

Nurses' Performance during Blood Transfusion for Neonates

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Abstract

Background: Blood transfusions is frequently life saving procedure in high risk neonate, but it is not without risks. The best transfusion practice in neonate provide good therapeutic outcome. **Aim** of this study was to assess nurses' performance regarding blood transfusion for neonates in Neonatal Intensive Care Unit. **Research design:** A descriptive design. **Setting:** Neonatal intensive care unit at Wady El-Natron Hospital and Etay El-Barod Hospital. **Subject:** A convenient sample include 60 nurses working at the previous mentioned settings. **Tools** of the study involved; First tool: A structured Questionnaire sheet to assess nurses' knowledge about blood transfusion for neonates. Second tool: Observational checklists to assess the studied nurses' practices regarding neonatal blood transfusion. Third tool: Attitudinal likert type scale to assess level of nurses' attitude regarding blood transfusion in neonates. **Results:** the results of this study showed that, half of the studied nurses their ages ranged from 20 to <25 years and most of them were female. While half of the studied nurses had years of experience <5 years and three quarters of them had graduated from health technical institute. Almost majority of the studied nurses didn't attend program related to blood transfusion. Also, there was positive correlation between total level of knowledge, total level of practice and total level of attitude of the studied nurses. **Conclusion:** More than half of the studied nurses had poor level of knowledge, near to two thirds of the studied nurses had incompetent level of practice and more than one third of the studied nurses had negative attitude regarding blood transfusion in neonates. **Recommendations:** Implementation of in service training programs for continuous updating nurses' knowledge regarding blood transfusion for neonates.

Key words: Blood transfusion, Neonates, Nurses' performance.

Introduction:

Blood transfusion is the process of infusion of blood and blood products in to an individual's circulatory system. Blood transfusion is used in a variety of medical conditions to replace the lost component of blood (Giridharan & Ramalingam, 2018). Blood transfusion is a highly effective and an important aspect of daily nurses' clinical practices. Blood and blood products provide unique therapeutic benefits to pediatric patients (World Health Organization (WHO), 2017).

Blood transfusion is a very common intervention practiced in newborns as it replaces the volume and the specific constituents of blood, which plays specific roles in oxygen carriage, immunity and clotting all of vital importance in a neonate

with immature reserves. Therefore, blood transfusion is required to maintain life by increasing cardiac output and oxygen delivery to tissues, ensure adequate haemostasis by increasing platelet count, increasing clotting factors and removing toxins like bilirubin from body (Ogunleis & Ogunfowora, 2019; Portugal et al., 2020).

The best transfusion practice in neonates provide good therapeutic outcome, especially in reducing transfusion transmitted infections due to exposure to multiple donors (O'Riordan et al., 2017). It can be assumed that specifications and guidelines for blood component transfusion used in adults can't be completely applied to neonates, the small size of neonates and the presence of unique physiological and immunological factors make transfusion

needs in neonates uniquely different from that of adult patients (Wade et al., 2019).

Nurses have a vital role in administering blood transfusion, their performance and knowledge are crucial to transfuse blood safely and efficiently. Professional nurses play a primary role in safety and effective blood administration, as well as protecting the neonates from the potential complications, moreover they are responsible for initiating, maintaining, monitoring and discontinuing the blood transfusion (Yesilbakan et al., 2019; Vincent & Piagnerelli, 2016)).

Blood transfusion service is multistep process which include blood collection, processing and storage of blood products and distribution. Preparation for neonate prior to blood bag collection in which nurse should check a written order, patent intravenous access and administer any pre medication (Hillyer et al, 2021; Bielby et al., 2019).

The nurses' responsibilities cover from pre- transfusion sampling, requesting blood from blood banks, collecting blood products, administering the transfusion and monitoring neonate's vital signs before, during and after transfusion. Errors in practice may lead to severe and some times life threatening consequences to the neonates (Gray et al., 2017).

Significance of the study:

World health organization reported that over nine million neonates in 90 different countries receive blood in a year. According to Serious Hazards of Transfusion(SHOT) program about 70% of all reported adverse events are recognized to the improper transfused blood component. More over half of these events involve more than one error in the transfusion process. Inadequate knowledge

about safe blood transfusion practices among nurses can lead to adverse consequences in the transfusion recipients. So, the nurse must understand the proper and safe method for blood transfusion practice (WHO, 2019).

Blood transfusion like many other clinical procedures, it is associated with clinical risks. These clinical risks include adverse effects that occur due to error and suboptimal care during the transfusion process. Red blood cells transfusion has significant risks, including volume overload, transmission of infectious agents and various immunologic consequences including transfusion reactions. Many of these complications can be avoided with careful administration of RBCs transfusions (Novis et al., 2020).

From the researcher's point of view, assessment of nurses' knowledge, practice and attitude is very important for enhancing care given to neonates undergoing blood transfusion, identify weakness point in performance and reduce blood transfusion risks or complication that may occur and ensure the safety of this intervention. There is an urgent need of training program in hospital critical units on blood transfusion.

Aim of study:

The aim of the study was to assess nurses' performance regarding blood transfusion for neonates in NICU.

Research Questions:

- 1- What are the nurses' knowledge about blood transfusion?
- 2- What are the nurses' practices concerning care of neonates undergoing blood transfusion ?
- 3- What are the nurses' attitudes concerning neonatal blood transfusion?
- 4- Are there a relation between nurses' knowledge, practices and their attitude

regarding caring for neonate undergoing blood transfusion ?

Subjects and Methods:

Aim of the Study

Descriptive study aimed to assess nurses' performance regarding blood transfusion for neonates at Neonatal Intensive Care Unit.

The subjects and methods used for achieving the study was portrayed under four main designs as follows :

- 1- Technical design
- 2- Operational design
- 3- Administrative design
- 4- Statistical design

1- Technical Design:

The technical design included research design of the study, settings of the study, subjects as well as tools for data collection.

Research Design:

A descriptive study design was utilized to fulfill the aim of the study and answer the research questions.

Research Settings:

The current study was conducted at neonatal intensive care unit at Wady El-Natron Hospital and Etay El-Barod Hospital affiliated to Directorate of health.

Subjects:

A convenient sample include all available nurses working at the previous mentioned settings who provide direct neonatal care and willing to participate in the study. The sample is composed of 60 nurses (52 female & 8 male) these were classified as follows: Wady El-Natron Hospital (20 female nurses), Etay El-Barod Hospital (32 female and 8 male). Also, the study included all neonates admitted to the previously mentioned settings during time of data collection and received blood

transfusion regardless of their diagnosis. The number was 60 neonates.

Tools for data collection:-

Data were collected through using of the following tools:

First tool: A structured Questionnaire sheet (Appendices II):

This tool used to assess nurses' knowledge about blood transfusion for neonates. The present tool was designed by the researcher in simple Arabic language after reviewing the current available literature and studies. It was written in the form of close ended questions in the form of multiple choice questions. It consists of three parts:

Part one:

A- Characteristics of the studied neonates

It was used to assess characteristics of the studied subjects for the neonates, it included (5questions) it was related to their gestational age, chronological age, gender, type of delivery, birth weight on admission.

B- Characteristics of the studied nurses

It was used to assess characteristics of the studied nurses it consists of 5 questions related their age, gender, years of experience, educational level and attendance of training program related to blood transfusion.

C- Medical history of the studied neonates

It included data about the diagnosis, type of blood transfusion, reason for blood transfusion and number of previously blood transfusion for neonates (4 questions).

Part two:

This part aimed to assess the nurses' knowledge regarding neonatal blood

transfusion and included (28 questions) which included definition of blood transfusion, indications, components, the importance of blood transfusion and blood transfusion reactions in neonates. Also, this tool included assessment of nurses knowledge regarding their role (pre, during and after) blood transfusion: it included:

Overview about blood transfusion (5 questions), preparation for blood transfusion (2 questions), pre blood transfusion (7 questions), during blood transfusion(6 questions), after blood transfusion (1 question), complications of blood transfusion (3 questions) and precautions of infection control: It consisted of (4 questions).

❖ **Scoring system:**

The studied nurses' answers were cross- coded with a model key answer prepared by the researcher. Regarding the knowledge of the studied nurses this part consisted of 28 questions (28 point). Each question was scored as the following: Correct answer was scored as a single point and the incorrect answer was scored as a zero point.

These scores were summed- up and categorized in to three level: more than or equal 75% is considered good level of knowledge, from 60 to less than 75% is considered average level of knowledge and less than 60% is considered poor level of knowledge.

Second tool : Observational checklists (Appendices III):

It was adopted from **David & Leaven (2007) and Tabiee & Nakhaei (2010)** to assess the studied nurses' practices regarding neonatal blood transfusion (pre, during, after) it consisted of 3 parts: pre blood transfusion (17 steps),

during blood transfusion (10 steps), after blood transfusion (6 steps).

❖ **Scoring system:**

The studied nurses' practices was scored while each step done was scored 1 degree and scored zero degree for each step done incorrectly or not done at all.

These scores were summed up and categorized in to two levels:

- **Competent (80 % and more).**
- **Incompetent (<80%)**

Third tool: Attitudinal likert type Scale (Appendices IV):

This tool was adapted from likert like type rating scale, adopted from **Lynne et al., (2013)** to assess level of nurses' attitude regarding blood transfusion in neonates.

The scale included 14 statements (7 positive and 7 negative). Nurses were asked to respond to statements on a 3- point likert scale (agree- uncertain- disagree).

❖ **Scoring system:**

A scoring system was followed to be assess nurses' attitudes pre, during, and post neonatal blood transfusion. Responses ranged from "agree", "uncertain" and "disagree", it was respectively scored 3, 2, 1. Negative scoring was followed for negative responses.

These scores summed up and classified into 2 categories:

- **Positive** attitude if score $\geq 60\%$.
- **Negative** attitude if score $< 60\%$.

2- Operational design

The operational design for this study consisted of three phases namely preparatory phase, content validity, pilot study and fieldwork.

A- Preparatory phase:

A review of the past and current related literature covering the various aspects of the research problem was done by using text books, articles, magazines and internet search to develop the study tools for data collection and to be acquainted with the research problem.

Validity: content validity was ascertained by panel of experts of professor of pediatric nursing (n=3) (one professor and two assistant professor of pediatric nursing Faculty of Nursing-Ain Shams University) to review the tools for its clarity, relevance and comprehensiveness. While, no modification was required.

Tool reliability:

Reliability of the designed tools was done to determine the extent to which items in the tool of data collection are related to each other. The study tools were ascertained using Cronbach's alpha test and the results were 0.876, 0.839 and 0.866 for knowledge, practice, and attitude respectively.

Ethical consideration:

For ethical consideration, a primary permits were grantee from the ethical research committee in the faculty of nursing, Ain Shams University as well as the hospital administration. Also, each legible subject was informed about the purpose of the study and its importance. The researcher was emphasis that participation in the study is entirely voulantry, anonymity and confidentiality was assured through coding the data. Oral approval was taken from nursing staff who accept to participate in the study. The studied nurses were informed that they have the right to withdraw at any time from the study without giving any reasons.

Pilot study:

The pilot study was conducted by the researcher on 6 nurses 10% of the study sample to evaluate the clarity and applicability of tools and estimated time

needed for filling the sheet tools. Subjects who shared in the pilot study were included in the main study sample while there was no modification in the study tools.

Field work:

Formal approval was obtained from hospital directors after explanation of the aim, nature and significance of the study. The study was carried out four days (Saturday- Monday- Thursday- Friday) per week (two days for each hospital) during morning and night over seven months period from the first week of November, 2019 till the end of May, 2020 using the previously mentioned tools. The researcher started introducing herself to the nurses and provide a brief explanation for the aim of the study. The tools were distributed and filled in by the subjects during the interval waiting time. The time required for each interview ranged from 20 minutes. The nurses assured about confidentiality of data collected that were used only for the purpose of the study. The prescence of the researcher all the time to clarify any ambiguities and answer any queries, then, the tools was collected and checked for completeness. Each nurse was observed closely using the observational checklists while performing the care for neonates undergoing blood transfusion for 2hours in each sessions. However, each nurse was observed during the direct care for neonates undergoing blood transfusion before, during, after the session. The researcher was available for four days weekly accordingly to their appointments for each settings. After performing the observational checklists for all nurses, the time spent to fill sheet was around 15 to 20 minutes for each procedure. Also, the nurses fill the Attitudinal Likert Type Scale within 5 minutes according their point of view according to their free time.

3- Administrative design:

An official approval were obtained from the dean of Faculty of Nursing- Ain Shams University to the director of each hospital at the previously mentioned settings for obtaining the permission for data

collection after explaining the aim of the study and its expected outcome.

4- Statistical design:

The collected data were coded and entered in to the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables. Qualitative variables were compared using Chi-square test. Pearson's correlation coefficient (r) test was used to assessment of the inter-relationship among quantitative variables. P-value denoted level of significance, where $P\text{-value} \leq 0.05^*$ was considered as statistically significant, $P\text{-value} \leq 0.001^{**}$ was considered as highly statistically significant and $P\text{-value} > 0.05$ was considered to be non statistically significant.

Results:

As regards characteristics of the studied nurses.

Table (1): reveals that, half (50%) of the studied nurses their ages ranged from 20:<25 years and the most (86.7%) of them were female. While half of the studied nurses (50%) had years of experience <5 years and three quarter (75%) of them had health technical institute. Almost majority of the studied nurses (90%) didn't attend program related to blood transfusion.

Figure (1): shows that only 18.3% of the studied nurses had good level of knowledge regarding blood transfusion for neonates, also, more than one quarter (26.7%) of them had average knowledge, while, more than half (55%) of them had poor level of knowledge.

Figure (2): illustrates that 38.3% of the studied nurses had competent level of practice pre blood transfusion, 41.7% of them had competent level of practice during blood transfusion and more than one third of them (35%) had competent level of practice after blood transfusion.

Figure (3): shows that 38.3% of the studied nurses had competent level of practice about blood transfusion and pulse oximeter, while, 61.7% of them had incompetent level of practice.

Figure (4): shows that the 63.3% of the studied nurses had positive attitude regarding attitude about blood transfusion, while, 36.7% of them had negative attitude.

Table (2): describes that, there is a highly statistically significant relation between the studied nurses' characteristics (age, years of experience and educational level) and their total level of knowledge about blood transfusion for neonates when p-value was $< 0.001^{**}$. While, the same table presents that there were no statistically significant relation between total level of knowledge of the studied nurses and their gender and attendance of training program related blood transfusion when p-value was > 0.05 .

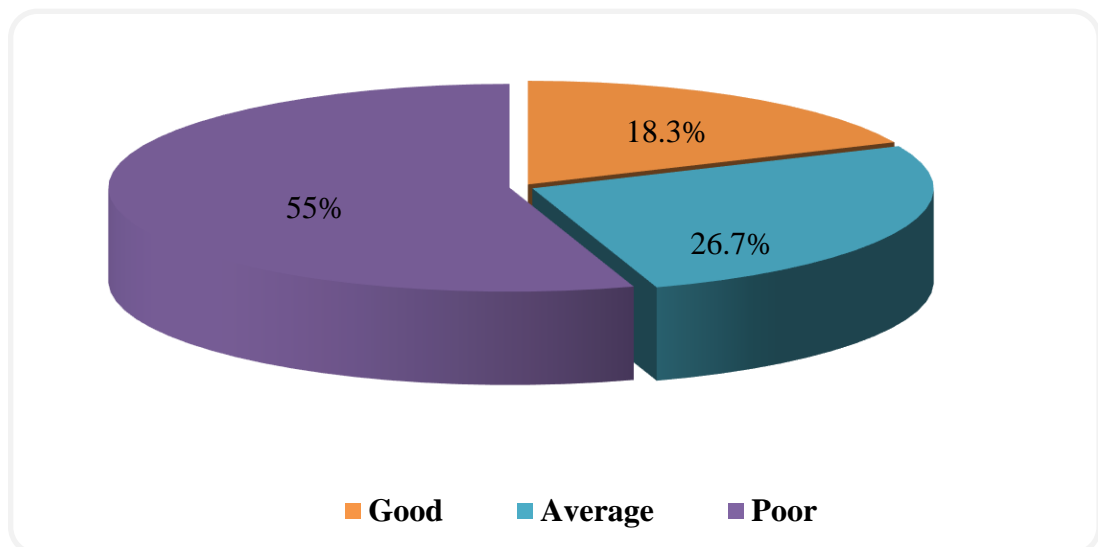
Table (3) represents that, there is highly statistically significant relation between level of practice of the studied nurses and their age, years of experience and educational level when p-value was $< 0.001^{**}$. While, the same table presents that there is no statistically significant relation level of practice of the studied nurses, their gender and their attendance of training program related blood transfusion when p-value was > 0.05 .

Table (4) illustrates that, there were highly statistically significant relation between level of attitude of the studied nurses and their age and years of experience when p-value was $< 0.001^{**}$. Also statistically significant relation was found between total level of attitude of the studied nurses, their educational level and their attendance of training program related to blood transfusion when p-value was $< 0.05^*$.

Table (5) presents that, there is a positive correlation between total score of knowledge, total score of practice and total score of attitude of the studied nurses at (p-value $< 0.001^{**}$).

Table (1): Number and Percentage Distribution of the Studied Nurses According to their Characteristics (n=60).

Characteristics	No.	%
Age (years)		
20:<25 years	30	50
25:<30 years	12	20
30:<35 years	9	15
≥35 years	9	15
Mean±SD		28.60±6.35
Gender		
Male	8	13.3
Female	52	86.7
Years of experience		
<5 years	30	50
5:< 10 years	12	20
10:<15 years	9	15
≥15 years	9	15
Mean±SD		8.41±3.75
Educational level		
Diploma of nursing	3	5
Health Technical Institute	45	75
Bachelor Degree	10	16.7
Post Graduate Studied	2	3.3
Attendance of program related to blood transfusion		
Yes	6	10
No	54	90

**Fig (1):** Percentage Distribution of The Studied Nurses According to Their Total Level of Knowledge about Blood Transfusion for Neonates (n=60).

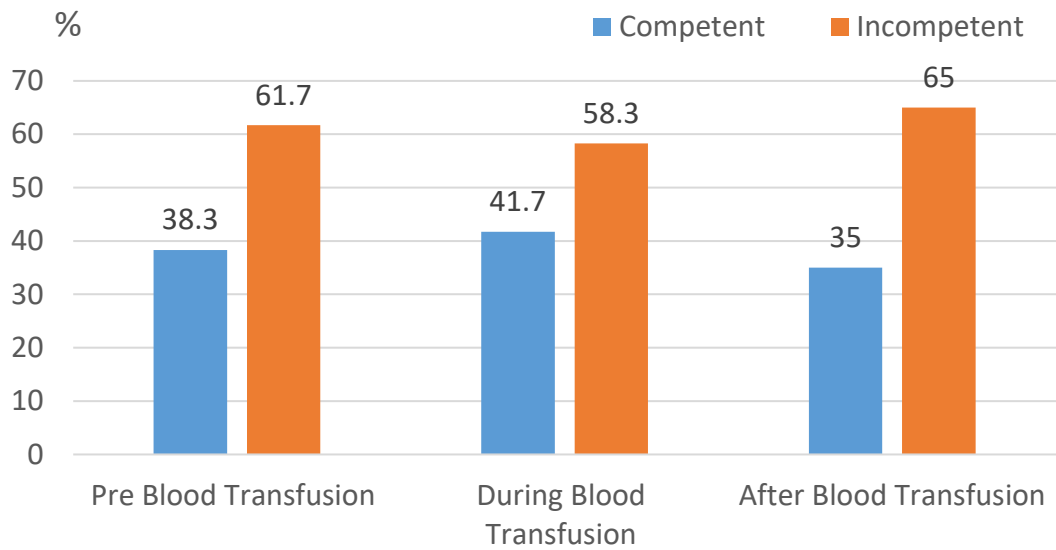


Fig. (2):Percentage Distribution of The Studied Nurses According to Their Total Practices about Blood Transfusion (n=60).

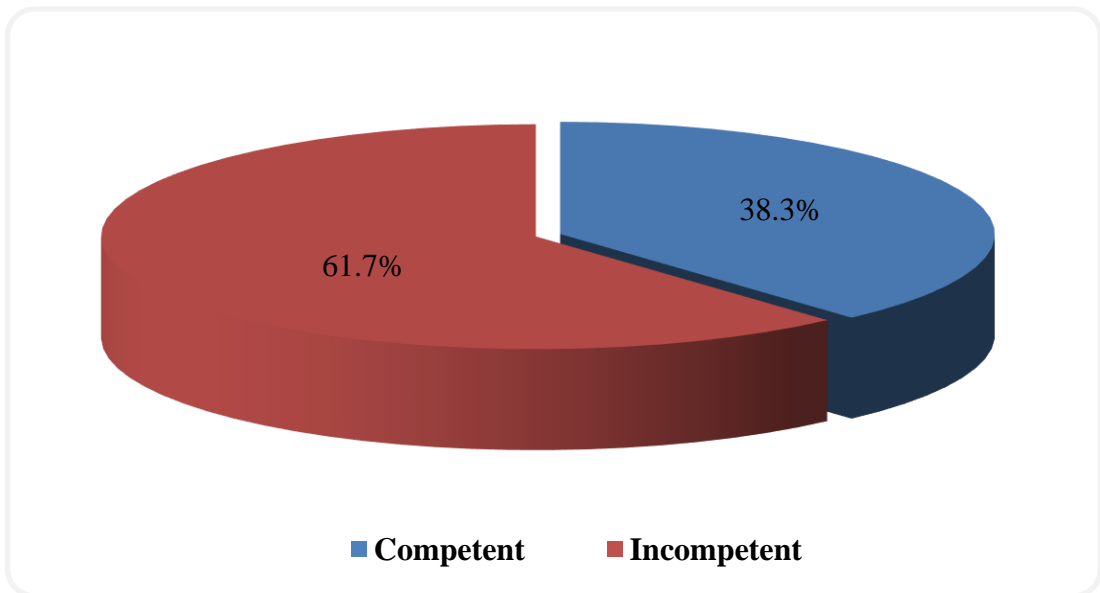


Fig. (3): Percentage Distribution of The Studied Nurses According to Their Total Level of Practices about Blood Transfusion (n=60).

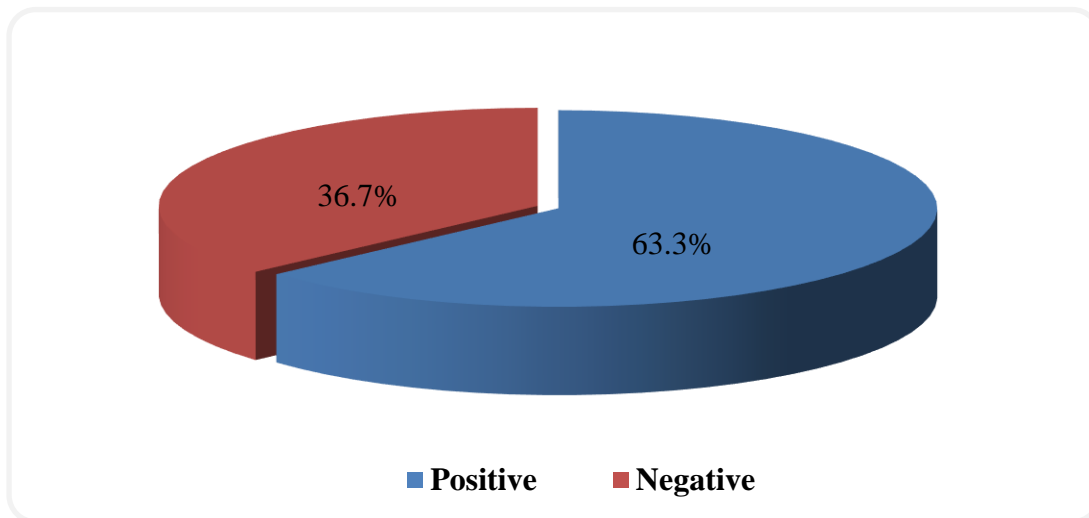


Fig. (4): Percentage Distribution of The Studied Nurses According to Their Total Level of Attitude Related to Blood Transfusion for Neonates (n=60).

Table (2): Relation between Total Level of Knowledge about Blood Transfusion for Neonates and the Studied Nurses' Characteristics (n=60).

Characteristics	Good N=11		Average N=16		Poor N=33		Total	Chi-square	
	N	%	N	%	N	%		X ²	P-value
Age (years)									
20-<25	0	0.0	3	10.0	27	90.0	30	48.236	<0.001**
25-<30	1	8.3	6	50.0	5	41.7	12		
30-<35	3	33.3	5	55.6	1	11.1	9		
35 or more	7	77.8	2	22.2	0	0.0	9		
Gender								0.620	0.734
Male	1	12.5	3	37.5	4	50.0	8		
Female	10	19.2	13	25.0	29	55.8	52		
Years of experience								41.115	<0.001**
<5	1	3.3	3	10.0	26	86.7	30		
5-< 10	0	0.0	6	50.0	6	50.0	12		
10-<15	4	44.4	4	44.4	1	11.1	9		
15 or more	6	66.7	3	33.3	0	0.0	9		
Educational level								30.222	<0.001**
Diploma of nursing	0	0.0	1	33.3	2	66.7	3		
Health Technical Institute	3	6.7	11	24.4	31	68.9	45		
Bachelor science in nursing	6	60.0	4	40.0	0	0.0	10		
Post Graduate Studied	2	100.0	0	0.0	0	0.0	2		
Attendance of training program related to blood transfusion								1.498	0.473
Yes	2	33.3	2	33.3	2	33.3	6		
No	9	16.7	14	25.9	31	57.4	54		

Using: Chi-square test; p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Table (3): Relation between Total Level of The Studied Nurses' Practices about Blood Transfusion and Their Characteristics (n=60).

Characteristics	Total Practice				Total	Chi-square	
	Competent N=23		Incompetent N=37			X ²	P-value
	N	%	N	%			
Age (years)							
20-<25	3	10.0	27	90.0	30	26.839	<0.001**
25-<30	7	58.3	5	41.7	12		
30-<35	4	44.4	5	55.6	9		
35 or more	9	100.0	0	0.0	9		
Gender						0.003	0.958
Male	3	37.5	5	62.5	8		
Female	20	38.5	32	61.5	52		
Years of experience						25.781	<0.001**
<5	2	6.7	28	93.3	30		
5-<10	8	66.7	4	33.3	12		
10-<15	6	66.7	3	33.3	9		
15 or more	7	77.8	2	22.2	9		
Educational level						18.966	<0.001**
Diploma of nursing	0	0.0	3	100.0	3		
Health Technical Institute	12	26.7	33	73.3	45		
Bachelor science in nursing	9	90.0	1	10.0	10		
Post Graduate Studied	2	100.0	0	0.0	2		
Attendance of training program related to blood transfusion						2.264	0.132
Yes	4	66.7	2	33.3	6		
No	19	35.2	35	64.8	54		

Using: Chi-square test; p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Table (4): Relation between Total Level of The Studied Nurses' Attitude and Their Characteristics (n=60).

Characteristics	Total attitude				Total	Chi-square	
	Positive N=38		Negative N=22			X ²	P-value
	N	%	N	%			
Age (years)							
20-<25	10	33.3	20	66.7	30	24.115	<0.001**
25-<30	10	83.3	2	16.7	12		
30-<35	9	100.0	0	0.0	9		
35 or more	9	100.0	0	0.0	9		
Gender						0.003	0.958
Male	5	62.5	3	37.5	8		
Female	33	63.5	19	36.5	52		
Years of experience						17.512	<0.001**
<5	12	40.0	18	60.0	30		
5-<10	8	66.7	4	33.3	12		
10-<15	9	100.0	0	0.0	9		
15 or more	9	100.0	0	0.0	9		
Educational level						9.282	0.026*
Diploma of nursing	1	33.3	2	66.7	3		
Health Technical Institute	25	55.6	20	44.4	45		
Bachelor science in nursing	10	100.0	0	0.0	10		
Post Graduate Studied	2	100.0	0	0.0	2		
Attendance in program related to blood transfusion						3.860	0.049*
Yes	6	100.0	0	0.0	6		
No	32	59.3	22	40.7	54		

Using: Chi-square test; p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Table (5): Correlation between Total Knowledge, Total Practice and Total Attitude of the Studied Nurses (n=60).

	Total score of knowledge		Total score of Practice	
	<i>R</i>	<i>p-value</i>	<i>r</i>	<i>p-value</i>
Total score of Practice	0.680	<0.001**		
Total score Attitude	0.847	<0.001**	0.538	<0.001**

Using: Pearson Correlation Coefficient; **p-value <0.001 HS

Discussion:

Blood transfusion is a life saving modality when used appropriately. It is a complex multistep process that involves professionals of different cadres, physicians, nurses and laboratory technologists. The process includes blood donation, preparation of blood components, decision to transfuse, patient identification, blood collection and labeling, collection and transportation of blood components from the laboratory, patient preparation, administration of blood components, monitoring of patients and documentation (Derek, 2018).

Neonates admitted to NICU require multiple blood transfusion as a consequence of extended NICU stay and repeated sampling (Keir et al., 2019). Multiple physiological changes occur when a fetus becomes a neonate. These changes refer to an alteration in their blood volume, hematological parameters and other body system (Dogra et al., 2018).

Regarding characteristics of the studied nurses, the result of the present study illustrated that half of the studied nurses were in the age group of 20:<25 years (table 1). This finding was congruent with Reda et al., (2019) whose study entitiled "Assessment of nurses' knowledge and practices related neonatal sepsis in neonatal intensive care units at EL- Minia hospitals" and found that near half of the studied nurses their age between 20:<25 years.

Concerning the gender of the studied nurses, the finding of the current study revealed that the most of them were female (table 1). This result was in the same line with Hendy et al., (2017) who conducted a study about "Nursing performance regard caring for patients undergoing blood transfusion" and revealed that the majority of study sample were female.

As regards to years of experience of the studied nurses, the finding of the present study

illustrated that half of them had experience <5 years (table 1). This finding was parallel to the finding of Wrwick & Modi, (2017) who conducted a study entitiled "Guidelines for the administratin of blood products" and clarified that half of nurses had three years of experience. The researcher attributed that to the majority of nurses were newly graduated and may change work place according to other unit needs.

As regards to educational level of the studied nurses the present study clarified that three quarters of them were health technical institute (table 1). This result was in agreement with Hendy et al., (2017) who found that more than half of nurses were technical institute. From the researcher's point of view, all staff nurses must be well educated and the highly educated nurses should occupied critical areas such as NICU.

However, this result was in contrast with lee et al., (2016) who coducted a study entitiled "Knowledge of blood transfusion among nurses at hospital Pulau" and reported that most of nurses were aged between 21-30 years, their years of experience ranged from 8 months to 23 years, most of the nurses had a basic qualification in nursing (either a nursing certificate or diploma). From the researcher's point of view, the safety and effectiveness of the transfusion process is dependent on the knowledge and experience of nurses who occupied NICU. Therefore, training and manager supervision is very important.

Concerning the attending of training program among the studied nurses, the finding of the present study clarified that the great majority of them didn't attend any previous training program related to neonatal care and blood transfusion (table 1). This finding came in accordance with a study conducted by Elbaqary et al., (2021) regarding "Assessment of nurses' knowledge and practice for caring of children undergoing blood products transfusion" and

revealed that nearly three quarters of the studied nurses didn't attend training course regarding blood products transfusion.

Conversely, this finding was inconsistent with **Sayed et al., (2018)** who conducted a study entitiled "Auditing and re-auditing nursing care for children receving blood transfusion" and found that most of participants did not obtain any training program. This result may be related to lack of inservice training program and there was no time for attending any extra training program because of work load. This procedure requires skilled and trained professionals to achieve transfusion safety.

As regards to total level of knowledge the finding of the present study illustrated that minority of the studied nurses had good level of knowledge, more than one quarter of them have average level of knowledge and more than half had poor level of knowledge (**fig. 1**). This result was supported with **Elbaqary et al., (2021)** who conducted study about "Assessment of nurses' knowledge and practices for caring of children undergoing blood products transfusion" and found that nuses' overall blood transfusion knowledge score had been moderate to poor in general.

From the researcher's point of view, nurses have a multifunctional role in the blood transfusion process, which require evidence based knowledge various skills and qualities. Even though having adequate knowledge doesn't always represent good practice, it is necessary to have a proper education in blood transfusion to ensure neonate's safety and minimize blood transfusion related hazardeous.

Concerning to total level of practices regarding nursing care pre, during and after blood transfusion the current study showed that more than half of the studied nurses had incompetent practice (**fig. 2,3**). This result was consistent with **Saif AL-Nasr et al., (2016)** who conduct a study entitiled "Nurses' performance regarding caring of patients undergoing blood transfusion" and found that who found that less than three quarters of the studied nurses had unsatisfactory level score of practice regarding nursing care of blood transfusion.

In addition, this result was supported with **Khetan et al., (2018)** who conducted a study entitiled "Assessment of bedside transfusion

practices at a tertiary care center" and mentioned that the majority of the studied nurses had poor practice regarding blood transfusion and IV maintenance. The current study explained that the most of the studied nurses had incompetent level of practice pre, during and after blood transfusion and this may be due to lack of experience and in service training program. It is necessary to develop educational program about blood transfusion to increase standard of care.

As regards to the total level of the studied nurses's attitude regarding blood transfusion for neonates the finding of the current study revealed that less than two thirds of the studied nurses had positive attitude regarding blood transfusion, while, more than one third of them had negative attitude (**Fig. 4**). This result was in agreement with **Saif AL-Nasr et al., (2016)** who stated that the majority of the studied nurses had positive attitude regarding the role of nurses in blood transfusion process and the important of written consent.

Concerning to relation between total level of knowledge about blood transfusion and the studied nurses' characteristics the finding of the present study revealed that there is a highly statistically significant relation between nurses knowledge and their (age, years of experience and educational qualification) (**Table 2**). This result was consistent with **Akyol, (2019)** who conducted a study entitiled "Assessing knowledge of nurses on blood transfusion in turkey" and reported that there is a highly statistically significant relation between nurses knowledge and their (age, years of experience and educational qualification).

The finding of the present study illustrated that, highly educated nurse, more years of experience showed good level of knowledge more than others.

Concerning to relation between total level of practice about blood transfusion and the studied nurses' characteristics the present study revealed that there was a highly statistically significant relation between nurses practice and their (age, years of experience and educational qualification) (**Table 3**). This result was consistent with **Sayed et al., (2018)** who found that that there is a highly statistically significant

relation between nurses practice and their characteristics.

The finding of the current study revealed that, highly educated nurse and more years of experience demonstrated competent level of practice. Educational programs is very important and affect positively on nurses level of practice.

Concerning to relation between total level of attitude about blood transfusion and the studied nurses' characteristics the present study revealed that there was a highly statistically significant relation between nurses attitude and their (age, years of experience and educational qualification) (Table 4). This result was consistent with **Abd Elhy & Aziz Kasemy, (2017)** who conducted a study entitiled "Nurses knowledge assessment regarding blood transfusion to ensure patient safety" and found that there was a highly statistically significant relation between nurses attitude and their characteristics. The majority of nurses knew that blood transfusion is a life saving procedure, however is not without risks. So, they had positive attitude regarding care and minimize risks.

Concerning to correlation between total knowledge, total practice and total attitude the present study showed that there is positive correlation between level of knowledge, practice and attitude (Table 5). This result came in accordance with **Bayomi & El-Nagar, (2020)** who conducted a study entitiled "Effectiveness of implementing evidence based practices guidelines regarding blood transfusion on quality of nursing care and patient's safety in pediatric units" and found that there is significant correlation between nurses knowledge and practice and attitude. From the researcher's point of view, the safety and effectiveness of the transfusion process depend on the knowledge and skills of nurses who perform. Nurses performance had interrelated components and the insufficiency in one of these components positively affects the other component.

Conclusion:

Based on findings of the current study, it can be concluded that:

Minority of the studied nurses had good level of knowledge regarding blood transfusion, and more than half of them had

poor level of knowledge. Also, near to two thirds of the studied nurses had incompetent level of practice about blood transfusion. While, more than one third of the studied nurses had negative attitude regarding blood transfusion, also there was a positive correlation between studied nurses' total score of knowledge, total score of practice and total score of attitude regarding care of neonates during blood transfusion.

Recommendations:

Based on the results of the present study, the following can be recommended:

- Establish in-service training programs for continuous updating nurses knowledge regarding blood transfusion for neonates.
- Periodical monitoring of nurses' knowledge and practices and close supervision is needed to ensure that quality of care provided by nurses while management of neonates undergoing blood transfusion.
- Availability of protocol for blood transfusion in Arabic and English language which contain procedure for neonates and nurses guidelines.
- Further study can be replicated in different setting and large sample of pediatric nurses to strengthen the study findings.

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