

## **Effect of Training Program on Nurses' Competent Practices Towards Children Receiving Blood Transfusion**

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### **Abstract:**

**Background:** Blood transfusion for children is considered an integral part of everyday life in an acute hospital setting and is a matter of life or death. Therefore, nurses should have a competent and safe transfusion practice. **Aim:** The present study aimed to evaluate the effect of training program on nurses' competent practice towards children receiving blood transfusion. **Design:** A quasi-experimental design was utilized to conduct this study. **Settings:** The study was carried out in Pediatric Medicine departments at Benha University Hospital, at Benha City. **Sample:** A convenient sample of 60 nurses from the previously mentioned settings. **Tools:** Tools of data collection included; **Tool (I):** A structured interviewing questionnaire sheet to explore nurses' personal data and their knowledge regarding blood transfusion for children to explore nurses' personal data and their knowledge regarding blood transfusion for children., **Tool (II):** Observational checklist to assess the actual nurses' practices towards caring for children receiving blood transfusion. **Results:** The present study results revealed that, the mean age of nurses was  $27.97 \pm 5.92$  years and more than half of them weren't attending training courses related to blood transfusion. There were highly statistical significant differences ( $P < 0.001$ ) concerning nurses' knowledge and practice pre/post-implementation of the training program regarding blood transfusion and there was a positive correlation between total nurses' knowledge and practice regarding blood transfusion post-implementation of the training program ( $r = 0.115$  &  $P < 0.386$ ). **Conclusion:** Nurses' total knowledge and practice scores regarding blood transfusion for children were improved post-implementation of the training program than pre-program implementation. **Recommendation:** The study, emphasized on the importance of continuing in-service training for nurses regarding pediatric blood transfusion.

**Keywords:** Training program, competent practices, Blood transfusion.

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### **I. Introduction**

Blood transfusion is considered a highly effective and potentially life saving treatment especially among pediatric patients. It also, considered an essential component of modern health care (de Graaf et al., 2009). Blood transfusion is a tissue transplantation which can cause serious adverse reactions. These reactions may potentially delay the recovery of the patient or may even lead to death(Whyte & Kirpalani, 2011). It is a complex multistep process involving members of several different professional groups; nurses, doctors, laboratory scientists as well as, the donors and recipients. the transfusion of a blood product into a child is associated with a greater risk of harm when compared to an adult. These risks may be resulted from omission of essential checks (short cuts) and perhaps an assumption of someone else is responsible for safety transfusion (World Health Organization, 2016).

Red blood cells (RBCs) transfusion is the back bone of blood transfusion therapy as they account for the majority of components issued to pediatric patients(Taylor et al., 2010). However, lack of knowledge related to various aspects of blood transfusion by clinical staff, including nurses, continues to be a real threat to child's safety. As well as, any errors in practice involving remote checks at nurses' stations considered one of the main causes for life threatening of the child (Fergusson et al., 2012). The blood transfusion should be appropriate to the child's health needs, delivered in time and correctly administered. Even when delivered in accordance with the recommended standards, correctly indicated and administered, the blood transfusion involves a health risk (Cole & Walker, 2012). This risk refers to the transfusion reactions during or after blood transfusion, besides the fact of being related to it. The complications include; those that are due to bacterial contamination, acute hemolytic reactions caused by incompatibility of the ABO system, anaphylactic reactions and fluid overload. These complications may be non-immune, and may be associated with human error; or immune, linked to the organic response mechanisms to the blood transfusion (de Mattia & de Andrade, 2016).

Nurses in pediatric units are in need to know the care that guides blood transfusion, the main indications and the possible complications this treatment may cause for the pediatric patient. Rather more, verify important data to prevent errors, educate relatives and children about the transfusion reactions and register the entire process (Joshua et al., 2011). These professionals' activities tend to guarantee transfusion safety and if

the transfusion process is managed efficiently. Nevertheless, nurses with limited knowledge on this specialty and without sufficient skills can cause a risky damage to the child (**Barclay, 2011**). So, improving blood transfusion practice especially in pediatric patients is a need. Thus developing blood transfusion policy and strategy, including appropriate guidelines as well as, providing training programs for nursing staff is an essential domain for successful transfusion (**Palmer, 2015**). Nurses has an important role in ensuring blood transfusion safety, because the nursing team is responsible for knowing the indications for transfusions, checking data to prevent errors, guiding patients on blood transfusion, detecting, acting in compliance with transfusion reactions and documenting the procedure (**Tavares et al., 2015**).

Due to the complexity of the transfusion process and the need for expertise during its development, this process requires skilled and trained professionals to achieve transfusion safety. Nursing professionals are directly involved in the care of patients submitted to blood transfusion (**Silva et al., 2009**). Teaching and training are essential for nursing staff members to improve the quality of health care and to acquire new knowledge and skills. Educational programs are considered as means for providing nurses with theoretical and technical information needed to acquire new skills and to continually improve nursing practice (**Gray & Illingworth, 2013**).

#### **Significance:**

Nurses have a central role in performing blood transfusions practice at pediatric units. Their skills and knowledge are crucial for transfusing blood safely and efficiently. Nursing professionals should be educated on current best practice and contemporary adverse events to impact patient care outcomes. So, children receiving blood transfusion require special care from nurses to ensure maximum nursing practice. Therefore, this study will be conducted to evaluate the effect of training program on nurses' competent practices towards children receiving blood transfusion.

#### **Aim of the study:**

The aim of this study was to evaluate the effect of training program on nurses' competent practice towards children receiving blood transfusion through:

- Assessing nurses' knowledge and practice regarding blood transfusion
- Designing and implementing training program based on nurses' actual needs assessment about blood transfusion in children.
- Evaluating the effect of implemented training program on nurses' knowledge and practice toward care for children receiving blood transfusion.

#### **Research Hypotheses :**

**H1-** Nurses will have satisfactory knowledge after implementation of the training program than pre-implementation.

**H2-** Nurses will have competent practice after implementation of the training program than pre-implementation.

**H3-** There will be significant relation between nurses' knowledge, and practice scores and their personal data after implementation of the training program.

## **II. Subjects and Method**

#### **Research Design:**

A quasi-experimental design was used to conduct this study.

#### **Settings:**

The study was carried out in pediatric medicine department at Benha University Hospital, at Benha City. The department contains three pediatric medicine units with capacity of 51 beds.

#### **Sample:**

A convenient sample of 60 nurses who are working at the previously mentioned settings were included in the current study regardless their; age, gender, years of experience, qualification and if they having training courses regarding blood transfusion therapy.

**Tools of Data Collection:**

**Tool (I): A Structured Interviewing Questionnaire Sheet:**

It was written in a simple Arabic language and comprised two main parts as follow:

**Part (1):** Personal data of the studied nurses which include; age, gender, qualifications, years of experience and attendance of training courses regarding blood transfusion therapy.

**Part (2):** Nurses' knowledge about blood transfusion:

It was developed by the researchers based on the scientific literatures of ; **de Graaf et al., (2009); Silva et al., (2009); Barclay, (2011); Palmer, (2015) and de Mattia & de Andrade, (2016)**, in order to assess nurses' knowledge. It consisted of three parts related to; blood related concepts (12 questions), rules and policies for blood transfusion for children(16questions), and equipment used for blood transfusion for children( 6 questions). It was in the form of multiple choice and true/false questions, and consists of (34questions).

**Scoring system for knowledge:**

One score was allocated for each correct answer and zero for incorrect answer. For each part, the scores of the items were summed up and the total divided by number of the items, giving a mean score for the part. These scores, were converted into a percent score and mean and standard deviations were computed. The nurses' knowledge was considered satisfactory if the percent scores equal to or more than 80% and unsatisfactory if scored less than 80%

**Tool (II): Observational Checklist:**

It was adopted from **Cowell, (2009) and de Mattia, (2016)** and modified by the researchers to suit the Egyptian culture. It was used to assess actual nurses' practices regarding care of children receiving blood transfusion in relation to; the studied nurses' preparation skills prior to blood transfusion (11 items), cannulation or central venous access for children receiving blood transfusion (10 items), their practice related to suspected reactions and child monitoring after blood transfusion (8 items).With total practice scores of (29 items) Each nurse was observed during each procedure for three different times using nurses' observational check lists. The mean of the three observations was calculated and the mean was taken.

**Scoring system for practice:**

A score of one was given for complete done and a score of zero was given for incomplete done/not done. For each part, the scores of the items were summed up and the total divided by number of the items, giving a mean score for the area. These scores were converted into a percent score and mean and standard deviations were computed. These scores were converted into a percent scores. The nurses' practice was considered competent if the percent scores is 80% or more and incompetent if scored less than 80%.

**Tool (III): Training program:**

The purpose of this program was to implement a training program for nurses on the topic of blood transfusion for children. The goal of this program was to educate nurses on blood transfusion related topics as; blood related concepts, rules and policies for blood transfusion for children, equipment used for blood transfusion for children.

It was designed in a simple Arabic language in the form of training program by the researchers based upon the actual needs assessment of nurses. It was also supplemented with information based on review of relevant literature (nursing textbooks, journals and internet resources) about blood transfusion for pediatric patients. Then the program was reviewed by a panel of experts before its implementation. An outcome indicator of nursing knowledge of current training blood transfusion educational program in the pediatric units has been established. Nursing knowledge and practice were evaluated prior to and following the implementation of the training program to assess its effect.

**Tools validity and reliability:**

The researcher reviewed the past, current regional and international related literatures which covering all aspects of the study using textbooks, articles, journal and scientific magazines. This helped the researcher to be acquainted with the research problem and be guided in developing the study tools. To measure content validity of the study tools, the researcher assure that items of the tools were adequately represent what are supposed to measure by presented it to five experts including one medical-surgical nursing, one pediatric medicine, and three of pediatric nursing field from the Faculty of Nursing Cairo, El-Menofia and Benha Universities, to test the content validity. Modifications of the tools were done according to the experts' judgment on clarity of sentences, appropriateness of content and sequence of items. The experts' agreed on the

content but recommended minor language changes that would make the information clearer and more precise, the suggested changes were made. Internal consistency reliability of all items of the tools was assessed using Chronbach's Alpha test. It was 0.83 for structured interviewed questionnaires sheet and 0.86 for nurses' practices observation checklist.

**Ethical considerations and human rights:**

An official permission was obtained from directors of the previously mentioned settings before starting the study. The researchers obtained oral consent from the studied nurses to participate in the present study after informed them about the nature and purpose of the study. Strict confidentiality was ensured throughout the study process. All nurses were assured that their data was used for research purpose only and each one was informed of the right to withdraw from the study at any time without giving any cause.

**Pilot study:**

A pilot study was carried out on 6 nurses (10%) from the total number of them to assess the clarity and applicability of the study tools, as well as to estimate the time needed for data collection. Nurses in the pilot study were excluded from the actual study sample since some modifications were done.

**Preparatory phase:**

**Field work:**

The field work was performed from the beginning of May, 2016 to the end of October, 2016 to collect data. The researchers were available three days per week (Saturday, Monday, and Tuesday) during morning and afternoon shifts. The program implementation was done through six months and nurses were divided into 12 small groups, each group contained 4-6 nurses. The structured interviewing questionnaire sheet was filled out by the nurse and observational checklists were collected by the researchers and the average time required for completion of each tool was around 20-25 minutes. The researchers observed the nurses' practice regarding blood transfusion during their actual practices with children; this part took about three weeks.

Every group had 9 sessions in this program; each session was variable and ranged between 30-45 minutes and conducted as 6 sessions for practice and 3 for theory. Each group was given the freedom to choose their optimal time for receiving the program whenever they have minimal workload. Each participant obtained a copy of the program booklet that included all the training materials. Each session usually started by a summary of what has been taught during the preceding sessions and the objectives of the new one. Giving praise and/or recognition to the interested nurses were used for motivation during program implementation.

The actual work started by meeting the nurses throughout the morning shift, each researcher first introduced herself to them and gave them a complete background about the study, its aim, then the pre-test format was distributed in order to collect the required data. The researchers were available for more clarification whenever needed. Then, the content of the program was designed based on the actual needs assessment of the studied nurses. Consequently, the subject content has been sequenced through theoretical and practical sessions that contained a practical demonstration to the targeted intervention from the researchers and re-demonstration from the studied nurses.

Methods of teaching that the researchers used were; modified lectures, demonstration and re-demonstration and group discussion. Suitable teaching aids were prepared and used especially for the program.

**Statistical analysis:**

Data entry was done using compatible personal computer. The Statistical Package for Social Sciences (SPSS version 20.0) was used. The content of each tool was coded, categorized and then analyzed. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables and means and standard deviations for quantitative variables. Quantitative continuous data were compared by using student t-test in case of comparisons between the mean scores of the studied group before and after implementation of the program.

The qualitative studied variables were compared using Chi-square test. Pearson correlation analysis used for assessment of the inter-relationships between the nurses' knowledge and practices about blood transfusion. A statistically significant difference was considered at P-value  $\leq 0.05$ , and a highly statistically significant difference was considered at P-value  $\leq 0.001$ .

### **III. Results**

**Table (1)** illustrated nurses' personal data; it was observed that, the mean ages of them were  $27.97 \pm 5.92$  years and all of them were females. Regarding nurses' education, more than half of them (60%) had diploma in nursing, 25% were graduated from technical institute of nursing while 15% of them had bachelor degree in nursing science. Also, it was noticed that the majority of nurses (85%) had 5 to less than 10 years of experience in pediatric medicine units and 60% of them not attended any previous training courses regarding blood transfusion for children.

**Table (2)** illustrated distribution of the studied nurses regarding their correct knowledge about blood. It was found that, there was a highly statistical significant difference ( $P < 0.001$ ) post-program implementation compared to pre- program implementation, where the majority of nurses (90%, 86.7%, 83%, 90%, 88% & 95%) had correct answers in relation to; components of blood, the most important blood groups in transfusion, diseases requiring blood transfusion, blood product which contains hemoglobin, blood product which contains coagulation factors and precautions before blood transferring from the blood bank to the unit, respectively.

**Table (3)** revealed nurses' correct knowledge regarding rules and policies for blood transfusion for children pre/post-program implementation. It was found that there was a highly statistically significant difference ( $P < 0.000$ ) before and after the program, where the majority of nurses had correct knowledge after the program implementation related to all items of knowledge.

**Table (4)** revealed that, there was a highly statistical significant difference ( $P < 0.001$ ) between nurses' correct knowledge regarding equipment used for blood transfusion for children during pre/post- program implementation, where the majority of them had correct knowledge after implementation of the program compared to before.

**Figure (1)** demonstrated distribution of the studied nurses regarding their total knowledge regarding blood transfusion for children pre/post- program implementation. It was clarified that, before implementation of the program 88.8% of the studied nurses have unsatisfactory knowledge compared to after implementation of the program, whereas, the majority of them (90%) had satisfactory knowledge.

**Table (5)** revealed the relation between nurses' knowledge regarding blood transfusion for children and their personal characteristics post- program implementation. It was revealed that, there was a statistical significant relation between total nurses' knowledge scores and their personal data.

**Table (6)** viewed nurses' practice regarding blood transfusion for children pre/post- program implementation. It was found that, there was a statistical significant difference between before and after the program where the majority of nurses had complete done practice after the program implementation related to all steps of blood transfusion for children.

**Table (7)** illustrated nurses' practice regarding cannulation or central venous access for children receiving blood transfusion pre/post- program implementation. It was found that, there were highly statistically significant differences ( $P < 0.000$ ) between pre/post program implementation where all of nurses (100%) after program implementation completely done steps about: cannulate the child and ensure its patency, secure with non-allergic tape or IV dressing, adjust infusion rate for transfusion completion within a 1-1½ hour period unless ordered and observe transfusion form left with unit of blood during transfusion.

**Table (8)** showed nurses' practice regarding suspected reactions and child monitoring after blood transfusion where, there was a statistically significant difference ( $P < 0.001$ ) between pre/post- program implementation as the majority of the studied nurses had complete done practice after implementation of the program.

**Figure (2)** revealed distribution of the studied nurses regarding their total practice scores towards children receiving blood transfusion pre/post- program implementation. It was revealed that 88.8% of the studied nurses had incompetent practices before implementation of the program compared to after implementation of the program, where 87.5% of them had competent practices.

**Table (9)** clarified that, there was a highly statistically significant difference ( $P < 0.001$ ) during pre/post-program implementation between nurses' total practice scores toward blood transfusion for children and their personal data regarding age and qualification. In addition, there was a statistically significant difference

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(P<0.05) during pre/post- program implementation between nurses' total practice scores toward blood transfusion for children and their years of experience in medical pediatric unit.

**Table (10)** viewed correlation between total scores of nurses' knowledge and practices in relation to blood transfusion for children pre/post-program implementation, it was revealed that there were a highly statistically significant positive correlation between nurses' knowledge and practices scores at post-program implementation ( $r=0.642$ ,  $P<.001^{**}$ ).

**Table (1):** Distribution of the studied nurses regarding their personal data (n=60).

Nurses' personal data	No.	%
<b>*Age in years</b>		
< 20	2	3.40
20<25	21	35.0
25<30	14	23.4
30<35	13	21.6
≥35	10	16.60
<b>X±SD</b>	<b>27.97±5.92</b>	
<b>*Gender</b>		
- Male	0	0.00
- Female	60	100.0
<b>*Educational level</b>		
- Bachelor in Nursing Science	9	15.0
- Technical Institute of Nursing	15	25.0
- Diploma in Nursing	36	60.0
<b>*Years of experience in pediatric medicine units</b>		
< 5 years	2	3.3
5<10	51	85.0
≥10	7	11.7
<b>X ± SD</b>	<b>8.42±5.56</b>	
<b>*Previous attendance of training courses regarding blood transfusion:</b>		
- Yes	24	40.0
- No	36	60.0

**Table(2):**Distribution of the studied nurses' correct knowledge regarding blood related concepts pre/post-program implementation (n=60).

Items	Pre-program Correct knowledge		Post-program Correct knowledge		$\chi^2$	P-value
	No.	%	No.	%		
-Components of blood	18	30.00	54	90.00	45.00	<0.001**
-The most two important blood groups in transfusion medicine	22	36.70	52	86.70	31.72	<0.001**
-Types of the most compatible RBCs with a pediatric patient who are A negative	21	35.00	46	76.70	21.12	<0.001**
-RBCs can be safely transfused to any child recipient	33	55.00	47	78.30	7.350	<0.001**
-Diseases requiring blood transfusion	22	36.70	50	83.30	27.22	<0.001**
-Products of blood	37	61.60	47	78.30	3.968	>0.05*
-Items must always be on the pre-transfusion specimen label	29	48.30	39	65.00	3.394	>0.05*
-Items included in the request of picking up blood components or products.	21	35.00	46	76.70	21.121	<0.001**
-Blood product which contains hemoglobin for providing cells with $O_2$	18	30.00	54	90.00	45.00	<0.001**
-Blood product which contains coagulation factors	10	16.70	53	88.30	61.788	<0.001**
-Precautions before blood transferring from the blood bank to the unit.	23	38.30	57	95.00	43.35	<0.001**
-Signs and symptoms of transfusion reactions	20	33.30	41	68.30	15.126	<.001**

\*\*Highly statistical significant difference; P<0.001

**Table (3):** Distribution of nurses' correct knowledge regarding rules and policies for blood transfusion for children pre/post-program implementation (n=60).

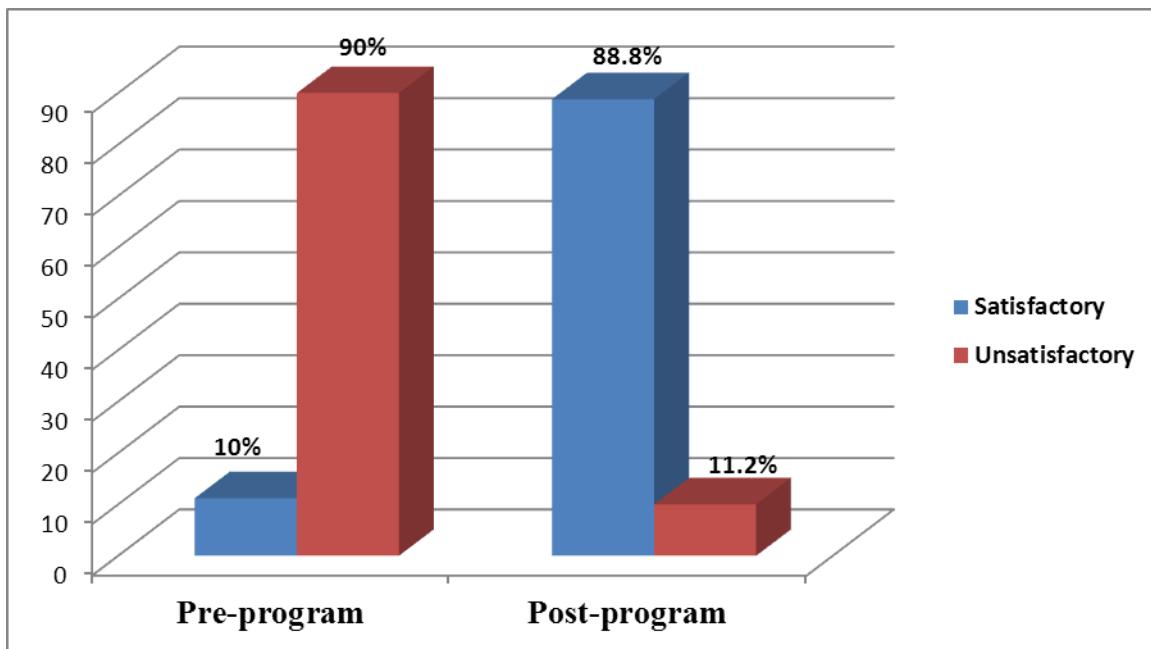
Items	Pre-program Correct knowledge		Post-program Correct knowledge		$\chi^2$	P-value
	No.	%	No.	%		
-Formal written consent must be obtained from child's parents for blood transfusion	27	45.00	55	91.70	30.19	<0.001**
-The seven checks for blood components that can be done either at the bedside or prior to entering the child's room	12	20.00	48	80.00	43.20	<0.001**
-The three checks that must be done at the patient bedside prior to start transfusion	18	30.00	44	73.30	22.56	<0.001**
-Time in which RBCs must be completely transfused after removal from storage	7	11.70	55	91.70	76.89	<0.001**
-The temperature at which platelets must always be kept	15	25.00	52	86.70	22.23	<0.001**
-Baseline vital signs are taken within minutes prior the start of transfusion	25	41.70	47	78.30	16.86	<0.001**
-The rate to initiate a transfusion on a child patient	16	26.70	57	95.00	58.79	<0.001**
-The suitable time for observation of the child for possible transfusion reaction.	27	45.00	47	78.30	14.10	<0.001**
-Nursing actions that could minimize the risk of transfusion reaction occurrence.	30	50.00	57	95.00	30.47	<0.001**
-The first action the nurse should take with mild allergic transfusion reaction.	12	20.00	56	93.30	65.70	<0.001**
-Complications of rapid administration of cold blood.	11	18.30	54	90.00	62.06	<0.001**
-A written policy for the administration of blood should be available in the unit	30	50.00	60	100.0	40.00	<0.001**
-The nurse should read the policies of blood transfusion	7	11.70	51	85.00	64.605	<0.001**
-Ways can improve blood management strategies in the pediatric unit	10	16.70	53	88.30	61.788	<0.001**
-The average total volume of blood drawn in a 24-hour period	32	53.30	50	83.30	12.478	<0.001**
-Blood Storage duration	10	16.70	45	75.00	41.119	<0.001**

\*\*Highly statistical significant difference; P<0.001

**Table (4):** Distribution of the studied nurses' correct knowledge regarding equipment used for blood transfusion for children pre/post- program implementation (n=60).

Items	Pre-program Correct knowledge		Post- program Correct knowledge		$\chi^2$	P-value
	No.	%	No.	%		
- Suitable filter size of transfusion set for pediatric patients	20	33.33	52	86.70	35.55	<0.001**
- Maximum time allowed for a transfusion set to hang	29	48.33	46	76.70	9.664	<0.05*
- The preferred mechanism for administration of blood components and products	28	46.70	53	88.30	23.742	<0.001**
- Use of the same tubing/transfusion set when switching from blood components to a blood product.	12	20.00	46	76.70	38.576	<0.001**
- When a transfusion has been completed and there is evidence of a transfusion reaction, the infusion set should not be discarding until after consultation with the transfusion service.	23	38.33	45	75.00	16.425	<0.001**
- Transfusion lines should be primed with the blood component	29	48.33	53	88.30	22.182	<0.001**

\*\*Highly statistical significant difference; P<0.001



**Fig. (1):** Distribution of the studied nurses regarding their total knowledgescores regarding blood transfusion for children pre/post- program implementation (n=60).

**Table (5):** Relation between total nurses' knowledge regarding blood transfusion for children and their personal data post- program implementation (n=60).

Personal data	Total Knowledge				$\chi^2$	P- value		
	Pre program satisfactory		Post program satisfactory					
	No.	%	No.	%				
<b>*Age in years</b>								
< 20	0	0.00	2	3.30	74.06	<0.05		
20<25	0	0.00	18	30.0				
25<30	2	3.33	12	20.0				
30<35	3	5.0	11	18.30				
≥35	2	3.33	10	16.70				
<b>*Qualification of Nurses</b>								
■ Bachelor in Nursing Science	3	5.0	9	15.0	69.153	<.001**		
■ Diploma of Technical Institute of Nursing	2	3.33	12	20.0				
■ Diploma of Secondary Nursing School	6	10.0	31	51.6				
<b>*Years of experience in medical pediatric unit</b>								
< 5 years	0	0.0	2	3.33	53.051	<0.05*		
5-<10	7	11.6	47	78.30				
≥ 10	3	5.0	4	6.60				

\*\*Highly statistical significant difference; P<0.001

**Table (6):** Distribution of the studied nurses regarding their total practice in relation to preparation skills prior to blood transfusion for children Pre/Post- Program Implementation (n=60).

Items	Pre-program Competently done		Post-program Competently done		$\chi^2$	P- value
	No.	%	No.	%		
- Obtain consent from children and their parents: Formally identify the child	14	23.30	50	83.30	43.39	<.001**
- Explain procedure to child/parents/carers	19	31.70	56	93.30	48.67	<.001**
- Assess for any history of reactions.	32	53.30	47	78.30	8.33	<0.05

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- Obtain verbal consent from child/parents/ carers	17	28.30	55	91.70	50.13	<.001**
- Document in transfusion record or in child's medical notes	13	21.70	50	83.30	45.54	<.001**
- Give information to child/parents/carers, about potential side effects of transfusion	27	45.00	48	80.00	15.68	<.001**
- Check that the blood component must be prescribed on a prescription chart or transfusion record	10	16.70	50	83.30	53.33	<.001**
- Inspect each blood component/product for defects prior to infusion	10	16.70	43	71.70	36.80	<.001**
- Check baseline observations	25	41.70	50	83.30	22.22	<.001**
- Collect or receipt of blood component	42	70.00	51	85.00	3.874	<0.05*
- Fill in the time of arrival of blood component /product in clinical area	0	0.00	55	91.70	-	-

\*\*Highly statistical significant difference; P<0.001

**Table (7):** Distribution of nurses' practice related to cannulation or central venous access for children receiving blood transfusion pre/post-program implementation (n=60).

Items	Pre-program Complete done		Post-program Incomplete done/not done		X <sup>2</sup>	P- value
	No.	%	No.	%		
- Cannulate the child and ensure its patency	55	91.70	60	100.00	5.217	<0.05
- Secure with non-allergic tape or IV dressing	38	63.30	60	100.00	26.93	<.001**
- Ensure cannula is well secured	35	58.30	59	98.30	28.28	<.001**
- Use a suitable pediatric gauge IV needle in place/functional	32	53.30	57	95.00	27.18	<.001**
- Record the start time of unit transfused	20	33.30	58	96.70	52.89	<.001**
- Use appropriate blood component giving set	34	56.70	57	95.00	24.05	<.001**
- Adjust infusion rate for transfusion completion within a 1-1½ hour period unless ordered	22	36.70	60	100.00	55.61	<.001**
- observe transfusion form left with unit of blood during transfusion	27	45.00	60	100.00	45.51	<.001**
- Hung Unit of blood right away	20	33.30	47	78.30	24.63	<.001**
- Observe child for first 15 min. of transfusion	23	38.30	55	91.70	37.55	<.001**

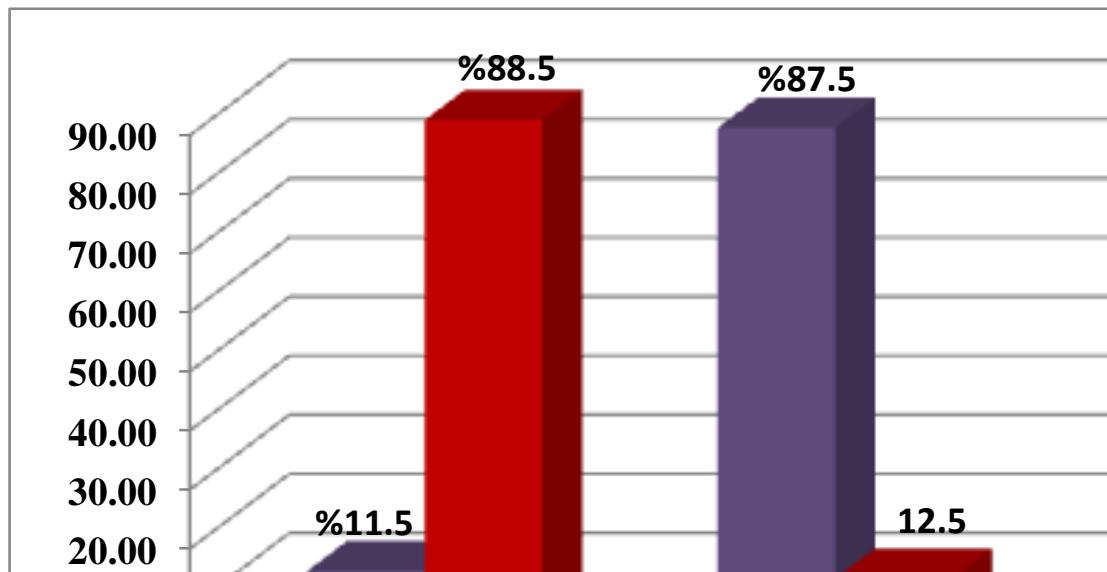
\*\*Highly statistical significant difference; P<0.001

**Table (8):** Distribution of the studied nurses regarding their practice towards suspected reactions and child monitoring after blood transfusion pre/post- Program Implementation (n=60)

Items	Pre-program Complete done		Post-program Incomplete done/not done		X <sup>2</sup>	P- value
	No.	%	No.	%		
<b>*Nursing actions toward suspected reactions during blood transfusion for children</b>						
- Stop transfusion immediately	30	50.00	59	98.30	36.57	<0.001**
- Check the child's identity (verbally and/or ID wristband) to the compatibility tag attached to the unit	15	25.00	57	95	51.52	<0.001**
- Check unit label to compatibility tag	20	33.30	56	93.30	46.50	<0.001**
- Get prompt medical evaluation	60	100	60	100	-	-
<b>*Children monitoring after blood transfusion</b>						
- Record post transfusion observations prior	8	13.30	50	83.30	58.86	<0.001**

to the removal of the cannula					
- Remove the cannula and secure the site, discard line in the clinical waste bag.	19	31.70	58	96.70	55.12
- Undiscard the blood bag in case of reaction occurred.	17	28.30	57	95.00	56.40
- Record the date and time transfusion ended.	16	26.70	49	81.70	36.55

\*\*Highly statistical significant difference; P<0.001



**Figure (2):** Distribution of the studied nurses regarding their total practice scores towards children receiving blood transfusion pre/post- program implementation (n=60).

**Table (9):** Relation between the studied nurses' total practice and their personal data

Personal data	Total practice				$\chi^2$	P- value		
	Pre-program		Post-program					
	No.	%	No.	%				
<b>*Age in years</b>								
< 20	0	0.0	0	0.00	51.07	<0.001**		
20<25	0	0.0	18	30.00				
25<30	5	8.3	12	20.0				
30<35	2	3.30	11	18.3				
≥35	3	5.0	9	15.0				
<b>*Qualification of Nurses</b>								
Bachelor in Nursing Science	3	5.0	7	11.60	64. 68	<0.001**		
Diploma of Technical Institute of Nursing	5	8.3	12	20.0				
Diploma of Secondary Nursing School	2	3.30	34	56.60				
<b>*Years of experience in medical pediatric unit</b>								
< 5 years	0	0.0	1	1.6	41.65	<0.05*		
5<10	4	6.6	45	75.0				
≥ 10	3	5.0	5	8.3				

\*\*Highly statistical significant difference; P<0.001

**Table (10):** Correlation between Total Scores of Nurses' Knowledge and Practice Regarding Blood Transfusion for Children Pre/Post-Program Implementation

Nurse's Knowledge	Nurse's practices	
	Pre-program	Post-program
r	.427	.642
P-value	<0.05*	<.001**

#### IV. Discussion

Blood transfusion for children is a potentially hazardous procedure. Stringent procedures must be followed to ensure that the correct blood is given and that any adverse reactions are dealt with promptly and efficiently practice. Blood transfusion should only be given when the clinical benefits to the child outweigh the potential risks (**World Health Organization, 2016**).

The present study was focused on assessing nurses' knowledge and practice about nursing care provided to children receiving blood transfusion, and to design, implement and evaluate the training program for those nurses based on the actual nurses' needs and relevant literatures. The study involved 60 nurses working in pediatric medicine departments at Benha University Hospital. They were mostly young age, with more than half holding a diploma of nursing school.

The finding of the current study revealed that, only about one third of the studied nurses in the pediatric units had received training courses related to blood transfusion. This along with their young age and lower level of nursing qualification is expected to have an impact on their knowledge and practice which were revealed to be very low at the pre-program phase. In the same line with the present study finding **de Graaf et al., (2009)** has reported that only 1 % of registered nurses are estimated to have any specialist blood transfusion training. Additionally **Khalil et al., (2013)** revealed that the majority of nurses did not attend any previous training program about blood transfusion. The importance of such training is of a crucial importance as indicated by **Tavares et al., (2015)**, who has emphasized that training program should be given in conjunction with a guided clinical practice, where nurses new to apply blood transfusion can develop skills safely and competently. This gave a support to the rationale of the present study result.

In order to design a training program for improving nurses' knowledge and practice regarding nursing care provided to children receiving blood transfusion, it was mandatory to assess their baseline knowledge and practice. The results of the present study revealed that nurses' knowledge before the program was generally unsatisfactory. This was quite clear regarding their knowledge about blood product which contains coagulation factor, blood product which contains hemoglobin for providing cells with oxygen and components of blood. The present study findings were supported by **Reza et al., (2009)** and **Hijji et al., (2012a)** who found that the majority of nurses' knowledge was inadequate regarding blood and its components which in turn prevent them from providing competent nursing care during transfusion procedure. Moreover, **Kabinda et al., (2014)** reported that training and education are essential for all staff involved in the transfusion procedure and as it minimize transfusion errors.

The present study has also revealed that nurses' knowledge about child's identification, maintaining written consent, the equipment used for transfusing blood components and products, signs and symptoms of transfusion reactions and rules and policies related to blood transfusion were unsatisfactory in the pre-program phase, but it improved significantly in the post-program implementation phase, this applied to all related areas of knowledge. On the same line **Hijji et al., (2012b)** found that nurses' knowledge regarding proper methods of blood and its components transfusion are deficits of all aspects of blood transfusion.

On the other hand, the current study assessed nurses' practice toward caring for children receiving blood transfusion. The study findings demonstrated very low levels of competent practice among them before implementation of the program. This was particularly evident in crucial tasks such as preparation skills prior blood transfusion, cannulation or central venous access, preparation skills prior to blood transfusion for children, nursing actions for all suspected reactions during blood transfusion for children and children monitoring after blood transfusion Overall, none of the nurses had adequate total practice at the pre-program phase. The minority of nurses had competent total practice at pre-program implementation. This deficient practice revealed among the present study nurses before implementation of the program is certainly linked to the previously mentioned low level of satisfactory knowledge among them. Both together, deficient knowledge and practice would certainly have a negative impact on the quality of nursing care provided by the studied nurses. As emphasized by **Hijji, et al., (2010)** who have also mentioned that the poor blood

transfusion practice is likely to play a role in the morbidity and mortality of patients who receive blood transfusion. So that, there is a need for blood transfusion policy and current practical guidelines.

Overall, the present study revealed that the training program about blood transfusion was effective in achieving better knowledge and practice among studied nurses. This effect was further confirmed by multivariate analysis, which has revealed that program attendance was the strongest statistically significant positive independent predictor of nurses' knowledge and practice scores at the post training. These findings were supported by Khalil et al., (2013) who revealed in their study that continued nursing education programs for nurses increase their knowledge and practice where there was an improvement in nurses' practice after the attendance continuing nursing education sessions.

However, the retention of knowledge in the current study was higher among more experienced nurses. Meanwhile, the retention of practice scores was higher among diploma nurses. Therefore, the training program was successful in improving nurses' knowledge and practice, which could be attributed to the structure, content and process of the program. As highlighted by British Committee for Standards in Haematology (2012) the primary responsibility of the nurse educator is to build quality program on the existing knowledge and practice and to translate their teaching needs into systematic learning experience. Learning in nursing must be related to the goal and objectives of the program.

### **III. Conclusion**

Based on results of the present study, after implementation of the training program nurses had satisfactory knowledge and competent practice, than before implementation, regarding blood transfusion for children. As well as, there was a statistically significant relation between nurses' knowledge and practices scores with their age, qualifications and years of experience pre and post program implementation.

### **V. Recommendations**

Based on results of the present study, it can be recommended that ; The developed program should be applied and repeated again every 6 months in the same study settings and adopted in other similar settings with required modifications, provision of continuing education programs on regular basis is suggested in order to refresh and update nurses' knowledge, as well as reinforce proper practices related to blood transfusion in pediatric units, continuous supervision and evaluation for nurses is needed to determine any defect related to knowledge or practices, Policies and strategies for hospital related to blood transfusion must be setting, applied and placed in a well visible place at the hospital as well as at the pediatric units.

**Limitation of the study:** Overcrowded work area

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