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Evaluating the Effectiveness of Sensitization Program on Prevention of Oxygen Wastage Among Staff Nurses – A Cross-Sectional Study

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ABSTRACT

Background: Medical oxygen is the only therapeutic resource, especially in acute and emergency care settings. However, inappropriate use and wastage remain a significant challenge due to limited awareness among healthcare providers. **Aim:** This study aims to evaluate the effectiveness of a sensitization program for staff nurses to raise awareness about the importance of medical oxygen, identify common causes of oxygen wastage, learn strategies to reduce oxygen wastage, and understand the significance of oxygen conservation.

Materials and Methods: This cross-sectional study was conducted in a tertiary care teaching hospital. A total of 203 staff nurses participated in the awareness program, who were directly involved in handling oxygen devices and managing oxygen administration to the patient. The study was conducted using pre-test and post-test methods. The pre-test was conducted with 15 validated Multiple-Choice Questions (MCQs). The classroom program was conducted using PowerPoint presentations. The post-test was conducted with the same questionnaires following the session. The Paired T-test was used for statistical analysis**.**

Results: The mean scores of the pre-test and post-test were 7.49 ±2.39 and 12.43 ±2.18, before and after the implementation of the educational program, respectively. Compared to the pre-test, the average post-test score was higher. The statistical significance of the result is made clear by the p-value of $p<0.001$. The difference between the pre-test and post-test means is -4.93, with a 95% confidence interval between -5.26 and -4.61.

Conclusion: Conducting a sensitization program for the staff nurses regarding optimal oxygen utilization and prevention of oxygen wastage will save costs, enhance the quality of patient care, and decrease future demand and wastage.

Keywords: *awareness, medical oxygen, prevention of oxygen wastage, sensitization program, staff nurses.*

1. INTRODUCTION

Oxygen is an essential life-saving medicine in healthcare[1]. It plays a vital role in emergencies, critically ill patients, operation theatres, and patients with hypoxemia throughout the hospital. The Medical Gas Pipeline System for medical oxygen was installed for uninterrupted oxygen supply throughout the hospital. The COVID-19 pandemic has taught us a great lesson about the importance of oxygen[2]. Due to sudden demand and insufficient oxygen supply during the pandemic, many lives were lost. Medical oxygen wastage in hospitals remains a significant challenge, with studies reporting that during the

COVID-19 crisis, Uttar Pradesh hospitals wasted 10 -15% of their oxygen at IIT Kanpur, The Times of India [3], also reported about an audit done by IIM Rohtak in Haryana hospitals which revealed that 30% of oxygen was wasted in cylinders, 18% was wasted due to insufficient monitoring of staffs handling oxygen in wards, and also oxygen kept running for 4 hours without patient[4]. As a result of the report, the suggestion was made to educate the patient, and the hospitals were asked to recruit inspectors to decrease oxygen wastage. Therefore, some preventive measures towards the conservation of medical oxygen will decrease oxygen wastage and ensure better utilization. Even though healthcare professionals are responsible for prescribing oxygen therapy, continuous monitoring and management are carried out by staff nurses. Staff nurses are the primary caregivers who closely communicate with patients, which places them at the forefront of patient care. Therefore, this study was carried out to conduct and evaluate the effectiveness of a sensitization program regarding oxygen as an essential medicine, its sources of leakage, and prevention among staff nurses.

2. MATERIALS AND METHODS

Study Design: A cross-sectional study

Sample Size: The sample size was based on the staff nurses employed in the hospital. A total of 509 staff nurses were employed at Mahatma Gandhi Medical College and Research Institute. Nurses employed in administrative roles, academic settings, outpatient departments, operating theatres, and dental units were excluded from the program to focus only on the nurses who actively engaged in oxygen management. Hence the sensitization program was organized for staff nurses working in areas where oxygen is highly utilized and the staff nurses who were directly involved in handling oxygen devices and managing oxygen administration to the patient. (Figure 1: Consort Diagram)

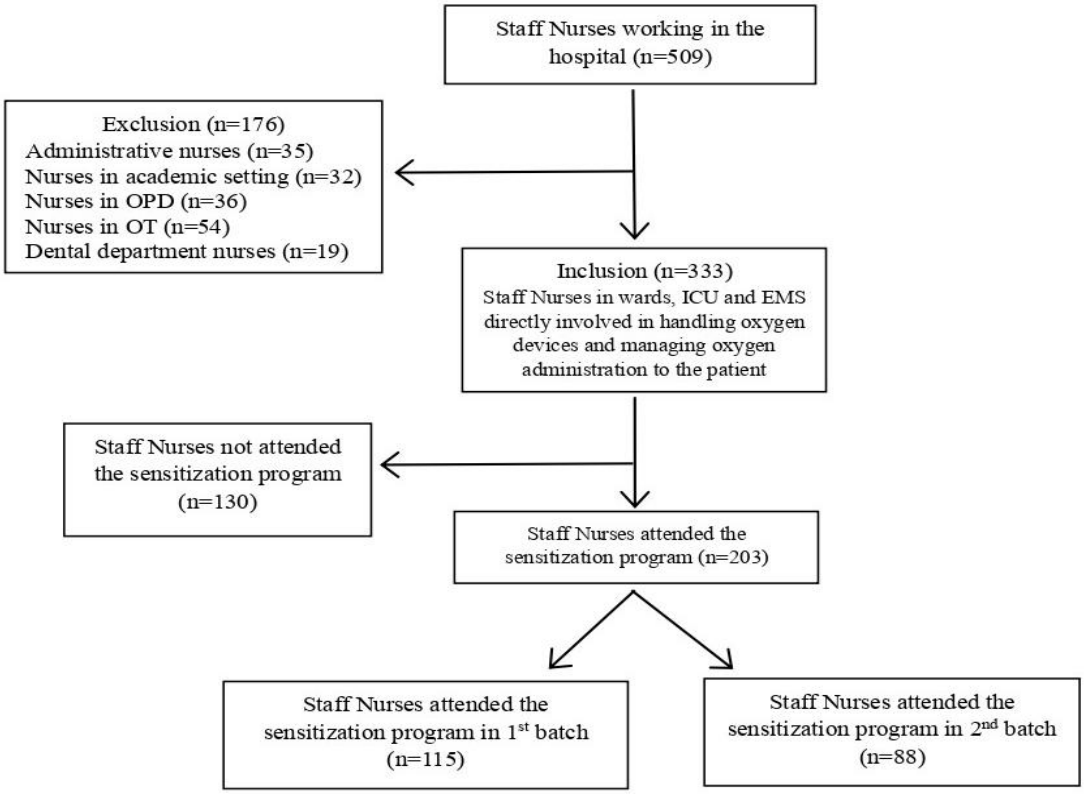


Figure 1: Consort Diagram

Data collection: No demographic data were collected from the staff nurses. The pre-test was conducted before the session with 15 validated multiple-choice questions which were prepared according to the sensitization program's objectives. The questionnaires were validated by the experts. The pre-test was conducted to assess their basic knowledge regarding medical oxygen. 10–15 minutes were provided to complete the pre-test. The awareness program was conducted for 203 staff nurses in 2 batches using PowerPoint presentations in the classroom following the pretest. The objectives of the program were to understand the importance of medical oxygen, identify common causes of oxygen wastage, learn strategies to reduce oxygen wastage, implement best practices in oxygen management, and understand the significance of oxygen conservation. After the session, the purpose of the post-test was to evaluate the knowledge acquired by staff nurses from the awareness program with the same questions given in the pre-test. A comparison of the pretest and post-test was made to assess the efficacy of the sensitization program.

Ethical Considerations

The Institutional Human Ethics Committee approved the research topic. Approval no: MGMCRI/2024/02/IHEC/73. The objectives and methodologies were explained to the study participants. Privacy and confidentiality were assured to the participants, and they retained the option to withdraw from the study.

3. RESULTS

Statistical Analysis:

The statistical analysis was performed using the Statistical Package for Social Science (SPSS, Version 21) for Microsoft Windows. Statistical significance was determined by the P-value <.05. A few important questionnaires were described using frequency, percentage, mean, and standard deviation. A paired t-test was performed to compare the pre-test and post-test.

The average test scores of staff nurses before and after the sensitization program (n = 203) (Table 1). The mean scores were 7.49 ±2.39 (pre-test) and 12.43 ±2.18 (post-test), before and after the implementation of the educational program, respectively. Compared to the pre-test, the average post-test score was higher. With 29 degrees of freedom and a t-value of 29.9570, the p-value corresponds to 0.001. The result is statistically significant, as indicated by the p-value of 0.001. The difference between the pre-test and post-test means is -4.93, with a 95% confidence interval between -5.26 and -4.61. The result shows that the oxygen awareness sensitization program was effective.

Table 1: The average test scores of staff nurses before and after the sensitization program (n = 203)

TEST	Mean	S.D.	S.E.	Mean difference	Paired t-test	p-value
Pre-Test	7.49	2.39	0.17	4.93	29.957	0.001 (<0.05)
Post-Test	12.43	2.18	0.15			

S.D. = standard deviation**,** S.E. = Standard Error, n = number of participants.

Sub Analysis

The study was conducted to assess the basic knowledge of staff nurses, to create awareness, and to assess the effectiveness of the sensitization program. However, the main objective is to make the staff nurses follow regular inspection practices, address and report leaks, apply oxygen conservation measures in their routine practice, and also understand their importance. Such highly significant questions were chosen, and those questions were analysed individually (Figure 2: comparison of pre-test and post-test)

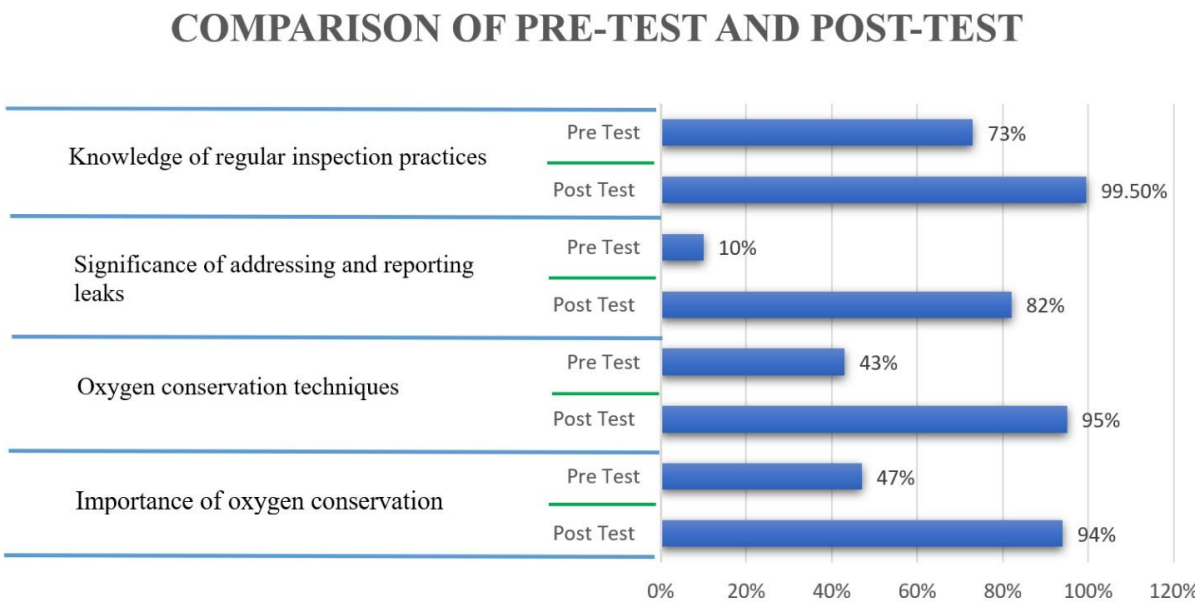
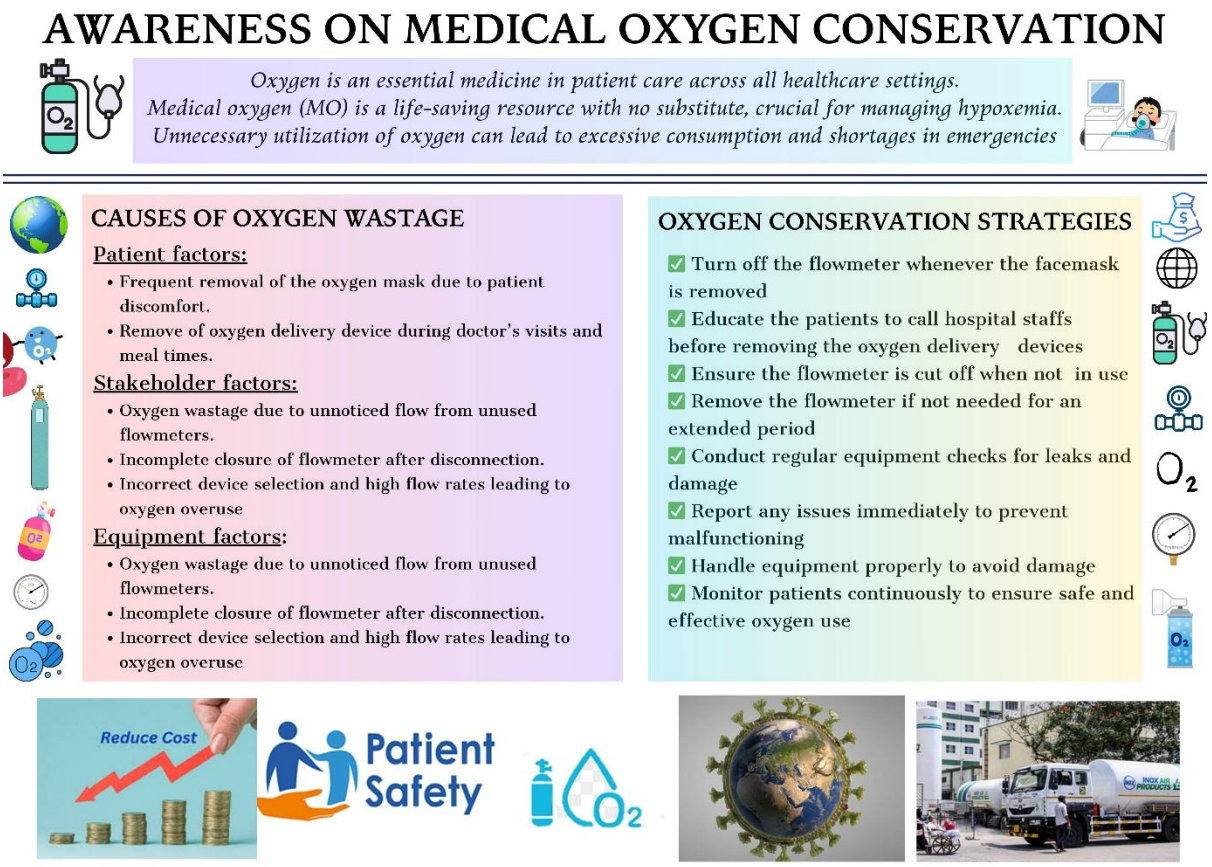


Figure 2: Comparison of pre-test and post-test regarding knowledge of regular inspection practices, the significance of addressing and reporting leaks, oxygen conservation techniques and understanding the importance of oxygen conservation.

Figure 3: Template for awareness on medical oxygen conservation



Knowledge of regular inspection practices: In the comparison of pre-test and post-test scores regarding the knowledge of regular inspection practices, the percentage of post-test 99.5% was greater than the pre-test 73.0%.

Significance of addressing and reporting leak: In the comparison of pre-test and post-test scores regarding the significance of addressing and reporting leaks in the pipeline, the percentage of post-test 82.0% was greater than the pre-test 10.0%.

Learning oxygen conservation techniques: In the comparison of pre-test and post-test scores regarding oxygen conservation techniques, the percentage of post-test 95.0% was greater than the pre-test 43.0%.

Understanding the importance of oxygen conservation: In the comparison of pre-test and post-test scores in understanding the importance of oxygen conservation, the percentage of post-test 94.0% was greater than the pre-test 47.0%.

4. DISCUSSION

This study was done to create awareness among the staff nurses regarding the prevention of oxygen wastage and oxygen conservation. According to the study findings, there is a significant improvement in staff nurses knowledge regarding oxygen conservation techniques, routine inspection practices, addressing and reporting leaks. The program's success highlights the value of focused education in improving oxygen stewardship among nurses, particularly in high-demand clinical areas. The findings demonstrate that targeted training can enhance nurses' ability to reduce oxygen wastage, suggesting its potential for broader implementation to optimize resource use in healthcare settings. Nevertheless, the results support the integration of such training into nursing education programs to promote cost-effective and efficient oxygen use in hospitals. According to our study findings, there is a significant improvement among staff nurses regarding routine inspection practices, addressing and reporting leaks, and oxygen conservation strategies. In addition, 94.0% of the staff nurses recognized the importance of oxygen conservation in hospital settings. Hence, the study results were found to be effective in creating awareness among staff nurses. Many studies have explored the effectiveness of educational programs on nurses, focusing on improving their knowledge regarding oxygen therapy, the administration of oxygen, and the risks of oxygen toxicity, and have been found to be effective [5–8]. Hence, the educational programs were found to be useful for staff nurses in understanding proper oxygen use in clinical settings, which is essential for patient safety and effective treatment. Many studies have assessed the knowledge levels of the staff nurses regarding medical oxygen[9–12]and showed that a knowledge gap was present among staff

nurses regarding medical oxygen. In addition, literature has broadened its scope by assessing attitudes and practices toward oxygen therapy for both doctors and nurses, which may lead to better adherence to guidelines and improved patient outcomes[13–16]. Ghulam Mustafa (2023) in his study found that educational programs improved the understanding of oxygen therapy among nurses, and most of them had a good view of it[5]. Similarly, our study also demonstrated that educational programs can enhance nurses' understanding of oxygen therapy. However, our intention specifically focused on oxygen wastage, which is a critical issue in resource-limited settings. But only a few studies have focused on proper oxygen utilization and the issue of oxygen wastage, highlighting the need for strategies to prevent unnecessary oxygen consumption and to reduce costs. Manpreet Singh et al (2022), during the pandemic, did an “oxygen audit” with a tool to preserve oxygen during the pandemic to raise awareness among medical personnel about inadvertent oxygen waste. His study revealed that over 20–25% of oxygen utilization and need were reduced after the sensitization session and their hospital employees acknowledged that the oxygen-saving sensitization campaigns opened their eyes and reduced their usage[17]. It is noticeable that regular educational sessions conducted annually can positively impact healthcare professionals' understanding and application of oxygen therapy[18]. The Times of India news report during the COVID-19 pandemic published that the Maharashtra government has adopted the practice of selecting an "oxygen nurse," whose main responsibility is to monitor optimum oxygen use and guarantee minimal waste[19]. Instead of appointing nurses, training the nurses already working in the institution will be an effective measure. Dipti Chand (2022) in their article said that, like "The National Oxygen Stewardship Program" introduced by the union government, training healthcare professionals will guarantee proper oxygen utilization and reduce wastage[20]. Gaurav Sindwani et al (2021) in their article said that educating nursing officers and technicians regarding anticipating leaks will decrease oxygen wastage[21].

5. CONCLUSION

The sensitization program proved effective in enhancing staff nurses’ knowledge on oxygen conservation, highlighting its potential to reduce wastage and improve resource management in healthcare facilities. Notable improvements were observed in areas such as leak identification, proper oxygen use, and awareness of conservation practices. These findings align with global initiatives aimed at optimizing medical oxygen use, particularly in resource-constrained settings. based on these results, hospitals are encouraged to implement regular training sessions and consider establishing “oxygen stewardship” roles for nurses to maintain and expand these gains. Future studies should investigate the long-term impact of such interventions and quantify oxygen savings. Empowering nurses with the necessary knowledge and tools not only contributes to significant cost savings and improved patient outcomes but also strengthens the healthcare system's resilience in facing future oxygen supply challenges

6. LIMITATIONS

- It was a single-centre design and lacked long-term follow-up to assess sustained practice changes.

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Conflict of Interest

We declare no conflict of interest

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