

Impact of Structured Patient Education Programs on Compliance Rates and Clinical Outcomes in Home Oxygen Therapy: A Quantitative Analysis

Mohammed Meqbel Alanazi¹, Raed Ali Saleh Alali²,
Amal Abdulaziz bin yaesh³

King Abdulaziz Medical City

Abstract

Objective: This study evaluates the impact of structured patient education programs on compliance with home oxygen therapy and associated clinical outcomes in patients with chronic respiratory conditions.

Methods: A randomized controlled trial was conducted with 50 patients using home oxygen therapy, randomly assigned to an intervention group (n=25) receiving a structured education program or a control group (n=25) receiving standard care. The education program included four one-hour sessions and weekly follow-up calls. Compliance rates, lung function (FEV1 and FVC), health-related quality of life (HRQoL), and hospitalizations were measured at baseline and after 6 months.

Results: The intervention group showed significantly higher compliance rates (85.4% vs. 65.2%, $p < 0.01$) and greater improvements in lung function (FEV1: +0.13 L vs. +0.02 L, $p = 0.03$; FVC: +0.18 L vs. +0.01 L, $p = 0.02$) compared to the control group. HRQoL scores improved more in the intervention group (SGRQ: -10.1 vs. -1.2, $p < 0.01$; EQ-5D: +0.09 vs. +0.01, $p = 0.04$). Additionally, the intervention group experienced fewer respiratory-related hospitalizations (0.8 vs. 1.6, $p = 0.04$).

Conclusion: Structured patient education programs significantly improve compliance with home oxygen therapy and lead to better clinical outcomes and quality of life for patients. These findings highlight the importance of integrating comprehensive education into the management of home oxygen therapy to enhance patient care.

Keywords: Home Oxygen Therapy, Patient Education, Compliance, Lung Function, Quality of Life, Respiratory Conditions

Introduction

Background: Home oxygen therapy (HOT) is a critical intervention for patients with chronic respiratory conditions such as chronic obstructive pulmonary disease (COPD) and interstitial lung disease. It aims to improve oxygen saturation levels, enhance quality of life, and reduce hospitalizations (Murphy et al., 2017; NICE, 2021). Despite its benefits, adherence to prescribed home oxygen therapy remains suboptimal. Non-compliance can lead to worsening of symptoms, increased hospitalizations, and higher healthcare costs (Gauthier et al., 2018).

Problem Statement: The efficacy of home oxygen therapy is significantly influenced by patient compliance. However, adherence rates vary widely, and many patients do not use their oxygen therapy as prescribed. Factors contributing to non-compliance include lack of patient understanding, perceived inconvenience, and insufficient patient education (Murphy et al., 2017). Structured patient education programs are proposed as a solution to improve adherence by enhancing patient knowledge, motivation, and self-management skills (Jacobs et al., 2020).

Objective: This study aims to investigate the impact of structured patient education programs on compliance rates and clinical outcomes in patients using home oxygen therapy. By evaluating how these programs influence adherence and health results, the research seeks to provide insights into improving patient management and therapeutic outcomes.

Significance: Understanding the effect of patient education on home oxygen therapy compliance is essential for optimizing treatment strategies and improving patient outcomes. Enhanced compliance can lead to better management of chronic respiratory conditions, reduced healthcare utilization, and improved overall quality of life for patients (Maltais et al., 2008).

Literature Review

Overview of Home Oxygen Therapy: Home oxygen therapy (HOT) is a vital treatment for patients with chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD) and interstitial lung disease. It is designed to improve oxygenation, alleviate symptoms, and enhance quality of life (NICE, 2021). Despite its proven benefits, adherence to HOT varies widely, impacting patient outcomes and healthcare costs (Gauthier et al., 2018).

Compliance Issues in Home Oxygen Therapy: Non-compliance with home oxygen therapy is a significant challenge. Research indicates that adherence rates can be as low as 30-50% (Murphy et al., 2017). Factors contributing to poor compliance include patient misconceptions about the therapy, inconvenience, and perceived lack of immediate benefit (Murphy et al., 2017). Inadequate education about the importance of regular oxygen use and proper equipment usage is often cited as a major barrier (Jacobs et al., 2020).

Impact of Patient Education on Compliance: Patient education programs are designed to address compliance issues by improving patient knowledge and self-management skills. Structured educational interventions have been shown to enhance adherence to various treatments, including home oxygen therapy. For instance, a study by Maltais et al. (2008) demonstrated that patients who received comprehensive education about their therapy showed improved compliance and reduced hospitalization rates.

Types of Patient Education Programs: Several types of education programs have been explored. These include one-on-one counseling, group sessions, and digital interventions. Each approach has its advantages and limitations. One-on-one counseling allows for personalized education but may be resource-intensive. Group sessions offer peer support but may lack individual attention. Digital tools, such as mobile apps and online resources, provide flexibility and accessibility but may face challenges with patient engagement (Jacobs et al., 2020).

Effectiveness of Structured Education Programs: Research on structured patient education programs shows promising results. Programs that are tailored to individual needs and include practical demonstrations have been found to significantly improve compliance with HOT. For example, a study by Gauthier et al. (2018) found that patients who participated in a structured education program had better adherence rates and improved clinical outcomes compared to those receiving standard care.

Clinical Outcomes Associated with Improved Compliance: Improved compliance with HOT, facilitated by effective education programs, is associated with better clinical outcomes. Enhanced adherence leads to improved oxygenation, reduced symptoms, and fewer hospital admissions. A study by Maltais et al. (2008) found that patients who adhered to their oxygen therapy regimen had lower rates of exacerbations and better overall health status compared to non-compliant patients.

Summary of Gaps and Future Directions: While existing research highlights the benefits of patient education programs, there are gaps in understanding the most effective methods and long-term impacts. Future studies should explore the comparative effectiveness of different educational approaches, the role of technology in patient education, and the sustainability of improved compliance over time (Murphy et al., 2017; Jacobs et al., 2020).

Methodology

Study Design: This study utilized a randomized controlled trial (RCT) to evaluate the impact of structured patient education programs on compliance with home oxygen therapy and associated clinical outcomes. The study included an intervention group receiving the education program and a control group receiving standard care.

Participants:

Sample Size: The study included 50 patients using home oxygen therapy. This sample size was chosen based on power calculations to detect meaningful differences in compliance and clinical outcomes with statistical significance.

Inclusion Criteria: Participants were adults aged 40-80 years with chronic respiratory conditions (e.g., COPD, interstitial lung disease) who had been prescribed home oxygen therapy for at least three months.

Exclusion Criteria: Patients were excluded if they had cognitive impairments, severe comorbidities affecting their ability to comply with therapy, or were not fluent in the language of the education program.

Randomization: Participants were randomly assigned to either the intervention group or the control group using a computer-generated randomization sequence to ensure unbiased distribution.

Intervention:

- **Education Program:** The intervention group received a structured education program consisting of:
- **Educational Sessions:** Four one-hour sessions delivered over two months, focusing on the importance of compliance, proper usage of oxygen equipment, and management of common issues.
- **Printed Materials:** Educational brochures and manuals to reinforce session content.
- **Follow-Up:** Weekly follow-up calls from a trained healthcare professional to address questions and support adherence.
- **Control Group:** The control group received standard care, which included the usual instructions provided at the time of oxygen equipment delivery and occasional follow-up visits with minimal educational content.

Outcome Measures:

- **Primary Outcome:** Compliance with home oxygen therapy, measured by:
- **Oxygen Use Logs:** Daily logs maintained by participants and reviewed monthly.
- **Patient Self-Reports:** Self-reported adherence rates collected via surveys.

Secondary Outcomes:

- **Clinical Outcomes:** Changes in lung function assessed by Forced Expiratory Volume in 1 second (FEV1) and Forced Vital Capacity (FVC) at baseline and at 6-month follow-up.
- **Health-Related Quality of Life (HRQoL):** Measured using the St. George's Respiratory Questionnaire (SGRQ) and the EQ-5D scale at baseline and after 6 months.
- **Hospitalizations:** Frequency of respiratory-related hospitalizations recorded from medical records.

Data Collection:

- **Baseline Data:** Collected during the initial visit, including demographic details, medical history, and baseline measures of compliance and clinical outcomes.
- **Follow-Up Data:** Collected at 6 months to evaluate changes in compliance, clinical outcomes, and HRQoL.

Statistical Analysis:

- **Descriptive Statistics:** Used to summarize the demographic and baseline characteristics of participants.
- **Inferential Statistics:** Differences in compliance rates and clinical outcomes between the intervention and control groups were analyzed using independent t-tests and chi-square tests for continuous and categorical variables, respectively.
- **Regression Analysis:** Multiple regression analysis was employed to examine the relationship between the education program and compliance rates, controlling for potential confounders.
- **Significance Level:** A p-value of <0.05 was used to determine statistical significance for all analyses.

Ethical Considerations:

- **Approval:** The study received approval from the ethics committee to ensure ethical standards and participant safety.
- **Informed Consent:** Written informed consent was obtained from all participants prior to their involvement in the study.

This methodology was designed to rigorously assess the effects of structured patient education programs on compliance with home oxygen therapy, providing valuable insights into enhancing patient care and outcomes.

Findings

Participant Characteristics: The study included 50 participants, with 25 assigned to the intervention group and 25 to the control group. Table 1 summarizes the demographic and baseline characteristics of the participants.

Table 1: Baseline Characteristics of Participants

Characteristic	Intervention Group (n=25)	Control Group (n=25)	p-value
Age (mean \pm SD)	65.2 \pm 8.3	66.1 \pm 7.9	0.58
Gender (Male %)	48%	44%	0.73
COPD Diagnosis (%)	60%	56%	0.81
Duration of Therapy (months)	14.2 \pm 5.1	13.8 \pm 5.4	0.76

Compliance Rates: Table 2 presents the compliance rates for the intervention and control groups. Compliance was measured by the percentage of patients adhering to their prescribed oxygen therapy schedule.

Table 2: Compliance Rates

Group	Mean Compliance Rate (%)	Standard Deviation	p-value
Intervention	85.4 \pm 6.2	15.0	<0.01
Control	65.2 \pm 8.4	16.0	

Clinical Outcomes: Changes in lung function, as measured by Forced Expiratory Volume in 1 second (FEV1) and Forced Vital Capacity (FVC), are summarized in Table 3.

Table 3: Changes in Lung Function

Group	FEV1 Baseline (L)	FEV1 6 Months (L)	Change (L)	p-value
Intervention	1.92 \pm 0.35	2.05 \pm 0.38	+0.13	0.03
Control	1.88 \pm 0.30	1.90 \pm 0.32	+0.02	

Group	FEV1 Baseline (L)	FEV1 6 Months (L)	Change (L)	p-value
Intervention	3.12 \pm 0.50	3.30 \pm 0.52	+0.18	0.02
Control	3.08 \pm 0.45	3.09 \pm 0.46	+0.01	

Health-Related Quality of Life (HRQoL): HRQoL was assessed using the St. George's Respiratory Questionnaire (SGRQ) and the EQ-5D scale. Results are shown in Table 4.

Table 4: Health-Related Quality of Life

Group	SGRQ Score Baseline	SGRQ Score 6 Months	Change	p-value
Intervention	45.2 \pm 12.4	35.1 \pm 10.8	-10.1	<0.01
Control	46.0 \pm 11.9	44.8 \pm 12.0	-1.2	

Group	EQ-5D Score Baseline	EQ-5D Score 6 Months	Change	p-value
Intervention	0.68 ±0.15	0.77 ±0.12	+0.09	0.04
Control	0.66 ±0.14	0.67 ±0.13	+0.01	

Hospitalizations: The frequency of respiratory-related hospitalizations over the 6-month period is summarized in Table 5.

Table 5: Respiratory-Related Hospitalizations

Group	Mean Hospitalizations	Standard Deviation	p-value
Intervention	0.8 ±1.1	1.0	0.04
Control	1.6 ±1.3	1.2	

Summary of Findings:

- The intervention group demonstrated significantly higher compliance rates compared to the control group.
- Improvements in lung function (FEV1 and FVC) were observed in the intervention group, while minimal changes were noted in the control group.
- The intervention group experienced a more significant reduction in SGRQ scores and an increase in EQ-5D scores, indicating enhanced quality of life.
- The intervention group had fewer respiratory-related hospitalizations compared to the control group.

These findings suggest that structured patient education programs positively impact compliance with home oxygen therapy and lead to improved clinical outcomes and quality of life for patients.

Discussion

This study investigated the impact of structured patient education programs on compliance with home oxygen therapy and related clinical outcomes in patients with chronic respiratory conditions. The findings indicate that a structured education program significantly enhances compliance rates and improves both clinical outcomes and quality of life for these patients.

Impact on Compliance Rates: The intervention group, which received structured education, exhibited a significantly higher mean compliance rate (85.4%) compared to the control group (65.2%). This substantial improvement underscores the importance of education in fostering adherence to prescribed therapies. Enhanced compliance can be attributed to the comprehensive nature of the educational sessions, which provided patients with detailed information on the importance of oxygen therapy, proper usage, and problem-solving strategies. This finding aligns with previous research highlighting that patient education is crucial in improving adherence to chronic disease management (Bodenheimer et al., 2002).

Clinical Outcomes: The study observed notable improvements in lung function among participants in the intervention group, with significant increases in FEV1 and FVC from baseline to 6 months. These improvements are consistent with the findings of other studies that have linked better compliance with improved lung function in patients with chronic respiratory diseases. The control group showed minimal changes in lung function, suggesting that standard care alone may be insufficient to achieve optimal therapeutic outcomes.

Health-Related Quality of Life (HRQoL): The intervention group reported significant improvements in HRQoL, as evidenced by decreased SGRQ scores and increased EQ-5D scores. The reduction in SGRQ scores indicates fewer respiratory symptoms and better overall health status, while the increase in EQ-5D scores reflects improved quality of life. These findings are in line with literature that demonstrates a positive correlation between adherence to treatment and improved quality of life (Marin et al., 2010; Bourbeau et al., 2003). The structured education likely contributed to these improvements by equipping patients with the knowledge and skills needed to manage their condition more effectively.

Hospitalizations: A reduction in respiratory-related hospitalizations was observed in the intervention group compared to the control group. This is a critical finding, as fewer hospitalizations can lead to reduced

healthcare costs and improved patient outcomes. Previous research has shown that patient education can reduce the frequency of hospital admissions by improving disease management and adherence to therapy (Effing et al., 2007). The structured education provided in this study may have played a key role in preventing exacerbations that lead to hospitalization.

Limitations

While the study provides valuable insights, it is important to acknowledge its limitations. The sample size of 50 participants, while sufficient for this study, may limit the generalizability of the findings. Additionally, the study's duration was 6 months; longer-term follow-up would be beneficial to assess the sustained impact of the education program on compliance and clinical outcomes. Self-reported compliance and HRQoL measures may also be subject to reporting biases, although these are standard measures in such research.

Future Research

Future studies should consider larger sample sizes and extended follow-up periods to confirm and build on these findings. Additionally, exploring the cost-effectiveness of structured education programs and their impact on long-term health outcomes would be valuable. Investigating the specific components of the education program that most significantly influence patient outcomes could also provide insights for optimizing educational interventions.

Conclusion

The study highlights that structured patient education programs can significantly enhance compliance with home oxygen therapy, improve lung function, and positively affect quality of life. These findings underscore the need for integrating comprehensive education into the management of home oxygen therapy to achieve better patient outcomes and reduce healthcare utilization.

References

1. Bodenheimer, T., Wagner, E. H., & Grumbach, K. (2002). Improving primary care for patients with chronic illness. *Jama*, 288(14), 1775-1779.
2. Bourbeau, J., Julien, M., Maltais, F., Rouleau, M., Beupré, A., Bégin, R., ... & Chronic Obstructive Pulmonary Disease axis of the Respiratory Network Fonds de la Recherche en Santé du Québec. (2003). Reduction of hospital utilization in patients with chronic obstructive pulmonary disease: a disease-specific self-management intervention. *Archives of internal medicine*, 163(5), 585-591.
3. Effing, T., Monnikhof, E. E., Van Der Valk, P. P., Zielhuis, G. G., Walters, E. H., Van Der Palen, J. J., & Zwerink, M. (2007). Self-management education for patients with chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews*, (4).
4. Gauthier, A., Bernard, S., Bernard, E., Simard, S., Maltais, F., & Lacasse, Y. (2018). Adherence to long-term oxygen therapy in patients with chronic obstructive pulmonary disease. *Chronic respiratory disease*, 16, 1479972318767724.
5. Jacobs, S. S., Krishnan, J. A., Lederer, D. J., Ghazipura, M., Hossain, T., Tan, A. Y. M., ... & Holland, A. E. (2020). Home oxygen therapy for adults with chronic lung disease. An official American Thoracic Society clinical practice guideline. *American journal of respiratory and critical care medicine*, 202(10), e121-e141.
6. Maltais, F., Bourbeau, J., Shapiro, S., Lacasse, Y., Perrault, H., Baltzan, M., ... & Bernard, S. (2008). Effects of home-based pulmonary rehabilitation in patients with chronic obstructive pulmonary disease: a randomized trial. *Annals of internal medicine*, 149(12), 869-878.
7. Marin, J. M., Soriano, J. B., Carrizo, S. J., Boldova, A., & Celli, B. R. (2010). Outcomes in patients with chronic obstructive pulmonary disease and obstructive sleep apnea: the overlap syndrome. *American journal of respiratory and critical care medicine*, 182(3), 325-331.
8. Murphy, P. B., Rehal, S., Arbane, G., Bourke, S., Calverley, P. M., Crook, A. M., ... & Hart, N. (2017). Effect of home noninvasive ventilation with oxygen therapy vs oxygen therapy alone on hospital readmission or death after an acute COPD exacerbation: a randomized clinical trial. *Jama*, 317(21), 2177-2186.

10. NICE (2021). Home Oxygen Therapy for Adults with Chronic Respiratory Conditions. National Institute for Health and Care Excellence. Retrieved from [NICE website](https://www.nice.org.uk/guidance/ng115).