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Comparison Between Nurses, Paramedics, and Doctors to Benefit from an Educational Intervention Related to Oxygen Therapy

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ABSTRACT

Introduction: The administration of oxygen is a crucial aspect of patient care that requires accurate assessment, adequate knowledge, and proper skills. Nurses, paramedics, and doctors all play important roles in the delivery of oxygen therapy, but few studies have investigated the benefits of educational interventions on their knowledge and practice of oxygen therapy. Therefore, this paper aims to compare the knowledge, attitudes, and skills of nurses, paramedics, and doctors regarding oxygen therapy and to assess the effectiveness of an educational intervention in improving their performance.

Methodology: Overall, 495 candidates from September 2022 to October 2022 were included in our study. The mean test score and the significance of each question before and after the educational program were noted for doctors, nurses, lady health workers, and technicians.

Results: Overall, 495 candidates were included in our study, of which 266 (53.7%) were doctors, 160 (32.3%) were nurses, 30 (6.1%) were lady health workers, 19 (3.8%) dispensers and 20 (4.0%) were technicians. There were 206 (41.6%) male and 289 (58.4%) female participants. The mean test score and the significance of each question before and after the educational program for doctors, nurses, lady health workers, and technicians were statistically significant ($p < 0.001$).

Conclusion: The study highlights the importance of continuous education to optimize patient outcomes and the need for interprofessional collaboration in providing optimal care.

Keywords: *emergency, oxygen therapy, educational training, healthcare providers*

INTRODUCTION

Oxygen (O_2) plays a vital role in sustaining life. The air we breathe contains O_2, which is essential in our body in producing energy [1]. The concentration of O_2 is 21% in the air everywhere and is the most abundant element on Earth and is necessary for the proper functioning of the human body [2]. O2 is considered an essential drug by WHO, and the WHO promotes using oxygen therapy for treating/preventing hypoxia (a condition in which the body is deprived of O_2). O_2 therapy is beneficial in managing critical patients and adequate resuscitation as an emergency drug [3]. High concentrations of O_2 can lead to toxicity which affects the human body (primarily the eyes, respiratory system, and CNS).

The individuals at high toxicity risk are deep sea divers, hyperbaric O2 therapy patients, premature infants, and patients exposed to high levels of O_2 [4]. The toxic nature of O2 should always be kept in mind before prescribing continuous O_2 therapy. Since pulmonary toxicity is irreversible the ABGs (arterial blood gases) and pulse oximetry should be monitored continuously [5].

To assess any signs of damage, nurses and doctors should conduct routine inspections of the mucous membrane and skin of the mouth [6]. This involves examining color changes, inflammation, ulceration, secretions, and other potential issues. Early detection of problems is crucial to prevent complications and ensure prompt treatment. Regular inspections are essential for maintaining optimal health and well-being [7].

Educational programs can positively affect healthcare professionals' knowledge and practice of oxygen therapy [8]. These programs offer physicians and nurses the information and training they need to properly implement oxygen therapy, leading to improved patient care and outcomes [9].

Oxygen therapy is frequently utilized in medical practices to treat respiratory illnesses [10]. Healthcare professionals, particularly nurses and doctors, play a crucial role in administering this treatment. Nevertheless, the effectiveness of oxygen therapy is heavily reliant on the knowledge and implementation of healthcare providers. Studies have indicated insufficient knowledge and inconsistent practices among doctors and nurses in administering oxygen therapy. Therefore, educating healthcare providers on proper oxygen therapy use is critical [11].

The absence of local research on the understanding and practices of nurses and doctors regarding oxygen therapy and the impact of educational programs in Pakistan is alarming, particularly in the midst of the COVID-19 pandemic [12]. It is critical for them to have a comprehensive understanding of the correct usage of oxygen therapy to ensure the best possible care for patients [13]. Without proper training and knowledge, they may incorrectly manage oxygen therapy, resulting in detrimental outcomes. Therefore, further research on this topic in Pakistan is necessary to enhance healthcare quality and guarantee patient safety [14].

METHODOLOGY

Between September and October 2022, the pediatric emergency department at Nishtar Hospital conducted a study on doctors' and nurses' awareness of oxygen toxicity. Based on a review of other studies, researchers developed a standardized two-part tool to ensure greater consistency and accuracy in assessing oxygen toxicity levels in patients. The first part of the tool is a questionnaire that covers various aspects of oxygen toxicity, including symptoms, risk factors, and treatments. It also asks about the patient's age, sex, workplace, experience, and qualifications.

The second part of the tool is a scoring system that assigns a numeric value to the patient's risk level, which can help determine an appropriate course of action. The numeric value is calculated based on the patient's responses to the questionnaire, with correct answers being scored as "1" and incorrect answers scored as "0". The satisfactory score threshold is set at 60% (score above 12) of the total score, which is 20.

Before starting an educational program, doctors and nurses completed a pre-test questionnaire. The program included steps for proper hygiene and safety measures during oxygen therapy, including using the correct equipment and monitoring patient responses. Different masks and flow rates were required for patients of different ages and sizes. After administering therapy, safety measures were taken when leaving the room, and hand sanitization was performed. Any concerning findings were noted and reported according to agency policy.

The research proposal was approved by the Institutional Review Board of the Institute of Mother and Child Care (I-MACCA) Multan, as evidenced by letter number CR/0622/0005 dated 12.06.2022. Before participating in the study, the healthcare providers were provided with a thorough explanation of the study's objectives

and nature, and written consent was obtained. The study's data was used solely for research purposes and the healthcare providers were assured of the option to withdraw from the study at any point without providing a reason while maintaining their anonymity. The researchers followed ethical principles to ensure the safety and well-being of the participants and the authenticity of the results.

Pre and post-knowledge assessments were conducted to evaluate the impact of the educational program aimed at improving the nurses' knowledge of oxygen therapy. The focus of the assessments was to test the healthcare providers' ability to understand and communicate the anatomy and physiology of the respiratory system, identify potential complications and steps in oxygen therapy, as well as educate patients and monitor oxygen therapy. Additionally, the assessments aimed to cover the role of doctors in oxygen therapy, interpretation of pulse oximetry, and oxygen therapy at home.

SPSS version 23 was used for data analysis. Data were recorded as mean ± SD and frequency percentages for numerical and categorical values. Chi-test and t-test were used to find the linkage among the different variables.

RESULTS
Overall, 495 candidates were included in our study, of which 266 (53.7%) were doctors, 160 (32.3%) were nurses, 30 (6.1%) were lady health workers, 19 (3.8%) dispensers and 20 (4.0%) were technicians. There were 206 (41.6%) male and 289 (58.4%) female participants. The mean test score and the significance of each question before and after the educational program for doctors, nurses, lady health workers, and technicians were shown in Table. I.

The average test score of doctors before and after the implementation of the educational program was 10.99 ± 2.77 and 18.15 ± 1.41, respectively ($p < 0.001$). The average test score of nurses before and after the implementation of the educational program was 10.75 ± 2.65 and 17.52 ± 2.04, respectively ($p < 0.001$). The average test score of lady health workers before and after the implementation of the educational program was 11.43 ± 2.43 and 18.16 ± 1.01, respectively ($p < 0.001$). The average test score of dispensers before and after the implementation of the educational program was 9.57 ± 4.10 and 16.05 ± 1.98, respectively ($p < 0.001$). The average test score of dispensers/technicians before and after the implementation of the educational program was 10.45 ± 2.37 and 18.00 ± 1.45, respectively, ($p < 0.001$). (Table. II).

The mean pre & post-test scores of doctors, nurses, lady health workers, and technicians are shown in Figure 1. The difference was statistically significant, ($p < 0.050$). (Figure. I).

TABLE I: The average test score of each question before and after the implementation of the educational program for doctors, nurses, LHV, dispenser, and technician

Question	Designation	Pre-test score	Post-test score	p-value	Decision
1	Doctor	0.73±0.44	0.61±0.48	0.004	S
	Nurse	0.68±0.46	0.69±0.46	0.905	NS
	LHV	0.87±0.35	0.60±0.49	0.009	S
	Dispenser	0.21±0.42	0.31±0.21	0.241	NS
	Technician	0.80±0.41	0.55±0.51	<0.001	S
2	Doctor	0.76±0.42	0.67±0.47	0.017	S
	Nurse	0.74±0.43	0.67±0.47	0.083	NS
	LHV	0.83±0.38	0.73±0.45	0.264	NS
	Dispenser	0.63±0.49	0.74±0.45	0.163	NS
	Technician	0.80±0.41	0.70±0.47	0.330	NS
3	Doctor	0.69±0.46	0.70±0.45	0.830	NS

	Nurse	0.70±0.46	0.63±0.48	0.116	NS
	LHV	0.83±0.38	0.80±0.41	0.745	NS
	Dispenser	0.63±0.49	0.63±0.49	1.000	NS
	Technician	0.80±0.41	0.75±0.44	0.666	NS
4	Doctor	0.80±0.41	0.73±0.44	0.080	NS
	Nurse	0.81±0.39	0.81±0.39	1.000	NS
	LHV	0.83±0.38	0.63±0.49	0.083	NS
	Dispenser	0.74±0.45	0.84±0.38	0.163	NS
	Technician	0.95±0.22	0.75±0.44	0.104	NS
5	Doctor	0.65±0.47	0.67±0.47	0.924	NS
	Nurse	0.65±0.48	0.70±0.46	0.319	NS
	LHV	0.60±0.49	0.70±0.47	0.415	NS
	Dispenser	0.53±0.52	0.53±0.52	1.000	NS
	Technician	0.75±0.44	0.65±0.48	0.494	NS
6	Doctor	0.41±0.49	0.55±0.49	0.012	S
	Nurse	0.44±0.49	0.51±0.50	0.219	NS
	LHV	0.50±0.51	0.63±0.49	0.423	NS
	Dispenser	0.58±0.51	0.58±0.51	1.000	NS
	Technician	0.45±0.51	0.65±0.48	0.214	NS
7	Doctor	0.27±0.44	0.42±0.45	<0.001	S
	Nurse	0.27±0.44	0.33±0.47	0.182	NS
	LHV	0.37±0.49	0.50±0.51	0.403	NS
	Dispenser	0.42±0.51	0.42±0.51	1.000	NS
	Technician	0.35±0.48	0.40±0.50	0.772	NS
8	Doctor	0.43±0.49	0.56±0.48	0.004	S
	Nurse	0.46±0.50	0.59±0.49	0.004	S
	LHV	0.40±0.49	0.53±0.51	0.354	NS
	Dispenser	0.32±0.48	0.32±0.48	1.000	NS
	Technician	0.40±0.50	0.45±0.51	0.716	NS
9	Doctor	0.71±0.45	0.72±0.44	0.677	NS
	Nurse	0.68±0.46	0.71±0.45	0.458	NS
	LHV	0.67±0.48	0.77±0.43	0.375	NS
	Dispenser	0.47±0.52	0.47±0.51	1.000	NS
	Technician	0.80±0.41	0.60±0.50	0.163	NS
10	Doctor	0.64±0.48	0.63±0.48	0.858	NS
	Nurse	0.60±0.49	0.67±0.47	0.217	NS
	LHV	0.83±0.38	0.67±0.48	0.134	NS
	Dispenser	0.37±0.49	0.79±0.42	0.002	S
	Technician	0.70±0.47	0.70±0.47	1.000	NS
11	Doctor	0.41±0.49	0.43±0.49	0.443	NS
	Nurse	0.40±0.49	0.44±0.49	0.356	NS
	LHV	0.50±0.51	0.57±0.51	0.489	NS
	Dispenser	0.21±0.42	0.21±0.41	1.000	NS
	Technician	0.30±0.47	0.40±0.50	0.428	NS
12	Doctor	0.42±0.49	0.54±0.50	0.010	S
	Nurse	0.44±0.49	0.60±0.49	0.001	S
	LHV	0.43±0.51	0.50±0.51	0.677	NS
	Dispenser	0.42±0.51	0.42±0.50	1.000	NS
	Technician	0.25±0.44	0.55±0.51	0.030	S
13	Doctor	0.46±0.47	0.59±0.48	0.012	S
	Nurse	0.47±0.50	0.66±0.47	<0.001	S
	LHV	0.30±0.46	0.57±0.51	0.073	NS
	Dispenser	0.53±0.52	0.68±0.48	0.241	NS

	Technician	0.25±0.44	0.55±0.51	0.055	NS
14	Doctor	0.65±0.49	0.71±0.45	0.297	NS
	Nurse	0.66±0.47	0.77±0.42	0.042	S
	LHV	0.53±0.51	0.83±0.37	0.026	S
	Dispenser	0.68±0.48	0.68±0.41	1.000	NS
	Technician	0.70±0.47	0.65±0.48	0.772	NS
15	Doctor	0.56±0.48	0.68±0.46	0.004	S
	Nurse	0.58±0.49	0.61±0.49	0.613	NS
	LHV	0.50±0.51	0.80±0.41	0.026	S
	Dispenser	0.84±0.38	0.84±0.37	1.000	NS
	Technician	0.70±0.47	0.70±0.47	1.000	NS
16	Doctor	0.47±0.50	0.41±0.49	0.171	NS
	Nurse	0.49±0.50	0.43±0.49	0.182	NS
	LHV	0.37±0.49	0.43±0.50	0.573	NS
	Dispenser	0.58±0.51	0.58±0.51	1.000	NS
	Technician	0.45±0.51	0.35±0.48	0.541	NS
17	Doctor	0.36±0.48	0.34±0.48	0.687	NS
	Nurse	0.36±0.48	0.39±0.49	0.458	NS
	LHV	0.37±0.49	0.27±0.45	0.326	NS
	Dispenser	0.21±0.42	0.21±0.41	1.000	NS
	Technician	0.40±0.50	0.35±0.48	0.666	NS
18	Doctor	0.64±0.48	0.64±0.48	1.000	NS
	Nurse	0.61±0.48	0.62±0.48	0.769	NS
	LHV	0.83±0.38	0.67±0.48	0.096	NS
	Dispenser	0.37±0.49	0.37±0.49	1.000	NS
	Technician	0.60±0.50	0.65±0.48	0.748	NS
19	Doctor	0.68±0.46	0.71±0.45	0.498	NS
	Nurse	0.67±0.47	0.73±0.44	0.114	NS
	LHV	0.87±0.35	0.77±0.43	0.264	NS
	Dispenser	0.58±0.51	0.58±0.51	1.000	NS
	Technician	0.60±0.50	0.70±0.47	0.494	NS
20	Doctor	0.70±0.46	0.52±0.50	<0.001	S
	Nurse	0.62±0.48	0.57±0.49	0.303	NS
	LHV	0.70±0.46	0.73±0.45	0.769	NS
	Dispenser	0.32±0.48	0.47±0.51	0.083	NS
	Technician	0.70±0.47	0.40±0.50	0.030	S
S=significant, NS=non-significant, LHV=leady health workers					

TABLE II: The average test score of the doctors, nurses, LHV, dispenser and technician before and after implementation of educational program

Designation	N	Pre-test score	Post-test score	p-value	Decision
Doctor	266	10.99±2.77	18.15±1.41	<0.001	S
Nurse	160	10.75±2.65	17.52±2.04	<0.001	S
LHV	30	11.43±2.43	18.16±1.01	<0.001	S
Dispenser	19	9.57±4.10	16.05±1.98	<0.001	S
Technician	20	10.45±2.37	18.00±1.45	<0.001	S
S=significant LHV=leady health workers					
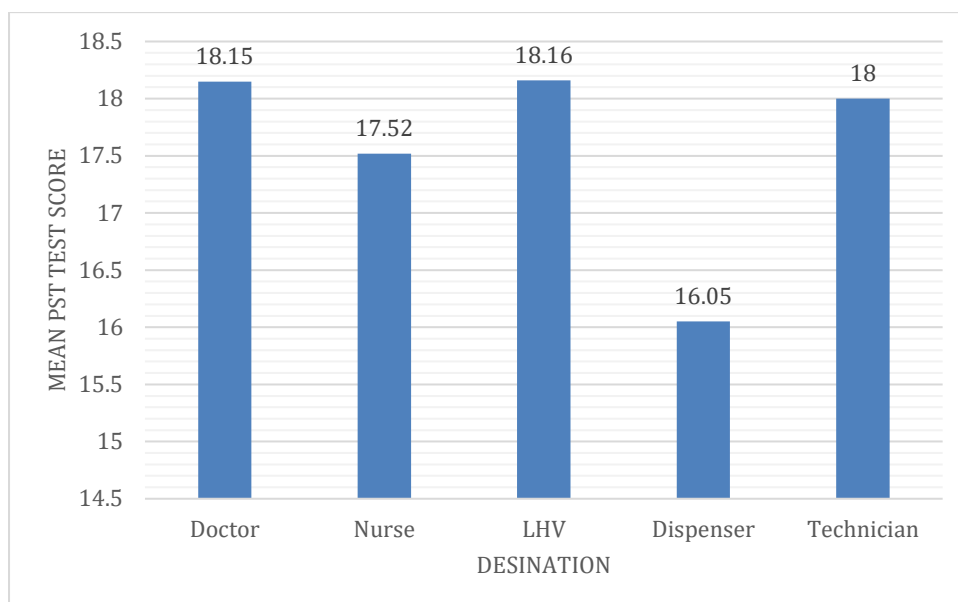
FIGURE I: Mean post test score of doctors, nurses, LHV, dispenser and technician

DISCUSSION

Oxygen therapy is an essential treatment for various medical conditions, and nurses and doctors play a vital role in assessing the need and administering the therapy [15, 16]. However, there needs to be more evidence to inform and support nursing practices related to oxygen therapy. To address this knowledge gap, research is required to better understand the needs of oxygen therapy in patients, identify best practices for the successful management of oxygen therapy, and develop evidence-based guidelines for nurses and doctors to follow when providing oxygen therapy [17, 18].

Aloushan et al. [1] found a significant knowledge, attitude, and practice gap among healthcare workers regarding providing oxygen treatment. This gap may have adverse effects on patient well-being. This result is supported by Rochester et al. [19] in 2017, who found that healthcare professionals working in intensive care units need to receive additional education to provide the best possible care to patients receiving O2 therapy to prevent O2 toxicity.

In our study, all nurse participants were female because the faculty only recently recognized male nursing. The majority of participants had experience of 5-10 years. Our study observed a significant difference regarding oxygen therapy knowledge after the training program. The average test score before and after the implementation of the educational program was 10.99 ± 2.77 and 18.15 ± 1.41, respectively ($p<0.001$). A survey conducted by Ginsburg et al. [20] and Chen et al. [21] among healthcare professionals working in resource-limited countries revealed that 63% do not use oxygen supplementation appropriately due to a lack of training. This highlights the need for increased awareness and education regarding the proper use of oxygen therapy, particularly in resource-limited settings. Such programs should include detailed information on how to safely and effectively administer oxygen therapy and the most up-to-date guidelines about medical protocols and standards of practice. As demonstrated in a 2016 study conducted by Markocic et al. [22], understanding the potential for oxygen toxicity is important for nurses to assess and identify any issues that could arise from oxygen therapy.

Nurses and doctors are crucial in providing oxygen therapy to patients with various medical conditions [15, 16]. However, there is a lack of evidence to support nursing practices related to oxygen therapy. Therefore, research is needed to identify the best practices for managing oxygen therapy, develop evidence-based guidelines for healthcare professionals, and better understand

the needs of patients receiving oxygen therapy [17, 18].

Aloushan et al. [1] found a significant gap in knowledge, attitude, and practice among healthcare workers providing oxygen therapy, which may adversely affect patient well-being. This result is consistent with Rochester et al. [19], who recommended additional education for healthcare professionals in intensive care units to prevent oxygen toxicity. In our study, the majority of the participants were experienced female nurses, as male nursing is a recent addition to the faculty.

Our study showed a significant improvement in oxygen therapy knowledge after implementing an educational program. Similar surveys by Ginsburg et al. [20] and Chen et al. [21] revealed a need for more appropriate use of oxygen supplementation among healthcare professionals in resource-limited countries due to the lack of training. Hence, there is a need for increased awareness and education regarding the proper use of oxygen therapy, especially in resource-limited settings. Education programs should provide detailed information on safely and effectively administering oxygen therapy, as well as the latest medical protocols and standards of practice. Additionally, understanding the potential for oxygen toxicity is crucial for nurses to identify and assess any issues arising from oxygen therapy, as demonstrated by Markocic et al. [22] in 2016.

Healthcare professionals, including nurses and doctors, are vital in providing oxygen therapy (OT) to critically ill patients. Inadequate knowledge in this area can adversely affect patients' health outcomes, as highlighted by Aloushan et al. [1] in 2019. Therefore, ensuring that nurses receive sufficient education to assess and administer OT safely and effectively is crucial. However, as reported by studies, nurses and doctors typically possess only moderate knowledge of oxygen therapy [23, 24]. To address this gap, in-service educational programs should be implemented to improve their knowledge and practice. The educational programs should emphasize improving their understanding of various aspects of oxygen therapy, such as oxygen delivery systems, oxygen saturation monitoring, and patient assessment. Considine et al. [25] showed that educating healthcare professionals (HCPs) about using supplemental oxygen in acute settings had a positive impact. The study found that increased knowledge among HCPs was strongly associated with independent decision-making. This indicates that providing education and training to HCPs can enhance their decision-making abilities and, in turn, lead to better patient outcomes.

Healthcare professionals, particularly nurses, and doctors who work with patients with respiratory conditions such as COPD, pneumonia, and premature infants, should receive education and training on the importance of oxygen therapy [26]. Such programs can equip them with a comprehensive understanding of oxygen therapy, including appropriate usage of oxygen therapy devices and potential risks associated with excessive or insufficient oxygen administration [27]. This knowledge can enhance their ability to provide the best possible care to their patients. It's essential to regularly assess the healthcare providers' knowledge and practices through the annual training program, allowing identification of any gaps or areas of improvement, followed by remedial action or further training to ensure optimal patient care.

One significant limitation in providing oxygen therapy is more resources and access to equipment. Even if healthcare providers have the necessary knowledge and skills, they may need more equipment to administer oxygen therapy promptly, leading to possible complications. Additionally, nurses may hesitate to provide oxygen therapy services if they are not adequately compensated for their time and effort.

However, after implementing the educational program, there was a significant improvement in the knowledge and practice of nurses and doctors in providing oxygen therapy, and most of them had a positive attitude toward the program.

CONCLUSION

It is essential to conduct regular practical and educational training for healthcare providers, including doctors, to keep them informed of the

latest guidelines on oxygen therapy. This knowledge will help them deliver optimal care to patients requiring oxygen therapy. Moreover, doctors in different hospital units should perform regular clinical audits of oxygen therapy to assess the indications, dose, and eventual outcome of patients who receive this therapy. Through clinical audits, doctors can identify areas that require improvement and ensure patients receive the most appropriate and effective treatment.

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