

Pitfalls in Nurses' Performance regarding Oxygen Therapy Administration at Neonatal Intensive Care Units : An Assessment Study

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Abstract

Background: Pitfalls in oxygen therapy administration can worsen a neonate's condition and can even be life threatening. Thus, ensuring that oxygen therapy is administered in a correct and safe way as well in the correct time is fundamental to neonates' nursing care. **Aim:** This study aimed to assess the pitfalls in nurses' performance regarding oxygen therapy administration at Neonatal Intensive Care Units. **Study design:** A descriptive study design was used. **Study setting:** This study was conducted at the Neonatal Intensive Care Units- El-Fayoum General Hospital affiliated to the Egyptian Ministry of Health. **Study subjects:** A convenient sample composed of 70 nurses who were working at the previously mentioned study setting and all available neonates (70) receiving O₂ therapy during the research period (six months). **Tools of data collection:** A pre-designed questionnaire sheet, observation checklists and Attitude likart-type rating scale to assess pitfalls in nurses' performance regarding oxygen therapy administration at NICUs. **Results:** The results of this study showed that, the mean age of the studied nurses was 23.93±3.52 years and all of the studied nurses were females. More than three quarters of the studied nurses had unsatisfactory knowledge, less than two thirds of them had incompetent practices and the majority of them showed positive attitudes about pitfalls in nurses' performance regarding oxygen therapy administration at Neonatal Intensive Care Units. Also, more than half of studied nurses had an incompetent total performance regarding pitfalls of oxygen therapy administration to neonates at Neonatal Intensive Care Units. **Conclusion:** The study findings concluded that, there was a positive correlation and highly statistical significance difference among all the study variables (p-value < 0.001). **Recommendations:** Training programs should be applied for nurses in the Neonatal Intensive Care Units to improve their knowledge and practice regarding pitfalls in oxygen therapy administration for neonates.

Key Words: Pitfalls, Nurses' Performance, Oxygen Therapy Administration, Neonatal Intensive Care Units (NICUs)

Introduction

Oxygen administration is a common therapy in NICUS. The goal of O₂ therapy administration is to maintain O₂ levels for term or preterm neonates. O₂ therapy administration is commonly used in the treatment of emergency, it is the first line of treatment in many critical conditions. Administering O₂ depends on the needs of the neonates, views and decision of the

medical team advising the care regimen. If O₂ administration is given inappropriately, it could be fetal. Hence, neonates must receive O₂ in an appropriate, safe and comfortable way (Argeta et al., 2022).

While, there are numerous benefits to O₂ therapy, there are similarly dangers and side effects that complicate the disease course or even worsen clinical

neonates' outcomes. Therefore, it requires constant monitoring of the dose, concentration, and side effects to ensure its safe and effective use. This might suggest that, health-care professionals especially nurse would be knowledgeable and familiar with its uses and limitations. So, it should be administered cautiously and according to the safety guidelines **(Wemple et al., 2023)**.

Pitfalls in O₂ therapy administration lead to an increase in the duration of hospitalization, disability and death up to 6.5% of neonatal hospital admissions. Nursing staff are involved in O₂ therapy administration more than other health care professionals and they are identified as major contributors to pitfalls in O₂ therapy administration **(Abukhader & Abukhader, 2020)**.

The lack of knowledge is one of the leading causes of pitfalls in O₂ therapy administration by nursing staff. Thus, assessing nurses' knowledge, practices and attitudes with regards to O₂ therapy administration is critical for enhancing neonate's safety in health care systems **(Argaw et al., 2023)**.

The possible causes for nurses' pitfalls in O₂ therapy administrating includes; a shortage of training, unavailability of hospital O₂ therapy guidelines and excessive nurses' workload. Also, the unavailability of well-functioning equipment or supplies used during O₂ therapy. In addition to, there are some other barriers which might be related to prescription itself as; unclear neonatologists' prescription regarding to dose and device that should be used according to neonates condition **(Adeniyi et al., 2021)**.

The progresses of science and technology in NICUs have contributed to the increased survival of neonates. Neonatal nurse is professional with special training, skills, and knowledge in

the care of neonates and their families. Nurses are conventionally in the first line of defense to maintain neonates' safety, which helps them detect issues that influence newborns safety, closely and directly. Thus detecting and relieving a source of damage is critical to offering safe care **(Saxton et al., 2020)**.

Nurses play a significant role in meeting neonates' safety-related requirements. A considerable decrease in pitfalls and improvement of nurses' performance at the NICU is realized when NICU nurses understand and recognize the related reasons and then implement evidence-based interventions **(Burd & Raghuraman, 2023)**.

Significance of the Study:

Nursing care of neonates with respiratory problems requires knowledge and practical skill necessary for application of O₂ therapy directed toward many problems. Lack of nurses' performance is one of the obstacles for delivery of nursing care needed for neonates. In Egypt 15% of neonates with O₂ therapy administrations have many complications as blindness and other complications on brain and death may occur as a result of O₂ therapy administration **(Sotiropoulos et al., 2023)**.

The pitfalls in O₂ therapy can affect the neonate's safety and are more common in neonates than other populations. Incidence of O₂ therapy errors are 18% of total medical errors, and are considered as one of the top ten causes of neonates' deaths **(Zein Eldin et al., 2018)**. In Egypt medication errors occur in 10.5% in neonates **(Hamed, et al., 2022)**. Also, based on a WHO report every year at least million deaths occur due to the lack of supplemental O₂ therapy and inappropriate administration of oxygen **(Mohammed et al., 2023)**.

Studies related to pitfalls in O₂ therapy in Middle Eastern Countries were

showing relatively few in nurses' number who have sufficient knowledge about O₂ therapy so, educational programs about O₂ therapy for nurses are urgently needed (Martin et al., 2022).

From clinical experience of the researcher it was clear that, there is a gap between nurses' actual knowledge and their practices regarding caring of neonates under O₂ therapy in NICUs. Therefore, it is essential to conduct such study to assess the pitfalls in nurses' performance regarding O₂ therapy administration for neonates at NICUs.

Aim of the study

This study aimed to assess the pitfalls in nurses' performance regarding oxygen therapy administration at Neonatal Intensive Care Units (NICUs).

Research questions:

1. What are the nurses' knowledge regarding O₂ therapy administration and pitfalls to neonates in the NICUs?
2. What are the nurses' pitfalls in their practices during O₂ therapy administration to neonates in NICUs?
3. What are the nurses' attitudes regarding pitfalls of O₂ therapy administration to neonates in NICUs?

Subjects And Methods:

I- Technical design:

The technical design for the study includes a description of the study design, setting, subjects, and tools of data collection.

A. Study Design:

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

B. Study Setting:

This study was conducted at the NICU in El- Fayoum General Hospital affiliated to the Egyptian Ministry of Health for increasing flow rate of the neonates in this setting. The NICU unit is located in the third floor and is consisted of eight rooms; each room includ 9

incubators so, the total number of incubators was 72.

C. Study Subjects:

- A convenient sample composed of 70 nurses working in the previously mentioned study setting regardless their characteristics (age, gender, qualifications and their years of experience).
- All available neonates (70) receiving O₂ therapy during the research period (six months) at the previously mentioned setting.

D. Tools of data Collection: Three tools for data collection were used in the current study as the following:

First Tool: Pre-designed Questionnaire Sheet: It was designed by the researcher after reviewing the relevant literature and it was written in simple Arabic language to suit the level of understanding of the studied nurses. It was used to assess nurses' knowledge regarding O₂ therapy administration and their pitfalls in the NICU. This tool included the following parts:

Part 1: It was concerned with the characteristics of the studied subjects including:

- A: **Characteristics of the studied nurses;** namely; age, gender, qualifications, years of experience and attending previous courses in O₂ therapy administration for neonates in the NICU.
- B: **Characteristics of the studied neonates;** namely; gestational age, gender, birth weight, type of delivery, diagnosis and apgar score.

Part 2: It was used to assess:

- A: **Nurses' level of knowledge regarding O₂ therapy administration at NICUs** including; definition, indications, methods of administration, advantages, disadvantages, dose, duration,

concentration, flow rate, complications, side effects, precautions and weaning from O₂ therapy.

B: Nurses' knowledge regarding pitfalls in O₂ therapy administration at NICU including; definition for the term of pitfalls, causes of nurses' pitfalls in O₂ therapy administration, types of nurses' pitfalls, early detection of pitfalls and how to prevent it at NICU.

The questionnaire consists of 75 questions, in the form of multiple choice questions (MCQs). That were divided into categories to assess nurses' knowledge regarding O₂ therapy administration to neonates and their pitfalls in the NICUs as the following:

1. Questions (46) to assess the nurse's knowledge about O₂ therapy in NICUs and pulse oximeter for neonates.
2. Questions (11) to assess nurses' knowledge regarding pitfalls in O₂ therapy administration at NICUs.
3. Questions (12) to assess nurses' pitfalls during O₂ therapy.
4. Questions (3) to assess role of nurses' toward preventing pitfalls in O₂ administration at NICUs.
5. Questions (3) to assess role of nurses' towards early detection of pitfalls in O₂ administration at NICUs.

Second Tool: Observation Checklists for oxygen therapy administration: It was adapted from **Lynn & Lebon, (2018) and MacDonald, et al., (2019)**. It was used to assess the actual nurses' practices regarding O₂ therapy administration and their common pitfalls pre, during and after O₂ therapy administration at NICUs.

It consisted of eight observation checklists for O₂ therapy administration namely; nasal cannula (12 steps), face

mask (12 steps), incubator (12 steps), head hood / head box (10 steps), nasal continuous positive airway pressure (13 steps), mechanical ventilator (12 steps), oropharyngeal nasal suctioning (14 steps) and pulse oximeter (12 steps). The total steps were 97. Nurses were directly observed for their practices and were evaluated during their actual working shifts.

Third Tool: Attitudes Likert Type Rating Scale: It was adapted from **Likert (1932) in Khalaf et al., (2015)**. It was used to assess the nurses' attitudes regarding the pitfalls in O₂ therapy administration to neonates in the NICUs. It included 32 statements (20 positive and 12 negative) were divided into four categories. The studied nurses were asked to respond on 3- points Likert scale. The statements were divided into "7" statements to assess nurses' attitudes regarding causes of pitfalls in oxygen therapy administration, "15" statements to assess nurses' attitudes regarding types of pitfalls in oxygen therapy administration, "5" statements to assess nurses' attitudes regarding hazards of pitfalls in oxygen therapy administration and "5" statements were stated to assess nurses' attitude regarding prevention of pitfalls in oxygen therapy administration.

II. Operational Design:

The operational design for this study included preparatory phase, content validity and reliability for the study tools, pilot study and field work.

a) Preparatory phase:

It included reviewing the related literature and theoretical knowledge of various aspects of the study using articles, periodicals, text books and websites.

b) Validity and reliability:

Validity:

Validity of the study tools was evaluated by a panel of three experts from

Pediatric Nursing Department; two professors and one assistant professor from Faculty of Nursing - Ain Shams University to ensure tools' objectivity, comprehensiveness, accuracy, clarity, applicability and its relevance.

Reliability:

Reliability of the study tools was done by using Cronbach's Alpha coefficient test which revealed that each of the three tools consisted of relatively homogenous items as indicated by the high reliability of each tool. The internal consistency of knowledge was 0.795 and 0.605 for practices and 0.632 for attitudes.

c) Pilot study:

A pilot study was carried out on 10% of the total sample (7 nurses and 7 neonates) from the study subjects to evaluate the clarity, applicability, feasibility and relevance of study tools used and time required to fulfill the tools. The nurses who were shared in the pilot study were included in the study subjects because with minor modification was done after conducting pilot study.

d) Field work:

The purpose of the study was simply explained to the nurses who agreed to participate in the study prior to data collection. The data collection process of this study started and completed within six months from the beginning of December 2021 to the end of May 2022. The researcher was available two days (Sunday and Tuesday) weekly from 10am to 2pm in NICU at Fayoum General Hospital.

The researcher was introducing herself to each nurse through, giving a clear and brief idea about the aim of the study and its expected outcomes.

Every studied nurse took about 30 minutes to complete the questionnaire and attitudes sheet (20 minutes for knowledge & 10 minutes for attitudes).

The researcher was observing the nurse directly when providing their care for neonates on O₂ therapy. The observation checklists were checked by the researcher and it took 30 minutes for every nurse. The researcher was assessing 2-3 nurses every week.

III- Administrative Design:

A written official letter was issued from the Dean of Faculty of Nursing, Ain Shams University to the director of El-Fayoum General Hospital affiliated to the Egyptian Ministry of Health for obtaining the permission for data collection after explaining the purpose of the study and its expected outcomes.

Ethical considerations:

An ethical approval obtained from the Scientific Research Ethical Committee - Faculty of Nursing - Ain Shams University to conduct this study after explaining its aim. In addition, informed oral consent was obtained from participants of the study. The researcher explained the objective and aim of the study to nurses' included in the study. The researcher emphasized that, the participation was voluntary, anonymity and confidentiality were assured.

The researcher emphasized that, the study subjects will not be exposed to any physical or psychological harm. Participants were allowed to withdraw from the study at any time freely without giving any justification.

IV- Statistical Design:

Collected data were organized, categorized, tabulated and statistically analyzed using the Statistical Package for Social Science (SPSS) version 20 to assess nurses' level of knowledge, practices and attitudes regarding O₂ therapy administration and pitfalls to neonates in the NICUs. Data were presented in the form of number, the statistical analysis percentages (%), the

arithmetic Mean (\bar{X}) and standard deviation (SD), for quantitative data such as; nurses' age and years of experience.

Frequency and percentage for qualitative data such as; nurses' gender, educational level, previous training courses, level of knowledge, attitudes and practices. All tests were performed at the level of significance at $P\text{-value} \leq 0.05$ was considered statistically significant, $P\text{-value} \leq 0.01$ was considered statistically highly significant, $P\text{-value} > 0.05$ was considered statistically insignificant. In large than 2×2 cross – tables. Mont Carlo test was applied whenever the expected value in 2 or more if the cells was than 5.

Results

Table 1 showed that, more than one third (37.1%) of the studied nurses were aged from $20 < 25$ years ($\bar{X} \pm SD$ 23.93 ± 3.52 years). Concerning years of experience, it was clear that, more than two fifths (42.9%) of them had experience at NICUs for less than 5 years ($\bar{X} \pm SD$ 4.87 ± 6.44 years). All of the studied nurses were females, and none of them had previously attended any training courses about O_2 therapy administration.

Table 2 portrayed the studied neonates' characteristics; it was shown that, nearly two thirds (64.3%) of them had gestational age < 37 weeks ($\bar{X} \pm SD$ 35.63 ± 4.55 weeks). As well as, more than half (58.6% and 57.1%) of the neonates were males, and their weight at birth was < 2500 gram ($\bar{X} \pm SD$ 2550.30 ± 25.32 gram) respectively.

Table 3 illustrated that, nearly one third (32.9 %) of the studied nurses had correct knowledge about definition of pitfall. Also, 68.6 % of the studied nurses had correct knowledge regarding causes of pitfalls before O_2 therapy administration, compared with 52.9% and

55.7% of them had incorrect knowledge during and after O_2 therapy respectively.

Figure 1 illustrated that, less than one quarter (22.9%) of the studied nurses had satisfactory total score level of knowledge regarding pitfalls in O_2 therapy administration at neonatal intensive care units, while more than three quarters (77.1%) of them had unsatisfactory total score level of knowledge.

Table 4 illustrated that, the majority (92.9%) of the studied nurses didn't comply with infection control rules and didn't adheres with neonatologist prescription (amount / method) before administering oxygen therapy to neonates. Concerning pitfalls during and after administration of oxygen therapy for neonates, it was clear that, the majority (92.9%) of the studied nurses neglected skin care around the nose, face and pressure area under the nasal cannula and more than half (61.4%) of them had a lack of documentation for neonates' condition respectively.

Table 5 revealed that, more than one third (35.7 %) of the studied nurses were competent regarding total score level of their practices in O_2 therapy administration. While, less than two thirds (64.3%) of them were incompetent.

Figure 2 illustrated that, most (84.3%) of the studied nurses had positive attitudes regarding pitfalls of O_2 therapy administration in NICUs, while, less than one quarter (15.7 %) of them had negative attitudes.

Figure 3 illustrated that, less than two fifths (38.6%) of the studied nurses had competent total performance regarding pitfalls in oxygen therapy administration at NICUs. While, more than half (61.4%) of them had an incompetent total performance.

Table (1): Distribution of the Studied Nurses according to their Characteristics (n=70)

Characteristics of studied nurses	No.	%
<u>Age/years</u>		
20 - < 25	26	37.1
25 - < 30	24	34.3
30 - < 35	7	10.0
≥35	13	18.6
$\bar{X} \pm SD$	23.93±3.52	
<u>Years of experience in NICUs</u>		
<5	30	42.9
5- < 10	22	31.4
10- < 15	5	7.1
15 ≤ 20	13	18.6
$\bar{X} \pm SD$	4.87±6.44	

Table (2): Distribution of the Studied Neonates according to their Characteristics (n= 70)

Characteristics of studied neonates	No.	%
<u>Gestational age (weeks) :</u>		
< 37	45	64.3
37 - < 42	22	31.4
≥42	3	4.3
$\bar{X} \pm SD$	35.63±4.55	
<u>Gender</u>		
Males	41	58.6
Females	29	41.4
<u>Birth Weight (grams):</u>		
< 2500	40	57.1
2500 - < 3000	27	38.6
3000 - ≤ 3500	3	4.3
$\bar{X} \pm SD$	2550.30±25.32	

Table (3): Distribution of the Studied Nurses' Knowledge regarding Definition and Causes of Pitfalls in Oxygen Therapy Administration (n= 70)

Items of Knowledge	Nurses' Knowledge			
	Correct		Incorrect	
	No.	%	No.	%
Definition of pitfalls.	23	32.9	47	67.1
Causes of pitfalls in O ₂ therapy administration:				
• Before.	48	68.6	22	31.4
• During.	33	47.1	37	52.9
• After.	31	44.3	39	55.7

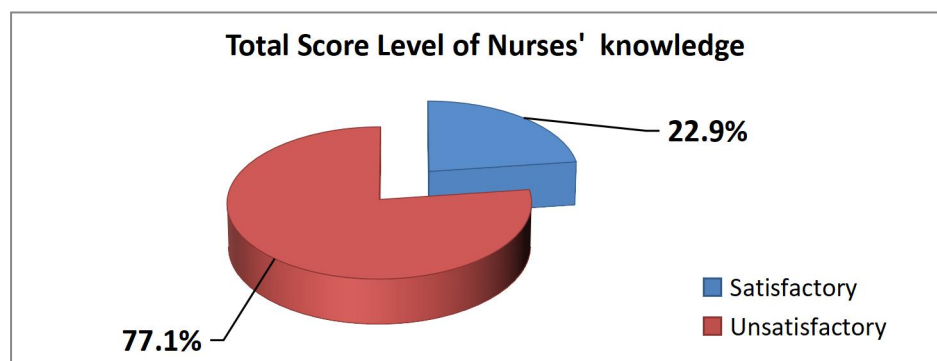
Figure (1): Percentage Distribution of the Studied Nurses' regarding their Total Score Level of Knowledge about Pitfalls in Oxygen Therapy Administration at Neonatal Intensive Care Units (n= 70)

Table (4): Distribution of the Studied Nurses' Pitfalls in their Practices regarding Oxygen Therapy Administration (n= 70)

Pitfalls in Nurses' practices	No.	%
Before		
Neglect check neonatologist prescription	51	72.9
Not compliance with infection control rules	65	92.9
Wear jewelry	52	74.3
Not adhere with neonatologist prescription (amount / method)	65	92.9
Neglect check equipment and ensure their efficiency	50	71.4
Not adjust appropriate flow rate as prescribed	57	81.4
During		
Lack of monitoring for vital signs	53	75.7
Use an inappropriate suction catheter	56	80.0
Use an inappropriate pulse oximeter size	30	42.8
Neglect checks humidifier temperature and level of distal water	60	85.7
Neglect place pads between simple face mask and facial parts	47	67.1
Use an inappropriate, catheter, nasal and mask size	51	72.9
Lack of constant monitoring SPO ₂	61	87.1
Neglect of skin care around nose, face, and pressure area under nasal cannula	65	92.9
Not constant change neonates' position	50	71.4
Ignoring the alarms sound	63	90.0
Neglect check for skin irritation or signs of pressure	54	77.1
Neglecting endotracheal suctioning and mouth care	55	78.6
Not lubricate the suction catheter	45	64.3
After		
Lack of documentation for neonates' condition	43	61.4

Table (5): Total Score Level of the Studied Nurses' Practices regarding Oxygen Therapy Administration (n= 70)

Total Score Level of Nurses' Practices	No.	%
Competent	25	35.7
Incompetent	45	64.3

Figure (2): Percentage Distribution for the Total Score Level of the Studied Nurses' Attitudes regarding Pitfalls of Oxygen Therapy Administration (n= 70)

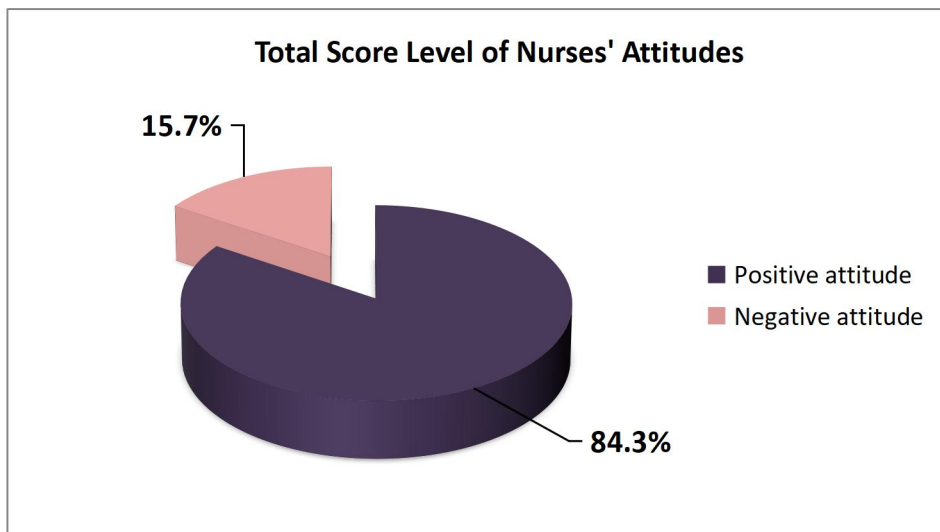
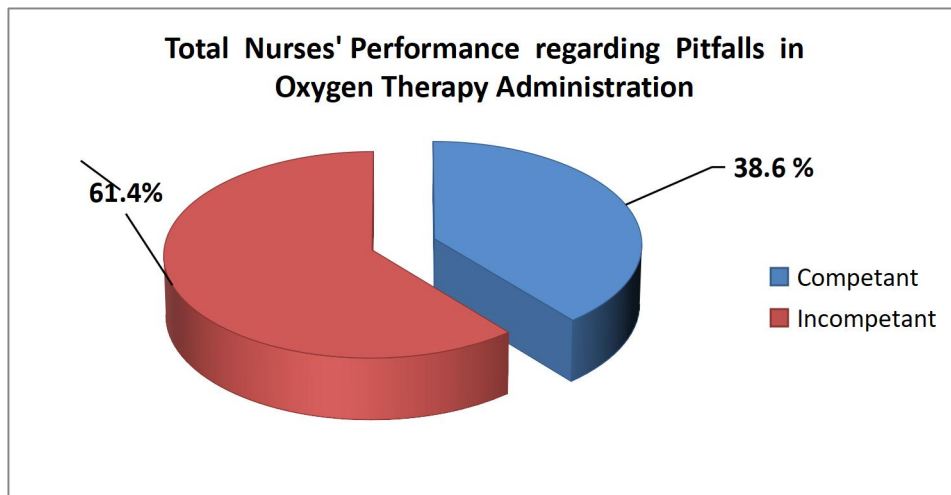


Figure (3): Percentage Distribution of the Studied Nurses' Total Performance regarding Pitfalls in Oxygen Therapy Administration (n= 70)



Discussion

Oxygen is a life saving therapy. However; it is essential to recognize that O₂ is a drug and should be prescribed accurately with the required flow rate and delivery device clearly identified. Careful monitoring by the nurse will prevent hypoxemia (**Weekley & Bland, 2021**). The pitfalls in O₂ therapy administration lead to increased neonates hospital lengths of stay, and increased risk of death. Uncontrolled O₂ administration, mainly when delivered at high concentrations, can result in a worsening of hypercapnia which is primarily caused by hypoxic vasoconstriction and not due to reduced hypoxic drive as previously believed (**Kim & Chae, 2022**).

In relation to the studied nurses' knowledge regarding pitfalls in O₂ therapy administration. The results of the current study clarified that, more than two thirds of the studied nurses had correct knowledge about causes of pitfalls before O₂ therapy administration such as lack of nurses about O₂ therapy, lack or unavailability of proper functioning equipment or supplies used during oxygen therapy, increasing the workload of nurses.

These findings were in an agreement with the findings of the study by **Mayhob, (2017)** entitled "Nurses' Knowledge, Practices and Barriers Affecting a Safe Administration of Oxygen Therapy" who reported that, unavailability of standardized protocol about O₂ therapy, lack of training courses, low educational level, absence of awareness for significance of O₂ therapy, and deficiency of the nursing staff in comparison to the number of the neonates are factors causes pitfalls in administration of O₂ therapy.

Concerning to the studied nurses regarding their total score level of knowledge about pitfalls in O₂ therapy administration at neonatal intensive care units, the results of the current study revealed that, more than three quarters of the studied nurses had unsatisfactory knowledge about O₂ therapy and their pitfalls in neonatal intensive care units, while less than one quarter of them had satisfactory knowledge.

These findings were in an accordance with study of **Bizuneh et al., (2022)** entitled "Assessment of Knowledge, Attitude and Factors Associated with Oxygen Therapy for Critically Ill Neonates among Nurses at the University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia" who mentioned that, the majority of nurses had poor knowledge about oxygen administration.

The results of the current study were in disagreement with the study performed by **Demilew et al., (2022)** entitled "Knowledge, Attitude, and Practice of Health Professionals for Oxygen Therapy Working in South Gondar Zone Hospitals" who stated that, two thirds of nurses had a good level of knowledge. From the researcher's point of view, these findings may be due to lack of opportunity for nurses to attend workshops which help in refreshing their knowledge, unavailability of suitable booklet & handouts that suit level of nurses' understanding and workload that hinder updating their knowledge.

Regarding the total score level of the studied nurses' practices regarding O₂ therapy administration, the results of the current study revealed that, less than two thirds of the studied nurses were incompetent regarding total practices in O₂ therapy administration. This may be due to the lack in nurses' efficiency for

updating their practices in O₂ therapy administration.

The results of the current study were compatible with the study by **Kamal et al., (2021)** entitled "Assessment of Nurses' Performance regarding Oxygen Administration to High Risk Neonates" who reported that, more than half of the studied nurses had incompetent total practice related to O₂ therapy, pulse oximeter and suctioning.

From the researcher's point of view, these findings may be due to that; the nurses were not fully aware by the importance of all steps in the three stages before, during and after oxygen therapy administration, as they thought that the preparation and finishing steps are not important to be done, and they might not know how proper preparation and finishing of the procedures can affect positively on the neonate's condition.

Additionally, these results were in disagreement with the study performed by **Demilew et al., (2022)** who reported that, the majority of nurses had proper practices regarding administration of O₂ by nasal cannula and face mask. These might be due to nurses had good practice about O₂ therapy administration.

Regarding total score level of the studied nurses' attitudes regarding pitfalls of O₂ therapy administration, the current study result showed that, most of the studied nurses had positive attitudes regarding pitfalls of O₂ therapy administration at the NICUs. This finding was in an agreement with the study of **Bizuneh et al., (2022)** who mentioned that, less than two thirds of the studied nurses had positive attitudes regarding O₂ therapy administration.

Concerning the studied nurses' total performance regarding pitfalls in O₂ therapy administration, the results of the

current study revealed that, more than half of the studied nurses had an incompetent total performance. These results were supported with the study by **Hemati et al., (2016)** who found that, less than two thirds of nurses had favorable performance related to O₂ therapy at NICU. From the researcher's point of view these findings may be due to decreased years of nurses' experience, absence of written protocol of O₂ therapy administration and lack of training courses.

Meanwhile, these results were in disagreement with the study performed by **Argeta et al., (2022)** entitled "Assessment of Knowledge, Attitude and Practice of Nurses towards Oxygen Therapy at Wolaita Sodo University Comprehensive Teaching and Referral Hospital" who reported that, the majority of nurses had good knowledge, attitude, and practice regarding O₂ therapy administration.

Concerning the relation between the studied nurses' characteristics & their total performance regarding pitfalls in O₂ therapy administration, the current study results showed that, there was a highly difference statistical significant between the studied nurses' total performance and their qualifications. These results were proportionate with study by **Mostafa et al., (2019)** entitled "Effect of Educational Program on Nurses' Knowledge and Practice about Oxygen Therapy" who stated that, there was a highly statistical significant difference between the studied nurses' total performance and their qualifications.

The findings of the current study revealed that, no statistically significant difference relation between the studied nurses' total performance and their age, gender, marital status and years of experience. These results were in disagreement with study performed by

ELgneid et al., (2020) "who stated that, there were negative, highly statistically significant relations between nurses' total performance scores and their age and years of experience.

The findings of the current study revealed that, there is highly significant and positive correlation between the nurses' total score levels of knowledge, practices and attitudes. These results were proportionate with study by Kamal et al., (2021) who reported that, there were highly significant correlation between studied nurse's total knowledge, practice and their attitude regarding oxygen administration to high risk neonates.

The researcher's point of view that, these findings reflected that nurses' performance based on the nurses' knowledge, practice & attitude. This result indicated that, the nurses' performance had interrelated components and the sufficiency in one of these components positively affects the other components. This explained that, improving nurse's performance depends on improving nurse's knowledge, practice & attitude.

Conclusion

In light of the current study findings it can be concluded that, more than three quarters of the studied nurses had unsatisfactory level of knowledge, less than two thirds of them had incompetent level of practices and the majority of them showed positive attitudes regarding pitfalls of O₂ therapy administration at NICUs. In addition to, more than half of studied nurses had an incompetent total performance regarding pitfalls of O₂ therapy administration to neonates at NICUs.

Recommendations

In the light of the current study findings, the following recommendations are suggested:

- Training programs should be applied for nurses in the neonatal intensive care units to improve their knowledge practices and attitudes regarding pitfalls in O₂ therapy administration for neonates.
- Neonatal intensive care units should have updated policies related to discovering and prevention of pitfalls in administration of O₂ therapy for neonates.
- Further studies should be conducted in other setting to assess nurses' performance regarding care of neonates undergoing O₂ therapy to prevent pitfalls of O₂ therapy.

References

- Abukhader, I., & Abukhader, K. (2020):** Effect of Medication Safety Education Program on Intensive Care Nurses' Knowledge Regarding Medication Errors. *Journal of Biosciences and Medicines*, 8(06), 135. Retrieved from: https://www.scirp.org/html/13-2151022_100 824 htm. Accessed on: 9-12-2021. At 8.00 P.M.
- Adeniyi, B., Akinwalere, O., Ekwughe, F., Olakanye, O., & Abejegah, C. (2021):** Assessment of Knowledge and Practice of Oxygen Therapy among Doctors and Nurses: A Survey from Ondo State, Southwest Nigeria. *Journal of the Pan African Thoracic Society*, 2(3), 161-166.
- Argeta, H., Bezabih, B., & Kebede, E. (2022):** Assessment of Knowledge, Attitude and Practice of Nurses towards Oxygen Therapy at Wolaita Sodo University Comprehensive Teaching and Referral Hospital, Ethiopia, 2021. *International Journal of Clinical Skills*, 16(7), 250.
- Argaw, R., Beza, K., Kebede, E., & Gebre, H. (2023):** Assessment of

- Pediatric Residents' Knowledge, Attitude and Practice regarding Oxygen Therapy and its Complications at Tikur Anbessa Specialized Hospital and Paul Hospital Millennium Medical College, Ethiopia. *Ethiopian Journal of Pediatrics and Child Health*, 18(1), 1010.
- Bizuneh, Y., Getahun, Y., Melesse, D., & Chekol, W. (2022):** Assessment of Knowledge, Attitude, and Factors Associated with Oxygen Therapy for Critically Ill Neonates among Nurses at The University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia, 2021. *Annals of Medicine and Surgery*, 80(15), 104334.
- Burd, J., & Raghuraman, N. (2023):** Intrapartum Oxygen for Fetal Resuscitation: State of the Science. *Current Obstetrics and Gynecology Reports*, 1(5), 290.
- Demilew, B., Mekonen, A., Aemro, A., Sewnet, N., & Hailu, B. (2022):** Knowledge, Attitude, And Practice of Health Professionals for Oxygen Therapy Working In South Gondar Zone Hospitals, 2021: Multicenter Cross-Sectional Study. *BMC Health Services Research*, 22(1), 1-10.
- ELgneid, H., Sherief, W., & Nabih, M. (2020):** Effect of Implementing Oxygen Administration Guidelines on Nurses' Performance Caring for Patients with Chest Disorders. *IOSR J. Nursing Health Science*, 9, (4) 49-55.
- Hamed, A., EL-Sayed, W., Abdelsadik, B., & Mohamed, A. (2022):** Effect of an Educational Program for Nurses regarding Errors in Medication Administration for Children. *Journal of Nursing Science Benha University*, 3(2), 461-478.
- Hemati, Z., Mohammadi, R., Boroumand, S., Poorpooneh, Z., & Ghazavi, Z. (2016):** Nurses' Performance in Oxygen Therapy for Infants Hospitalized at the Neonate Intensive Care Unit. *Isfahan University of Science*, 10(2), 17795/6475.
- Kamal, A., Salah, S., Abd ELsamia, A. (2021):** Assessment of Nurses Performance regarding Oxygen Administration to High Risk Neonates, Master Thesis, Helwan University, PP 100 - 110.
- Khalaf, M., Ahmad, M., & Ali, N. (2015):** Nurses Knowledge, Attitude and Practice about Oxygen Therapy to High Risk Neonates. Master Thesis, Faculty of Nursing, Cairo University, PP 130.
- Kim, S., & Chae, S. (2022):** Missed Nursing Care and its Influencing Factors among Neonatal Intensive Care Unit Nurses in South Korea: A Descriptive Study. *Child Health Nursing Research*, 28(2), 142.
- Likert, R. (1932):** A technique for the Measurement of Attitudes. *Arch Psychology*, 22(140), 55.
- Lynn, P., & Lebon, M. (2018):** Skills Checklists for Taylor's Clinical Nursing Skills, 5th ed, Wolters Kluwer Health, Lippincott Williams & Wilkins, United States, pp: 307-337.
- MacDonald, M., Ramasethu, J., & Rais-Bahrami, K. (2019):** Atlas of Procedures in Neonatology, 6th ed, Lippincott Williams & Wilkin, Philadelphia, United States, pp: 190 - 200.
- Martin, R., Deakins, K., & Faarc, M. (2022):** Respiratory Support, Oxygen Delivery and Oxygen Monitoring in

- the Newborn. Waltham, MA: UP to Date, 3(3), 30.
- Mayhob, M. (2017):** Nurses' Knowledge, Practices and Barriers Affecting a Safe Administration of Oxygen Therapy. *Journal Nurses Health Scientific*, 7(3), 42-51.
- Mohammed, G., Hassan, H., Fathy, A. (2023):** Nursing Guidelines Regarding Safe and Effective Practices of Supplemental Oxygen Therapy among Critically Care Patients. An Unpublished Doctorate Thesis, Pediatric Nursing, Benha University, 8(1), 5-8.
- Mostafa, A., Mehany, M., & Ahmed, M. (2019):** Effect of Educational Program on Nurses' Knowledge and Practice about Oxygen Therapy. *Assiut Scientific Nursing Journal*, 7(18), 95-104.
- Saxton, S., Dempsey, A., Willis, T., Baughcum, A., Chavis, L., Hoffman, C & Steinberg, Z. (2020):** Essential Knowledge and Competencies for Psychologists Working in Neonatal Intensive Care Units. *Journal of Clinical Psychology in Medical Settings*, 27(4), 830-841.
- Sotiropoulos, J., Schmoelzer, G., Libesman, S., Hunter, K., Williams, J., & Seidler, A. (2023):** Prospective Meta- Analysis of Trials of Initial Oxygen in Preterm Newborns (PROMOTION): Protocol for a Systematic Review and Prospective Meta- Analysis with Individual Participant Data on Initial Oxygen Concentration for Resuscitation of Preterm Infants. *Acta Paediatrica*, 112(3), 372-382.
- Weekley, M., & Bland, L. (2021):** Oxygen Administration. In *Statpearls* [Internet]. Statpearls Publishing.
- Wemple, M., Swensone, K., & Swensone, E. (2023):** Oxygen Therapy Part 2 Indications and Toxicity. *NEJM Evidence*, 2(7), 2300111.
- Zein Eldin, Z., Okby, O., Abd Elrazek, F., & Badawy, S (2018):** Children Medication Safety Strategies: Its Effecton Reducing Medication Errors among Pediatricnurses. *Menoufia Nursing Journal*, 3(2), 79-88. Retrieved from: https://journals.ekb.eg/article_157727.html Accessed on: 11-1-2022.