

Effect of an Educational Program on Nurses' Practices Regarding the Care of Newborns with Respiratory Distress Syndrome in Neonatal Intensive Care Units

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Abstract

Background: Respiratory Distress Syndrome (RDS) is a major cause of morbidity and mortality in neonatal intensive care units NICU, especially for preterm infants. Nurses have a significant role and responsibility in managing RDS, and their competency directly influences patient outcomes. There is also some evidence of discrepancies in knowledge levels and application of practice. This study aimed to investigate the impact of a structured educational program on nurses' practices related to the care of newborns with RDS in a NICU. To assess the impact of an educational intervention on the clinical practices of NICU nurses in managing neonatal RDS and to examine the association between nurses' socio-demographic characteristics and their practices levels.

Methods: A quasi-experimental pre-test/post-test design was completed from June to August 2025 at two children's hospitals in Al-Hilla, Iraq, with a sample of 50 nurses (25 in the study group and 25 in the control group) selected using convenience sampling. Data were collected using a validated observational checklist to evaluate nursing practice before and after the educational program. The intervention consisted of both theoretical and practical educational sessions on the management of RDS. Data analysis was conducted using descriptive statistics, independent t-tests, and chi-square in SPSS version 23. A Shapiro-Wilk test was conducted to confirm normality ($p=0.087$).

Results: Both groups had moderate levels of practice before the intervention. There was no significant difference in the mean practice score (study group: 1.59 ± 0.14 ; control group: 1.64 ± 0.12 ; $p=0.17$). After the educational program, the study group showed a significant increase in practice post intervention (mean score 1.76 ± 0.08), with 80% of students in the good practice category compared to only 28% pre-intervention. The control group remained largely unchanged post intervention (mean score 1.65 ± 0.10 ; $p=0.006$). There was no significant association between the nurses' practice and age, educational level, previous education or training, and years of work experience ($p>0.05$).

Conclusion: The organized educational intervention made a significant difference in nurses' practices surrounding infants with RDS. The findings make a clear case for the value of education and practice to improve the practice of neonatal nursing beyond passive clinical experience or background qualities or characteristics.

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Keywords: Educational program; Nursing practice; Respiratory Distress Syndrome; Newborn; Neonatal Intensive Care Unit

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Introduction

Respiratory Distress Syndrome (RDS) is one of the most prevalent and life-threatening conditions affecting newborns, especially preterm infants, due to a deficiency in pulmonary surfactant that is necessary to maintain alveolar stability and adequate gas exchange. This disorder primarily affects infants who are the primary source of morbidity and mortality in neonatal intensive care units (NICUs) and are born before 37 weeks of gestation globally. The World Health Organization indicates that complications of preterm birth, which include RDS, cause 35% of neonatal deaths worldwide.¹ The care of newborns with RDS requires prompt diagnosis, skilled interventions, and evidence-based nursing care to optimize clinical outcomes of care while also aiming to limit the complications such as bronchopulmonary dysplasia, intraventricular hemorrhage, and sepsis.²

Nurses are an important member of the multidisciplinary team involved in the care of neonates with RDS in a NICU. Their responsibilities include the continuous monitoring of respiratory status, administration of surfactant therapy, managing mechanical ventilation or non-invasive respiratory support while maintaining thermoregulation, and providing nutrition and family-centered care. The effectiveness of nursing care, however, is heavily derived from the nurse's knowledge, clinical competence, and updated guidelines. Studies have demonstrated that knowledge and practice gaps exist amongst NICU nurses and, as a result, patient safety and outcome may be compromised.³

Education-based programs have been recognized as effective mechanisms for transforming practice into evidence-based practice. Organized educational interventions have the potential to inform nurses about RDS pathophysiology, improve technical skills, reinforce compliance with clinical protocols, and develop critical thinking in challenging and time-limited scenarios. Several published studies have indicated that targeted education boosts nurse's confidence and performance to manage critically ill neonates, and simulation-based training and multidisciplinary workshops meaningfully improve compliance with neonatal respiratory best practice.⁴

Although there have been advances in neonatal care, there continues to be a need to assess the impact of specific educational programs on nursing practice regarding RDS in NICUs, especially in contexts where resources and training opportunities may be constrained. Assessing the efficacy of these programs will assist in developing standardized modules used for training and ultimately enhancing the quality of neonatal care.⁵ This study aimed to assess how a structured educational program affects nurses' practice

regarding the care of newborn infants diagnosed with respiratory distress syndrome in Neonatal Intensive Care Units. By measuring changes in nursing practice before and after the intervention, this study will contribute to the evidence supporting ongoing professional development for neonatal nurses. This study presents a new direction in Neonatal Nursing Education through evaluation of a well-defined educational program designed specifically for use by nurses who provide care for infants with respiratory distress syndrome (RDS) in limited resource neonatal intensive care units (NICU). This program differs from existing research in that it contains a combination of Evidence-Based Clinical Practice Guidelines for RDS, a hands-on component to improve clinicians' skills in treating infants with RDS, and a realistic simulation scenario that replicates the actions a clinician would take when presented with a neonate having difficulty breathing. Where previous studies have assessed clinician competence using only knowledge scores and/or self-reported competency, this study also assessed the changes in nursing practice related to the nurse's provision of care to neonates with RDS before and after the training intervention. By creating a combination of a standardized clinical protocol for RDS with a live performance assessment of nurses performing the protocol, the authors have established an educational model that can be replicated by other institutions to improve the quality of treatment for RDS and provide actionable evidence in developing a standardized national or institutional training program for nursing neonatal education and improving the care of preterm neonates at risk for RDS.

Methods

3.1. Design of the Study

This pre-post quasi-experimental study was conducted from 15th of September 2024 to 30th of August 2025 to assist with program development, design, and evaluation of program effectiveness.

3.2. Administrative Agreements and Ethical Considerations

The formal administrative agreements were obtained before data collection, which was required to conduct the study as follows:

1. A formal requisition was sent to the Babylon Health Directorate for agreement.

2. An official agreement was attained from the Center for Training and Human Development in Babylon health directorate.

3.3. Setting of study

The study was conducted in children's hospitals in Al- Hilla (Babylon Maternity and Children's Teaching

Hospital and AL-Noor hospital) that had Neonatal Intensive Care Units.

3.4. Sample of the Study

The participants were composed of 60 nurses who worked in neonatal intensive care unit, selected using convenience sampling. 5 nurses were excluded from the study group because they participated in the pilot study, and five of them were excluded since they participated in the needs assessment. Then, the study sample consisted of 50 nurses, 25 in the control group and 25 in the study group.

3.5. Sample Size Calculation Method

The sample size for this study was determined based on the total accessible population of nurses working in the neonatal intensive care units (NICUs), which consisted of 60 nurses. Because the study aimed to compare the effectiveness of the educational program between a study group and a control group, it was necessary to ensure that each group contained a sufficient number of participants to allow meaningful comparison. The sample size was, therefore, calculated using a practical, population-based approach rather than a statistical power analysis, due to the relatively small total population available in the NICUs. After excluding 5 nurses who participated in the pilot study and another 5 who took part in the initial needs assessment, the remaining accessible sample was 50 nurses. These 50 nurses were divided equally into two groups: 25 nurses in the study group and 25 nurses in the control group. Using the entire remaining accessible population ensured adequate representation of NICU nurses while maximizing feasibility and maintaining the integrity of the quasi-experimental design.

Rationale for Using Convenience Sampling

Convenience sampling was used in this study because the number of nurses working in neonatal intensive care units (NICUs) in Babylon Province is relatively small and they have strict scheduling and workload constraints that make random or systematic selection difficult to implement. Access to participants depended on their availability during working hours, cooperation of hospital administration, and the operational demands of the NICUs, which often restricted the researchers' ability to apply probability-based methods. Additionally, because the study required both a study group and a control group within the same clinical environment and timeframe, convenience sampling provided a practical and feasible means of recruiting an adequate number of participants quickly without disrupting patient care. Other probability sampling methods, such as simple random sampling or stratified sampling, were not used due to logistical barriers, limited staffing flexibility, and the risk of reducing sample size if randomly

selected nurses were unavailable or unwilling to participate. Therefore, convenience sampling was the most suitable approach for ensuring sufficient participation while maintaining the continuity of clinical services in the NICU setting.

3.6. The Study Tool

Part one: Socio-demographic characteristics of the participants studied

The participants' sociodemographic details, such as age, educational attainment, years of NICU experience, and attendance at training sessions for neonatal respiratory distress syndrome care, were examined.

Part two: Practices of the participants regarding respiratory distress syndrome (Observation check list)

After reviewing a large body of research, an observational checklist was adapted from⁶ in order to assess the study participants' practices by direct observation. Each item in the practice part comprises three observations, one observation a day for three consecutive days and each observation has two parts, each with a score of 1 and 2 for 30 minutes.

Scoring of the questionnaire

Practice part: 1 scores for not done and 2 for done.

3.7. Steps of the Study:

3.7.1. Educational program on nurses' practices toward care of neonatal intensive care units, a newborn with respiratory distress syndrome:

The aim of the study was to explore the nurses' needs in order to develop an educational program to educate pediatric nurses to work in neonatal intensive care units at Babylon teaching hospital for maternity and children and Al-Noor hospital. Then, the researcher evaluated the nurses' practices preferences as done or not done. This assessment was based on the nurses' preferred writing. The assessment was conducted on 25 nurses for the study groups working in NICU in Babylon teaching hospital for maternity and children from 4th to 11th of June, 2025, and we used a sample of 25 nurses from Al-Noor hospital for the control group from 13th to 22nd of June, 2025. The nurses' assessment consisted of 30 questions. It took 20–40 minutes for each nurse to finish the questionnaire.

3.7.2. Construction of the Nursing Educational Program:

Information about the nurses was included in the education program. It was evaluated by professionals in other fields. The content of the program was re-examined with the content of the recommendations of the professionals. They concluded that the program was outlined sufficiently for the nurses' learning about managing the infants with respiratory distress

syndrome.

3.7.3. Evaluation of the Effect of an Educational Program:

The final stages of the research were to evaluate a change that takes place on nurses' practices regarding the neonates with respiratory distress syndrome when taking a week of time from the implementation date of the program on the 27th of July 2025 as indicated in the post-test sheet.

3.8. Validity of the questionnaire

Fifteen experts evaluated the questionnaire's content quality: 3 nursing faculty members from Babylon University, 3 nursing faculty members from Baghdad University, 4 nursing faculty members from Al-Kufa University, 3 nursing faculty members from Karbala University, and 2 nursing faculty members from Al-Mustaqbal University.

3.9. The Criteria Used to Select the Sample of the Study

Inclusion Criteria:

- Nurse working in the neonatal intensive care units
- The years of experience more than 1 year
- The patients willing to participate in the study

Exclusion Criteria:

- Nurses with experience less than 1 year
- Nurses unwilling to participate in the study

3.10. Reliability

The reliability of the instrument was evaluated by examining the reliability of the study questionnaire and performing the statistical analyses using Cronbach's Alpha as it computes reliability and the coefficient of internal consistency. The nurses practice values were derived from the reliability of the standard observation check list which had been conducted in a previous study, as shown in Table 1.

3.11. Collection of Data Methods

Data collection procedure

Data were collected retrospectively from nurses

working in neonatal intensive care units in two pediatric hospitals (Babylon Teaching Hospital for Maternity and Child and AL-Noor Hospital) with a questionnaire developed in English as a means of assessing the nurses' practices of care of newborns with respiratory distress syndrome, and finally the data were re-screened by the researcher to be audited; the researcher then compared the data to that of hospitals for the purpose of screening verification and authenticity validation.

3.12. Statistical Data Analysis Approach

Data input was done using the statistical package for social sciences (SPSS), version 23. Frequencies and percentages were used to represent categorical data, while mean±standard deviation was used to represent continuous variables. When examining categorical variables and determining the mean differences between the groups, a student t-test was usually employed. A P value of 0.05 was considered statistically significant.

3.13. The study limitations

1. Recruiting all nurses to attend the program sessions at the same time proved challenging. Thus, nurses were separated into smaller groups and allowed to attend the program during the time when their responsibilities were the least. When a nurse failed to attend a session, the researcher had to repeat the information to the nurse separately before the next session.

2. A lot of time was wasted in the neonatal critical care unit without training due to an increase in admissions and a decrease in the number of nurses.

Results

Normal distribution (Table 2)

Part I: Sociodemographic characteristics

Table 3 shows that most of the participants (44% in the control group and 52% in the study group) were between 20-25 years. Regarding educational level of nurses, 48% in the control group and 44% in the study group were graduated from a nursing institute. Regarding pediatric respiratory distress syndrome, 36% in the control group and 20% in the study group had participated in training regarding RDS. Finally, 56% in the control group and 64% in the study group had a 5 year of experience in PICU.

Table 1: Reliability of Nurses Practices toward Care of Newborns with Respiratory Distress Syndrome in Neonatal Intensive Care

No. of Items	Reliability Technique	Actual Value (r)	Accepted Value	Results
20	Cronbach Alpha	0.730	0.70	Reliable (Pass)

Table 2: Tests of Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
Nurse's Practice toward Respiratory Distress Syndrome in Neonates	.978	100	.087

Table 3: Distribution of socio-demographic characteristics of the study samples

Socio-demographic characteristics		Control		Study		p-value
		f	%	f	%	
Age	20-25years	11	44.0	13	52.0	.267
	25-30years	3	12.0	6	24.0	N.S
	30-35years	4	16.0	3	12.0	
	More than 35	7	28.0	3	12.0	
	Total	25	100	25	100	
Educational level	Nursing School Graduated	4	16.0	3	12.0	.538
	Nursing Institute graduated	12	48.0	11	44.0	N.S
	College of Nursing Graduated	9	36.0	11	44.0	
	Total	25	100	25	100	
Training regarding pediatric respiratory distress syndrome	No	16	64.0	20	80.0	.212
	Yes	9	36.0	5	20.0	N.S
	Total	25	100	25	100	
Years of experience in PICU	5years	14	56.0	16	64.0	.445
	6-10years	4	16.0	5	20.0	N.S
	more than 10years	7	28.0	4	16.0	
	Total	25	100	25	100	

Mann-Whitney U test, N.S=no significant, p-value=0.05, f=frequency.

Table 4: Responses of Nurses toward Practice of Respiratory Distress Syndrome in Neonates

Items	Control			Study		
	f	M	SD	f	M	SD
Make sure that nurses wash their hands before touching/holding neonate	25	1.36	.490	25	1.28	.458
Wear personal protective equipment (gown, gloves, etc.)	25	1.68	.476	25	1.60	.500
Explain newborn condition to the parents to reduce their anxiety	25	1.16	.408	25	1.36	.490
Have good practices about neonates with RDS	25	1.92	.277	25	1.8	.436
Maintain the newborn's privacy	25	1.64	.490	25	1.48	.510
Use sterile techniques with invasive procedures	25	1.40	.500	25	1.28	.458
Encourage mother's skin-to-skin contact by kangaroo position	25	1.92	.277	25	1.64	.490
Make airway suctioning	25	1.56	.507	25	1.72	.458
Assess the vital sign	25	1.88	.332	25	1.72	.458
Administration O2 therapy	25	1.84	.374	25	1.40	.500
Check oxygen humidifier chamber every shift	25	1.80	.408	25	1.60	.500
Monitor pulse and O2 oximeter	25	1.80	.408	25	1.72	.458
Assess the neonate in the incubator (eyes and genitals covered when exposed to light [phototherapy])	25	1.64	.490	25	1.64	.490
Monitor incubator temperature .	25	1.20	.408	25	1.24	.436
Chest physiotherapy	25	1.36	.490	25	1.40	.500
Assess neonate growth status (weight, length, head, and chest circumference)	25	2.00	.000	25	1.44	.507
Change the newborn position continuously to prevent the bed sore	25	1.72	.458	25	1.76	.436
Administer drug therapy	25	1.32	.476	25	1.20	.408
Support parents	25	1.68	.476	25	1.76	.436
The nurse makes documentation	25	1.52	.510	25	1.56	.507

Part I: Pre-test

Table 4 shows that the maximum mean in the control group was 2.00 in "Assess the neonate growth status (weight, length, head, and chest circumference)", while the minimum mean was 1.16 in the item "Explain newborn condition to the parents to reduce their anxiety". In the study group, the maximum mean in the study group was 1.8 in the item "The nurse has good practices about neonates with RDS", while the minimum mean was 1.20 in the item "Administer drug therapy".

Table 5 demonstrates that moderate practices for neonatal respiratory distress syndrome were observed in 64% of the control group and 84% of the study

group participants.

Part II: Post test

Table 6 shows that 64% of the control group participants had a moderate practice toward respiratory distress syndrome in neonates, while 80% of the subjects in the study group had a good practice toward respiratory distress syndrome in neonates.

According to Table 7, there was no significant correlation between the demographic features of NICU nurses and their practices regarding respiratory distress syndrome in neonates ($p\text{-value} \leq 0.05$) with respect to age, educational level, training, and years of PICU experience (Figure 1).

Table 5: Overall Nurse's Practices for Neonates with Respiratory Distress Syndrome

		Control		Study		p-value
		f	%	f	%	
Nurse's Practices with Neonates with Respiratory Distress Syndrome	Low	2	8.0	1	4.0	.17
	Moderate	16	64.0	21	84.0	
	Good	7	28.0	3	12.0	
	Total	25	100	25	100	
Mean±SD		1.64±.12		1.59±.14		

Independent sample t-test, N.S=no significant, p-value=0.05, f=frequency.

Table 6: Overall Nurses' Practices for Neonates with Respiratory Distress Syndrome

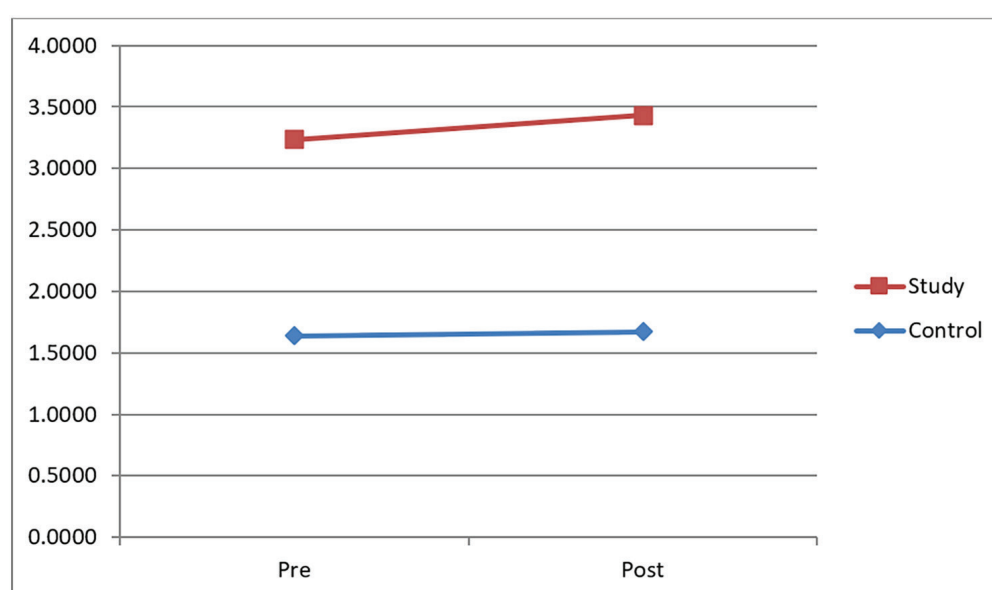
		Control		Study		p-value
		f	%	f	%	
Nurse's Practice toward Respiratory Distress Syndrome in Neonate	Poor	2	8.0	0	0	.006
	Moderate	16	64.0	5	20.0	
	Good	7	28.0	20	80.0	
	Total	25	100	25	100	
Mean±SD		1.65±.098		1.76±.080		

Independent sample t-test, N.S=no significant, p-value=0.05, f=frequency.

Table 7: Association between demographic characteristics among nurses working in NICU and knowledge and practices regarding RDS in neonates

Socio-demographic characteristics		Practice
Age	X ² Calculate	2.083
	X ² table	7.82
Educational level	Sig.	N.S
	X ² Calculate	4.908
	X ² table	7.82
	Sig.	N.S
Having Pediatric Respiratory distress syndrome Training	X ² Calculate	1.563
	X ² table	3.84
	Sig.	N.S
	X ² Calculate	1.667
Years of experience in PICU	X ² table	5.99
	Sig.	N.S

Chi- square, If X² Calculate>X² table reject the null hypothesis (significant relationship), N.S=no significant, Sig=significant, p-value=0.05.

**Figure 1:** Differences in nurses' practice toward respiratory distress syndrome in neonates in pre- and post-test across the two groups

Discussion

The study assessed how an educational program affected the nurses' practices in neonatal intensive care units (NICUs) when caring for neonates with respiratory distress syndrome (RDS). The results indicated a strong, statistically significant improvement in nursing practice in the study group after the educational intervention, while there was a minimal change in the control group. These findings highlight the importance of structured educational programs in improving neonatal healthcare quality and strengthening evidence-based nursing care.

According to the pre-test evaluation, both groups showed moderate practice (1.64 ± 0.12 versus 1.59 ± 0.14 , $p=0.17$) and overall mean scores did not significantly differ. This similarity in practice demonstrates the comparability between the control and study groups, promoting internal validity. The practices of assessing the newborn's growth status (e.g., weight, length, head, and chest circumference) were rated highly across both groups. This is probably related to a habitual practice that is standard in most NICUs for anthropometric measurements. However, the lowest scores (lowest amount of practice) came from domains that pertain to "explaining the newborn's condition to the parents" or "drug therapy administration", indicating a lack in communication skills and deficit in pharmacological safety that is often lacking in basic training.

A considerable improvement was seen in the study group following the educational intervention, with 80% reaching "good" practice levels, while only 28% of the control group reached "good" practice levels ($p=0.006$). The total practice score in the study group improved from 1.59 ± 0.14 at baseline to 1.76 ± 0.08 for the final total practice score, indicating a statistically and clinically significant improvement. Similar to the present study, the study conducted by⁷ found a structured educational program on neonatal respiratory care improved the nurses' performance in practice interventions and adherence to protocols in several areas including oxygen therapy, suctioning, and monitoring. The improvement in this study may be due to the comprehensive design of the educational program, incorporating theoretical knowledge, the demonstration of the skill, and practical reinforcement (all elements that can enhance knowledge retention and application in practice).⁸

Several specific items improved in the study group, notably oxygen therapy, chest physiotherapy, and documentation in practice. These items are both necessary skills for the management of RDS, where timely and accurate care measures can prevent complications, such as hypoxia, atelectasis, and ventilator-associated pneumonia.⁹ The documentation practices in the clinic were improved and are of

particular significance as documenting vital signs, oxygen saturation and treatment response in a timely manner is necessary for coherent interdisciplinary communication and continuity of care.¹⁰

On the other hand, observing the control group, we found only a trivial increase in the mean practice score (from 1.64 to 1.65) and no measurable change in levels of practice. These results suggest that simply relying on a regular clinical exposure is inadequate to improve nursing practice without the presence of a purposeful educational input. This aligns with¹¹ who argued that passive learning at the bedside further contributed to normalization of out-of-date practice, while organized education might enact changes that will facilitate adherence to evidence-based care plans/goals for practice use.

The study also explored the relationship between socio-demographic characteristics and their relationship to nursing practices. No association was found between the levels of practice and age, level of education, training experience, or years of experience ($p>0.05$). This means that formal education and experience alone do not ensure competence in RDS management. The findings indicate that ongoing, topical training is a larger contributing factor of practice than personal characteristics as supported by¹² who did not find a relationship between years of experience and knowledge of RDS among NICU nurses in Saudi Arabia; addressing this question raises awareness for the need for continuous professional development regardless of a nurse's position or educational background.

While 36% of the control group had prior training in pediatric respiratory distress syndrome, they did not achieve practice levels higher than the untrained group. These training may be outdated and otherwise inadequate in length or content, or not adequately practice based - as was emphasized by the need for regular updating, ongoing and competency-based education.

The outcomes of this study have significant implications for nursing education and hospital policy. Regularly and formally implementing educational programs focused on neonatal respiratory care should be a consideration in all NICUs to promote uniform high-quality care. Simulation training, case deliberation, and bedside coaching can be useful options to augment the effectiveness of the educational program.¹³ The improvement of nursing practice may also be sustained if these educational programs are incorporated into hospital accreditation practices.

Conclusion

The research demonstrated that a structured education

program substantially improved the nurses' practices for the care of neonates in neonatal intensive care units (NICUs) who have respiratory distress syndrome (RDS). Before the intervention, both groups exhibited primarily moderate practice (with no statistically significant difference between the study and control groups). After the educational intervention, the study group significantly improved their practice today to 80% of nurses demonstrating "good" practice after the intervention compared to only 28% of nurses demonstrating "good" practices in the pretest (with no impact in the control group). The mean practice score showed a statistically significant positive change in the study group from 1.59 ± 0.14 to the mean after the intervention of 1.76 ± 0.08 ($p=0.006$), indicating that the educational program had a substantial effect on the group's development and practice today. We also noted improvement in key practice indicators including oxygen therapy, chest physiotherapy, documentation and parental support, which are core components of complete care in RDS.

We also noted that there did not appear to be any association between the nurses' practices and their socio-demographic variables (age, highest education level, training received prior to pre-test, and number of years practicing), suggesting that professional seniority, or education/training alone, does not guarantee competent practice in neonatal respiratory care. Instead, our results highlight that specific and continuing education programs is a much stronger influence for improving clinical practice.

Recommendations

Implement Regular Educational Programs, Incorporate Simulation-Based training, Develop standardized protocols and guidelines, Mandate Continuing Professional Development (CPD),

Conduct Periodic Evaluation of Nursing Practices, and Encourage Parental Involvement and Communication Training.

Authors' Contributions

All authors contributed significantly to this study. The first author conceptualized the study, conducted data collection, performed data analysis, and prepared the initial manuscript draft. The second author supervised the research process, contributed to the study design and methodology, and critically revised the manuscript. All authors reviewed, approved, and agreed to the final version of the manuscript.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this study

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