

Effect of Nursing Care Protocol on Nurses' Competency regards Children with Thalassemia

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Abstract: Thalassemia is estimated to affect one thousand children out of every 1.5 million live births in Egypt. **Aim:** This study aimed to evaluate the effect of nursing care protocol on nurses' knowledge and practice provided to children with thalassemia. **Design:** A quasi-experimental (pre, post, and follow-up test) was used. **Setting:** This study was conducted in Pediatric Department at El Menoufia University Hospital, Egypt. **Sample:** A purposive 35 pediatric nurses providing care to children with thalassemia. **Instruments:** A structured interview questionnaire to assess nurses' knowledge about thalassemia and an observational checklist to assess nurses' practice provided to children with thalassemia. **Results:** A highly statistically significant difference was found between pre and post-tests and between post and follow-up tests. It noted that none of the studied nurses had competent nursing practice on the pre-test. Meanwhile, all of them (100%) had competent nursing practice on post-test. Also, a highly statistically significant positive correlation between total knowledge and total practice score. **Conclusion:** Nurses who received nursing care protocol had a higher level of knowledge and practice on post and follow-up tests compared to the pre-test. **Recommendations:** Continuous training program for developing nurses' knowledge and practices regarding nursing care protocol of thalassemia.

Keywords: Nursing care, Protocol, Competency of care, Children, Thalassemia.

1. INTRODUCTION

In the Mediterranean, thalassemia is a major public health concern. As a result of the aforementioned circumstances, thalassemic children experience a variety of psychosocial challenges (OZ & Tarm, 2022). It's a type of inherited anemia marked by a decrease in globin chain synthesis. Around 4.4 out of every 10,000 live neonates in the world are affected. The treatment includes a regular transfusion schedule as well as chelating therapy to reduce transfusion iron excess. Normal growth and development are allowed, extending life expectancy into the third to fifth decades (Andriani et al., 2022).

The most frequent and severe form of thalassemia is beta-thalassemia, often known as thalassemia major or Cooley's anemia. It has a major impact on the lives of millions of youngsters in poor nations. Thalassemia was identified in 4.4 out of every 10,000 live births in the United States. One in every 272, 000 live births was recorded (United States of America, 2015). Thalassemia affects one thousand children out of every 1.5 million live births in Egypt, according to estimates. In Egypt, the carrier rate is believed to be between 9% and 10% of the population (El- Shanshory et al., 2021).

Thalassemia is a life-threatening blood disorder that can be fatal if not treated properly. Most thalassemic children appear healthy at birth, but they quickly become pale, listless, and irritable, with a poor appetite (Chiew et al., 2021). They are frequently affected by jaundice (yellowing of the eye and skin mucous membranes) and grow slowly. An excess of iron is the most common cause of thalassemia complications, which can affect a variety of organs. Diabetes, puberty delays, heart failure, liver illnesses, endocrine issues, and the risk of contracting blood-borne infections such as Hepatitis C and the Human Immunodeficiency Virus, as well as mortality, are all risks (Elsoudy et al., 2022).

Despite advancements in thalassemia major treatment, the cardiovascular illness remains the leading cause of mortality among thalassemia children. Symptoms of the thalassemia-related cardiac illness include myocardial dysfunction, arrhythmias, and atrial fibrillation. Endocrine disorders and reduced endocrine function are caused by iron accumulation in the gland. Short stature is the most prevalent symptom, followed by puberty difficulties, thyroid issues, and diabetes (Robinson & Watson, 2021).

Children with thalassemia should get supportive nursing care. A thalassemia child's nursing assessment should contain the following items (Aldoori et al., 2020): Anemia, splenomegaly, or hepatomegaly with belly expansion, recurrent infections, bleeding tendencies such as epistaxis, and anorexia are all things to look out for in thalassemia major youngsters. Anemia, jaundice, splenomegaly, and hemosiderosis, which are caused by increased iron absorption in the intestine, should all be examined in children with thalassemia intermediate. Children with thalassemia minor were tested for mild anemia since they had no symptoms or warning indications (Belleza, 2021).

Pediatric nurses receive both practical and theoretical training to equip them for their responsibilities in educational nursing as nursing experts. They must be aware of their responsibilities in terms of the quality of care offered to children, as well as the institution, ethics, and laws (Abolwafa, 2019). Nurses must participate in a lot of ongoing training in order to keep up with changing children's requirements and new advancements in the treatment. Nurses' education never ends because they must learn new skills and concepts on a regular basis throughout their employment (Chiew et al., 2021). Nurses are also vital in maintaining a child's quality of care by minimizing needless difficulties and providing therapy that does not conflict with a patient's education or work obligations (Azize et al., 2015).

Nursing care is of high quality because it guarantees that the right processes are followed, which leads to better results for patients, their families, and communities. Quality standards could include structure, approach, or outcome. It's the optimum mix of realized potential and a set of values and standards. Nurse staffing is a critical component in improving patient care and avoiding problems. The quality of nursing care has a significant impact on the results and safety of patients (Zaghamir et al., 2019).

Operational Definitions

-**Nursing protocol:** means written instructions that guide and educate nurses in evaluating patients' health status and providing Clinical interventions (Lockhart, 2020).

-**Nursing competency:** describes the ability to integrate knowledge, experience, clinical reasoning, sound clinical judgment, skills, beliefs, and values, to fulfill the demands of patients (Fukada, 2018).

-**Thalassemia:** is a heterogeneous group of blood disorders affecting the hemoglobin genes and resulting in decreased synthesis of alpha or beta chains of hemoglobin (Bajwa, 2022).

Aim of the study

The aim of this study was:

- To evaluate the effect of nursing care protocol on nurses' knowledge and practice provided to children with thalassemia.

Research hypothesis

- Nurses who receive nursing care protocol education will have a higher level of knowledge about thalassemia on post-test than on pre-test.
- Nurses who receive nursing care protocol training will have a more competent nursing practice delivered to children with thalassemia on post-test than on pre-test.

2. SUBJECT AND METHOD

Research Design: A quasi-experimental (pre, post, and follow-up test) was utilized.

Research Setting: The study was conducted in the Pediatric Department at El Menoufia University Hospital, Egypt.

Sample: A purposive sample of 35 pediatric nurses providing nursing care to thalassemic children in the previously mentioned setting.

Instruments

Two instruments were utilized to accomplish the current study's aims.

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Instrument one: A structured interview questionnaire sheet was developed by researchers guided by Hashem, (2006) to assess nurses' knowledge about thalassemia. It consisted of two parts:-

Part 1: Characteristics of the studied nurses such as age, level of education, years of experience, and previous training.

Part 2: Nurses' knowledge about thalassemia which is divided into fifth subparts:

First: It included multiple-choice questions about the definition of thalassemia, types, clinical manifestation, sex, and hemoglobin level.

Second: It comprised multiple-choice questions about the management of thalassemia, new trends, warning signs, complications, and nurses' rules.

Third: It involved multiple-choice questions about the purpose of desferal, methods of injection, precaution, side effects, frequency of administration, and iron exertion.

Fourth: It included multiple-choice questions about investigations.

Fifth: It comprised multiple-choice questions about blood transfusions, child weight, precautions, blood reactions, and its management.

Scoring system for knowledge

The scoring system included one score for correct answers and zero for the wrong answer.

Total scoring system for knowledge

- High knowledge scored $\geq 75\%$ of the total score.
- Fair knowledge scored from 50- 74% of the total score.
- Poor knowledge less than $\leq 50\%$ of the total score.

Instrument two: An Observational checklist to assess nurses' practices provided to thalassemic children. It was adapted from Kulger, (2008).

It was divided into three main parts:

- **Part 1:** Nursing care provided before blood transfusion, it included assessment of growth & development and vital signs.
- **Part 2:** Nursing care provided during blood transfusion
- **Part 3:** Nursing care provided after blood transfusions such as assessment of vital signs, observation of iron chelation side effects, and health education.

Scoring system for practices observation:-

Each step of the observational checklist was scored as the following: (2) for adequately done, (1) for inadequately done, and (0) for not done.

The total practice score was categorized as the following:

- Competent practice $\geq 80\%$ of the total score.
- Incompetent practice less than 80% of the total score.

Validity:

Instruments were presented to a jury of five experts for validity assurance (two professors and one assistant professor in Pediatric Nursing and one professor and another assistant professor in Pediatric Medicine). To assess the correctness of the content and make any necessary changes to the instruments. All of the necessary changes were made.

Reliability

The instrument's reliability was determined using the test-retest procedure among five subjects separated by two weeks. This was done to determine the degree to which various instruments were related to one another. Cronbach's alpha was calculated using the two scores. It was 0.78, showing that the instruments were sufficiently dependable to meet the study's objectives.

Consideration of Ethics

- The Scientific Ethical Committee of Menoufia University's Faculty of Nursing provided official ethical approval.
- After the researchers explained the study's purposes, nature, and benefits, as well as their right to withdraw at any time, nurses granted verbal and written agreement. Nurses in the study were told that their data would be kept private and that their identities would be respected.
- Nurses completed questionnaires or were interviewed, and they indicated that the questionnaire's content did not affect them physically or emotionally.

Pilot study

- The pilot study was done on five nurses to assess the clarity, feasibility, practicability, and consistency of the utilized instruments after they were developed and before data collection began, as well as to estimate the time required for data collection. The pilot study was included in the full sample because no instrument modifications were required.

Procedure:

- **Written permission:** The director of the previously stated hospital granted official permission to conduct the study after receiving an official letter from the Dean of the Faculty of Nursing, Menoufia University outlining the purpose of the study and the method of collecting data. The researchers introduced themselves to the nurses who would be participating in the study and discussed the goal and outcomes of the study at the beginning.
- **Data collection instruments** were created after a review of previous, current, local, and international related literature, including books, articles, periodicals, and magazines, in order to become familiar with the many aspects of the research problem and gain the knowledgeability to carry out the study.
- **Creation of the nursing care protocol**, which began in English and was later, translated into Arabic.

The present study was conducted in four phases:

Data collection procedure: Data was collected for a period of 7 months starting from May to November 2021 in four phases:

A. Assessment phase (pre-test):

- A structured interviewing questionnaire was created. The researchers conducted individual interviews with each nurse to measure her expertise, and the questionnaire took the researchers 30 minutes to complete while the nurses were at work.
- At the start of the study (pre-test), the nurses' characteristics were assessed using **instrument one part 1**.
- **Part 2:** assessment of the nurse's knowledge & care of thalassemia.
- **Instrument two:** - An observational checklist for the assessment of nursing practice was utilized. It took 40 minutes to complete Instrument two.

B. Planning phase:

- The overall objectives of nursing care protocol were: to improve nursing knowledge and practice for children with thalassemia.
- Specific nursing care protocol's objectives: Define thalassemia, list causes, types, signs, and symptoms of each type, complications, and nursing care of thalassemia, demonstrate nursing care for children with thalassemia such as methods of treatments, warning signs for hospitalization, the new trend in management, complications, and nurse role.
- The numbers of studied nurses were 35, and were divided into seven groups; each group consists of 5 nurses, to ensure continuity of children care, and proper acquisition of knowledge.
- The time required for the nursing care protocol implementation was 3 months.
- Each group take 4 sessions, duration of each session was 30 minutes, in addition, there were 15-25 minutes to discuss any questions and regain feedback.

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- The researchers met nurses three days weekly for seven months at morning and afternoon shifts and gave two sessions per week for each group.
- The content of the nursing care protocol booklet was provided to nurses. After an explanation of the content of the clinical practice guideline, nurses were given copies of the booklet and the researchers discussed any questions with them
- The time required for the pre-test test was 2 months.

C. Implementation phase:

The nursing care protocol was implemented in three sessions for nurses who learned about thalassemia and how to care for children. Nurses were taught the following knowledge and techniques, which were guided by a nursing care protocol:

- **Theoretical contents:** For theoretical content, two teaching sessions were conducted; the session took 30 minutes
 - **First session:** Definition of thalassemia, causes, types, sign and symptoms, complications, and management of thalassemia, required investigations for thalassemic children.
 - **Second session:** Indications for blood transfusion, complications of iron overload, vital signs during blood transfusion, precautions before, during & after blood transfusion, and blood reactions
 - The researchers continued to reinforce the gained information answer any raised questions, and gave feedback
 - Communication channel was kept open between the researchers, and the nurses.
- **Practical contents,** two training sessions were held; each session lasted 25 minutes, and each nurse was observed before providing any information (pre-test) using the observational checklist in relation to practices provided to children with thalassemia. Then, in a short session of roughly 20 minutes, practical knowledge was presented. Two sessions for nurses' practice relevant to thalassemia nursing care were taught. Methods of treatments, the new trend in management, warning signs for child hospitalization, and nurse's role regards desferal administration.
- Nurses' practices provided to thalassemic children before, during, and after blood transfusion,
- The researchers used discussion, diagrams, posters, feedback questions & teaching aids such as booklets, brochures, and self-learning packages to illustrate the contents of the nursing care protocol for all sessions.

D. Evaluation phase:

Following the completion of the nursing care protocol, an evaluation was conducted. This phase included an immediate assessment of the effect of a nursing care protocol on nurses' knowledge & practices offered to thalassemic children. The post-test was used to analyze the outcomes after the nursing care protocol was completed using the same pre-test instruments. Nurses' knowledge and practices were reevaluated immediately nursing care protocol was completed.

E. Follow-up phase

The researchers used the same instruments used in the pre and post-tests to evaluate the effect of a nursing care protocol on nurses' knowledge & practices offered to thalassemic children in a follow-up test to measure care continuity two months after giving the nursing care protocol.

Statistical Analysis:

- Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package 22 version on IBM compatible computer. Graphics were done using the Excel program.
- **The mean (X) and standard deviation (SD)** was used to depict quantitative data (SD). For comparisons between two means, the student t-test was used, and for comparisons between more than two means, the ANOVA (F) test was used. Measures that are repeated The ANOVA test of significance for repeated measures was used to compare mean scores pre, post, and follow-up tests.
- Frequency distribution charts, numbers, and percentages were used to display qualitative data. The chi-square (2) test was used to examine it. If the predicted value of any cell in the table was less than 5, the table was considered invalid. For

comparison of (knowledge and practice levels) between the three-time periods of intervention among nurses participating in the study, a repeated Friedman test (a sort of Chi-square test for repeated procedures for qualitative data) was used.

- **Level of significance** was set as P-Value
- <0.05 for all significant tests regarding:
- P-Value > 0.05 : not statistically insignificant.
- P-Value ≤ 0.05 : statistically significant
- P-Value ≤ 0.001 : highly statistical significance.

3. RESULTS

Table 1: Showed distribution of studied nurses according to their characteristics, it found that the mean and standard deviation of nurse's age was (27.91 ± 4.21) . Also, more than half of them (58.6%) had technical nursing institutes. Concerning the years of experience, it was clear that 44.2% of nurses experienced in pediatric nursing from 3 to 5 years. Regards attendance of training programs, most of them (80%) didn't attend training programs regarding thalassemia.

Table 2: Clarified the distribution of nurses' knowledge about thalassemia on pre, post, and follow-up tests. As indicated in the table, all studied nurses (100%) had correct knowledge on post-test regarding definition, types, clinical manifestation, and association with gender. Furthermore, there were highly statistically significant differences between pre and posttest related to nurses' knowledge definition, types, clinical manifestation, association with gender, and hemoglobin value (P-value < 0.01).

Table 3: Illustrated distribution of nurses' knowledge about nursing care for thalassemic children on pre, post and follow-up tests. It noted that a highly statistically significant differences between pre and post-test as well as between post and follow-up tests according to nurses' knowledge about methods of treatments, the new trend in management, warning signs for hospitalization, complications, and nurse role (P-value < 0.01).

Table 4: Showed distribution of nurses' knowledge about desferal administration for thalassemic children on pre, post, and follow-up tests, it clarified that there were statistically significant differences between pre and post nurses' knowledge about desferal administration for thalassemic children. Also, all the studied nurses (100%) had correct knowledge about methods of desferal administration and its utilization on post-test. As well as, approximately all of them (98.6%) had correct knowledge about desferal side effects and times for administration /week in post-test too.

Table 5: Represented the distribution of nurses' knowledge about required investigations for thalassemic children on pre, post, and follow-up tests. It showed that the majority of the studied nurses (91.4%) had correct knowledge about the required investigation needed / 3 months on pre-test compared to a hundred percent on post-test. Meanwhile, more than three-quarters of them (80%) had correct knowledge on the pre-test about the required investigation/year.

Table (6): Illustrated the total mean score and standard deviation of nurses' knowledge about thalassemia, desferal administration & nursing care for thalassemic children, on pre, post, and follow-up tests. It clarified that highly statistically significant differences were found between the total mean score and standard deviation of nurses' knowledge about thalassemia, desferal administration & nursing care for thalassemic children, between pre and post-tests (P-value < 0.01). Also, a highly statistical significant difference was found between the total mean score and standard deviation of nurses' knowledge about thalassemia, desferal administration & nursing care for thalassemic children, between post, and follow-up tests as P-value < 0.01 .

Table (7): Showed the distribution of nurses' knowledge about nursing care for blood transfusion on pre, post and follow up tests. It cleared a highly statistically significant difference were between pre and post-tests regards all items of nursing care for blood transfusion

Table (8): Represented the distribution of nurses' knowledge about reactions to blood transfusion for thalassemic children on pre, post, and follow-up tests. It noted that nurses had correct knowledge scores on the post-test. Also, a highly statistically significant difference was between pre and post-tests and between post, and follow-up tests.

Table (9): Showed levels of total nurses' knowledge scores on pre, post, and follow-up tests, it showed that nurses had high knowledge scores on the post-test. Also, highly statistically significant difference was found between pre and post-test and between post and follow-up test.

Table (10): Illustrated distribution of nurses’ practice provided to thalassemic children before blood transfusion on pre, post, and follow-up test. It illustrated a highly statistically significant difference between nursing practices on pre and post-test and between post and follow-up test.

Table (11): Showed distribution of nurses’ practices provided to thalassemic children during blood transfusion on pre, post, and follow-up tests. It illustrated a highly statistically significant difference between nursing practices on pre and post-tests and between post and follow-up tests. Furthermore, it showed that nurses had the highest scores of adequate nursing practices on post-test than on pre and follow-up tests.

Figure (1): Clarified levels of nurses' practice of blood transfusion procedure on pre, post, and follow-up tests. It noted that none of studied nurses had competent nursing practice on the pre-test. Meanwhile all of them (100%) had competent nursing practice on the post-test. In follow-up test it cleared that about one-third of them (31.4%) had incompetent nursing practice

Figure (2): Showed Pearson correlation between total score of nurses' knowledge and total score of nurses' practices there was a highly statistically significant positive correlation between the total knowledge, total practice score as P-value (<0.01).

Table (1): Distribution of the studied nurses according to their characteristics (No=35).

Items	No	%
Age in years		
Mean ± SD	27.91±4.21	
Qualification		
• Bachelor of Nursing	13	37.1
• Technical Nursing Institute	29	58.6
• Nursing Diploma	3	4.3
Years of experience in pediatric nursing		
• Less than two years	19	38.6
• From 3 to less than 5 years old	15	44.2
• From 5 to less than 7 years	3	8.6
• 7 years and over	3	8.6
Training attendance		
• Yes	7	20.0
• No	28	80.0

Table (2): Distribution of nurses' knowledge about thalassemia on pre, post and follow-up tests (No= 35).

Items	Pre-test		Post-test		X ¹ / P ¹ -value	Follow-up test		X ² / P ² -value
	No	%	No	%		No	%	
1-Definition								
Incorrect	10	28.6	1	1.4	18.90 .000*	4	11.4	5.81 .016*
Correct	25	71.4	34	98.6		31	88.6	
2-Types								
Incorrect	16	45.7	0	0.0	41.48 .000*	1	2.8	2.02 .154 ^{ns}
Correct	19	54.3	35	100		34	97.2	
3- Clinical manifestation								
Incorrect	25	71.4	0	0.0	80.22 .000*	1	2.8	2.02 .154 ^{ns}
Correct	10	28.6	35	100		34	97.2	
4- Association with gender								
Incorrect	25	71.4	0	0.0	82.72 .000*	1	2.8	2.02 .154 ^{ns}
Correct	10	28.6	35	100		34	97.2	
Hemoglobin value								
Incorrect	28	80.0	7	20.0	29.86 .000*	8	22.9	2.24 .134 ^{ns}
Correct	7	20.0	28	80.0		27	77.1	

P¹: between pre and post –tests

P²: between post and follow-up-tests

* P≤.05 : statistically significance

^{ns} means not significant

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Table (3): Distribution of nurses' knowledge about nursing care for thalassemic children on pre, post, and follow-up test (No= 35).

Nurses' Knowledge	Pre-test		Post-test		X ¹ / P ¹ -value	Follow-up Test		X ² / P ² -value
	No	%	No	%		No	%	
Methods of treatments								
Incorrect	11	31.4	1	2.8	68.13 .000*	19	54.3	45.36
Correct	24	68.5	34	97.2		16	45.7	.000*
New trend in management								
Incorrect	10	28.6	0	0.0	36.57 .000*	15	42.9	38.18**
Correct	25	71.4	35	100		20	57.1	.000*
Warning signs for child hospitalization								
Incorrect	23	65.7	0	0.0	68.51 .000*	17	48.5	46.66
Correct	12	34.3	35	100		18	51.5	.000*
Complications								
Incorrect	30	85.7	2	5.7	93.76 .000*	20	57.1	47.86
Correct	5	14.3	33	94.3		15	42.9	.000*
6- Nurse role								
Incorrect	33	94.3	2	5.7	102.94 .000*	18	51.4	46.75
Correct	2	5.7	33	94.3		17	48.6	.000*

P¹: between pre and post –test P²: between post and follow-up-test * P ≤ .05: statistically significance

Table (4): Distribution of nurses' knowledge about desferal administration for thalassemic children on pre, post and follow-up test (No= 35).

Nurses' Knowledge	Pre-test		Post-test		X ¹ / P ¹ -value	Follow-up Test		X ² / P ² -value
	No	%	No	%		No	%	
1 – Utilization of Desferal								
Incorrect	26	74.3	0	0.0	82.72 .000*	1	2.8	2.02
Correct	9	25.7	35	100		34	97.2	.154 ^{ns}
2- Methods of administration								
Incorrect	14	40.0	0	0.0	36.57 .000*	3	8.6	5.18
Correct	21	60.0	35	100		32	91.4	.023*
2- Methods of administration								
Incorrect	24	68.5	3	8.6	48.23 .000*	7	20	2.74
Correct	11	31.5	32	91.4		28	80	.098*
3- Precautions during administration								
Incorrect	27	77.1	2	5.7	73.59 .000*	9	25.7	9.46
Correct	8	22.9	33	94.3		26	74.3	.002*
4- Side effects								
Incorrect	22	62.9	1	2.8	60.55 .000*	2	5.7	2.78
Correct	13	37.1	34	97.2		33	94.3	.095*
5- Duration of administration								
Incorrect	28	80.0	5	14.3	63.23 .000*	11	31.4	6.70
Correct	7	20.0	30	85.7		24	68.6	.010*
6- Times for administration / week								
Incorrect	21	60.0	1	1.4	62.68 .000*	6	17.4	10.26
Correct	14	40.0	34	98.6		29	82.6	.001**
7- Iron excretion								
Incorrect	29	82.8	1	2.9	94.38 .000*	8	22.8	9.03
Correct	6	17.2	34	97.1		27	77.2	.003*

P¹: between pre and post –tests P²: between post and follow-up-test
 ** P ≤ .001: highly statistical significance * P ≤ .05 : statistically significance ^{ns} means not significant

Table (5): Distribution of nurses' knowledge about required investigations for thalassemic children on pre, post and follow-up test (No= 35).

Items	Pre-test		Post-test		X ¹ / P ¹ -value	Follow-up Test		X ² /P ² -value
	No	%	No	%		No	%	
- Required Investigation / Year								
Incorrect	7	20.0	1	2.8	29.86 .000*	8	22.9	2.24 .134 ^{ns}
Correct	28	80.0	34	97.2		27	77.1	
Required Investigation Needed / 3 Months								
Incorrect	3	8.6	0	0.0	6.26 .012*	15	42.9	38.18* .000*
Correct	32	91.4	35	100		20	57.1	

P1: between pre and post –tests

P2: between post and follow-up-tests

* P≤.05 : statistically significance

^{ns} means not significant

Table (6): Total mean score and standard deviation of nurses' knowledge about thalassemia, desferal administration, and nursing care for thalassemic children, on pre, post and follow-up test (No= 35).

Items	Pre-test X±SD	Post-test X±SD	Follow-up test X±SD	Anova test	P- value
Nurses' Knowledge about thalassemia	4.90 ±2.83	12.16 ± 1.67	11.24 ±1.52	248.331	.000*
Nurses' Knowledge about Desferal Administration	3.69 ± 3.21	6.48 ± 1.60	5.42 ± 5.40	195.164	.000*
Nurses' Knowledge about Nursing Care for thalassemic children	1.91 ±1.92	9.60±1.31	5.66 ±3.43	228.4	.000*
Total Score of Nurses' Knowledge	10.50 ±2.83	30.41 ± 2.32	22.32 ±5.79	303.962	.000*

Table (7): Distribution of nurses' knowledge about nursing care for blood transfusion on pre, post and follow -up tests (No=35).

Nurses' Knowledge	Pre-test		Post-test		X ¹ / P ¹ -value	Follow-up Test		X ² / P ² -value
	No	%	No	%		No	%	
Indication for blood transfusion								
Incorrect	14	40.0	0	0.0	36.57 .000*	15	42.8	38.18 .000*
Correct	21	60.0	35	100		20	57.2	
Complication								
Incorrect	23	65.7	0	0.0	68.51 .000*	17	48.5	46.66 .000*
Correct	12	34.3	35	100		18	51.5	
Complications of iron overload								
Incorrect	30	85.7	2	5.7	93.76 .000*	15	42.8	47.86 .000*
Correct	5	14.3	33	94.3		20	57.2	
Vital signs during blood transfusion								
Incorrect	32	91.4	2	5.8	102.94 .000*	21	60	46.75 .000*
Correct	3	8.6	33	94.2		14	40	
Precautions before blood transfusion								
Incorrect	34	97.2	4	11.4	106.85 .000*	23	65.7	48.23 .000*
Correct	1	2.8	31	88.6		12	34.3	
Precautions during blood transfusion								
Incorrect	32	91.4	5	14.3	83.93 .000*	21	60.0	30.87 .000*
Correct	3	8.6	30	85.7		14	40.0	
Precautions after blood transfusion								
Incorrect	34	97.2	1	2.8	128.28 .000*	13	37.2	25.71 .000*
Correct	1	2.8	34	97.2		22	62.8	

P¹: between pre and post –tests

P²: between post and follow-up-tests

* P≤.05 : statistically significance

^{ns} means not significant

Table (8): Distribution of nurses' knowledge about reactions of blood transfusion for thalassemic children on pre, post and follow up tests (No= 35).

Items	Pre-test		Post-test		X ¹ / P ¹ -value	Follow-up test		X ² / P ² -value
	No	%	No	%		No	%	
1- Blood reactions								
Incorrect	24	68.5	0	0.0	80.22 .000*	1	2.8	2.02
Correct	11	31.5	35	100		34	97.2	.154 ^{ns}
2-Clinical manifestations of incompatibility								
Incorrect	26	74.3	0	0.0	82.72 .000*	1	2.8	2.02
Correct	9	25.7	35	100		34	97.2	.154 ^{ns}
3-Nurses role during chills & hyperthermia								
Incorrect	14	40.0	0	0.0	36.57 .000*	2	5.7	5.18
Correct	21	60.0	35	100		32	91.3	.023*
4- Nurses role during incompatibility								
Incorrect	28	80.0	3	8.6	48.23 .000*	7	20.0	2.74
Correct	7	20.0	32	91.4		28	80.0	.098*
5- Nurses role during Fever								
Incorrect	27	77.1	2	5.7	73.59 .000*	8	22.9	9.46
Correct	8	22.9	33	94.3		27	77.1	.002*
6- Nurses role during Infection								
Incorrect	22	62.9	1	2.9	60.56 .000*	3	8.6	2.78
Correct	13	37.1	34	97.1		32	91.4	.095*
7- Nurses role during Hypocalcaemia								
Incorrect	21	60.0	5	14.3	63.23 .000*	12	34.3	6.70
Correct	14	40.0	30	85.7		23	65.7	.010*

P¹: between pre and post –tests

P²: between post and follow-up-tests

* P≤.05 : statistically significance

^{ns} means not significant

Table (9): Levels of total nurses' knowledge score on pre, post and follow-up tests (No= 35).

Total of nurses' knowledge Score	Pre-test		Post-test		Follow- up		X ¹ / P ¹ -value	X ² / P ² -value
	No	%	No	%	No	%		
Poor	28	80	0	0.0	0	0.0	101.86**	5.87
Fair	2	5.7	1	2.8	4	11.4	.000	.053
High	5	14.3	34	97.2	31	88.6		-

P¹: between pre and post –tests

P²: between post and follow-up-tests

** P≤.001: highly statistical significance

* P≤.05 : statistically significance

^{ns} means not significant

Table (10): Distribution of nurses' practices provided to thalassemic children before blood transfusion on pre, post and follow-up tests (No =35)

Nurses' practices	Pre-test		Post-test		X ¹ / P ¹ -value -	Follow-up Test		X ² / P ² -value
	No	%	No	%		No	%	
Weight (Infant & child):								
a. Place the scale horizontally on a firm surface								
Not done	33	97.1	0	0.0	132.22 .000*	0	0.0	NA
Inadequately done	0	0.0	0	0.0		0	0.0	
Adequately done	2	2.9	35	100		35	100	
Set the scale at zero								
Not done	34	97.2	0	0.0	136.06 .000*	0	0.0	1.12 .288 ^{ns}
Inadequately done	0	0.0	3	8.6		5	14.3	
Adequately done	1	2.8	32	91.4		30	85.7	
• Wipe the scale using cotton with alcohol								
Not done	24	68.6	0	0.0	93.40 .000*	2	4.3	3.10 .211 ^{ns}
Inadequately done	7	20.0	3	8.6		3	8.6	
Adequately done	4	11.4	32	91.4		30	87.1	
• Put a paper on the scale (Infant)								
Not done	13	37.1	0	0.0	32.88 .000*	1	2.8	13.57 .001**
Inadequately done	12	34.3	15	47.1		7	20.0	
Adequately done	10	28.6	20	52.9		27	77.1	
Put the child on a scale								
Not done	10	28.5	1	1.4	41.76 .000*	2	4.3	4.95 .084 ^{ns}
Inadequately done	8	22.8	1	1.4		3	8.6	
Adequately done	17	48.6	33	97.1		30	87.1	
Record it in the infant's or child's chart.								
Not done	11	31.4	0	0.0	64.16 .000*	6	17.1	15.55 .000*
Inadequately done	11	31.4	0	0.0		1	2.8	
Adequately done	13	37.1	35	100		28	80.1	
Assess Height								
Not done	25	71.3	0	0.0	73.04 .000*	3	8.6	7.36 .025 ^{ns}
Inadequately done	4	11.3	0	0.0		1	2.8	
Adequately done	11	31.4	35	100		31	88.6	
1-Assess child development								
Not done	11	31.4	0	0.0	64.16 .000*	2	5.7	3.06 .216 ^{ns}
Inadequately done	11	31.4	0	0.0		1	2.8	
Adequately done	13	37.2	35	100		32	91.5	
1- Assess vital signs								
Not done	34	97.2	0	0.0	136.10 .000*	7	20.0	22.66 .000*
Inadequately done	1	2.8	8	22.9		18	51.4	
Adequately done	0	0.0	27	77.1		10	28.6	

P¹: between pre and post –tests

P²: between post and follow-up-tests

** P<.001: highly statistical significance

* P<.05 : statistically significance

^{ns} means not significant

Table 11: Distribution of nurses' practice during blood transfusion on pre, post and follow-up tests (No= 35).

Nurses' Practices	Pre-test		Post-test		X ² / P ¹ -value	Follow-up test		X ² / P ² -value
	No	%	No	%		No	%	
1. Check physician order								
Not done	5	14.3	0	0.0	57.98 .000*	6	17.1	13.12 .000*
Inadequately done	7	20.0	0	0.0		0	0.0	
Adequately done	23	65.7	35	100		29	82.9	
2. Ensured Informed Consent								
Not done	7	20.0	1	2.8	11.42 .001**	5	14.3	81.84 .000*
Inadequately done	28	80.0	0	0.0		7	20.0	
Adequately done	0	0.0	34	97.2		23	65.7	
3. Ensured Cross Match Completion								
Not done	0	0.0	0	0.0	10.76 .001**	0	0.0	9.61 .002*
Inadequately done	5	14.3	0	0.0		5	14.3	
Adequately done	30	85.7	35	100		30	85.7	
4. Explained Blood Transfusion Procedure.								
Not done	6	17.1	0	0.0	13.14 .001**	0	0.0	9.01 1.00 ^{ns}
Inadequately done	1	2.8	1	2.8		1	2.8	
Adequately done	28	80.1	34	97.2		34	97.2	
5. Administered Pre-Transfusion Medications								
Not done	0	0.0	0	0.0	18.06 .000*	6	17.1	13.12 .000*
Inadequately done	8	22.9	0	0.0		0	0.0	
Adequately done	27	77.1	35	100		29	82.9	
6. Ensured child's IV site of 20 G or larger bore.								
Not done	2	5.7	0	0.0	13.24 .001**	6	17.1	16.66 .000*
Inadequately done	11	31.4	4	12.9		2	5.7	
Adequately done	22	62.9	31	87.1		27	77.1	
7. Measure vital signs								
Not done	8	24.3	0	0.0	43.17 .000*	6	17.1	13.12 .000*
Inadequately done	8	22.9	0	0.0		0	0.0	
Adequately done	19	52.9	35	100		29	82.9	
8. Hand washing								
Not done	27	77.1	10	28.6	41.82 .000*	12	34.3	1.66 .436 ^{ns}
Inadequately done	2	5.7	3	7.1		1	2.8	
Adequately done	6	17.1	22	64.3		22	62.9	
9. Connected unit of blood product to "Y" tubing								
Not done	3	8.6	2	4.3	1.74 .418 ^{ns}	6	17.1	6.76 .034*
Inadequately done	5	14.3	5	12.9		3	8.6	
Adequately done	27	77.1	28	82.9		26	74.3	
10. Monitor for Blood Transfusion Reactions								
Not done	15	42.9	0	0.0	114.17 .000*	1	2.8	8.12 .017*
Inadequately done	14	40.0	1	2.8		4	11.4	
Adequately done	6	17.1	34	97.2		30	85.8	
11. Asses vital signs / 15 minutes, 1 hour until completion of unit								
Not done	31	88.6	1	2.8	122.23 .000*	2	5.7	2.98 .225
Inadequately done	4	11.4	3	8.6		2	5.7	
Adequately done	0	0.0	31	88.6		31	88.6	
12. Finished blood unit in less than 4 hours.								
Not done	18	51.4	0	0.0	107.99 .000*	2	5.7	6.04 .049*
Inadequately done	13	37.2	1	2.8		2	5.7	
Adequately done	4	11.4	34	97.2		31	88.6	
13. Hand washing								
Not done	20	57.1	0	0.0	57.98 .000*	6	17.1	8.42 .015*
Inadequately done	0	0.0	0	0.0		0	0.0	
Adequately done	15	42.9	35	100		29	82.9	
14- Documentation								
Not done	34	97.2	0	0.0	136.0 .000*	8	22.8	22.17 .000*
Inadequately done	0	0.0	5	14.3		5	14.4	
Adequately done	1	2.8	30	85.7		22	62.8	

P¹: between pre and post –tests

P²: between post and follow-up-tests

** P<.001: highly statistical significance

* P<.05 : statistically significance

^{ns} means not significant

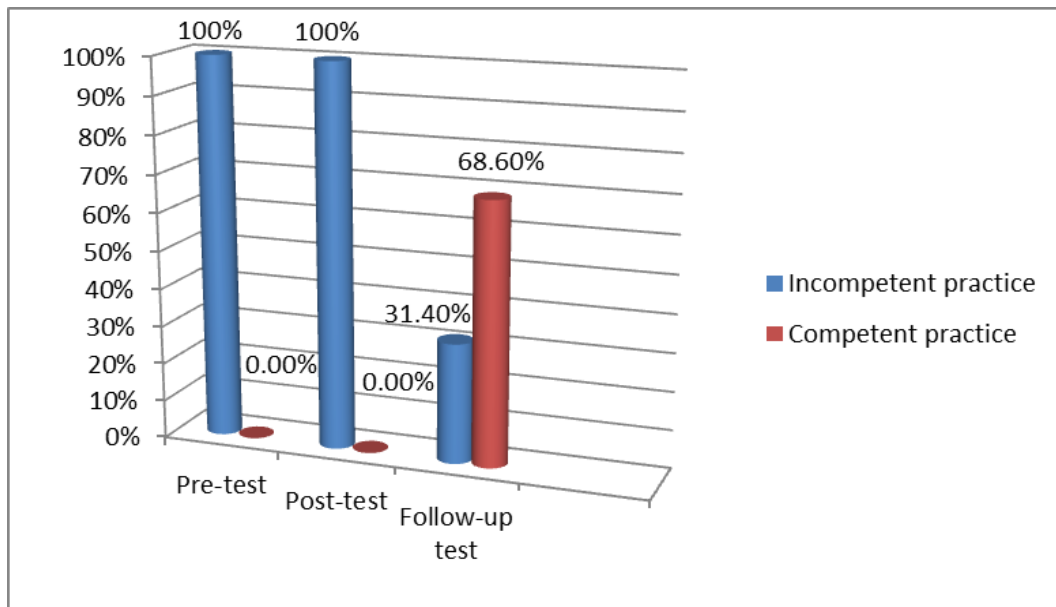


Figure (1): Levels of nurses' practice of blood transfusion procedure on pre, post and follow-up tests (No: 35).

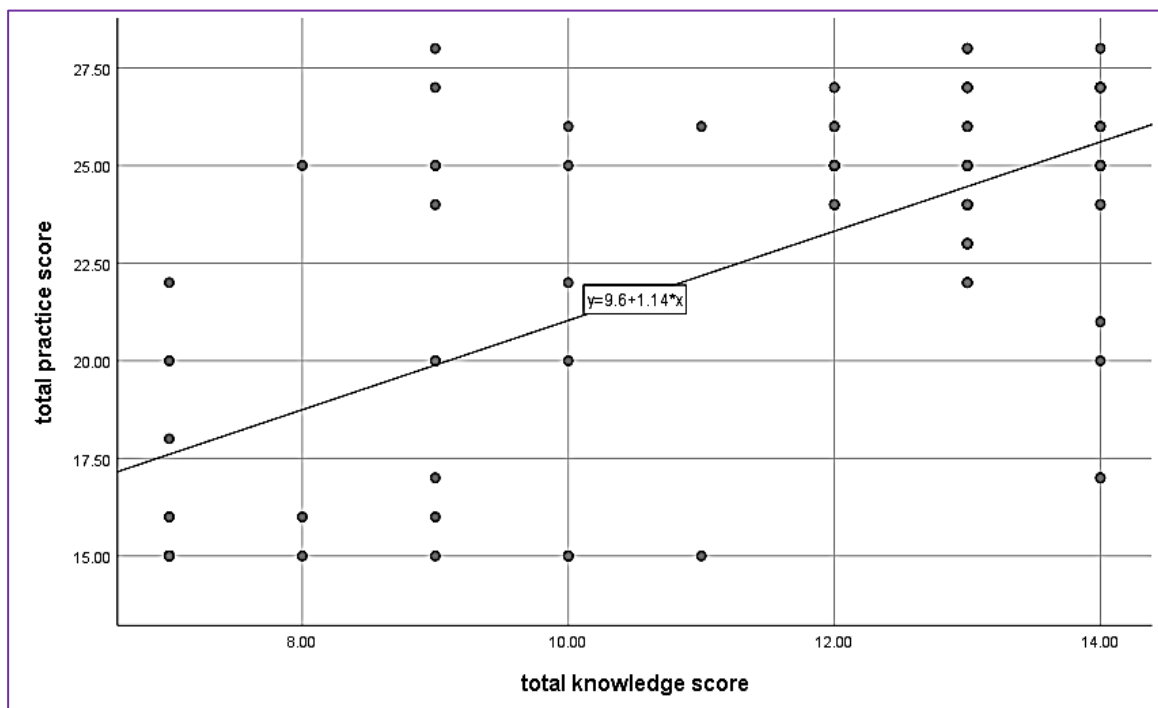


Figure (2): Pearson correlation between total score of nurses' knowledge and total score of nurses' practices

4. DISCUSSION

Thalassemia is an autosomal recessive genetic condition. Insufficient globin chain formation causes inefficient erythropoiesis and anemia of varying degrees of severity, according to the Center of Disease Control and Prevention, (2019). Children with thalassemia have an excess of either alpha or beta-globin chains, which impairs the creation and survival of red blood cells. Monthly For lifetime treatment, RBC transfusions and iron chelators are essential. A pediatric nurse is essential to successfully manage thalassemia. Nurse professionals provide informed, specialized care and encouragement during an often routine treatment program. The nurse is uniquely prepared to serve as a key link between the hematologist, the patient, and other health professionals and services since she is familiar with the patient, their family, and their social circumstances. Nurses provided the finest treatment possible.

Concerning the distribution of the studied nurses according to their characteristics, the results of this study revealed that more than half of the nurses (58.6%) graduated from Technical Nursing Institute, which could imply that they lack expertise and training in caring for thalassemic youngsters. Meanwhile, numerous international healthcare systems have abolished the secondary school certificate system for nurses, alleging that diploma nurses are too immature to perform life-saving duties and manage the pain of children and their families adequately.

For these reasons, higher levels of education and training were required of these nurses in order for them to fulfill tasks and provide exceptional care. Also, Eefje et al., (2014) and Chiappini et al., (2012) their results clarified the importance of educational programs to improve knowledge and practice about the management of diseases. Meanwhile, more than one-third of the studied nurses (38.6%) had less than two years of experience in pediatric nursing this may render them inexperienced in caring for thalassemic children

In relation to training attendance, it was obvious that most of the studied nurses (80.0%) did not attend any previous training regards thalassemia. From the perspective of the researchers, they had a lack of recent advancements in the care of thalassemia children. This could result in consequences from blood transfusions, such as viral infections, allergic responses, and iron excess. All medical and nursing professionals must update their knowledge continuously and follow new trends in genetic disease management .

Regarding nurses' knowledge about thalassemia on pre, post, and follow-up tests, the finding revealed that a high statistically significant difference was found in nurses' knowledge between pre and post-tests regards definition, types, clinical manifestation, association with gender, and hemoglobin value. Such findings showed that nurses' adherence to evidence-based care during their practice is very important for the improvement of pediatric children's outcomes (Savage et al., 2018 .(

In a study titled "Patients' satisfaction with the quality of nursing care in thalassemia units," Awamreh & Suleiman, (2019) determined that strengthening nursing care practice plays an essential role in molding nurses' and hospitals' quality of care among patients in thalassemia units. Furthermore, Elewa & Elkattan, (2017) found that the educational program had a positive effect on nurses' knowledge and practice related to thalassemia and blood transfusion, which improved nursing care quality and increased patient satisfaction in their study "Effect of an Educational Program on Improving Quality of Nursing Care of Patients with Thalassemia Major as Regards Blood Transfusion." This result corresponded to Boonchuay et al., (2016) in a study about "The Effect of the Educational Program on Knowledge and Care Behaviors of Caregivers of Children with Thalassemia" who mentioned that the experimental group had a higher mean score of knowledge after the educational program .

In relation to the definition of thalassemia, it was found that 74.3% of studied nurses had correct knowledge on the pre-test. Such finding came in agreement with Chouhan & Pujari, (2021) in a study about "Nurses' Knowledge and Role on Care of Children with Thalassemia" The study concluded that nurses were lacking knowledge and skills in caring for children with thalassemia and needed engagement in continuous training about thalassemia .

On pre, post, and follow-up tests, there was a highly statistically significant difference between pre and post-test in terms of treatment methods, new trends in management, and warning signs for hospitalization, complications, and nurse role in regards to nurses' knowledge about nursing care for thalassemic children. This result goes in line with Abu Samra, et al., (2015) in a study "Impact of educational program regarding chelation therapy on the quality of life for B thalassemia major children". They conclude that there was a positive effect of the educational program in improving B-thalassemia children's knowledge regarding thalassemia and chelation therapy and their QOL. Also, they recommended educational programs should be conducted for the nurses working with thalassemia patients about the importance of chelation therapy. This could be attributed to receiving adequate knowledge and training regarding nursing care for thalassemic children.

Furthermore, Atshan & Radha, (2022) found a high statistical significant relationship between parents' knowledge and their educational level in their study "Effectiveness of an Educational Program on Parents' Knowledge about Home Health Care Management to Children with Beta Thalassemia-Major at Thalassemia Center in Al-Zahra Teaching Hospital for Maternity and Children in Al-Najaf City." This finding highlighted the significance and efficacy of adopted recommendations in boosting nurses' knowledge.

In a study titled "The Effectiveness of An Educational Intervention on Maternal Management of Children with Beta-Thalassemia," Elsayed & Hussein, (2002) concluded that -thalassemia requires a long-term management and care regimen. This finding was also supported by Nabih et al., (2022) that did a study titled "Assessment of Nurses Pitfalls in Caring for

Children with Hematological Diseases" and came to the conclusion that nursing standards for caring for children with hematological diseases should be established. This could be because the intervention program was successful in emphasizing the importance of following clinical guidelines when caring for thalassemic children. "Exploring the Gap between Thalassemia Knowledge and Behavior among University Students: A Cross-Sectional Study," by Elsadek et al., (2022) was another study.

In terms of nurses' knowledge of desferal administration for thalassemic children on pre, post, and follow-up tests, it was clear that all of the nurses were correct on the post-test about Desferal Use, Methods of Administration, Precautions During Administration, Side Effects, Administration Times/Week, and Iron Excretion. This could be due to the educational intervention included in the nursing care protocol, which clarified the importance of desferal administration for thalassemic children to nurses. Nurses also require advice and assistance for further education and training in order to reach their full potential. This finding came in agreement with Azize et al., (2015) in a study about "Nurses' Knowledge and Role in the Management of Thalassemic Patients in Sulaimania Thalassemia Center" and showed that nurses in Kurdistan region of Iraq have a limited role in terms of decision making and a lack of knowledge about and engagement in continuous training about the management of thalassemia and consider themselves not involved in initial or ongoing patient education. However, they do have the role of explaining the risk of non-adherence to chelation drugs for the families .

Moreover, the results showed a highly statistically significant difference was found between pre and post-test regards desferal administration for children with thalassemia. This revealed that designing and implementing a training program based on the clinical practice guidelines was effective in enhancing nurse's knowledge about desferal administration. In relation to nurses' knowledge about required investigations for thalassemic children on pre, post, and follow-up tests, the findings revealed that all nurses on post-test had correct knowledge about the required investigation needed /3 months as well as every year. From the researchers' perspective, high outcomes among nurses could be linked with awareness of the disease as well as the importance of routine laboratory investigations for children with thalassemia to avoid the occurrence of complications .

On pre, post, and follow-up tests, the mean score and standard deviation of nurses' knowledge on thalassemia, desferal administration, and nursing care for thalassemic children. Nurses' knowledge of post- and follow-up tests had improved, according to the findings of this study. This could be attributable to the favorable impact of implementing nursing care protocol. Pediatric nurses were also eager to learn more about thalassemia consequences and how to prevent them. El-Shahat & Kafal, (2020) identified a statistically significant relationship between nurses' knowledge and their practice in a study titled "Effect of an Educational Program on Nursing Care Practices Regarding Pediatric Transfusion-Dependent-Thalassemia Major." during the pre and post-implementation stages of the program. These findings demonstrate the importance of knowledge. In relation to nurses' knowledge about nursing care for blood transfusion on pre, post, and follow-up tests, this study illustrated that the majority of the studied nurses had incorrect knowledge on the pre-test. This could be due to nurses' organizational culture, a lack of managerial support, a lack of continuous training, a lack of easy access to the literature, a lack of time to study and comprehend the literature, a lack of guidelines, and competing-task constraints. Meanwhile, the findings of this study revealed that nurses' knowledge of post and follow-up testing had improved .

This finding was supported by El-Shahat & Kafal, (2020) according to the findings, the examined nurses have higher total mean scores for practices related to pediatric transfusion dependent -thalassemia major and blood transfusion after program implementation (20.41 ± 4.23) than before program implementation (11.37 ± 4.64). From the researchers' perspective, when it comes to blood transfusions for children with B-thalassemia, pediatric nurses play a crucial role. As a result, nurses must have sufficient knowledge and abilities to secure and preserve the safety of children .

Regarding, nurses' knowledge about reactions of blood transfusion for thalassemic children on pre, post, and follow-up tests, the findings of this study showed improvement in nurses' knowledge on the post and follow-up tests than pre-test. These findings matched those of Abolwafa et al., (2018) who investigated Improving Quality of Nursing Care among School-Aged Children with Thalassemia Major in the Area of Blood Transfusion. Following the execution of the educational program, they discovered a considerable improvement in all items of knowledge among the nurses evaluated. Furthermore, according to Vaghar, (2018), all staff nurses involved in the transfusion procedure require training and education in order to reduce transfusion mishaps. This implies that the clinical nursing practice guideline was successful in enhancing nurses' knowledge.

Concerning levels of total nurses' knowledge score on pre, post, and follow-up tests, the findings of the current study clarified all studied nurses had high levels of total nurses' knowledge score on post-test. These findings matched those of Abolwafa et al., (2018), they discovered a significant improvement in all knowledge items among the nurses studied after implementing the instructional program. Such findings were inconsistent with Chouhan & Pujari, (2021) in a study about "Nurses' Knowledge and Role on Care of Children with Thalassemia" they found that only 6.1% had good knowledge regarding thalassemia with a mean score for knowledge was 12.74 ± 4.97 . Also, the result of this study disagreed with Ghazanfari & Pouraboli, (2013) conducted a study on the knowledge of nurses about thalassemia revealed that 65.4% of nurses had inadequate knowledge and 34.6% had adequate knowledge with a mean knowledge score of 14.53 ± 5.85 . It could reflect the fact that nurses lacked knowledge and skills in caring for children with thalassemia and that they should participate in ongoing thalassemia training.

Concerning the distribution of nurses' practices provided to thalassemic children before blood transfusion on pre, post, and follow-up tests, the present study reflected that a highly statistically significant difference was found between pre and post-tests related to all nurses' practices. This result was consistent El-Shahat & Kafal, (2020) who illustrated that the studied nurses had the high mean scores of practices regarding pediatric transfusion-dependent β -thalassemia major in terms of measuring vital signs, preparing for blood transfusion, during blood transfusion, after blood transfusion, and administration of iron IV chelation therapy, post-program implementation compared to preprogram implementation with a statistical significance difference between pre/post phases of educational program implementation .

In a similar line, in their study "Safe Blood Transfusion Practices among Nurses in a Major Referral Center in Ghana," Bediako et al., (2021) emphasized the need for hospitals to offer opportunities for clinical personnel to obtain ongoing transfusion medicine training. The blood transfusion unit should design simplified standard procedures based on the clinical blood transfusion policy, which should be posted in clinical areas where blood transfusion is performed. Individual blood transfusion nurses must be in charge of their own continuing education. This could reflect the guidelines' effectiveness and impact on nurse practices in improving thalassemic children's outcomes. Furthermore, the results of this study showed that all studied nurses had incompetent nursing practice on the pre-test. Such finding was in a line with Sapkota et al., (2018) in a study about "Blood Transfusion Practice among Healthcare Personnel in Nepal: An Observational Study " and found that there was no proper practice of recording the details related to the time of dispatch of blood from the laboratory and completion of blood transfusion. Also, the findings revealed a significant knowledge gap in clinical transfusion medicine and practice among healthcare personnel.

Furthermore, Shelan et al., (2021) supported the study findings in a study titled "Blood Transfusion Understanding And Practices Among Nurses In Kirkuk City Hospitals," which found that nurses' knowledge of blood transfusion was poor, potentially jeopardizing patient safety. In a study titled "Knowledge on safe blood transfusion practice of senior staff nurses working in a tertiary hospital," Nessa et al., (2020) determined that during blood transfusions, nurses undertake self-protection as well as patient protection. Comprehensive blood transfusion training is essential for the prevention of problems in both the patient and the nurses. It might be viewed as the provision of blood transfusion techniques and practices and this was corresponding with Stacy et al., (2021) .

In relation to the documentation of blood transfusion, the findings of this study clarified that the majority of studied nurses (87.1%) adequately document blood transfusion procedures. Such results came in a line with Naveena et al., (2021) in a study about "Compliance of documentation by healthcare professionals: Evaluation of transfusion practices at the bedside". They noticed that transfusion-related documentation by healthcare staff at the bedside is infrequent. Strict measures should be implemented to prevent morbidity and mortality. Time is of importance for training and education.

Regarding the correlation between the total score of nurses' knowledge and the total score of nurses' practices, the results of the current study found a highly statistically significant positive correlation between total knowledge and the total practice score. This finding was supported by Bayomi & Taha, (2022) who conducted a study titled "Effect of Self-Learning Package on Nurses' Knowledge and Practice Regarding Arterial Blood Gases Analysis for Critically Ill Patients," there was a statistically significant positive correlation between studied nurses patient health status scores and total practice scores throughout the self-learning package's phases.

Such findings revealed the effectiveness of the nursing care protocol to improve nurses' knowledge and practices regarding nursing care for children with thalassemia. Also, this could be attributed to the clarity and simplicity of the methods of teaching (oral presentations, group discussion, smartphone, communication board, feedback, and explanatory booklets) that

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were used in sessions which in turn helped nurses to acquire and improve their knowledge and practices from the researchers' perspectives, nurses were much uploaded with nursing and non-nursing responsibilities.

5. CONCLUSION

Based on the finding of the current study, it is concluded that:

Nurses who received nursing care protocol education had a higher level of knowledge about thalassemia on the post-test than on the pre-test. Also, Nurses who receive nursing care protocol training had a more competent nursing practice delivered to thalassemic children on the post-test than on pre-test. Therefore, there were statistically significant differences between pre, post, and follow-up tests.

6. RECOMMENDATIONS

In the light of the findings obtained from the current study and its conclusion, the following recommendations are suggested:

- Continuous training program for developing nurses' knowledge and practices regarding nursing care of thalassemic children.
- Ongoing training is required to enhance nurses' competencies in order to ensure safe blood transfusion practices.
- Each pediatric care unit should have advanced pamphlets and electronic media about the nursing care package for thalassemic children.
- Strict supervision for nursing interventions such as blood transfusion and desferal administration must be encouraged.
- Establishment of scientifically documented protocols of care for thalassemic children and their parents by experts in pediatrics and pediatric nursing.
- Further research should be conducted on a bigger sample to evaluate the effect of the thalassemia nursing care protocol to confirm the generalizability of the results.

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