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### RESEARCH ARTICLE

#### EFFECT OF IMPLEMENTING EDUCATIONAL PROGRAM ABOUT SAFETY BLOOD TRANSFUSION ON THE NURSE'S KNOWLEDGE AND PRACTICE.

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Nurses, knowledge, practice, safe blood transfusion, educational program.

#### Abstract

Errors in blood transfusion practice can lead to serious consequences, morbidity and mortality complications for children. Nurses play an important role in safety blood transfusion. Safety blood administration, and child surveillance. The aim of this study was to determine the effect of implementing an educational program about safety blood transfusion on nurses' knowledge and practice. Quasi- experimental research design was used. The study was conducted at Pediatric Hematology and Oncology Department of Tanta University Hospital and El Oboor Hospital of Kafr El-sheikh. A convenient sample of 25 nurses were selected from Pediatrics Hematology and Oncology Department of Tanta University Hospital and simple random sample of 25 nurses from 32 nurses were selected from El Oboor Hospital of Kafr El-sheikh. Two tools were used for data collection: A structured questionnaire schedule to assess nurse's knowledge about blood transfusion and observation checklist to assess nurse's practices pre, during and after blood transfusion. The results shows an improvement of nurses' knowledge and practice about safe blood transfusion after the program implementation and the child got fewer acute adverse reactions such as fever, chills, myalgia, nausea and/or vomiting, urticaria, dyspnea, hypoxia, hypotension, pain and severe anxiety. The study concluded that nurse's knowledge and practice improved after the implementation of blood transfusion educational program. Based on the findings of the present study the following recommendation were recommended that ongoing in-service education programs to nurses at pediatric hematology units are necessary to improve their knowledge and practice. Universal protocols for blood transfusion should be integrated into pediatric nursing curriculum.

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**Introduction:-**

Blood transfusion is an important part of day-to-day clinical practice. Blood and blood products provide unique and life-saving therapeutic benefits to children. However, due to resource constraints, it is not always possible for the blood product to reach the child at the right time. <sup>(1)</sup> According to WHO 2016 in low-income countries, up to 65% of blood transfusions are given to children under 5 years of age. <sup>(2)</sup> Pediatric Hospital of Ain Shams University reports that blood diseases ranked as the second most common indication for admission 18.58% of admitted cases for year 2015. <sup>(3)</sup>

The major concern from the point of view of both the user (recipient) and the prescriber (clinician) is for safe, effective and quality blood to be available when required. Standard practices should be in place to include appropriate testing, careful selection of donors, screening of donations, compatibility testing, storage of donations for clinical use, issue of blood units for either routine or emergency use, appropriate use of blood supplied or the return of units not needed after issue, and reports of transfusion reactions – all are major aspects where standard practices need to be implemented. <sup>(4)</sup>

In order to implement guidelines for standard transfusion practices, a coordinated team effort by clinicians, blood transfusion experts, other laboratory personnel and health care providers involved in the transfusion chain, is needed. Orientation of standard practices is vital in addressing these issues to improve the quality of blood transfusion services. <sup>(5)</sup>

The majority of errors occurs due to incorrect sampling of blood from a child, fetching the wrong unit of blood for a child and transfusing blood inappropriately. These clinical transfusion guidelines describe protocols for the collection of blood samples for blood grouping and cross matching, and for the collection, storage and administration of blood and blood products. <sup>(6)</sup>

The guidelines provide a standardized approach to transfusion so that the potential for errors is minimized and the administration of safe and efficacious blood products in the health care setting is maximized. They also contain protocols for the investigation and treatment of adverse transfusion reactions and provide guidelines for the use of specialized blood products. <sup>(7)</sup>

Nurses have an important role during blood transfusion; they are responsible for completing blood request forms, administering blood, monitoring transfusions and being vigilant for the signs and symptoms of adverse reactions. These guidelines are intended to enhance the implementation of standard clinical transfusion practices for improved child safety. <sup>(8)</sup> This protocol is, for staff responsible for requesting, sampling, prescribing, supplying, collecting and administering blood products. This protocol is to reduce/eliminate the risk of transfusion errors by providing staff involved in the transfusion process with the information required to provide the best practice. This, combined with continuing education of all hospital staff involved in the transfusion process, is crucial if the errors above are to be avoided <sup>(9,10)</sup>. Errors in blood transfusion practices can lead to serious consequences for morbidity and mortality complications. Nurses play an important role in safety blood transfusion.

**the aim of this study**

is to determine the effect of implementing educational program about safety blood transfusion on the nurse's knowledge and practice.

**Research Hypothesis**

Nurse's knowledge and practice expected to be improved after educational program about safety of blood transfusion

**Settings:**

This study was conducted at Pediatrics Hematology and Oncology Department of Tanta University Hospital and El Oboor Hospital of Kafr El-sheikh which is affiliated to Health Insurance.

**Subjects:**

A convenient sample of 25 nurses were selected from Pediatrics Hematology and Oncology Department of Tanta University Hospital and 25 nurses were selected from 32 nurses by simple randomization from El Oboor Hospital of Kafr El-sheikh and assigned according to power analysis equation (with power of test 90% and significance level  $\alpha = 0.005$ )

**Tools of data collection:**

Two tools were developed by the researcher and used to collect the data required data as follows:

**Tool I: A structured questionnaire schedule. It was used to assess the nurse's knowledge about blood transfusion and includes two parts:**

**Part I:**

Sociodemographic characteristics of nurses such as: age, levels of education, years of experience, and if any related training courses.

**Part II:**

Nurse's knowledge about blood transfusion such as: definition, blood products, indications, contraindications, complications, and acute adverse reactions of blood transfusion.

**Scoring system for nurse's knowledge was as follows:**

A questionnaire including 3 sections with the total number of 30 questions: It covered general issues relating to the care of blood transfusion to child (20 items), complications of blood transfusion (8 items), and issues of local hospital policies (2 items).

**Scoring system for nurse's knowledge:**

Three levels of scoring for each question were used: Correct and complete answer was scored (2), Correct and incomplete answer was scored (1), and Don't know or incomplete answer was scored (0).

**Total scores for nurses' knowledge**

were 60. It was calculated and classified as follows:  $\downarrow$ 65% were considered poor knowledge, from 65- $\downarrow$  75% were considered fair knowledge, and from 75-100% were considered good knowledge.

**Tool II:**

Nurses' Observation checklist: It was developed by blood product administration policy <sup>(118)</sup> and modified by the researcher after review the literature to assess nurse's practices regarding blood transfusion (see appendix II). It includes four parts.

**Part one:- Care provided before blood transfusion includes:**

Child information such as: age, sex, and diagnosis. History of blood transfusion assessment. Prescribing a clear rational for transfusion should be recorded on the blood transfusion record sheet and the child's notes. Venous access to ensure that the child has a patent peripheral cannula or central venous catheter in site. Vital signs measurement. Collection and transport of blood.

**Part two:- Nursing care provided during blood transfusion .****Part three:- Nursing care provided after blood transfusion .****Part four: - Nursing care provided for acute adverse reactions of blood transfusion.****Scoring system for nurse's practice were as follows:**

observation checklist includes 3 sections with the total number of 40 items of nurse's practices, (20 items covered care provided before blood transfusion, 10 items covered care provided during blood transfusion, and 10 items covered care provided after blood transfusion).

**Scoring system for nurse's practice were as follows:**

Three levels of scoring for each question were used:

1. Done correctly and complete was scored (2).
2. Done correctly and incomplete was scored (1).
3. Not done or incomplete was scored (0).

**Total scores of nurses' practice were 80 and, it was calculated and classified as follows:**

1. ↓65% were considered unsatisfactory practice.
2. 65-↓75% were considered satisfactory practice.

### **Method:-**

An official permission was obtained from Faculty of Nursing of Tanta University to the responsible administrators of Pediatrics Hematology and Oncology Department of Tanta University Hospital and El Oboor Hospital of Kafer El-Sheikh after explaining the aim of the study. Ethical and legal considerations: A written consent was obtained from the nurses who worked and selected from the previously mentioned settings to participate in the study.

Nurses were assured about the confidentiality of data which were gathered during the study. The researcher informed them about their right to withdraw from the study at any time. Tools validity: The tools of study were tested for its content validity and reliability by five experts in pediatric nursing and hematology. A pilot study was carried out on 10% of the studied sample to test clarity, visibility and applicability of the study tools and the changes required were done accordingly. It was excluded from the study sample. Study tools (I and II) were developed and modified by the researcher after reviewing the related literature and they were used to assess nurse's knowledge and practices about blood transfusion. . These tools were used three times before, immediate and one month after program implementation. The study was carried out by meeting the nurses individually or in the group according to the availability of nurses who were participated in the study. A structured questionnaire schedule (Tool I) administered individually and filled by nurses to assess their knowledge about safety blood transfusion.

Implementation of the educational program to nurses about safety of blood transfusion were conducted to all of them in 3 sessions using different teaching methods, such as: PowerPoint, small lectures, and posters to facilitate their learning. The reliability of tool was also evaluated by using the test-retest method, the time interval between the test and the retest measurements was one month. **First session:** Theoretical principles of blood transfusion. **Second session:** Reviewing the concepts presented previously in the first session and the care provided before, during, and after blood transfusion. **Third session:** Review the concepts presented previously in the second session and the care provided to blood transfusion reactions. Data were collected over a period of 7 months starting from June, 2016 till the end of December, 2016.

### **Statistical analysis:-**

The data collected were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 19, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, a comparison between two groups and more was done using Chi-square test . For a comparison between means of two groups of parametric data of independent samples, student t-test was used. For comparison between means of two groups of non-parametric data of independent samples, Z value of Mann-whitney test was used. For a comparison between means of two related groups (before & after change) of non-parametric data, Z value of Wilcoxon Signed Ranks Test was used. For a comparison between more than two means of parametric data, F value of ANOVA test was calculated. For a comparison between more than two means of non-parametric data, Kruskal-Wallis (X2 value) was calculated. The correlation between variables was evaluated using Pearson's correlation.

### **Results:-**

Table (1): demonstrates the percentage distribution of socio-demographic characteristics of the studied nurses. It was found that the mean age was  $29.0 \pm 1.111$  for the studied nurses. Less than half of them (42.0%) aged 30 years or more, while 14.0% of them were less than 20 years, only 20.0% their aged 25 or less than 30 years, and 24.0% aged 20 or less than 25 years. As regards the nurses' marital status, most of them (82.0%) were married while 12.0% were single. Concerning the educational level, it was found that half of nurses (50.0%) had diploma of nursing school, while about one quarter (24.0%) had Technical Nursing Institute, and 16.0% had Partial Degree of Nursing Science. Concerning years of experience, it was observed that less than half of nurses (44.0%) had three years or more experience while 20.0% of them had one to less than two years and 16.0% had less than one year. Regarding to how many time of administration blood transfusion over the last 6 months , less than three quarters of nurses (72.0%) administered blood transfusions with a frequency of more than 12 times while 18.0% administered blood

transfusions with a frequency that ranged from 9 – 12 times. It was found that more than half of nurses (56.0%) reported that they never received any related in-service training.

Figure (1): illustrated the mean score of total nurses knowledge about safe blood transfusion before, immediate and after one month from program implementation. It was found that, the mean of total nurses knowledge were  $27.16 \pm 5.977$  before the program, compared by  $43.88 \pm 4.628$  and  $36.34 \pm 5.247$  immediate and after one month of the program implementation respectively. There was a statistical significant difference for nurses' knowledge before, immediate and after one month of the program implementation ( $P = 0.0001$ ).

Table (2): illustrates nurses' knowledge about the complication of blood transfusion and action taken before, immediate and after one month of the program implementation, Regarding signs and symptoms of acute haemolytic reaction and nursing management, it was found that 14.0% and 22.0% of nurses of them gave correct and complete answers before the program compared by double percentage (48.0% and 40.0%) after one month of the program implementation respectively. On the other hand, the answer of 34.0% of nurses about mild allergic transfusion reaction were correct and complete before the program, compared by 76.0% after one month of the program implementation, while more than half (52.0%) of nurses don't know the most common causes of fatal transfusion reaction before the program, compared by 36.0% after one month respectively, the answers of 52.0% of nurses about nursing action for unit of blood were correct and complete before compared by 78.0% immediate after program implementation. It was showed that the answers of 20.0% of nurses about nursing interventions to minimize the risk of developing transfusion reaction were correct and complete before the program, compared by 56.0% after one month of the program implementation. There were a statistical significant difference for nurse's knowledge about complication of blood transfusion and action taken ( $P < 0.05$ ), except the usual presenting complaint of a mild allergic transfusion reaction and the first action the nurse should take with mild allergic transfusion reaction, no statistical significant difference.

Table (3 and figure 2) illustrated Total practice and mean scores of nurses' practice regarding safety blood transfusion before, immediate and after one month of the program implementation. It was noticed that, the mean score of nurses' practice were  $54.34 \pm 3.962$  before the program implementation, compared by  $79.74 \pm 6.839$ , and  $73.22 \pm 9.543$  immediate and after one month of the program implementation respectively. There were improvement in total nurses' practice scores immediately and one month compared by before the program. With a statistical significant difference ( $P = 0.0001$ ).

Table (4): illustrates the relation between total knowledge and total practice scores of the nurses and their socio-demographic data before, immediate and after one month of the program implementation. It was found that there were a statistical significant differences between years of experience of the nurses and their total knowledge scores after one month of the program implementation ( $P$  value = 0.005). No a statistical significant difference between total nurses' practice score with their socio-demographic data immediate and after one month of the program implementation ( $P$  value  $< 0.05$ ).

Figure (3): clarifies the correlation between total knowledge and total practice scores of studied nurses before, immediate, and after one month of the program implementation. It was found that before the program implementation 51.11% of nurses had poor knowledge and unsatisfactory practice scores while as all of them (100.0%) and 92.3% had good knowledge and satisfactory practice scores immediately and one month after the program implementation respectively. There were no a statistical significant difference between immediate, and after one month of the program implementation ( $P$  value  $> 0.05$ ).

**Table 1:-**Percentage Distribution of Socio-Demographic Data of the Studied Nurses. (n=50)

Socio-demographic data of nurses	The studied nurses (n=50)	
	n	%
<b>Age in years:</b>		
< 20	7	14.0
20 - <25	12	24.0
25 - <30	10	20.0
$\geq 30$	21	42.0
Mean $\pm$ SD	29.0 $\pm$ 1.111	

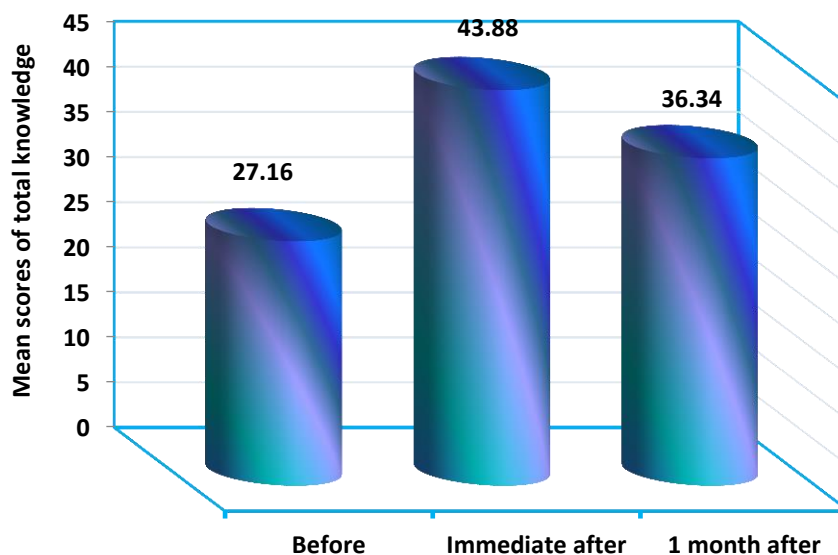
<b>Marital status:</b>		
Single	6	12.0
Married	41	82.0
Divorced	1	2.0
Widowed	2	4.0
<b>Educational level</b>		
Nursing School Diploma (3years)	25	50.0
Technical Institute of Nursing	12	24.0
Partial Degree of Nursing Science	8	16.0
Diploma in Nursing (1 year)	5	10.0
<b>Years of experience</b>		
<1	8	16.0
1-< 2	10	20.0
2-<3	10	20.0
≥ 3	22	44.0
<b>Times of administered blood transfusions over the past 6 months</b>		
1-4 times		
5-8 times	5	10.0
9-12 times	0	0.0
More than 12 times	9	18.0
	36	72.0
<b>Previously in-service training program</b>		
yes	22	44.0
no	28	56.0

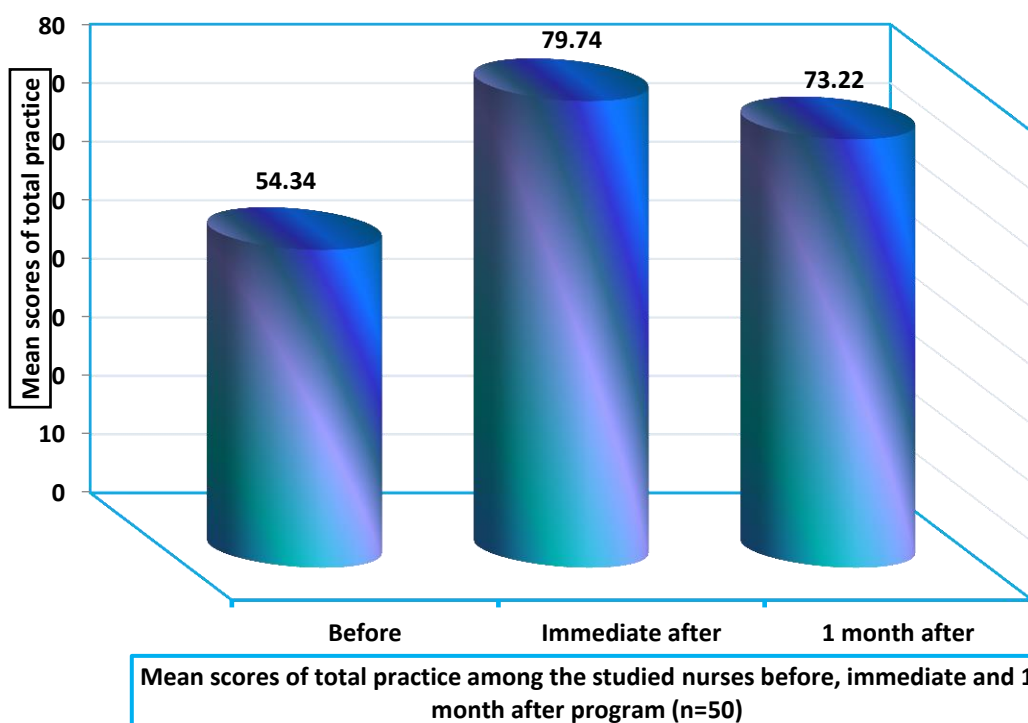
**Table 2:-**Percentage Distribution of Nurses' Knowledge about Complications of Safe Blood Transfusion and Action Taken Before, Immediate, and One Month after Program Intervention. (n=50)

Nurses' Knowledge about Complications of blood transfusion and Action Taken	Knowledge of the studied nurses before and after program intervention (n=50)							
	Before  (n =50)		Immediate  (n =50)		1 month after (n =50)		$\chi^2$	P
	n	%	N	%	n	%		
<b>Signs and symptoms of acute haemolytic reaction.</b>								
Don't know or incomplete answer	9	18.0	4	8.0	2	4.0	23.002	0.000*
Correct and incomplete answer	34	68.0	18	36.0	24	48.0		
Correct and complete answer	7	14.0	28	56.0	24	48.0		
<b>The usual presenting complaint of a mild allergic transfusion reaction</b>								
Don't know or incomplete answer	18	48.0	10	20.0	12	24.0	3.545	0.170
Correct and incomplete answer	0	0.0	0	0.0	0	0.0		
Correct and complete answer	32	52.0	40	80.0	38	76.0		
<b>The most common cause of fatal transfusion reaction</b>								
Don't know or incomplete answer	26	52.0	13	26.0	18	36.0	7.301	0.026*
Correct and incomplete answer	0	0.0	0	0.0	0	0.0		
Correct and complete answer	24	52.0	37	74.0	32	64.0		
<b>Nursing action for unit of blood</b>								
Don't know or incomplete answer	24	48.0	11	22.0	15	30.0		

Correct and incomplete answer	0	0.0	0	0.0	0	0.0	7.980	0.018*
Correct and complete answer	26	52.0	39	78.0	35	70.0		
<b>Nursing interventions minimize the risk of developing transfusion reaction</b>								
Don't know or incomplete answer	12	24.0	1	2.0	1	2.0	29.962	0.000*
Correct and incomplete answer	28	56.0	19	38.0	21	42.0		
Correct and complete answer	10	20.0	30	60.0	28	56.0		
<b>The first action the nurse should take with mild allergic transfusion reaction</b>								
Don't know or incomplete answer	27	54.0	19	38.0	17	34.0	4.598	0.100
Correct and incomplete answer	0	0.0	0	0.0	0	0.0		
Correct and complete answer	46	20.0	31	62.0	33	66.0		
<b>Nursing management of acute haemolytic reaction</b>							18.033	0.001*
Don't know or incomplete answer	9	18.0	0	0.0	2	4.0		
Correct and incomplete answer	30	60.0	25	50.0	28	56.0		
Correct and complete answer	11	22.0	25	50.0	20	40.0		

**Figure 1:-**Mean Scores of Total Nurses' Knowledge about Safe Blood Transfusion Before and after program Intervention (No =50)



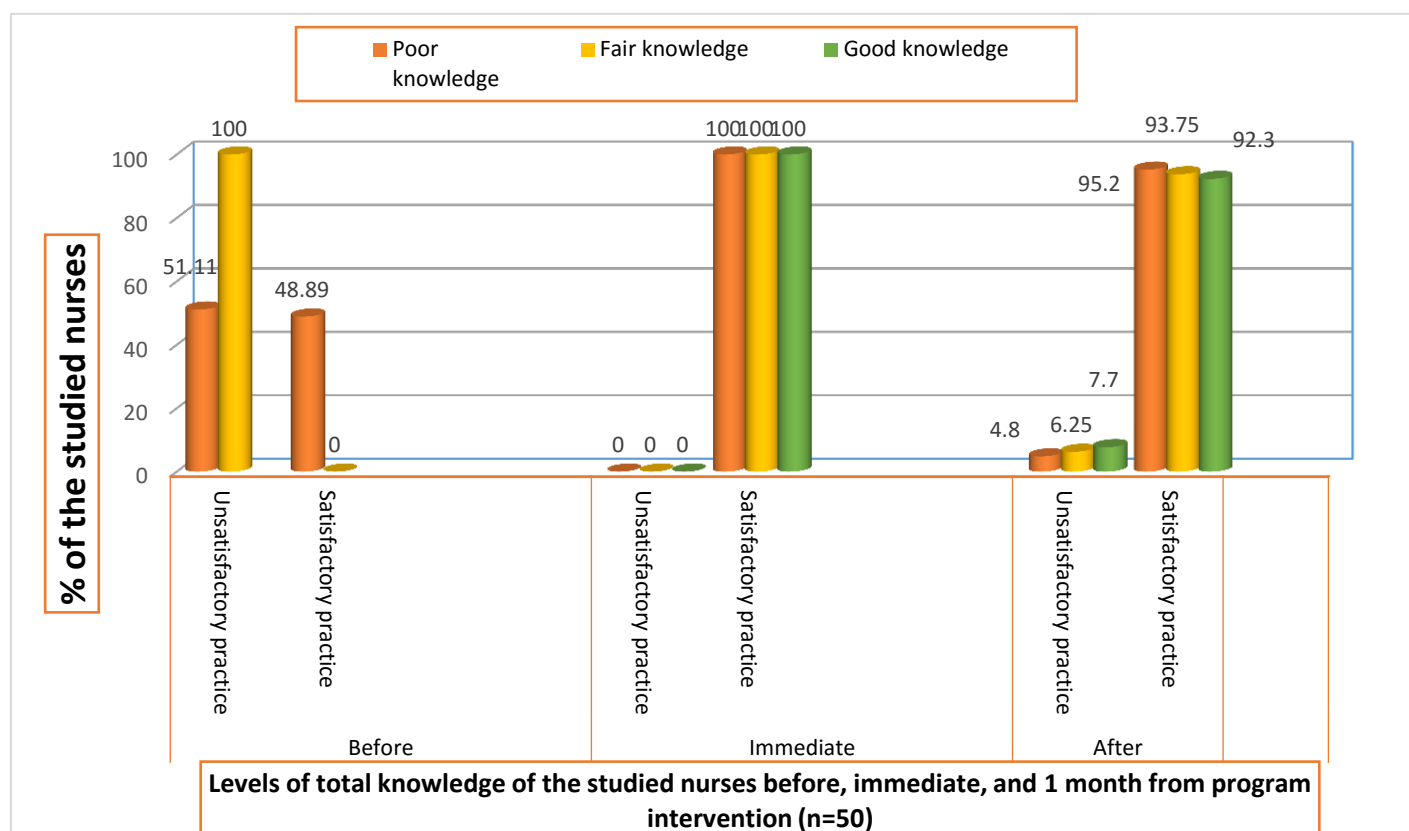
**Figure 2:-**Total Practice scores of Nurses Regarding Blood Transfusion Before and After Program Intervention (n =50).**Table 3:-**Percentage Distribution of Total Practice Mean Scores for Nurses Regarding Safe Blood Transfusion Before, Immediate, and After One Month Program Intervention. (n =50)

Total practice Mean Scores for Nurses about blood transfusion	practice of the studied nurses before and after program intervention (n =50)						$\chi^2$ P
	Before		Immediate		1 month after		
	(n=50)		(n =50)		(n =50)		
	n	%	n	%	n	%	
Levels of total practice:							57.658 0.0001*
Unsatisfactory practice: <65% (0 - <55)	28	56.0	0	0.0	3	6.0	
Satisfactory practice: 65->75% (55 - > 63)	22	44.0	50	100.0	47	94.0	
<b>Total practice scores:</b>							
Range	(45 – 64)		(60 – 84)		(53 – 84)		
Mean±SD	54.34±3.962		79.74±6.839		73.22±9.543		
<b>F value</b> <b>P</b>	170.010 0.0001*						
<b>Changing of total practice scores immediate than before program intervention:</b>							
Range	2 : 39						
Mean ± SD	25.40 ±7.946						
<b>Z value</b>	6.159						



<b>P</b>	0.0001*	
<b>Changing of total practice scores 1 month after than before program intervention:</b>		
Range	-8 : 34	
Mean $\pm$ SD	18.88 $\pm$ 10.201	
<b>Z value</b>	5.977	
<b>P</b>	0.0001*	

**Figure 3:-**Correlation between Total Knowledge and Total Practice of the Studied Nurses Regarding Safe Blood Transfusion Procedures before, Immediate, and One Month after Program Intervention. (n=50)



**Table 4:-**Percentage Distribution of Correlation between Total Nurses Knowledge and Total Practice Scores and Their Socio-demographic Data Before, Immediate and one Month after Program Intervention

Socio-demographic data of nurses	Total knowledge scores of nurses (n =50)				Total practice scores of nurses (n =50)			
	Immediate than before		After 1 month than before		Immediate than before		After 1 month than before	
	Mean±SD	χ <sup>2</sup> value P	Mean±SD	χ <sup>2</sup> value P	Mean±SD	χ <sup>2</sup> value P	Mean±SD	χ <sup>2</sup> value P
<b>Age in years:</b>								
< 20	14.14±3.33	5.365	6.00±2.38	8.286	26.14±3.97	0.844	20.14±7.96	1.951
20-<25	17.50±3.47	0.147	10.08±3.17	0.400	23.33±11.78	0.839	17.38±13.82	0.583
25-<30	17.10±4.25		9.40±5.31		21.40±9.05		12.50±10.36	
≥ 30	16.95 ±5.32		9.61±4.57		28.23±4.18		22.09±7.07	
<b>Marital status:</b>								
Single	14.0±3.633	2.363	5.66±2.42	3.106	26.00±4.33	0.786	20.00±8.71	0.856
Married	16.78±4.97	0.307	9.41±4.31	0.212	24.87±8.44	0.675	18.80±10.65	0.652
Widowed	21.0±1.41		12.00±1.41		33.50±0.707		17.00±12.72	
<b>Educational level</b>								
Diploma in Nursing School	16.0±3.43		8.56±3.948		24.080±9.160		17.76±11.40	
High Nursing Institute	18.25±5.51	0.589	9.25±5.83	0.288	24.000±7.298	0.514	16.92±10.31	0.477
Bachelor of Science in Nursing	15.0±5.65	0.899	8.62±2.92	0.962	29.000±4.000	0.916	25.00±5.50	0.924
Diploma in Nursing	19.40±3.28		13.00±1.58		19.400±7.402		19.40±7.40	
<b>Years of experience</b>								
<1	14.0±3.11		6.25±2.31		26.25±3.69		21.25±8.01	
1-< 2	17.7±3.43	7.650	10.60±3.23	12.715	21.90±12.37	0.679	15.40±13.92	2.006
2-<3	17.60±4.27	0.054	4.70±5.05	0.005*	21.90±9.64	0.878	15.00±11.56	0.571
≥ 3	10.86±5.21		9.36±4.62		28.27±4.08		21.36±7.71	
<b>Time of administered blood transfusions Over the past 6 months</b>								
1-4 times	14.40±3.91	1.213	6.40±1.81	1.840	25.60±4.72	1.142	18.40±8.70	1.060
9-12 times	16.00±3.57	0.545	8.77±3.96	0.399	23.55±12.10	0.565	17.44±14.39	0.589
More than 12 times	17.22±4.72		9.66±4.52		25.83±7.16		19.30±9.42	

**Discussion:-**

Nurses have a crucial role in safe blood transfusion process beginning with sample collection and end with blood administration. Errors that result in inappropriate blood transfusion remain the highest risk and usually occur when details of identification are overlooked. Nursing staff play an important role in planning and management of blood transfusion. Using recent technological advances to improve their performance. <sup>(11)</sup>

Knowledge deficits for many aspect of safe blood transfusion before program, as evidenced by the low mean score they achieved. This could be due to the insufficient information and the lack of educational training program. More than half of nurses reported that they never had any post-qualifying training program in blood transfusion. This is in harmony with **Saillour Glenisson et al. (2002)**<sup>(12)</sup> who mentioned that insufficient knowledge was attributed to deficiency in orientation or training.

Nurses perform many common practices related safe blood transfusions. Although widely adopted as routine practices, they are primarily based on long-standing practices, child surveillance, or efficiencies in care. Regarding nursing performance, the present study revealed that before the program, more than half of nurses provided poor quality of care to children who received blood transfusion, while after the program the majority of them provided good practice. It could be due to the lack of nurse motivation, hospital facilities and recourses and good satisfactory scores, and the lack of training courses which help them to perform standardized nursing care.

The results of the present study clarified that nurse's knowledge and practice improved after the implementation of the educational program of safety of blood transfusion. It could be due to the effect of the educational program that enhance nurses knowledge. This result was in agreement with the **Smith et al. (2010)**<sup>(13)</sup> and **Taylor et al. (2010)**<sup>(14)</sup> who stressed the point that training and education are essential for all staff involved in the transfusion procedures and developed a standardized training program for all healthcare providers including student nurses to promote safe practice.

In relation to the reactions that may happened to studied children, it was observed that about two thirds of nurses gave correct but incomplete answers about signs and symptoms of acute haemolytic reaction and nursing interventions to minimizing the risk of developing such complication. This may be due to insufficient training course for nurses before the program. And this finding were consistent with **Janatpour et al. (2008)**<sup>(15)</sup> who mentioned that, nearly half of nurses were aware about clinical picture of acute haemolytic reaction and had the ability to promptly recognize and successfully manage an emergent hemolytic transfusion reaction. Nurses should keep learning, training and conducting research rather than being stagnated in their educational background.<sup>(16)</sup>

Small number of children got blood transfusion reactions and the percentage was decrease after the program implementation, it can be explained that our nurses followed to preventive measures to minimize the risk for developing acute transfusion reaction. However, they are required to be aware to all elements that may be apply in practice to achieve this goal. Administering compatible blood is required; but, on its own, it is insufficient to prevent the transfusion reaction if the duration of transfusion is prolonged or if incompatible solutions are so administered with blood. Acute transfusion reactions may occur and may be fatal.<sup>(17)</sup>

What would make a difference in the child's life is a vigilant nurse who has the ability to promptly recognize and successfully manage an emergent hemolytic transfusion reaction. However, this may not be possible because less than half of nurses were aware of the clinical picture of acute haemolytic reaction and slightly more than one third of the sample knew nursing management of this condition after program intervention. This could be due to the insufficient information and education provided to them.

This result was in agreement with **Belal (2012)**<sup>(18)</sup> who found that one third of nurses were aware about clinical picture of acute haemolytic reaction and less than one half of the nurses knew nursing management of this condition after educational courses.

The results of the present study revealed that, there was no statistical significant difference between nurse's knowledge and practice and to their demographic data. This result was incongruent with **Moore (2008)**<sup>(19)</sup> who mentioned that an individual nurse's education level and years of experience both influence nurses' level of expertise, and gains the probability of an individual nurse being an expert can be also achieved through having more educated nursing staff.

Overall results of this study revealed that most participant nurses had good knowledge and practices about safety blood transfusion and children got less acute adverse reactions after the implementation of blood transfusion program. This could be due to effect of the educational program and good the interaction response of nursing staff especially all of them educated and about the half of them had three years or more experience and received in-service training program about blood transfusion. This is in the same line with **Ibrahim (2015)**<sup>(20)</sup> who stated that,

nurses showed an improvement in their knowledge and practices about blood transfusion and children who received blood transfusion got fewer acute adverse reactions after the implementation of blood transfusion protocol.

Finally, these findings may be explained in the light of the fact that good education helps the nurses to understand the importance of their practice that reflect that promoting a better care and prevent side effect.

### **Conclusion:-**

Based on the findings of the present study, it can be concluded that nurses showed an improvement in their knowledge and practices about safe blood transfusion after implementation of the program. Children who received safety of blood transfusion got fewer acute adverse reactions. There were a statistical significant difference between total knowledge and practice scores of studied nurses before and after the educational program.

### **Recommendations**

Based on the findings of the present study, the following recommendations were recommended:

1. Ongoing in-service education programs must be designed and implemented to nurses in Pediatric Hematology Units to enhance their knowledge and improve their practices.
2. Resources such as articles, Journals, Computers and Internet should be accessible in the pediatric as a reference to units' staff members.
3. Universal protocols for blood transfusion should be integrated into pediatric nursing curricula.

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