for the continuation of safe medication administration. This aspect of medication error minimization was studied by Johnson et al. (2017) on a sample of 56 MEs that occurred with 101 interruptions, and aimed to investigate the nature, causes and consequences of interruptions during medication preparation. In terms of interruptions' characteristics, results showed that 36.2% and 34.0% of interruptions happen in a rate of one and two interruptions per patient, respectively, with 51.8% happening at a rate of one interruption per medication event. Most of the interruptions are done by nurses (39.6%), the patient (12.9%) and medical officers (10.9%) and are focused in their nature on social interactions (27.8%), administrative issues (19.4%) and attending to patients' need (13.9%). On the other hand, 96.4% of interruptions did not result in any clinical errors occurring, as 58.7% of the procedural failures following interruptions did not reach the patient. The researchers emphasized the importance of education of nurses to increase the capability of focusing and acquire the skills of minimizing interruptions.

2.3 Educational sessions association with knowledge and perception of PICU and NICU nurses towards MEs

To investigate the association between educational sessions and the improvement in the level of knowledge and perceptions among nurses about MEs, it is important to start the study with an overall assessment of the knowledge and perception level among them towards MEs, which was investigated in several studies worldwide, for example Palestine, like the cross-sectional study that was conducted on a sample of 394 nurses, doctors and pharmacists from four representative areas in West Bank to assess their overall knowledge about MEs actions. Results showed that 51.5% of the HCPs have good level of awareness, compared to 32% with average level of awareness and 16.5% with poor level of awareness regarding MEs actions, with significantly higher level of awareness among HCPs of older age, who work in Jerusalem governorate (60.6%, compared to 38.1% in Bethlehem, for example) and higher experience, with greater level of awareness among doctors (71.1% for good awareness level) compared with nurses (50%) and pharmacists (26.9%). The study also reported the most common reasons for not reporting MEs, as stated by the HCPs, which were fear of legal or social consequences (61.2%), being too busy (41.1%) and not knowing whom to inform (31.7%). Finally, the study also found that the most common positive attitudes toward MEs actions are the importance of reporting even if no harm has reached the patient, as well as that ME reporting is the professional responsibility of the HCP (Damin Abukhalil et al., 2022).

Compared to the Egyptian study of Fathy Moustafa, Ibrahim Abd Al Moniem, and Refaat Tantawi (2018), who conducted their study on a sample of 60 NICU nurses, found that 63.3% of them had incorrect knowledge regarding medication meaning questions, compared to 70.0% for the medication preparation meaning, 71.7% for the incorrect meaning of wrong medication

preparation, while 73.3% had correct knowledge about medication administration methods. Also, medication safety is important to investigate its knowledge among nurses, which the current study found that incorrect answers were found in 76.7% of the nurses regarding storage temperature, compared to 80.0% for incorrect knowledge about storage precautions. The nurses also addressed the most common factors and causes that may result in MEs, which was age (27.6%) and weight (23.9%) of child, as well as medication prescription route (29.6%) when it comes to the physicians, compared to limited nurses number (35.9%) for staffing category, drug allergy (47.0%) for the medication category itself, and absence of hospital's policy and procedure (32.3%). As expected significantly higher of awareness is found among nurses who received previous related training.

The identification of the limitations in the nurse's knowledge and perception towards MEs in PICUs and NICUs is important for the purpose of guiding the educational efforts in the right direction, because effective educational sessions should be based on scientific evidence of the shortage that is found among the targeted type of HCPs. A cross-sectional study in Iran was conducted to achieve this goal, and among the reported 131 MEs, most common error was related to dose (36.6%), followed by wrong preparation (14.5%) and wrong infusion velocity (11.5%). When nurses were asked about the possible causes for committing MEs in NICUs, the most common reported causes were poor knowledge level regarding medications (96.2%), followed by lack of enough nurses' staff (81.1%), poor calculation skills (73.6%), nurses' fatigue (58.5%) and nurses' incorrect attitude towards medications (32.1%). Such identification of causes and general aspects of MEs helps in the direction of proper improvement and education of nurses (Miladinia, Zarea, Nouri, Pishgooie, & Gholamzadeh, 2016).

The impact of educational and training sessions in area of MEs can also be studies by investigating the incidence of MEs themselves, which is the optimal outcome when the institution

because it is reflected on the quality of care and outcomes of the patients. Similar to the current study's design, a pre-post study was conducted by Kadam et al. (2018) on a sample of 48 neonates in the pre-interventional phase and 69 neonates in the post-interventional phase, with no significant differences in their characteristics of mean gestational age, birth weight and gender, which indicates a homogeneity of the sample. The incidence of MEs significantly decreased 5.3 times from 313 over 368 prescriptions (85%) to 265 over 511 prescriptions (52%), most notably in areas of prescription date and time omission error type (90.4% to 73.2%), name and signature of the nurse (95.8% to 67.9%) and illegible order type of error (25.2% to 14%), respectively. Moreover, the percentages of errors significantly decreased in morning rotations from 85.7% to 50.8% (p-value < 0.001). Therefore, the impact of educational session is not focused on the performance and knowledge of nurses themselves, but the actual outcomes related to ME incidence.

In Palestine, Abukhader (2020) conducted a pretest-posttest study that aimed to investigate the impact of educational sessions on the knowledge of MEs in ICUs among nurses. The researchers recruited 52 nurses and found that the percentage of accurate nursing procedures related to rights of medication about name, route, time and documentation were very high and did not significantly improve in the posttest phase, while in areas of right reason and response, they witnessed a significant improvement in the posttest phase (3.9% to 61.5% and 9.6% to 51.9%, respectively, p-value < 0.001). Also, the overall level of knowledge improved from a mean score of 29.3 in the pretest phase to 43.7 in the posttest phase (p-value = 0.029), with a significant improvement in nurses with younger age, female gender, surgical and cardiac ICU settings, and less experienced nurses, regardless to the educational degree. Such findings emphasize the mentioned points, as well as the importance of investigating the several factors that should be

taking in consideration when applying educational sessions, like the demographic and professional factors.

2.4 Conclusion

The current review highlights the need for careful and precise assessment and investigation of the prevalence and corresponding factors related to the prevalence of MEs in the pediatric and neonatal ICUs, because they have their special concerns in terms of patients' characteristics and diagnoses, as well as the capabilities of the HCPs who work in them. The review concluded that MEs are mostly witnessed in the areas of medication preparation and administration, which are mainly focused on the nurses' scope of practice, and therefore, efforts are commonly targeted and tested on nurses. Moreover, well-established educational sessions regarding such topic is so beneficial in terms of post-interventional outcomes.

Chapter three

Methodology

The overview of the methodological approaches used for the current study's design, sampling, data collection and analysis, and ethical considerations is provided in this chapter.

3.1 Study design

The current study used a quantitative, quasi-experimental, pretest-posttest design, in which the researcher first assessed the sampled nurses' level of knowledge and perception about MEs, followed by an educational session on the subject. Finally, the researcher reassessed the level of perception on the same group of nurses, to see what effect the educational sessions had on the nurses' knowledge and perception of MEs.

Quasi-experimental design is the design where the researcher aims to identify a cause-and-effect relationship between independent and dependent variables, and it contains the same process of true experimental design, except for randomization, and therefore it includes manipulation (the presence of a treatment or procedure, which is the educational sessions in the case of the current study). The main advantages of the current design is in the external validity, where in comparison with other true experiments, in which it involves real-world implementation of a procedure, and internal validity advantage, in which it allows the researcher to control for confounding variables, while the main disadvantage it the absence of randomization in sample selection, which is overcome in the current study by the implementation of total sampling method of recruitment, as explained later (Thomas, 2022).

Also, the current study design benefits of the advantages of pretest-posttest implementation, which include its feasibility when randomization is unavailable or impractical, as well as it requirement for fewer resources, with no temporality issue consideration, as the researcher is sure that the posttest impact of the educational session has followed the session, which is absent in case of posttest-only design (Choueiry, 2020).

3.2 Site and setting

The current study was held in the pediatric intensive care unit (PICU) and neonatal intensive care unit (NICU) of Palestine Medical Complex in Ramallah – West Bank – Palestine.

The NICU department in PMC contains 16 incubators and is divided into two rooms A and B. Each room has 8 incubators and 23 nurses work in it. The pediatric intensive care department contains 10 beds and 25 nurses work in it.

The mentioned settings are suitable for the current study, as they contain the targeted characteristics of nurses, who work in specialized ICUs that receive a variety of medical and surgical cases of pediatric and neonatal patients, which is supported by the presence of gynecology and obstetric department in the mentioned hospital, and therefore, there is a high probability of admitting respiratory distress syndrome (RDS) cases. Also, several job titles are included in the care for pediatric and neonatal cases, including experienced pediatricians and pediatric surgeons, as well as the recent opening of pediatric open-heart surgery center. The mentioned factors increase the applicability of the current study, which is supported by the use of several medications, and therefore, more representation of the overall knowledge and perception about errors.

3.3 Population, sample and inclusion criteria

The population of the current study includes all nurses who work in the mentioned PICU and NICU settings, regardless to age, gender or educational qualifications. In terms of sampling, the researcher adopted a total sampling method, in which the researcher recruited all 23 NICU and 25 PICU nurses, as convenient sample for the quasi-experimental design. Total population sampling technique is beneficial especially when the population size is relatively small, and therefore, it also benefits from the advantages of prospective data collection, as well as more control of confounders.

3.4 Data collection tool and process

For the purpose of data collection, the researcher used a self-administered questionnaire that was developed based on previous literature, clinical experience and experts' opinions. The original questionnaire was developed by Damin Abukhalil et al. (2022), and the original author was contacted and granted the ability to use the original tool via an official e-mail (see Annexes). Self-administered questionnaires have several advantages, including their cost effectiveness, as well as ease to administer regardless to group size, and its suitability for anonymity of the participant, especially when sensitive topics are asked for. (Phellas, Bloch, & Seale, 2011). The limitation is overcome in the current study by total population sampling method and the help of NICU and PICU head nurses in the follow up process of participants' answering the questionnaires in both phases.

The used questionnaire consisted of two main parts: demographic variables and knowledge and perception. The first part consisted of close-ended questions related to nurses' gender, age group, experience and residency, while the second part was concerned with the investigation of nurses' knowledge and perception towards MEs, which is conducted using "yes/no" questions on

statements that are grouped in four classes: “Class A” for basic knowledge about MEs and interventions, “Class B” for ME reporting, “Class C” for capability to give recommendations and opinion, and “Class D” for possible causes and precautions of MEs.

The researcher disseminated the first version of the questionnaire on the nurses (as a pretest phase) after granting the informed consent from them, and then and educational session was provided to nurses in several topics related to MEs to cover the areas (classes) that were asked for in the questionnaire, which was a set of interactive lectures that aimed to increase the level of knowledge and perception among nurses, and focusing on the areas of weakness as tested in the pretest phase. Following the educational session, which was provided in face-to-face method by an experienced nurse, the posttest phase was conducted after 10 days of the education, which included the investigation of perception and knowledge using the same pretest method. Pre test questionnaires were distributed from 11/2/2023 to 27/2/2023, and the educational session was given on 29/2/2023, and then on 9/3/2023 posttest questionnaires were distributed.

3.5 Validity and reliability

Validity of the questionnaire was conducted using content validity, in which the researcher reviewed the content and coverage of the questionnaire by asking 5 experts in the field of medications and MEs in neonates and pediatric patients, including 2 specialists, 2 experienced nurses and a pharmacologist, who gave a general positive feedback and recommended miscellaneous modifications related to some of the questions, like the recommendation of more explanatory questioning of protocols and guidelines related to MEs.

Cronbach’s alpha was calculated to determine the internal consistency of the scale, and the result was 0.778, which indicates an acceptable level of reliability of the scale that was used.

3.6 Data analysis

To achieve the quantitative analysis of the current study's data, Statistical Package for Social Sciences (SPSS) software v27.0 on Windows Operating System (OS) was used to produce both descriptive and analytical results. Descriptive results included frequencies and percentages of the nurses' responses to the items of questionnaires' sections (demographic and perception/knowledge), as well as mean and standard deviation for the description of their perception and knowledge scores, in order to be followed by classification of their knowledge level into unsatisfying (< 60%), satisfying (60% - < 80%) and very satisfying (80% and above).

Moreover, analytical results were used to investigate the relationship between nurses' demographic factors (as independent variables) and the pretest and posttest knowledge and perception levels (as dependent variables), and between demographic factors and the differences in pretest-posttest scores to investigate for the most common demographic factors that have the impact on the differences in knowledge and perception level after the educational sessions, which was conducted using independent sample t-test for the relationships according to gender, age groups and department (as dichotomous variables) and one-way Analysis of Variance (ANOVA) according to educational level and experience in the ward (as non-dichotomous variables). In addition, paired-sample t-test was used to investigate the significance level of the differences between pretest and posttest scores in general.

3.7 Ethical considerations

The researcher fully adhered to the set of ethical principles that ensure anonymity and confidentiality of the data obtained while conducting the current investigation. The researcher gave the nurses a written informed consent that explained the purpose and procedures of the study, the grant of anonymity by collecting no sensitive data, the numbering of the questionnaires with a

contact detail for only follow-up, the assurance of confidentiality by stating that the collected data will be used only by the researcher and for research purposes only, and many other important factors. Additionally, the nurse may leave the research at any time without providing a reason in writing.

Chapter Four

Results

This chapter reviews the descriptive and analytical results of the current study, where the descriptive results review the frequencies and percentages of the nurses' demographic data and their responses to the questions related to all aspects of medication errors, while analytical results review the investigation of the relationships between study's independent and dependent variables.

Part 1: Demographic data

Table 1 distributes the demographic data of the nurses who participated in the current study, which shows that the percentage of male nurses (62.5%) is higher than female nurses (37.5%), and that majority of the nurses hold the bachelor's degree in nursing (87.5%), followed by 8.3% for master's degree, and only 4.2% for diploma degree.

All of the participants are between 22 and 32 years old (100.0%), and 52.1% of them work at the pediatric ICU while 47.9% of them currently work at the NICU department, with more than half of them (56.3%) having less than 5 years of experience, compared to 29.2% who have between 5 and 9 years of experience, with 14.6% of them having more than 10 years of experience.

Table 1: Distribution of nurses' demographic data

Variable	Values	Frequency	Percentage
Gender	Male	30	62.5%
	Female	18	37.5%
Educational level	Diploma degree	2	4.2%
	Bachelor's degree	42	87.5%

	Master's degree	4	8.3%
Age group	22 – 32 years old	48	100.0%
	Older than 32 years old	0	0.0%
Department	PICU	25	52.1%
	NICU	23	47.9%
Experience in the ward	< 5 years	27	56.3%
	5-9 years	14	29.2%
	more than 10 years	7	14.6%

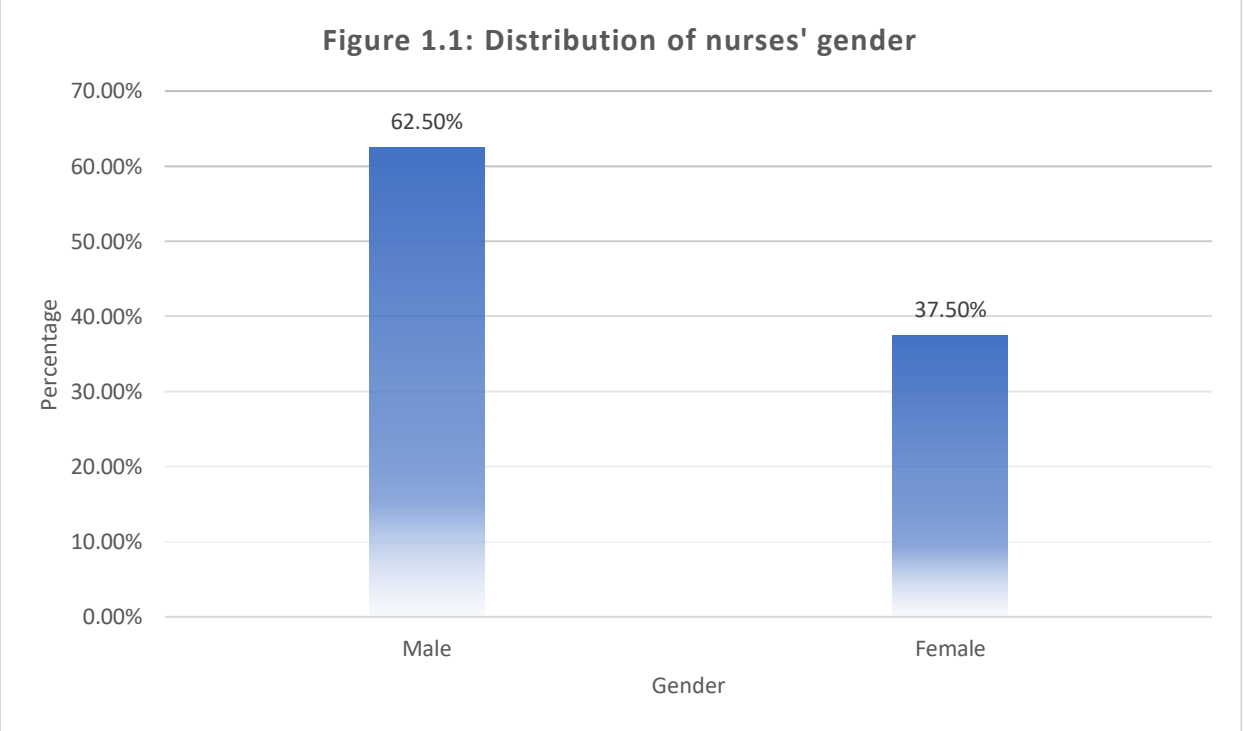


Figure 1.2: Distribution of nurses' educational level

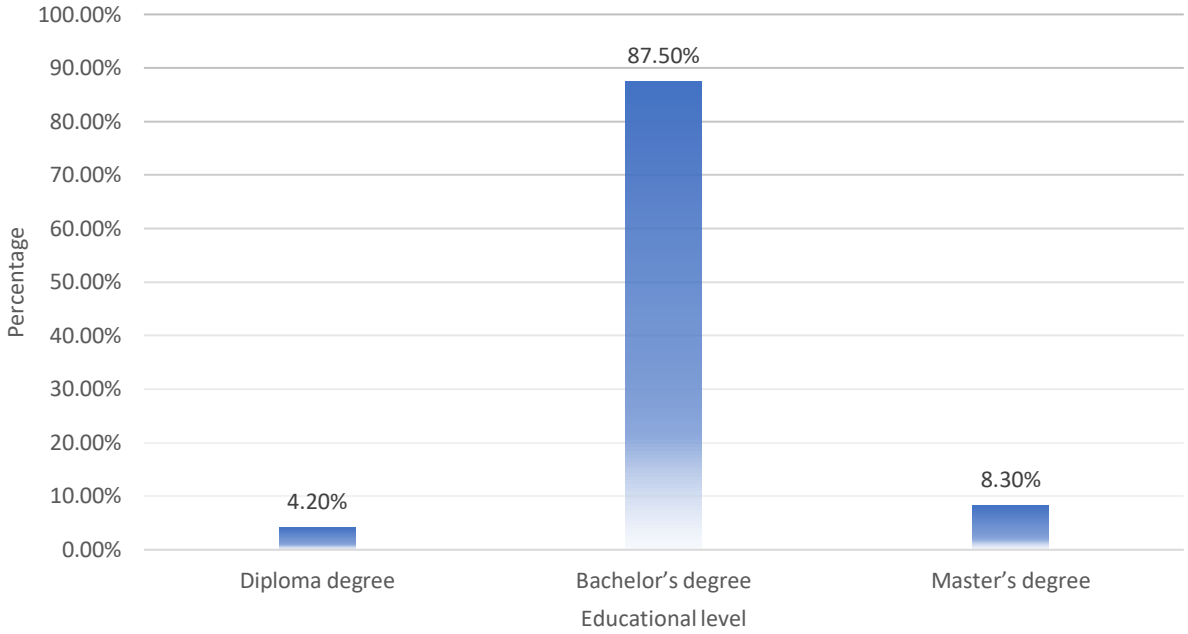
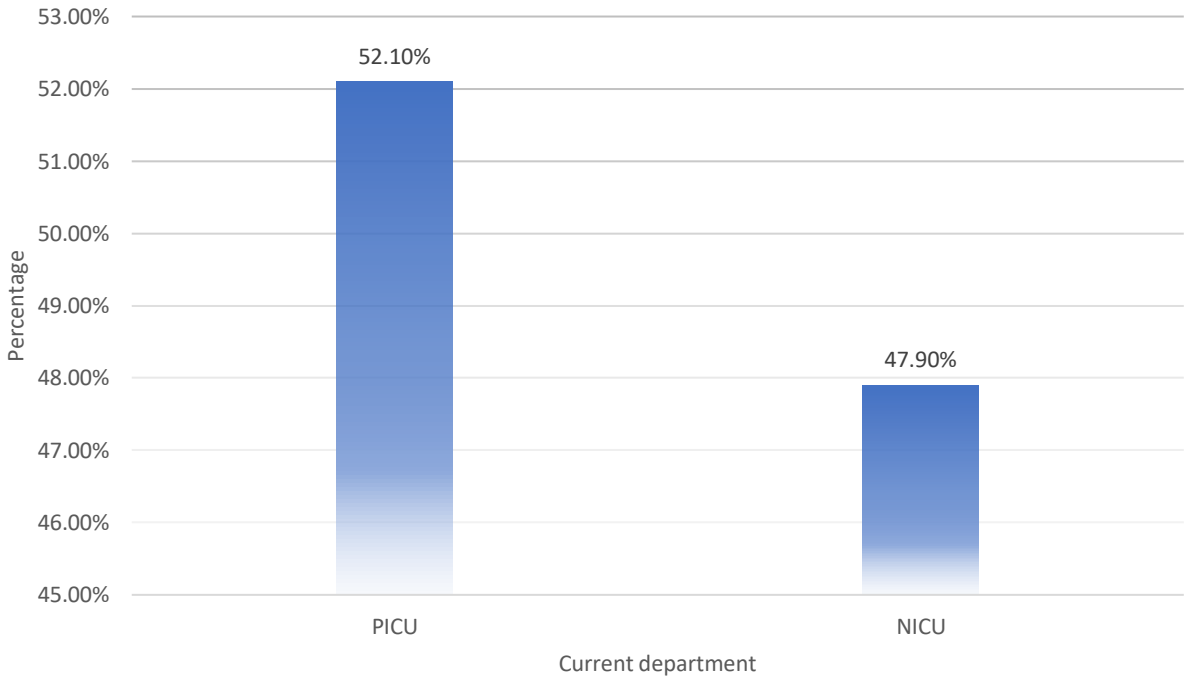


Figure 1.3: Distribution of department of current work



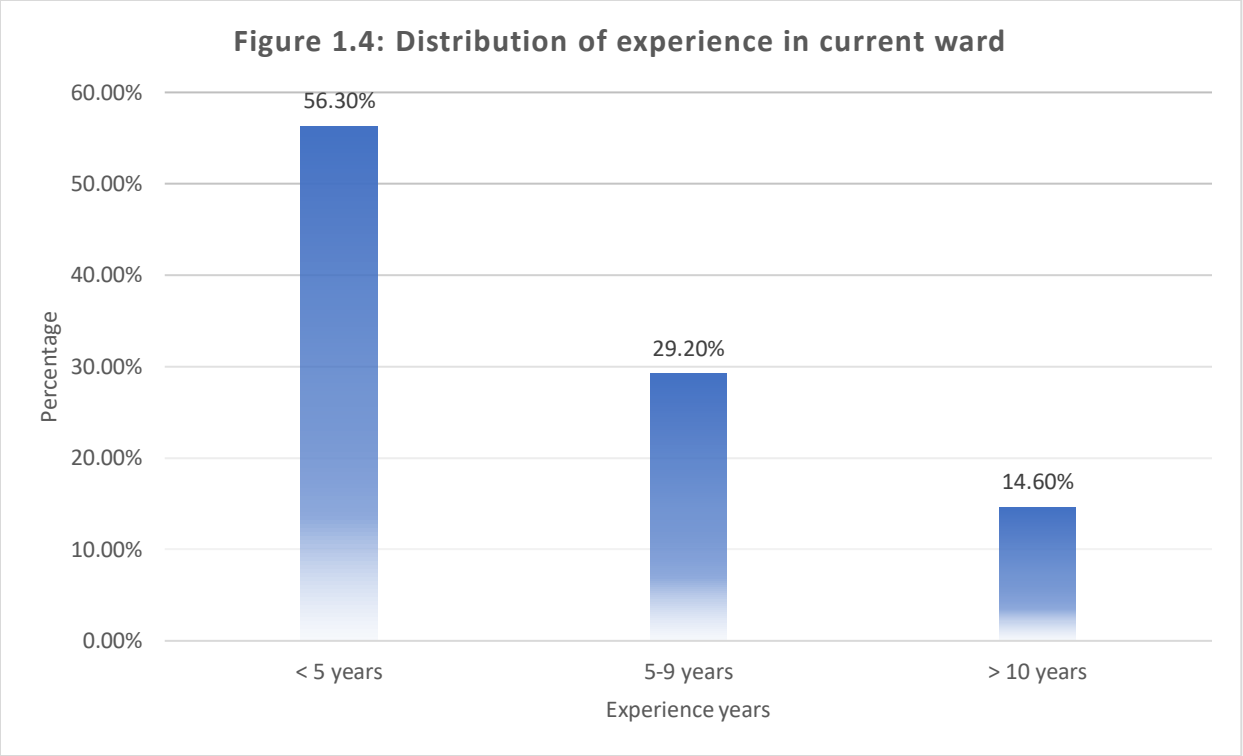


Figure 1.4: Distribution of experience in current ward
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Percentage
56.30%
29.20%
14.60%
< 5 years
5-9 years
> 10 years
Experience years

Part 2: Medication errors

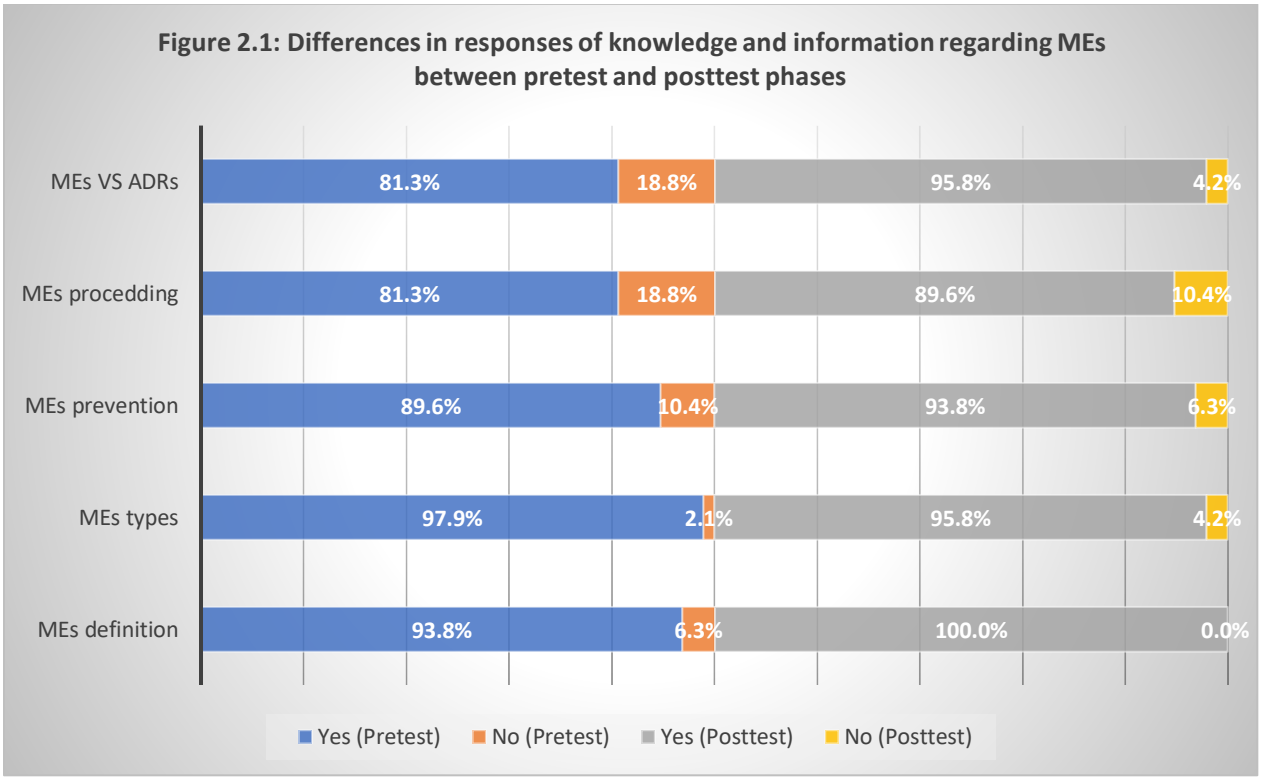
This part reviews the description of participants' responses to the close-ended questions related to their basic knowledge, reporting, capability of giving opinions and recommendations, as well as perceived causes of medication errors. It also reviews the differences in the percentages of responses between pretest and posttest phases of the study, with the significance level of the differences.

The first table (Table 2.1) shows that the perceived level of knowledge and information insignificantly increased from a mean of 4.438 ± 0.943 out of 5 in the pretest phase to 4.750 ± 0.758 out of 5 in the posttest phase (p-value = 0.077). More deeply, the nurses' awareness insignificantly increased from 93.8% to 100% regarding the definition of MEs (p-value = 0.078), decreased from 97.9% to 95.8% regarding various types of MEs (p-value = 0.557), increased from 89.6% to 93.8% regarding the various interventions to prevent MEs (p-value = 0.460) and from 81.3% to 89.6% regarding what to proceed after MEs (p-value 0.247), while it significantly increased from 81.3% to 95.8% regarding the differences between MEs and ADRs (p-value = 0.025).

Table 2.1: Distribution of participants' responses and their differences between pretest and posttest phases regarding medication errors basic knowledge and information

Statement	Pretest		Posttest		X^2	p-value
	Yes	No	Yes	No		
1. Are you aware of the definition of a medication error?	45 (93.8%)	3 (6.3%)	48 (100.0%)	0 (0.0%)	3.097	0.078

2. Are you aware of the various types of medication errors?	47 (97.9%)	1 (2.1%)	46 (95.8%)	2 (4.2%)	0.344	0.557
3. Are you aware of the various interventions to prevent medication errors?	43 (89.6%)	5 (10.4%)	45 (93.8%)	3 (6.3%)	0.545	0.460
4. Are you aware how to proceed if medication errors occur?	39 (81.3%)	9 (18.8%)	43 (89.6%)	5 (10.4%)	1.338	0.247
5. Are you aware of the difference between a medication error and an adverse drug reaction?	39 (81.3%)	9 (18.8%)	46 (95.8%)	2 (4.2%)	5.031	0.025
Total score out of 5 (mean ± SD)	4.438 ± 0.943		4.750 ± 0.758		- 1.79	0.077



In the following table, level of knowledge was compared according to the nurses' demographic factors at the pretest and posttest phases, taking into account that age of the nurse was excluded from the comparison as all of the nurses are in the same age category.

The table shows that both gender and experience were not significantly related to a difference in knowledge level in both pretest and posttest phases (p-value > 0.05). On the other hand, mean level of knowledge was significantly higher among nurses with Master's (4.750 ± 0.500) and Bachelor's (4.548 ± 0.739) degrees than diploma (1.500 ± 0.707) degree (p-value < 0.001), and among nurses of NICU (4.826 ± 0.388) than PICU (4.080 ± 1.152) departments (p-value = 0.005) in the pretest phase, while such differences were not significant in the posttest phase (p-value = 0.896 and 0.925, respectively). Such results indicate that the differences in knowledge levels disappear in the posttest phase, and therefore, educational sessions were effective among all nurses regardless of their demographic factors.

Table 2.2: Differences in level of knowledge regarding medication errors in the pretest and posttest phases according to nurses' demographic factors

Demographic factor	**Values**	**Pretest knowledge**				**Posttest knowledge**			
		Mean	**SD**	**Test value**	**p-value**	**Mean**	**SD**	**Test value**	**p-value**
Gender	Male	4.533	0.973	0.907	0.369	4.667	0.922	- 1.202	0.236
	Female	4.278	0.895			4.889	0.323		
Educational level	Diploma	1.500	0.707	17.271	< 0.001	5.000	0.000	0.110	0.896
	Bachelor's	4.548	0.739			4.738	0.798		
	Master's	4.750	0.500			4.750	0.500		

Department	PICU	4.080	1.152	- 3.056	0.005	4.760	0.663	0.094	0.925
	NICU	4.826	0.388			4.739	0.864		
Experience in the ward	< 5 years	4.519	0.802	0.551	0.580	4.815	0.622	1.255	0.295
	5-9 years	4.214	1.251			4.500	1.092		
	> 10 years	4.571	0.787			5.000	0.000		

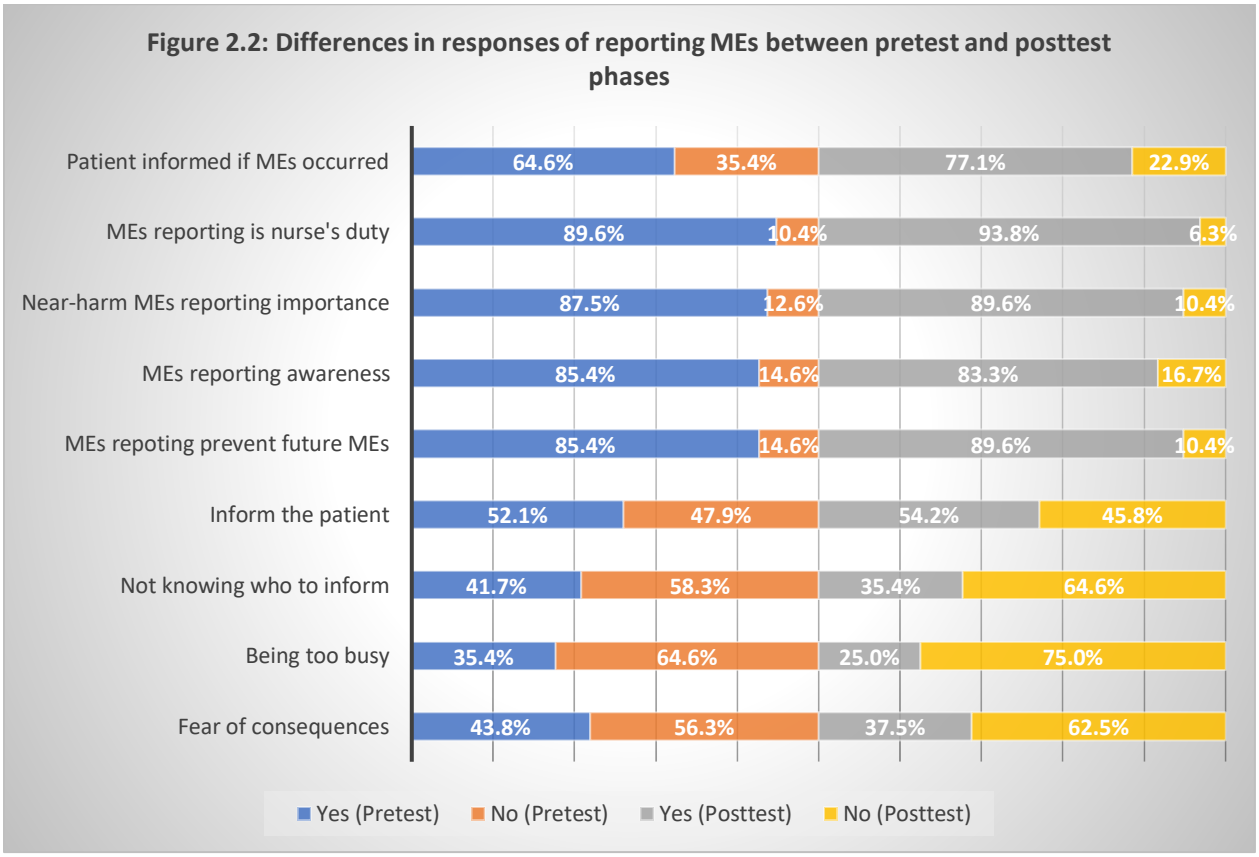
The second table (Table 2.3), on the other hand, was concerned with the responses of the nurses regarding MEs' reporting. It showed that the overall reporting score insignificantly increased from a mean of 6.438 ± 1.486 out of 9 in the pretest phase to a mean of 6.896 ± 1.533 out of 9 in the posttest phase (p-value = 0.140). In more details, the abstention of reporting MEs because of legal or social consequences fear (like fear of punishment or being blamed) had decreased from 43.8% to 37.5% (p-value = 0.533), and because of being busy from 35.4% to 25.0% (p-value = 0.266), while because of not knowing who to inform from 41.7% to 35.4% (p-value 0.529).

Moreover, notifying the patient about the ME insignificantly increased from 52.1% to 54.2% (p-value = 0.838). The opinion related to the beneficence of reporting MEs for the future errors prevention insignificantly increased from 85.4% to 89.6% (p-value = 0.537), while the perceived awareness related to reporting system increased from 83.3% to 85.4% (p-value = 0.779), while the opinion related to the importance of reporting MEs that did not reach or could have harmed the patient increased from 87.5% to 89.6% (p-value = 0.749). Lastly, the belief that reporting MEs is the nurse's professional duty increased from 89.6% to 93.8% (p-value = 0.460), while the belief that informing the patient about the MEs that has occurred increased from 64.6% to 77.1% (p-value = 0.178).

Table 2.3: Distribution of participants' responses and their differences between pretest and posttest phases regarding medication errors reporting

Statement	Pretest		Posttest		X^2	p-value
	Yes	No	Yes	No		
6. If you noticed a medication error, did you **not** inform due to fear of any legal or social consequences?	21 (43.8%)	27 (56.3%)	18 (37.5%)	30 (62.5%)	0.389	0.533
7. After noticing the medication error, did you **not** inform as you were too busy?	17 (35.4%)	31 (64.6%)	12 (25.0%)	36 (75.0%)	1.235	0.266
8. After noticing the medication error, did you **not** inform as you did not know whom to inform?	20 (41.7%)	28 (58.3%)	17 (35.4%)	31 (64.6%)	0.396	0.529
9. After noticing the medication error, did you inform the patient?	25 (52.1%)	23 (47.9%)	26 (54.2%)	22 (45.8%)	0.042	0.838
10. Do you believe that medication errors reporting would significantly benefit the patient and help prevent future errors?	41 (85.4%)	7 (14.6%)	43 (89.6%)	5 (10.4%)	0.381	0.537
11. Are you aware of the reporting system and how to report?	40 (83.3%)	8 (16.7%)	41 (85.4%)	7 (14.6%)	0.079	0.779
12. Do you think that it's important to report medication errors that don't cause patient harm? Or those that could have caused harm but didn't reach the patient?	42 (87.5%)	6 (12.6%)	43 (89.6%)	5 (10.4%)	0.103	0.749

13. Do you believe it is your professional duty to report medication errors?	43 (89.6%)	5 (10.4%)	45 (93.8%)	3 (6.3%)	0.545	0.460
14. Should a patient be informed if a medication error occurred?	31 (64.6%)	17 (35.4%)	27 (77.1%)	11 (22.9%)	1.815	0.178
Total score out of 9 (mean ± SD)	6.438 ± 1.486		6.896 ± 1.533		- 1.49	0.140

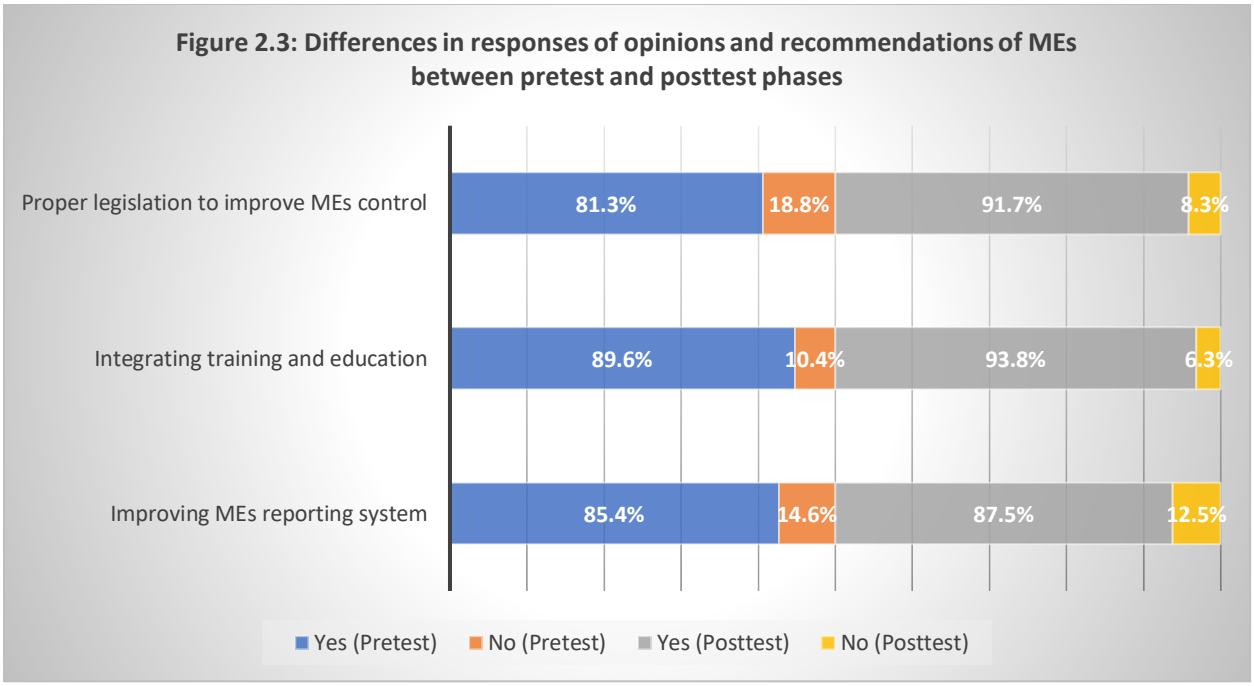


The next table (Table 2.4) distributed the responses of the nurses about statements related to their capability of giving opinion and recommendations, which showed that the mean score insignificantly increased from a mean of 2.563 ± 0.649 out of 3 in the pretest phase to a mean of 2.729 ± 0.676 out of 3 in the posttest phase (p-value = 0.221). In more details, giving opinion and recommendations related to the improvement of MEs reporting system in the hospital increased

from 85.4% to 87.5% (p-value = 0.765), while the recommendation of integrating MEs education and training in medical institutes and the general public increased from 89.6% to 93.8% (p-value = 0.460), and the recommendation of proper legislation and regulations to improve the control of MEs and increase drug safety increased from 81.3% to 91.7% (p-value = 0.136).

Table 2.4: Distribution of participants' responses and their differences between pretest and posttest phases regarding medication errors' capability to give opinion or recommendations

Statement	Pretest		Posttest		X^2	p-value
	Yes	No	Yes	No		
15. Should there be an improved system in hospitals regarding medication errors reporting?	41 (85.4%)	9 (14.6%)	42 (87.5%)	6 (12.5%)	0.089	0.765
16. Do you recommend integrated approach toward training and education about the medication error in medical institute and the general public?	43 (89.6%)	5 (10.4%)	45 (93.8%)	3 (6.3%)	0.545	0.460
17. Should proper recommendations of organization, legislation, regulation and resources improve control of medication errors and safe use of drugs?	39 (81.3%)	9 (18.8%)	44 (91.7%)	4 (8.3%)	2.224	0.136
Total score out of 3 (mean ± SD)	2.563 ± 0.649		2.729 ± 0.676		- 1.23	0.221



The last table (Table 2.5) was concerned with the investigation of the differences in the perceived causes of MEs between the pretest and posttest phases, where it insignificantly decreased from a mean of 8.063 ± 2.096 to 7.583 ± 2.938 out of 11, respectively (p-value = 0.424). Focusing more on the specific causes, missing clinical information decreased from 83.3% to 70.8% (p-value = 0.145), missing drug information increased from 79.2% to 81.3% (p-value = 0.798), problems related to drugs' name, labeling or packaging decreased from 81.3% to 66.7% (p-value 0.104), drugs' storage or delivery from 62.5% to 60.4% (p-value 0.834), while problems related to drug order miscommunication or delivery device remained the same (72.9% and 62.5%, respectively).

Moreover, causes related to problems of environmental staffing or workflow decreased from 68.8% to 60.4% (p-value = 0.393), staff education lack decreased from 81.3% to 79.2% (p-value = 0.798), as well as patient monitoring lack that decreased from 70.8% to 62.5% (p-value =

0.386), and patient education lack from 72.9% to 64.6% (p-value = 0.378), while independent check system and quality control lack increased from 70.8% to 77.1% (p-value = 0.845).

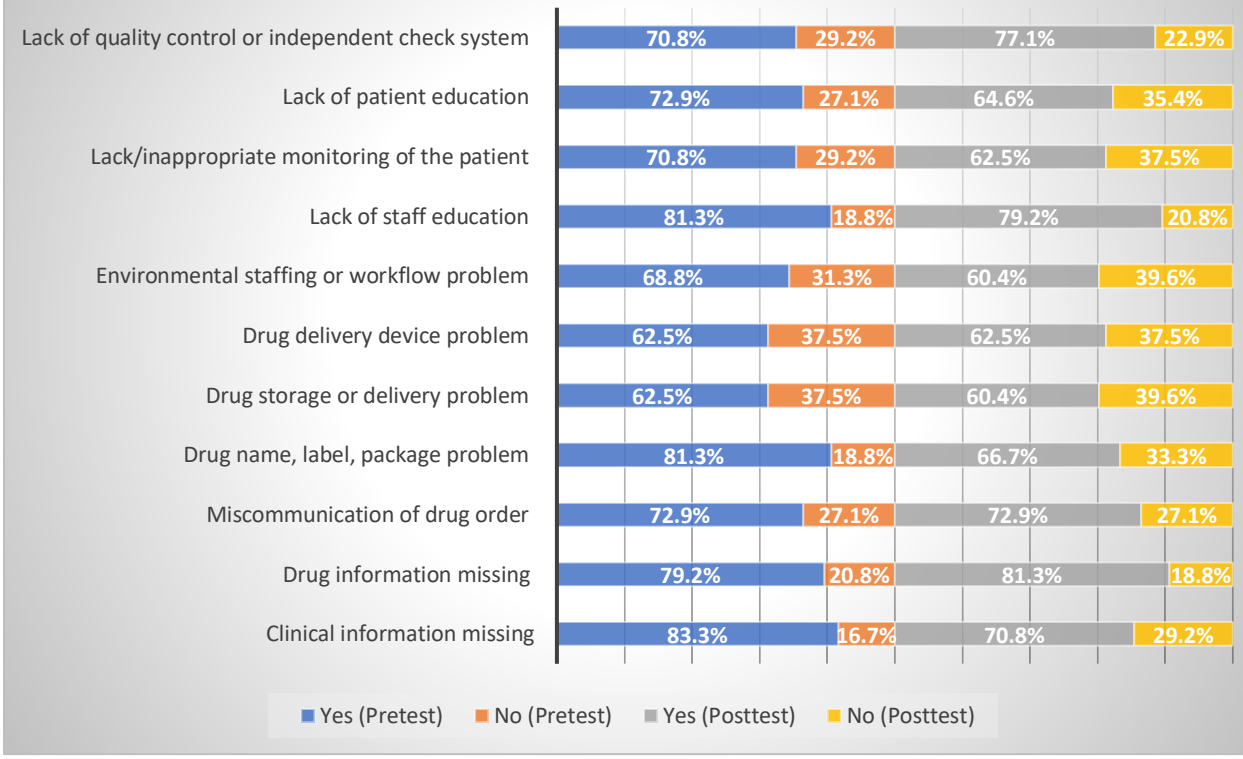
In the end, the responses of nurses' belief that the institution have written policies and procedures on safe medication practices decreased from 87.5% to 75.0% (p-value = 0.117), and the opinion related to providing continuous education on MEs also decreased from 79.2% to 64.6% (p-value = 0.112).

Table 2.5: Distribution of participants' responses and their differences between pretest and posttest phases regarding medication errors causes

Statement	**Pretest**		**Posttest**		X^2	**p-value**
	Yes	**No**	**Yes**	**No**		
18. What do you think is the cause of a medication error/Contributing factor?						
1) Clinical information missing	40 (83.3%)	8 (16.7%)	34 (70.8%)	14 (29.2%)	2.123	0.145
2) Drug information missing	38 (79.2%)	10 (20.8%)	39 (81.3%)	9 (18.8%)	0.066	0.798
3) Miscommunication of drug order	35 (72.9%)	13 (27.1%)	35 (72.9%)	13 (27.1%)	--	--
4) Drug name, label, package problem	39 (81.3%)	9 (18.8%)	32 (66.7%)	16 (33.3%)	2.650	0.104
5) Drug storage or delivery problem	30 (62.5%)	18 (37.5%)	29 (60.4%)	19 (39.6%)	0.044	0.834

6) Drug delivery device problem	30 (62.5%)	18 (37.5%)	30 (62.5%)	18 (37.5%)	--	--
7) Environmental staffing or workflow problem	33 (68.8%)	15 (31.3%)	29 (60.4%)	19 (39.6%)	0.729	0.393
8) Lack of staff education	39 (81.3%)	9 (18.8%)	38 (79.2%)	10 (20.8%)	0.066	0.798
9) Lack/inappropriate monitoring of the patient	34 (70.8%)	14 (29.2%)	30 (62.5%)	18 (37.5%)	0.750	0.386
10) Lack of patient education	35 (72.9%)	13 (27.1%)	31 (64.6%)	17 (35.4%)	0.776	0.378
11) Lack of quality control or independent check system	34 (70.8%)	14 (29.2%)	37 (77.1%)	11 (22.9%)	0.487	0.485
Total score out of 11 (mean ± SD)	8.063 ± 2.096		7.583 ± 2.938		0.80	0.424
19. Does your institution have written policies and procedures on safe medication practice?	42 (87.5%)	6 (12.5%)	36 (75.0%)	12 (25.0%)	2.462	0.117
20. Does your institution provide continuous education on medication errors?	38 (79.2%)	10 (20.8%)	31 (64.6%)	17 (35.4%)	2.525	0.112

Figure 2.4: Differences in responses of causes of MEs between pretest and posttest phases



Chapter Five

Discussion

The following chapter discusses the results of the current study, in which the researcher criticized the results of the study from the individual point of view, and depending on the previous experience, as well as comparing the current results with the findings of the previous studies.

In the beginning, the researcher adopted total population sampling technique, in which all of the nurses who are working at the targeted settings were included in the study (25 nurses from PICU and 23 nurses from NICU), and therefore, the researcher benefited from the advantages of total population sampling, which is a type of convenient non-probability sampling techniques, and is based on the researcher's judgment to collect data from and recruit participants depending on the information that suits the study's objectives (Etikan & Bala, 2017), and was chosen in the current study because of the relatively smaller population size. This kind of sampling method is the most suitable for theoretical, analytical and logical generalization of the results on the overall population, as all population members are included in the study, especially in cases when the researcher has the ability to do so, with the benefit of overcoming the disadvantages of other purposive sampling techniques, which have the limitation of researcher's selection bias (Sharma, 2017). Although several advantages are found in the current study's selection criteria, data collection process and the use of a questionnaire that was adopted in previous Palestinian studies and has covered all of the targeted variables that the researcher intended to investigate for, the current study has a main selection limitation of conducting the study on a single center only, which was mainly caused by limited timeframe and easier to contact health facilities of Palestinian MoH, as one letter to MoH is enough to grant the data collection from several governmental health

centers, while it is relatively harder for the non-governmental facilities, where each private health institution needs a separate communication letter, form and process.

In terms of the study's sample characteristics, the sample had around two thirds (62.5%) of male nurses compared to 37.5% of female nurses. Moreover, the percentage of nurses who hold bachelor's degree in nursing (87.5%) in the current days is higher than previous periods, where there was more dependance on nurses with diploma degrees, taking in consideration that it is witnessed that there is an increased turnout on the higher educations (master's and PhD) degrees (8.3%), because such educational levels are increasingly available for the specialties of neonatal and pediatric nursing. This distribution of educational levels is also coherent with the distribution of age groups in the current study, where all of the nurses were between 22 and 32 years old, which means that they are relatively younger generations than the rest of departments, reflecting more ambitious thoughts towards the improvement of neonatal and pediatric nursing care.

The questionnaire that was used to investigate nurses' opinions and practices related to medications errors has some major advantages, including the use of close-ended questions only, which allows for more control over that quantitative analytical process, because it allows for presenting the data using frequencies and percentages, as well as the ability to quantitatively compare the answers between pretest and posttest phases. Also, the questionnaire included several sections that tried to cover all the aspects that nurses in PICUs and NICUs are interested in when it comes to the assessment and monitoring of MEs inside these wards, starting with the assessment of their knowledge and awareness towards MEs, then covering the area related to their reporting, because MEs may not be corrected or even discovered if not reported, and proper reporting process starts with a proper reporting system inside the hospital, as well as increasing the awareness of its importance among healthcare providers, especially nurses, because they are the frontline in the

care of neonates and pediatric patients, therefore it is important for continuous education departments to continuously try to build the error reporting culture inside them (Kim, Seok, & Kim, 2020). Rather than assessing the level of knowledge and awareness among nurses towards MEs, the tool also included an important aspect regarding the nurses' capability to give opinions and recommendations about MEs and reporting, which was then followed by a thorough investigation of the most common factors and causes that may correspond to MEs, because such investigation is taken from the subjective view of nurses rather than the objective view of the stakeholders and administrative body.

Overall, almost all items and scores related to the four aspects of MEs in the current study witnessed insignificant differences in terms of agreement levels (p-value > 0.05), which can be primarily related to the presence of actual high levels of pretest knowledge (mean = 4.438 ± 0.943 out of 5), positive MEs reporting habits and opinions (mean = 6.438 ± 1.486 out of 9), as well as good comprehension of the most common causes of MEs (mean = 8.063 ± 2.096), that reflects an overall positive attitude and practices of the samples nurses regarding MEs, taking in consideration that majority of the questions have had increased percentages of positive answers in the posttest phase. The only significantly improved percentage of answers was related to the awareness of the difference between MEs and ADRs (from 81.3% to 95.8%, p-value = 0.025), which may reflect the need to focus on the differentiation between both terms and emphasizing that ADRs are a type of the events that are reported about MEs. Also, it is expected to find insignificant differences in all categories changes between pretest and posttest phases according to the demographic and professional factors of the nurses, which is in general consistent with come of the previous studies, while it is was against many of them, as discussed later.

The current study adopted the quasi-experimental quantitative pretest-posttest design, which is one of the most rigorous designs when the researchers aim to investigate the actual differences in teaching efforts and educational sessions on a specific area of the clinical practice, and stimulates the importance of continuous education among the nurses themselves. It is also good to find that several previous studies were also conducted using rigorous study designs.

The use of a retrospective design in the investigation of MEs nature from several aspects was suitable for the Qatari study of Pawluk et al. (2017), because the researchers aimed to conclude the most common causes and characteristics of MEs inside the targeted departments, which is different than the general aim of the current study. On the other hand, the previous Qatari study mentioned that 98.5% of the errors occur during the prescription phase, which is not much involved in the nursing care process, but rather in the medical role of medication administration. This also appears in the exclusion of medication prescription as a possible cause of MEs in the current study's questionnaire, and focusing more on the possible causes that nurses are more involved in, like communication process, drug storage, delivery and labeling, care for environmental staffing and work flow, as well as staff education, which all showed high level of anticipated role in the process of MEs by the nurses of the current study. On the other hand, the Palestinian literature should include more studies that focus on the assessment and monitoring of specific areas in MEs, as found in the previous study. For example, it is important to investigate for the most common demographic and medical factors of the patients who are involved in MEs reporting, like the differences in MEs themselves according to the age, gender and type of disease that the patients have (e.g., the previous study of Al-Ramahi et al. (2017) in Palestine on non-PICU patients younger than 16 years old), as well as the importance of continuously reporting the most common types of medication that are reported, as well as the percentages of classifications of ADRs, and

not just shortening this on the annual or seasonal reports inside hospitals, and try to compare different types of departments and hospitals.

As found in the Egyptian study of Elmeneza et al. (2018), the second leading cause of MEs was related to transcription/verification phase, which nurses are mostly involved in, and this is also consistent with the current findings that 83.3% of the possible MEs are caused by missing clinical information, which are very important to acquire among nurses, and can be considered an umbrella that contains all the needed knowledge among nurses related to medication dispensing, storage, monitoring, … etc., which were also found to be high in rank in the current study, and are mentioned in the previous Egyptian study. The previous study also mentioned an important point regarding the importance of enough medical team ratios with the patients, because they enhance the workflow and medication prescription and administration process, which the current study found that 68.8% of the nurses agreed that environmental staffing or workflow problems are involved in MEs occurrence.

The Egyptian study mentioned that the prevalence of MEs is approximately 96.1 per 100 patients, which is significantly larger than the ration that was reported in the Spanish study of Esqué Ruiz et al. (2016), who reported a ratio of 20 per 100 patients. The differences may be related to different equations used, as well as that nurses tend to differently report several types of MEs, with less reporting of the less harmful MEs in some hospitals compared to others, where 40.1% of them were in class “D” in the Egyptian study, compared to 89.4% of harmless MEs in the Spanish study. Also, the Spanish study investigated for the most common possible causes of MEs, with distraction being the most common cause (59.9%), which is consistent with the high percentage of nurses who answered for miscommunication as a possible cause (72.9%). Also, training shortage was found to be the second leading cause of MEs in the previous study, which

was also high in the current study, where 81.3% agreed for lack of staff education as a possible cause, and while there were high levels of agreement that the hospital that they are working at provides written policies and procedure (87.5%) as well as continuous education (79.2%) on safe medication practices, 70.8% of them also agreed that there is a lack in the quality control or independent check system as possible causes for MEs, which highlights the need for the improvement of continuous education content and process of the targeted hospital.

The importance of communication process also appears in the previous study of Manias et al. (2019), who deeply investigated for the possible factors related to MEs inside the umbrella of miscommunication. Such important factors included impaired documentation, handover, bedside communication and orders' misinterpretation, and it is recommended to conduct future studies to investigate the role of such specific communicational factors on the incidence of MEs among Palestinian NICU and PICU patients. The previous study also stated that several human factors are involved, which were higher in the current study compared to the previous one, such as deficit in performance (21.5%, compared to 70.8% agreement about the lack of monitoring skills of the patients and 83.3% regarding the clinical information missing in the current study), policies and procedures (24.2% in the previous study, compared to 70.8% for the lack of quality control in the current study), and deficit in the level of knowledge (7.5%, compared to 81.3% for the lack of staff education and 79.2% for the missing of drug information in the current study). Another specific point that was found in the previous study is related to the role of family member education role in the decrease of MEs and the increase of its detection, which may be absent from large percentage of nurses, and is compared to the high percentage of nurses who reported lack of patient education as a possible factor that plays a role in the presence of MEs (72.9%).

With the increased use of qualitative design in the nursing field, it is important to recommend implementing such design in the field of MEs, because it allows for more in-depth investigation of the causes of MEs, demographic and professional factors, as well as the perceived knowledge and attitude of nurses towards MEs reporting. This importance also appeared in the previous study of Shawahna et al. (2022), which recruited a total of 15 HCPs in NICU, and focused on several areas related to quality assurance in the field of medication preparation and administration, including dose calculation, choosing the right solvent, as well as storage, which are all considered to be major roles in the nursing job description, and the qualitative type of research helps in identifying several areas of knowledge, practice and limitations related to the applicability of these specific points. Also, qualitative approach helps in forming a general idea for the researchers about the most common factors that correspond to the medication administration practices among nurses in NICU and PICU, which can be quantitatively studies later, and test a hypothesis that can be generalized on the nursing population. The previous study mentioned an important point related to the miscommunication that may happen between nurses themselves and between nurses and other HCPs, which is the interruption that nurses face while dispensing or administering medications, which happen in a higher rate inside critical care units like the targeted departments of the current study, and therefore, it is worth focusing on such phenomenon to try to eliminate interruptions and maximize the efficiency during medication preparation.

As mentioned earlier, most of the previous study that were reviewed in the current study found a positive significant impact of educational sessions on the overall MEs knowledge, attitude and practicing, especially in NICUs and PICUs, while the current study found an increase in the overall knowledge, awareness, positivity of opinions related to recommendations and reporting, as

well as the most common causes of MEs, while the increase was not significant in all of the mentioned domains, and is mainly related to already high scores in the pretest phase.

The previous study of Damin Abukhalil et al. (2022) who investigated the level of knowledge about MEs from several aspects have found that 51.5% of the HCPs had good level of knowledge, and when compared to the current study, the pretest level of knowledge and awareness was found to have a mean of 4.438 ± 0.943 out of 5, which is equal to 88.76%, which indicated very high level of knowledge in the pretest phase, which insignificantly increased to a mean of 4.750 out of 5, which is equal to 95.0%, and therefore, both pretest and posttest mean knowledge and awareness scores are high, and resulted in insignificant increase. The main differences between the current study and the previous Palestinian study is that the previous study was conducted on a larger sample size compared to the current study (n = 394 vs 48), which allowed for more generalizability, taking in consideration that the current study has adopted the same tool of the previous one after granting the approval. Also, the previous study conducted the assessment of level of knowledge on doctors and pharmacists in addition to nurses, which gave the researchers the opportunity to compare between several specialties, which is recommended to be applied in a similar way as in the current study, with the inclusion of doctors and nurses who work in NICUs and PICUs, which will allow for the recruitment of larger sample size. According to the previous study, the most common cause of not reporting MEs was related to feat of legal or social consequences (61.2%) which was higher than what was found in the current study during the pretest phase (43.8%), but was similar during the posttest phase (62.5%), which indicates that the educational session that the nurses in the current study have received was associated with an increased awareness about the man limitations of proper MEs reporting. On the other hand, the previous study found that being too busy (41.1%) and not knowing who to inform (31.7%) were

the second leading factors of not reporting MEs, which were approximate to the related findings in the current study in both pretest (35.4% and 41.7%), while they were less than the current study during the posttest phase (75.0% and 64.6%, respectively).

The difference in the level of knowledge about the meaning of medication-related questions in the current study and the previous Egyptian study of Fathy Moustafa et al. (2018) may be related to several factors, majorly the differences in some specific nurses' roles in terms of medication preparation and administration between the Palestinian and Egyptian nurses, as well as that the previous study used close-ended questions to assess the level of knowledge, while the current study used close-ended questions that measure the perceived level of knowledge, rather than actual measurement of knowledge related to specific terms of medications and medication errors. Also, the differences include that the previous study asked about the possible causes of MEs related to several aspects rather than medication preparation and storage causes, including factors related to the characteristics of the child (age and weight), while the current study focused on the factors related to nurses' roles in preparation, storage, delivery, administration, continuous education, and policy application.

When comparing to the current study, the previous Iranian study of Miladinia et al. (2016) stated that the most common causes related to committing MEs were poor level of knowledge (83.3% for clinical and 79.2% for drug information in the current study vs 96.2% in the previous study), lack of staffing (68.8% vs 81.1%), while communication-related causes had a percentage of 32.1% in the previous study compared to 72.9% in the current study, which may be related to different sampling methods, as well as that the previous study was concerned with the investigation of causes related to MEs only, while the current study recruited all the nurses in the targeted departments, and also aimed to assess several aspects related to causes of not reporting. The sample

of the precious study also included 131 MEs in addition to nurses of NICU and PICU. The current study also has the advantage of comparing pretest and posttest scores related to the possible perceived causes of MEs, which showed an overall decrease in the mean score.

Differences in methodological approaches may also make it harder to compare results of the current stud with the previous studies, including the study of Kadam et al. (2018), who sampled MEs of patients themselves, investigating for the most common related causes, rather than the questioning of nurses and other HCPs themselves. Also, the previous study of Abukhader and Abukhader (2020) conducted a strong comparison in terms of MEs and their causes between several departments, which is highly recommended to be applied in future studies, as well as the recommendation to apply comparisons in level of knowledge, reporting, opinions and causes of MEs between the nurses of NICU and PICU in several health settings in Palestine.

Conclusion

Nurses' skills related to medication administration and preparation are among the highest priority in the professional requirements of nursing job description, and this importance increases when it comes to neonatal and pediatric patients, who have specific considerations related to medication calculation and quality assurance, resulting in the need for mare caution related to the incidence of MEs. The assessment of nurses' knowledge regarding MEs, practices related to MEs reporting, recommendations and causes are important to be investigated, which was the main aim of the current study, alongside the assessment of the impact of educational sessions on the mentioned aspects of MEs, among a total population sample of NICU and PICU nurses in Ramallah – West Bank, Palestine, who received a self-administered questionnaire that was developed based on previous literature.

Main results showed overall high scores of MEs perceived knowledge and perception , as well as positive attitudes towards reporting and giving opinions and recommendations, and the main causes related to possible MEs, which were insignificantly improved in the posttest phase after receiving a comprehensive educational session related MEs. As none of the domains were significantly improved, none of the demographic or professional factors were significantly related to the changes in mean scores between pretest and posttest phases.

Recommendations

Based on the findings and discussion of the current study results, the researcher recommends to:

1- Conduct further educational sessions regarding the area of safe medication administration and errors prevention for nurses in neonatal and pediatric critical care units, which will help in increasing level of awareness among them about the proper medication skills, and the prevention of errors and related consequences.

2- Apply similar studies on nurses with the recruitment of larger samples, by applying the study on several hospitals in several areas of the West Bank, which will help in gathering better overview of the awareness and practices level of nurses, as well as better ability to generalize the results on the overall population of nurses. Also, better methodological aspects include the comparison between several departments, whether it was between several NICUs and PICUs of different hospitals, or between NICUs and PICUs and other departments inside the same hospital.

3- Increase the role of administrative and continuous education departments inside hospitals in terms of educational sessions, as well as the role of quality assessment departments in terms of continuous monitoring of MEs and related causes and focus on the integrated workflow

of different departments of hospitals, which will unite the efforts towards better MEs reporting and prevention.

Limitations

1- The study was mainly limited to small sample size, and although the researcher was able to collect a total population sample, the targeted departments may be not enough when compared to recruiting nurses from several hospitals or areas.

2- Although the used questionnaire included several domains related to MEs (knowledge, reporting, opinions, causes), it did not include the assessment of knowledge using multiple-choice questions that calculates the actual level of knowledge, which could have helped the researcher to compare the results with previous studies, as well as being more suitable for pretest-posttest comparison of the impact of educational sessions.

3- The researcher also faced an issue that is commonly shared with other studies when it comes to collecting data from nurses, which is limited time to answer questions caused by the work pressure and duty. This issue can be overcome by encouraging the nurses to take the questionnaires to their residence or answering during breaks, or by using online questionnaires that are easier to answer during any time.

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Annexes

Annex 1: Agreement to use the original questionnaire

From: Diana Qandeel <dianaqandeel715@gmail.com>
Sent: Monday, May 23, 2022 11:55 AM
To: Abdallah D Abu Khalil <adkhalil@birzeit.edu>
Subject:

•••

Annex 2: Facilitation paper for governmental hospitals

State of Palestine
Ministry of Health
ation in Health and Scientific
Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي
والبحث العلمي

الرقم: عبد/ ١٧٨/ ٢٠٢٠
التاريخ: ٢٠/١٠/٢٠٢٠

.....
.....

عطوفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،،
تحيـة واحتـرام،،،

الموضـــوع: تسهيل مهمة بحث

يرجى تسهيل مهمة الطالبة: **ديانا قنديل – ماجستير تمريض اطفال حديثي الولادة**- الجامعة العربية الامريكية، لعمل بحث بعنوان:

"The effect of educational sessions on knowledge and perception of medication administration errors among Palestinian neonatal and pediatric ICU nurses "

حيث ستقوم الطالبة بجمع معلومات من خلال تعبئة استبانة الدراسة (قبل وبعد الجلسة التعليمية) لممرضي اقسام الاطفال وحديثي الولادة، تحت اشراف د. عماد ابو خضر، وذلك في:

-مجمع فلسطين الطبي

على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات.
على ان يتم الالتزام بجميع تعليمات واجراءات الوقاية والسلامة الصادرة عن وزارة الصحة بخصوص جائحة كورونا.
على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام،،،

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: مساعد العميد للشؤون الطبية والصحية المحترم/ الجامعة العربية الامريكية

دولة فلسطين وزارة الصحة
وحدة التعليم الصحي والبحث العلمي

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Annex 3: Study questionnaire

كلية التمريض والمهن الصحية

برنامج ماجستير تمريض حديثي الولادة

إستبيان الأفراد

مدى وعي الطاقم التمريضي بالأخطاء الطبية ، لدراسة تم تصميم هذا الاستبيان لمساعدة الباحث في الحصول على معلومات المتعلقة بالأدوية, وكيفية التعامل معها ,علما بأنه سيتم استخدام المعلومات لتحقيق الهدف سابق الذكر ولخدمة أغراض البحث العلمي فقط، وبالتالي سيتم التعامل مع المعلومات الواردة بسرية تامة ولن يتم الإفصاح عنها إلى إي جهة أخرى غير الباحث.

ديانا قنديل

1) لقد قرأت وفهمت المعلومات الخاصة بالمشروع ، كما هو منصوص عليه في الفقرة السابقة

2) لقد أتيحت لي الفرصة لطرح الأسئلة حول المشروع ومشاركتي

3) أوافق طواعية على المشاركة في المشروع

4) أفهم أنني أستطيع الانسحاب دون إبداء الأسباب

5) لقد تم شرح استخدام البيانات في الأبحاث والمنشورات والمشاركة والأرشفة

6) أفهم أن باحثين آخرين سيتمكنون من الوصول إلى هذه البيانات

شكرا لتعاونكم،

مع فائق الإحترام والتقدير،،

Q1: What's your gender?

☐ Male

☐ Female

Q2: Your Educational Background

Diploma

Bachelor

Master

Q3: What's your age group?

☐ 22-32 years old

☐ 33-43 years old

☐ 44-54 years old

☐ 55-65 years old

Q4: Your Department:

☐ Pediatric ICU

☐ Neonate ICU

Q5: How long have you been practicing your career in your ward ?

☐ Less than 5 year

☐ 5-9 years

☐ More than 10 years

Part 2 – Yes/ No questions

Class A: Basic knowledge and information on medication errors and interventions

Q1: Are you aware of the definition of a medication error?

☐ Yes ☐ No

Q2: Are you aware of the various types of medication errors?

☐ Yes ☐ No

Q3: Are you aware of the various interventions to prevent medication errors?

☐ Yes ☐ No

Q4: Are you aware how to proceed if medication errors occur?

☐ Yes ☐ No

Q5: Are you aware of the difference between a medication error and an adverse drug reaction?

☐ Yes ☐ No

Class B : Reporting of medication errors

Q6: If you noticed a medication error, did you **not** inform due to fear of any legal or social consequences? (Fear of punishment or fear of being blamed)?

☐ Yes ☐ No

Q7: After noticing the medication error, did you **not** inform as you were too busy?

☐ Yes ☐ No

Q8: After noticing the medication error, did you **not** inform as you did not know whom to inform?

☐ Yes ☐ No

Q9: After noticing the medication error, did you inform the patient?

☐ Yes ☐ No

Q10: Do you believe that medication errors reporting would significantly benefit the patient and help prevent future errors?

☐ Yes ☐ No

Q11: Are you aware of the reporting system and how to report?

☐ Yes ☐ No

Q12: Do you think that it's important to report medication errors that don't cause patient harm? Or those that could have caused harm but didn't reach the patient?

☐ Yes ☐ No

Q13: Do you believe it is your professional duty to report medication errors?

☐ Yes ☐ No

Q14: Should a patient be informed if a medication error occurred?

☐ Yes ☐ No

Class C: capability to give an opinion or recommendations

Q15: Should there be an improved system in hospitals regarding medication errors reporting?

☐ Yes ☐ No

Q16: Do you recommend integrated approach toward training and education about the medication error in medical institute and the general public?

☐ Yes ☐ No

Q17: Should proper recommendations of organization, legislation, regulation and resources improve control of medication errors and safe use of drugs?

☐ Yes ☐ No

Class D: (The causes of medication errors & assessment if the institution has written policies on safe medication practice and provides continuous education on medication errors)

Q18: What do you think is the cause of a medication error/Contributing factor: (May mark more than one)

☐ Clinical information missing (age, weight, allergy, vitals, lab, pregnancy, ID#, location, diagnosis, renal/liver impairment).

☐ Drug information missing (outdates/absent references, inadequate computer screening uncontrolled drug formulary).

☐ Miscommunication of drug order (illegible, ambigous, incomplete, misheard order, misunderstood order, and intimidation).

☐ Drug name, label, package problem (looks/sound-alike name, look alike packaging, unclear/no label, faulty drug identification).

☐ Drug storage or delivery problem (slow turnaround time, inaccurate delivery, doses missing or expired, multiple concentrations, placed in the wrong bin).

☐ Drug delivery device problem (poor device design, misprogramming, free-flow, mixed up lines).

☐ Environmental staffing or workflow problem (lighting, noise, clutter, interruption, staffing deficiency workload, employee safety).

☐ Lack of staff education (competency validation, new or familiar drug/device, orientation process, feedback about errors).

☐ **Lack/inappropriate monitoring of the patient** (failure to measure the drug concentration/peak/trough in the patient's blood and make the appropriate adjustments accordingly , not monitoring the patient's signs and symptoms to assess the drug's efficacy/toxicity)

☐ **Lack of** patient education (lack of information, on-compliance, not encourage to ask question, not investigating patient's inquiries).

☐ Lack of quality control or independent check system (equipment quality control checks, independent checks for high alert medications/High risk patient population drugs).

Q19: Does your institution have written policies and procedures on safe medication practice?

☐ Yes ☐ No

Q20: Does your institution provide continuous education on medication errors?

☐ Yes ☐ No

Thank you for taking the survey

if you have any comments/concerns/recommendations regarding the study, please feel free to write them below:

_____

_____

_____

Annex 4: Material of educational program

INTRODUCTION

*Neonatal intensive care units are high-risk settings where medication errors can occur and cause harm to this fragile segment of patients. Neonates in intensive care units are particularly vul- nerable to medication errors because of their immaturity, small body size, need for laborious error-prone dose cal- culations or dilutions, the severity of their disease condi- tion, and intensity of medications used.

CONT…

The incidence and consequences of medication errors in the neonatal intensive care unit (NICU) demonstrate the importance of established safety procedures and guidelines for the prescribing, dispensing, and administration of medications.

As the professional voice of neonatal nurses, the National Association of Neonatal Nurses (NANN) recommends that appropriate measures and education be made available to everyone who prescribes or administers medications in the NICU and that members be proactive in participating in the development and implementation of safe medication practices in the NICU

CONT…

Three important variables make the medication administration process in the NICU uniquely and inherently risky: the vulnerable nature of NICU patients, the complexity of the medications used, and the challenges of the NICU environment.

Patients in the NICU are undergoing maturational changes in drugsensitive areas such as renal, gastrointestinal, and hepatic systems, resulting in variable responses to drugs and the disease process.

Medications are universally weight based, requiring calculations for each dose. But some of the drugs used also are based on gestational age, making it even more complex

CONT…

NICU patients often have long hospital stays, which increases exposure to medications and medication errors. In premature infants, the immaturity of developing body systems affects the absorption, distribution, metabolism, and excretion of drugs, and therefore, the risk for medication errors is present.

•NICU patients are nonverbal and unable to actively participate in the patient identification process, which increases the likelihood of wrong-patient errors

•The increased incidence of multiple gestation births has also contributed to the misidentification of NICU patients

CONT...

*"A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer

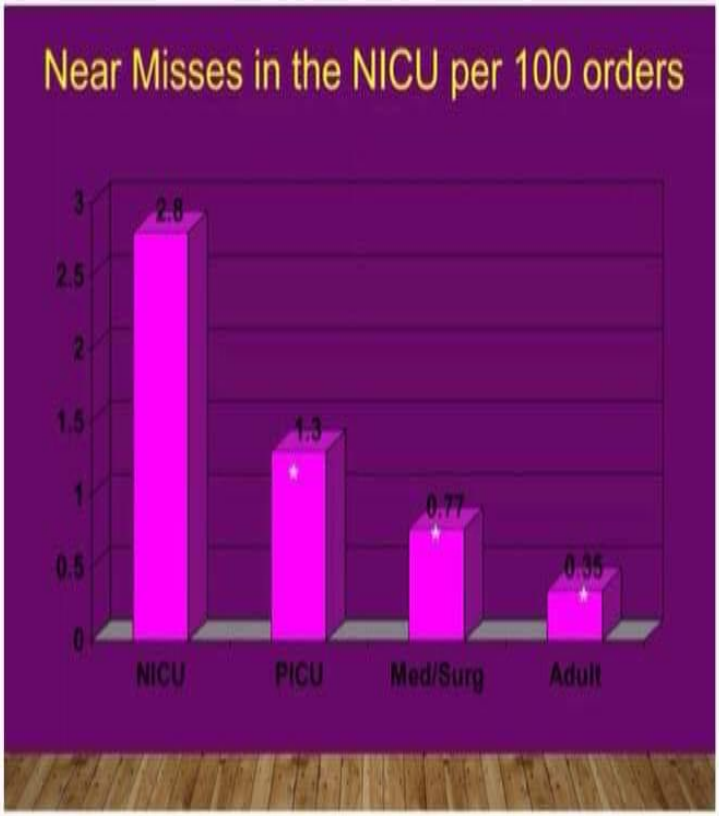
Incidence

*Available studies indicate that 13–91 medication errors per 100 admissions may happen in the NICU. Several studies conducted in developed countries showed that medication error mostly occurred during prescribing phase.The most common types of medication errors are drug dosage error, frequency, and route of administration .

*A recent systematic review reported medication error rates in the range of 4 to 35.1 per 1,000 patient-days in neonatal intensive care units and from 5.5 to 77.9 per 100 medication orders in palestine.

CONT...

*Nichter et al. observed an incidence of medication errors in pediatric intensive care units ranging between 22 and 59 errors per 1,000 doses, seven times more frequently than other pediatric inpatient units.



CAUSES

***Human factors :**

1.Heavy staff workload and fatigue

2.Inexperience, lack of training, poor handwriting, and oral orders

***Workplace factors :**

1.Poor lighting, noise, interruptions, excessive workload

CONT…

***Harmaceutical factors:**

1.Excessive prescribing

2.Confusing medicine nomenclature, packaging, or labeling

3.Increased number or quantity of medicines per patient

4.Frequency and complexity of calculations needed to prescribe, dispense, or administer a medicine

5.Lack of effective policies and procedures

PT RIGHTS

*Right to Appropriate Medical Care and Humane Treatment.

*Right to Informed Consent

*Right to Privacy and Confidentiality

*Right to Information.

*The Right to Choose Health Care Provider and Facility.

*Right to Self-Determination

PT RIGHTS

*Right to Religious Belief

*Right to Medical Records

*Right to Leave

*Right to Refuse Participation In Medical Research.

MAR (MEDICATION ADMINISTRATION RECORD)

*A Medication Administration Record (MAR, or eMAR for electronic versions), commonly referred to as a drug chart, is the report that serves as a legal record of the drugs administered to a patient at a facility by a health care professional. The MAR is a part of a patient's permanent record on their medical chart.

Medication Administration Record (MAR)

Name: _____ Month: _____ Year:_____

Medication/ dosage/ frequency/route	Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Initial	Signature	Known allergies or adverse reactions:

PRN AND REFUSED MEDICATION NOTES

Date/Time	Medication/Dosage	Reason	Results	Hour/Initials

Vital signs or other tracking per physician or team request:

	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____
Weight						
Blood Pressure						
Temperature						
Pulse						
Other:						

RIGHTS OF DRUG ADMINISTRATION

1. Right Drug/Medication
2. Right Client/Patient
3. Right Route
4. Right Dose
5. Right Frequency/Time
6. Right Assessment
7. Right Approach

RIGHTS OF DRUG ADMINISTRATION

8. Right Education
9. Right Evaluation
10. Right Documentation
11. Right to Refuse
12. Right Principle of Care
13. Right Prescription
14. Right Nurse Clinician

ADVERSE DRUG REACTION

*Adverse drug reactions (ADRs) are under-recognized and under-reported in the Neonatal Intensive Care Unit (NICU) population, with up to 95% of all ADRs not reported. Compared with non-elderly adults, pediatric patients are 3 times more likely to experience an ADR, with varying rates from 0.6% to 16.8%.

HIGH ALERT MEDICATION

*Based on local medication error data, the National Medication Safety Committee (NMSC) identified 5 core HAMs with the highest numbers of locally reported errors, and issued an advisory to inform PHIs of the core HAM categories on 3 February 2021:

1) Insulin
2) Anticoagulants
3) Opioids1
4) Concentrated electrolytes
5) Cytotoxics, chemotherapeutic agents

HIGH ALERT MEDICATION

•There are three primary principles that healthcare organizations can use to safeguard against medication errors that might result from HAM:

******Eliminate or reduce the possibility of error

a) • Ward stocks should be kept in automatic dispensing cabinets that limit accessto specific drugs whenever possible, otherwise, storage areas for HAM shouldbe clearly demarcated
b) • Limiting the available concentrations and volumes, either for the wholeinstitution or for specific sites
c) • Use of auxiliary warning labels or HAM stickers to differentiate and highlightHAM from other drugs
d) • To employ closed loop medication management e.g. barcode scanningverification upon administration, whenever possible
e) • To use assistive technologies (e.g. barcode technology) in drug-relatedlogistics when topping up, or returning unused drug to storage areas

HIGH ALERT MEDICATION

*Make errors visible through detection

• Conduct independent double-checking prior to administration of HAM to catcherrors before they reach the patient.

• Information technology systems used in the hospital (e.g., pharmacy computersystem, computerized prescriber order entry system, smart pump technology, automated compounding devices) are routinely tested to assure that maximum and minimum dose alerts are present and functional for high-alert drugs, and alerts are built for those that do not have them.

HIGH ALERT MEDICATION

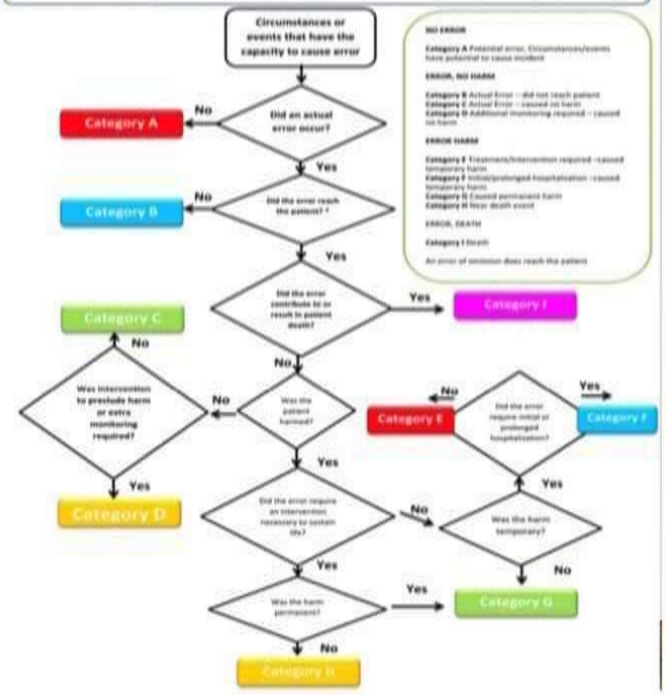
*Minimize the harm consequences of errors

• Change practices to reduce the adverse effects of errors that do occur (e.g.close monitoring to improve early detection of errors and institute prompt remedial action)

FADIC

Assess the Medication Error Severity

The severity of medication error can be classified to nine categories according to NCC MERP index as the following chart:



RECOGNIZING AND REPORTING MEDICATION ADMINISTRATION ERRORS

Any staff member who discovers a medication error, whether a physician, pharmacist or nurse, must immediately complete the Medication Error Report (Appendix I). The details include; patient name, hospital number, prescription details, details of errors and any incorrect medicine or dose administered to the patient.

When these details of errors are recorded on the form, the manager or deputy needs to identify those staff involved, explain the error to get them, and then write about the causes of any comments about the error. The manager or deputy needs to mention the immediate action taken.

Send the completed form to the Pharmacy department in the hospital within 24 hours

The Medication Safety Officer must complete the medication error, such as assessing the incident severity, conducting Root Cause Analysis (RCA) if needed (for all significant or potentially significant medication errors) and suggesting recommendations to reduce the reoccurrence of the error.

FADIC

FILE NO.: ..... NAME: ..... AGE: .....
GENDER: ○ M , ○ F DIAGNOSIS: ..... CONSULTANT IN-CHARGE: .....

Employee Discovering the Error

Date Error Occurred:	**Time Error Occurred:**
Date Error Discovered:	**Time Error Discovered:**
Location (Ward/Unit):	**Date/ Time Error Reported:**

Which category made the initial incident? ○ Physician ○ Nurse ○ Pharmacist ○ Other: .....

In which medicine use stage did the error occur?
○ Prescribing ○ Preparation ○ Dispensing ○ Transcribing ○ Administration ○ Monitoring ○ Other: .....

Brief Description Error: .....

Which category made the initial incident? ○ Physician ○ Nurse ○ Pharmacist ○ Other: .....

Other category also involved in the incident? ○ Physician ○ Nurse ○ Pharmacist ○ Other: .....

Error Discovered by: ○ Physician ○ Nurse ○ Pharmacist ○ Other: .....

Involved Medicine
General Name: **Brand Name:** **Frequency:** **Dose/Concentration:**

Dosage Form:	**Route of Administration:**	**Package Container:**
○ Tablet/Capsule/Oral liquid	○ Oral	○ Unit Dose
○ Cream/Ointment/Gel/Paste	○ Eye/ Ear/nose	○ Syringe
○ Aerosol/Inhalation/Drops	○ Inhalation/aerosol	○ Bottle
○ Injectable (IV/IM/ET/SC)	○ Injectable (IV/IM/IT/SC)	○ Single Dose Vial/ Ampoule
○ Suppository	○ Topical Skin/ Rectal	○ IV Piggy Bag
○ Others:	○ Other:	○ Intravenous Solution

Did the Incident reach the patient? ○ Yes ○ No

Was the incorrect medication, dose, dosage form administrated to or taken by the patient? ○ Yes ○ No

Immediate Action Taken: What was the follow-up action(s)? .....

Name of immediate supervisor: *Signature:* *Date/Time:* *Date forwarded to pharmacy:*

Physician Intervention

Physician Follow-up: *(if error, reached the patient)*
Have the Patient seen by physician? ○ Yes ○ No
Assessment: .....
Examination/Treatment: ○ Antidote to be given: .....
○ Patient for monitoring/observation ○ Blood tests requested ○ Other

Medication Safety Officer

Outcome of Error:
○ Category A ○ Category B ○ Category C ○ Category D ○ Category E ○ Category F ○ Category G ○ Category H ○ Category I

Indication the possible incident cause(s) and contributed factor(s)
○ Lack of policy ○ Wrong labeling/ instruction on dispensing envelope or bottle/container
○ Inexperienced Personnel ○ High workload Patient information/ record unavailable/inaccurate
○ Sound alike medication ○ Look alike medication/ packaging ○ Illegible prescription
○ Failure to adhere to work procedure ○ Stock arrangement storage problem ○ Others.....

Recommendations: (Suggestions to prevent recurrence of error) .....

○ Action taken complete ○ Action taken in complete ○ Action taken not documented
○ Report forwarded/referred to: .....
Name of pharmacist: *Signature:* *Date/Time:*

Dear Medication Safety Officer
Please complete the electronic form to inform the medication safety committee at General Administration of Pharmaceutical Care.

STRATEGY TO IMPROVE MEDICATION ADMINISTRATION SAFETY

Plan medication administration to avoid disruption:

Dispense medication in a quiet area.

Avoid conversation with others.

Follow agency's no-interruption zone policy.

Prepare medications for ONE patient at a time.

Follow the RIGHTS of medication preparation.

Check that the medication has not expired.

Perform hand hygiene.

Check room for additional precautions.

Introduce yourself to

STRATEGY TO IMPROVE MEDICATION ADMINISTRATION SAFETY

Confirm patient ID using two patient identifiers (e.g., name and date of birth) AND check against MAR.

Check allergy band for any allergies, and ask patient about type and severity of reaction.

Complete necessary focused assessments, lab values, and/or vital signs, and document on MAR.

Provide patient education as necessary.

If a patient questions or expresses concern regarding a medication, stop and do not administer.

GENERAL RECOMMENDATIONS

الملخص باللغة العربية

المقدمة: الأخطاء الدوائية (MEs) هي من بين العواقب الأكثر شيوعا لإعداد الدواء وإدارته في وحدات العناية المركزة للأطفال وحديثي الولادة، حيث الممرضات هم مقدمي الرعاية الصحية الأكثر مشاركة (HCPs). لذلك، قامت العديد من الدراسات باختبار تأثير الجلسات التعليمية على مستوى المعرفة والممارسة لدى ممرضات NICU وPICU تجاه MEs، وهو هدف الدراسة الحالية، إلى جانب دراسة العوامل الديموغرافية والمهنية الأكثر شيوعًا.

المنهجية: تم إجراء دراسة شبه تجريبية قبلية وبعدية على ممرضات وحدة العناية المركزة لحديثي الولادة ووحدة العناية المركزة للأطفال في مجمع فلسطين الطبي - فلسطين باستخدام طريقة أخذ العينات السكانية الإجمالية، وتم التحقيق فيها باستخدام استبيان ذاتي تم نشره قبل وبعد وجلسة تعليمية. تم تقديمه من قبل ممرضة ذات خبرة. وقد تم تحليل البيانات باستخدام برنامج SPSS باستخدام الإحصائيات الوصفية والاستدلالية المناسبة.

النتائج: من بين الممرضين، 62.5% ذكور، 87.5% حاصلون على درجة البكالوريوس، 52.1% يعملون في وحدة العناية المركزة للأطفال، و 56.3% لديهم أقل من 5 سنوات من الخبرة. بشكل عام، كان التحسن في جميع جوانب MEs ضئيلًا من حيث المعرفة والإدراك (4.438 ± 0.943 إلى 4.750 ± 0.758 من 5، القيمة $p = 0.077$)، الإبلاغ (6.438 ± 1.486 إلى 6.896 ± 1.533 من 9، p-) القيمة = 0.140)، الرأي والتوصية (2.563 ± 0.649 إلى 2.729 ± 0.676 من 3، القيمة $p = 0.221$) والأسباب (8.063 ± 2.096 إلى 7.583 ± 2.938 من 11، القيمة $p = 0.424$) من الاختبار القبلي إلى الاختبار البعدي المراحل على التوالي.

الخلاصة: كان متوسط درجات المجالات الأربعة مرتفعا في مرحلتي الاختبار القبلي والبعدي، وبالتالي لم يلاحظ أي تحسن كبير. يوصى بإجراء الدراسة على عينات أكبر والمقارنة بين عدة أقسام ومستشفيات للمساعدة في تعميم النتائج.

الكلمات المفتاحية: الأخطاء الدوائية، وحدة العناية المركزة لحديثي الولادة، وحدة العناية المركزة للأطفال، الممرضات، التعليم، الدورات التعليمية.