ASSESSMENT OF NURSES' KNOWLEDGE AND SKILLS ABOUT SURFACTANT ADMINISTRATION FOR PRETERM INFANTS

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Abstract

Background: Surfactant Replacement therapy plays a crucial role in reducing morbidity and mortality associated with respiratory distress syndrome among preterm infants. **Aim:** To assess nurses' knowledge and skills regarding surfactant administration for preterm infants. **Methods:** A descriptive research design was conducted at two neonatal intensive care units at El Manial University Hospital (Kasr Al-Aini) and Cairo University Children's Hospital (El Monira) from December 2024 to May 2025. A convenient sample of fifty bedside nurses working in the previously mentioned settings was included. Data were collected using two tools: a structured questionnaire to assess nurses' knowledge and an observational checklist to evaluate nurses' skills related to surfactant administration. **Results:** The study findings revealed that only a small proportion of nurses achieved an overall satisfactory level of knowledge regarding respiratory distress syndrome (RDS) and surfactant administration. Although many nurses demonstrated satisfactory knowledge related to RDS, knowledge concerning surfactant administration remained unsatisfactory. Furthermore, none of the studied nurses demonstrated a satisfactory level of skills related to surfactant administration .A moderate positive correlation was found between nurses' knowledge and skills scores. Educational qualification demonstrated a strong positive association with both knowledge and skills levels. **Conclusion**: The study concluded that the level of nurses' knowledge and skills regarding surfactant administration for preterm infants was unsatisfactory. A positive association was found between nurses' knowledge and their clinical skills. **Recommendation:** Regular assessment programs and continuous educational training should be implemented for nurses working in neonatal intensive care units to enhance their knowledge and clinical skills related to surfactant administration.

Keywords: Surfactant Administration, Preterm Infants, Nurses' Knowledge, Nurses' Skills, Neonatal Intensive Care Units.

1. INTRODUCTION

Surfactant Replacement therapy (SRT) plays a crucial role in reducing morbidity and mortality associated with respiratory distress syndrome (RDS) among preterm infants by improving pulmonary function and gas exchange. Effective surfactant therapy depends not only on physician prescription but also on nurses' competence in recognizing eligible infants, preparing the environment and equipment, administering the therapy safely, and monitoring infants for complications and outcomes. (1) Neonatal RDS, also known as hyaline membrane disease, primarily affects preterm infants and accounts for 30–40% of NICU admissions (2) RDS typically appears immediately after birth, presenting with signs of respiratory distress such as tachypnea, grunting, nasal flaring, chest retractions, and cyanosis, with severity linked to prematurity. Extreme pre-term infants exhibit the most severe symptoms, and disease progression can lead to apnea, hypotonia, diminished

breath sounds, and circulatory shock (3). Prenatal corticosteroid administration significantly decreases neonatal morbidity and mortality, particularly reducing risks of RDS, while decreasing the need for respiratory support and NICU admission. Current guidelines recommend a single course for women at imminent preterm delivery risk (24–34 weeks gestation), and consideration for preterm premature rupture of membranes before 32 weeks to mitigate RDS and mortality risks (4), (5). Surfactants, a phospholipid secreted by alveolar cells, reduce surface tension in the lungs, promoting uniform alveolar expansion and preventing collapse. While adequate levels develop by 35 weeks' gestation, preterm infants often experience deficiency-related respiratory distress. Surfactant replacement therapy (SRT) improves survival and reduces morbidity, with early rescue administration now preferred over prophylaxis (6), (7). Several empirical studies have documented knowledge and practice gaps among neonatal nurses. For example, research assessing nurses' understanding and care provision for neonates receiving surfactant therapy found that while many nurses demonstrated moderate to good practice levels, there were significant deficiencies in specific knowledge domains such as recognizing RDS diagnostic criteria and risk factors.

These gaps were strongly associated with educational attainment and prior specialized training (1). Additionally, broader assessments of neonatal nursing competence (e.g., non-invasive CPAP care) revealed that many nurses had poor theoretical knowledge despite acceptable practical performance, indicating that knowledge deficits may exist even when skills appear clinically sufficient. (8) Deficits in nurses' theoretical knowledge are not limited to surfactant care. Studies examining nurses' knowledge of basic neonatal conditions such as hypothermia in preterm infants showed considerable variability in knowledge levels, further emphasizing the need for regular competency assessments in NICUSs (9). Similarly, investigations into overall quality of nursing care provided to preterm infants with RDS demonstrated that a significant proportion of nurses had poor knowledge and practice scores, with education level strongly linked to performance outcomes (10).

Assessment of nurses' baseline knowledge and skills is therefore fundamental to identifying competency gaps and educational needs, which can inform the development of targeted in-service education, guideline implementation, and ongoing professional development strategies. Despite the critical role of skilled nursing care in surfactant therapy and RDS management, few studies have specifically evaluated neonatal nurses' baseline competence in surfactant administration, creating a substantial research gap. This study aims to address this gap by systematically assessing nurses' knowledge and skills regarding surfactant administration for preterm infants, providing evidence to support educational interventions and quality improvement efforts in neonatal care.

2. METHODS

2.1 Aim

The aim of the current study was to assess nurses' knowledge and skills regarding surfactant administration for preterm infants.

Research Questions

To achieve the aim of the study, the following research questions were formulated:

- What is the level of nurses' knowledge regarding surfactant administration for preterm infants?

- What is the level of nurses' clinical skills related to surfactant administration for preterm infants?

- Is there a relationship between nurses' knowledge and their clinical skills regarding surfactant administration?

2.2 Design

A descriptive research design was utilized to achieve the aim of this study.

2.3 Setting

The current study was conducted in two Neonatal Intensive Care Units (NICUs). The first NICU is located on the fourth floor of El Manial University Hospital (Kasr Al-Ainy), while the second NICU is located on the third floor of Cairo University Children's Hospital (El Monira).

Each unit has a capacity of 64 incubators and is well equipped to provide comprehensive care for high-risk neonates from different regions of Egypt. Both units follow similar medical care protocols in neonatal management.

2.4 Participants

A convenience sample of 50 bedside nurses working in the previously mentioned NICUs and responsible for providing direct nursing care for preterm infants was included in the study, regardless of age, gender, educational level, or years of experience.

Undergraduate nursing students undergoing clinical training in the NICUs were excluded from the study. Of the total sample, 20 nurses were recruited from El Manial University Hospital (Kasr Al-Ainy), while 30 nurses were recruited from Cairo University Children's Hospital (El Monira).

2.5 Data Collection Tools:

Data were collected using the following tools:

Tool I: Structured Questionnaire

The questionnaire was developed by the researchers after reviewing relevant and updated literature to assess nurses' knowledge regarding surfactant administration.

It consisted of two parts:

Part I: Personal Characteristics of Nurses

This part included demographic and professional data such as age, gender, years of experience in pediatric nursing, years of experience in NICU settings, and previous

attendance of training courses related to care of high-risk neonates and surfactant administration.

Part II: Nurses' Knowledge Regarding RDS and Surfactant Administration

This part consisted of 30 multiple-choice and true/false questions covering: Definition, etiology, pathophysiology, clinical manifestations, complications, and nursing care of Respiratory Distress Syndrome (RDS) (8 questions).

Definition, origin, and function of surfactant, indications, sources of exogenous surfactant, route and optimal timing of administration, administration criteria, required investigations, medication preparation and dosing, adverse effects, complications, and nursing care before, during, and after surfactant administration (22 questions).

Scoring System of Nurses' Knowledge

Each correct answer was assigned one score, while incorrect answers received zero. The total knowledge score was 30 points (100%).Knowledge levels were classified as follows:

- Satisfactory knowledge: ≥ 60% (≥ 18 scores)
- Unsatisfactory knowledge: < 60% (< 18 scores)

Tool II: Observational Checklist of Surfactant Administration Skills

An observational checklist adopted from previous related research was used to assess nurses' clinical skills during surfactant administration for preterm infants. The checklist included 28 procedural steps: 8 steps before administration, 14 steps during administration and 6 steps after administration

Scoring System of Nurses' Skills

One score was assigned for each correctly performed step, while zero was given for incorrectly performed or omitted steps. The total score was 28 points (100%).Skills levels were classified as:

- Satisfactory skills: ≥ 80% (≥ 22.4 scores)
- Unsatisfactory skills: < 80% (< 22.4 scores)

Validity and reliability

The content validity of the study tools was assessed by a panel of three experts specialized in pediatric nursing and high-risk neonatology to evaluate clarity, relevance, and comprehensiveness of the tools. The reliability of Part II of Tool I (knowledge questionnaire) and Tool II (observational checklist of skills) was tested using Cronbach's alpha coefficient to ensure internal consistency. The reliability coefficients were 0.903 for nurses' knowledge and 0.920 for nurses' skills.

2.6 Procedure

The study procedure was conducted through two main phases: preparatory phase and assessment phase.

Preparatory Phase:

Prior to data collection, an extensive review of recent literature, textbooks, and related studies was carried out to develop the study tools. Official administrative approval was obtained from the responsible authorities of both neonatal intensive care units. The researchers met the head nurses of the selected units to explain the purpose and nature of the study. Thereafter, nurses were approached individually or in small groups according to their availability during working hours. A clear explanation about the study aim and procedures was provided to all participants.

Assessment Phase:

Data collection was carried out to assess nurses' knowledge and skills regarding surfactant administration for preterm infants. Nurses' knowledge was assessed using the self-administered structured questionnaire (Tool I), which required approximately 20–30 minutes to complete. Nurses' clinical skills were assessed using the observational checklist (Tool II) through direct observation conducted individually by the researchers. Observation required approximately 10–15 minutes for each nurse and was performed either during actual clinical practice or using a preterm infant Simbad manikin when clinical cases were unavailable. Data collection was conducted four days per week during the morning shift (8:00 a.m.–7:00 p.m.) over a six-month period study.

2.7 Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 20. Descriptive statistics were used to summarize the collected data. Qualitative variables were presented as frequencies and percentages, while quantitative variables were expressed as means and standard deviations. The reliability of the study tools was assessed using internal consistency measures, including Cronbach's alpha coefficient and Guttman split-half reliability test. Inferential statistical analysis was performed to examine relationships between study variables. The Chi-square test was used to compare categorical variables. Differences in quantitative variables were analyzed using appropriate non-parametric tests according to data distribution. Spearman's rank correlation coefficient was applied to assess the relationship between nurses' knowledge and skills scores. Statistical significance was considered at a p-value of < 0.05.

3. RESULTS

The results of the current study showed that 62% of the studied nurses were male; their mean age was 26.1 ± 5.4 years old. 66% of them held bachelor's and higher degree in nursing, 72% had less than five years' experience in pediatric nursing, 54% had experience in the NICUs and only 10% attended one course regarding SA.

Table (1) illustrates the distribution of nurses' total knowledge level regarding surfactant administration for preterm infants. The findings revealed that more than half of the nurses (56.0%) had satisfactory knowledge regarding respiratory distress syndrome (RDS). However, the majority of nurses (90.0%) demonstrated unsatisfactory knowledge related

to surfactant administration. Overall, only a small proportion of nurses (6.0%) achieved a satisfactory total knowledge level, whereas the vast majority (94.0%) showed unsatisfactory knowledge at baseline assessment, indicating considerable knowledge gaps among nurses regarding surfactant administration for preterm infants.

Table (2) demonstrates nurses' total skill level regarding surfactant administration for preterm infants. The findings revealed that all studied nurses (100%) demonstrated unsatisfactory skill levels before and after surfactant administration. However, nearly three-quarters of nurses (74.0%) showed satisfactory performance during the administration procedure itself. Despite this, the overall total skill level remained unsatisfactory among all nurses (100%), indicating deficiencies particularly in preparation and post-administration nursing care.

Table (3) illustrates the relationship between nurses' personal characteristics and their knowledge and skills scores. The findings indicated that nurses with a bachelor degree or higher had higher mean knowledge and skills scores compared with diploma nurses, with a statistically significant difference observed regarding knowledge scores ($p < 0.05$), while no significant difference was detected in skills scores.

Regarding gender, male nurses demonstrated slightly higher mean knowledge and skills scores than female nurses; however, the differences were not statistically significant ($p > 0.05$).

Furthermore, no statistically significant relationships were found between nurses' age groups and their total knowledge or skills scores during the assessment phase ($p > 0.05$). Similarly, years of experience in pediatric nursing as well as NICU experience showed no significant association with nurses' baseline knowledge and skills levels.

In addition, attendance of previous training courses related to neonatal care showed no statistically significant effect on nurses' knowledge or skills scores at the assessment phase ($p > 0.05$).

Table (1): Distribution of Nurses' Satisfactory Total Knowledge Levels regarding RDS and surfactant administration (n=50)

Knowledge domains	Satisfactory Level (≥ 60%)
RDS knowledge	56. 0%
Surfactant administration knowledge	10.0%
Total Knowledge Level	6.0%

Table (2): Distribution of Nurses' Satisfactory total Skill Levels regarding Surfactant Administration (n=50)

skill domains	Satisfactory Level (≥ 80%)	Unsatisfactory :(< 80%)
Before surfactant administration	0.0%	100.0%
During surfactant administration	74.0%	26.0%
After surfactant administration	0.0%	100.0%
Total skill Level	0.0%	100.0%

Table (3): Relations between Nurses' Personal Characteristics and their Total Knowledge and Skills Scores (n=50)

Nurses' characteristics	Knowledge		Skills	
	Mean± SD	P	Mean± SD	P

Gender:
  Female
  Male
	52.8±5.6
	50.0±8.3
		
		0.16
			71.7±1.4
			69.7±3.1
				
				0.003*

Age: <25 25+	53.2±6.4 49.7±7.0	 0.07	70.9±2.3 71.1±2.5	 0.75

Nursing qualification:
  Diploma
  Bachelor/ higher
	45.9±7.6
	54.8±3.8
		
		<0.001*
			69.6±3.3
			71.7±1.4
				
				0.003*

Experience years in pediatric nursing: <5 5+	52.2±6.8 50.5±6.9	 0.42	70.7±2.7 71.7±1.4	 0.20
Experience years in NICU: <1 1+	52.6±6.1 50.7±7.7	 0.34	71.0±2.4 70.9±2.5	 0.89

Training courses about RDS and surfactant administration:
  No
  Yes
	51.9±6.7
	50.7±8.3
		
		0.72
			71.0±2.5
			70.4±1.9
				
				0.56

4. DISCUSSION

The present study aimed to assess nurses' knowledge regarding surfactant administration for preterm infants working in neonatal intensive care units. The findings of the current study revealed noticeable deficiencies in nurses' overall knowledge related to surfactant administration despite relatively better knowledge concerning respiratory distress syndrome (RDS). More than half of the studied nurses demonstrated satisfactory knowledge regarding RDS. This finding may be attributed to the frequent exposure of nurses to preterm infants diagnosed with RDS in neonatal intensive care units, where the condition represents one of the most common causes of neonatal admission. Continuous clinical interaction with affected neonates may enhance nurses' general understanding of disease manifestations and basic management principles. However, the majority of nurses showed unsatisfactory knowledge regarding surfactant administration. This result may reflect insufficient structured educational programs and limited in-service training focusing specifically on surfactant therapy procedures, indications, preparation, administration techniques, and post-administration monitoring. Surfactant administration is considered a highly specialized neonatal intervention that requires updated theoretical knowledge and clinical competency to ensure patient safety and optimal outcomes. Furthermore, the overall total knowledge level was unsatisfactory among most nurses, indicating existing knowledge gaps related to evidence-based neonatal respiratory care.

These findings highlight the necessity for continuous professional education and periodic competency assessment for nurses working in neonatal intensive care units. The findings of the present study are consistent with (11), who reported insufficient knowledge among NICU nurses regarding respiratory distress syndrome. Similarly, (12) highlighted variations in the quality of nursing care provided for neonates with RDS. Comparable results were also reported by (13), who identified inadequate knowledge levels among neonatal nurses despite acceptable clinical performance. Furthermore, (14) emphasized the ongoing need for continuous assessment of NICU nurses' knowledge to ensure evidence-based neonatal care. The findings of the present study revealed that overall nursing practices related to surfactant administration for preterm infants were unsatisfactory, particularly in the pre- and post-administration phases. While a portion of nurses demonstrated satisfactory performance during the administration itself, deficiencies in preparation and post-procedure care were evident. These results highlight gaps in the comprehensive nursing care of neonates receiving surfactant therapy.

These findings are consistent with (15), who reported that NICU nurses exhibited significant deficiencies in clinical practices concerning preterm infant care, particularly in areas requiring anticipatory and post-procedure interventions. Similarly, (14) found that despite competent technical execution in non-invasive respiratory support, NICU nurses displayed considerable practice gaps when assessed for adherence to evidence-based protocols. Furthermore, (12) emphasized persistent quality issues in the nursing care of neonates with respiratory distress syndrome, aligning with the current observation that practice inconsistencies are common in NICU settings. Also, (15) reported that the study revealed that the majority of nurses lacked adequate training and sufficient knowledge, with more than half of them demonstrating low levels of knowledge and practice. These findings align with the current study regarding gaps in nursing performance and clinical competence. The variation between findings underscores the multifactorial nature of nursing practice, suggesting that knowledge, experience, and system-level support collectively influence care quality.

The assessment phase findings of the present study revealed that nurses' educational qualification had a statistically significant relationship with baseline knowledge and skills scores. Nurses holding a bachelor degree or higher demonstrated better knowledge and skills performance compared with diploma nurses. This finding may be attributed to the comprehensive academic preparation and greater exposure to evidence-based clinical practices provided through higher nursing education programs, which enhance clinical competency and technical performance in neonatal intensive care settings. This result is consistent with previous evidence indicating that nurses with higher educational attainment exhibit improved clinical competence and safer neonatal care practices. Educational preparation plays a crucial role in strengthening nurses' understanding and application of specialized neonatal procedures. (16) Emphasized that competent neonatal care largely depends on adequately educated healthcare professionals capable of applying standardized clinical guidelines effectively. Additionally, the assessment findings showed a significant association between nurses' gender and baseline skills scores, while no significant relationship was observed with knowledge scores. Variations

in skills performance may be related to differences in clinical exposure, workload responsibilities, or opportunities for hands-on practice rather than gender differences themselves. Conversely, no statistically significant relationships were identified between nurses' age, years of pediatric nursing experience, years of NICU experience, or previous attendance of training courses and their baseline knowledge and skills scores. This finding suggests that clinical experience alone may not ensure adequate competency without continuous professional education and structured training programs. Similar findings were reported by (17), who highlighted that improved neonatal outcomes are strongly associated with nurses' competency level rather than years of experience alone.

Overall, the assessment phase results indicate that educational qualification represents the primary determinant influencing nurses' baseline knowledge and skills prior to guideline implementation, highlighting the necessity of structured educational interventions to standardize nursing performance in neonatal intensive care units.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion: The study concluded that the level of nurses' knowledge and skills regarding surfactant administration for preterm infants was unsatisfactory. A positive association was found between nurses' knowledge and their clinical skills. The assessment findings highlight the presence of knowledge and skills gaps among neonatal nurses, emphasizing the need for structured educational programs and standardized clinical guidelines to enhance nurses' competency in surfactant administration and improve the quality of neonatal care.

Recommendation: Based on the findings of the current study, the following recommendations are suggested:

- Regular assessment programs and continuous educational training should be implemented for nurses working in neonatal intensive care units to enhance their knowledge and clinical skills related to surfactant administration

- Continuous assessment of neonatal nurses' knowledge and clinical skills should be conducted regularly to identify performance gaps.

- Standardized evidence-based protocols should be made available in neonatal intensive care units to support safe nursing practices.

- Orientation and competency-based training programs should be provided for newly recruited neonatal nurses.

- Hospital administrators should support continuous professional development programs aiming at improving neonatal nursing competency.

LIMITATIONS

There were no limitations in the current study.

ABBREVIATIONS

CPAP	Continuous Positive Airway Pressure
NICUSs	Neonatal Intensive Care Units
NRDS	Neonatal Respiratory distress syndrome
SA	Surfactant administration
SPSS	Statistical Package for Social Science
SRT	Surfactant Replacement Therapy
WHO	World Health Organization

DECLARATIONS

Ethical Considerations

Ethical approval for this study was obtained from the Research Ethics Committee of the Faculty of Nursing at Cairo University as an integral part of a Master's thesis. Before data collection, the researchers provided a detailed explanation of the study's aim and nature to all potential participants, ensuring that written informed consent was secured. Participation was strictly voluntary, and all nurses were explicitly informed of their right to withdraw from the study at any point without providing justification or facing any professional repercussions. Furthermore, strict measures were implemented to maintain the confidentiality and anonymity of the participants, with all collected data being utilized exclusively for scientific research purposes.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Reference

1) Elbilgahy, A. A., Jothirajan, D., Alanazi, L. O., Alanazi, F. A., Alanazi, M. G., & Alanazi, A. S. (2025). Nursing practices and risk factors in neonates with respiratory distress syndrome undergoing surfactant replacement therapy: A cross-sectional study in Saudi Arabia. *Journal of Multidisciplinary Healthcare, 18*, 4903–4918. https://doi.org/10.2147/JMDH.S532177

2) Wang, Y. (2017). The advance treatment on neonatal respiratory distress syndrome. *Journal of Pediatrics & Neonatal Care, 6*(5), 78–98. https://doi.org/10.15406/jpnc.2017.06.00262

3) Rezaei, M., Abassi, B., Najib, K., et al. (2023). Surfactant therapy in neonates with respiratory distress syndrome: Minimally invasive surfactant therapy (MIST) or intubation–surfactant administration–extubation (INSURE). *JAMA Pediatrics, 177*(5), 512–519.
https://doi.org/10.1001/jamapediatrics.2023.0123

4) Roberts, D., Brown, J., Medley, N., & Dalziel, S. R. (2017). Antenatal corticosteroids for accelerating fetal lung maturation for women at risk of preterm birth. *Cochrane Database of Systematic Reviews, 2017*(3), Article CD004454. https://doi.org/10.1002/14651858.CD004454.pub3

5) Sahaf, F., & Zakariya, N. A. (2021). The effect of antenatal betamethasone on prevention of neonatal respiratory distress syndrome before elective cesarean section at term. *Journal of Clinical Neonatology, 10*(4), 220–226. https://doi.org/10.5005/jp-journals-10009-1767

6) Ng, E. H., & Shah, V. (2021). Guidelines for surfactant replacement therapy in neonates. *Paediatrics & Child Health, 26*(1), 35–41. https://doi.org/10.1093/pch/pxaa116

7) Gharehbaghi, M., Moghaddam, Y. J., & Radfar, R. (2018). Comparing the efficacy of surfactant administration by laryngeal mask airway and endotracheal intubation in neonatal respiratory distress syndrome. *Crescent Journal of Medical and Biological Sciences, 5*(3), 222–227.

8) Masoud, Y. A., Mohamed, M. S., & Fouda, M. I. (2025). Assessment of nurses' knowledge and practice regarding nursing care for neonates on non-invasive continuous positive airway pressure. *Egyptian Journal of Health Care, 16*(4), 175–188. https://ejhc.journals.ekb.eg/article_462134.html

9) Wang, L., Zheng, Y., Wang, X., Liu, A., Cui, N., & Zhang, W. (2025). Knowledge and practices of neonatal intensive care unit nurses concerning hypothermia in preterm infants: A descriptive cross-sectional study. *Journal of Advanced Nursing*. https://doi.org/10.1111/jan.16374.

10) Abdullateif, A. L. (2014). Quality of nursing care provided for preterm infants suffering from respiratory distress syndrome. *Port Said Scientific Journal of Nursing, 1*(2), 281–295. https://pssjn.journals.ekb.eg/article_35072.html

11) Ali, R. A., Obeisat, S. M., & Tarawneh, L. H. (2019). Improving nursing knowledge and care for neonates with respiratory distress. *International Nursing Review, 66*(3), 338–345. https://doi.org/10.1111/inr.12510

12) Mamo, J. R., & Shaker, N. Z. (2024). Quality of nursing care for neonates with respiratory distress syndrome at neonatal intensive care unit in teaching hospitals in Erbil City. Erbil Journal of Nursing and Midwifery,7(1),10–22. https://doi.org/10.15218/ejnm.2024.02

13) Ahmed, S. M., & Hassan, H. E. (2015).Nurses' knowledge versus their performance in caring for neonates with respiratory distress syndrome. *Egyptian Journal of Health Care, 6*(1).https://doi.org/10.21608/ejhc.2015.216948

14) Abuhammad, S., Elayyan, M., & Ababneh, H. (2023).Neonatal intensive care unit nurses' knowledge and attitude toward neonatal palliative care: A review of the literature. *Future Science OA, 9*(5), FSO856.https://doi.org/10.2144/fsoa-2022-0062

15) Teikyomedical Journal. (2021). Nurses' knowledge, attitude, and practice toward respiratory distress syndrome in neonates at Salah Al-Deen Governorate Hospital. *TMJ, 44*(6). https://www.teikyomedicaljournal.com/article/nurses-knowledge-attitude-and-practice-toward-respiratory-distress-syndrome-in-neonate-at-salah-al-deen-governorate-hospital

16) World Health Organization. (2023). *Preterm birth*.https://www.who.int/news room/fact-sheets/detail/preterm-birth

17) Algameel, A., Elhawary, M., Amin, S., & Abd Elmenem, M. (2020).Outcome of late preterm newborns in Upper Egypt. *Egyptian Pediatric Association Gazette, 68*(1), 11.https://doi.org/10.1186/s43054-020-00023-1