



Cross-sectional Study

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

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ABSTRACT

Background: Administering oxygen therapy has an essential role in preventing and managing hypoxemia in both acute and chronic conditions. The aim of this study was to assess knowledge, attitude and factors associated with oxygen therapy for critically ill patients among nurses.

Methods: An institutional-based cross-sectional study was conducted from May 23 to June 07 at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, in 2021. A self-administered, structured and validated questionnaire was used. It has socio-demographic characteristics, multiple choice questions, items that measure the possible associated factors and items that were used to assess the level of knowledge and attitude. Epi Data ("The EpiData Association" Odense, Denmark) version 4.6 was used to enter data, and SPSS (IBM) version 20 was used to analyze it. Both bivariate and multivariate logistic regression analyses were used to identify associated factors. Variables with a p value < 0.05 were considered statistically significant.

Results: The overall proportion of critically ill patients with good knowledge and a positive attitude toward oxygen therapy was 33% (95% CI: 25.8–37.8) and 53.8% (95% CI: 49–59), respectively. Age (AOR; 1.738, 95% CI: 1.034–2.921), level of education (AOR; 7.731, 95% CI: 2.507–23.846) and guideline (AOR; 4.338, 95% CI: 2.233–8.428) and good level of practice (AOR; 1.885, 95% CI: 1.173–3.030) were discovered to be significant factors associated with good knowledge towards oxygen therapy and the reading guideline was found to be a significant factor associated with a positive attitude toward oxygen therapy (AOR; 1.396, 95% CI: 0.830–2.348).

Conclusions: and recommendations: The level of knowledge was low, whereas the attitude of nurses was positive towards oxygen therapy. Reading guidelines, older aged nurses, master holder nurses, and good practice were significant factors associated with good knowledge of oxygen therapy, and reading guidelines was statistically associated with a positive attitude toward oxygen therapy. Thus, nurses need to be aware and skillful regarding the updated oxygen therapy guidelines. They should improve their level of education.

1. Introduction

Oxygen therapy is the administration of oxygen at concentrations greater than those in the ambient air with the intent of treating or preventing hypoxia. Oxygen therapy is very useful in managing acutely ill patients. Therefore, it is an essential and emergency drug for adequate resuscitation [1–3].

Oxygen is listed as a core item in the World Health Organization (WHO) model of essential medicines, which is a list of the most effective and safe drugs used in a health care system [4]. Many patients will die if

they do not receive additional oxygen treatment [5]. Patients whose blood exchange is severely impaired may require a high inspiratory oxygen concentration. Oxygen should be administered to achieve a target saturation of 94–98% for the most critically ill patients or 88–92% for those at risk of respiratory insufficiency or hypercarbia [6,7].

A high concentration of oxygen could cause changes in the lungs that cause oxygen toxicity. Oxygen should be administered by a professionally trained nurse. Nurses are the most responsible health-care providers, closely monitoring oxygen therapy and minimizing the risk of supplemental oxygen as quickly as possible [6–9].

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Knowledge and positive attitudes enable nurses to improve the quality of their patients' lives and prevent hypoxemia and acute lung injury [10,11]. The knowledge of oxygen administration by nurses is below the expected quality, according to studies. Nurses must have knowledge about indications of oxygen therapy and normal oxygen saturation at different ages, and regular training should be integrated into their work schedule [12–15]. However, based on different studies, the overall knowledge related to the administration of oxygen by nurses was below the expected quality and needed change to reach the expected level [2,16–19].

According to research studies conducted in various nations, there is an oxygen therapy knowledge and attitude gap among practicing nurses in hospitals [20,21]. Studies stated nurses did not have sufficient knowledge and understanding of oxygen therapy and that there was a need to update the knowledge and other practical abilities of staff nurses through training and workshops [22–24].

Many studies claim that workers in underdeveloped countries are undertrained in caring for critically ill patients, resulting in a lack of awareness of critical care principles and a barrier to providing high-quality care [10,25]. The mortality rate in patients who received OT, was higher than those who did not receive OT mainly related to inappropriate use of oxygen [26–29].

Critical care nurses must be well-versed in the administration of oxygen to critically ill patients as well as have a positive attitude [30]. As a result, the purpose of this study is to assess nurses' knowledge and attitudes toward oxygen therapy for critically ill patients, as well as the factors that influence oxygen therapy.

2. Materials and methods

2.1. Study area, design and period

An institution-based cross-sectional study was conducted from May 23 to June 07, 2021, at the University of Gondar Comprehensive Specialized Hospital. This hospital is located in Gondar City, Northwest Ethiopia. It is far away, at 738 km from Addis Ababa and 180 km from Bahirdar, which are the capital cities of Ethiopia and Amhara regional state, respectively. This hospital provides a wide range of clinical services for around 7 million people in its catchment area. A statistics report in 2019 showed that the hospital had 450 nurses working in the different medical and surgical wards who work as a rotation method every two years. The Research Registry number was stated as 8039, in accordance with the Declaration of Helsinki, 2013 [31]. This study has been reported in line with the STROCSS criteria [32].

2.2. Variables of the study

The dependent variable are the level of knowledge and attitude. Socio-demographic characteristics (degree of education, age, sex, and marital status), work experience, workload, training, availability of local guidelines, enough oxygen supply, and delivery methods are all independent variables.

2.3. Sample size determination and sampling technique

2.3.1. Sample size determination

The sample size was calculated using a single population proportion formula. A prior study conducted in Addis Ababa [6] had a similar goal to this one. We take the proportion of 53.3% by assuming a 95% confidence interval with a 5% margin of error, and finally, the sample size for the study is calculated as: $n = \frac{(z \alpha/2)^2 pq}{e^2}$ Where;

n = is the desired sample size; z = is the standard normal distribution, usually set as 1.96 (corresponds to 95% confidence level); p =

population proportion (53.3%, 0.533), and q , which is $1 - 0.533 = 0.467$.

d = the degree of accuracy desired (marginal error is 5% (0.05)); then the sample size was

$$n = \frac{(1.96)^2 \times (0.533 \times 0.467)}{(0.05)^2} = 382.486 \approx 383, \text{ we add a non-response rate of}$$

10%, which was $38.3 \approx 39$, so that our sample size was 422, which was nearly equal to the total number of nurses, so we took all nurses as a sample size.

2.3.2. Sampling technique

A cross-sectional survey of an institution was carried out based on inclusion and exclusion criteria.

Inclusion and Exclusion criteria: In this study, nurses who were readily available at the workplace were included, whereas nurses who weren't specifically engaged in patient care at the bedside, like nurse managers, were left out.

2.4. Data collection procedure

A self-administered structured and validated questionnaire was adopted from Rwanda; the questionnaire was validated by a panel of five nurses. Internal consistency among the questionnaire items was 0.90 Cronbach's alpha (α) and it was considered within the acceptable range [33]. It has socio-demographic characteristics, multiple-choice questions, items that measure the possible associated factors and items that were used to assess the level of knowledge and attitude. A small meeting with unit managers was organized to clarify the idea and procedures of the study and obtain their consent to carry it out. A brief preamble to the participants has been organized to obtain the consent forms provided by the researcher to eligible participants at work. The data collector allowed nurses sufficient time to read the consent form and if any ask questions.

2.5. Data quality management

The lead investigator offered training to the data collectors. Throughout the study period, the primary investigator kept a careful eye on the data collectors. Participants in the study were given enough information about the assessment tool. On the day of data collection, the primary investigator reviewed the obtained data for completeness, accuracy, and clarity before entering it into the database.

2.6. Processing and analysis of data

For this study, Epi data ("The EpiData Association" Odense, Denmark) version 4.6 was used to enter data into the computer, which was then transferred to the Statistical Package for Social Sciences (IBM) version 20 for analysis. Descriptive and inferential statistics were analyzed and presented. Initially, bivariate logistic regression was carried out to see the association of each independent variable with the study variable. Thereafter, to see the relationship between practice and associated factors, multivariable logistic regression was used. The Chi-square test was used to measure the strength of associations between variables. A p -value of < 0.05 was considered to be statistically significant.

3. Results

3.1. Socio-demographic characteristics of study participants

A total of 400 nurses took part in the survey, with a 94.8% response rate. Males made up 50.7% of the study participants. The mean age of the study participants was 32.18 ± 5.16 years, and 68.5% of them were married. Eighty-eight percent of the survey respondents have a bachelor's degree in nursing. Approximately 40% of study participants (39%)

have 4–6 years of relevant work experience (Table 1).

3.2. Knowledge of nurses on oxygen therapy

In this study, about 33% (95% CI: 28.8, 37.5) of the nurses from the study participants had good knowledge, whereas 67% (95% CI: 62.5, 71.3) of the nurses had poor knowledge of oxygen therapy (Fig. 1). The mean knowledge score of the participants was 3.03 ± 1.38 (mean \pm SD). The level of knowledge differs across different working areas. The most correctly answered questions by study participants were that SOT should be administered to treat and prevent hypoxia (82.3%), followed by SOT contraindicated for untreated pneumothorax (60.3%). The least answered question was the normal breathing rate of a child of school age (65.8%) followed by the passive process in respiratory physiology (59.5%) (Table 2).

3.3. Attitude of nurses towards oxygen therapy

Of the majority of the study participants, 53.8% (95% CI: 48.8–58.7) had a positive attitude and the rest, 46.2% (95% CI: 41.3–51.2), had a negative attitude towards oxygen therapy. The mean attitude score of the participants was 25.94. Half of the study participants (50%), (95% CI: 45–54.8) strongly agreed that oxygen is a drug that should be given only by trained staff (Table 3).

3.4. Factors associated with knowledge of nurses towards oxygen therapy

In the bivariable logistic regression analysis, age, gender, level of education, guidelines, attitude, and practices were significant. However, level of education, age, practices and guidelines were significantly associated with good knowledge. Accordingly, nurses who had master's degree (AOR: 7.73, 95% CI 2.51–23.85) in nursing were 7.73 times more likely to have good knowledge than nurses who had diplomas. Similarly, the likelihood of having good knowledge of oxygen therapy was 1.74 times higher among nurses whose age ranged from 30 to 39 (AOR: 1.74, 95% CI (1.03–2.92) as compared with the age group 20–29. The study also revealed the odds of having good knowledge of oxygen therapy were 1.89 times higher among nurses who had good practice (AOR: 1.89, 95% CI 1.17–3.03) as compared with nurses with their counterparts. Finally, nurses who read international SOT guidelines (AOR: 4.34, 95% CI 2.23–8.43) were 4.34 times more likely to have good knowledge than those who did not read international SOT guidelines (Table 4).

3.5. Factors associated with attitude of nurses towards oxygen therapy

Both bivariable and multivariable logistic regression analyses were

Table 1
Socio-demographic characteristics of nurses at University of Gondar Comprehensive Specialized Hospital, 2021, (N = 400).

Socio-demographic variables	Classification	Frequency (N)	Percent (%)
Age	20–29	158	39.5
	30–39	207	51.8
	≥ 40	35	8.8
Gender	Female	197	49.3
	Male	203	50.8
Marital status	Single	123	30.8
	Married	274	68.5
	Divorced	3	0.8
Level of education	Diploma	49	12.3
	Bachelor	323	80.8
	Masters	28	7.0
Year of experience	<1 years	7	1.8
	1–3 years	39	9.8
	4–6 years	156	39
	7–9 years	145	36.3
	≥ 10 years	53	13.3

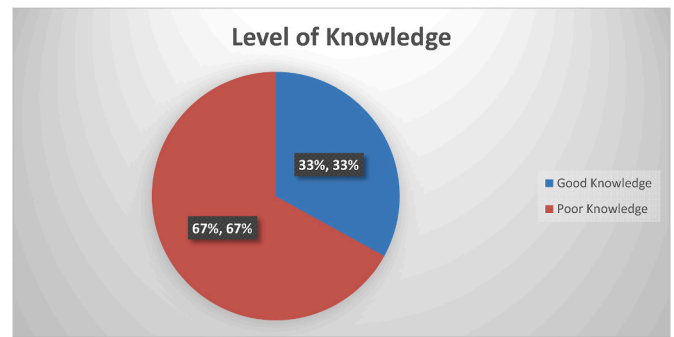


Fig. 1. Level of knowledge of nurses on oxygen therapy: University of Gondar Comprehensive Specialized Hospital, 2021; (N = 400).

Table 2
Response of nurses for questions of Knowledge towards oxygen therapy: University of Gondar Comprehensives Specialized Hospital, 2021; (N = 400).

Variables	Category	Frequency	Percent
Oxygen is administered to	Correct	329	82.3
	Incorrect	71	17.8
The normal oxygen saturation at rest for adults < 70 years is	Correct	196	49
	Incorrect	204	51
Oxygen therapy is contraindicated in:	Correct	241	60.3
	Incorrect	159	39.8
Movement of air into and out of the lungs is	Correct	146	36.5
	Incorrect	254	63.5
The passive process in respiratory physiology is	Correct	162	40.5
	Incorrect	238	59.5
The normal breathing rates in a child of school age ranges between	Correct	137	34.3
	Incorrect	263	65.8

done to see the effect of selected characteristics on the attitude of nurses towards oxygen therapy ill critical patients. Variables such as level of education, training, reading SOT guidelines, and nurses' having good knowledge had a significant association with the attitude of nurses in the bivariable analyses. However, only reading SOT guidelines was significantly associated with a positive attitude in the multivariable analysis. Accordingly, the likelihood of having a positive attitude towards oxygen therapy was 2.132 times (AOR: 2.13, 95% CI 1.23–3.71) higher among nurses who read SOT guidelines as compared with nurses who did not read SOT guidelines (Table 5).

4. Discussion

Oxygen therapy is the administration of oxygen as a medical intervention, which can be for medical as well as surgical conditions. Patients can be affected by getting too much, too low, or no oxygen, which is mainly determined by the level of knowledge and attitude of medical and health professionals towards oxygen therapy [18,34,35].

This study focused on the knowledge and attitude of nurses working on critical care patients in a teaching comprehensive specialized hospital about the oxygen therapy given to patients. In this study, results showed that the majority of nurses (67%) had poor knowledge regarding oxygen therapy. This poor knowledge of using oxygen therapy in those critical situations could deteriorate patients' conditions and outcome. This result indicates that the nurses do not receive sufficient training on oxygen therapy during their undergraduate studies or after they graduate from these programs. As a result, nurses working in this field require additional education or training on the risks of administering oxygen therapy to patients in order to improve their knowledge. Hemati et al. state that poor nurses' knowledge level could result from a shortage of nursing staff, failure to attend training courses, and a lack of up-to-date knowledge resources [36].

Another study revealed that after receiving training on the therapy,

Table 3

Responses to attitude questions by nurses, University of Gondar Comprehensive Specialized Hospital, 2021; (N = 400).

esx	Category	Frequency (N)	Percent (%)
Oxygen is a drug that should be given only when ordered by a medical officer, or a registered nurse initiated order in an emergency situation	Strongly agree	200	1
	Agree	138	4.3
	Neutral	41	10.3
	Disagree	17	34.3
	Strongly disagree	4	50
Continuous oxygen administration is more beneficial than intermittent oxygen therapy	Strongly agree	24	6
	Agree	59	14.8
	Neutral	83	20.8
	Disagree	114	28.5
	Strongly disagree	120	30
Humidification is the best practice to prevent dryness of mucus membrane of upper respiratory tract causing soreness.	Strongly agree	169	5.3
	Agree	131	19.8
	Neutral	79	32.8
	Disagree	21	42.3
	Strongly disagree	-	-
Persons with severe lung disease need to be maintained at the prescribed oxygen saturation range.	Strongly agree	100	25
	Agree	124	31
	Neutral	117	29.3
	Disagree	54	13.5
	Strongly disagree	5	1.3
The oxygen is a medicine its administration to the patient is safe and also it is very dangerous	Strongly agree	88	22
	Agree	109	27.3
	Neutral	95	33.8
	Disagree	89	22.3
	Strongly disagree	19	4.8
A patient on oxygen therapy signposts that the patient could be at the end stage of life.	Strongly agree	36	9
	Agree	79	19.8
	Neutral	85	21.3
	Disagree	120	30
	Strongly disagree	80	20
Oral and nasal hygiene and normal saline drops as necessary should be done when giving oxygen therapy in Adult critical care ill patient.	Strongly agree	166	41.5
	Agree	170	42.5
	Neutral	44	11
	Disagree	18	4.5
	Strongly disagree	2	0.5

Note, N=Number.

nurses' knowledge scores about oxygen therapy rose by almost 20% [37]. The results of our investigation were comparable to those of a study conducted in Addis Abeba, Ethiopia, which revealed that 63.8% of nurses had poor knowledge of oxygen therapy [6]. However, this was higher than research done in Beirut hospital, Lebanon (55.1%) [22] and Debretabor hospital (48%) [9]. This variation could be attributed to differences in sample size, study setting, and study period.

Nurses with a master's degree, those over 39 years old, the level of practice, and the existence of standard guidelines were all significantly linked to good knowledge, while reading standard oxygen therapy recommendations was linked to a positive attitude. This study found that education was positively related to the level of knowledge. The distribution of knowledge score was significantly better among master's degree holders nurses, according to research done by Zeleke & Kefale [9] and Lemma [6]. The other study, also done by Lewis, concluded that the level of education is very important in nurses' knowledge of oxygen therapy [38]. This study found that nurses who were working in the hospital during the study period and in the study areas had poor

Table 4

Bivariable and multivariable logistic regression analysis of factors associated with knowledge towards oxygen therapy at University of Gondar Comprehensive Specialized Hospital, 2021; (N = 400).

Variables	Category Knowledge		COR(95%CI) AOR(95%CI)
	Poor	Good	
Age	118 40	1 1	
	20-29	129 78	1.78(1.13-2.81) * 1.74(1.03-2.92)**
	30-39	21 14	1.97(0.92-4.23)* 1.80(0.71-4.58)
Gender female	141 56	127 76	1 1
	male		1.507(0.597-2.324) * 1.138(0.690-1.877)
Level of education	35 13	1 1	
	Diploma	224 99	1.19(0.60-2.35) * 1.193(0.57-2.51)
	BSc	9 20	5.98(2.18-16.46)* 7.73(2.51-23.85)**
MSc	69 72	105 38	4.458(2.522-7.881)* 4.338(2.233-8.428)
	Yes	94 22	**
	I don't know		1.546(0.854-2.801) * 1.410(0.729-2.729)
No			1 1
Attitude	135 80		1.516(0.993-2.315)* 1.271(0.791-2.040)
	Good	133 52	1 1
Poor			
Practice	112 76		1.890(1.240-2.283)* 1.885(1.173-3.030)
	Good	156 56	**
Poor			1 1

Note: *, Factors associated in bivariate analysis; **, Factors associated in multivariate analysis; 1, reference; AOR, adjusted odds ratio; COR, crude odds ratio; CI, confidence interval, %, percent.

Table 5

Bivariable and multivariable logistic regression analysis of factors associated with attitude of nurses towards oxygen therapy at University of Gondar Comprehensive Specialized Hospital, 2021; (N = 400).

Variables	Category Attitude		COR (95%CI) AOR (95%CI)
	Negative	Positive	
Education level	27 21	1	1
	Diploma	145 178	1.58(0.86-2.91)* 1.49(0.81-2.77)
	BSc	13 16	1.58(0.63-4.00) * 1.25(0.47-3.31)
MSc	22 43		1.85(1.06-3.23)* 1.70(0.95-3.05)
	Yes	163 172	1 1
	No		
Guideline	51 90		2.17(1.32-3.59)* 2.13(1.23-3.71)**
	Yes	70 73	1.28(0.79-2.19)* 1.49(0.83-2.35)
	I don't know	64 52	1 1
No			
Work load	128 134	1	1
	Yes	29 46	1.52(0.99-2.56) 1.65(0.96-2.82)
	I don't know	28 35	1.19(0.69-2.08) 1.59(0.88-2.89)
No			
Knowledge	52 80		1.52(0.99-2.32)* 1.26(0.79-2.99)
	Good	133 135	1 1
	Poor		

Note: *, Factors associated in bivariate analysis; **, Factors associated in multivariate analysis; 1, reference; CI, confidence interval; COR, crude odds ratio; AOR, adjusted odds ratio.

knowledge of oxygen therapy.

In this study, nurses whose age was >39 years old were significantly associated with good knowledge. Kord et al. clarified that nurses' age was directly and significantly correlated with the adherence rate to the standardized protocol of oxygen therapy [39]. Another study demonstrated a significant correlation between age and nurses' performance [36].

Several guidelines on oxygen therapy exist, including the WHO guidelines and the British Thoracic Society Guidelines for oxygen use in adults in healthcare and emergency settings [15,40,41]. In our study,

reading standard oxygen therapy guidelines was significantly associated with a positive attitude. The other study identified potential associated factors on attitude, such as differences in work experience, education level, and marital status [42]. However, in our study, these factors were not correlated with attitude.

More than half of nurses had a positive attitude towards oxygen therapy. Much more awareness and related updates constitute a paramount factor to professional performance success. This finding contributes to the guidelines for oxygen therapy where nurses should have an encouraging attitude towards the needs of mouth hygiene in adults and the use of humidification devices when administering oxygen therapy [43].

In terms of nurses' attitudes toward oxygen as a medication prescribed by a physician, 53.8% of those polled thought oxygen was a drug. The same other showed that the exception should be in life-threatening situations, where high-flow oxygen via a reservoir (non-rebreather) bag should be given immediately, without a prescription, but subsequent documentation should take place [8].

Participants were also asked about the availability of oxygen therapy guidelines, and 20.3% agreed and 47.3% disagreed about the availability of guidelines. Because the majority of nurses in this study demonstrated a lack of oxygen therapy guidelines, this could be the beginning of gaps in knowledge and attitude toward oxygen therapy. The guidelines address the use of oxygen in critically ill and hypoxemic adults, as well as those at risk of hypoxemia [8].

Regarding information on the availability of an adequate supply of oxygen, 18.5% of study participants agreed and 51% disagreed on the availability of an adequate supply of oxygen. But 50.8% of respondents illustrated that there was a gap between the number of oxygen cylinders and equivalent to the label written on, which is lower than research done in Rwanda stated that 64.6% had a gap between the number of oxygen cylinders and equivalent to the label noted [33].

4.1. Strengths and limitations of the study

The strengths of this study were that it had a large sample size and used a validated tool. The limitations of our study were that it was a cross-sectional design. Therefore, it did not show temporal relationships. It was also a single-centered study, which raises questions about the generalizability of our results. All study populations didn't work in the critical care area during the study period.

5. Conclusions & recommendations

The level of knowledge was low, whereas the attitude of nurses was positive towards oxygen therapy. Reading guidelines, older aged nurses, master holder nurses, and good practice were significant factors associated with good knowledge of oxygen therapy, and reading guidelines was statistically associated with a positive attitude toward oxygen therapy. Thus, nurses need to be aware and skillful regarding the updated oxygen therapy guidelines. They should improve their level of education.

Ethics approval and consent to participate

Ethical clearance to conduct the research was obtained from the ethical review committee of the School of Medicine, College of Medicine and Health Sciences. Written informed consent was obtained from each study participant after a clear explanation of what they would have to do to take part in the study.

Consent for publication

This is not applicable.

Availability of data

This published article contains all of the data generated or analyzed during this study.

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Consent

Not applicable.

Guarantor

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Authors' contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declared that they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104334>.

Acronyms and Abbreviations

GA	General Anesthesia
COR	Crude Odds Ratio
AOR	Adjusted Odds Ratio
CI	Confidence Interval
ASA	American Society of Anesthesiologists
Hr	Hour

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