



Original Article

# Assessment of knowledge and practice of oxygen therapy among doctors and nurses: A survey from Ondo State, Southwest Nigeria

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## ABSTRACT

**Objectives:** Oxygen is among the commonly used drugs in acute emergencies. Prescription and administration of oxygen in emergencies by healthcare providers are reported to be inappropriate in most settings. There is a huge gap in the knowledge of health-care providers on various aspects of oxygen therapy. The purpose of this study was to assess the knowledge and practice of oxygen therapy among doctors and nurses working in Ondo State, South-West Nigeria and see how it compares with standard practice with a view to improving the quality care in this regard.

**Materials and Methods:** A descriptive cross-sectional study was employed. The data were collected electronically using the Monkey survey application from consenting doctors and nurses through a self-administered validated and structured questionnaire. The questionnaire included the professional characteristics, educational background, awareness and use of oxygen therapy guidelines, knowledge of oxygen, indication for acute oxygen, and oxygen delivery practices. Data were analyzed using descriptive statistics and association between variables explored with Chi-square test at  $P < 0.05$ .

**Results:** One hundred and seventy-six health workers participated in the study with mean age of  $37.30 \pm 8.88$  years. One hundred and twelve (63.60%) of the respondents were doctors while 64 (36.40%) of the respondents were nurses. Sixty-eight (60.70%) of the doctors and 19 (29.70%) of nurses had a high level of knowledge of oxygen therapy ( $p < 0.001$ ). About half of both doctors and nurses had a poor practice level of oxygen therapy. The duration of oxygen administration (how long ago the respondent was involved in oxygen use and previous to formal training on oxygen therapy) were significantly associated with level of knowledge of oxygen therapy ( $p < 0.001, 0.017$ ).

**Conclusion:** Results from this study suggest that the level of knowledge was high in about half of the respondents and about the same percentage had poor oxygen therapy practice in hospitals in Ondo State, South West Nigeria. Therefore, regular training of healthcare workers should be encouraged to update their knowledge and practice of oxygen therapy.

**Keywords:** Oxygen, Doctors, Nurses, Knowledge, Practice

## INTRODUCTION

Oxygen is a component of ambient air at 21.00% concentration. It makes up about 65.00% of human body mass and essential to all tissues of the body for energy production. It is one of the

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essential drugs listed by the World Health Organization (WHO). Oxygen therapy is the administration of oxygen at concentrations greater than that in the ambient air with the intent of treating or preventing hypoxia. Oxygen therapy is very useful in managing acutely ill patient hence an essential and an emergency drug for adequate resuscitation.<sup>[1]</sup>

As a drug, it has its own toxicity hence should be used only when indicated and must be prescribed. The prescription should include; dose, duration, method of delivery, device of delivery, defined target arterial oxygen saturation range (SaO<sub>2</sub>), and monitoring process. Like other drugs order, oxygen order must be included in a treatment chart before administration.<sup>[2-4]</sup>

The administration of supplemental oxygen is an essential element for appropriate management of many clinical conditions.

The previous studies have reported varying degree of gaps in knowledge and practice among health-care professionals regarding oxygen therapy.<sup>[5-7]</sup> In a study carried out by Lemma,<sup>[7]</sup> the level of knowledge of oxygen therapy was good in only about a third of 152 nurses.

There is paucity of local studies assessing the knowledge and practice of oxygen therapy among healthcare workers in Nigeria. Given that oxygen is a key element in the treatment of acutely unwell patients and its appropriate use or otherwise can affect patients' outcome use, we set out to find out how much the doctors and nurses in our locality know and how well they practice regarding correct use of oxygen in line with globally acceptable standards.

## MATERIAL AND METHODS

It was a descriptive cross-sectional study. We used the oxygen study group questionnaire which had been previously validated among doctors and nurses.<sup>[2]</sup> It was a self-administered questionnaire. The sample size was calculated using the Leslie Kish formula for sample size determination for proportion with prevalence of 12.4% in a previously studied knowledge of oxygen indication.<sup>[1]</sup> The degree of accuracy (precision) was set at 5% (0.05) and compensating for non-response rate was set at 30%, the calculated sample size required was 136.

Data were collected electronically using the Monkey survey application from consenting doctors and nurses. We used a convenient sampling method by forwarding the link of the questionnaire to the WhatsApp and Telegram pages of doctors and nurses in Ondo State, and South West Nigeria, respectively. We sent daily reminders for 2 months.

There were 252 doctors on the WhatsApp page of doctors of which 112 of them responded giving a response rate of 44% while there were 341 nurses on the Telegram page for nurses of which 64 responded giving a response rate of 19%.

The questionnaire included the educational background, awareness and use of oxygen therapy guidelines, knowledge of oxygen therapy, indication for acute oxygen, and oxygen delivery practices (see appendix for the complete version of the questionnaire). There were 17 structured questions that assessed the knowledge of participants which include indications of acute oxygen therapy, indications for acute oxygen therapy and recognizing hypoxemia, while practice was assessed using four structured questions on oxygen delivery practices. The knowledge assessment, all questions had two wrong answers and one correct answer. The correct answer scores 1 point and the wrong answer scores 0. The total marks ranged from 0 to 17. The respondents' overall knowledge was then categorized using Bloom's cutoff point method, and classified into three levels of knowledge: High level if the score was between 80 and 100% (14–17 points); moderate level, if the score was between 60% and 79% (11–13 points), and poor level if the score was <60% (<11 points).<sup>[8]</sup> The Bloom's cutoff method was also used to categorized the overall respondents' level of practice scores into good practice, moderate practice, and poor practice. Data were analyzed using descriptive statistics for the socio-demographic characteristics, information on training, prescription and administration of oxygen therapy and knowledge and practice of oxygen therapy for the frequency and associations between the knowledge and practice of oxygen therapy among doctors and nurses' and previous exposure to formal oxygen therapy were explored with Chi-square test at  $P < 0.05$  level of significance.

Ethical approval was obtained from the Human Research and Ethics committee of the Federal Medical Centre, Owo, before commencement of the study.

## RESULTS

### Socio-demographic characteristics of participants

One hundred and seventy-six health workers participated in the study with mean age of  $37.30 \pm 8.88$  years. One hundred and ten respondents (>60%) were <40-years-old. Males were more than 50%, with male:female ratio of 1.2:1. One hundred and twelve (63.60%) of the respondents were doctors and 64 (36.40%) of the respondents were nurses. One hundred and one (57.40%) of the respondents had a decade or more years working experience on the job. Other demographic data are shown in [Table 1].

### Information on trainings and administration of oxygen therapy by the participants

[Table 2] showed the information regarding previous training exposures of the respondents on oxygen administration. More than three-quarters 139 (79.00%) of the respondents had no previous exposure to formal training on oxygen therapy.

Ninety-six (54.50%) were not aware of any guidelines on oxygen therapy and more than two-third 122 (69.30%) had never read about any oxygen therapy guidelines. Two-third 113 (64.20%) of the respondents had personally participated in oxygen therapy administration in the preceding 2 months [Table 2].

**Table 1:** Socio-demographic characteristics of participants.

Variables (n=176)	Frequency (n)	Percentage
Age (years)		
20–29	45	25.6
30–39	65	36.9
40–49	49	27.8
≥50	17	9.7
Sex		
Male	97	55.1
Female	79	44.9
Profession		
Doctor	112	63.6
Nurse	64	36.4
Post first degree qualification		
Yes	111	63.1
No	65	36.9
Years of practicing (years)		
<2	24	13.6
2–5	23	13.1
6–9	28	15.9
≥10	101	57.4
Current workplace		
Private health facility	31	17.6
Federal hospital	130	73.9
State hospital	15	8.5

MBBS: Bachelor of medicine and surgery, RN: Registered nurse

**Table 2:** Information on training, prescription, and administration of oxygen therapy by the participants.

Variables (n=176)	Frequency	Percentage
Previous exposure to formal Oxygen therapy training		
Yes	37	21.0
No	139	79.0
Awareness of Oxygen therapy guideline		
Yes	80	45.5
No	96	54.5
Ever read Oxygen therapy guideline		
Yes	54	30.7
No	122	69.3
How long ago did you administer Oxygen to patients (months)		
<1	113	64.2
1–6	26	14.8
>6	37	21.0

### Participants' knowledge on oxygen therapy

About 169 (90.00%) of the respondents knew that hypoxemia could be recognized by clinical signs and that blood gas analysis is useful for confirming hypoxemia while pulse oximetry is useful in detecting and monitoring hypoxemia. Concerning the indication for acute oxygen therapy, 174 (98.90%) of the respondents said that central cyanosis is an indication while only 57 (32.40%) agreed that asymptomatic anemia is an indication. This is shown in [Table 3].

### Level of knowledge and practice of oxygen therapy among study participants

Knowledge and practices of oxygen therapy is shown in [Table 4]. About 87 (49.50%) of the respondents had a high level of knowledge of oxygen therapy while 33 (20.00%) had good practice level of oxygen therapy.

### Relationship between socio-demographic distribution, participation in oxygen administration and knowledge of oxygen therapy

[Table 5] shows the relationship between socio-demographic distribution, oxygen administration and

**Table 3:** Participants' general knowledge on oxygen therapy.

Statements (n=176)	True n (%)	False n (%)
Oxygen is like any other medication	109 (61.9)	67 (38.1)
Hypoxemia can be recognized by clinical signs	169 (96.0)	7 (4.0)
Blood Gas Analysis is useful for confirming hypoxemia	172 (97.7)	4 (2.3)
Central cyanosis is an indication for acute oxygen therapy	174 (98.9)	2 (1.1)
Asymptomatic anemia is an indication for acute oxygen therapy	57 (32.4)	119 (67.6)
Restlessness and convulsion in children are indications for acute oxygen therapy	112 (63.6)	64 (36.4)

**Table 4:** Knowledge of oxygen therapy and oxygen administration practices among professionals using bloom's original cutoff points.

Variables	Frequency	Percentage
Level of knowledge		
High	87	49.5
Moderate	74	42.0
Low	15	8.5
Best practice level		
Good	33	18.8
Moderate	58	33.0
Poor	85	48.2

knowledge of oxygen therapy. Sex had no significant association with the level of knowledge of oxygen therapy ( $P = 0.084$ ), but profession (where a doctor or a nurse) had significant association with level of knowledge of oxygen therapy ( $p < 0.001$ ). The time interval of last patient oxygen administration participation was significantly associated with level of knowledge of oxygen therapy ( $p < 0.001$ ). Participants' past trainings on oxygen therapy were significantly associated with level of knowledge of oxygen therapy.

#### Relationship between participants' training exposures and oxygen administration practices

[Table 6] shows the relationship between participants' training on oxygen therapy and oxygen administration practices. Knowledge of the participants on oxygen therapy was significantly associated with practice of oxygen administration ( $P = 0.004$ ).

## DISCUSSION

This study focused on assessing the knowledge and practice of oxygen therapy among doctors and nurses in hospitals in Ondo State, South West Nigeria.

Formal training of healthcare workers on oxygen therapy was poor as 79% of our respondents had not received additional training on administration of oxygen therapy. This is an important gap as lack of training and education of medical and nursing staff have been identified as a factor that affects the effective administration of oxygen therapy adversely, resulting in poor patient outcomes.<sup>[9]</sup> In a survey of clinicians working in resource-limited countries, it was reported that 63% of clinicians practicing in Africa, Asia, and South America do not use oxygen supplementation appropriately due to lack of training.<sup>[10]</sup> Similarly, lack of training on oxygen therapy was also identified as a limitation to the provision of safe and effective oxygen therapy to children in Nigerian hospitals<sup>[11]</sup>

**Table 5:** Relationship between oxygen administration and knowledge of oxygen therapy.

Variables	Level of knowledge of participants			Chi-square	P value
	High level of knowledge n (%)	Moderate level of knowledge n (%)	Poor level of knowledge n (%)		
Profession					
Doctor	68 (60.7)	41 (36.6)	3 (2.7)	22.441	<0.001
Nurse	19 (29.7)	33 (51.6)	12 (18.8)		
How long ago did you administer oxygen to patients (months)					
<1	57 (50.4)	45 (40.9)	9 (8.2)	21.037	<0.001
1-6	21 (80.8)	4 (15.4)	1 (3.8)		
>6	9 (24.3)	25 (67.6)	3 (8.1)		
Previous exposure to formal Oxygen therapy					
Yes	26 (70.3)	9 (24.3)	2 (5.4)	8.149	0.017
No	61 (43.9)	65 (46.8)	13 (9.4)		

**Table 6:** Relationship between participants' training on oxygen therapy and Oxygen administration practices.

Variables	Oxygen administration best practices of participants			Chi-square	P value
	Good practice n (%)	Moderate practice n (%)	Bad practice n (%)		
Previous exposure to formal Oxygen therapy					
Yes	11 (29.7)	8 (21.6)	18 (48.6)	4.839	0.089
No	22 (15.8)	50 (36.0)	67 (48.2)		
Ever read Oxygen therapy guidelines					
Yes	11 (20.4)	24 (44.4)	19 (35.2)	6.002	0.050
No	22 (18.0)	34 (27.9)	66 (54.1)		
Knowledge of participants on Oxygen therapy					
High level of knowledge	24 (27.6)	32 (36.8)	31 (35.6)	15.259	0.004
Moderate level of knowledge	9 (12.2)	22 (29.7)	43 (58.1)		
Low level of knowledge	0 (0.0)	4 (20.7)	11 (73.3)		

while 86.00% of nurses identified lack of training as a barrier to safe administration of oxygen in a study from Egypt.<sup>[5]</sup> The implication is that until appropriately planned training and retraining activities on oxygen therapy are enshrined into schedules of healthcare workers, better health outcomes are not expected in patients requiring oxygen therapy.

Several guidelines<sup>[12,13]</sup> on oxygen therapy exist including the WHO guidelines and the British Thoracic Society Guideline for oxygen use in adults in healthcare and emergency settings.<sup>[14]</sup> Regarding awareness and use of oxygen therapy guidelines, about half of our study participants were totally oblivious of oxygen therapy guidelines which was better than the result of the Nepal survey where 81.0% of resident doctors were not aware of the WHO or any other guideline on oxygen therapy.<sup>[6]</sup> This means that very few healthcare workers had ever read any guideline on oxygen therapy. This becomes very pertinent as it is unlikely that one will follow a guideline without knowing it even exists. That further fuels in itself, sub-standard practice with regard to oxygen therapy.

As shown in our study, the knowledge of the respondents on oxygen therapy is significantly related with their practices of oxygen administration; implying that those with good knowledge do better in the area of practice. This findings was similar to what was reported by Piryani *et al.*<sup>[6]</sup> of good knowledge by the respondents. Oxygen is a medication which should be used only for specific indications.<sup>[5,6]</sup> This is an important background knowledge which influences how a health-care think of and use oxygen. Ideally, oxygen should be accorded same care with which other regular medications are administered. This implies that attention should be given to the correct dose, duration, and route of administration to get the maximum benefits from its use.

Pulse oximetry is a non-invasive, painless, and reliable method for measuring arterial oxygen saturation and it is important as a point of care access hence very useful in emergency conditions; however, it has clinical variations in practice. The respondents in our study had better knowledge on pulse oximetry as a useful tool in detecting hypoxemia and monitoring adequacy of oxygen administration when compared to the study done by Orimadegun *et al.*<sup>[15]</sup> This is quite important as pulse oximeter helps to determine when oxygen use is needed and also helps to aim for appropriate target during oxygen administration. That a greater percentage of our respondents are aware of its use is quite reassuring whether this is actually been used is another thing to consider. The increase in the knowledge of use of pulse oximetry in our study could be explained by the time difference of 11 years in the study and possibly gradual improvement in the equipping of hospitals in Nigeria.

Recognition of hypoxemia is one of the requirements for provision of safe and effective oxygen therapy to sick children and adults.<sup>[16]</sup> Oxygen which can be lifesaving is

associated with deleterious side effect, especially if the right concentration is not administered and properly monitored, hence the need for blood gas analysis. It should be prescribed to achieve a target saturation of 94–98% for most acutely ill patients or 88–92% for those at risk of hypercapnic respiratory failure.<sup>[7]</sup> Nearly two-third of our respondents had good knowledge of hypoxemia; its clinical signs and the use of blood gas analysis. This is higher compared to the study done by Piryani *et al.*<sup>[6]</sup> in which only 44.4% agreed that oxygen prescription should be to a target saturation range rather than a fixed dose. The observed difference in the two studies could be explained by the different cadre of healthcare workers as most respondents in this study were from the tertiary institution.

The need for proper documentation of oxygen flow rate, source, delivery device, and frequency was emphasized in a study done by Desalu *et al.* in Ilorin.<sup>[17]</sup> This reduces the risk of oxygen toxicity and hypercapnic respiratory failure. In a study from Australia, appropriate oxygen delivery was said to improve as prescription rates increased and the number of patients at risk of Type II respiratory failure with saturation levels above 92% decreased from 47% at initial audit to 18% following a multicomponent intervention which included implementation of a local hospital oxygen policy, introduction of a specific oxygen prescription chart and targeted staff education.<sup>[18]</sup> It is, therefore, good to note that a substantial number of the respondents in our study had good knowledge that oxygen flow rate, source, delivery device, and frequency should be documented in the treatment chart of patients.

Result from our study showed that the respondents had slightly higher level of knowledge of oxygen therapy when compared to the result from Lemma's study in Ethiopia where 36.2% of nurses studied had moderate knowledge.<sup>[7]</sup> Overall, only about a third (33.0%) of our respondents had good practice level of oxygen therapy, which was lower than 43.4% reported in Ethiopia.<sup>[7]</sup> This is quite an important finding as a larger percentage of the respondents were from tertiary centers where standard of care is expected to be high suggesting that quality of oxygen therapy might be lower in other secondary and primary care centers. The implication of this is the likelihood of potentially harmful oxygen practices that may adversely affect patients' outcome if appropriate interventions are not applied.

## CONCLUSION

We concluded that there is gap in knowledge and practice of oxygen therapy among nurses and doctors. Hence, extensive educational and training programs about oxygen therapy are needed to raise awareness among health-care professionals. Furthermore, regular practical training sessions should be organized for health workers to update their knowledge on the latest guidelines on oxygen therapy. Regular clinical audit of oxygen therapy by nurses and doctors in the various units

in the hospital should be carried out with the aim to review the indications, dose, and eventual outcome of patients that had oxygen therapy.

Publications on prescription, dose, duration, method of delivery, and device of delivery of oxygen should be readily available in wards of various units in the hospital to serve as a reminder for healthcare worker when administering oxygen.

The limitation of this study included the low response rate from nurses which mostly occurred because the study was conducted only by doctors. This study was also not stratified according to specialties which may have helped to further characterize difference in knowledge and practice. This was because, the aim of this study was to highlight important aspect of clinical practice on an area, we considered basic and common to all medical practitioners regardless of specialty. We hope to explore this area in future studies. In spite of these limitations, the study provided an important insight into the gaps in the area of oxygen therapy among the most relevant healthcare workers involved in patient care.

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#### Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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#### Conflicts of interest

There are no conflicts of interest.

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