Research Article

Effect of competency-based training on Nurses' Regarding Oxygen Administration Safety for Neonates with Respiratory Distress

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Abstract

Background: Oxygen therapy is a life-saving intervention for neonates with respiratory distress. Nurses' competency is a matter of concern worldwide and the complexity of assessing nurses' clinical competence has challenged educators for decades

Aim: to evaluate the effect competency-based training on nurses' regarding oxygen administration safety for neonates with respiratory distress.

Design: quasi experimental research design was used in this study.

Setting: The study was conducted at the Neonatal Intensive Care Unit (NICU) in Aswan University Hospital.

Subjects: A convenience sample of 50 nurses working in the NICU.

Methods: Two tools were used in this study: (1) Structured interview questionnaire for personal data, (2) nurses' competence questioner.

Results: The training led to a highly significant improvement in nurses' competency 78%. The a marked improvement in the total nurses' competence score post-intervention with a highly statistically significant difference (p=0.000). The mean total competence score increased from 27.84 ± 12.33 pre-intervention to 68.84± 9.36 post-intervention.

Conclusion: Training is highly effective in improving nurses' competency regarding oxygen administration safety for neonates

Recommendation: Implement regular competency-based training for nurses to improve their skills regarding safe oxygen administration for neonates with respiratory distress

Keywords: Neonates, Nurses' competency-based, Oxygen administration safety, Respiratory distress.

Introduction

Respiratory system is one of the most vital systems in the human body, playing a fundamental role in sustaining life through the continuous exchange of gases between the external environment and body tissues. This system ensures the delivery of oxygen, which is essential for cellular metabolism, and elimination of carbon dioxide, a potentially toxic by-product of metabolic processes (Mortola et al., 2024). In addition its primary function of gas exchange, the respiratory system contributes significantly to the regulation of acid–base balance, immune defense mechanisms, vocalization, and thermoregulation . Any disturbance in its structure or function can lead to serious physiological consequences, emphasizing the importance of understanding both the anatomy and physiology of this system, particularly in clinical and nursing practice (Bhandari et al. , 2023).

Competency represents the integration of knowledge, skills, values, and attitudes. Nurses' competency is a matter of concern worldwide and the complexity of assessing nurses' clinical competence has challenged educators for decades (Khan& Ramachandran, 2020). Professional competence helps nurses perform well at work. Also competence increases care skills and nursing education. Frustration and work discontent might impair nursing care when nurses don't know what they're doing. To improve nursing care, nurses must be strengthened and trained (Karami et al., 2025).

The essential elements of competency-based includes determining the competencies needed for each job role, creating standards and assessment criteria for competencies, assessing nurse performance, offering opportunities for training and development, and continuously tracking and evaluating nurse performance *(*Cruz-Sandoval et al., 2023*).* Competency-based has several benefits, such as enhanced output, higher caliber output, fewer mistakes, higher neonate satisfaction, and more engaged and happy nurses. This kind of training makes it easier to pinpoint the precise areas in which workers need to develop and those in which they already excel (Goldhamer et al., 2022*).*

An effective organizational strategy to teach, assesses, and enhances nurse satisfaction and performance must include competency-based training. By establishing a competency-based training education, organizations may guarantee that their workforce possesses the requisite skills and knowledge to carry out their job duties with efficiency. Among other advantages, this can result in increased neonate satisfaction, decreased errors, and increased productivity *(*Maunsell-terry& Taşkin, 2023*).*

Significance of the Study:

A high proportion of very unwell neonates admitted to hospitals in impoverished nations continue to require oxygen therapy, yet supplies are frequently unreliable, and the benefits of treatment may be diminished by poorly maintained equipment or poorly trained staff with inadequate guidelines (Morrow et al., 2023). Demand for competent nurses is rising, as healthcare professionals must discover and develop more appropriate strategies for learning specific information (Heydari et al., 2022). Thus, the objective of the present study is to evaluate the effect of competency-based training on nurses' regarding oxygen administration safety for neonates with respiratory distress.

Aim of the Study

The aim of this study was to evaluate effect of competency-based training on nurses' regarding oxygen administration safety for neonates with respiratory distress.

Research Hypotheses

(H1): The training is expected to improve nurses' competency regarding oxygen administration safety for neonates with respiratory distress.

Subjects and Method Research design:

quasi experimental research design was used in this study.

Setting:

The study was conducted at the Neonatal Intensive Care Unit (NICU) in Aswan University Hospital. Which located in the third floor at building A and consisted of two rooms with 7 incubators, and at the fifth floor in building B that had 6 incubators .This setting was selected because it receives a large number of neonates suffering from respiratory disorders.

Subjects:

A convenience sample of all nurses (n=50) working at the NICU and providing care for neonates with respiratory distress were included.

Tools for data collection: Two tools were used:

Tool I: Structured interview questionnaire

Developed by the researcher after reviewing literature. It consisted of two parts:

Part (1): personal data of the nurses as : age, gender, level of education, years of experience, and attendance of previous training courses.

Part (2): personal data of the neonates: age, gender, weight on admission , current weight ,type of birth , gestational age and duration in NICU

Tool (II): The nurses' competence questionnaire : It is based on Meretoja et al. (2004) that consisted of 25 steps divided into seven categories: helpful role (4 steps), diagnostic functions (2 steps), teaching-coaching (3 steps), situation management (7 steps), quality assurance (3 steps), therapeutic interventions (2 steps), and work role (4 steps).

- **Scoring system:** from 0 to 100, with low competence being 0-25, quite competence being 25-50, competence being 50-75, and very competence being 75-100. Individual items' frequency of use in clinical practice is expressed on a four-point scale (not applicable to nurse's work had score (0), used very rarely (1), used occasionally (2), and used very often (3).(Meretoja et al. 2004)

Method of data collection

1. 1 .Ethical approval was accomplished by ethical committee at the faculty of nursing at Assiut University.
2. The researcher obtained official permission from the director of the neonate intensive care unit (NICU) at Aswan University Children's Hospital to collect the necessary data after explaining the nature of the study.
3. The researcher studied relevant literature, both national and international, to gain comprehensive knowledge about the topic and develop data collection tools.
4. The researcher introduced herself, explained the nature and purpose of the study, and then obtained the nurses' written consent for voluntary participation.
5. Pilot study

A sample of five nurses (10%)= 50 nurses was tested to assess the tool clarity and applicability and to estimate the time required to complete each form. According to the pilot study results, no changes, omissions, or additions were made. The nurses in the pilot study were included in the entire sample

6. Validity

The content validity index of the tools were evaluated by five expertise in Pediatric nursing and pediatrics field for its clarity , relevance , comprehensiveness , simplicity and applicability

- The validity of tool (1) yielding a score of 97%.
- The validity of tool (2) yielding a score of 90%.

7. Reliability

Reliability was performed on tools (1) and (2) using alpha Cronbach's test to measure the internal consistency

- The reliability of tool (1) was (r = 0.826).
- The reliability of tool (2) was (r = 0.801)

Field of the work:

The fieldwork of the study was conducted over a six-month period, from the beginning of May to the end of October 2025, at the Neonatal Intensive Care Unit (NICU) of Aswan University Hospital. The study included a convenience sample of 50 nurses who provided care for neonates with respiratory distress.

The research visited the NICU twice weekly and conducted data collection during morning and evening shifts, according to the nurses' availability and workload. Each interview with a nurse lasted approximately 10–15 minutes. Before starting data collection, the researcher introduced herself, explained the nature and purpose of the study. Two tools were used for data collection. The first tool was a structured interview questionnaire. The second tool was the Nurses' Competence Questionnaire

. The sessions were arranged according to the nurses' working shifts to facilitate attendance without interfering with routine patient care. PowerPoint presentations, illustrative pictures and diagrams, verbal explanations, and group discussions were used as teaching methods to support the learning process and improve nurses' understanding of safe oxygen administration for neonates with respiratory distress. The nurses' competence was assessed before and after the training intervention using the Nurses' Competence Questionnaire. The pre-intervention assessment established the nurses' baseline competence levels, while the post-intervention assessment was conducted to evaluate changes in competence following the training.

The Nurse Competence level contains the following items:

Helpful role: (4 steps)

1. Care planning for oxygen therapy administration safety.
2. Changing the care plan to meet the demands of the oxygen therapy administration.
3. Ethical ideals guide decision-making.
4. Workload organization and time management strategies for meeting duties).

Teaching –coaching: (3 steps)

1. Taking proactive steps to maintain and build professional abilities in oxygen therapy administration safety.
2. Mentoring people in my area of responsibility.
3. Delegating the nursing team as a method of controlling the work flow.

Diagnostic functions: (2 steps)

1. Documentation of nursing care delivered to children with respiratory insufficiency about oxygen therapy administration safety.
2. Identifying the demands of oxygen therapy administration safety supplied to children with respiratory insufficiency for physical assistance.

Situation management: (7 steps)

1. Setting flexible priorities for Oxygen Therapy Administration Safety offered to neonate with respiratory insufficiency in response to changing circumstances.
2. Organizing debriefing sessions for the care team in response to changing circumstances.
3. Fostering adaptable teamwork in rapidly changing conditions.
4. Recognizing situations that pose a risk to neonate's lives early on.
5. Taking appropriate action in life-threatening situations for neonate with respiratory failure.
6. Consistently planning care for Oxygen Therapy Administration Safety with existing resources.
7. Maintaining the condition of nursing care equipment.

1- Therapeutic processes (2 steps).

1. Including relevant knowledge to deliver the best possible treatment for oxygen administration safety.
2. Evaluating Nursing Care Outcomes Following oxygen administration safety.

Assuring quality. (3 stages).

1. Be familiar with hospital policies and procedures.
2. Understand the hospital's vision, purpose, and goals.
3. Capable of identifying areas of nursing care that require more development.

Work role:

1. Acting independently.
2. Recognize the limitations of one's own resources.
3. Being responsible with little financial resources.
4. Using information technology in my work to facilitate safe care and improve outcomes for oxygen therapy administration safety.

Results

Table (1): Personal data of the studied nurses. (n=50).

Personal data	No.	%
Age (years)		
<25	7	14.0
25-30	40	80.0
>30	3	6.0
Mean ± SD (rang)	27.1 ± 2.2	
Gender		
Males	14	28.0
Females	36	72.0
Educational level		
Secondary school of nursing	20	40.0
Technical institute of nursing	10	20.0
Bachelor's degree in nursing	11	22.0
Master degree in nursing	7	14.0
Doctorate degree in nursing	2	4.0
Years of experience		
<5	3	6.0
5-10	38	76.0
>10	9	18.0
Mean ± SD (rang)	8.1±2.5	
Training course regarding oxygen administration safety		
Yes	5	10.0
No	45	90.0

SD= Standard deviation

Table (1): Shows the distribution of the studied nurses according to their personal data. The results showed that the majority 80.0% of the studied nurses were aged between 25 and 30 years, with a mean ± SD 27.1 ± 2.2 years. Regarding gender, less than three quarters of the nurses (72.0%) were females. Concerning the educational level, two-fifth of them (40.0%) had a secondary school of nursing, while a small minority (4.0%) held a doctorate degree. Furthermore, more than three-quarters of the nurses, (76.0%) had 5 to 10 years of experience in the nursing filed.

Table (2): Comparison between nurses' competence in helping role and teaching–coaching regarding oxygen administration safety pre and post intervention (n=50).

Items	Pre intervention								Post intervention								X^2	P-value
	Used very often		Used occasionally		Used very rarely		Not applicable		Used very often		Used occasionally		Used very rarely		Not applicable			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Helping role																		
Planning care for oxygen therapy administration Safety.	4	8.0	12	24.0	21	42.0	13	26.0	41	82.0	6	12.0	3	6.0	0	0.0	58.92	0.000**
Modifying the care plan according to oxygen therapy administration needs.	2	4.0	16	32.0	22	44.0	10	20.0	41	82.0	9	18.0	0	0.0	0	0.0	69.33	0.000**
Decision-making guided by ethical values.	3	6.0	10	20.0	27	54.0	10	20.0	40	80.0	6	12.0	4	8.0	0	0.0	59.90	0.000**
Organizing own workload and time management principles	4	8.0	11	22.0	20	40.0	15	30.0	39	78.0	10	20.0	1	2.0	0	0.0	60.72	0.000**
Teaching–coaching																		
Taking proactive actions to preserve and develop the professional skills	5	10.0	9	18.0	23	46.0	13	26.0	36	72.0	11	22.0	3	6.0	0	0.0	52.02	0.000**
Coaching others in duties within my responsibility area.	2	4.0	12	24.0	26	52.0	10	20.0	37	74.0	11	22.0	2	4.0	0	0.0	62.02	0.000**
Controlling technique for the workflow through delegating the nursing team.	6	12.0	11	22.0	19	38.0	14	28.0	39	78.0	9	18.0	2	4.0	0	0.0	52.16	0.000**

X^2: Chi-square test. **Highly significant at p ‹ 0.01.

Table (2): Represents comparison between nurses' competence in helping role and teaching–coaching

regarding oxygen administration safety pre and post intervention . The results indicated that there were a highly statistically significant differences (p=0.000) in all items of the helping role and

Table (3): Comparison between nurses' competence in diagnostic functions and managing situations regarding oxygen administration safety pre and post intervention (n=50).

Items	Pre intervention								Post intervention								X^2	P-value
	Used very often		Used occasionally		Used very rarely		Not applicable		Used very often		Used occasionally		Used very rarely		Not applicable			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Diagnostic functions																		
Documentation of nursing care regarding oxygen therapy administration safety.	4	8.0	7	14.0	31	62.0	8	16.0	39	78.0	10	20.0	1	2.0	0	0.0	65.14	0.000**
Identifying needs of oxygen therapy administration safety.	5	10.0	10	20.0	26	52.0	9	18.0	38	76.0	8	16.0	4	8.0	0	0.0	50.68	0.000**
Managing situations																		
Prioritizing activities flexibly regarding oxygen therapy administration safety.	6	12.0	9	18.0	18	36.0	17	34.0	42	84.0	7	14.0	1	2.0	0	0.0	59.46	0.000**
Arranging debriefing sessions for the care team according to changing situations.	2	4.0	11	22.0	23	46.0	14	28.0	41	82.0	7	14.0	2	4.0	0	0.0	67.90	0.000**
Promoting flexible team co-operation in rapidly changing situations.	3	6.0	6	12.0	29	58.0	12	24.0	42	84.0	5	10.0	3	6.0	0	0.0	67.01	0.000**
Recognizing situations posing a threat to children ' life early.	2	4.0	9	18.0	22	44.0	17	34.0	39	78.0	10	20.0	1	2.0	0	0.0	69.61	0.000**
Acting appropriately in life-threatening situations for children.	3	6.0	11	22.0	20	40.0	16	32.0	44	88.0	5	10.0	1	2.0	0	0.0	71.20	0.000**
Planning care consistently regarding oxygen therapy administration safety with resources available.	1	2.0	15	30.0	21	42.0	13	26.0	40	80.0	8	16.0	2	4.0	0	0.0	67.92	0.000**
Keeping nursing care equipment in good condition.	4	8.0	10	20.0	18	36.0	18	36.0	44	88.0	2	4.0	4	8.0	0	0.0	65.57	0.000**

X^2: Chi-square test. **Highly significant at p ‹ 0.01.

Table (3): Indicates comparison between nurses' competence in diagnostic functions and managing situations regarding oxygen administration safety pre and post intervention. The data showed that, there were a highly statistically significant differences (p=0.000) in all items of diagnostic functions and managing situations post-intervention. Aching-coaching competence post-intervention.

Table (4): Comparison between nurses' competence in therapeutic interventions, ensuring quality and work role regarding oxygen administration safety pre and post intervention (n=50).

Items	Pre intervention								Post intervention								X^2	P-value
	Used very often		Used occasionally		Used very rarely		Not applicable		Used very often		Used occasionally		Used very rarely		Not applicable			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Therapeutic interventions																		
Incorporating relevant knowledge to provide optimal care.	1	2.0	10	20.0	25	50.0	14	28.0	37	74.0	11	22.0	2	4.0	0	0.0	67.74	0.000**
Evaluating systematically nursing care after oxygen therapy administration safety.	2	4.0	12	24.0	29	58.0	7	14.0	40	80.0	8	16.0	2	4.0	0	0.0	65.69	0.000**
Ensuring quality																		
Familiar with hospital policy and rules.	3	6.0	8	16.0	20	40.0	19	38.0	42	84.0	6	12.0	2	4.0	0	0.0	67.81	0.000**
Familiar with hospital vision, mission and goals.	1	2.0	21	42.0	23	46.0	5	10.0	40	80.0	7	14.0	3	6.0	0	0.0	64.48	0.000**
Able to identify areas in nursing care that need further development.	6	12.0	15	30.0	15	30.0	14	28.0	38	76.0	9	18.0	2	4.0	1	2.0	45.98	0.000**
Work role																		
Acting autonomously.	3	6.0	11	22.0	24	48.0	12	24.0	42	84.0	6	12.0	2	4.0	0	0.0	65.88	0.000**
Aware of the limits of own resources.	2	4.0	14	28.0	29	58.0	5	10.0	37	74.0	9	18.0	4	8.0	0	0.0	56.43	0.000**
Acting responsibly in terms of limited financial resources.	3	6.0	10	20.0	26	52.0	11	22.0	41	82.0	6	12.0	3	6.0	0	0.0	63.06	0.000**
Utilizing information technology in work to support safe care for oxygen therapy administration.	5	12.0	13	26.0	22	44.0	10	20.0	40	80.0	9	18.0	1	2.0	0	0.0	57.12	0.000**

X^2: Chi-square test. **Highly significant at p ‹ 0.01.

Table (4): Shows comparison between nurses' competence in therapeutic interventions, ensuring quality and work role regarding oxygen administration safety pre and post intervention. The analysis presented that, there were a highly statistically significant differences (p=0.000) in all items of therapeutic interventions, ensuring quality, and work role post-intervention.

Table (5): Comparison between nurses regarding their total competence score at pre and post intervention (n=50).

Competence subscales	No. of items	Pre-intervention	Post-intervention	Z	P-value
		Median (IQR) Mean ± SD	Median (IQR) Mean ± SD		
Helping role	4	4.0 (3.0-6.0) 4.54 ± 2.47	12.0 (11.0-12.0) 11.06 ± 1.71	6.116	0.000**
Teaching–coaching	3	3.0 (2.0-5.0) 3.42 ± 1.86	9.0 (7.0-9.0) 8.10 ± 1.45	6.067	0.000**
Diagnostic functions	2	2.0 (2.0-3.0) 2.36 ± 1.29	6.0 (5.0-6.0) 5.44 ± 0.95	6.161	0.000**
Managing situations	7	6.0 (4.0-9.0) 7.12 ± 3.88	21.0 (19.0-21.0) 19.56 ± 2.54	6.162	0.000**
Therapeutic interventions	2	2.0 (1.0-3.0) 2.14 ± 1.23	6.0 (5.0-6.0) 5.46 ± 0.89	6.217	0.000**
Ensuring quality	3	4.0 (2.0-4.0) 3.52 ± 1.94	9.0 (8.0-9.0) 8.22 ± 1.34	6.116	0.000**
Work role	4	4.0 (3.0-6.0) 4.72 ± 2.44	12.0 (11.0-12.0) 11.00 ± 1.77	6.116	0.000**
Total competence score	**25**	25.0 (20.75-38.25) 27.84 ± 12.33	74.0 (64.0-75.0) 68.84 ± 9.36	6.158	0.000**

**Highly significant at p ‹ 0.01.

Table (5): Exhibits comparison between nurses regarding their total competence score at pre and post intervention. The findings confirmed that, there was a marked improvement in the total nurses' competence score post-intervention with a highly statistically significant difference (p=0.000). The mean total competence score increased from27.84 ± 12.33 pre-intervention to 68.84± 9.36 post-intervention.

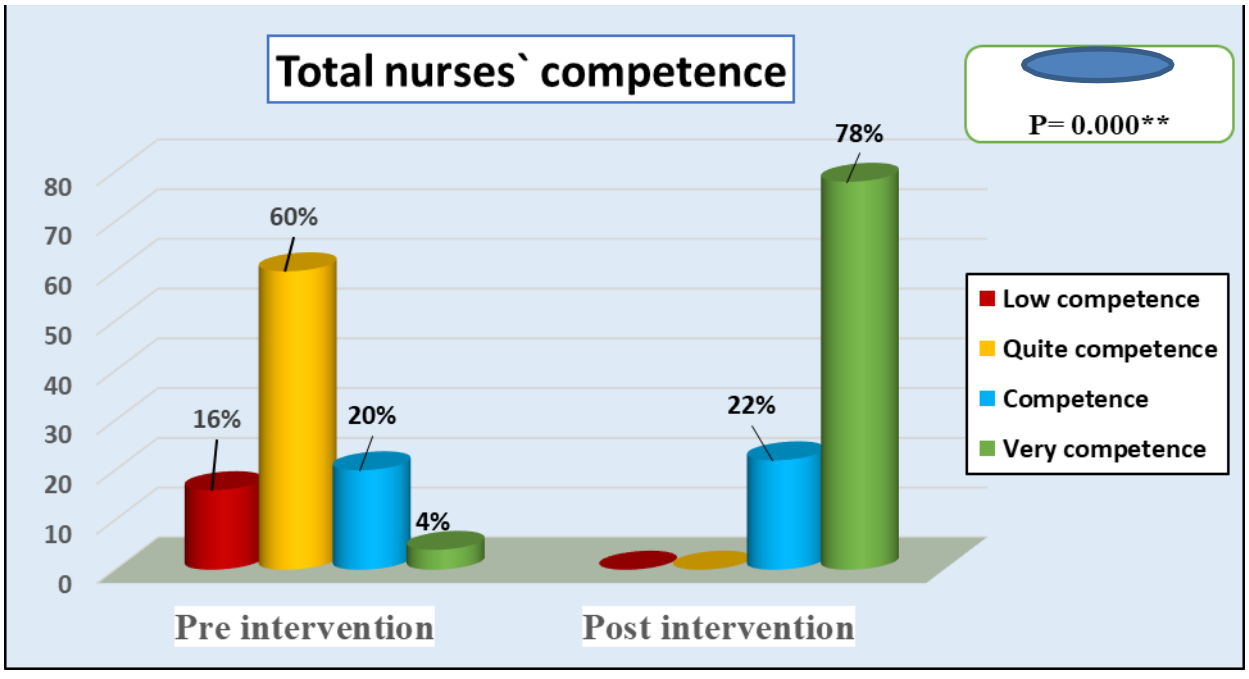


Figure (1): Total nurses' competence score regarding oxygen administration safety pre and post intervention (n=50).

Figure (1): Shows that, total nurses' competence score regarding oxygen administration safety pre and post intervention. It, illustrated from this figure that 4% of the studied nurses had very competence score in pre intervention compared with 78% of them in post intervention. with a highly statistically significant difference (p=0.000**)

Table (6): Relations between personal data of the studied nurses' and their total competence level at pre and post intervention (n=50).

Personal data		Level of total competence at pre-intervention								X^2	P-Value	Level of total competence at post- intervention				X^2	P-Value
		Very (n=2)		Competence (n=10)		Quite (n=30)		Low (n=8)				Very (n=39)		Competence (n=11)			
		No.	%	No.	%	No.	%	No.	%			No.	%	No.	%		
Age (years)	<25	0	0.00	0	0.0	4	13.3	3	37.5	9.515	0.147	4	10.3	3	27.3	2.714	0.257
	25-30	2	100.0	8	80.0	25	83.3	5	62.5			32	82.1	8	72.7		
	>30	0	0.00	2	20.0	1	3.3	0	0.0			3	7.7	0	0.0		
Gender	Males	1	50.0	2	20.0	10	33.3	1	12.5	2.174	0.537	10	25.6	4	36.4	0.489	0.484
	Females	1	50.0	8	80.0	20	66.7	7	87.5			29	74.4	7	63.6		
Educational level	Secondary school	0	0.0	0	0.0	13	43.3	7	87.5	84.17	0.000**	11	28.2	9	81.8	11.83	0.019*
	Technical institute	0	0.0	0	0.0	9	30.0	1	12.5			8	20.5	2	18.2		
	Bachelor's degree	0	0.0	4	40.0	7	23.3	0	0.0			11	28.2	0	0.0		
	Master	0	0.0	6	60.0	1	3.3	0	0.0			7	17.9	0	0.0		
	PhD	2	100.0	0	0.0	0	0.0	0	0.0			2	5.1	0	0.0		
Years of experience (years)	<5	0	0.0	1	10.0	1	3.3	1	12.5	13.08	0.042*	2	5.1	1	9.1	0.245	0.885
	5-10	0	0.0	6	60.0	26	86.7	6	75.0			30	76.9	8	72.7		
	>10	2	100.0	3	30.0	3	10.0	1	12.5			7	17.9	2	18.2		
Training course	Yes	1	50.0	3	30.0	1	3.3	0	0.0	10.37	0.016*	5	12.8	0	0.0	1.567	0.211
	No	1	50.0	7	70.0	29	96.7	8	100.0			34	87.2	11	100.0		

X^2: Chi-square test. No significant at p >0.05. *Statistically significant at p<0.05. **Highly significant at p ‹ 0.01.

Table (6): Illustrates, relations between personal data of the studied nurses' and their total competence level at pre and post intervention that, It was found that there were a highly statistically significant relation between total nurses' competence at pre-intervention and their personal data as regards educational level ,years of experience and training course (0.000** , 0.042 and 0.016**) respectively . Also, the results found that, there was a statistically significant relation at post-intervention as regards educational level only (0.019*)

Discussion

The World Health Organization highlights the crucial need to prioritize the safety of hospitalized neonate, especially those in intensive care units. Also, emphasize that neglecting neonate safety can lead to increased financial burdens, emotional distress for both the neonate and their families, and extended hospital stays (Kalroozi et al., 2022) .The safe administration of oxygen to neonates is a cornerstone of care in the neonatal intensive care unit (NICU). Oxygen, while life-saving, is a medication that can lead to severe complications such as retinopathy of prematurity (ROP) and bronchopulmonary dysplasia (BPD) if not administered safely. (Adly et al., 2020).

The concept of competence extends beyond discrete to encompass broader professional roles. The current study revealed a profound and highly significant improvement in all seven competence subscales post-intervention. This holistic development aligns with Wilborn et al. (2024) , who emphasized that education and training are foundational to developing overall nursing competence and ensuring neonate safety. Similarly, Deuber et al. (2013) Theoretical framework of nursing competence suggests that nurses progress from novice to expert through a combination of education and experience, which is precisely what the current intervention facilitated. The researcher interprets these findings as evidence that the intervention did not just teach isolated tasks; it fostered a deeper integration of safety into the nurses' professional identity and decision-making processes. The improvement in areas like "decision-making guided by ethical values" and "recognizing situations posing a threat to neonate's life early" reflects the development of critical thinking and clinical judgment. These are higher-order competencies that cannot be achieved through simple skills training but require a comprehensive educational approach that addresses cognitive, affective, and psychomotor domains of learning.

This finding is particularly important as it reflects the development of critical thinking and accountability, which

are hallmarks of a competent practitioner. Competent nurses are not just those who can perform procedures correctly, but those who can assess situations, make sound decisions, prioritize care, and collaborate effectively with the healthcare team. The significant improvement in all seven subscales suggests that the intervention successfully addressed these broader professionalcompetencies. Luk et al. (2025) similarly found that comprehensive quality improvement initiatives enhanced not only technical skills but also team collaboration and situational awareness.

The study found statistically significant relation between nurses' total knowledge score at pre-intervention and their educational level, years of experience, and attendance of previous training courses.This finding aligns with Dansa et al. (2024) , who found that work experience was significantly associated with knowledge .Similarly, Khalid et al. (2024) reported significant relationships between knowledge and educational qualifications. Abohadida et al. (2025) also found that prior training was strongly associated with better knowledge scores.

The researcher suggests that higher educational levels provide specialized knowledge and critical thinking skills, as nurses with bachelor's and master's degrees have more extensive theoretical preparation compared to those with secondary school of nursing education. Experience allows nurses to learn from clinical situations and apply theoretical knowledge in practice, while prior training courses provide focused, up-to-date information on specific topics. All of these factors contribute to building a stronger knowledge foundation and increase the nurses'competence.

This is a powerful finding that suggests a well-designed educational can effectively level the playing field by reducing knowledge gape , bringing nurses from diverse educational and experiential backgrounds to a uniformly high standard of knowledge. The researcher believes this demonstrates the value and effectiveness of structured continuing education programs in addressing knowledge gaps and ensuring that all nurses, regardless of their background, have access to essential information needed for safe practice. Wilborn et al. (2024) reported similar findings, noting that standardized education programs reduced knowledge disparities among nurses.

The persistence of this relation post-intervention, particularly for educational level, suggests that while training is immensely beneficial, a strong educational foundation continues to influence the application of practical skills. The researcher attributes this to the deeper understanding and enhanced clinical reasoning that often accompanies advanced education. Nurses with higher education may be better able to adapt general principles to specific clinical situations, understand the rationale behind procedures, and troubleshoot when problems arise This finding may be due to training courses providing nurses with updated knowledge, practical skills, and a better understanding of protocols, all of which contribute to improved performance in clinical practice. Additionally, training courses often include opportunities for hands-on practice and feedback, which are essential for skill development. The researcher emphasizes that regular, structured training are essential for maintaining and improving clinical competence, particularly in specialized areas like neonatal care where technology and evidence-based are constantly evolving.

The concept of nursing competence extends beyond the acquisition of knowledge and performance of technical skills, encompassing a wide range of professional abilities such as clinical decision-making, teamwork, ethical practice, and quality improvement. The findings of the present study revealed a remarkable and highly statistically significant improvement in nurses' competence regarding oxygen administration safety for neonates following the training intervention.

The results demonstrated significant improvements across all competence domains including helping role, teaching–coaching, diagnostic functions, managing situations, therapeutic interventions, ensuring quality, and work role. The total competence score increased substantially from

27.84 ± 12.33 pre-intervention to 68.84 ± 9.36 post-intervention, indicating the strong impact of the educational program on developing nurses' professional capabilities in the neonatal intensive care unit.

This finding is consistent with Wilborn et al. (2024), who emphasized that structured educational programs and competency-based training are essential for enhancing nurses' clinical competence and ensuring safe neonatal care Similarly, Luk et al. (2025) reported that comprehensive quality improvement initiatives significantly improved nurses' competencies in neonatal oxygen management, including clinical judgment and teamwork. In the same context, Deuber et al. (2013) highlighted that nursing competence develops through continuous education combined with clinical experience, allowing nurses to progress from novice to proficient practitioners. From the researcher's perspective, the significant improvement in competence observed in the present study may be attributed to the comprehensive design of the competency-based training, which integrated theoretical knowledge, clinical demonstrations, and hands-on practice. Suchan approach allows nurses not only to acquire information but also to develop clinical reasoning and decision-making abilities. Additionally, the emphasized real clinical scenarios related to oxygen therapy administration, enabling nurses to better recognize life-threatening situations and respond appropriately, which is critical in neonatal intensive care settings.

Furthermore, the present study found statistically significant relations between nurses' total competence levels and certain personal characteristics at the pre-intervention phase, particularly educational level, years of

experience, and attendance of training courses. This finding is supported by Dansa et al. (2024), who reported that higher educational qualifications and clinical experience significantly contributed to higher competence levels among neonatal nurses. Similarly, Khalid et al. (2024) found that nurses who had attended specialized training demonstrated higher competence in managing oxygen therapy and neonatal respiratory care.

The researcher interprets these findings as evidence that education and professional training play a crucial role in shaping nursing competence. Nurses with higher educational levels often possess stronger theoretical foundations and critical thinking abilities, enabling them to integrate knowledge into clinical practice more effectively. In addition, clinical experience allows nurses to develop confidence and practical judgment in handling complex neonatal conditions.

Interestingly, after the implementation of the educational intervention, the relationship between most personal characteristics and competence levels disappeared, except for educational level. This finding suggests that training can effectively reduce disparities in competence levels among nurses with different backgrounds. In other words, structured educational interventions can help bring nurses with varying levels of experience and qualifications to a more consistent and higher level of professional competence.

Overall, the findings of the present study confirm that competency-based training is an effective strategy for enhancing nurses' competence and improving the safety of oxygen administration for neonates in intensive care settings

Conclusion:

In the light of the study results, it can be concluded that the training was highly effective in improving nurses' competence- based regarding the safety of oxygen administration for neonates. The successfully transformed nurses from routine-based performance to more conscious and professional

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Recommendations:

Based on the findings, the following recommendations are suggested:

1.. Provide regular competency-based training for NICU nurses on the safe administration of oxygen to neonates with respiratory distress.

2.Conduct periodic assessment and reassessment of nurses' competence using a structured checklist covering all competence domains related to oxygen administration safety.

3. Include practical demonstrations, hands-on practice, and clinical scenarios on oxygen equipment, safe oxygen delivery, recognition of early danger signs, and appropriate nursing responses.

4.Offer continuing education and additional support according to nurses' learning needs, while ensuring that all nurses receive standardized

5.training regardless of their years of experience or previous training attendance.

Conduct further studies with larger samples, comparison groups, and follow-up assessments to evaluate whether improvements in competence are sustained over time.

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