

Impact of Simulation-Based Training on Nurses' Performance and Satisfaction regarding Blood Transfusion at Neonatal Intensive Care Unit

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Abstract

Background: A blood transfusion is an emergency operation for very ill newborns. Nursing care is required for preparation before, during, and after the procedure in addition to ongoing medical competence for life-saving interventions. Clinical practice and classroom learning are connected through simulation-based education. It helps nurses become competent before dealing with newborns in a real-world setting, raising the standard of care and assuring the safety of the infants. **This study aimed to** determine the impact of simulation-based training on nurses' performance and satisfaction regarding blood transfusion at the neonatal intensive care unit. **Method:** A quasi-experimental research design was used to achieve the aim of the current study. **Setting:** The study was conducted in the Neonatal Intensive Care Unit affiliated at Sohag University Hospital. **Subjects:** Included all nurses (50) who are working in the neonatal intensive care unit. **Tools for data collection:** (1) Structured interview questionnaire sheet (2) observational checklist, and (3) Nurses' satisfaction scale was used to collect data. **Results:** In terms of knowledge, practice, and satisfaction, there was a very statistically significant difference among the nurses. The study's findings showed that, before the implementation of the simulation-based training, more than two-thirds of the nurses were poorly informed about blood transfusions, and more than half of them had incompetent levels of practice in this area. Following the implementation of simulation-based training, the vast majority of the examined nurses had a good level of knowledge and the majority of them had a competent level of practice. When compared to pre-training, nurses' performance showed a very statistically significant difference and improvement. **Conclusion:** According to the findings of the current study, simulation-based training enhanced nurses' performance and satisfaction with blood transfusion. **Recommendations:** The study suggested that simulation-based training be used as an effective technique for teaching nurses about blood transfusion.

Keywords: Blood transfusion, Nurses' Performance, Satisfaction, Simulation-based training.

Introduction

The neonatal period is possibly the most fragile in a human's lifespan. The neonate moves from intrauterine to extrauterine life and adjusts to a different environment during these few days. During this period, the focus of nursing care is to guard and support the neonates as they go through several physiological fluctuations and adjust to extrauterine life (Stroustrup et al., 2018).

Approximately 90% of babies referred to neonatal intensive care units receive blood products at least once while they are in the hospital; as a result, infants are at a high risk for transfusion-related problems and adverse

effects. The primary causes of transfusion-related anemia are preterm newborns' rapid growth, iron insufficiency, inadequate erythropoiesis, short fetal hemoglobin half-life, and oxidative hemolysis, particularly iatrogenic loss brought on by frequent blood collection (Dos Santos et al., 2020). Transfused blood products need specific attention, including careful adherence to medical treatment recommendations for managing infusion pace, keeping track of vital signs, and properly documenting all procedures. Neglecting such items may raise the danger of embolism, cause an abrupt rise in blood concentration, cause incomplete oxygenation to appear, and cause unfavorable changes in vital signs (Hurrell, 2019).

Blood transfusion is the process through which one person's blood is administered into the circulation of another for therapeutic reasons. Blood transfusions were a factor in several negative side effects in the early twenty-first century, but today these effects can be avoided by training healthcare professionals and screening blood and blood products (**Hijji et al., 2019**). Some patients require blood transfusions, yet doing so without prudence can be a life-threatening procedure. According to estimates, one blood transfusion error happens every 13,000 cases—mostly because of human error, which can be avoided with the right training and changes to the protocols. The knowledge and abilities of nurses must be improved due to their critical role in a safe and successful blood transfusion. Four of the five stages of blood transfusion, including blood unit preparation, blood pack collection, pre- and post-transfusion activities, and patient safety monitoring, are carried out by nurses (**Aslani et al., 2020**).

Blood transfusion is a crucial medical procedure that calls for adequate training and expertise. The level of knowledge and awareness of nurses and doctors regarding blood transfusion has been the subject of numerous researches. To ensure the safety of this intervention, nurses' level of knowledge and performance must be improved, nevertheless, given the rising demand for blood transfusions in hospitals and their significance in saving patients' lives (**Hijji et al., 2021**).

Simulation-based clinical education activities using pediatric patient simulators in nursing, these activities go beyond simply handling mannequins and include the use of gadgets, skilled professionals, lifelike virtual environments, and role-playing. A crucial component of nursing education is a clinical simulation, which is described by the National Council of State Boards of Nursing as "an activity or event replicating clinical practice using scenarios, high-fidelity manikins, medium-fidelity manikins, standardized patients, role-playing, skills stations, and computer-based critical thinking simulations (**AbdElbaky, 2018**).

The benefits of simulation-based training treatments include the ability to adjust

the difficulty level, the ability to repeat practice learning, the ability to provide quick feedback, and the potential to personalize learning (**Alexander et al., 2015**). The research, however, indicates that opportunities to practice nursing skills on actual patients are often scarce during undergraduate degrees (**Powell et al., 2018**). This fact might affect how competent freshly trained healthcare professionals evolve in the future, raising the risk of mistakes and endangering patient safety (**Cant & Cooper, 2017**).

The most effective method for teaching beginning nurses how to react to dangerous clinical procedures is simulation training. They require chances to put new knowledge into practice in a low-risk, secure, and encouraging learning environment, as well as the ability to spot process flaws and practice gaps and assist in quality improvement. Clinical learning aids in the development of professional identity, role learning for nurses, and the acquisition of cognitive, reflective, and practical nursing abilities. A well-planned and organized simulation exercise could aid in the development of students' critical reflection and clinical competence. Professional nursing also involves knowledge and skills to handle a variety of obstacles. Nursing students' confidence and stress levels are boosted by the competence they acquire through simulation (**Akselbo and Aune, 2023**).

Evaluation of a student's motivation, satisfaction, and acceptance of a teaching technique all depend on how satisfied they are with the lesson. It measures how well a learner can demonstrate cooperation skills in diverse healthcare environments while providing exceptional service with a good attitude (**Shin & Kim, 2019**). According to many pieces of data, nurses frequently carry out procedures traditionally or routinely, which suggests that there is a discrepancy between scientific understanding and everyday practice (**Hockenberry, M., & Wilson, 2018**).

Pediatric nurses undertaking the role of preparing neonates for blood component transfusion and providing written instruction will be working at a level beyond initial registration, exerting an advanced level of knowledge, expertise, clinical reasoning, and diagnostic skills. They will have a high level of professional autonomy and accountability to

fulfill their role and responsibilities, working interdependently within a healthcare team (Edward, et al., 2017).

Significance of the study

In developing countries transfusion blood is still widely used in the management of severe jaundice, G6PD, and severe sepsis, reports showed that more than 5% of neonatal admitted into a newborn unit had blood transfusion done, while over the world approximately 6/100,000 needs blood transfusion (Gottstein et al., 2019). Blood Transfusions decrease the mortality of this group of critically ill newborn infants. Newborn infants in NICU, especially those born premature are at particular risk for exchange transfusion adverse effects. Moreover, blood transfusion carries a significant risk of morbidity and mortality due to vascular accidents, cardiac complications, biochemical and hematological disturbances, and a low risk of blood-borne infections. Therefore, it should be initiated only when the benefit of preventing kernicterus outweighs the complications associated with the procedure (Lynn & Lebon, 2019). So, this study was applied to improve the nurses' knowledge, practice, and satisfaction by using simulation-based training regarding blood transfusion at the neonatal intensive care unit.

Aim of the study

To determine the impact of simulation-based training on nurses' performance and satisfaction regarding blood transfusion at neonatal intensive care unit

Research Hypotheses

The knowledge, skills, and satisfaction of nurses about blood transfusion at neonatal intensive care units are expected to improve as a result of simulation-based training.

Subject and methods

Research design

The goal of the current study was accomplished using a quasi-experimental approach (one group pre/post-test design).

Settings

The study was applied in the Neonatal Intensive Care Unit affiliated to Sohag University Hospital

Subjects

A sample of all nurses (50) who were working in the previously mentioned setting during the study period and caring for neonates regardless of their age, education, or years of experience were included.

Tools for data collection

Three tools were used for collecting data in this study.

Tool (I): Structured interview questionnaire sheet: It was developed by the researchers after reviewing the national and international related literature (Gottstein et al., 2019; Issa et al., 2018). This tool is divided into two parts as the following:

Part 1: Information about nurses' age, gender, education, years of experience, and attendance at blood transfusion training courses was included in this section.

Part (2): A structured nurses' knowledge multiple-choice questionnaire: For assessing the nurses' knowledge of neonatal blood transfusions (before, immediately following, and one month later). Ten questions were asked on the definition, intent, indications, and side effects of blood transfusion.

2. Pre-blood transfusion' preparation and evaluation (5 questions).

3. The nurse's role in providing care during blood transfusions (10 questions).

4. The nurse's role in reducing the risks associated with blood transfusion problems (5 questions).

Scorings system

Each right response received one point, whereas the wrong response received (zero). The nurses' knowledge was divided into the following categories: Poorer than 50%, fairer between 50% and 75%, and better than 75% (Hegazy & Abusaad, 2019).

Tool II: blood transfusion observational checklist (pre/post-test).

This instrument Observational checklist was adopted from Beardsall et al. (2018), Perry &

Lebon (2015), Lynn & Lebon (2014), and MacDonald et al. (2012). It was used to assess nurses' care for newborns receiving exchange transfusions. It included the following components:

Part 1: This section covered eight practice procedures, including the use of a pulse oximeter (14 steps), emergency drugs for blood transfusion (15 steps), flushing an umbilical venous catheter (10 steps), a bundle to prevent infection when maintaining a central venous catheter (CVC) or umbilical catheter (UC), or pharyngeal and nasal suctioning (18 steps), ryle insertion (19 steps), taking blood samples (14 steps) and testing blood glucose (15 steps).

Part 2: This section covered 4 procedures: the preparation for exchange transfusion (25 steps), the procedures before blood transfusion (9 steps), the procedures during blood transfusion (8 steps), and the procedures following blood transfusion (3 steps).

Scoring System:

A score of one was given for "done" satisfactorily and a score of zero for "not done" on all 12 observational checklists, which had a total of 155 steps. There were 155 scores overall for the practices. These scores were converted to percentage scores by adding together the scores for each step and dividing by the number of steps. As a result, the practices were deemed competent if their scores were below 85% and incompetent if they were over 85%.

Tool III: Nurses' satisfaction scale: A scale created by the National League for Nursing was used to gauge the nurses' satisfaction with the simulation experience (Jeffries, 2005). It was developed to gauge nurses' satisfaction with the simulation exercise and has five items. Each item was rated on a 5-point Likert scale. Strongly disagree was given a score of 1, disagreement was given 2 points, uncertainty was given 3 points, agreement was given a score of 4, and agreement was given 5 points. The overall score ranged from 5 to 25, and the higher the score, the more satisfied the respondent was. There were inquiries in it regarding whether. Whether teaching by simulation was enjoyable, the simulation teaching material was motivating, and the simulation was designed in such a way that it

was appropriate for learning. The simulation provided a variety of learning materials and activities to promote my learning.

Scoring System

The nurses' level of satisfaction was scored as unsatisfied if the nurses' score was less than 80% and satisfied if the nurses' score was 80% or higher.

Validity and reliability:

Five pediatric nursing professionals evaluated the tools' content validity and amended them for comprehensiveness, clarity, and usefulness. According to the Cronbach's alpha coefficient test, tool (I) had a reliability score of 0.942, tool (II) had a score of 0.892, and tool (III) had a score of 0.94.

Ethical considerations

An official letter from the dean of the nursing faculty at Sohag University served as the official authorization document. To explain the goal of the study and obtain their approval and cooperation for carrying it out, the researchers met with the neonatal intensive care unit administration. After explaining the current study's purpose and advantages, nurses gave their informed consent to participate in it. The study's nurses were informed by the researchers that they had the option to discontinue participation at any moment. They also received assurances of the confidentiality of their data.

Pilot study

To assess the tools' clarity, objectivity, viability, and application as well as to identify potential challenges and issues that the researcher might encounter and that might obstruct the collection of data, a pilot study using 10% of the entire sample (5 nurses) was carried out. The time required for data gathering was also estimated, which was helpful. There were no modifications made. The nurses who took part in the pilot study were included in the study.

Field of work

The director of Sohag University Hospital gave his approval. The study was carried out between the first of July 2023 and the last day of September 2023. The interview

began with the researchers greeting each nurse individually, introducing themselves, and outlining the purpose and scope of the study.

Stages of the research the study was carried out in the four stages listed below:

I-Assessment Phase

- To gather the characteristics of the nurses using a tool (I) part (I), every nurse was interviewed before the program's conduct.
- Through the use of the study tools, nurses' understanding of blood transfusions, practice, and satisfaction were evaluated.

II. Planning phase:

Based on the results of the previous phase, the objectives, priorities, and expected results were developed to address the practical requirements, knowledge gaps, and satisfaction of the nurses about neonatal blood transfusion. The researchers prepared five sessions for the nurses they were researching—two theoretical and three practical.

The educational program

The creation and revision of an educational program were completed. The sessions on blood transfusion comprised both theoretical and practical components.

The main objective of simulation-based training sessions:

The nurses were supposed to gain knowledge and practice at the end of the courses that would enhance their performance and level of satisfaction with blood transfusions in neonatal intensive care units.

Specific goals for the program:

- Define the term "blood transfusion."
- Define the goal of a blood transfusion.
- List the signs and symptoms of the blood transfusion.
- Show that the blood transfusion was taken care of.
- List the most frequent side effects associated with blood transfusions.
- Complete the necessary paper documentation

III. Implementation phase:

- Through five sessions, which included two theoretical and three practical (each lasting around 30 to 45 minutes); simulation-based

training was used to improve nurses' knowledge practices and satisfaction regarding blood transfusion at the newborn critical care unit.

Each session began with the researchers gathering background about the previous session, and each session ended with a summary from the researchers.

Six to eight nurses in each subgroup were divided up among the nurses who were the subject of the study.

The researchers visited the study settings 3 days per week from 9 a.m. to 1 p.m. using the previously mentioned study tools, each nurse was individually interviewed.

After examining the relevant literature based on the evaluation of the real needs of the studied nurses, the simplified booklet was used as supportive material and distributed to nurses in the Arabic language to cover all topics on the knowledge and practice surrounding blood transfusion.

To apply for simulated-based training, many teaching approaches were used, including lectures, small group discussions, photographs, brainstorming, demonstrations, and re-demonstrations using the necessary tools and a simulation manikin that was available in a hospital teaching class faculty clinical lab. Several teaching tools were used, including handouts, PowerPoint, graphics, flipcharts, and illustrated videos about blood transfusion.

he theoretical and practical sessions were carried out as the following

The first session (Theoretical): The researchers introduced themselves at the start of this session, welcomed the nurses, expressed gratitude for their participation in the study, and described the goals of these instructional sessions. The following topics were covered in the first session: definition, purpose, indications, and adverse effects of blood transfusion.

Second session (Theoretical): The topics discussed in these sessions related to the nurse's role in caring for blood transfusions and preventing complications from blood transfusions.

Third session (Practical): During these sessions, the nurses under study received

instructions on how to prepare and examine newborns before blood transfusion.

Fourth session (Practical): In these courses, nurses who had learned the blood transfusion method gave clinical demonstrations and re-demonstrations of it in the faculty clinical lab. The simulated manikin was used during these sessions. After the demonstrations in the faculty lab sessions, the trainees moved to the neonatal intensive care at Sohag University Hospitals to receive real-time re-demonstration while being watched by the researchers. This was done to build their confidence and confirm their competency in carrying out the blood transfusion procedure for their neonates.

Fifth session (Practical): The researcher began by gathering feedback from the previous sessions and responding to any queries about blood transfusion before handing out the post-test and thanking each participant's nurse for their participation in the study.

IV-Evaluation phase:

The effectiveness of the simulated-based training program was measured by reassessing nurses' knowledge and practices and satisfaction both immediately following the execution of the program (posttest) and one month later (follow-up) using the same previous pretest tools.

Statistical analysis:

Data were tabulated, coded, and translated into a specially created form that could be entered into a computer. The data was entered and evaluated using SPSS version 22. The Excel program was used to assist in creating the visuals. Quantitative data were reported as mean and SD and analyzed using a t-test for comparison of the same group on the pretest and posttest. Quantitative data were represented using numbers and percentages. Pearson correlation was used to explain the relationship between normally distributed numerical variables. A P-value of 0.05 was used to establish the significance as follows:

A P-value less than 0.05 was considered to be statistically significant.

A P-value less than or equal to 0.001 was considered to be highly statistically significant.

Results:

Table 1 reveals that (58%) of the nurses who participated in the study were over the age of 25 with a mean age of 24.9 1.8 years, and 80% of them were female. 36% of the nurses who were studied had a baccalaureate degree in nursing, whereas 64% had technical institute nursing degrees. In terms of experience, 48% of them had between five and ten years' worth and 32% had more than five years.

Figure 1 illustrates that only 20% of the nurses in the study attended blood transfusion training sessions, whereas 80% did not.

Table 2 portrays an improvement in nurses' knowledge of blood transfusions with a highly significant difference detected between pre/immediate post and one-month post-implementation of simulated-based training ($P < 0.001$).

Figure (2) demonstrates that before to obtaining the simulated-based training, 70% of nurses had a poor knowledge level about blood transfusion. However, one month following receiving simulated-based training, their level of knowledge improved to a good level among (96.0%) of them, and one-month post- after simulated-based training implementation (94.0%). A highly significant difference was found between nurses' knowledge level pre/immediate post, and one-month post-simulated-based training implementation ($P < 0.001$).

According to Table (3), there was a very statistically significant difference in the way blood transfusions were performed before, just after, and one month after the deployment of simulated-based training ($P < 0.001$). Regarding preparation before the implementation of simulated-based training, it was evident that 46% of the nurses under study, their level of practice was incompetent, as opposed to 100% and 96%, respectively, immediately following the implementation of

the training and one month later, who had a competent level of practice. Additionally, it was discovered that 96% of nurses immediately after the simulated-based training implementation and 92% of nurses one month later had a competent level of practice compared to 58% of the study's nurses who had an incompetent level of practice regarding nursing care during blood transfusion. Finally, it was discovered that 68% of the examined nurses had an incompetent level of practice regarding nursing care after blood transfusion before the implementation of simulated-based training, in contrast to 98% immediately after the implementation of simulated-based training and 90% one month later had a competent practice level.

Figure (3) depicts the distribution of the studied nurses' practice levels for blood transfusion procedures before, immediately after, and one month after the implementation

of simulated-based training. It shows that 84% of the nurses had incompetent practice levels before the implementation of simulated-based training, compared to 16% after, while 92% of them had competent practice levels post one month of simulated-based training for implementation.

Table (4) demonstrates the distribution of the nurses' level of satisfaction with the procedures following the implementation of simulation-based training, all of them showed a satisfactory level following receipt of the training and at one month following the implementation with a high statistically significant difference.

Table (5): demonstrates that a statistically significant positive correlation was detected between the satisfaction scores before and after the implementation of simulated-based training for one month ($P \leq 0.001$).

Table (1): Demographic characteristics of the studied nurses (n. =50)

Demographic characteristics	No.	%
Age (Years)		
< 25 years	29	58
25 - $\geq$ 36 years	21	42
Mean $\pm$ SD	24.9 $\pm$ 1.8	
Gender:		
Male	10	20
Female	40	80
Qualifications:		
Technical Institute of Nursing	32	64
Baccalaureate degree in nursing	18	36
Years of experience:		
< 5 years	16	32
5 - <10 years	24	48
10 - $\geq$ 15 years	10	20

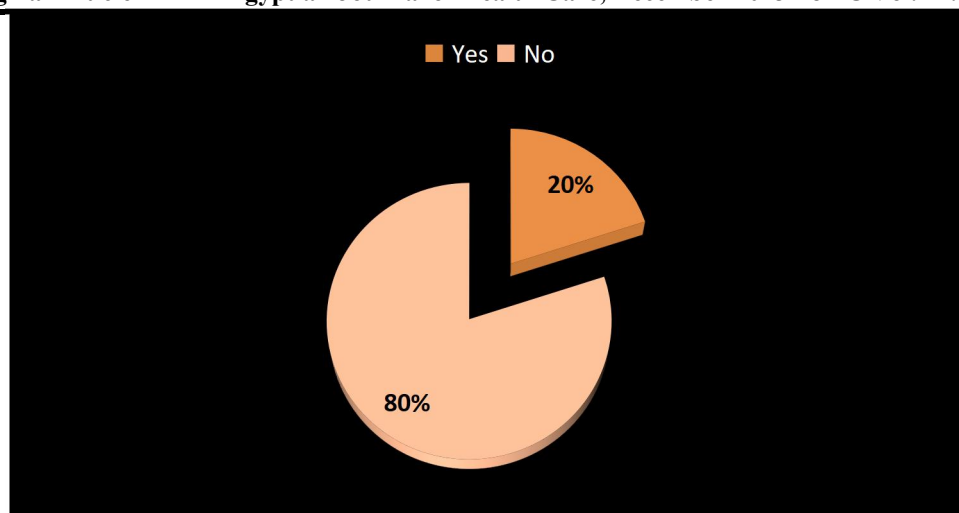


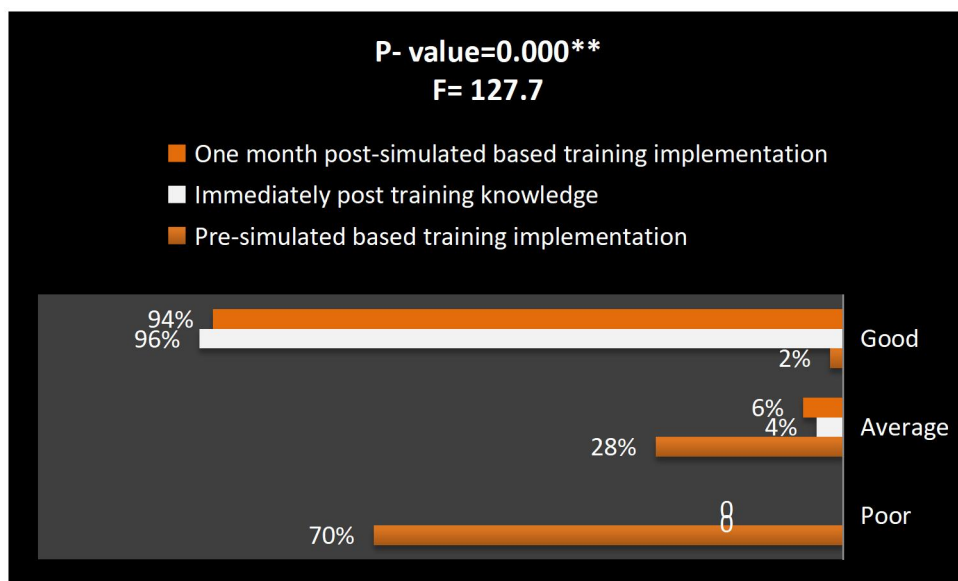
Figure (1): Percentage distribution of the studied nurses regarding attending training courses about blood transfusion.

Table (2): Nurses' knowledge regarding blood transfusion pre-, immediately post, and one month post-simulated based training (n. =50)

Nurses' knowledge regarding blood transfusion	Pre-simulated based training		Immediately post-simulated based training		One month post-simulated training		F	P-value
	No	%	No	%	No	%		
Definition								
- Correct	31	62.0	50	100	50	100	116.7	<0.001**
- Incorrect	19	38.0	0	0.0	0	0.0		
Purposes								
- Correct	23	46.0	48	96.0	47	94.0	142.6	<0.001**
- Incorrect	27	54.0	2	4.0	3	6.0		
Indications								
- Correct	27	54.0	48	96.0	46	92.0	132.7	<0.001**
- Incorrect	23	46.0	2	4.0	4	8.0		
Side effects								
- Correct	25	50.0	47	94.0	46	92.0	127.5	<0.001**
- Incorrect	25	50.0	3	6.0	4	8.0		
Nurse' role in blood transfusion								
- Correct	24	48.0	49	98.0	48	96	119.6	<0.001**
- Incorrect	26	52.0	1	2.0	2	4.0		
Nurse's role regarding care during blood transfusion								
- Correct	20	40.0	48	96	47	94.0	97.9	<0.001**
- Incorrect	30	60.0	2	4.0	3	6.0		
Nurse' role to prevent complications								
- Correct	27	54.0	48	96.0	46	92.0	87.6	<0.001**
- Incorrect	23	46.0	2	4.0	4	8.0		

(**) highly statistical significance at $p < 0.001$

Figure (2): Nurses' total level of knowledge regarding blood transfusion pre-, immediately post, and one-month post-simulated-based training (n=50)



(**) Highly significant at $P < 0.001$

Table (3): Distribution of the total nurses' practice regarding blood transfusion pre-, post, and two months post simulated training (n=50)

Nurses' practice	Pre-simulated based training				Immediately post-simulated based training				One month post-simulated training				F	P
	Incompetent		Competent		Incompetent		Competent		Incompetent		Competent			
	No	%	No	%	No	%	No	%	No	%	No	%		
Before blood transfusion	23	46.0	27	54.0	0	0	50	100	2	4.0	48	96.0	117.2	0.000**
During blood transfusion	29	58.0	21	42.0	2	4.0	48	96.00	4	8.0	46	92.0	183.2	0.000**
After blood transfusion	34	68.0	16	32.0	1	2.0	49	98.0	5	10.0	45	90.0	123.36	0.000**

** A highly statistically significant difference ($P \leq 0.001$)

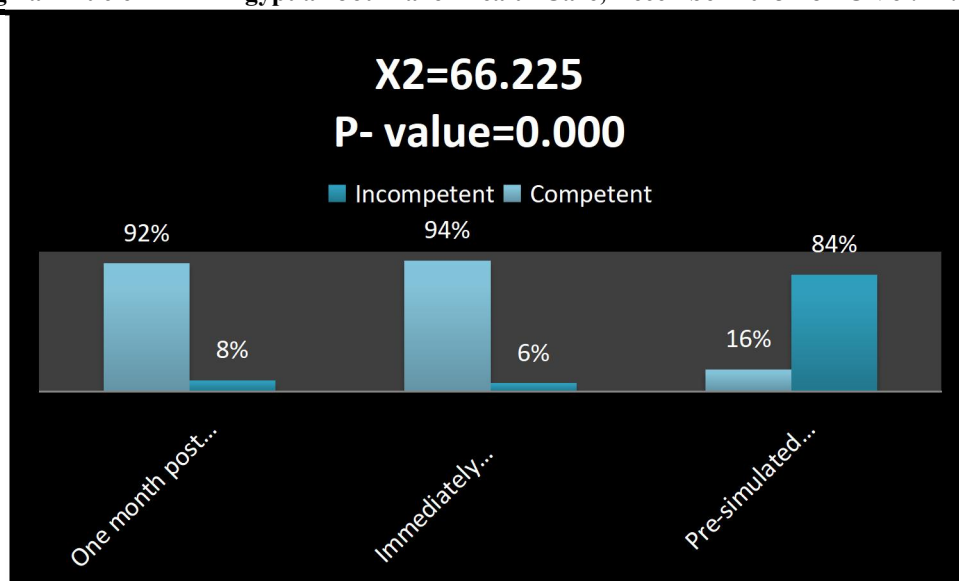


Figure (3) Nurses' total practice level regarding blood transfusion pre-, immediately, and post-simulated based on training

Table (4): Nurses' satisfaction level immediately post and after one month post-simulated based training (no=50)

Nurses' satisfaction items	Post-simulation-based training				one month Post- simulated based training implementation				F	P
	Unsatisfisfied		Satisfied		Unsatisfisfied		Satisfied			
	N	%	N	%	N	%	N	%		
The simulation teaching methods used were effective	17	34%	31	62%	0	0.0	50	100%	34.4	0.000**
Simulation promotes my learning	18	36%	32	64%	0	0.0	50	100%	69.2	0.000**
Using simulations to teach me was enjoyable.	15	30%	35	70%	0	0.0	50	100%	35.5	0.000**
The simulation teaching material used was motivating	18	36%	32	64%	0	0.0	50	100%	50.3	0.000**
The simulation's application was suitable for learning.	20	40%	30	60%	0	0.0	50	100%	69.7	0.000**

(**) Highly significant at P<0.001

Table (5): Correlation coefficient between total knowledge, practice, and satisfaction among the studied nurse'spre and post-one month of simulated-based training (No= 50)

Variables	Total knowledge score			
	Pre-simulated based training (n= 50)		The post-one month of simulated-based training (n= 50)	
	R	P	r	P
Total practices score	0.516	0.000**	0.712	0.000**
Total satisfaction score	0.533	0.000**	0.544	0.000**

(**) Correlation is highly significant at the <0.001

Discussion

Nursing educators can aid future nurses in preparing for real-world practice by using a variety of methods, including simulation. Performance refers to how well a certain task

performs when measured against accepted benchmarks for accuracy, completeness, cost, and speed. A growing body of evidence indicates that inadequate nursing performance is related to poor outcomes, especially in critically ill babies (McGaghie et al., 2019).

An efficient way to instruct nursing students without endangering them is through simulation training. Simulation training is regarded as an effective teaching approach because it gives students the chance to put their newly acquired skills to use while receiving immediate feedback in a friendly setting. As nurses are exposed to high-risk medical scenarios more frequently in simulated settings, they can form habits that will help them handle emergencies more expertly and with greater enjoyment (**Baayd et al., 2023**). Hence, the study was done to determine the impact of simulation-based training on nurses' performance and satisfaction regarding blood transfusion at the Neonatal Intensive Care Unit.

The results of this study showed that, with a mean age of 24.9 ± 1.8 years and a majority of female nurses, less than three-fifths of the studied nurses were older than 25 years. This result was consistent with the study by **Kotwal et al. (2017)**, "Morbidity and mortality among neonates admitted to a neonatal intensive care unit of a tertiary care teaching hospital of Jammu and Kashmir (India)". Similar findings were made by **Deshmukh and Shinde (2014)**, who performed a study in India, titled "Impact of structured education on knowledge and practice regarding venous access device care among nurses." They discovered that most of the nurses were female and between the ages of 21 and 30. Since nursing was previously only offered to girls in Egyptian institutions a few years ago, this fact may help to explain the high proportion of females and help to explain the findings of the current study.

In terms of nurses' experience years, it was discovered that fewer than half of the nurses in the study had spent between 5 and 10 years working in the Neonatal Intensive Care Unit. **Deshmukh and Shinde (2014)**, who discovered that the majority of the sample had less than 5 years of clinical experience, reported that the results were inconclusive. Similar findings were made by **Issa et al. (2018)** in their study, "Evaluation of Nurse's Knowledge in the Management of Premature Babies in Neonatal Units," which found that close to one-third of the nurses under investigation had one to five years of experience. More than half of the

nurses had between one and five years of experience, according to **Mohammed and Abdel Fattah's (2018)** research.

Results of the current study revealed that the majority of the nurses who were evaluated did not attend blood transfusion training classes, according to the study's findings. It supported the researchers' hypothesis that simulated-based training should be implemented for nurses.

According to the study findings, Less than two-quarters of the studied nurses had a poor total level of knowledge about blood transfusion before receiving the simulated-based training, but the vast majority of them improved to a good level after the simulated-based training, and one-month post simultaneous implementation and a highly statistically significant difference found between nurses' knowledge level pre/immediate post, and one-month post- simulated-based training implementation. From the researchers' point of view, this indicates how successful the use of simulated-based training was. This demonstrated the critical requirement to comprehend the simulated-based training implementation's goal of knowledge improvement. The current outcome might be brought about by nurses' interest in academic curricula and their inability to retain knowledge, in addition to a lack of refresher programs, while they attempt to pass academic exams.

Additionally, the fact that nurses have such a high level of knowledge may be a result of the beneficial effects of simulation training combined with theoretical learning sessions. This finding is corroborated by **Cerra et al. (2018)**, who investigated the "Effects of high-fidelity simulation-based on life-threatening clinical condition scenarios on learning outcomes" among undergraduate and postgraduate nursing students and found that simulation training enhanced nursing students' performance and knowledge.

These findings were in line with a study by **Purfarзад et al. (2021)** entitled "Is it necessary to give calcium infusion during the blood transfusion in newborns," which discovered that the majority of the nurses under investigation had sufficient knowledge of

appropriate transfusion monitoring and the necessary actions to take in the event of a transfusion reaction. Similarly, **Deshmukh and Shinde's (2014)** research, which indicated that fewer than half of the sample's knowledge was inadequate before the intervention but improved in the post-test, also lends support to this finding. Additionally, compared to the pre-test, the post-test's mean knowledge score increased. A study conducted in London by **Chou et al., (2022)**, carried out in London and published there supports the findings of the current study and reported that there was an improvement in clinical knowledge following the simulation of scenarios.

The findings regarding nurses' blood transfusion practice before, immediately following, and one month following the implementation of simulated-based training showed that a highly statistically significant difference was observed between nurses' practices before, immediately following, and one month following the implementation of simulated-based training. According to the researcher, nurses must develop their abilities to meet the unique needs of newborns in terms of blood transfusion to decrease complications during hospitalization and demonstrate the value of simulation-based education. Additionally, this outcome can be explained by the fact that a high degree of knowledge has a good impact on the level of practice.

The results of **Deshmukh and Shinde (2014)**, which discovered that most nurses' practice scores improved after structured education, are likewise consistent with this finding.

This finding contradicts a study by **Mukhlif and Neamah (2021)** titled "Efficacy of an Educational Program on Nurses' Practices about Exchange Transfusion Procedure in Neonatal Intensive Care Unit in Al-Ramadi Teaching Hospital for Maternity and Children," which found that the majority of the studied nurses had reasonable exchange transfusion practices.

The current study's findings showed that after receiving the simulation-based training and one month after its deployment, every participant reported performing at a

satisfactory level. The introduction of simulated-based training had a good impact on practice among the researched nurses, according to the researchers, and it was successful in raising the scores of practice level among the studied nurses. Regarding contentment, this outcome might be a result of the simulation training being a secure learning environment where new nurses can master skills that advance their knowledge and practices, which in turn boost their satisfaction.

This was consistent with other studies by **Gomes et al. (2020)**, who investigated "Clinical simulation for the teaching of wound evaluation and treatment," and **Nuraini et al. (2015)**, who studied the effect of simulation-based education on nursing students' practical achievements and found that it enhanced performance. Additionally, **Beal et al. (2017)** discovered that clinical simulation was a beneficial tactic for raising the performance of the students they studied when compared to other training methods.

The current study's findings showed that after obtaining the simulated-based training, the nurses reported performing at a satisfactory level. This finding is consistent with that made by **Zapko et al. (2018)**, who found that the sample was satisfied with the simulated education experience, were confident in their abilities, and believed the simulations were grounded in sound educational principles and were essential for learning. Additionally, **Saied's (2017)** study on "The impact of simulation on pediatric nursing students' knowledge, self-efficacy, satisfaction, and confidence" found that the same result after the simulation session. The students were satisfied with the simulation learning activity, according to **Mattson (2013)** who used the Solomon-Four study design to examine the effects of high-fidelity simulation on knowledge acquisition, self-confidence, and satisfaction with Baccalaureate Nursing Students.

The current study's findings showed a positive association between nurses' satisfaction before and after obtaining simulated-based training on blood transfusion procedures as well as their knowledge and practice of the technique. According to the researchers, the application of simulated-based training was linked to an increase in knowledge level that

assisted the nurses in mastering the performance of clinical skills. This result is in line with the findings of **Abd Elbaky (2018)**, who studied "Impact of a simulated education program on nurses' performance of invasive procedure at intensive care units" and reported that a positive correlation was detected between knowledge and general performance post the simulation education program.

According to the findings of the current study, there is a positive correlation between the total score level of nurses' knowledge about blood transfusions for neonates and the total score level of nurses' practices regarding the care of neonates receiving blood transfusions. The findings are consistent with those of **Abdel-Gafour et al. (2020)**, who investigated the "Effect of Nursing Intervention on Care of Neonates Suffering from Hyperbilirubinemia" and found a positive correlation between the total score level of nurses' knowledge of blood transfusion and the total score level of nurses' performance.

Conclusion

Based on the results of this study, it can be said that simulation-based training helped nurses perform better regarding blood transfusion procedures and be more satisfied. One month after the implementation of the simulation-based training, all of them reported a sufficient level with a high statistically significant difference. As a result, the study's goal was accomplished and its hypotheses were confirmed.

Recommendations

Depending on the current study findings, it can be recommended that:

- It is essential to regularly examine and update the established administrative policy, written standards, and nursing measures regarding blood transfusion for both normal and preterm neonates.
- It is advised that nurses working in the Neonatal Intensive Care Unit receive ongoing training regarding changes to blood transfusion.
- Regular evaluation of nurses' performance in the Neonatal Intensive Care Unit's blood transfusion care of newborns.
- Motivate nurses to attend workshops, conferences, and training sessions on the care of newborns receiving blood

transfusions to enhance and refresh their knowledge and practices.

- For all nurses caring for newborns receiving exchange transfusions, a procedure book should be available in the neonatal intensive care unit.
- Offer simulation-based pre-service and in-service training programs for newly hired nurses to raise their performance levels.
- It is need to undertake additional research to carry out a comparable study with a larger sample size in diverse contexts for the findings to be generalized.

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