Original Article

Developing Blood Transfusion Educational Booklet for Nurses Based on
Pre-Estimated Assessment at Specialized Medical Hospital - Mansoura University

Nanis Moustafa Mohamed¹, Wafaa Gameel Mohamed Ali²,

₁*B.SC.Nursing,Faculty of Nursing - Mansoura University*

²*Prof. of Medical- Surgical Nursing, Faculty of Nursing, Mansoura University*

1.ABSTRACT

Blood transfusion may be a fundamental aspect of nursing practice and nurses 'knowledge of it is essential for safe practice. **Study:** aimed to develop a blood transfusion educational booklet for nurses based on pre-estimated assessment. **Method:** A descriptive, cross- sectional design was used for this study and it was conducted at Specialized Medical Hospital, Mansoura University. A convenience sample of 80 nurses from both sexes was enrolled. **Tools:** Two tools were used for data collection; tool I; Routine blood transfusion knowledge questionnaire (RBTKQ) and tool П Procedure Checklist which aimed to assess nurses 'practice during the performance of blood transfusion procedure. **Results:** There was a significant deficit of knowledge and a satisfied level of practice of the studied nurses regarding blood transfusion. **Conclusion and Recommendations:** This study revealed that; there was a significant deficit of knowledge and a satisfied level of practice regarding the blood transfusion among studied nurses, in addition there is a positive association between nurses 'level of knowledge and their level of practice regarding the blood transfusion. So, nurses and hospital should struggle to improve the quality and safety of blood transfusion because it is a potentially hazardous procedure and this will be maintained through establishing an educational booklet containing all necessary information about blood transfusion, receiving a training program in blood transfusion, and statement of hospital blood transfusion policy.

Keywords: *Blood Transfusion, Educational Booklet, Nurses.*

2.Introduction

Each year, a lot of individuals all over the world receive life-saving blood transfusions. Blood component therapy is commonly utilized in management of hematologic disorders **(Tancred & Bates, 2019).** Several therapeutic and operative techniques are dependent upon blood products support. But, blood transfusions only temporarily support patients till managing the underlying condition. Since blood transfusion can some risks, it must be utilized only when essential **(Stubbs,Klompas,&Thalji, 2021).**

Blood transfusion remains well- defined as " the administration of whole blood and its components with knowledge of precise administration methods to prevent probable complications" **(Saif Al-Nasr, Abd-El Razik, Mohamed& Al-Mezaien, 2016).** Additionally, it involves the administration of whole blood and blood components to boost the delivery of oxygen to the tissues and organs **(Kaplan, 2021).**

Transfusion reactions are unintended responses that are linked to transfusion of blood or its components. Which may cause death, be life-threatening, incapacitating, and lead to prolonged hospitalization and morbidity. The entire blood transfusion treatment process is under the purview of nurses, who are also responsible for monitoring patient reactions. Blood types and blood component therapy are both included in the knowledge of blood transfusion Administration tools, and specific administration techniques for each component **(Encan & Akin, 2019).**

Poor knowledge might reason the nurse to implement unsafe blood transfusion practice or to give wrong blood components that might be associated with increased mortality and morbidity **(Akyol, 2019).** Studies about transfusion knowledge of the nurse might guide nurse bosses and clinicians to develop regular in-service training and developing educational programs to make sure safe transfusion administration agendas **(Panchawagh, Melinkeri & Panchawagh, 2020).**

П. Significance of the Study

Despite nurses' involvement in blood transfusions for many years, there are few studies that describe their practices in this area. **(Aulbach, 2013).** Based on the findings of prior researchers who claimed that nurses have an unacceptable degree of knowledge and inadequate practices

regarding the care of patients receiving blood transfusions in their studies **(Bediako, Ofosu-Poku & Druye, 2021).** Furthermore, the justification for conducting the present study is the lack of nursing research in Egypt which examine blood transfusion knowledge and practices among nurses and the need to develop a blood transfusion educational booklet for nurses based on pre-estimated assessment.

Aim of the study;

This study aimed to develop a blood transfusion educational booklet for nurses based on pre-estimated assessment.

Research Questions;

To fulfill the aim of the current study, the research question will be formulated:

- What is the nurses' knowledge regarding blood transfusion?
- What is the nurses' practice level regarding blood transfusion?

3.. Method

3.1 Research Design;

A descriptive, cross- sectional design was used**.**

3.2 The Setting of Study;

This study was conducted at (cardiology ,hepatology, and endocrinology ward) at Specialized Medical Hospital, Mansoura University.

3.3 Subjects;

A convenience sample of 80 nurses from both genders was used for this study their ages ranged from 20 to 39ys. Each participant was interviewed and observed during the performance of the blood transfusion procedure. Data were collected over a period of 4 months that started from November 2019 to March 2020.

3.4 Tools of data collection;

Data were collected by using two tools:

Tool I: Routine blood transfusion knowledge questionnaire (RBTKQ).

This tool was adapted from by **Hijji, Oweis, & Dabbour, (2012) et al.,** and was modified by the investigator. It consists of six sections:

- **Section 1:** nurses' demographic characteristics and training. This section consists of 8 items; included demographic and training data. The demographic data included nursing qualifications, department, age, gender, years of experience. The training data included the number of blood transfusion performance, number of programs they participated in,

specific areas relating to blood transfusion they in need for further training.

- **Section 2:** included issues related to blood bag collection from the bank and prior patient preparation. It consisted of 4 items. Method of the blood transportation, information needed for collected the right blood for the right patient, checking the patency and availability of the intravenous access.

- **Section 3:** included issues related to pre-transfusion initiation nursing responsibilities. Consisted of 11 items included information the patient need to know before each blood transfusion episode, actions done by the nurse before transfusion following obtaining a blood pack, how the nurse handled the blood, maximum time the blood could be out of the fridge prior to transfusion, steps should be followed to identify the right patient, suitable filter size of transfusion set, action taken by the nurse to be protected against infections.

- **Section 4:** included post transfusion initiation nursing responsibilities. It consisted of 11 items modified to 10 items by omitting the item related to an infant. this section is concerned with action taken by nurses after the initiation of blood transfusion until its ends, agents/solutions compatible with blood, how to adjust the drip rate, intervals where vital signs should be checked, and recorded during transfusion and for whom patients' blood transfusion should be administered slowly.

- **Section 5:** included complications related to blood transfusion and Consisted of 13 items. Including actions minimized the risk of blood transfusion reaction, signs and symptoms indicated the patient developed an acute hemolytic transfusion reaction, actions done when transfusion reaction symptoms are seen, infections caused by transfusion, actions done against mild allergic transfusion reaction and identified the most common cause of most fatal transfusion reaction.

- **Section 6:** included issues related to blood transfusion policies and procedure.

Scoring system:

Each question was in the form of choosing the correct answer the correct answer takes 1 score and incorrect one takes 0. The other form of question was complete the blanks. Nurses 'Knowledge assessment (38 questions) classified as the following

25 questions * 1score = 25   1 question scores * 2 =2   7 question * 3 scores = 21   5 question * 4 score = 20   Total score = 25 +2+21+20= 68

The participant' total score ranged from 0 to 68 score. The total scores were converted into percent score. Then score% was transferred into categories as below:

Unsatisfactory level of knowledge (<75%)

Satisfactory level of knowledge: (≥ 75.0%).

Tool ΙΙ:nurses' performance checklist :

This tool aimed to assess nurses ' performance during blood transfusion procedures adapted from **(Wilkinson & leuven**, **2007).** It consisted of 40 steps the first 17 of them related to pre blood transfusion procedure performance from 18 to 26 step concerned with the initiation of blood transfusion procedure performance, from 27 to 30 step concerned with post-transfusion procedure performance finally steps from 31 to 40 variations related to a transfusion reaction.

Scoring system

Not done/done incorrectly=0   done partially accurate= 1   done accurately = 2

Total nurses 'practice assessment (30 steps x 2) = 60 score

 75%<Unsatisfactory level of Practice:( ) ▪

 75.0% ≤Satisfactory level of Practice: () ▪

3.5Validity and reliability:

Tools were adopted from **Hijji etal**. **(2012)** and **Wilkinson & leuven**, **2007** and were modified by the investigator then tested for content validity by five experts in the field of medical surgical nursing for tools' clarity, relevance, comprehensiveness, applicability and simplicity for implementation and some modifications were applied accordingly. Internal consistency and a reliability coefficient (Cronbach's alpha) of the tools of the questionnaire were tested by SPSS software. For knowledge tool, Cronbach's alpha = 0.766 and for 2nd tool, Cronbach's alpha = 0. 753. This means that reliability of both tools is very good.

3.6Pilot study:

A pilot study was carried out on 10% (8 nurses) of study participants to assess the clarity and applicability of the tools, and the necessary modifications were done prior to data collection those nurses were excluded from the study.

3.7Ethical considerations:

All relevant ethical issues were taken into consideration including the research approval which was obtained from research ethical committee of nursing faculty, the aim of the study was explained to each nurse and then an oral consent for participation in the study was obtained. Privacy and confidentiality of the collected data were assured for participated nurses. They were assured that their information would be used for research purposes only and any nurse has the right to withdraw from the study at any time.

3.8Procedure:

The study was employed through the following phases:

Phase 1: The preparatory phase

a) Two tools were adapted after reviewing related literature used for data collection.

b) Taking ethical approval.

c) Taking administrative approval.

d) The investigator introduced herself to each participant and explained the aim of the study.

e) Oral consent was taken from all study participants.

Phase2: Implementation phase:

This study has been carried out at the three main departments At Specialized Medical Hospital (endocrine ward, hepatic ward, and cardiology ward). The investigator was introducing herself to each nurse and clarifies the purpose of the study for each nurse. The data was collected via personal interview and observation of nurses' performance by the investigator during morning and afternoon shifts from November 2019 to March 2020. The participant was asked to answer the questions related to his/her experience it took about 25 to 35 minutes. After completing the questionnaire, The investigator collects it and make sure that the sheet was being filled completely.

Phase3: Developing nurses' performance guidelines

Based on the results of the learning needs assessment the investigator developed performance guidelines through literature review and internet searching for relevant information for construction of an educational booklet. A simple colored Arabic booklet was developed for nurses regarding blood transfusion written in simple Arabic language and supported with colored pictures for more clarifications.

3.9Statistical analysis:

Data were extracted from the interview questionnaire and computerized. Analysis was undertaken using SPSS (statistical package for social science) version 22.0. Numbers and percent were used represent qualitative data. Quantitative data were described using mean and standard deviation (SD). Qui square test (X2) was used to compare qualitative variables.   When p-value ≤

0.05 a significant level value was measured and a highly significant level value was indicated when p-value ≤ 0.001, but p-value > 0.05 shows the non-significant results.

4. Results

Table (1) shows the characteristics of the studied nurses. Out of eighty nurses; 38 (47.5%) were graduated as nursing diploma and 42 (52.5%) were graduated from technical institute of nursing. About one third of the studied nurses were working in the three departments: cardiology, hepatology and endocrinology department. Nearly three quarters were females (72.5%). Their ages ranged from 20 to 39 years and mostly in age 25-30 years (47.5%) and 30-35 years (31.2%) with average 28.87 ±3.90 years. Their years of experience ranged from 1.5 to 20.5 years and mostly; 5-10 years (36.2%) and 10-15 years (27.5%) with average 9.40 ±4.78 years. All nurses practiced blood transfusion in last six months. Most of them practiced 1-4 times (45%) and 5-8 times (27.5%). Only 21 nurses participated previously in training about blood transfusion and now 62 (77.5%) of the nurses reported they are in need of training.

Table (1): Distribution of the studied nurses according to their demographic characteristics (NO=80).

Characters	Items	No	%
Graduation	Nursing diploma	38	47.5
	Technical institute of nursing	42	52.5
Departments	Cardiology	26	32.5
	Hepatology	27	33.8
	Endocrinology	27	33.8
Gender	Males	22	27.5
	Females	58	72.5
Age Years	20-	9	11.2
	25-	38	47.5
	30-	25	31.2
	35-39	8	10.0
	Min-Max: 20-39 years, Mean ± SD= 28.87 ± 3.90 years		
Years of experience (years)	< 5	13	16.2
	5-	29	36.2
	10 -	22	27.5
	15+	16	20.0
	Min-Max: 1.5-20.5 years, Mean ± SD= 9.40 ± 4.78 years		
Blood transfusion in last 6 months?	No	0	0.0
	Yes	80	100.0
Frequency of blood transfusion in the last 6 months	1-4 times	36	45.0
	5-8 times	22	27.5
	9-12 times	6	7.5
	>12 times	16	20.0
Participation in training about blood transfusion	Yes	21	26.2
	No	59	73.8
How many?	Once	20	95.2
	Twice	1	4.8
Training needs	Yes	62	77.5
	No	18	22.5

Table (2) shows the knowledge of the studied nurses related to blood bag collection and prior patient preparations. It is found that 53.8% of the studied nurses gave correct answer for the question about the importance of checking IV-line availability and patency before transfusion. While

their full correct answers were 52.5% for knowledge related to patient rights, 18.8% for Knowledge related to blood cross matching and compatibility and 93.8% for Knowledge related to blood transportation method. Out of 4 the average score is 2.19 ±0.92.

Table (2): Knowledge of the studied nurses related to Blood bag collection from the blood bank and preceding patient's preparation (NO=80)

Items	Correct answer		Incorrect answer	
	No	%	No	%
1. Knowledge related to importance of checking IV-line availability and patency before transfusion	43	53.8	37	46.2
2. Knowledge related to information should the nurse ensure in order to collect the right blood for the right patient	42	52.5	38	47.5
3. Knowledge related to blood cross matching and compatibility	15	18.8	65	81.2
4. Knowledge related to method should the nurse use to transport blood from the blood bank to the ward	75	93.8	5	6.2
Mean of total score (4)	**1-4(2.19 ± 0.92)**			

Table (3) shows the knowledge of the studied nurses related to Pre-transfusion initiation nursing responsibilities. The full correct answers of the studied nurses are very high for the knowledge related to actions should be done before transfusion (81.2%), knowledge related to international patient safety goals (82.5%), Knowledge related to safety implementation of blood transfusion through CVC terminating in or near right atrium (82.5%), knowledge related to infection prevention and control (71.2%) and knowledge related to the

maximum time blood unit could be out of fridge (66.2%). While, their answers are highly not correct for knowledge related to blood handling (78.8%), knowledge related to the accurate time blood should be administered after delivering to the ward (75.0%), Knowledge related to indications of blood warming before administering blood (63.8%) and knowledge related to suitable blood transfusion filter size (60.0%). Out of score 17, the average score of the studied nurses for this domain is 11.70 ±2.07

Table (3): Knowledge of the studied nurses about pre-transfusion initiation nursing responsibilities (NO=80)

Items	Correct		Partial correct		incorrect	
	N	%	N	%	N	%
1. Knowledge related to actions should be done before transfusion	65	81.2	14	17.5	1	1.2
2. Knowledge related to information should be provided for the patient prior to blood transfusion	15	18.8	65	81.2	0	0.0
3. Knowledge related to how to handle blood after being obtained	17	21.2	0	0.0	63	78.8
4. Knowledge related to steps for proper identification of the correct patient	66	82.5	14	17.0	0	0.0
5. Knowledge related to safe transfusion	46	57.5	0	0.0	34	42.5
6. Knowledge related to the accurate time blood should be administered after delivering to the ward	20	25.0	0	0.0	60	75.0

7.	Knowledge related to the maximum time blood unit could be out of fridge	53	66.2	0	0.0	27	**33.8**
8.	Knowledge related to indications of blood warming before administering it	29	36.2	0	0.0	51	**63.8**
9.	Knowledge related to safety implementation of blood transfusion through CVC terminating in or near right atrium	66	82.5	0	0.0	14	**17.5**
10.	Knowledge related to suitable blood transfusion filter size	32	40.0	0	0.0	48	**60.0**
11.	Knowledge related to infection prevention and control	57	71.2	0	0.0	23	**28.8**
	Mean of total score (17)				7- 16 (11.70 ± 2.07)		

Table (4) shows the knowledge of the studied nurses related to post-transfusion initiation nursing responsibilities. The full correct answers of the studied nurses are very high for knowledge related to activities nurses should perform from the beginning to the end of transfusion (77.5%), Knowledge related to the time needed for close observation to the patient for possible reactions (76.2) and knowledge related to actions should be done to administer un compatible drugs at the same line access with blood (52.5%). Their responses are mostly incomplete correct for Knowledge related to precautions of blood transfusion (83.8%) and knowledge related to solutions compatible with blood (86.25). While, their answers are highly not correct for knowledge related to drip rate adjustment (80.0%), knowledge related to blood flow formula (90.0%), knowledge related to time needed to infuse one unit of blood (75.0%) and knowledge related to the time needed to replace administration set (82.5%). Out of score 19, the average score of the studied nurses for this domain is 10.68 ±3.04.

Table (4): Knowledge of the studied nurse's about post-transfusion initiation nursing responsibilities (NO= 80)

Items	Correct		Partial correct		incorrect	
	N	%	N	%	N	%
1.Knowledge related to activities nurses should perform from the beginning to the end of transfusion	62	77.5	18	22.0	0	**0.0**
2.Knowledge related to drip rate adjustment	16	20.0	0	0.0	64	**80.0**
3.Knowledge related to blood flow formula	8	10.0	0	0.0	72	**90.0**
4.Knowledge related to actions should be done to administer un compatible drugs at the same line access with blood	42	52.5	0	0.0	38	**47.5**
5.Knowledge related to time needed to infuse one unit of blood	20	25.0	0	0.0	60	**75.0**
6.knowledge related to precautions of blood transfusion	13	16.2	67	83.8	0	**0.0**
7.Knowledge related to solutions compatible with blood	7	8.8	69	86.2	4	**5.0**
8.Knowledge related to intervals vital signs should be checked and recorded during transfusion procedure	30	37.5	17	21.3	33	**41.2**
9.Knowledge related to the time needed for close observation to the patient for possible reactions	61	76.2	0	0.0	19	**23.8**
10.Knowledge related to the time needed to replace administration set	14	17.5	0	0.0	66	**82.5**
Mean of total score (19)	4-16 (10.68 ± 3.04)					

Table (5) shows the knowledge of the studied nurses 'related complications of blood transfusion. The correct answers of the studied nurses are very high for Knowledge related to reaction of administrating cold blood through CVC terminating in or near the right atrium (71.2%), knowledge related to standard precautions for infection control (73.8), Knowledge related to symptoms of mild allergic reaction of transfusion (52.5%) and knowledge related to action should be done with mild allergic reaction (68.8%). Their responses are mostly incomplete correct for Knowledge related to manifestations of acute hemolytic reaction (88.8%), Knowledge related to management of acute hemolytic transfusion reaction (66.3%), Knowledge related to diseases which could be transmitted through bl transfusion (81.3%) and knowledge related to complications can be caused by single blood transfusion event (51.2). While, their answers are highly not correct for knowledge related to causes of fatal transfusion reaction (77.5%) and knowledge related to actions should be done to infuse incompatible solution with blood at the same time and line (48.8%). Out of score 28, the average score of the studied nurses for this domain is 18.11 ±3.59.

Table (5): Knowledge of the studied nurses about complications associated with blood transfusion (No = 80)

Items	Full Correct		Partial correct		Not correct	
	No	%	No	%	No	%
1. Knowledge related to actions done to minimize the risk of acute transfusion reaction	6	7.5	73	91.1	1	1.2
2. Knowledge related to reaction of administrating cold blood through CVC terminating in or near the right atrium	57	71.2	0	0.0	23	28.8
3. Knowledge related to actions should be done to infuse incompatible solution with blood at the same time and line	28	35.0	13	16.2	39	48.8
4. Knowledge related to manifestations of acute hemolytic reaction	9	11.2	71	88.8	0	0.0
5. Knowledge related to management of acute hemolytic transfusion reaction	26	32.5	53	66.3	1	1.2
6. Knowledge related to diseases which could be transmitted through blood transfusion	14	17.5	65	81.3	1	1.2
7. Knowledge related to complications can be caused by single blood transfusion event	36	45.0	41	51.2	3	3.8
8. Knowledge related to What should the nurse do with the remaining blood in the bag after the transfusion time is out?	44	55.0	0	0.0	36	45.0
9. Knowledge related to when you couldn't start the transfusion and notify the blood bank and return the blood	32	40.0	0	0.0	48	60.0
10. Knowledge related to standard precautions for infection control	59	73.8	0	0.0	21	26.2
11. Knowledge related to symptoms of mild allergic reaction of transfusion	42	52.5	0	0.0	38	47.5
12. Knowledge related to action should be done with mild allergic reaction	55	68.8	0	0.0	25	31.2
13. Knowledge related to causes of fatal transfusion reaction	22	27.5	0	0.0	58	77.5
Mean of total score (28)	**9-25 (18.11 ± 3.59)**					

Figure (1) shows the knowledge levels of the studied nurses about blood transfusion. Unsatisfactory level (< 75.0%) of total knowledge was 83.8% and satisfactory knowledge (≥75.0%) was 16.2%

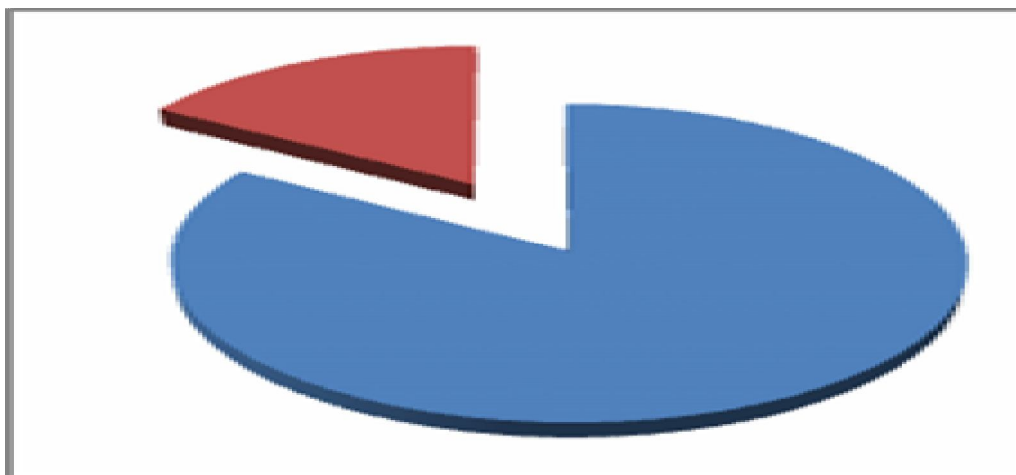**Figure (1): Total knowledge level among studied nurses**

Table (6) shows the performance average scores of the studied nurses about blood transfusion. The total performance score ranged from 31 to 51 with mean total score (44.86 ±5.33)

Table (6): Performance average score

Performance	Maximum score	Min - Max	Mean ± SD
Pre	34	15.0 – 31.0	26.08 ± 4.43
Initiation	18	10.0 – 16.0	13.01 ± 0.99
Post	8	4.0 – 8.0	5.78 ± 0.66
Total score	60	31.0 – 51.0	44.86 ± 5.33

Figure (2) show the performance levels of the studied nurses about blood transfusion. Unsatisfactory level (< 75.0%) of total performance was 31.2% and satisfactory knowledge (≥75.0%) was 68.8%
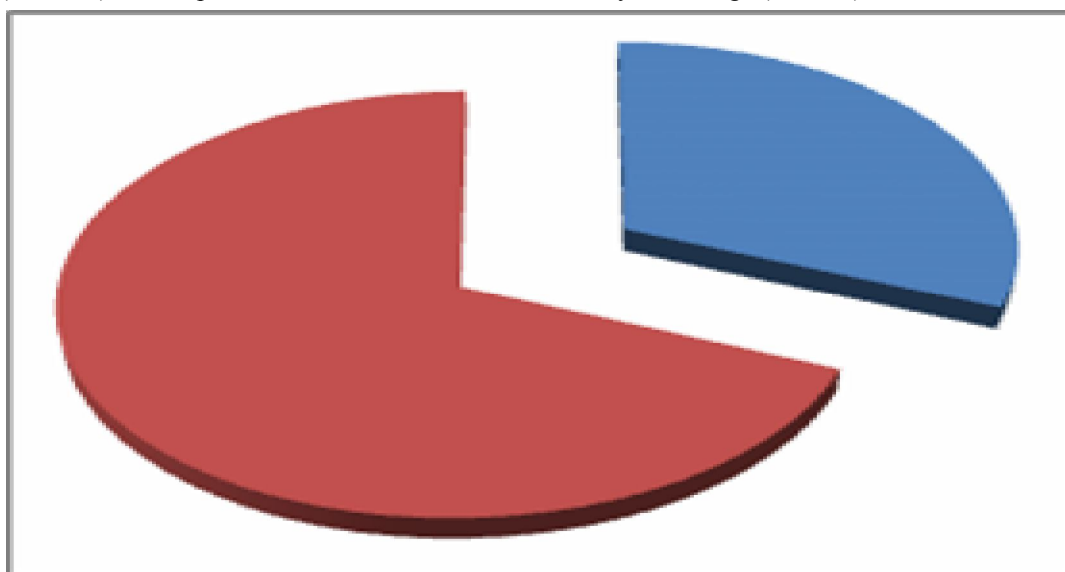

Figure (2): Total performance level among the studied nurses

Figure (3) illustrated that there was a significant, positive, strong correlation between total knowledge and total performance score; as the total knowledge increase, the total performance also increases ($r = 0.570$, $P<0.001$)
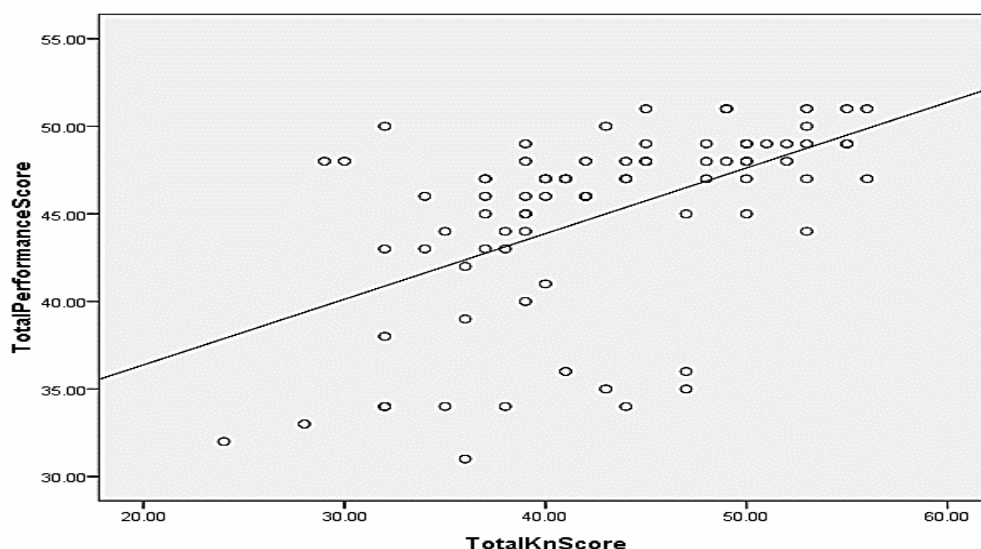

Figure (3): Correlation between total knowledge and total performance scores among the studied nurses

Table (7) shows the relationship between average total knowledge and total performance scores and characteristics of the studied nurses. Nurses who graduated from nursing institute had significant ($P<0.001$) higher average scores of knowledge and performance. The average scores of knowledge and performance were significantly ($P<0.001$) higher among nurses working in hepatology and endocrinology departments. Male nurses had a significant ($P<0.001$) higher knowledge score and insignificant ($P0.242$) higher performance score. Knowledge and performance scores were not significantly to differ by age of nurses. The older nurses (30 years and more) had a significant ($P0.003$, $P0.001$) lower average knowledge and performance scores. Knowledge scores were significant ($P0.003$) among nurses practicing a low number of blood transfusions while performance scores did not significantly differ. Although, the average knowledge and performance scores were higher among the nurses trained previously on blood transfusion, the difference was not significant ($P 0.086$, $P0.219$).

Table (7): Relationship between average total knowledge and total performance scores and characteristics of the studied nurses (No=80)

Characters	Items	No	Total knowledge score	Total performance score
Significance test			**Mean ± SD**	**Mean ± SD**
Graduation	Nursing diploma	38	39. 08 ± 7.24	42. 53 ± 6.08
	Nursing institute	42	45. 86 ± 6.22	46. 98 ± 3.43
Significance test			**t=4.503,P<0.001**	**t=4.083,P<0.001**
Departments	Cardiology	26	38. 62 ± 7.45	42. 63 ± 6.50
	Hepatology	27	44. 37 ± 6.33	46. 37 ± 3.33
	Endocrinology	27	44. 78 ± 7.30	45. 33 ± 5.27
Significance test			**F=6.308,P 0.003**	**F=3.301,P 0.042**
Sex	Males	22	46. 86 ± 6.85	46. 00 ± 4.51
	Females	58	41. 03 ± 7.15	44. 43 ± 5.58

Significance test			t=3.292,P 0.001	t=1.179,P 0.242
Age (Years)	20- 25- 30- 35-39	9 38 25 8	40. 44 ± 7.60 43. 84 ± 7.77 42. 24 ± 7.72 40. 63 ± 5.10	46. 11 ± 2.98 45. 82 ± 4.62 42. 80 ± 7.01 45. 38 ± 2.56
Significance test			F=0.793,P 0.502	F=1.906,P 0.136
Years of experience (years)	< 5 5- 10 - 15+	13 29 22 16	42. 23 ± 7.34 46. 34 ± 6.24 41. 18 ± 8.76 38. 25 ± 4.75	46. 62 ± 2.72 47. 10 ± 3.45 43. 73 ± 6.00 40. 94 ± 6.22
Significance test			F=5.190,P 0.003	F=6.545,P 0.001
The approximate number of times performing blood transfusion over last six months	1-4 times 5-8 times 9-12 times >12 times	36 22 6 16	42. 83 ± 8.42 46. 18 ± 5.80 38. 33 ± 5.43 39. 94 ± 5.77	45. 28 ± 5.45 44. 14 ± 5.76 43. 83 ± 4.26 45. 31 ± 5.10
Significance test			F=6.308,P 0.003	F=0.313,P 0.816
Participation in previous training about blood transfusion	Yes No	21 59	45. 05 ± 8.58 41. 78 ± 6.96	46. 10 ± 5.83 44. 42 ± 5.12
Significance test			t=1.737,P 0.086	t=1.239,P 0.219

5. Discussion

Globally, millions of individuals receive lifesaving blood transfusions yearly. However, these transfusions can carry some risks (**Akyol, 2019**). The rapid growth of human knowledge in the medical field has saved the lives of millions of people all over the world and blood transfusions have played a crucial role in this field. The correct blood transmission is a complex issue and it is very dangerous without the use of special skills (**Fergusson, 2016**). Human errors by blood bank technicians, doctors, and nurses have an important role in adverse reactions associate with transfusion. Nurses are involved at all steps of transfusing, and thus investing time and energy in their training goes a long way in ensuring patient's safety (**Panchawagh, Melinkeri & Panchawagh, 2020**).

By conducting research that is concentrated on the gaps in transfusion knowledge, surveillance, and reporting transfusion adverse events, the nurse who is at the point-of-care has the opportunity to make essential contributions to the national transfusion safety initiatives and nursing science. This nurse's role in patient safety during a blood transfusion is therefore crucial. (**Saied, Galal, Abd-El Aziz & Al-Mezaien, 2016**) Therefore, the current study aims to develop a blood transfusion educational booklet for nurses based on pre-estimated assessment.

According to nurses' training about blood transfusion, the current study clarified that about a quarter of studied nurses reported that they obtain previous training about blood transfusion and most of them practiced 1-4 times of blood transfusion at last six months. On the other hand, **Encan & Akin, (2019)** reported that almost all of the nurses reported having received in-service blood transfusion training and nearly a quarter of the nurses stated that they carried out a transfusion once daily. On the same line, **Nunes da Silva et al., (2017)** revealed that more than a quarter of nurses participated in specific training courses on blood transfusions. This may be a weak point in our health system that doesn't give attention to training.

Our study reported that > one third of nurses who had the highest training needs were about high-risk blood transfusion and a quarter of them were stored and collected. Likewise, **Choudhary, Cheema, and Kaur (2020)** show that half of the nurses surveyed reported that educational needs were of significant risk, and nearly a third of them reported educational needs for storage and

collection. This is because nearly three-quarters of nurses haven't received training about blood transfusion.

According to nurses 'knowledge about blood bag collection from blood bank and previous patient preparation, this study revealed that > 50% of nurses had correct answers about the need for transfusion must checking the availability and patency of an IV line. On the contrary, **Jones (2018)** explained that nurses must verify that a patient has access to the IV patent. In addition to **Demiraǧ & Hintistan (2020)** clarified that the majority of nurses knew the establishment of vascular access before transfusion. Nurses' knowledge is related to the usual practice in procedure.

Additionally, > 50% of nurses had correct answers concerning checking patients' identification information and being matching on blood bag label and blood request form, then proceed to blood collection. On the same line, **Ajmani, (2020)** who nurses must check patient's last, first, and middle name, medical record number with check digits (8 digits), clinic or ward number, ordering physician's last and first name, ID code number, and type of blood component requirement. It is related to health system rules of patient safety.

Nearly all of the studied nurses had a correct answer about the way of blood bag transportation way from the blood bank, Which explained by **Yoshida, Prudent& D'Alessandro (2019)** who clarified that blood is fragile and components must be handled with due care; mechanical trauma is detrimental to their viability and functionality and rough handling might damage the collection bag.

As regards nurses' knowledge of nursing responsibilities before initiating transfusion, nearly all of the nurses reported satisfactory knowledge about checking of patient data, patient identification, and confirmation of patient vital signs consisting of **Chou et al., (2019)** who articulated the need to implement standardized techniques throughout transfusion, including patient's identification, blood management, and patient's monitoring.

Transfusion of an incorrect blood component is an important avoidable serious hazard of transfusion resulting from process errors. Correct identification of the patient is crucial at the time of blood sampling, and at the time of transfusion (**Bolton-Maggs, Watt, 2020**), so the majority of studied nurses realized that and answered correctly patient identification question

Regarding knowing the issues that must be reported to the patient before each blood transfusion, this work showed that most of the nurses had a correct answer about explaining the reasons for blood transfusion to the patient, and > 50% of nurses had a correct answer regarding the risk of a blood transfusion, and more than two-thirds of the nurses had a correct answer on explaining the symptoms of the reaction. On the other hand, **Shakur and Salih (2020)** stated that more than two-thirds of the nurses provide incorrect answers about three aspects of the information provided to patients (causes and risk of transfusion as well as symptoms of reaction).

While two-thirds of the studied nurses reported that the maximum time thee blood could be out of the fridge prior to transfusion initiation is about 30 min, **Louw et al., (2020)** reported that slightly more than a quarter of the nurses knew that RBCs might be removed from the cold chain for a maximum of 30 minutes prior to transfusion beginning. This point was usually mentioned in the nursing curriculum.

Additionally, the current study demonstrated that only about half of the nurses knew an appropriate size for a blood transfusion set. This corresponds to **Shakur and Salih, (2020)** as only about a quarter of the nurses knew an appropriate size for a transfusion set. Whereas **Whitman, Osborne, & NL2012, (2019)** insisted that blood components should be transfused via sterile pyrogen-free administration with a 170-260 μm filter.

Also, the majority of the study nurses knew that normal 0.9% saline was safely mixed with the packed red blood cell transfusion. This corresponds to **Winkler, (2021)** who stated that no drugs other than 0.9% NaCl have to be administered through the same tube at the same time. Severe reactions are likely to happen in the first 15 min/50mls of each unit and the patient must be carefully observed. Vital signs must be assessed and recorded prior to transfusion and when transfusion is complete (**Suddock, Crookston, 2019**). This is realized by more than three a quarter of studied nurses. Which was mentioned before in their educational curriculum.

Regarding knowledge of the studied nurses about Complications related to blood transfusion, this study found that 50% of nurses had a correct answer about signs and symptoms that point to the patient had an acute hemolytic transfusion reaction. In contrast, **Encan, & Akin, (2019)** found that nearly a quarter of nurses knew signs of blood transfusion reactions. Also, **Ibrahim, (2016)** reported that only 4%, 13% of nurses knew that hypotension, dyspnea are signs of blood transfusion reaction respectively.

Additionally, the literature supports that if a transfusion reaction is suspected, transfusion must be stopped, patency of intravenous line maintained, and health-care provider informed (**Kleinman, McDaniel, & Molloy, 2021**). This was recognized by the majority of the nurses surveyed, who responded by stopping the transfusion as soon as signs of a reaction appeared.

The present study revealed that the majority of nurses knew that Hepatitis B is a disease which could occur after transfusion, and nearly half of them mentioned that the Herpes virus and malaria are other diseases. While **Nessa, Faruquee, Yasmin, & Ahmed, (2020)** reported that the majority and only 5% of nurses mentioned that HIV and Hepatitis B are diseases that spread through blood respectively.

Regarding overall nurses' knowledge regarding transfusion, this study found to > 50% of nurses had unsatisfactory knowledge about blood bag collection from the blood bank and prior patient's preparation. While **Rudrappan, (2019)** found the majority of nurses had a score of ≥50% about prior patient preparation and time for cross-matching, cross-match test-taking least time, the storage temperature of the blood.

On completion, the current work clarified that two-third of nurses had insufficient knowledge about pre- post-transfusion initiation nursing responsibilities respectively. Which consistent with **Encan, & Akin, (2019)** who reported that nurses had a moderate knowledge level about transfusion and nursing interventions.

Additionally, the current study showed that nearly three-quarters of nurses had unsatisfactory knowledge of complications of transfusion. On the same line, **Saied, Galal, Abd-El Aziz & Al-Mezaien, (2016)** who revealed that most of nurses have insufficient knowledge concerning blood transfusion complication. Our study illustrated that most of nurses showed insufficient knowledge regarding total knowledge about blood transfusion. On the other hand, **Louw et al., (2020)** reported that more than the third quarter of nurses reported that their knowledge of blood transfusion was sufficient. While **Nessa, Faruquee, Yasmin, & Ahmed, (2020)** found that > 50% of nurses had moderate knowledge of transfusion. This is maybe due to insufficient training about blood transfusion.

Related to blood transfusion procedure performance, the current study illustrated that all nurses reported that obtain informed consent. On the other hand, **Bhombo et al., (2020)** mentioned that two-third of nurses had not consent before

blood transfusion. Furthermore, the current study revealed that all nurses verified the physician's order, noting the indication, infusion rate & any pre-medication orders. On the same line, **Nemati et al., (2019)** reported that all nurses control blood product specifications with physicians and blood application forms.

Additionally, only a quarter of studied nurses rechecked physician orders before transfusion. In contrast **Sayed, (2018)** revealed that the majority of nurses rechecked physician orders before transfusion. The current study illustrated that nearly all nurses obtained blood product from blood bank in accordance with agency policy. That is in agreement with **Sefatbaqa, JafarianAmiri, Zabihi, Pourdad, & Arzani, (2020)** who showed that most of nurses carried blood components from blood bank to the ward by the box Specific. This may be contributed to the general policy of health facilities toward blood transfusion precautions.

Moreover, none of the nurses documented birth date and time of transfusion beginning on blood bank form. While **Shakor, & Salih, (2020)** who reported that two-third of nurses documented of patient's name which matched cross-match results and other record sheets (Blood bag number. Date. Group).

According to **Stein, & Hollen, (2020)**, the nurse must have the patient's full name and birth date to compare them to that on blood bank form to prevent mistakes in blood transfusion. On the other hand, the current study revealed that none of the studied nurses performed this step.

Regarding initiation of blood transfusion procedure performance, all studied nurses obtained and recorded the patient's vital signs, such as temperature, prior to transfusion initiation. It is consistent with **Shakor, & Salih, (2020)** who reported that more than two-thirds of nurses took a baseline vital signs (heart rate, respiratory rate, blood pressure and temperature). It is about hospital policy during a blood transfusion.

Moreover, about one-fourth of studied nurses obtained vital signs in 15 min, then again in 30 min. It is consistent with **Sayed, (2018)** who reported that two-third of nurses remained with the patient during the first 5 min to 30 min and then obtained vital signs. It is about hospital policy during a blood transfusion.

Also, the majority of studied nurses hanged the normal saline solution container on the IV pole. While, **Sefatbaqa, JafarianAmiri, Zabihi, Pourdad, & Arzani, (2020)** reported that three-

quarters of nurses performed venous line washing using saline. Regarding nurses' performance average score, the total performance score ranged from 31 to 51 with an average of 44.86 ±5.33. It is consistent with **Elewa, & Elkattan, (2017)** who reported that the total nurses' performance score with an average of 36.67 ±13.66.

In this study, more than two-third of studied nurses had satisfactory performance. On the other hand, **Choudhary, Cheema, & Kaur, (2020)** reported that nearly half of nurses had a poor practice of blood transfusion. Completing the current study showed that there was a significant positive correlation between total knowledge and overall performance score of blood transfusion. On the same line, **Nemati et al., (2019)** reported there was an association between the performance and knowledge of blood transfusion (P<0.05). While Rudrappan, (2019) clarified that there was a negative association between knowledge and practices of nurses about blood transfusion.

The current study also showed that nurses employed in hepatology and endocrinology departments had significantly higher average knowledge and performance scores. Male nurses scored substantially higher on knowledge and marginally higher on performance. Age of nurses did not significantly affect knowledge and performance scores. Although the nurses who had previously had blood transfusion training had higher average knowledge and performance scores, the difference was not statistically significant. In contrast to that, **Vaghar, (2018)** who discovered there was no statistically significant association between nurses' mean performance scores and gender. There was no significant relationship between nurses' knowledge score and their age, gender, level of experience, or hospital department.. Also **Kafl, & El-Shahat, (2020)** illustrated a significant statistical association between overall knowledge and practice of the studied nurses and their characteristics (age, educational level, experience years & previous training) about blood transfusion.

6. Conclusion

According to the findings of the present study, it could be concluded that there was a significant deficit of knowledge and a satisfied level of practice regarding the blood transfusion among the studied nurses. In addition, there is a positive association between nurses 'level of knowledge and their level of practice regarding the blood transfusion.

7.. Recommendations

This study revealed knowledge deficit and satisfied level of practice so nurses and the hospital should struggle to improve the quality and safety of blood transfusion because it is a potentially hazardous procedure and this will be maintained through:

1. Establishing an educational booklet containing all necessary information about blood transfusion.
2. All nurses should receive a training program in blood transfusion.
3. Statement of hospital blood transfusion policy.

8. References

Ajmani, P. S. (2020). Blood Bank Protocols. In Immunohematology and Blood banking (pp. 157-167). Springer, Singapore.

Akyol, A. (2019). Assessing Knowledge of Nurses on Blood Transfusion in Turkey. International Journal of Caring Sciences, 12(1), 521-528.

Aulbach, R. K. (2013). *Nurses' practices with blood transfusions in medical-surgical patient care units of acute care US hospitals the state of the science* (Doctoral dissertation, Texas Woman s University).

Bediako, A. A., Ofosu-Poku, R., & Druye, A. A. (2021). Safe Blood Transfusion Practices among Nurses in a Major Referral Center in Ghana. *Advances in Hematology, 2021.*

Bhombo, A. J., Mwashiuya, O., Mauka, W. I., Meda, E., Ngerageza, I., Furia, F. F., & Lyimo, M. A. (2020). Impact of Training to Improve Knowledge on Blood Transfusion among Health Care Providers from Tertiary Hospitals in Tanzania. Tanzania Medical Journal, 31(2), 59-69.

Bolton-Maggs, P. H., & Watt, A. (2020). Transfusion errors—can they be eliminated?.

Chou, S. S., Chen, Y. J., Shen, Y. T., Yen, H. F., & Kuo, S. C. (2019). Implementation and Effectiveness of a Bar Code–Based Transfusion Management System for Transfusion Safety in a Tertiary Hospital: Retrospective Quality Improvement Study. JMIR medical informatics, 7(3), e14192.

Choudhary, N., Cheema, P. K., & Kaur, J. (2020). EFFECTIVENESS OF A STRUCTURED TEACHING PROGRAM FOR STAFF NURSES ON KNOWLEDGE AND PRACTICE REGARDING BLOOD TRANSFUSION. i-Manager's Journal on Nursing, 10(1), 22.

Demirağ, H., & Hintistan, S. (2020). Knowing and Use Situations of Hemovigilance System in the Scope of Blood Transfusion Safety of Nurses: Rural Example.

Elewa, A., & Elkattan, B. (2017). Effect of an educational program on improving quality of nursing care of patients with thalassemia major as regards blood transfusion. American Journal of Nursing Research, 5(1), 13-21.

Encan, B., & Akin, S. (2019). Knowledge of blood transfusion among nurses. *The Journal of*

Fergusson ,DA.(2016). Oxford's Systematic Review Initiative: leading by example in evidence-based transfusion medicine. Transfus Med.;26(6):397-400. doi: 10.1111/tme.12361 pmid: 27873379

Hijji, B. M., Oweis, A. E., & Dabbour, R. S. (2012). Measuring knowledge of blood transfusion: A survey of Jordanian nurses. *Am Int J Contemp Res*, 2(10), 77-94.

Ibrahim, H. (2016). Assessment of Nurses Knowledge about Blood Transfusion Reactions at Elmak Nimer University 2016 (Doctoral dissertation, Shendi University).

Jones, A. (2018). Safe transfusion of blood components. Nursing Standard (2014+), 32(25), 50.

Kafl, R. H., & El-Shahat, H. T. M.(2020). Effect of an Educational program on Nursing Care Practices regarding Pediatric Transfusion-Dependent β-Thalassemia Major.

Kaplan, A. (2021). 5 Preparation, Storage, and Characteristics of Whole Blood, Blood Components, and Plasma Derivatives. *Transfusion Medicine*, 59.

Kleinman, K., McDaniel, L., & Molloy, M. (2021). The Harriet Lane Handbook: South Asia Edition-E-Book. Elsevier Health Sciences.

Louw, L. D., Grobbelaar, J., Henn, L., van Zyl, L., Wernich, C., Wessels, P. L., ... & Barrett, C. (2020). Management of blood products: Nursing knowledge and practices at an academic hospital. Transfusion and Apheresis Science, 102971.

Nemati, F., Maali, A., Ahmadi, M. H., Poorkarim, H., Rahmani, H., Tabatabaei, Z. S., & Azad, M. (2019). The Study of Nurses Knowledge and Performance Quality of Qazvin Hospitals about the Process of Blood Transfusion. Advances in Nursing & Midwifery, 28(2), 14-18.

Nessa, S., Faruquee, M. H., Yasmin, N., & Ahmed, M. (2020). Knowledge on safe blood transfusion practice of senior staff nurses working in tertiary hospital. Asian Journal of Medical and Biological Research, 6(3), 587-593.

Nunes da Silva, K. F., Dagma Duarte, R., Floriano, D. R., Foroni Andrade, L., Lumênia Tavares, J., dos Santos Felix, M. M., ... & Barbosa, M. H. (2017). Blood transfusion in Intensive Care Units: knowledge of the nursing team. Avances en Enfermería, 35(3), 313-323.

Panchawagh, S. J., Melinkeri, S., & Panchawagh, M. J. (2020). Assessment of Knowledge and Practice of Blood Transfusion Among Nurses in a Tertiary Care Hospital in India. Indian Journal of Hematology and Blood Transfusion, 36(2), 393-398.

Rajki, V., Csóka, M., Deutsch, T., & Mészáros, J. (2015). Reliability and validity of a new questionnaire for the assessment of nursing skills and knowledge in relation to transfusion therapy. *New Medicine*.

Rudrappan, R. B. (2019). Evaluating the knowledge and practices of nurses and paramedics in blood transfusion services–A survey in the states of Tamil Nadu and Pondicherry, India. Journal of education and health promotion, 8.

Saied, M., Galal Abd-El Razik, B., Abd-El Aziz Mohamed, M., & Al-Mezaien, M. (2016). Nurses' Performance Regarding Caring of Patients Undergoing Blood Transfusion. Port Said Scientific Journal of Nursing, 3(2), 166-182.

Saif Al-Nasr, M., Abd-El Razik, B., Mohamed, M., & Al-Mezaien, M. (2016). Nurses' Performance Regarding Caring of Patients Undergoing Blood Transfusion. *Port Said Scientific Journal of Nursing*, *3*(2), 166-182.

Sayed, M. M. (2018). Auditing and Re-auditing Nursing Care for Children Receiving Blood Transfusion. Assiut Scientific Nursing Journal, 6(15), 179-192.

Sefatbaqa, S., JafarianAmiri, S. R., Zabihi, A., Pourdad, P., & Arzani, A. (2020). Performance of Nurses in Neonatal Intensive Care Unit Regarding Transfusion of Blood and Blood Products. Evidence Based Care, 10(3), 7-14.

Shakor, S. Q., & Salih, H. S. (2020). Blood Transfusion Knowledge And Practices Among Nurses In Kirkuk City Hospitals. Mosul Journal Of Nursing, 8(1), 14-24.

Stein, L., & Hollen, C. J. (2020). Concept-Based Clinical Nursing Skills E-Book: Fundamental to Advanced. Elsevier Health Sciences.

Stubbs, J., Klompas, A., & Thalji, L. (2021). Transfusion Therapy in Specific Clinical Situations. *Transfusion Medicine*, 257-324.

Suddock, J. T., & Crookston, K. P. (2019). Transfusion reactions. StatPearls [Internet].

Tancred, T., & Bates, I. (2019). Improving blood transfusion services. *Best Practice & Research Clinical Obstetrics & Gynaecology*, *61*, 130-142.

Vaghar, M. I. (2018). The impact of an educational program on blood and blood products transfusion on nurses 'level of knowledge and performance. Journal of medicine and life, 11(3), 238.

Wilkinson, J. M., & Van Leuven, K. (2007). Fundamentals of Nursing: Theory, Concepts, & Applications, vol. 2. FA Davis, Philadelphia, Pa, USA.

Whitman, L., Osborne, D., & NL2012, T. (2019). Transfusion Of Blood Components and Administration of Blood Products.

Winkler, A. M. (2021). Red Blood Cell Transfusion. In Trauma Induced Coagulopathy (pp. 335-351). Springer, Cham.

Yoshida, T., Prudent, M., & D'Alessandro, A. (2019). Red blood cell storage lesion: causes and potential clinical consequences. Blood Transfusion, 17(1), 27.