Knowledge, attitude, and practice of physicians and nurses working in Addis Ababa on oxygen therapy

Mohammed Kalifa¹*, Menbeu Sultan¹, Yemane G/Medhin¹

ABSTRACT

Background: Oxygen is a commonly used drug in the clinical setting and like other drugs its use must be considered carefully. It is administered daily to a wide number of patients in the emergency care setting. But the knowledge and skill of health care providers is not well known.

Objective: The study sought to gain full understanding on physicians and nurses’ knowledge, attitude and practice on clinical administration of oxygen and factors associated with it.

Methodology: A cross-sectional descriptive study design was used. The target population was all physicians and nurses working in the emergency department during the study period. Data was collected using structured questioners that measured physicians and nurses’ knowledge, attitude and practice about oxygen therapy including associated factors.

Results: This study proved that overall mean and standard deviation of knowledge and practice of physicians on oxygen therapy are satisfactory with respective result of 72 and 7, and 71 and 20 while their attitude on oxygen therapy is unsatisfactory, 49 and 23. Among nurses all variables were unsatisfactory with respective mean value of knowledge, attitude and practice of 35, 32 and 46.

Conclusion: This study concluded that, majority of the studied sample of physicians had satisfactory level of knowledge and practice, but unsatisfactory level of attitude towards oxygen therapy. The majority of studied sample of nurses had unsatisfactory level of knowledge, attitude and practice regarding oxygen therapy. Lack of proper training, absence of guide lines on oxygen therapy, inadequate supply and delivery system of oxygen in the ER, heavy workload, and incomplete written prescription for oxygen therapy were the contributing factors.

Recommendations: Physician and nursing staff should have continuous training courses, workshops, and educational programs to ensure appropriate practice of oxygen therapy. In addition, oxygen therapy protocol should be implemented, making sure that physicians write prescription for oxygen properly and adequate supply of oxygen.

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1. Introduction

Oxygen therapy is the first-line treatment in many critical conditions. Patients must receive this therapy in an appropriate, safe, and comfortable way. (1) Maintenance of adequate oxygen delivery to vital organs often requires the administration of oxygen, sometimes at high concentrations. Despite its importance in virtually all types of acute severe illness, hypoxemia is often not well recognized or managed in settings where resources are limited. According to the WHO report 2017, Oxygen treatment remains an inaccessible luxury for a large proportion of severely ill patients admitted to hospitals in developing countries. This is particularly true for patients in rural hospitals where, even if some facility for delivering oxygen is available, supplies are often unreliable and the benefits of treatment may be diminished by poorly maintained equipment, lack of appropriate supplies, poorly trained staff, or inadequate guidelines.

Although there is an increase in the production of oxygen in Ethiopia, the long distance between oxygen production plants and locations of hospitals remains a problem for hospitals and ultimately health care providers and patients. This will have an impact on Ethiopia’s effort to expand ICU care and treat emergency conditions timely. It has been reported that there was a severe shortage of oxygen during previous COVID-19 surges.

Oxygen therapy like any drug has toxic effects on the human body and exposure to higher concentrations of oxygen can lead to life-threatening health problems. The most common serious health problem that can result from high oxygen concentration is “oxygen toxicity”, also called oxygen poisoning or oxygen intoxication. This results when a person inhales a high concentration of oxygen during therapy. (16)

Oxygen therapy is an essential component of resuscitation, acute medical care, basic life support, anesthesia, and post-operative care. However, oxygen therapy is often done by health team members without special attention and sufficient knowledge or practice. (5)

Objectives of the study: To assess knowledge, attitude, and appropriate use of oxygen therapy and associated factors among healthcare professionals working in Addis Ababa hospitals.

2. Methods

Study design and period

A descriptive cross-sectional study was conducted to assess the knowledge, attitude, and practice of physicians and nurses working in the Emergency departments of Addis Ababa hospitals. The study was conducted for one month starting from December 1, 2019, to January 1, 2020.

Study area

This study was conducted in the emergency room of Saint Paul’s Hospital Millennium Medical College, AaBET Hospital, St. Peter Hospital, and ALERT Hospital all of which are found in Addis Ababa.

Study population

The study included all physicians and nurses working in the ER of respective hospitals during the study period.

Data collection

Structured questionnaires were prepared and data collectors were trained from each study area on the questionnaires. The questionnaires were prepared in English language and developed to meet the specific objectives of the study. A pre-test was done before the actual data collection to measure the standard of the structured
questionnaire. The role of the supervisor was to ensure data completeness, consistency, and clarity during data collection.

**Operational definition**

A score equal to or above 70% was considered satisfactory or good in the areas of Knowledge, Attitude, and Practice. On the contrary score of less than 70% was considered unsatisfactory in all three areas.

**Data analysis**

Statistical analysis was done using computer software, the Statistical Package for Social Sciences (SPSS) version (20). Descriptive statistics were applied (Mean, Standard Deviation, Frequency, and Percentages). The level of physicians' knowledge regarding oxygen therapy was assessed with eight different items of questionnaires. The results were computed out of 100% and a score of \( \geq 70\% \) was considered satisfactory knowledge and a result of \(< 70\% \) was considered unsatisfactory or poor for each item of the knowledge questionnaire.

**Ethical Consideration**

Before starting our data collection, we got IRB approval from Saint Paul's Hospital Millennium Medical College department of EMCC and IRB of SPHMMC. In addition, we got individual consent from the respondents after the explanation and a request was forwarded to all respondents to voluntarily respond to the questionnaires. We also omitted the name of the respondents to ensure the confidentiality of the data obtained.

**3. Results**

A total of 160 healthcare professionals were assessed. Most physician participants were trainees (residents or interns) or GPs. And the majority of nurses had <12 months of experience. The majority of studied participants were male accounting for about 74%. Most of the participants were in the age range of 20-30 years of age, accounting for 62% and 31-40 years of age accounted for 37%. Most of the participants were nurses, 60%. Nurses from four different Hospitals were involved. Please refer to Table 1 below for details.

**Table 1: Demographic Characteristic of the participated physicians and nurses**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>118</td>
<td>74</td>
</tr>
<tr>
<td>Female</td>
<td>42</td>
<td>26</td>
</tr>
<tr>
<td><strong>Age in years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>99</td>
<td>62</td>
</tr>
<tr>
<td>31-40</td>
<td>59</td>
<td>37</td>
</tr>
<tr>
<td>41-50</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>( \geq 50)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultant</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Resident</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>GP</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>Intern</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Nurse</td>
<td>97</td>
<td>60</td>
</tr>
<tr>
<td><strong>ED Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \leq 6) months</td>
<td>52</td>
<td>38</td>
</tr>
<tr>
<td>7-12 months</td>
<td>28</td>
<td>18</td>
</tr>
</tbody>
</table>
Health professional level of knowledge on oxygen therapy

On knowledge assessment questions focusing on an indication of oxygen therapy, contraindications to oxygen therapy, the definition of hypoxia, and the use of pulse oximetry, participant physicians had satisfactory knowledge with respective scores of 76%, 83%, 79%, and 79% (Table 2). Seventy-eight percent of nurses demonstrated satisfactory knowledge on the indications of oxygen therapy. The studied nurses had unsatisfactory knowledge of most parameters with the lowest value on questions regarding the definition of hypoxia, normal ABG values, the use of pulse oximetry, and potential adverse effects of oxygen therapy with respective results of 33%, 10%, 5%, and 0.2% respectively.

**Table 2: Overall physicians KAP assessment on oxygen therapy**

<table>
<thead>
<tr>
<th></th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician</td>
<td>Mean</td>
<td>72</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Nurses</td>
<td>Mean</td>
<td>35</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>23</td>
<td>18</td>
</tr>
</tbody>
</table>

Attitude towards Oxygen Therapy

Concerning questions on attitude towards oxygen therapy, 73%, 70%, and 71% of physicians had a satisfactory or good attitude towards the concept that oxygen is a drug that should be given only when prescribed by physicians, in addition oral and nasal hygiene should be maintained during oxygen therapy, and that humidification is the best practice to prevent dryness of mucous membrane of the upper respiratory tract to prevent soreness. Only 27% prescribe oxygen properly for patients who meet clinical criteria. Among nurses, 56%, 29%, and 3% of nurses believed that oxygen is a drug that should be given only when prescribed by physicians, oral and nasal hygiene should be done during oxygen therapy, and continuous oxygen administration is not more beneficial than intermittent oxygen administration.

The practice of oxygen therapy

Physicians’ response rate on the practice of documentation, pulse oximetry monitoring, and COPD management is 95, 83, and 86 respectively. While in the nurses' group most practical values are unsatisfactory, the lowest value being on oxygen administrative devices and ordering of oxygen therapy. Please refer to table 3 below for the detail of the professionals' practice level.

Overall assessment of knowledge attitude and practice

The mean and standard deviation of knowledge and practice of physicians on oxygen therapy were satisfactory with a mean and standard deviation of 72&7 and 71&20 while attitude on oxygen therapy was unsatisfactory with mean and SD of 49&23. Among nurses all variables were unsatisfactory. (Table 3)
Table 3: Factor affecting O2 Therapy in Addis Ababa

<table>
<thead>
<tr>
<th></th>
<th>Doctors</th>
<th></th>
<th>Nurses</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>UK</td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Are you trained on oxygen</td>
<td>17</td>
<td>27</td>
<td>46</td>
<td>63</td>
<td>-</td>
<td>57</td>
<td>59</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>therapy/administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a guideline of oxygen</td>
<td>8</td>
<td>13</td>
<td>29</td>
<td>46</td>
<td>26</td>
<td>41</td>
<td>38</td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td>therapy in the currently working emergency department?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you know that using too little oxygen in emergency room may contribute to carbon dioxide retention?</td>
<td>30</td>
<td>48</td>
<td>11</td>
<td>18</td>
<td>22</td>
<td>35</td>
<td>39</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>Is there adequate supply of oxygen and delivery systems in emergency department?</td>
<td>33</td>
<td>52</td>
<td>23</td>
<td>37</td>
<td>4</td>
<td>5</td>
<td>54</td>
<td>56</td>
<td>40</td>
</tr>
<tr>
<td>Do you think work load/burden affects oxygen therapy in emergency department?</td>
<td>53</td>
<td>84</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>5</td>
<td>63</td>
<td>65</td>
<td>18</td>
</tr>
<tr>
<td>Do those your patients administered oxygen paid/charged for the procedure?</td>
<td>9</td>
<td>14</td>
<td>54</td>
<td>86</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>26</td>
<td>72</td>
</tr>
<tr>
<td>Do you get the amount of oxygen cylinders equivalent to the label written?</td>
<td>17</td>
<td>27</td>
<td>46</td>
<td>63</td>
<td>-</td>
<td>-</td>
<td>33</td>
<td>34</td>
<td>64</td>
</tr>
</tbody>
</table>

UK: Unknown

Factors affecting Oxygen Therapy

Only 27% of physicians in the study had proper training on oxygen therapy. Forty-six percent of them stated that there are no guidelines on oxygen therapy in the emergency department (ED) where they are working, and 41% of them did not know if guideline on oxygen therapy is present or not. On top of the factors mentioned above, 52% answered that there is no adequate supply and delivery system of oxygen in the ED, and 84% said heavy workload affected them not to practice or provide oxygen therapy properly.

Among nurses, 59% had proper training on oxygen therapy, 41% stated that there are no guidelines on oxygen therapy in the ER where they are working, and 20% of them didn’t know if guideline on oxygen therapy is present or not. On top of the factors mentioned above, 41% answered that there is no adequate supply and delivery system of oxygen in the ED, and 63% said heavy workload affected them not to practice or provide oxygen therapy properly.

4. Discussion

In this study 160 participants from four different public hospitals in Addis Ababa, Ethiopia completed and returned the questionnaire. The findings in our study revealed that physicians had satisfactory knowledge on the indication of oxygen therapy 48(76%), contraindication of oxygen therapy 52(83%), definition of hypoxia 50(79%), and use of pulse oximetry 50(79%). But, showed poor or unsatisfactory knowledge of what normal oxygen saturation means 42(67%), conditions when oxygen therapy should not be administered 42(67%), what the normal level of ABG values are 40(64%), and potential adverse
effects of oxygen 41(65%). The knowledge of nurses towards indications for oxygen therapy was satisfactory 76(78%), but poor to the other knowledge questions (<70%).

Our findings are different from a study done in Tehran-Iran in 2017 by Goharani et al. showed poor knowledge towards reasons for oxygen therapy at 27.9% by both participants than our study, and a good knowledge by physicians on the necessity of blood gas analysis at 77.2%, but poor for nurses 66.9%. (5) This might be attributed to the differences in training and availability of guidelines, oxygen delivery, and monitoring devices.

With regard to the attitude of physicians on oxygen therapy, this study showed satisfactory or good attitude on items that states oxygen prescription 44(70%), Oral and nasal hygiene during oxygen therapy, and need for humidification 45(71%). Both physicians and nurses answered correctly on factors that affect pulse oximetry monitoring or reading, best practices on pulse oximetry, measures to be taken to prevent side effects associated with dry gas administration and to promote patient comfort, the effect of collection water in the tubing and things to do to remove during oxygen administration, when to use and not to use nasal cannula, what non-rebreather face mask is and its use, the importance of the use of venturi system and simple face mask, the concern of oxygen therapy in a patient with COPD and things that have to be documented for a patient on oxygen therapy.

Oxygen therapy is one of the most critical considerations in the management of diseases crossing different medical and surgical specialties. But this is one subject that remains poorly understood and inadequately practiced. Invariably, enormous errors are committed in the use of oxygen. Oxygen prescription often comprises of a single written or frequently is administered merely on verbal orders. (10 & 13) It is essential to provide optimal oxygen therapy to patients who need it. For most patients, the major risk is giving insufficient oxygen therapy which can lead to cardiac arrhythmias, tissue damage, renal damage, and eventually cerebral damage. (17)

Generally, this study revealed that the overall knowledge, attitude, and practice of nurses towards oxygen therapy were more unsatisfactory than their physician counterparts. Different from a study done in Tehran-Iran in 2017 by Goharani et al., which showed familiarity among nurses and physicians with some aspects of O2 therapy such as its indications, necessary measurements and monitoring during therapy, and identifying delivery devices was fair to weak. (5) Differences might be attributed to their level of training and duration of practice to oxygen therapy.

In our study, both physicians and nurses reported that some barriers could have affected their knowledge, attitude, and practice of oxygen therapy such as lack of proper training on oxygen therapy, absence of guidelines on oxygen therapy in the ER where they are working, absence of adequate supply and delivery system of oxygen in the ER, heavy workload and absence of the number of oxygen cylinders equivalent to the label written. These barriers were similarly reported in a previous study done on nurses working at the emergency department of Addis Ababa-Ethiopia public hospitals. (9) In a study done in Addis Ababa, Ethiopia, emergency department nurses determined possible associated factors for knowledge, attitude, and practices (KAP gaps included lack of proper oxygen therapy training, guidelines, workload, and inadequate supplies of oxygen delivery
A study done in Ghana by Adipa et al. also reported knowledge and information gap, lack of protocol, availability, and cost of delivery devices, and oxygen supply systems as barriers to oxygen therapy. We recommend that more focus should be given to oxygen delivery trainings as basic courses for both physicians and nurses. Guidelines on oxygen therapy should also be developed and distributed to hospitals' emergency departments. Constant and periodic performance evaluation methods should be applied. Evaluating and monitoring the availability of oxygen and its delivery devices should also be considered an important step to improving knowledge, attitude, and practice of oxygen therapy. Therefore, more emphasis on further theoretical and practical training courses on this topic sounds critical. The small number of consultant physicians who participated in this study was regarded as a limitation.

Limitations

The assessment was performed using non-standardized questions for testing. However, the best evidence was used as possible to make it evidence-based.

The generalizability of the study in other settings is limited due to differences in resources and training.

Participants were busy since they had clinical responsibilities and there was also a threat of Covid-19.

The number of senior physicians who participated in this study was very few. Limited knowledge of SPSS use, delayed data analysis, and interpretation.

5. Conclusions

This study concluded that a majority of the studied sample of physicians had a satisfactory level of knowledge and practice, but an unsatisfactory level of attitude towards oxygen therapy. The majority of the studied sample had an unsatisfactory level of knowledge, attitude, and practice regarding oxygen therapy. In relation to the barriers that might affect the safe administration of oxygen therapy; the entire studied sample reported that lack of proper training on oxygen therapy, absence of guidelines on oxygen therapy in the ER where they are working, absence of adequate supply and delivery system of oxygen in the ER, heavy workload, absence of the number of oxygen cylinders equivalent to the label, and incomplete written prescription for oxygen therapy, which are the most serious barriers facing them.

6. Recommendation

Depending on this study, it is recommended that physicians and nursing staff should have continuous training courses, workshops, and educational programs to ensure the appropriate practice of oxygen therapy. In addition, oxygen therapy protocol should be implemented, making sure that physicians prescribe oxygen properly in the order sheet and the hospital authority should establish an adequate supply of oxygen to guarantee that nurses are administering oxygen therapy safely.

Abbreviations

AaBET: Addis Ababa Burn Emergency and Trauma Hospital
ABG: Arterial Blood Gas
ALERT: All African Leprosy Rehabilitation and Training Center
COPD: Chronic Obstructive Pulmonary Disease
SPHMMC: St. Paul Hospital Millennium Medical College
Author Contributions
All authors made substantial contributions to the conception, COPD design, acquisition of data, analysis, interpretation of data, drafting of the manuscript, and critical review of the draft manuscripts. All authors read and approved the final draft of the manuscript.

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Conflict of Interest
The authors declare that they have no competing interests

Data Availability
Datasets used or analyzed during the current study are available without restriction at the request of the corresponding author.

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