Nurses' Malpractices during Blood Samples Withdrawal at Neonatal Intensive Care Unit

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1.ABSTRACT

Background: Blood sampling withdrawal is the most frequently procedure performed to neonates at neonatal intensive care unit (NICU). In order to overcome the mortality and morbidity caused by nurses' malpractices that happen during blood sampling withdrawal we need to look at this research point. **Aim**: this study aimed to assess nurses' malpractices during blood samples withdrawal at NICU. **Method**: A descriptive study was conducted in NICU at Mansoura University Children Hospital on (80) nurses. Data were collected using structured interview questionnaire and observational checklist. **Results**: revealed that, over half of the studied nurses' total practical knowledge regarding blood samples withdrawal was unsatisfactory and more than one quarter of the studied nurses' total practices regarding blood samples withdrawal were incompetent. **Conclusion**: the majority of the studied nurses were lacking knowledge and the minority of them had incompetent practice toward blood samples withdrawal. **Recommendation**: the study emphasizes on the necessity to train and educate the neonatal nurses in NICU on best practices about blood sampling procedure to get the best in health care of neonates.

Keywords: Blood samples, Neonatal Intensive Care Unit, Neonates, Nurses malpractice.

2.Introduction:

Blood sampling is the medical procedure of taking blood from a neonate's vein with a needle or a skin puncture lancet. In order to process the blood for a range of diagnostic medical tests, blood is collected into a succession of collection tubes, each of which has been treated with particular chemical additives (Romero, Gómez-Salgado, Domínguez-Gómez & Ruiz-Frutos, 2018). Blood sampling withdrawal is an important service up to two thirds of all neonate's diagnoses depend partially or wholly upon laboratory results. Moreover, many neonates require continuous monitoring of blood tests. So, may require serial blood draws or venepunctures. When taking blood samples from neonates, special skills are required because you must consider not only their size but also their pain sensitivity (Brown, 2019).

For newborns, venepuncture is the recommended technique of blood collection since it produces less pain than heel pricks. The selection of a location and a process (venous site, heel-prick also referred to as "capillary sampling" or "skin puncture") depending on the amount of blood required for the procedure and the type of lab test

to be performed. Because of its increased potential of contamination with skin bacteria and smaller overall volume, capillary blood is only acceptable for a restricted number of tests (Paterson et al., 2020).

Capillary blood collection is a medical technique that is rapidly being utilized across the world to aid with neonatal diagnosis, management, and therapy. It's also commonly used to get tiny amounts of blood for scientific testing (Flasch, Brueck, Lynn & Henningfeld, 2018). As well as central venous access devices (CVADs) are multifunctional venous catheters with a catheter tip in the superior, inferior, or right atrium. Umbilical, internal jugular, subclavian, and femoral veins are the most often utilized in newborns. The number of lumens, lumen size, location, and use of CVADs all vary (Conley et al., 2017).

Significance of the Study:

Nursing staff play a key role within the diagnostic testing process, they often identify the need for diagnostic and microbiological investigations, initiate the collection of blood samples and assume the responsibility for timely

and safe transportation to the laboratory. Also, the nursing staff should follow aseptic technique when performing a venepuncture as the skin disinfected and a foreign device is introduced into a sterile circulatory system. The two major sources of microbial contamination are cross infection from practitioner to neonate and skin flora of the neonate (Pyle-Eilola & Dickerson, 2020). Therefore, assessing nurses' malpractices during blood sampling withdrawal at neonatal intensive care unit should be regularly repeated and stimulated.

Malpractice is defined as, negligence on the part of the nurse, in that she or he has failed to comply with the standards of ordinary nursing practiced by nurses of similar background in the same specialty of nursing. Malpractice is professional misconduct that may be intentional or unintentional. Therefore, it is an act that does not satisfy the level of professional competence or the provision of inadequate treatment that causes harm or injury that may be proven. This might be due to a mistake or omission, negligence, or deliberate wrongdoing (Grant, 2017).

Malpractices during blood samples withdrawal at neonatal intensive care unit are common. According to the study of Atia, (2019) more than half of the nurses in her study had incompetent level of practice during blood samples withdrawal from neonates. So, we need to search in this research point. Also, it is the first study in Dakahlia concerning blood sampling from neonates and the second study in Egypt after the study done by Atia, (2019) who conducted the study in NICUs at Children's Hospital affiliated to Ain Shams University Hospitals about "Nurses Malpractices during Blood Samples Withdrawal from Neonates".

Aim of the Study:
Assess nurses' malpractices during blood samples withdrawal at neonatal intensive care unit.

Research Questions:
1- What are nurses' practical knowledge about blood sampling withdrawal?
2- What are nurses' practices regarding blood samples withdrawal?
3- What are the nurses' malpractices during blood samples withdrawal?
4- Are there relations between nurses' practices and their characteristics?

3. Method:
3.1. Research design:
A descriptive cross-sectional design was used to accomplish this study. In this design the researcher observes, describes and documents the subject without interfering. No manipulation variable is involved, and this design will be used to search for accurate information about the

characteristics of particular subject about the frequency of the phenomena. Additionally, this design is primarily used to identify and describe the study variables (Queiros, Faria & Almeida, 2017).

3.2. Setting:
This study was conducted at Neonatal Intensive Care Unit (NICU) in Mansoura University Children Hospital placed at the six floor of the hospital and consists of 8 rooms; three rooms for ordinary cases equipped with 9 incubators in each room three incubators, 5 rooms for ICU cases equipped with 10 incubators two cases in every room of the five rooms of ICU rooms. The nurse to neonate patient ratio was in the ICU rooms (1:1), but in ordinary rooms was (1:3).

3.3. Subjects:
The study included a convenient sample of 80 nurses who represented all those who work in Mansoura University Children Hospital's NICU. Nurses had a minimum of one year working experience and were willing to participate in the current study regardless of their age, gender, years of experience, or nursing educational categories.

3.4. Tools of Data Collection
Data were collected using two tools a structured questionnaire sheet and observational checklist that developed by the researcher after reviewing of related literature.

Tool I: Structured Interview Questionnaire Sheet. It included two parts:

Part 1: Characteristics of the studied sample.
A. Socio demographic data of the studied nurses (5 items) including: Age of the nurse, sex, level of education, years of work experience in NICU and previous attendance of training program about blood sampling withdrawal.
B. Data about studied neonates (7 items) including: Neonatal gestational age, gender, age, diagnosis, weight, delivery method and length of stay at NICU.

Part 2: Nurses' practical knowledge about blood sampling withdrawal.
Composed of **39 questions** about definition of blood sampling withdrawal, types of blood sampling withdrawal, contraindication, precautions during blood sampling withdrawal and complications for each type …etc.

Scoring system:
The nurses' practical knowledge level was categorized according to (Soliman, Ouda, Mahmoud & Kafl, 2019) into:

- Satisfactory: if the percent score was $\geq$ 75% (29.25 marks).
- Unsatisfactory: if percent score was <75% (29.2 marks).

Tool II: Observational Checklist.

After reviewing the related literature observational checklist was adapted based on observational checklist of Seemann & Nybo, 2016; WHO, 2010. It includes observations during blood sampling withdrawal to help in recognizing the weak points in practice of the nurses during venepuncture (24 items), arterial blood sampling (16 items), heel prick (13 items) and sampling from central venous access devices (22 items). Also, noticing common malpractice items during nurses' practices for blood sampling withdrawal.

Scoring system:

Total practical level of nurses was categorized according to (**Atia, 2019**) into:
- Competent ≥ 75% (56.25 marks).
- Incompetent <75% (56.25 marks).

3.5. Method:

1. The preparatory phase:

This is the beginning of the data collection process which involved a summary of previous, current, and worldwide relevant literature utilizing books, journals, periodicals, and magazines that were accessible to ensure that all elements of the research topic were covered and also, to develop relevant tools for data collection.

- After reading the relevant literature, the researcher created a standardized questionnaire sheet for nurses, which was then translated into Arabic then revised and adjusted by supervisors to assess nurses' practical knowledge about blood sampling withdrawal at NICU.
- The five experts reviewed and improved the study instruments' content validity (jury). The five experts were from Mansoura University for clarity, substance, and relevance or irrelevance in the realm of nursing care. The needed adjustments, according to their recommendation were done in form of omission, addition and modifying some questions. Then the final form of questionnaire was used for data collection.
- The tools' internal consistency was checked for reliability using the Pearson correlation coefficient test; $r = 0.702$ for tool I, $r = 0.700$ for tool II.

2. The exploratory phase: It included pilot study and field work.

a) Pilot study:

A pilot study was performed after the development and modification of tools. Pilot study was conducted over a period of one month from first of January 2020 to the end of January 2020. It was conducted on 10% (9 nurses) of the total sample to evaluate the clarity and applicability of the study tools. The total sample included the pilot sample because the pilot study was not altered.

b) Field work:

Data collection period:

- Data collection period extended throughout a six-month period, beginning January 1st, 2020, and ending June 30th, 2020.
- The researcher began by speaking with the nurses and introducing herself and providing a quick summary of the study's purpose and scope.
- The framework for the study was completed in three phases, as follows:

1) Assessment phase

- Using tool, I part (1), each nurse was individually interviewed to obtain baseline data.
- Assessment of the nurses' practical knowledge about blood sampling withdrawal at NICU was performed using the study tool I part (2).
- Nurses' practices assessment regarding blood sampling withdrawal at NICU was performed using tool II.
- The researcher was available two days per week from 9.00 am to 12.00 pm and the duration of each meeting lasted from 20-25 minutes to collect the necessary data.

2) Implementation phase

- An initial assessment was carried out for all neonates in (NICU) on admission to confirm that they fulfill the inclusion criteria.
- Nurses' demographic data and neonates' characteristics were collected.
- Nurses' practical knowledge about blood sampling withdrawal were collected through open-ended questions that evaluated with scores 1, 0 this is was through the second part of the tool I of the structured interview questionnaire sheet.
- Nurses' practices before, during and after procedure of blood sampling withdrawal observed and scored with the observational checklist taking score 1 for completely done and 0 score for incompletely done or not done.

3) Evaluation phase

- Nurses' knowledge and practice were evaluated using scoring system for practical knowledge and scoring system for nurses' practice

regarding blood sampling withdrawal. Through data collection tool the researcher recognized the nurses' weak point.

3.6. Ethical considerations

The research was conducted in accordance with the following ethical research guidelines:

- After describing the study's purpose and nature to the nurses, they gave their verbal permission.
- The researcher emphasized that participation in the study is entirely voluntary, and each participant has the freedom to withdraw at any moment. Throughout the study, the anonymity and confidentiality of the data obtained were ensured.

3.7. Statistical design:

The gathered data were coded, computed and analyzed. Excel is a Windows-based spreadsheet application. Any errors were detected using frequency analysis and manual review. Data were entered into the Statistical Package for Social Sciences (SPSS) version 20.0, where they were analyzed using frequency tables and percentages. Qualitative data was presented as number and percent. Continuous variables were presented as mean ± SD (standard deviation). The Chi-Square test was used to examine the relationship between categorical variables. Pearson correlation coefficient test was used correlating different parameters. All tests were performed at a level of significance (P value < 0.05), also it was considered high with (P value < 0.001).

4. Results:

Table (1) showed that, more than half of the studied nurses were aged between 30 years and more of years old with mean age of **(30.1± 7.88)** and the majority of the nurses that were interviewed were female. Concerning qualification, in this study more than half of the nurses held a bachelor's degree in nursing science qualification respectively. Regarding the studied nurses' years of experience working at NICU, less than half of the studied nurses had years of experience ranged from 10 years and more working as a neonatal nurse with mean years of **(7.94 ± 3.40)**. As regards to the previous attendance of training program about blood sampling withdrawal, it is apparent that almost (96.25%) of the studied nurses didn't attend any training programs about blood sampling withdrawal. Only 1.25% had 1 course about blood sampling withdrawal, 1.25% had 2 courses, and 1.25% had three and more courses.

Figure (1) confirmed that, more than one third (35%) of the studied nurses had years of experience ranged from one year to less than 5 years working at NICU. The same figure cleared that, less than one quarter (17.50%) of the studied nurses worked in the NICU for 5 to less than 10 years.

Figure (2) proved that, respiratory distress syndrome constitutes the higher percentage (70%) of the diagnoses and that the lower percentage was hyperbilirubnemia (5%).

Figure (3) illustrated that, more than half (58.75%) of the studied nurses' total practical knowledge was unsatisfactory. While, more than two fifth (41.25%) of the studied nurses' total practical knowledge was satisfactory.

Figure (4) showed that, more than two thirds (70%) of the studied nurses' total practice regarding blood samples withdrawal were competent, while more than one quarter (30%) of the studied nurses' total practice regarding blood samples withdrawal were incompetent.

Table (2) showed that, the highest percentage of the studied nurses malpractices regarding blood samples withdrawal at neonatal intensive care unit (56.3%) was at the step of permitting the alcohol to dry for 30 seconds. Also, more than half of the studied nurses (51.3%) had malpractice at stopping TPN for 1hr before sample withdrawal. Moreover, less than half (47.5%) didn't apply pressure for 3-5 minutes after withdrawal. 38.75%, 32.5% didn't follow aseptic technique during central venous access withdrawal (e.g. wearing sterile surgical gloves before sampling from central venous access devices), and puncturing the posterior curvature of the heel, respectively.

Additionally, the same table illustrated that, less than one quarter of the studied nurses (22.5%) delayed sending samples to lab and didn't follow the correct order of tube used during withdrawal, 12.5% of the studied nurses didn't invent the samples a proper time, and 16.2% of the studied nurses applied adhesive tape to heel after withdrawal.

Table (3) showed that, there is a positive correlation between total nurses' level of knowledge and their total level of practice. The more nurses' knowledge, the better level of practice of the studied nurses regarding blood sampling withdrawal at NICU.

Table (1): Percentage distribution of the studied nurses according to their characteristics (No = 80):

Nurses' characteristics		No=80	
		No.	%
Age in years	20-<25ys	4	5%
	25- <30ys	32	40%
	30 year & more	44	55%
	Mean ± SD	**30.1± 7.88**	
Gender	Male	14	17.5%
	Female	66	82.5%
Qualification	Nursing Technical Institute	30	37.5%
	Bachelor Degree	50	62.5%
Years of experience	1-<5ys	28	35%
	5 -<10ys	14	17.5%
	10 year & more	38	47.5%
	Mean ± SD	**7.94 ± 3.40**	
Previous attendance of training program	Yes	3	3.75%
	No	77	96.25%
Number of Courses	One	1	1.25%
	Two	1	1.25%
	Three & more	1	1.25%

Figure (1): Percentage distribution of studied nurses according to their years of experience at neonatal intensive care unit:
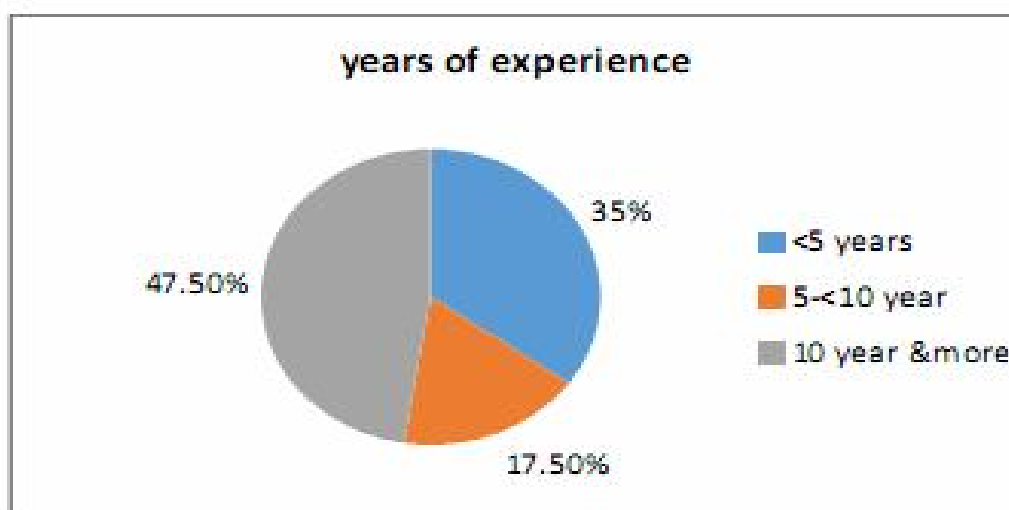
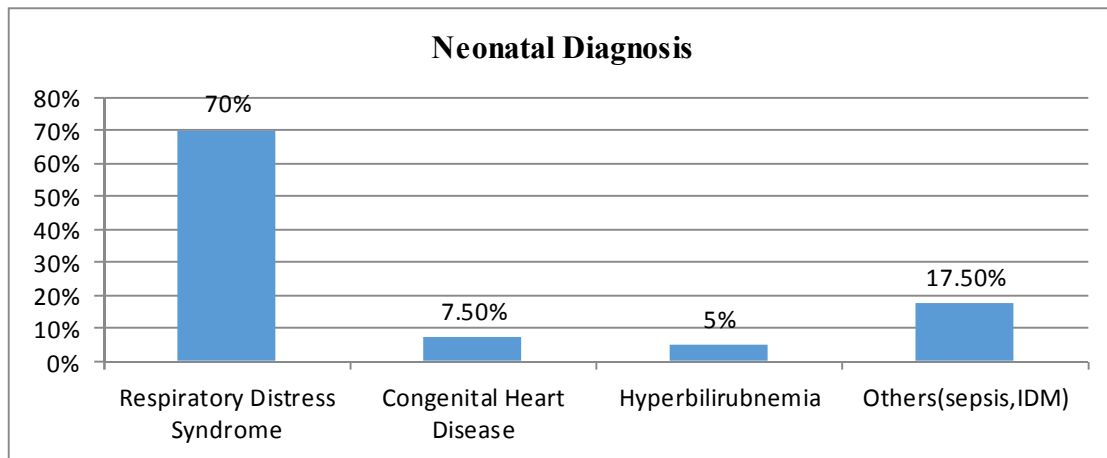**Figure (2): Percentage distribution of studied neonates according to their diagnosis:**

Neonatal Diagnosis

Figure (3): Total level of nurses' practical knowledge regarding blood sampling withdrawal at neonatal intensive care unit:
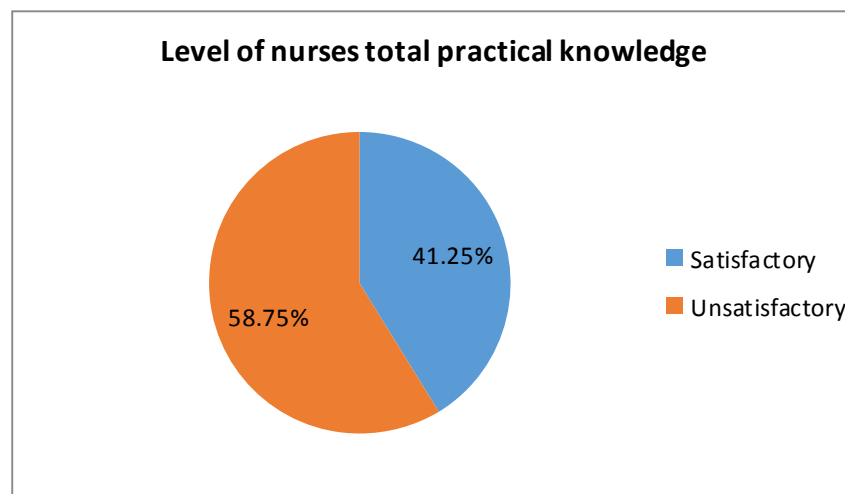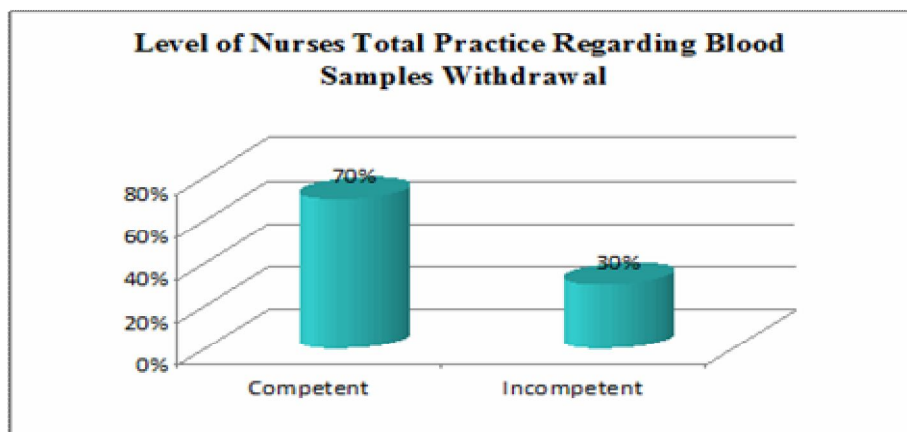

Level of nurses total practical knowledge

Figure (4): Total level of nurses' practice regarding blood sampling withdrawal at neonatal intensive care unit:

Level of Nurses Total Practice Regarding Blood Samples Withdrawal

Table (2): Percentage distribution of the studied nurses' malpractices regarding blood samples withdrawal at neonatal intensive care unit (No = 80):

Items of malpractice	No	%
Don't permit alcohol to dry for 30 seconds.	45	56.3
Don't apply pressure for 3-5 minutes after withdrawal.	38	47.5
Delayed sending samples to lab.	18	22.5
Don't invert samples a proper time.	10	12.5
Don't follow aseptic technique during central venous access withdrawal.	31	38.75
Don't stop TPN for 1 hour before sample withdrawal.	41	51.3
Puncturing the posterior curvature of the heel.	26	32.5
Apply adhesive tape to heel after withdrawal.	13	16.2
Don't follow the correct order of tube used during withdrawal.	18	22.5

*More than one items selected

Table (3): Correlation between studied nurses' knowledge and practice regarding blood samples withdrawal at neonatal intensive care unit:

		Total practice
Total knowledge	R	.783
	p- value	0.000

5. Discussion:

According to the findings of the present study more than half of the studied nurses were between the ages of 30 and more of years old with mean age of (30.1± 7.88) and the majority of the studied nurses were female Table (1). In line with these results the study conducted by Atalla & Henedy, (2018) who conducted a study about "Effectiveness of Structured Teaching Program on Knowledge and Practice Regarding Blood Specimen Collection among Nurses" in Menoufia University Hospital at Menoufia governorate, Egypt, and found that more than half (55.2%) of the studied sample aged above 30 years old and the majority of this sample was female (87.9%). Moreover, came in accordance with these results the study conducted in Indonesia by Iswari, Murad & Parwati, (2015) about "Nurses' Knowledge of Blood Culture Sampling Procedure" which clarified that, (46.9%) were aged 30-39 years old and more than half (51.9%) of the studied nurses were female from a total of 81 subjects.

Concerning qualification, the current study revealed that more than half of the studied nurses had a bachelor degree in nursing science qualification Table (1). From the researcher point of view, this due to the increasing numbers of nursing personnel completing their studies in nursing and joining to faculties of nursing. The study results was in contrast with Soliman, Ouda, Mahmoud & Kafl, (2019) about "Nurses' Knowledge and Practices Regarding Peripheral Intravenous Cannulation and Blood Sampling in

Pediatric Health Care Settings" that clarified that slightly less than two thirds of the studied nurses (61.70%) had technical nursing institute. On the other hand, the current study consistent with the study of Shakerkovar et al., (2019) about "Performance of Neonatal Intensive Care Unit Nurses in Blood Culture Procedure in Tabriz Children Hospitals in 2016" that stated that most of the nurses had a bachelor degree in nursing science.

Regarding the studied nurses' years of experience working at NICU, according to the findings of the present study, less than half of the nurses surveyed had years of experience ranged from 10 years and more working as a neonatal nurse with mean years of (7.94 ± 3.40) Figure (1) and Table (1). This result come in accordance with the study conducted in Indonesia by Iswari et al., (2015) that clarified that the majority working for 11-19 years.

Concerning neonatal diagnosis, the current study revealed that respiratory distress syndrome constitutes the higher percentage of the neonates' diagnoses Figure (2). This result was in accordance with Qari, Alsufyani, Muathin & El Margoushy, (2018) about "Prevalence of Respiratory Distress Syndrome in Neonates" that stated that respiratory distress syndrome is a challenging problem and one of the most common causes of admission in Neonatology Intensive Care Units (NICU). Also, mentioned that respiratory distress syndrome is one of the major problems among newborns and a major reason for increased morbidity and mortality among neonates. Preterm neonates are the main

risk factor for development of respiratory distress syndrome.

Concerning total level of nurses' practical knowledge about blood sampling withdrawal at NICU, according to the findings of the current study slightly more than half of the studied nurses their answers were unsatisfactory Figure (3). On contrary to Soliman et al., (2019) who conducted the Egyptian study that clarified that half of the studied nurses had satisfactory knowledge regarding peripheral intravenous cannulation and blood sampling.

Concerning total level of nurses' practice regarding blood sampling withdrawal at NICU, according to the findings of the current study more than two thirds of the studied nurses' total practice regarding blood samples withdrawal were competent, while more than one quarter of the studied nurses' total practice regarding blood samples withdrawal were incompetent (Figure 4). On contrary to the study conducted by Iswari et al., (2015) that found that when nurses asked to describe the steps of blood sample collection only 8 subjects or 9.9% were able to do so correctly. Also, the finding of the present study versus the finding of the Egyptian study conducted by Soliman et al., (2019) in Port Said Scientific Journal of Nursing, Egypt who found that, the majority had incompetent practice. Also, the study of Chang et al., (2012) about "Adherence to Major Standard Precautions: An Audit of Venepuncture and Intravenous Cannula Insertion" in The Pediatric Unit of Hospital Sultanah Aminah, Johor Bahru.

Concerning percentage distribution of the studied nurses' malpractices regarding blood samples withdrawal at NICU, the current study revealed that the highest percentage of the studied' nurses malpractices regarding blood samples withdrawal at neonatal intensive care unit was at the step of permitting the alcohol to dry for 30 seconds. Also, more than half of the studied nurses had malpractice at stopping TPN for 1hr before blood sample withdrawal, more than one third didn't follow aseptic technique during central venous access withdrawal. Also, less than one quarter of the studied nurses delayed sending samples to lab and didn't follow the correct order of tube used during withdrawal, 12.5% of the studied nurses didn't invert the samples a proper time Table (2). This could be explained in the light of the fact that, nurses were less knowledgeable about blood sample quality control, most likely because they were more concerned with the blood sample technique than with the quality of the blood sample. This might also be due to nurses' insufficient blood sample training.

These findings are in agreement with Atalla & Henedy, (2018) who found in their study that rather than the quality of the blood sample, nurses were concerned about the blood sampling method. Several of the participants also had no idea how to identify test tubes or how to execute a blood collection process in the proper sequence and order.

Table (3) revealed that, the total nurses' knowledge level and their total practice level had a positive correlation. This finding came in accordance with Atia, (2019) who found in her study that there was significant relation and positive correlation between total knowledge and practice of studied nurses regarding blood sampling withdrawal.

6. Conclusion:

The majority of the studied nurses were lacking knowledge and the minority of them had incompetent practice toward blood samples withdrawal in NICU at Mansoura University Children Hospital. The current study results showed that, the more nurses' knowledge, the better level of practice of the studied nurses regarding blood sampling withdrawal at neonatal intensive care unit.

7. Recommendations:
The following recommendations are suggested:
1. The study emphasizes on the necessity to train and educate the neonatal nurses in NICU on best practice during blood sampling procedure to get the best in health care of neonates.
2. Improving the performance of the neonatal nurses by monitoring them through observational audit using the standardized structured auditing checklist and bringing practices closer to the standards to ensure neonate' safety is being guaranteed.
3. Further research with intervention program involving larger study sample of nurses at different study setting all over Egypt should be done to assess the effect of educational program on nurses' knowledge and practice regarding blood samples withdrawal.

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