**Original Article**

# Assessment of Knowledge and Associated Factors with Supplemental Oxygen Administration for Critically Ill Patients Among Nurses

**Moniba Younas[1], Amjad Ali[1*], Nasim Rafiq[1], Ammara Tayyab[1], Hadiqa Asif[1], Shabana Asghar[1] and Maham Afzal[1]**

[1]Shalamar College of Nursing, Lahore, Pakistan

## ARTICLE INFO

## ABSTRACT

Oxygen is a commonly used medication. Insufficient oxygen levels in the bloodstream can lead to cellular malfunctions, organ failure, and ultimately, death. Oxygen, much like any other pharmaceutical substance, can be beneficial in reducing mortality when administered correctly, but it can also have adverse effects when misused. The use of supplemental oxygen therapy (SOT) plays a crucial role in preserving the lives of numerous patients suffering from cardio-pulmonary issues, requiring the development of updated guidelines. **Objective:** To assess the knowledge level of nurses and to identify the associated factors regarding oxygen administration for critical ill patients. **Methods:** A descriptive cross sectional study carried out among nurses of Shalamar hospital, Lahore with a sample size of 82. A modified form of questionnaire was used to collect data. Statistical chi-square test was utilized to analyze the study findings. **Results:** This study found that there were 69.5% females and 30.5% were male. Most of them had age between 20 to 30 years. Regarding knowledge level almost 75.6% participants had good knowledge, 19.5% had moderate knowledge with a mean score of 11.37. Furthermore there was a signification association among knowledge level and experience, duration of administration and duration of prescription with $p<0.05$ while gender, age, qualification and working area were not directly associated with the knowledge level of nurses with $p>0.05$. **Conclusions:** Most of participants were female having age between 20 to 30 years. Most of the nurses had good and moderate knowledge regarding supplemental oxygen therapy (SOT). So it needs a continuing education to stay updated regarding new guidelines for oxygen administration.

## INTRODUCTION

Oxygen is a frequently prescribed medication in clinical practice. Insufficient oxygen levels in the bloodstream can lead to cellular dysfunction, organ failure, and ultimately, mortality[1]. Oxygen is a frequently prescribed medication in clinical practice. Insufficient oxygen levels in the bloodstream can lead to cellular dysfunction, organ failure, and ultimately, mortality[2]. Furthermore, the utilization of Supplemental oxygen therapy (SOT) plays a crucial role in preserving the lives of numerous patients diagnosed with heart and lung diseases. This treatment proves highly effective when administered at the right time and in the appropriate dosage, as per the updated guidelines provided by the World Health Organization (WHO) [3]. However; the ideal quantity and approach for administering oxygen differ based on the patient's underlying medical condition and whether the condition is acute or chronic[4]. The determination of the most suitable oxygen delivery device and oxygen flow rate relies on several factors, including the patient's age, therapeutic objectives, and the patient's ability to tolerate the treatment [5]. Similarly, when a high concentration of oxygen is present, it can have adverse effects on lung tissue, leading to oxygen toxicity. This can reduce the production of surfactant in the lungs, subsequently causing the collapse of alveoli [6]. Likewise, utilizing a simple face mask with a flow rate below 5L/minute can result in the rebreathing of exhaled air and the subsequent elevation of carbon dioxide ($CO_2$) levels[7]. Conversely, recognizing the appropriate need for oxygen

and effectively administering it can greatly influence the overall well-being of a patient [8]. Hence, it is crucial to conduct thorough assessments and consistently monitor patients who are receiving oxygen therapy [9]. In addition, within hospital settings, nurses hold the responsibility for oxygen therapy administration and promptly addressing any adverse effects caused by the therapy. Supplemental oxygen plays a crucial role in managing clinical conditions, and in cases of suspected hypoxia, immediate initiation of oxygen therapy is essential, even without a medical prescription, due to the urgency of the situation. Based on research conducted in various countries, there exists a noticeable gap in both knowledge and practical implementation of oxygen therapy among nurses working in hospitals [10]. Likewise, providing supplemental oxygen to critically ill patients is a vital component of patient care, as it aligns with the fundamental responsibility of nurses to ensure patient comfort and well-being [11]. In this context, possessing the necessary knowledge, demonstrating proficient practice, and maintaining positive attitudes regarding oxygen administration are crucial elements in providing effective care in this area [12]. By acquiring these skills, nurses can effectively evaluate the condition of patients and provide personalized care tailored to each individual, thereby enhancing their quality of life. This approach also helps in preventing hypoxemia and acute lung injury [13].With these concers in mind, the objective of this study was to evaluate the knowledge and attitudes of nurses regarding oxygen administration. Additionally, it seeks to identify potential factors contributing to this issue, such as insufficient training in supplemental oxygen therapy, the absence of standardized guidelines for oxygen administration, heavy workload, and inadequate supply of oxygen and delivery devices. Ultimately, the findings of this study can serve as an indication to policymakers regarding the significance of regular audits and reviews of clinical practices and knowledge gaps.

## METHODS

A descriptive cross-sectional study was conducted at Shalamar Hospital in Lahore, Punjab, Pakistan. The study duration was four months, starting after obtaining approval. The calculated sample size for the study was 82, based on the population size of 235 staff nurses working at Shalamar Hospital. The sample size calculation took into account a previous study that reported knowledge and practice assessment of oxygen therapy among doctors and nurses in Southwest Nigeria, with a prevalence of 29.7%, a 95% confidence level, a margin of error (d) of 5%, and a 40% drop-out rate. Purposive sampling was used to select nurses working on the clinical side, both male and female, with nursing experience of more than one year and easily available at the workplace. Staff nurses working in general wards and those not directly involved in patient care (nurse managers and nursing supervisors) were excluded from the study. The study utilized a true/false-based questionnaire consisting of 22 questions, divided into subheadings: demographic (7), knowledge of oxygen (5), recognizing hypoxemia (5), and indications for acute oxygen therapy (5). Each question in the questionnaire was scored as 1 for a correct answer and 0 for a wrong answer. The scoring system categorized knowledge as good (11-15, >70-100%), average (6-10, 40-69%), or poor (<5, <40%). Nurses who agreed to participate provided signed consent forms and completed the questionnaire within a 40-minute session conducted in the presence of the researcher. Knowledge levels were analyzed using frequencies and percentages. The strength of connections between variables was evaluated through the chi-square test, with a significance level (p-value) below 0.05 indicating statistical significance. Those variables having significance less than or equal 0.05 were the associated factors. Data were entered and analyzed by using SPSS version 25.0. All the qualitative variables were presented by frequency and percentages and quantitative with mean ± SD.

## RESULTS

Table 1 shows the distribution of participants' characteristics. The results indicate that the majority of participants, comprising 51.2%, were aged between 20 to 30 years, while 41.5% fell within the age range of 31 to 40 years. Only a small percentage, 7.3%, belonged to the age group of 41 to 50 years. In terms of gender, 69.5% of the nurses were female, whereas 30.5% were male. When considering the department in which they worked, 31.7% were employed in the surgical intensive care unit (SICU), 15.9% in the operation theater (OT), 14.9% in the medical intensive care unit (MICU), and a mere 7.3% in the cardiac care unit (CCU). As for qualifications, 41.5% of the nurses held the RN BSN qualification, 22.0% had a BSN, 18.3% possessed a Diploma, and an additional 18.3% held a Diploma PBS. In terms of experience, 41.5% had 1 to 3 years of experience, 34.1% had 4 to 6 years, 19.5% had 7 to 9 years, and only 4.9% had more than 10 years of experience. When it came to the administration of oxygen, 34.1% of the nurses had been doing so for 6 to 12 months, 32.9% for 1 to 5 months, 29.3% for less than 1 month, and a mere 3.7% for over 1 year. In terms of the duration for which oxygen was prescribed, 43.9% of nurses had prescribed it for 1 to 5 months, 25.6% for less than 1 month, 24.4% for 6 to 12 months, and only 6.1% for over 1 year.

**Table 1:** Demographic variables of Nurses working in Shalamar Hospital

**Table 1:** Demographic variables of Nurses working in Shalamar Hospital

| Demographic Variables | | %age |
|---|---|---|
| Age | 20–30 | 42 (51.2) |
| | 31–40 | 34 (41.5) |
| | 41–50 | 6 (7.3) |
| Sex | Male | 25 (30.5) |
| | Female | 57 (69.5) |
| Department you work | HDU | 25 (30.5) |
| | OT | 13 (15.9) |
| | SICU | 26 (31.7) |
| | MICU | 12 (14.6) |
| | CCU | 6 (7.3) |
| Education level | Diploma PBS | 15 (18.3) |
| | RN BSN | 34 (41.5) |
| | BSN | 18 (22.0) |
| | Diploma PBS | 15 (18.3) |
| How much is your experience | 1–3 years | 18 (22.0) |
| | 4–6 years | 34 (41.5) |
| | 7–9 years | 28 (34.1) |
| | > 10 years | 16 (19.5) |
| | 1–3 years | 4 (4.9) |
| Administration of oxygen | < 1 month | 24 (29.3) |
| | 1–5 months | 27 (32.9) |
| | 6–12 months | 28 (34.1) |
| | > 1 year | 3 (3.7) |
| How long ago did you prescribed oxygen to a patient | <1 month | 21 (25.6) |
| | 1–5 months | 36 (43.9) |
| | 6–12 months | 20 (24.4) |
| | > 1 year | 5 (6.1) |

Analyzed through frequency (n) and percentage (%); CI: 95%, d: 5%

Table 2 stated that most of the participants have good knowledge. Almost 75.6% participants had good knowledge scored (11–15), 19.5% had moderate knowledge scored (6–10) and only (4.9%) participants had poor knowledge score less than 5 regarding supplemental oxygen administration.

**Table 2:** Knowledge level of nurses regarding oxygen administration for critical ill patient

| Level of knowledge | Frequency (%) | X ± SD |
|---|---|---|
| Good knowledge: 11–15 | 62 (75.6) | |
| Average knowledge: 6–10 | 16 (19.5) | 11.37±2.48 |
| Poor knowledge: <5 | 4 (4.9) | |

Analyzed by frequency(n), percentage(%), mean(X) and standard deviation(S.D)

Table 3 analyzed that experienced nurses (p= 0.005), duration of administration of oxygen to the patient which someone practice (p=0.000), duration of prescription of oxygen which they practice during their duty hours (p=0.001) were significantly associated with knowledge level of nurses regarding oxygen administration. The participants who had more experience (>10years) they more likely to have good knowledge (11–15). Similarly participants who recently (<1 month ago) administered oxygen, had good knowledge (11–15). The study also revealed that the participants who recently (<1 month ago) prescribed the oxygen had good knowledge (11–15). However the likelihood of having good knowledge was higher among nurses whose age ranged from 41–50 as compared to minor nurses.

**Table 3:** Factors associated with oxygen administration for critical ill patients among Nurses

| Demographic Factors | | Good knowledge: 11–15 | Average knowledge: 6–10 | Poor knowledge: <5 | p-value |
|---|---|---|---|---|---|
| How much is your experience | 1–3 years | 11 | 6 | 2 | 0.005 |
| | 4–6 years | 16 | 10 | 1 | |
| | 7–9 years | 30 | 0 | 1 | |
| | >10 years | 5 | 0 | 0 | |
| How long did you administer oxygen to a patient | <1 month | 38 | 5 | 1 | 0.000 |
| | 1–5 months | 10 | 7 | 1 | |
| | 6–12 Months | 14 | 4 | 1 | |
| | >1 year | 0 | 0 | 1 | |
| How long ago did you prescribed oxygen to a patient | <1 month | 38 | 4 | 0 | 0.001 |
| | 1–5 months | 18 | 7 | 1 | |
| | 6–12 months | 4 | 5 | 3 | |
| | > 1 year | 2 | 0 | 0 | |

Analyzed by chi-square test with a significance <0.05

Table 4 analyzed that gender (p=0.396), department (p=0.570), qualification (p=0.714) and age (p=0.854) were not significantly associated with knowledge level of nurses regarding oxygen administration. Regarding male participants 20 had good knowledge; similarly in female participants 42 had good knowledge. According to qualification, regarding diploma participants 11 had good knowledge, in diploma PBS 13 participants had good knowledge, in RN BSN 24 participants had good knowledge, in BSN 14 participants had good knowledge. Related to age of participants, in age group of 20–30years 20 participants contained good knowledge.

**Table 4:** Factors not significantly associated with oxygen administration for critical ill patients among nurses

| Demographic Factors | | Good knowledge: 11–15 | Average knowledge: 6–10 | Poor knowledge: <5 | p-value |
|---|---|---|---|---|---|
| What is your gender? | Male | 20 | 3 | 2 | 0.396 |
| | Female | 42 | 13 | 2 | |
| What is your qualification? | Diploma | 11 | 4 | 0 | 0.714 |
| | Diploma PBS | 13 | 2 | 0 | |
| | RN BSN | 24 | 7 | 3 | |
| | BSN | 14 | 3 | 1 | |
| What is your age in year? | 20–30 | 20 | 7 | 2 | 0.854 |
| | 31–40 | 37 | 8 | 2 | |
| | 41–50 | 5 | 1 | 0 | |

Analyzed by chi-square test with a significance <0.05

# DISCUSSION

Oxygen therapy involves delivering oxygen at concentrations higher than what is naturally present in the surrounding air, aiming to treat or prevent hypoxia. This therapy plays a critical role in the care of patients experiencing acute illness. As a result, it is considered a vital and urgently needed intervention for ensuring proper resuscitation. This study identified that most of the participants have good knowledge. Almost (75.6%) participants have good knowledge scored (11-15), (19.5%) have moderate knowledge scored (6-10) and only (4.9%) participants have poor knowledge score less than 5 regarding supplemental oxygen administration. The analysed mean (x) was 11.37 with standard deviation (S.D) 2.48. Its means that most of the participants were in good knowledge score as well as in average knowledge reported 75.6% and 19.5% respectively. Similarly, a study conducted according to study 94.9% of nurses had good knowledge on oxygen humidification [14]. According to a conducted study, approximately one-third of the nurses included in the research possessed adequate understanding, while the remaining two-thirds exhibited insufficient knowledge regarding oxygen therapy [15]. A separate study revealed that approximately 52% of the nurses surveyed demonstrated proficient understanding, while the remaining 48% exhibited inadequate knowledge of oxygen therapy [16]. This study found that experience of the nurse, dealing with oxygen, and regular practice with oxygen are the factors associated with oxygen administration for critical ill patients among nurses with a $p < 0.05$. The age of nurses was found to have no significant association with oxygen administration ($p > 0.05$). Likewise, a study revealed that approximately two-thirds of nurses who received training in supplemental oxygen therapy (SOT) demonstrated proficient practice in its administration. Furthermore, the study discovered that nurses holding a Bachelor of Science (BSc) degree were 10 times more likely to exhibit proper practice in supplemental oxygen administration compared to those with a diploma ($p < 0.05$). Moreover, nurses with a strong understanding of SOT were 12 times more likely to demonstrate good practice in supplemental oxygen administration compared to those with limited knowledge ($p < 0.05$) [17]. However, a study conducted find that there was a significant association of age and gender of participants with good knowledge which is different from our study but level of education was significantly associated with good knowledge score. [18]. Furthermore, a separate study was carried out, which concluded that there was no noteworthy disparity in the overall knowledge scores of nurses based on factors such as gender, duration of work, training status in oxygen therapy, and employment status ($p > 0.05$). Additionally, no correlation was found between the age of the participants and their knowledge scores [19]. Similarly in a study there was significant association with education level [20]. On the contrary, a conducted study demonstrated noteworthy connections between the level of knowledge concerning oxygen therapy and the specific working unit ($p = 0.000$) [4]. Similarly, another study yielded results indicating no significant correlation between the level of knowledge regarding oxygen therapy and the training received ($p = 0.157$) [21]. In the same way, a study found no statistically significant relationships between age ($p = 0.57$), gender ($p = 0.09$), employment status ($p = 0.68$), workplace ($p = 0.86$), current position ($p = 0.11$), degree ($p = 0.27$), and graduation time of nurses ($p = 0.58$) and their level of knowledge regarding appropriate oxygen usage. Furthermore, no significant relationship was found between nurses' work experience at Masih Daneshvari Hospital, participation in oxygen therapy training courses, and understanding of proper oxygen usage ($p = 0.15$). However, there was a statistically significant relationship found between nurses' relevant work experience and their understanding of proper oxygen usage [14]. The participants who had experience >10 years contained good knowledge score (11-15). Participants who recently (<1month) administered oxygen to the patients had good knowledge and who recently (<1month) prescribed oxygen to a patient had good knowledge score.

# CONCLUSIONS

The findings of study revealed that regarding to the knowledge level most of the participants had good knowledge. This study also find out that the experience, duration of administration and prescription of oxygen were directly correlated with the knowledge level of nurses with $p < 0.05$. However gender, age, qualification and working area were not directly associated with the knowledge level of nurses with $p > 0.05$.

# Authors Contribution

Conceptualization: MY
Methodology: HA, MA
Formal analysis: AA
Writing-review and editing: MY, AA, NR, AT, SA

All authors have read and agreed to the published version of the manuscript.

# Conflicts of Interest

The authors declare no conflict of interest.

# Source of Funding

# REFERENCES

[1] YA, Bizuneh YB, Melesse DY, Chekol WB. Assessment of practice and barriers of oxygen therapy in critically ill patients among nurses: A survey from University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia, 2021. Annals of Medicine and Surgery. 2022 Apr; 76: 103481. doi: 10.1016/j.amsu.2022.103481.

[2] Woodrow P. Intensive care nursing: a framework for practice. Routledge; 2002. doi: 10.4324/9780203445730.

[3] Chu DK, Kim LH, Young PJ, Zamiri N, Almenawer SA, Jaeschke R, et al. Mortality and morbidity in acutely ill adults treated with liberal versus conservative oxygen therapy (IOTA): a systematic review and meta-analysis. The Lancet. 2018 Apr; 391(10131): 1693-705. doi: 10.1016/S0140-6736(18)30479-3.

[4] Demirel H and Kazan EE. Knowledge levels of nurses about oxygen therapy in Turkey. International Journal of Health Services Research and Policy. 2020 Apr; 5(1): 1-4. doi: 10.33457/ijhsrp.700150.

[5] O'Driscoll BR and Smith R. Oxygen use in critical illness. Respiratory Care. 2019 Oct; 64(10): 1293-307. doi: 10.4187/respcare.07044.

[6] Tolla HS, Woyessa DB, Balkew RB, Asemere YA, Fekadu ZF, Belete AB, et al. Decentralizing oxygen availability and use at primary care level for children under-five with severe pneumonia, at 12 Health Centers in Ethiopia: a pre-post non-experimental study. BMC Health Services Research. 2022 May; 22(1): 676. doi: 10.1186/s12913-022-08003-4.

[7] Goharani R, Miri M, Kouchek M, Sistanizad M. Familiarity of physicians and nurses with different aspects of oxygen therapy; a brief report. Emergency. 2017 Jan; 5(1): e39.

[8] O'Driscoll BR, Howard LS, Earis J, Mak V. British Thoracic Society Guideline for oxygen use in adults in healthcare and emergency settings. BMJ Open Respiratory Research. 2017 May; 4(1): e000170. doi: 10.1136/bmjresp-2016-000170.

[9] L'Her E, Dias P, Gouillou M, Riou A, Souquiere L, Paleiron N, et al. Automatic versus manual oxygen administration in the emergency department. European Respiratory Journal. 2017 Jul; 50(1): 1602552. doi: 10.1183/13993003.02552-2016.

[10] Siemieniuk RA, Chu DK, Kim LH, Güell-Rous MR, Alhazzani W, Soccal PM, et al. Oxygen therapy for acutely ill medical patients: a clinical practice guideline. BMJ. 2018 Oct; 363: k4169. doi: 10.1136/bmj.k4169.

[11] Adeoti AO, Desalu OO, Elebiyo T, Aremu OA. Misconception on oxygen administration among patients and their caregivers in Ado Ekiti, Nigeria. Annals of African Medicine. 2022 Jul; 21(3): 269. doi: 10.4103/aam.aam_63_21.

[12] Bakare AA, Graham H, Ayede AI, Peel D, Olatinwo O, Oyewole OB, et al. Providing oxygen to children and newborns: a multi-faceted technical and clinical assessment of oxygen access and oxygen use in secondary-level hospitals in southwest Nigeria. International Health. 2020 Jan; 12(1): 60-8. doi: 10.1093/inthealth/ihz009.

[13] Schell CO, Gerdin Wärnberg M, Hvarfner A, Höög A, Baker U, Castegren M, et al. The global need for essential emergency and critical care. Critical Care. 2018 Dec; 22: 1-5. doi: 10.1186/s13054-018-2219-2.

[14] Hassanzad M, Ghaffaripour H, Rekabi M, Mirzendehdel M, Sadati E, Elahimehr N, et al. Nurses' Knowledge Regarding Oxygen Therapy; a Cross-Sectional Study. Archives of Academic Emergency Medicine. 2022 May; 10(1): e38. doi: 10.22037/aaem.v10i1.1553.

[15] Bizuneh YB, Getahun YA, Melesse DY, Chekol WB. Assessment of knowledge, attitude, and factors associated with oxygen therapy for critically ill patients among nurses at the University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia, 2021. Annals of Medicine and Surgery. 2022 Aug; 80: 104334. doi: 10.1016/j.amsu.2022.104334.

[16] Zeleke S and Kefale D. Nurses' supplemental oxygen therapy knowledge and practice in Debre Tabor general hospital: a cross-sectional study. Open Access Emergency Medicine. 2021 Feb; 13: 51-6. doi: 10.2147/OAEM.S299139.

[17] Jamie A. Knowledge and practice of nurses towards oxygen therapy in the public hospitals of Harari region, Ethiopia. Journal of Research Development in Nursing and Midwifery. 2022 Feb; 18(2): 11-3. doi: 10.52547/jgbfnm.18.2.11.

[18] Desalu OO, Ojuawo OB, Adeoti AO, Oyedepo OO, Aladesanmi AO, Afolayan OJ, et al. Doctors' and Nurses' Knowledge and Perceived Barriers Regarding Acute Oxygen Therapy in a Tertiary Care Hospital in Nigeria. Advances in Medical Education and Practice. 2022 Dec; 13: 1535-45. doi: 10.2147/AMEP.S378533.

[19] Yasemin US and Altay M. Assessing Critical Care Nurses' knowledge on Oxygen Therapy in Covid-19 Patient Care in Turkey; A Multicenter Study. Journal of Advanced Research in Health Sciences. 2022 Nov; 5(3): 153-9. doi: 10.26650/JARHS2022-1122168.

[20] Uwineza Didi V. Knowledge, attitudes and practice among nurses toward oxygen administration to the critically ill patients at UTHK (Doctoral dissertation, University of Rwanda). 2017. Available at: http://dr.ur.ac.rw/handle/123456789/421.

[21] Kalpana K, Sunita G, Srijana G, Muna B. Nursing awareness of oxygen therapy among nurses at selected district hospital in Nepal. RUDN Journal of Medicine. 2021 Jun; 25(3): 202-8. doi: 10.22363/2313-0245-2021-25-3-202-208.

**20**