

Effects of Intervention Training Module Regarding Hospital Nurse's Preparedness for Patient's Blood Transfusion

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Abstract: Although nursing plays a fundamental role in blood transfusion, but nursing research on this subject is still inadequate. Blood transfusion is a lifesaving management for many medical conditions; the nurse should maintain the safety during blood transfusion by applying principles of blood transfusion safety based on an intentional blood transfusion safety policy. The aim of the study: The study aimed to examine the effects of intervention training module regarding hospital nurse's preparedness for patient's blood transfusion safety. Methods: quasi-experimental design, (study & control) comparative study, pre-post-tests used to achieve the study aim. A convenience sample of 400 nurses working in hospital settings, two tools were used to collect data, 1- Structured interviewing questionnaire: consists of two parts:- Part-A: Socio-demographic data related to nurses in the study which included the following characteristics: nurses sex, age, qualification, number of years' experience, Part-B: Structured designed questionnaire used to collect the nurses knowledge related to blood transfusion preparation, safety, common reactions and nursing actions for each type of reaction (theoretical part of module). 2- An Observational checklist used for the practical part of the module. The main results: the current study revealed that, most all groups had bachelor degree, they aged in between 25-35 years, the mean score of total knowledge and practice increased after the intervention training module for both studied groups; there was high significance between both groups (study & control) related to post knowledge and practice, on the other hand there were no differences between Egypt and Sudan study groups in relation to post-knowledge and practice. A strong positive correlation between some of socio-demographic characteristics, post-knowledge and practice for both studied groups. Recommendations: the study recommended that establishment of Hospital Blood Transfusion Committee and Hospital Blood Transfusion Team for review and reporting blood transfusion incidents through local risk management, establishment educational programs centers in all hospitals which responsible updating and refreshing the nurses knowledge and practice; workshops which emphasizing on the evidence-based practices about critical nursing interventions as blood administration within all hospital settings, these services must be included the recently graduated nurses, conduct similar studies by including more additional demographic variables.

Keywords: Blood transfusion, blood transfusion reactions, Blood transfusion safety, Training module for nurses.

1. INTRODUCTION

Blood transfusion is more well-organized and predictable for life-saving management for a set of patients and an important component of current health care. Adequate knowledge is very important for safe and sound practice, and one of the new trends in nursing research focuses on the advantage of investigating nurses' knowledge of clinical practice. Thus, the works are comprehensive with trainings examining the nurse's knowledge base of many areas the first stage in refining the excellence of patient care could be simplified through investigating and recording the current state of knowledge of blood transfusion [1].

Blood transfusions (red blood cell) are one of the most shared medical interferences. Although they can be lifesaving, blood transfusions especially red blood cell came under strong inspection over the last few decades [2]. The duration of blood storage differs among units. Many recent studies have stated a mean duration for blood storage in between 16 and 21 days with a maximum duration limited to 42 days based on cell life span. [2] In the United Kingdom, Canada and United States of America; the blood storage time is 42 days, with common additive solutions being the Adsol, Nutricel and Optisol preservative solutions [3].

Blood transfusion depends on clinical manifestations of the patients and not recommended until the hemoglobin (Hb) level reached 6-8 g/dl without bleeding [4]. The decision for blood transfusion is usually made by a doctor or a nurse, the blood pack put into a newly designed compact container whose internal temperature can be maintained between 2°C and 6°C for at least 8 hours. The container also included two frozen coolants and a dummy blood bag to monitor the temperature donors after informed consent had been obtained whole-blood units were filtered through an integrally attached filter initially, the box must be equipped with three probes to monitor blood temperature. Blood sampling could be performed by nurses using a sterile connection device to avoid contamination [3, 4]. Blood transfusion is the most commonly used therapeutic procedures. Although RBCs can be stored for up to 42 days, 2 multiple studies suggest that transfusions of RBCs stored for >14–21 days may increase the risk of adverse events [5].

Blood and blood product transfusions have many reactions; which can be categorized into immunological (acute) which, may occur rapidly after starting the transfusion by 5 minutes or less than 24 hours after blood administration as hemolytic reaction caused by ABO incompatibility which may happen in early 15 minutes after starting the blood transfusion; manifested by chills; fever, back pain and chest pain; and can be prevented by pre transfusion compatibility testing between donor and recipient to enrich blood safety measure [6,7].

Febrile non-hemolytic reaction occurs due to leukocyte incompatibility which occurs after initiation of transfusion by 2 hours; it manifested by fever; flushing, chills; prevented by use of leukocyte filter tubing and limiting the duration storage of the blood. Allergic reaction; the symptoms may either occur within seconds or minutes after starting of transfusion or may take several hours to develop; it's caused by sensitivity to performed antibodies to certain chemical donor plasma protein, which manifested by hives; itching; skin rashes' clinical pre-orbital edema; swelling in lips and tongue; change in the hemodynamic state includes decrease oxygen saturation; increasing in heart and respiratory rate and low blood pressure [7].

Bacterial sepsis; cross infection happens during blood transfusion due to incorrect blood storage temperature, which occurs after administering 100 ml of infected blood or its product; it manifested by rigors; increase in body temperature; heart rate; and circulatory collapse; and can be prevented by correct storage temperature for the product, correct check the package for air bubbles, administer blood product within 1/2 hour after out from refrigerator and apply infection control measures during administration. Circulatory overload happens after transfusion by hours; caused by rapid transfusion and administers too much intravenous fluids; it manifested by difficulty of breathing with cyanosis; increase heart rate and blood pressure; congested jugular vein and clinical lung edema; and can be prevented by right assess the cardiac patient at just flow rate, restrict the amount of transfused by one unit each 12 hour and pre-transfusion medication as diuretics for cardiac patients. Post transfusion purpura is uncommon complications; but can occur after platelet and red blood cell transfusion related to present of antibodies in recipient blood to human platelet antigen and treated by immunoglobulin intravenous [8,9].

While Chronic or delayed reactions may occur after more than 24 hours of blood administration to 6 months; as a delayed hemolytic reaction, due to antigen antibody reaction or immune response; which manifested by jaundice; dark urine; drop in hemoglobin level; and high liver enzymes; and can be prevented by antibodies screening before blood transfusion. Transmission –associated graft –versus –host disease due to response to T-cells of donor blood; occurs within 1-6 weeks after blood transfusion, it manifested by increasing in body temperature as a first sign; gastrointestinal symptoms and signs as abdominal pain and profuse bloody diarrhea; drop in the number of red; and white blood cells; and platelet due to bone marrow functioning depletion and high liver enzymes reflect cholestatic hepatitis; and can be prevented by Gama irradiation for blood component specially susceptible recipient, appropriate blood transfusion as restrict unneeded transfusion; administer accurate blood component and amount and avoid fresh blood transfusion. A variety of infectious agents may be transmitted by transfusion as HIV or AIDS, hepatitis B or hepatitis C and malaria which can be prevented by effective tests and screening of blood donors and products before transfusion [10,11].

Nurses are the patient's chief basis of information regarding to blood transfusion; they play an important role in process of blood transfusion; by pre-transfusion preparation, the nurse should check doctor order; obtain informed consent from the patient, in urgent situations or in case of unable patient; the nurse should be documented in the patient's notes the blood transfusion decision and the pre-medication, flow rate, patient laboratory investigation result and evaluating patient needs for blood transfusion and rate of infusion [6]. So, they establish the protocol to minimize blood transfusion reaction and improve blood transfusion safety through the main nursing role. Nurse should educate the patient about the blood transfusion process, indication, adverse effects and clinical manifestation; establish the measures to maintain a safe transfusion competency and patient monitoring, it is necessary to obtain baseline observations and the need to continue the monitoring during the transfusion to notice any adverse event as early as possible. Before starting the transfusion, it is necessary to encourage the patient to inform a nurse immediately if he or she becomes alert for any signs or symptoms such as shivering, flushing, pain or shortness of breath or begins to feel anxious [12]. The nurses support patient in the blood transfusion process, promote evidence-based practice, maintain safe blood transfusion phases practice, allow for patient express his or her behalf. Therefore, for nurses to provide high quality care and function effectively, they must have adequate knowledge that they use in practice; prepare patient before blood administration by intravenous line and psychological support [13].

Patient identification (ID) applications require zero-error accuracy. No procedure or treatment can take place if not the patient's ID is scanned with a portable scanner and compared with a bar code generated by the doctor's order [14]. The nurses maintain the positive patient identification for blood transfusion safety by asking the patient about full name and date of birth, the obtaining information from the patient must be identical to that on the patient's identity band (ID band), for unable patients as pediatric, unconscious, confused or language barrier obtain the identification from a parent or career at the bedside. Improper identification of patient as the main cause of mistransfusion resulting in significant transfusion mortality may indicate similar lack of knowledge. Prior to starting the transfusion, the patient's ID is scanned with a portable scanner and matched with a bar code generated by the doctor's order [15]. Other methods of patient identification are Biometric Technologies as fingerprints, iris and facial are the three most prominent commercially available biometric technologies [14].

The blood bank is responsible for typing and cross matching the donor's blood with the recipient's blood. Check with compare the blood or blood component to the doctor order; check the patient to the blood or blood component; (ABO and Rh group and donation number all identical on label on the blood component pack), compatibility label, it is necessary bedside double blood checks by using a two qualified nurse verification process or a one-nurse verification process accompanied by automated identification technology, such as bar coding; before initiating a blood or blood component transfusion check up of unit before administration date and unusual color, appropriate transfusion rates for blood should not exceed 2-4 mls/kg/h, infusion duration of the pack should take a maximum of 4 hours. Blood components can be administered safely through a 23-gauge needle [16, 17, and 21].

Direct heating and rubbing of blood pack should be avoided to prevent damaging blood cells, the nurse should keep the blood/ blood product away from over-bed lights. Never place blood or blood products in a refrigerator or next to a source of heat. For whole blood, red cells, platelets, plasma and cryoprecipitate, an infusion set containing an integral filter (170-200 microns) must be used. This is a standard clot screen filter. Blood transfusion sets should be changed normally after a maximum of 6 hours [18]. The nurse should be oriented to monitor the patient for each unit of blood transfused, before

starting the transfusion (baseline observation), 15 minutes after starting the transfusion; at least every hour during transfusion and carry out a final set of observations 15 minutes after each unit had been transfused [19].

If the nurses suppose transfusion reaction happened; identify doctor immediately, check vital signs; and the management depends on the type and severity of the reaction. If a severe reaction is suspected or if an acute transfusion reaction occurred, the following steps should be taken (1) Immediately the nurse stop the transfusion and search for urgent medical intervention; (2) Change the intravenous set and maintain venous access with normal saline; (3) Write report for the reaction and send it with blood unit into the Blood bank; (4) Treat symptoms pre doctor order; (5) Take further blood samples from the patient; (6) Assess and record the volume and color of any urine passed; if there are signs of haemolysis the urine should be saved for analysis; (7) Assess the patient until haemodynamically stable, recording vital signs; (8) Finally document in the patient's medical records all these data, the transfusion consent, date and time of transfusion, clinical indication for the transfusion, type of blood component and the number of units transfused, the unit numbers of each blood component transfused, and transfusion reaction type and their management. The blood bank and laboratory which are responsible for identifying the type of reaction [20, 21].

The principles of blood transfusion safety based on 8 rights as the following; Right product, appropriate product for the clinical presentation; the nurse collect blood from blood bank and assured that the label is matched in all patient parameter and cross matching before initiation of transfusion; Right patient; two nurses identification using two unique identifiers; Right dose, lowest dose necessary to achieve target response; Right time; start time within 30 minutes from time of out blood from blood bank refrigerator; Right reason; transfusion indication is a medical diagnosis; Right site; confirm that the patient has a patent intravenous line; Right response; based upon the indication, did the transfusion have the desired clinical effect and right documentation; as required by hospital policy, regulatory requirements and patient condition, transfusion consent signed before transfusion; dual identification process starting and stop times, vital signs according to hospital policy, volume infused, any potential adverse event related to the transfusion and assessment of response to transfusion [22].

SIGNIFICANCE OF THE STUDY:

Based on study by Khalil; et al (2013), [21] other studies have been published in Iran by Reza *et al* 2009; [23], Aslani *et al.* (2009); [24], study in the United Arab Emirates by Hijji; *et al.* (2012) [1] and study in India by Kaur; et al (2014) [25] all these studies recommended that nurses are in need for in-service training programs and refreshing courses to improve their knowledge which will reflect on their practice while providing care to patients. According to the researchers past clinical experience during student training at both hospitals, a lot of patients were receiving blood transfusion and exposed too many complications, these patients are in need for special nursing care to minimize their complications, therefore the researchers observed most of nurses have poor knowledge and bad practice related to blood transfusion safety measures, lack of nurse's knowledge of various aspects of blood transfusion, which is a real risk of patient safety. Furthermore nursing research on this subject is still inadequate in both study setting; and this study will be the first study in both location conducting this title to develop nurses' knowledge and practice of reducing patient blood transfusion complications by providing them with training modules.

AIM OF THE STUDY:

To examine the effects of intervention training module regarding hospital nurse's preparedness for patient's blood transfusion safety.

STUDY HYPOTHESES:

1. The mean knowledge score of nurses in the study groups regarding preparedness for blood transfusion safety post intervention test will be higher than pre-intervention test.
2. The mean practice score of nurses in the study groups regarding preparedness for blood transfusion safety post intervention test will be higher than pre-intervention test.
3. There will be statistical differences in mean knowledge and practice scores among study and control groups in post-test for Egypt and Sudan subjects.

4. There will be no statistical differences in mean knowledge and practice scores between Egypt and Sudan subjects in post-test.
5. There will be a strong relationship between mean of post knowledge and practice scores of the both study groups and some of socio-demographic characteristics.

2. METHODS

This chapter begins by presenting the research design, followed by setting and sample, sample size, inclusion and exclusion criteria, tools; pilot study; ethical considerations; procedure of data collection and the designed training module, data management and statistical analysis.

2.1 Design: - Quasi-experimental design, (study & control) comparative study, was utilized to achieve the aim of the study; pre-post-tests for both study & control groups were used.

2.2 Setting: - This study was conducted in Menoufia University hospital, Shibin Elkom, Egypt and Ibn Sina specialized hospital, Khartoum, Sudan.

2.3 Sample: - The convenience sample for this study was 200 nurses from total nurse number who work in Menoufia University hospital Shibin Elkom, Egypt and another 200 nurses from Ibn Sina specialized hospital, Khartoum, Sudan at the time of the study, each 200 nurses having 100 nurses as study group and the rest were control group.

2.4 Tools for data collection:

Two tools were developed and used by the researchers to gather data relevant to the study. These tools are as follow:

I-Structured Interviewing Questionnaire: consists of two parts: -

Part-A: Socio-demographic designed questionnaire was used to collect the demographic data related to nurses in the study; which included the following characteristics: nurses' sex, age, qualification, and number of years' experience.

Part-B: Structured designed questionnaire was used to collect the nurses' knowledge related to blood transfusion preparation and safety, and common reactions and nursing actions. It consists of a reliable and valid questionnaire consists of 37 multiple choice questions; each question has 3, 4, or more choices, only one is correct. (Theoretical part of the module).

II- An Observational Checklist was used for the practical part of the module which included preparation and steps regarding procedures (practical part of the module) consist of 29 steps of the procedure). Adopted from [26] and modified by researchers.

The two collection points, before and after the introduction of the training module to allow the researcher to examine the effect of the training module .The intervention group was participating in filling the questionnaire and checklist at day one, then reading the English module; then post-test by questionnaire and checklist done within 2 months. The study was done by using purposive sampling for selection of hospitals; the training module was done for nurses by the researcher and a nurse assistant team (nursing staff who provided care on the same day), this is started from the beginning of study depending on the availability of nurses (conveniences sampling method) .

2.4.1 Validity of the tools:

The tools were tested for their content by three experts in the field of Medical-Surgical Nursing and Pediatric Nursing to ascertain relevance and completeness.

2.4.2 Scoring system:

For observation checklist: Total score was 29 degrees; zero degree was given for each wrong or missing step in practice & one degree for each right step in practice; then coding system represented as scoring from (0-17) considered bad practice, scoring from (18-23) inefficient practice, finally scoring from (24-29) efficient practice.

For pre/post test questionnaire sheet: Total score was 37 degrees for blood transfusion knowledge, the complication and nursing actions in case of reaction; zero degree was given for each wrong answer & one degree for each right answer;

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then coding system represented as scoring from (0-22) for poor knowledge level, scoring from (23-29) for nurses have an inadequate knowledge level, finally scoring from (30-37) for nurses have an adequate knowledge level.

2.5 Pilot Study:

A pilot study was carried out on 40 nurses (20 nurses from each study area) to assess the clarity, feasibility, applicability of the study tools, and the time needed to fill each tool. The needed modifications were done as revealed from the pilot study. The total sample didn't include the pilot study to ensure the stability of the results.

2.6 Ethical considerations:

All potential nurses who participate in this study was given verbal information about the study and informed of their rights. The participants were assured that their work progress would not be affected by their decision to participate, or not participate, in the research study. The researcher and assistant team were provided ongoing support during the training program. Opportunities were provided for participants to ask questions at any time, and the researcher and assistant team, will be freely available to answer all participants' questions related to the study. All nurses were assured about the confidentiality of their responses. All information collected will be confidential and will not be disclosed to anyone other than the researcher. No names appeared on any results and a coding system known only to the researcher will be developed and used.

2.7 Procedure of data collection:

Official letters were issued to the director of the hospital and to the head of each unit, and then approval for carrying out the study was obtained after explaining the aim of the study.

Nurses were approached individually to explain the purpose and the nature of the study and to obtain their written consent for participation.

Duration of study: Data were collected throughout a period of the 3-months between June & Aug. 2016.

First, classification of nurses into small groups by unit; 10 nurses from each shift, then the nurses were oriented about the objectives of the module.

For teaching sessions: short interactive lectures and group discussions supported by audio-visual aids as power point lectures, illustrated pictures and videos; were conducted for each group. Each session lasted (30) minutes, 10 sessions were covered in the first week and the same sessions repeated in the second week, 2 sessions daily; one for the morning group and one for night group. Continuous feedback and communication were assured to clear any misunderstanding, and to reinforce learning for these sessions. Followed by the practical part, which consisted of 10 sessions each one lasted for 30 minutes and covered around 2 weeks, it done through demonstration and re-demonstrations utilized on top of using audiovisual aids.

- The researchers were available for 5 days/week at most hospital care units at the two shifts for 6 hours per shift.

- Nurses were evaluated by post-test after the pretest by six weeks.

2.8 The designed-training module:**2.8.1 General Objectives:**

Upon completion of this teaching-training module, the nurse will gain knowledge and practice regarding blood transfusion safety measures.

2.8.2 Specific Objectives:

Upon completion of this teaching-training module, the nurse will be able to:

1. Help health care personnel to use the best practices and improve their performance in the administration of blood transfusion.
2. Decrease in the incidence of blood transfusion reactions.

3. Encourage and provide nursing leaders of each hospital unit with proposal included recommendations to improve surveillance systems, education and training in blood transfusion safety measures.
4. Nursing team were encouraged to develop plans to reduce the incidence of adverse events in all health care settings.

2.9 Data management:

Data were collected by questionnaire and checklist pre-and post-training module for the nurses, by researcher and assistant team. Knowledge and practice of nurses were calculated. Manual coding was done to check any error in coding. The manual coding and tables were developed before entering the data. Double entry of data by researchers was done to prevent potential data entry error. The data were checked and cleaned by performing preliminary frequency distribution to enhance accuracy and reliability .

2.10 Statistical analysis:

Data was presented using SPSS program (version 20) in numbers, percentages, mean and standard deviation (SD), T-test, Pearson correlation analysis were used for assessment of the inter-relationships among quantitative variables and one-way Anova. The level of significant was adopted at $p < 0.05$

3. RESULTS

Table (1): showed that, frequency distribution of socio-demographic characteristics of the studied subjects, wherever the majority from studied sample was female nurses, they represented 71% from Egypt and 75.0% from Sudan. Seventy six percent from Egypt studied sample and fifty-six from Sudan studied sample aged between 25-35 year old, with a mean of age 30.20 ± 4.763 and 32.75 ± 7.079 respectively. In relation to professional educational qualification more than half of both studied groups had Bachelor degree in nursing. Concerning to years of experience 47.0% and 43.0% of studied nurses had 5 - 10 years of experience.

Table (2): illustrated that level and total knowledge scores among study subjects during Pre- intervention training module; most all samples had poor and inadequate knowledge related to the preparedness of blood transfusion safety, the mean was $(14.28 \pm 8.620$ and $14.41 \pm 7.302)$ of both Egypt samples, while was $(10.78 \pm 6.061$ and $7.82 \pm 1.585)$ of both Sudan sample. However, the mean score of total knowledge increased after the intervention training module raised to $(33.01 \pm 3.743$ and 33.73 ± 2.888 respectively) and both studied subjects had an adequate level of knowledge (statistically significantly, $p < 0.000$), while both control groups still constant. Hypothesis (1) was supported by the data.

Table (3): showed that levels and total practice scores among study subjects were about (84.0%,75.0% and 83.0%,75.0%) from both studied & control groups respectively, had a bad practice related to preparedness of blood transfusion safety, the mean was $(7.07 \pm 6.769$, 8.11 ± 7.977 and 7.22 ± 6.508 , $8.11 \pm 7.847)$ during Pre- intervention training module. On the other hand, the practice levels and mean score of total practice increased to $(23.98 \pm 6.695$ and 23.25 ± 5.919 respectively) after intervention training module for both studied groups, (statistically significant, $p < 0.001$), while both control groups their levels and mean still constant. Hypothesis (2&3) were supported by the data.

Table (4): exposed that, the mean knowledge and practice in the post intervention training program increased for both studied groups, and there were no differences between Egypt and Sudan Study Groups In relation to post-knowledge and practice. Hypothesis (4) were supported by the data

Table (5): showed from this table, the presence of a strong positive correlation among some of socio-demographic characteristics as age, number of experience years and post-knowledge and practice. Hypothesis (5) was supported by the data.

Table (6): illustrated that, effect of socio-demographic characteristics on mean knowledge and practice score for both studied groups in the post intervention module. Mean of post-knowledge and practice score for both groups improved in relation to sex, age, number of experience years and education level. There was a statistical significant difference regarding to post-practice and knowledge for both Egypt and Sudan study groups.

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Table (1): Frequency distribution of socio-demographic characteristics of the study subjects (N=400)

Socio-demographic			Menoufia University Hospital (Egypt) (N=200)		P-value	Ibn Sina specialized hospital (Sudan) (N=200)		p-value			
			Study (1)	Control (1)		Study (2)	Control (2)				
Sex	Male	No.	29	13	.004	25	38	.034			
		%	29.0	13.0		25.0	38.0				
	Female	No.	71	87		75	62				
		%	71.0	87.0		75.0%	62.0				
Age	< 25	No.	8	3	.296	10	27	.000			
		%	8.0	3.0		10.0	27.0				
	25 - 35	No.	76	81		56	54				
		%	76.0	81.0		56.0%	54.0				
	36 - 45	No.	16	16		30	9				
		%	16.0	16.0		30.0	9.0				
	46 - 55	No.				4	10				
		%				4.0	10.0				
	$\bar{x}\pm SD$			30.20 ± 4.763		31.12 ± 5.060			32.75 ± 7.079	30.34 ± 6.486	
	Qualification	Diploma	No.	42		22	.003		31	27	.816
%			42.0	22.0	31.0	27.0					
Bachelor		No.	56	78	61	64					
		%	56.0	78.0	61.0	64.0					
Master		No.	2	0	8	9					
		%	2.0	0.0	8.0	9.0					
No. of experience years	< 5 years	No.	28	31	.775	18	23	.008			
		%	28.0	31.0		18.0	23.0				
	5 - 10 years	No.	47	48		43	58				
		%	47.0	48.0		43.0	58.0				
	> 10 years	No.	25	21		39	19				
		%	25.0	21.0		39.0	19.0				
	$\bar{x}\pm SD$			8.99 ± 6.144		8.54 ± 6.053			10.42 ± 6.888	8.49 ± 5.654	

Table (2): levels and total knowledge scores among study subjects (Pre-& post intervention)

Variable		Menoufia University Hospital (Egypt) (N=200)		P value	Ibn Sina specialized hospital (Sudan) (N=200)		P value
		Study (1)	Control (1)		Study (2)	Control (2)	
Pre-knowledge test (37)	Poor knowledge (0-22)	50	42	.000	72	100	.000
		50.0	42.0		72.0	100.0	
	Inadequate (23-29)	38	50		26	0	
		38.0	50.0		26.0	0.0	
	Adequate (30-37)	12	8		2	0	
		12.0	8.0		2.0	0.0	
$\bar{X}\pm SD$		14.28 ± 8.620	14.41 ± 7.302		10.78 ± 6.061	7.82 ± 1.585	
Post-knowledge test (37)	Poor knowledge (0-22)	1	42	.000	0	100	.000
		1.0	42.0		0.0	100.0	
	Inadequate (23-29)	1	51		1	0	
		1.0	51.0		1.0	0.0	
	Adequate (30-37)	98	7		99	0	
		98.0	7.0		99.0	0.0	
$\bar{X}\pm SD$		33.01 ± 3.743	14.40 ± 7.288		33.73 ± 2.888	7.82 ± 1.585	

Table (3): levels and total practice scores among study subjects (pre-& post intervention).

Variable		Menoufia University Hospital (Egypt)		P value	Ibn Sina specialized hospital (Sudan)		P value	
		Study (1) N=100	Control (1) N=100		Study (2) N=100	Control (2) N=100		
Pre-practice test (29)	Bad practice (0-17)	84 84.0	75 75.0	.000	83 83.0	75 75.0	.000	
	Inefficient (18-23)	5 5.0	14 14.0		11 11.0	16 16.0		
	Efficient (24-29)	11 11.0	11 11.0		6 6.0	9 9.0		
	X±SD	7.07±6.769	8.11±7.977		7.22±6.508	8.11±7.847		
	Post-practice test (29)	Bad practice (0-17)	10 10.0		75 75.0	5 5.0		75 75.0
		Inefficient (18-23)	6 6.0		16 16.0	15 15.0		17 17.0
Efficient (24-29)		84 84.0	9 9.0		80 80.0	8 8.0		
X±SD		23.98±6.695	8.15±7.631		23.25±5.919	8.16±7.491		

Table (4): Differences between Egypt and Sudan Study Groups in Relation to Post-Knowledge and Post-Practice Scores. (N=200)

	Menoufia University Hospital (Egypt)		Ibn Sina specialized hospital (Sudan)		T-P Value
	Mean	±SD	Mean	±SD	
Post-knowledge	33.03	3.751	33.73	2.888	1.479 NS
Post- practice	23.98	6.504	23.25	5.919	0.830 NS

Table (5): Correlation among post-knowledge and practice for both studied groups and some selected socio-demographic characteristics (age, numbers of experience years) (N = 200)

Control Variables		Age	No. of experience years	Post-practice	Post-knowledge
Type of sample	Age	1.000	0.741**	0.042**	0.140*
	No. of experience years	0.741**	1.000	0.009**	0.261**
	Post-practice	0.042**	0.009**	1.000	0.043*
	Post-knowledge	0.140*	0.261**	0.043*	1.000

** . Correlation is significant at 0.01 level

*. Correlation is significant at 0.05 level

Table (6) Mean knowledge and practice score for both groups and selected demographic variables. (N=200) (Egypt & Sudan study)

Type of study	Menoufia University hospital (Egypt)				Ibn Sina specialized hospital (Sudan)			
	post practice		Post-knowledge		post practice		Post-knowledge	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Sex								
Male	23.1±7.394		34±2.464		22.88 ± 6.405		34.40 ± 2.102	
Female	24.34±6.41		32.61±4.1		23.37± 5.789		33.51± 3.086	
P-Value	0.007 (HS)		0.002 (HS)		0.432 (NS)		0.026 (S)	
Age (years)								
< 25	23.76±7.024		30.81±4.43		23.16±6.217		32.77±3.848	
25 – 35	27.12±1.458		33.58±2.604		24.00±3.464		35.00±0.000	
36 –45	23.44±6.511		32±8.229		23.30 ±6.111		34.70 ±1.418	
46-55	-----		-----		23.30±5.778		33.98 ±2.453	
P-Value	0.119 (NS)		0.002 (HS)		0.021(S)		0.000 (HS)	
No. of years' experience								
< 5 years	23.64±7.296		31.04±3.857		22.67±6.126		33.08±3.542	
5 - 10 years	24.61±6.057		34.21±4.954		23.40±6.165		34.72±2.516	
> 10 years	23.92±6.396		33.34±2.209		23.36±5.682		33.91±2.213	
P-Value	0.043 (S)		0.002 (HS)		0.220 (NS)		0.038 (S)	
Levels of education								
Diploma	22.93±7.652		32.52±4.298		23.11±6.476		33.41±3.106	
Bachelorette	24.96±5.487		33.71±2.822		23.26±4.878		34.19±2.600	
Master	18.5±14.849		32±2.828		24.25±5.726		34.38±1.996	
P-Value	0.043 (S)		0.002 (HS)		0.608 (NS)		0.838 (NS)	

4. DISCUSSION

Blood transfusion is a very effective and potentially life-saving treatment for many patients. Lack of knowledge for various aspects of blood transfusion by nurses, is danger to patient safety. Otherwise adequate knowledge is necessary for safe practice, so the existing trends in nursing research emphasizes the importance of investigating nurses' knowledge of clinical procedures [1]. The present study aimed to investigate the effects of intervention training module regarding hospital nurse's preparedness for patient's blood transfusion safety.

The current study found that all nurses included in the study reported that they had never received any training service in this field; although nurses have an important function in maintaining blood transfusion safety, by identifying its indications, applying transfusion principles to prevent errors; so, this process requires skilled and trained professionals to achieve transfusion safety. This is supported with Valesca, et al. (2016) [27] they documented that blood transfusion requires trained and updated professionals, which enable them to differentiate between the diverse causes of transfusion reactions, and can categorize reactions per its clinical manifestations. Regarding to socio-demographic characteristics; the present study findings revealed that the minority sample sex was male, supported by El-Halem, et al. (2011) [28] and

Ibrahim; et al. (2015) [29] they reported that although the male nurses have many probabilities to roll in appropriate positions in hospitals and community health settings, but they are still insignificant numbered, as our Arabian societies still recognize nursing as feminine labor work in female wards because of cultural consideration. Also Tavares, et al (2015) [30] said that the percentage of the nursing team exceeds 90%; is female because of the male contingent in nursing showing a current trend. In relation to age, most all groups sample aged between 25-35-year-old and they had higher mean in post-knowledge and practice score these results agreed with Labrague, et al., 2012[31] and El-Sol, And Badawy, (2016) [32] they stated that young age nurses had the capability to gain knowledge and alter their behaviors. While Alwutaib, et al., (2012)[33] they said that older age is an important indicator of lesser knowledge levels.

In relation to current study result revealed that; most of all groups (study and control) (Egypt and Sudan) had poor knowledge and bad practice in pre-training module, with low mean total score of knowledge and practice of all groups; which supported by Tavares, et al (2015) [30] they found that most of studied sample has lower score average was (52.7%), and in the same line; Diakit , et al (2013) [34] showed that most of participants nurses had inadequate knowledge. In addition, the current results supported by Nurhusien et al; (2015) [35] who stated that lack of learning resources for nurses to update their knowledge would be another reason for the poor level of knowledge. However, ninety eight percent and ninety nine percent from both studied groups had adequate level of knowledge and eighty four percent and eighty percent from both studied groups had efficient practice after training module; and the mean score of knowledge and practice in both study increased after the training module; these results supported by El-Sol, And Badawy, (2016) [32] and hypothesis 1&2 were supported by the data. As regards to both control groups had no improvement in their knowledge and practice. These results agreed with Bianco et al., (2013) [36] and El-Sol, And Badawy, (2016) [32] they documented that continuing education, training, personal experience, or in-service training, are essential sources to increase knowledge.

Concerning effect of socio-demographic characteristics on total score of knowledge and practice in post intervention module, the current study showed that; male nurses had high mean total knowledge score than female nurses regarding to blood transfusion safety knowledge; while female nurse had high mean total practice score than male nurses regarding to blood transfusion safety practice measures; these results supported by Freahiywot ,et al (2015) [37] they reported that male nurses had three times knowledge about prevention of surgical site infection than female nurses; additional to female nurses were about two times more likely to practice surgical site infection prevention activities when compared with male nurses.

Furthermore recent study revealed that, Bachelorette nurses had higher total score of knowledge and practice in post module intervention; than diploma nurses supported by Nurhusien et al; (2015) [35] they reported that nurses' level of education as Bachelorette level of education was found to be significantly associated with knowledge of pressure ulcer prevention. This result was in contrast with Freahiywot ,et al (2015) [37] they reported that diploma nurses had two times more likely to practice about surgical site infection prevention activities when compared to those with Bachelorette degree had knowledge and practice; due to the educational system of the nursing schools where in all three-year diploma nursing programs the percentage of practical courses is 70% with 30% theoretical supplement; however, in a four-year degree program the percentage of practical courses is below 50%.

Concerning effect of socio-demographic characteristics on total score of knowledge and practice in post intervention groups; the current study showed that nurses who aged more than 35 years, experienced nurses over 10 years had significantly the greatest mean total knowledge and practice score, also nurses who had bachelorette degree in nursing had the greatest mean total knowledge and practice score than who had diploma nursing. Furthermore, the findings of the existing study reported that, there is a strong positive correlation was found among age, experience, knowledge and practice for studied nurses.

Regarding to master degree of educational level in Egypt groups mean knowledge and practice score were low because they had administration master degree and enrolled as nurse administrator who has skills for financial management strategic planning and systems thinking and away from bedside patient care so with time their knowledge and practice decreased these results support by Ann and Colleagues; (2013) [38] who said to bed side nurses has unique skills to their work as nursing clinicians and play an important role in the delivery of safe patient care; on the other hand master degree

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in Sudan study higher in post-knowledge and practice can be explained by the fact that percentage of nurses in Sudan lower than Egypt nurses percentage although they had a master degree; they work as bedside nurses.

Finally to reach a successful goal, reducing patients' morbidity and mortality and improving the quality of nursing care must provide visible support; sufficient resources for continuous educational programs and training modules in different hospital settings; additional to application of the current study in two setting not affect on the study aim because of all nurses in any country or hospital wish for improvement in their knowledge and practical skills; which happen after implementation of training module or educational program; which supported by Mohammed and Ibrahim (2016) [39].

5. CONCLUSION

The current study concluded that knowledge and practice of all nurses included in the study were insufficient at the pre-training module implementation, while the improvement occurred for only both studied groups after module implementation. Otherwise, it was observed that there was a relation between age, number of experience years, and knowledge and practice of nurses .

6. RECOMMENDATION

The study recommended establishment of Hospital Transfusion Committee and Hospital Transfusion Team for review and reporting transfusion incidents through local risk management and clinical governance structures, establishment educational programs centers in all hospitals which responsible updating and refreshing the nurses knowledge and practice; workshops which emphasizing on the evidence-based practices about critical nursing interventions as blood administration within all hospital settings, these services must be included the recently graduated nurses, conduct similar studies by including more additional demographic variables. Establishing skills and competencies tools for assessment of nurse's knowledge and practice frequently to improve the procedures implementation quality and practical monitoring.

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