Performance of Nurses Regarding High Alert Medications in Critical Care Units

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Abstract

Background: Medication safety is a major concern and global issue related to the quality and safety of pediatric patient care. Majority of these errors are preventable if doctors and nurses consult the drug formulary more often, doses and related issues are routinely cross checked during the clinical rounds **This study aimed** to assess performance of nurses regarding high alert medications in critical care units. **Subject and methods:** A descriptive design was used to conduct this study. **Setting**: The study was conducted at critical care units in children Hospital affiliated to Ain Shams University **Sample:** A convenient sample of 100 nurses was working at the previously mentioned settings. **Tools of the study**: 1- Predesigned Questionnaire Format to assess characteristic of studied nurses and their knowledge about high alert medications in critical care units. 2- Observational checklist to assess the practice of nurses regarding high alert medications in critical care units. **Results:** There was a high statistically significant difference between nurses' knowledge level and their practice level regarding high alert medications, with a positive correlation between them. **Conclusion:** Based on result of the current study, it can be concluded that, critical care nurses have inadequate knowledge and practice regarding selected high alert medications. Nurses with higher educational level had better knowledge and practice score than nurses with low educational level. **Recommendations**: Based on findings of the current study, implement educational programs and upgrading courses aimed with evidence based guidelines based on nurses' needs to improve their knowledge and practice related to administration of high alert medications.

Key words: Critical care- High Alert Medications, performance, nurses.

Introduction

High-alert medications are medications that are most likely to cause significant harm to the pediatric patient when misused. Mistakes with these medications may not be more common but may be more devastating to the pediatric patient if an error occurs. Additionally, the consequence of an error with these medications is far more devastating for pediatric patients units **(World Health Organization, 2016).**

High alert medications are the group of medications characterized by the narrow therapeutic window, often causing adverse drug events (**Geravandi et al., 2016**). Adrenergic agonists, adrenergic antagonists, anesthetic agents, antiarrhythmic, antithrombotic agents including anticoagulants, Factor Xa inhibitors, direct thrombin inhibitors, thrombolytics and glycoprotein IIb/IIIa inhibitors, cardioplegic solutions, chemotherapeutic agents, dextrose- hypertonic, dialysis solutions for peritoneal and hemodialysis, epidural or intrathecal medications, oral hypoglycemic agents, insulin, inotropic medications, subcutaneous and IV liposomal forms of drugs and conventional counterparts, moderate sedation agents such as: Dexmedetomidine, midazolam, narcotics/opioids, neuromuscular blocking agents, parenteral nutrition preparations, radiocontrast agents, hypertonic sodium chloride for injection (> 0.9%) (**Kalisch et al., 2015**).

A critical care unit is a special facility within a hospital that is dedicated to treat pediatric patients who are critically ill. The

pediatric patients are experiencing serious problems that require intensive monitoring. The staff are specially trained to administer critical care, and there are sometimes several staffers assigned to each pediatric patient to ensure that pediatric patients get the care they need(**smith et al., 2015).**

Medication administration is an everyday part of the care that is provided to children in a nursing facility. Due to the potential danger of medication administration, it is imperative that the nurse understands the importance of performing the task safely. Becoming proficient in all of the aspects of medication administration will ensure that the children are kept safe through all areas of the care provided to them. The nurse needs to understand not only the routes of medications, but also the ways in which medications affect the children in their care, as well as the federal regulations that discuss medication administration. The nurse must also be able to report medication errors as required by hospital policy and procedure and adequately supervise unlicensed personnel who are responsible for medication administration **(Thenmozhi & Aruna, 2014).**

The role of the pediatric nurse in the pediatric care nursing area not only provides administrative and clinical leadership but also has 24 hours accountability for all pediatric patient care activities in the unit, monitoring and evaluation of the pediatric patient outcomes. Therefore, pediatric nurse's role is important because it is the direct link between the administrative duties and the direct care provider (**Chen et al., 2014**).

Nurses hold responsibility for taking care of children and providing safety for them. Therefore, medication administration and preventing medication errors impose more obligations on them (**Donnelly & Kirk, 2015**).

Significance of the study

Assessing performance of nurses regarding high alert medications is beneficial in many ways for identifying different sources of medication errors help to reduce number of those errors, saving child life and improving quality of life. In addition, it can reduce the cost associated with medication administration problem and decrease length of hospitalization also it will reduce adverse outcome. A low estimation of 450,000 medication errors result in harm annually to children in the United States, with approximately 25% of these errors considered preventable. According to the Institute of Medicine, 7.000 deaths each year are attributed to prevente medication errors **(Engels & Ciarkowski, 2015).** At least 20% of all harm is associated with medication errors(**Yousseif et al., 2018).** High-alert medications are more likely to be associated with harm than other medications; they cause harm more commonly, the harm they produce is likely to be more serious, and they "have the highest risk of causing injury even when used correctly.

In Egypt according to Egyptian National Online Reporting System, 23% of medications errors came from intensive care units. Prescribing errors were the most common type of medications errors (54%), followed by monitoring (25%) and administration errors (16%). The most frequent error was incorrect dose (20%) followed by drug interactions, incorrect drug, and incorrect frequency. Most reports were potential (25%), prevented (11%), or harmless (51%) errors; only 13% of reported errors lead to patient harm. The top three medication classes involved in reported MEs were antibiotics, drugs acting on the central nervous system, and drugs acting on the cardiovascular system. Causes of MEs were mostly lack of knowledge, environmental factors, lack of drug information sources, and incomplete prescribing. Recommendations for addressing MEs were mainly staff training, local ME reporting, and improving work environment (**Shehata et al., 2016**).

From this point, this current study was done to highlight on performance of nurses regarding high alert medications. Because children are in a vulnerable age to any errors; the pediatric nurse is the corner stone of saving those children.

Aim of the study

This study aimed to assess performance of nurses regarding high alert medications in critical care units.

Research questions:

1) What are nurses knowledge about high alert medications?

2) What is the nurse's practice while administering high alert medications in critical care units?

Subjects and Methods

This study was aimed to assess the performance of nurses regarding high alert medications in critical care units.

The subject and methods of the current study discussed under the following four (4) designs:

I. Technical Design
II. Operational Design
III. Administrative Design
IV. Statistical Design

Research Design

A descriptive design was used to conduct this study.

Setting

This study was conducted at Neonatal and Pediatric Intensive Care Units in Children's Hospital affiliated to Ain Shams University. The Neonatal Intensive Care Units consist of two units, one at the old building and the other in the new building. The old Neonatal Intensive Care Unit consist of three rooms, each room had 4-5 incubators, only 4 ventilators, three phototherapy incubators and one room for the formula preparation. The new Neonatal Intensive Care Unit consists of two large rooms with 15 incubators, 5 for the critical cases. The staff nurses who are working at the Neonatal Intensive Care Units for both buildings 60 nurses. In addition, 10 nurses for contract and turned over and new 10 contract nurses were involved in the study, also 30 nurses all hospital hot area were involved in the study.

Subject

A convenient sample of (100) nurses were working at the previously mentioned setting.

Data collection tools

Data collected by using two tools:

Predesigned Questionnaire Format

The researcher has developed it after reviewing the relevant literature. It was written in simple Arabic language. It was designed by the researcher after reviewing the currently available literature and was written in simple Arabic language to assess the following parts:

Part (I): It was concerned with: Characteristic of studied nurses such as Age, gender, qualification, years of experience, working hours and attending of training programs regarding high alert medications.

Part (2): It was related to nurse's knowledge about high alert medications in critical care units include: meaning, classification, preparation and complications of high alert medications, mechanism of action, indications, drug interaction, route of administration, complications, precautions, contraindications and unit prescription of(Anticoagulant Insulin, Calcium, adrenaline, Noreadrenaline, Dopamine, Dobutamine, Sedatives Chemotherapy), preparation of high alert medications and care for anaphylactic shock.

Scoring system:

According to the responses obtained from the nurse's, a scoring system was followed to assess the nurse's knowledge each question scored one (1) for the correct answer and each incorrect answer, scored zero (0). The score of questions was summed up and the total divided by the number of the items, giving a mean score. These scores were converted into a percent score was classified as the following:

< 75 unsatisfactory knowledge.
≥ 75 satisfactory knowledge

II. Observational checklist:

It was adopted from the Agency for Health Care Research and Quality (2015). It was reviewed to assess the practice of nurses regarding high alert medication in critical care unit 6 checklists include: Removing medication

from an ampoule, Removing medication from vial, Administration subcutaneous injection, Administration medication by intravenous bolus\push through an intravenous infusion, Administration medication by intermittent peripheral venous access device, Storage, Prescribing , Preparation, Administration, Monitoring high alert medications.

Scoring system:

The right step was scored one, and that wrong was scored zero. The score of steps was summed-up and the total divided by the number of the steps, giving a mean score. These scores were converted into a percent score was classified as the following:

- < 75% incompetent practices
- ≥ 75% competent practices

II- Operational Design:

Preparatory phase:

This phase included reviewing literature related to the performance of nurses regarding high alert medications in critical care units. This served to develop the study tools for data collection. During this phase, the researcher also visited the selected places to be acquainted with the personnel and the study setting. Development of the tools was under supervisors' guidance and experts' opinions considered.

Face and content validity:

Content validity was ascertained by a group of three experts they were professors in the field of Pediatric Nursing to test its content validity and applicability. Reliability was don used test-retest and Cronbach's alpha (0.89) for questionnaire.

Pilot Study

A pilot study carried out on 10% (10 nurses) of nurses were working at the previously mentioned setting to test the applicability of the constructed tools and the clarity of the included questions related to high alert medications in pediatric critical care units. The pilot has also served to estimate the time needed for each subject to fill in the questions. According to the results of the pilot study, few corrections include rephrasing and added questions performed as needed. The pilot participants were excluded from the main study sample, they were 110 nurses.

Fieldwork

The actual fieldwork of this study was carried out over 6 months period started from the beginning of January 2019 till the end of June 2019. The researcher was available in the study setting two days per week in the morning shift (8Am-2Pm) . Each nurse was interviewed individually to gather the necessary data of the study. As regards the nurses' practices, it was assessed by the researcher throughout their daily care in the study setting. The nurses were asked to give their responses according to the study tools .the required time to collect data from each nurse about 10 -15 minutes.

III. Administrative Design

Approval obtained through on issued letter from the Dean of Faculty of Nursing, Ain Shams University to directors of the previously mentioned settings. The researcher then met the hospital director and explained the purpose and the methods of the data collection.

Ethical consideration

The research approval obtained from the faculty ethical committee before starting the study. Verbal approval obtained from the nurses before inclusion in the study; a clear and simple explanation given according to their level of understanding, physical and mental readiness. They secured that all the gathered data as confidential and used for research purpose only. The nurses informed that they are allowed to choose to participate or not in the study and they have the right to withdraw from the study at any time.

IV. Statistical Design:

Data collected from the studied sample was revised, coded and entered using. Computer. Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages. Chi-square test (X^2) used for comparisons between qualitative variables and

correlation coefficiency was used to test the correlation between variables. There was high statistically significant difference between gender (P<0.01), qualifications (P<0.0001), years of experiences (P<0.05) and attending a training program (P<0.01) of the studied nurses and their total knowledge regarding high alert medications. There was statistically significant difference between gender (P<0.0001), qualifications (P<0.01), years of experiences (P<0.05), working hours (P<0.05) and attending a training program (P<0.01), of the studied nurses and their total practices regarding high alert medications. Statistical significant was considered at p-value <0.05.

Results

Table (1) shows that, more than one third (40%) of the studied nurses were in the age group 30<35 years old, with mean age 31.4±2.4years, meanwhile 66% of them were females and 45% of them were diploma nurses. In addition to one third (43%) of the studied nurses had years of experience ranging between 10<15with mean experience years 12.3±3.1.

Figure (1) shows that, (93%) of the studied nurses were full time workers.

Figure (2) shows that, (70%) of the studied nurses weren't attending training program regarding high alert medications.

Table (2) illustrates (88%, 71% & 72%) of the studied nurses had incorrect knowledge regarding the meaning of high alert medication, Preparation before administration of high alert medications & complications may occur when high alert medication were injected intravenously respectively.

Table (3) shows that, (68%) of the studied nurses had unsatisfactory knowledge about high alert medications, while less than one third (32%) of them had satisfactory knowledge about high alert medications.

Table (4) shows that, (66%) of the studied nurses were incompetent to practices of the high alert medications, while 34% of them were competent

Table (5) clarifies that, there was high statistically significant difference between nurse's knowledge level and their practice's level regarding high alert medications, with a positive correlation between them.

Table (1): Distribution of the studied nurses regarding their socio-demographic characteristics (n=100)

Item	No	%
Age in years		
• 20<25	16	16
• 25< 30	24	24
• 30<35	40	40
• ≥35	20	20
Mean ±SD	31.4±2.4	
Gender		
• Male	34	34
• Female	66	66
Qualification		
• Diploma	45	45
• Technical Institute	30	30
• Baccalaureate	25	25
Years of experiences		
• <5	13	13
• 5<10	24	24
• 10<15	43	43
• 15≤	20	20
Mean ±SD	12.3±3.1	

Figure (1): Distribution of the studied nurses according to their working hours (n=100)

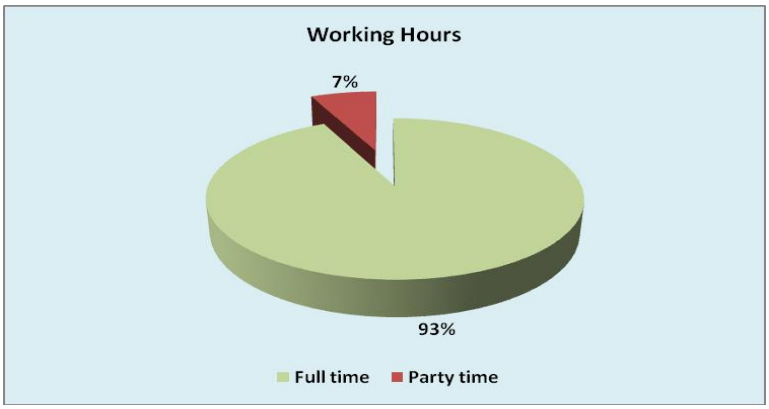

Figure (2): Distribution of the studied nurses according to their attending attaining program (n=100)

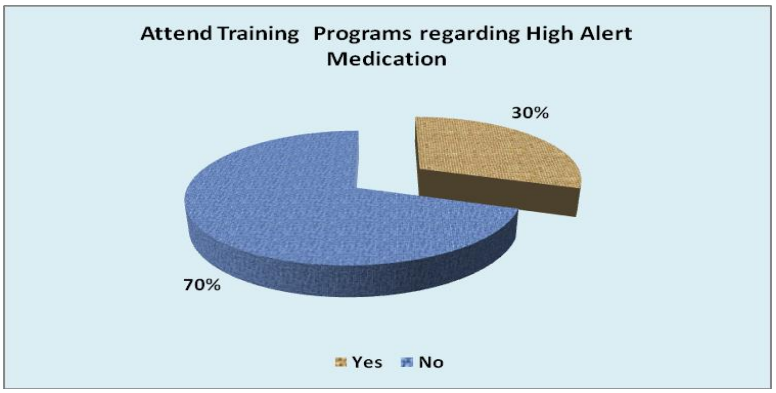

Table (2): Distribution of the studied nurses according to their knowledge about high alert medications (no =100)

Item	Correct		Incorrect	
	No	%	No	%
Meaning of high alert medication	12	12	88	88
Clear physician orders	69	69	31	31
Preparation before administration of high alert medications	29	29	71	71
Complications may occur when the high alert medication is injected intravenously	28	28	72	72
Classification of high alert medication	33	33	67	67

Table (3): Distribution of the studied nurses according to their total knowledge about high alert medications (no =100)

Item	No	%
Satisfactory	32	32
Unsatisfactory	68	68

Table (4): Distribution of the studied nurses according to their total practices regarding high alert medications (no =100)

Item	No	%
Competent	34	34
Incompetent	66	66

Table (5): Correlation between the total knowledge of the studied nurses and their total practices regarding high alert medications (no=100)

Item	Knowledge	
	r	P-Value
Practices	0.87	**0.001

(**)Statistical significant difference at p<0.01

Discussion

High-alert medications are medications that are most likely to cause significant harm to the pediatric patient when misused. Mistakes with these medications may not be more common but may be more devastating to the patient if an error occurs. Additionally; the consequence of an error with these medications is far more devastating for pediatric patients in critical care units. Safe practices during prescribing, dispensing and administration of these medications can reduce the potential harm to pediatric patient **(Lin Lin, et al., 2017).**

Medication safety is one of the highest priorities of the nursing staff. Nurses are required to perform special considerations to ensure safe medication practices and to eliminate medication errors that cause harm to the patient. The plan of nurses in managing the safety of high alert medication is identifying all high alert drugs and establishes policies and process to minimize the risk associated with the use of these drugs (**Wang, et al., 2015**).

The nurses also reduce the risk of errors by standardizing the ordering, storage, preparation and administration of these products; improving access to the high alert list, using auxiliary labels and automated alerts and employing redundancies such as automated or independent double check when necessary (**Meretoja et al., 2014**).

The nurse role in managing the safety of high alert medications is currently seen as one of the hardest, most complex roles in healthcare. Nowadays, little is known about what nurses are doing in practice to ensure and improve the safety of high alert medications. If nurses understanding is better, as well as her practicing, the health cares organizations are able to anticipate and solve any errors that could arise in the future. Also, they achieve many benefits regarding the patient, nurses, and heath care outcomes (**Mostafa et al., 2013**).

Therefore this study aimed to assess the performance of nurses regarding high alert medications in critical care units .

Regarding the socio-demographic characteristics of the studied nurses, the current study showed that, less than half of them were in the age group 30-35years old, with mean age 31.4 ±2.4 years, with diploma nurses regarding qualification, had years of experience ranging between10-15 years.

Also it was clarified that, more than two thirds of the studied nurses were females and didn't attend any programs regarding high alert medications and the majority of them were full time workers.

This was supported by **Hermina et al., (2013),** who conducted study about "Nurses Perception and Performance of the Elements Promoting Effective Team Work" mentioned that, less than half of the studied nurses were in the age group 30-35 years old, had years of experience ranging between 10-15 years.

Also in the study of **Wang et al., (2015),** which was about "Quality improvements in decreasing medication administration errors made by nursing staff" showed that , more than two thirds of the studied nurses were females and less than half of them were diploma nurses.

The current work clarified that, more than two thirds of the studied nurses had unsatisfactory knowledge regarding general high alert medications in addition about three quarters of them didn't know the meaning of high alert medication, high alert medication need to measure the child pulse before administration and complications may occur when the high alert medication injected intravenously.

This was in agreement with **Engels and Ciarkowski (2015),** who studied " Nursing, Pharmacy, and Prescriber Knowledge and Perceptions of High-Alert Medications" showed that, more than two thirds of the studied nurses had unsatisfactory knowledge regarding high alert medications and three quarters of them didn't know the meaning and complications of the high alert medications.

As regard the knowledge of the studied nurses about anticoagulant and insulin, the current work showed that, three quarters of them had unsatisfactory knowledge regarding anticoagulant; more than three quarters didn't know the mechanism of action of anticoagulant and precautions of anticoagulant. Meanwhile more than half of the studied nurses had satisfactory knowledge regarding insulin and most of them knew the indications and contraindications of insulin.

This study was supported by **Poole and Carleton, (2010),** who studied "Medication errors: neonates, infants, and children are the most vulnerable" clarified that, more than half of the studied nurses had good knowledge regarding insulin, as most of them knew the indication and contraindication of insulin.

The current study showed that, more than three quarters of the studied nurses had unsatisfactory knowledge about potassium chloride regarding the mechanism of action of potassium chloride and complications of potassium chloride, calcium in relation to the mechanism of action, route of administration, complications and precautions and adrenaline.

This was in agreement with **Ghenadenik, et al., (2012),** who studied "Potential risks associated with medication administration mentioned that, three quarters of the studied nurses had poor knowledge about mechanism of action and complications of both potassium chloride and calcium.

Meanwhile, this wasn't supported by **Shahrokhi et al., (2013),** whose study was about "Factors effective on medication errors" mentioned that, more than half of the studied nurses had satisfactory knowledge about mechanism of action and the complications of adrenaline.

Also the current study clarified that, more than three quarters of the studied nurses had unsatisfactory knowledge about noradrenaline regarding the mechanism of action and precautions and dobutamine in relation to the indications. Meanwhile, more than two thirds of them had unsatisfactory knowledge about dopamine regarding the indications.

This was in the same line of the study of **Hsaio et al., (2010),** which was about "Nurses' knowledge of high-alert medications" showed that, more than three quarters of the studied nurses had poor knowledge regarding noradrenaline and dobutamine in relation to unit prescription of the dose.

On the other hand, a study of **Nicholas and Agius (2015),** which was about "Toward Safer IV medication administration" clarified that, more than two thirds of the studied nurses had satisfactory knowledge regarding the indication of dopamine.

The current work showed that, more than two thirds of the studied nurses had unsatisfactory knowledge regarding sedatives in relation to unit prescription of the dose and route of administration. Also, more than half of them had unsatisfactory knowledge regarding anaphylactic shock from high alert medications. Meanwhile, more than half of them had satisfactory knowledge about chemotherapy. In addition more than half of the studied nurses had satisfactory knowledge regarding the preparation of the high alert medications .This was supported by **Pronovost et al., (2016),** who studied "Defining and measuring patient safety" clarified that, more than half of the studied nurses had good knowledge regarding the preparation of the high alert medications as regard checking the name and the dosage of high alert medications.

The researcher believes that Nurses' lack of knowledge is considered to be one of the most significant factors contributing to medication administration errors. That's why

educational intervention appears to be effective in strengthening nurses' knowledge of high-alert medications.

Regarding the total knowledge of the studied nurses about high alert medications, the current study clarified that, more than two thirds of them had unsatisfactory knowledge. This was in agreement with **Xu et al., (2014),** who made a study about "An intervention to improve inpatient medication management " mentioned that, two thirds of the studied nurses had poor total knowledge regarding high alert medication.

The researcher point of view that unsatisfactory knowledge of nurses may be due to the Medication practice standard describes nurses' accountabilities when engaging in medication practices, such as administration, dispensing, medication storage, inventory management and disposal. Three principles outline the expectations which related to medication practices that promote public protection. These principles are: - authority - competence -safety.

Authority, Nurses must have the necessary authority to perform medication practices. Nurses accept orders that are: - clear - complete - appropriate.

Competence, Nurses should ensure that they have the knowledge, skill and judgment needed to perform medication practices safely.

Safety, Nurses should promote safe care, and contribute to a culture of safety within their practice environments, when involved in medication practices **(College of Nurses of Ontario, 2014).**

As regard the nurses practices of high alert medications, the current study showed that, about three quarters of the studied nurses were incompetent in removing high alert medications from the ampoule and from the vial. This was not in agreement with **Curry, (2014),** who studied "Nurse Practitioners in the emergency department " mentioned that , more than half of the studied nurses were competent in practicing of high alert medications including removing these medications from the ampoule and the vial

This difference could be attributed to that, more than two thirds of the studied nurses in our work didn't attain any training programs regarding the high alert medications, but in the study of **Curry, (2014)** about two thirds of them attained training programs.

The current work clarified that, more than half of the studied nurses were incompetent in S.C injection of high alert medications and their administration by intravenous bolus /push through an intravenous infusion and by the intermittent peripheral venous access device.

This was supported by **Robert et al., (2017),** who made a study, about "High alert medications: Strategies for improving safety "clarified that, half of the studied nurses were incompetent in the administration of high alert medications by intravenous bolus through an intravenous infusion and by the peripheral venous access device.

The current study mentioned that, more than three quarters of the studied nurses were incompetent in prescribing of the high alert medications, also more than two thirds of them were incompetent regarding the storage, the preparation, the administration and the monitoring of high alert medications.

This was in agreement with **Tumulty, (2012),** who studied "Head nurse role re-design, improving satisfaction and performance " showed that, more than two thirds of the studied nurses were incompetent in the storage, the administration and the monitoring of high alert medications .

Regarding the total practices of the studied nurses in relation to high alert medications, the current work mentioned that more than two thirds of them were incompetent. This was supported by **Engels and Ciarkowski, 2015.** Who studied "Nursing, Pharmacy, and Prescriber Knowledge and Perceptions of High-Alert Medications" mentioned that, two thirds of the studied nurses were incompetent regarding the total practices of high alert medications.

Also this was in agreement with **Charalampopoulos et al., (2016),** whose study was about "Theoretical knowledge and skill retention 4 months after a European Pediatric Life Support course" clarified that, regarding the total practices of the studied nurses, about two thirds of them were incompetent.

As regard the relation between the socio-demographic characteristics of the studied nurses and their knowledge about high alert medications, the current work showed that, there was high statistically significant difference between the gender, the qualifications and attending training program of the studied nurses and their knowledge. Also there was statistically significant difference between years of experience and the knowledge of the studied nurses.

This was supported by **Kendall-Gallagher and Blegen (2015),** who studied about "Competence and certification of registered nurses and safety of patients in intensive care units mentioned that, there was statistically significant difference between the years of experience, the qualifications and attaining training programs and the knowledge of the studied nurses regarding high alert medications.

Also this was in agreement with **Lo, et al., (2013),** who studied "Faculties' and nurses' perspectives regarding knowledge of high-alert medications" showed that, there was high statistically significant difference between the qualifications and attaining programs and the knowledge of the studied nurses regarding high alert medications.

The current work mentioned that, there was statistically significant difference between the working hours and years of experience of the studied nurses and their total practices regarding high alert medications. Also there was high statistically significant difference between the gender, the qualifications and attending training programs of the studied nurses and their total knowledge regarding high alert medications.

This was in the same line with the study of **Agrawal, (2016),** which was about "Medication errors: prevention using information technology systems" mentioned that, there was high statistically significant difference between the qualifications, years of experience and attaining training program of the studied nurses and their total practices regarding high alert medications .

Also, this was supported by **Dabliz and Levine, (2012),** who studied "Medication safety in neonates " clarified that, there was high statistically significant difference between the years of experience and attaining training programs of the studied nurses and the total practices regarding high alert medications.

The current work mentioned that, there was high statistically significant difference between the total knowledge of the studied nurses and their total practices regarding high alert medications with positive correlation between them. This was in agreement with **Graham et al., (2018),** whose study was about "Implementation of a high-alert medication program" mentioned that, there was positive correlation between the total knowledge of the studied nurses and their total practices regarding high alert medications.

Also this was supported by **Stavroudis et al., (2016),** who studied "NICU medication errors: Identifying a risk profile for medication errors in the neonatal intensive care unit "showed that, there was positive correlation between the total knowledge of the studied nurses and their practices regarding high alert medications.

Conclusion

Based on the result of the current study; it can be concluded that:

Majority of critical care nurses have unsatisfactory knowledge and practice regarding selected high alert medications. In addition Nurses with higher educational level had better knowledge and practice score than nurses with low educational level.

Recommendations

Based on findings of the present study, the followings are recommended:

- Implement educational programs and upgrading courses armed with evidence based guidelines based on nurses' needs to improve their knowledge and practice related to administration of high alert medications

- Further studies should be conducted to evaluate nurse's knowledge and practice for proper dealing with high alert medications, because nurses play an important role in the maintenance of health and improve quality of life.

- Further research studies are needed for ongoing assessment of knowledge and practices of critical care unit's nurses.

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