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Oxygen Therapy: A Study To Assess The Compliance Of Staff Nurses On Oxygen Administration Among Patients Admitted In Emergency Department Of Apollo Main Hospital, Chennai.

Ms. Jebapackiam Devathangam, Dr. Dhavapalani Alagappan,
Ms. Juliet Joji Varghese
(Clinical Lead Nurse Specialist, Apollo Main Hospital, Chennai)
(Consultant And Head - Emergency, Apollo Main Hospital, Chennai)
(Director Of Nursing, Apollo Main Hospital, Chennai)

Abstract:
Background*: Oxygen is a critical medical intervention in emergency clinical settings, especially for patients experiencing respiratory distress, hypoxia, or other conditions that compromise oxygenation. When used appropriately, oxygen therapy can be life-saving by enhancing tissue oxygenation and preventing organ damage. However, improper use may result in significant adverse effects, which are often underrecognized in clinical practice. The knowledge and practice of staff nurses regarding acute oxygen therapy are vital for ensuring patient safety and improving clinical outcomes. As frontline healthcare providers, nurses must understand both the benefits of appropriate oxygen use and the risks associated with its inappropriate administration, such as over-oxygenation.*
Materials and Methods*: It was a descriptive cross-sectional study of 55 staff nurses who cared for those who received supplemental oxygen among acutely ill medical admissions in ER. The staff nurses practice on administration of oxygen therapy was observed and the medication charts of patients on oxygen were audited.*
Results*: Of the fifty-five staff nurses on oxygen administration only 32 (58%) had an actual prescription for oxygen written. The target saturation was not specified in 8 (25%) cases. In 41 (75%) cases, staff followed SPO_2 documentation periodically within TAT. 26(47%) cases used nasal cannula and 2 (4%) cases requested for Blood gas analysis. In 16 (29%) cases oxygen device changed and 9 (56%) cases were documented about the oxygen device changed. In 26(47%) cases were weaned off from oxygen therapy and out of which 15(58%) cases were documented about the wean off details in the medical chart. The adherence of the staff nurses practice on the work instruction of oxygen administration is 90%. 83% compliance before oxygen administration, 100% compliance during oxygen administration and 86% compliance after oxygen administration.*
Conclusion: *The study conducted on oxygen administration practice with appropriate documentation was sub-optimal. The findings indicate a pressing need for enhanced education and training regarding acute oxygen therapy among nursing and medical staff.*
Key Word*: Oxygen administration, Oxygen Devices, Flow rate, Target saturation, Emergency Room (ER), Staff nurses, Compliance*

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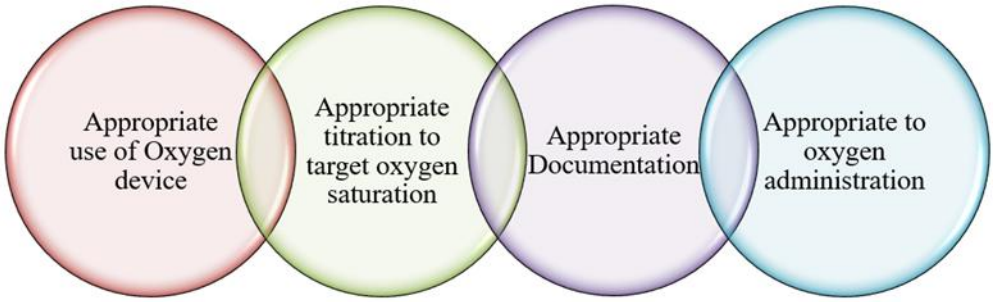
I. Introduction

Oxygen must be considered as a drug and as such should be prescribed. The appropriateness of Oxygen administration ensures that sufficient oxygen is provided at tissue level to meet metabolic demand of the patients. However, in some cases, such as life-threatening situations, oxygen can be given and adjusted before an individual prescription has been written. Patients not achieving the target saturation level or experiencing a rapid decline in saturation levels must be reviewed, so that possible causes of deterioration can be identified and appropriate investigations and treatments commenced. This could include an increase or decrease in the percentage of oxygen to be delivered and associated flow rates, which must be documented by qualified staff who have undertaken appropriate training in titrating the amount of oxygen delivered according to the patient's oxygen saturation levels.

Definite treatment guidelines have been laid down by the British Thoracic Society (BTS), 2008 which recommends the use of O_2 as a drug in that it had to be specifically prescribed and continuously monitored [1]. The BTS guide on oxygen therapy advises that oxygen can be provided without a written script when needed in an emergency situation [2] . The clinicians are, however, expected to follow this up with a written record. It also recommends that appropriate devices and flow rates are used in order to achieve the target saturation range and that those involved with oxygen administration are trained in the use of available oxygen delivery devices to ensure safe oxygen delivery [3]. It recommends oxygen delivery to achieve target oxygen saturation range between 94% and 98% for medically unwell adult patients, and 88% to 92% in patients at risk of hypercapnic respiratory failure. Quite often it is noticed that there is no prescription over the delivery of oxygen, there is no appropriate use of oxygen device and there is no titration happening on the target oxygen saturation. Our aim is to improve the compliance of oxygen administration to patients admitted in the Emergency department. The identification of compliance factors such as



1. Documentation of physician order for Oxygen administration and patient's oxygen saturation level
2. Use of Oxygen device
3. Titration to target oxygen saturation prescribed
4. Oxygen administration by staff nurses

The above factors will improve the oxygen administration practice in the Emergency department.

Problem Statement:

A study to assess the compliance of staff nurses on oxygen administration among patients admitted in emergency unit of Apollo Main Hospital Chennai.

Objectives:

- To assess the compliance of the staff nurses on oxygen administration
- To standardize a work instruction on oxygen administration

Aim:

The aim of this study is to assess the compliance of oxygen administration practiced by the staff nurses on patients admitted in Emergency Unit.

Defining the Variables:

- **Compliance:** It refers to the extent to which the oxygen administration is performed by the staff nurses based on the observation checklist. It is determined by the following scores:
  - Full -compliance= 75.1%-100%
  - Partial compliance = 50.1%-75%
  - Non-Compliance= 0%-50%
- **Oxygen Administration:** Oxygen administration refers to the process by which supplemented oxygen is administered in high concentration than that of atmospheric air.
- **Assess:** It refers to statistical analysis of practice scores of staff nurses on oxygen administration through observational checklist.
- **Staff Nurses:** Staff Nurses who takes care of the patients/comes in contact with the patients who are admitted in the emergency unit.

II. Material And Methods

This descriptive cross-sectional study was carried out on staff nurses of Emergency Department at Apollo Main hospital, Chennai from November 2023 to February 2024. A total 55 staff nurses (both male and females) of aged ≥ 18, years were for in this study.

Study Design: Descriptive cross-sectional study.

Study Location: study conducted in 24 bedded Emergency Unit of Apollo Main Hospital, Chennai

Study Duration: November 2023 to February 2024

Sample size: 55 staff nurses working in Emergency unit.

Subjects & selection method: Nurses working in the Emergency department of Apollo Main Hospital were included with convenient sampling. Nurses selected based on availability and willingness to participate.

Inclusion criteria:
1. Staff nurses working in Emergency department
2. Adult medical patients (18 years and above) admitted in Emergency unit
3. Patients who will be on oxygen therapy for an acute or chronic illness in Emergency unit.

Exclusion criteria:
1. Other critical care units or wards were not included in the study
2. Patients who are on tracheostomy and need oxygen supplement will not be included in the study

Data collection method:

In this cross-sectional study, nurses were consecutively enrolled from Emergency department of Apollo Main Hospital, Chennai from November 2023 to February 2024. The nurses' practice about various aspects of oxygen therapy was investigated using a predesigned and validated Observation Checklist. Prior to implementation, the study protocol was discussed in the Institutional Ethics Committee- Bio Medical Research Apollo Hospitals Chennai and approved with the code of ethics number AMH-C-S-011/02-23.

The Observation checklist used for data collection had 3 sections.
Section A: Demographic data of patients & staff nurses.
Section B: Observation Checklist on Appropriate documentation, Appropriate device in order to achieve the target saturation range and Appropriate Titration in order to achieve the target saturation range
Section C: Work Instruction during Oxygen Administration by Staff nurses.

The observation checklist was designed and to determine the individual staff's practice about the various aspects of oxygen therapy, was used for data gathering. Specialists validated the observational checklist. Consent got from the staff nurses for willingness on skill observation study. Once received the patient in emergency unit, the investigator checks for the inclusion criteria and observed the oxygen administration practice and other oxygen parameters and followed till the patient moved from emergency unit.

The first section of the toolkit includes demographic information of patient as Age, past history of respiratory disease, relevant co-morbidity and indication for oxygen administration and staff details about the professional qualification and work experience in Apollo Main Hospital.

The second section of the toolkit comprised of Observation on (i)Appropriate documentation about oxygen prescribed, completeness of prescription, target saturation, staff nurse monitored and documented the saturation level and staff nurse followed the SpO_2 documentation periodically (TAT monitored), (ii)Appropriate device in order to achieve the target saturation range about oxygen device used, staff nurse documented the oxygen device used, Blood gas requested and (iii)Appropriate titration in order to achieve the target saturation range about oxygen device changed, duration of the first device used, change of oxygen device documented, weaning off, saturation at the time of weaning off and weaning off details documented.

The third section of the toolkit includes the work instruction followed by the staff nurses when administering oxygen therapy as before oxygen administration, during oxygen administration and after oxygen administration

Statistical analysis:

After the data collection, the data were entered into SPSS software version 26 and analyzed using descriptive statistics to find Frequency &Percentage distribution.

III. Result

The findings from the study yield significant insights into the demographic characteristics of patients and the compliance of nurses regarding oxygen therapy administration. The results not only highlight the existing practices but also identify areas for improvement. Below, we will discuss the findings across several key dimensions:

Section A: Demographic Characteristics of Patients & Staff (Refer Table 1)

A total of fifty-five staffs were observed. A majority of 52 staffs fall under the qualification of B.Sc.(N) and 24 staffs with the experience of 0-6 months.

Age Distribution: The predominant age group of patients receiving oxygen therapy was 31-60 years (69%), followed by those aged >61 years (26%) and 12-30 years (5%). This aligns with common clinical observations that respiratory issues are more prevalent in middle-aged and older patients.

Past Respiratory Diseases: A significant portion of patients (62%) had a history of respiratory conditions, with Chronic Obstructive Pulmonary Disease (COPD) being the most common (56%). This finding emphasizes the need for effective oxygen therapy protocols, particularly among patients with chronic respiratory diseases, suggesting a high demand for trained nursing staff capable of managing such patients.

Co-morbidities: The high prevalence of coronary heart disease (75%) among patients indicates the potential complexity of their medical management. This suggests that nurses should be equipped not only with knowledge of oxygen therapy but also with an understanding of how these co-morbidities can affect patient care.

Indications for Treatment: The majority of the admissions (60%) were for breathing difficulty. Chest pain with discomfort accounted for about 22%. The primary indication for oxygen therapy was breathing difficulty, reinforcing the critical nature of timely oxygen administration in respiratory distress cases.

Table 1: Demographic Characteristics

S.No	Criteria	Observation	Number	Frequency (%)
	Patient:-			
1	Age	12-30 years	3	5
		31-60 years	38	69
		> 61 years	14	26
2	Past History of respiratory disease	Yes	34	62
		No	21	38
3	If YES, mention the respiratory disease	COPD	19	56
		Respiratory arrest	2	6
		Pneumonia	9	29
		Pleural Effusion	3	9
4	Other Relevant Co-morbidity	Previous history of Tracheostomy	1	2
		Heart Failure	4	7
		Coronary Heart Disease	41	75
		Not Applicable	9	16
5	Indication	Breathing difficulty	33	60
		Tachycardia & Increased BP	5	9
		Chest pain /Chest Discomfort	12	22
		Agitation	3	5
		RTA	2	4
	Staff:-			
1	Professional qualification	GNM	3	5
		B.Sc(N)	52	95
		Post basic BSC	0	0
2	Experience	0-6 months	24	44
		7-12 months	19	34
		13-24 months	12	22

SECTION B: Observation Checklist

The findings of appropriate titration in order to achieve the target saturation range, 16 cases oxygen device changed. Out of which 11 cases (69%) oxygen device changed to nasal prongs. The percentage of duration of the first device used between 0-2 hours is 44%. 56% of staff nurses documented the oxygen device changed. 26 cases weaned off from oxygen. Out of which, 73% maintained saturation of about 94-98% at the time of weaning off. 58% staff nurses documented the weaned off details in the chart.

Oxygen Prescription and Documentation: **(Refer Table 2(i))**

Compliance in ensuring that oxygen was prescribed was 58%, with a higher adherence to documentation of prescription completeness (75%). The twenty-three cases written the prescription after the oxygen started as a matter of urgency. However, 42% reported not checking prescriptions which raises concerns, as this is a critical safety step in therapy administration.

In one of a study, Among 811 hospitalized patients, 153 (19%) were on supplemental O2. Forty-nine percent were in the recommended range, 55% above, and 1% below. All patients with COPD on O2 supplementation had a SpO2 of more than 92% exposing them to the risk of hypercarbia. Only 43% of patients on oxygen had an associated order and only 52% of patients with an O2 order had an order for a goal SpO2 range**Error! Reference source not found.**[4]

In a university Hospital, 1022 patients of ambulance and Emergency department were audited on oxygen use. In that study, Oxygen saturation was recorded for 90% of patients, 17% of whom had SpO_2 <94% and 7% had SpO_2 <90%, including 33% of patients with COPD and 5.5% of patients without COPD. Only 58% of patients with COPD were correctly identified and 73% of these patients were treated with flow rates >4 l/min (equivalent to >35% oxygen)[5].

Table 2(i): Observation Checklist on Documentation

(i) Documentation				
S.No	**Criteria**	**Observation**	**Number**	**Frequency**
1	Oxygen prescribed	Yes	32	58
		No	23	42
2	Prescription complete	Yes	24	75
		No	8	25
3	If NO, mention the missed parameter	Rate flow	0	0
		Target saturation	8	25
		Mode	0	0
4	Target saturation	94-98%	5	21
		88-92%	19	79
5	Staff monitored and documented the saturation level	Yes	55	100
		No	0	0
6	Staff followed the SPO2 documentation periodically (TAT Monitored)	Yes	41	75
		No	14	25

Appropriate device in order to achieve the Target Saturation and Documentation: **(Refer Table 2(ii))**

As shown in the Table 2(ii), the target oxygen saturation was specified only in 24 charts. Out of 24 written target oxygen saturation, 79% prescribed the target oxygen saturation range of 88-92%. Monitoring blood oxygen saturation by the staff nurses showed commendable compliance (100% documentation of saturation levels). All the 55 staffs monitored and charts were documented the saturation level at the initial administration period but 41 (75%) staffs followed the saturation documentation periodically and monitored as per the TAT period. However, only 4% of patients had blood gas tests requested, reflecting a potential gap in practice, particularly in critically ill patients who may benefit from more comprehensive assessments.

In a study, a total of 65 patients received oxygen supplementation within the study period; 36 of these patients (55.4%) had target oxygen saturations prescribed by doctors, and 25% of the prescribed targets were judged to be inappropriate. In total, 49 patients (75.4%) were exposed to a potential risk from oxygen therapy due to prescription error and/or delivery error. A real risk was identified in 19 patients (29.2%) as they received oxygen at levels outside their appropriate medically indicated target range [6].

Table 2(ii): Appropriate device in order to achieve the target saturation range

(ii) Appropriate device in order to achieve the target saturation range				
S.No	**Criteria**	**Observation**	**Number**	**Frequency**
1	Oxygen device used	Nasal cannula	26	47

		Face mask with nebulizer	21	38
		Venturi mask	5	9
		Reservoir mask	3	6
2	Staff documented the oxygen device used	Yes	55	100
		No	0	0
3	Blood Gas requested	Yes	2	4
		No	53	96
4	If YES, mention how often does the test requested	30 mins	1	50
		60 mins	1	50

Appropriate titration in order to achieve the target saturation on Device Usage and Documentation: (Refer Table 2 (iii))

The choice of oxygen delivery devices indicated a preference for nasal cannulas (47%), followed by face masks with nebulizer and Venturi masks. The consistent documentation of device usage (100%) reflects a high standard of nursing practice. However, changing devices based on patient need was inadequate, with only 29% compliance in switching devices when required.

Table 2(iii): Appropriate Titration in order to achieve the target saturation range

(iii) Appropriate Titration in order to achieve the target saturation range				
S.No	**Criteria**	**Observation**	**Number**	**Frequency**
1	Oxygen Device changed	Yes	16	29
		No	39	71
2	If YES, mention the device	Nasal Prongs	11	69
		Oxygen Mask	4	31
3	Duration of the first device used	0-2 hours	7	44
		2-4 hours	4	31
		4-6 hours	4	25
4	Device change Documented	Yes	9	56
		No	7	44
5	Weaning off	Yes	26	47
		No	29	53
6	Saturation at the time of Weaning off	94-98%	19	73
		88-92%	7	27
7	Wean off details documented	Yes	15	58
		No	11	42

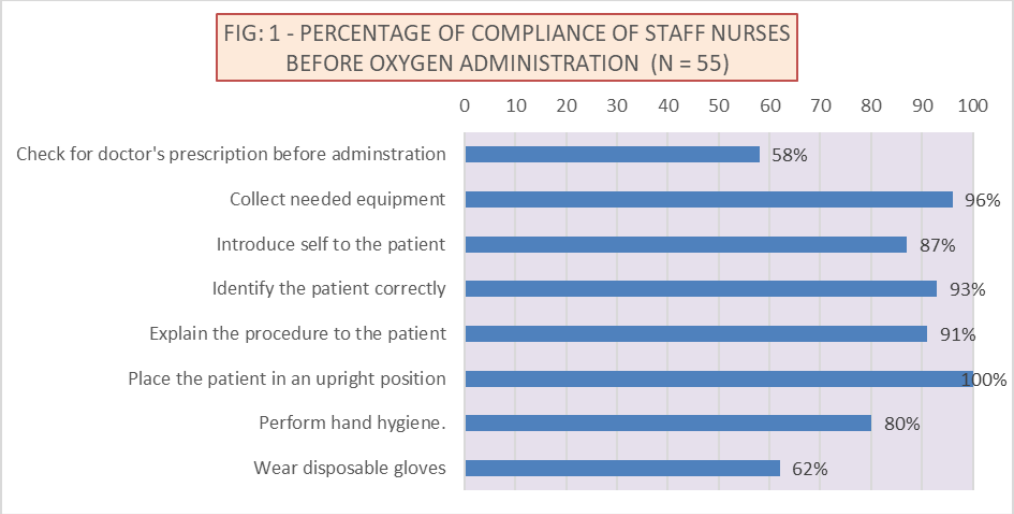
Section C: Nurses Work Instruction on Oxygen administration

The adherence of the staff nurses practice on the work instruction during oxygen administration by nurses is 90%. 83% Compliance before oxygen administration, 100% compliance during oxygen administration and 86% Compliance after oxygen administration.

Pre-Administration Checks: **(Refer Figure 1)**

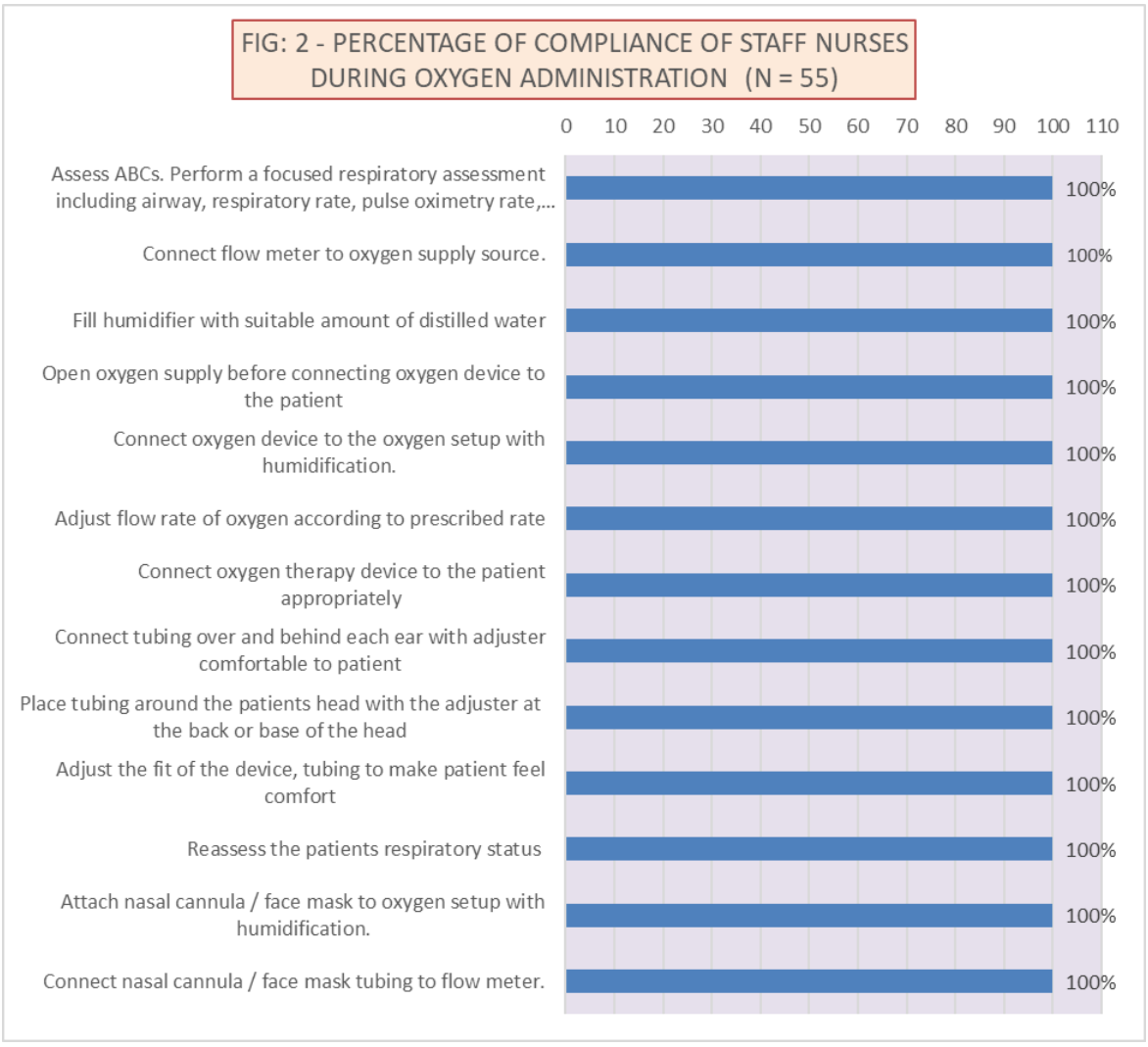
Critical compliance issues were noted pre-administration, with only 58% of nurses checking the doctor's prescription before oxygen administration. This indicates an urgent need for reinforced protocols and potentially increased training to ensure adherence to this vital step in the process.

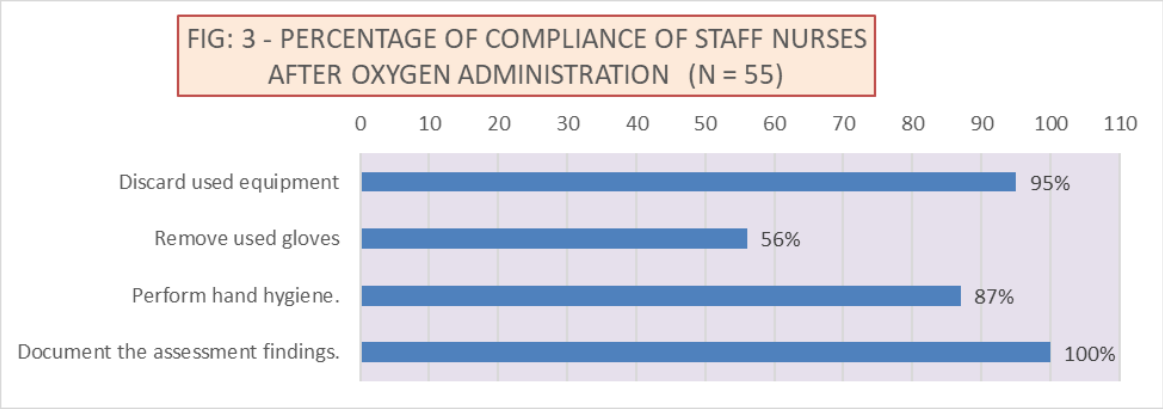
Patient Preparation: High rates of compliance were observed for patient identification (93%) and introduction (87%), which are crucial for maintaining patient safety and comfort. 80% staff nurses performed hand hygiene before oxygen administration and 62% staff nurses only worn gloves.



During and After Administration: **(Refer Figure 2 & 3)**

Compliance rates for key practices during administration, such as assessing the patient's respiratory status and confirming device connection (100% adherence), reflect an appropriate standard of care. However, post-administration compliance showed some deficiencies, particularly in removing gloves (only 56% compliance) and 87% staff nurses performed hand hygiene, highlighting the need for training in infection prevention practices.





IV. Discussion

Although supplemental oxygen remains a critical, life-saving intervention in emergency settings, there is limited literature examining the nuances of oxygen therapy practices among nurses. In this study, out of fifty-five staff nurses involved in oxygen administration, only 32 (58%) had an actual prescription for oxygen documented, indicating area for improvement in prescribing practices. Notably, the target oxygen saturation was not specified in 8 (25%) cases, which could impact patient safety and goal achievement.

Periodic SPO_2 documentation within the target time frame was maintained in 41 (75%) cases, reflecting a relatively high adherence to monitoring protocols. Regarding oxygen delivery methods, 26 (47%) cases utilized nasal cannula.

Device management practices showed that oxygen equipment was changed in 16 (29%) cases, with documentation of device changes in 9 (56%) cases, indicating a gap in record-keeping. Weaning from oxygen therapy was performed in 26 (47%) cases, with 15 (58%) of these documented appropriately, underscoring the importance of thorough documentation during this critical phase.

Overall, staff nurses demonstrated a high adherence rate to work instructions for oxygen administration, with an adherence of 90%. Compliance rates were also favorable before (83%) and during (100%) oxygen administration, with a slight decrease after administration (86%). These findings suggest that while immediate administration practices are well-followed, documentation and specific protocols such as target saturation settings and device change records require strengthening.

Enhancing documentation practices, ensuring clear prescription and target saturation specifications may improve the safety and efficacy of oxygen therapy. Additionally, ongoing training and protocol reinforcement could address inconsistencies in changing of oxygen device and weaning procedures.

Recommendations:

The research study highlights critical areas for improving oxygen therapy practices among health care professionals. The below structured approaches are recommended as the research study results.

1. Implement targeted training programs to staff nurses and emergency medical officers emphasizing the critical nature of compliance with pre-administration checks and the importance of adapting oxygen therapy to individual patient needs.
2. Conduct regular audits to review oxygen therapy prescriptions, administration and patient outcomes. Use compliance data to monitor performance, identify areas needing improvement, reinforce best practices and inform continuous quality improvement. This may also build a culture of accountability within the nursing team.
3. Strengthen communication channels between nursing staff and physicians regarding oxygen prescriptions and other treatment changes to enhance overall patient safety.

By addressing these recommendations, healthcare facilities can improve patient safety and outcomes in the administration of oxygen therapy, ultimately fostering a culture of excellence in care.

Limitation:

This study had some limitations. First, the present study only examined the nurses working in the Emergency department of Apollo Main Hospital. Therefore, the generalization of the results to the nurses of other hospitals in the country should be made cautiously. Also, due to the small sample size, the interpretation of relationships between variables should be made with caution. In order to accurately identify the factors affecting nurses' compliance about oxygen therapy, it is suggested that a multicenter study be conducted.

V. Conclusion

The findings underscore the importance of demographic factors in influencing both patient needs and nursing compliance regarding oxygen therapy. While strong adherence to protocols is observed during oxygen administration, significant gaps exist in pre-administration checks and continuous compliance with device changes. Further training and education focused on tailoring pre-administration assessments and ongoing monitoring to diverse patient demographics are crucial for improving patient safety and outcomes. Further research is needed to understand the specific factors contributing to these gaps, particularly the influence of diverse patient demographics, to inform targeted interventions and improve compliance across the entire oxygen therapy process.

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