

## Capnography-Assisted Respiratory Therapy's Acceptability As A Novel Mind-Body Treatment For COPD

Abdulrahman Theeb Mohammed Alqahtani<sup>1</sup>, Khaled Mohammed Nahil Alotaibi<sup>2</sup>, Amer Obelk Attya Alanazi<sup>3</sup>,  
Owaidh Faisal Bijad Albagami<sup>4</sup>

<sup>1-4</sup>Respiratory Therapy Technician.

### **Abstract:**

For patients with COPD, self-management of dyspnea is frequently suboptimal. Chronic dyspnea is distressing and incapacitating for many patients with COPD, especially when they are exercising. A behavioral intervention called breathing therapy aims to lessen the discomfort caused by dyspnea and its effects on daily living exertion.

After 14 patients underwent capnography-assisted respiratory therapy (CART), a novel mind-body breathing therapy intervention adjunct, in conjunction with outpatient pulmonary rehabilitation, we interviewed them using a qualitative design. Patient-centered biofeedback, customized breathing techniques, a home workout regimen, and motivational interviewing counseling comprised the comprehensive CART. In order to determine the acceptability of CART and make necessary adjustments based on participant feedback, we evaluated their perceptions and reported experiences. To find themes and commonalities, constant comparative analysis was employed.

We identified three main themes relating to the acceptability and reported benefits of CART: (1) self-regulating breathing; (2) impact on health; and (3) patient satisfaction. Our findings were used to refine and optimise CART (i.e. its intensity, timing and format) for COPD. By addressing dysfunctional breathing behaviours and dysregulated interoception, CART offers a promising new paradigm for relieving dyspnoea and related anxiety in patients with COPD.

**Keywords:** Respiratory therapy's, Capnography-assisted acceptability, Copd.

## Introduction

The third most common cause of death worldwide is COPD. Airflow restriction and dysfunctional breathing are hallmarks of COPD, which results in abnormal oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) levels. Specifically, the abnormally fast, upper thoracic-dominant breathing pattern that is typical of COPD leaves the lungs with little time to empty, which leads to dyspnea and abnormal CO<sub>2</sub> levels. The main symptom of COPD is dyspnea, or labored, uncomfortable breathing. It is a highly unpleasant symptom that causes severe anxiety and distress and is felt as suffocation, air hunger, and unfulfilled inspiration (Siu , 2016). Hyperventilation-induced airway hypocapnia (low CO<sub>2</sub>) exacerbates bronchoconstriction and airway secretions, making breathing more difficult and producing a dyspnea sensation. Tachypnea and shallow breathing are examples of dysfunctional breathing patterns that are linked to a vicious cycle of anxiety, physical activity and exercise limitations, and dyspnea. Therefore, tachypnea brought on by emotional stress and exercise intolerance can result in neuromechanical uncoupling (ventilatory pump failure and CO<sub>2</sub> retention), which can cause fear and, in certain situations, necessitate emergency medical attention. Due to limited treatment options and low pulmonary rehabilitation uptake, dyspnea management in COPD populations remains suboptimal (Kummer , 2010).

In order to help patients break the cycle of increased dyspnea and associated anxiety, breathing therapy is a crucial part of pulmonary rehabilitation and self-management interventions. More psychological and educational services for dyspnea remediation are recommended by experts. Patients can learn to control their respiratory rate, flow, and depth to help manage their symptoms because the brainstem and skeletal muscles control the respiratory muscles. However, due to the large range of breathing exercises and protocols that have been studied, the effects of breathing therapy on dyspnea and associated disability in COPD have been unclear. Therefore, additional data regarding the efficacy of breathing therapy as a supplement to exercise training is required in order to direct clinical practice and the provision of care ( O'Donnell , 2007 ).

A new method for treating underlying dysfunctional breathing patterns and abnormal CO<sub>2</sub> levels in patients with COPD is capnography- assisted respiratory training, or CART. In order to treat dyspnea and related anxiety symptoms, CART is a comprehensive, multi- component, patient-centered intervention that focuses on learning more functional breathing habits and achieving optimal CO<sub>2</sub> levels (eucapnic or balanced breathing) through real-time breathing biofeedback, breathing exercises, and counseling.

"Providing the care that the patient needs in the manner that the patient desires at the time that the patient desires, including the ability to be active partners in their care and the opportunity to share in treatment decisions" is the definition of patient-centered care, a quality indicator. The study's objectives were to evaluate the acceptability of CART in adults with COPD when paired with outpatient pulmonary rehabilitation and to make necessary adjustments to CART in response to participant feedback. "The belief among implementation stakeholders that a particular treatment, service, practice, or innovation is agreeable, palatable, or satisfactory" is what is meant by acceptability (Cooper , 2006).

#### **Methods - Assessments:**

Descriptive information about patients' experiences with CART was gathered using a qualitative design. In order to support the continued development and application of the CART intervention, open-ended questions offered a chance to gain a deeper understanding of its acceptability, satisfaction, and addressable contextual challenges. After the intervention, semi-structured, in-depth interviews lasting 15 to 30 minutes were conducted by trained interviewers over the phone or in person.

The Social Cognitive Theory served as the foundation for the development of the intervention evaluation questions, which were centered on how the intervention addressed self-management techniques like behavior modification and self-efficacy (Macklem , 2010).

#### **CART Programme:**

Our qualitative study's objectives were to better understand participants' perceptions of CART, a novel mind-body therapy that supplements pulmonary rehabilitation, and to make necessary adjustments to CART in response to their input.

The beneficial in-session breathing computer biofeedback and the resources to support at-home breathing exercises for dyspnea relief were two aspects of the CART program that participants particularly emphasized. In general, participants said it was simple to carry out the breathing exercises at home on their own. Additionally, participants reported being better able to detect and control their breathing patterns, particularly slowing their rate of breathing. They claimed that practicing mindful breathing led to feelings of serenity and tranquility as well as a renewed sense of trust and connection to their bodies for improved wellbeing. One promising advantage of CART, according to some participants, is an increased capacity to tolerate and stick with exercise (O'Donnell , 2019).

In adults with COPD, dysfunctional and ineffective breathing patterns are particularly common. Hyperventilation, thoracic-dominant breathing, tachypnea, open-mouth breathing, thoraco-

abdominal asynchrony, and deep sighing are some of these patterns. CART may lessen physiological impairment (hypocapnia, hypercapnia, lung hyperinflation, impaired respiratory muscle function, and ineffective recovery from a breathing challenge) linked to both dyspnea and comorbid anxiety by addressing dysfunctional behavioral breathing habits.

#### **Health Benefits :**

The health benefits of our modified CART intervention for COPD that patients reported may have been caused by a number of mechanisms. To lessen the symptoms of anxiety and dyspnea, CART placed a strong emphasis on eucapnic breathing and effective breathing techniques. Some participants gained the ability to correlate dyspnea symptoms with changes in ETCO<sub>2</sub>. Similarly, (Meuret et al. 2010) discovered that, in contrast to a cognitive therapy control group, ETCO<sub>2</sub> mediated changes in anxiety control in a CART treatment group in patients with panic disorder. Better expectations for breathing pattern control and a reassessment of the risk of dyspnea in people with COPD may have lessened stress reactions and learned helplessness ( Laviolette , 2014 ).

#### **CART enhanced breathing:**

CART may help patients develop resilience to episodes of worsened breathing by restoring a perceived sense of control over anticipating and experiencing aversive dyspnea sensations. Through desensitization that is, addressing a sensitized suffocation alarm system—breathing exercises may also have increased a low arterial CO<sub>2</sub> tension (PaCO<sub>2</sub>) set point. By easing the tension in the respiratory muscles, exercises may have also helped with dyspnea (Reardon , 2006 ).

Additionally, CART may have enhanced breathing interoception regulation to foster resilience (better adaptation to the stress of dyspnea). According to a recent study, people with low resilience were much less aware of their bodies and less receptive to interoceptive breathing signals, which may have increased their anxiety and body prediction errors. Specifically, they discovered that when anticipating aversive dyspnea, low-resilience individuals' thalamus and middle insula were more activated than those of normal and high-resilience individuals ( Mularski , 2013). They maintained that a mismatch between actual and expected body states led to exaggerated and ineffective limbic system neural processing in less resilient people, and that trouble observing bodily stimuli resulted in a less adaptive reaction to stressful breathing sensations. Participants in our study may have better anticipated breathing difficulties and used relief techniques in advance of dyspnea with exercise and other physical activities because they were more aware of their bodies following CART.

### **Recommendations:**

The acceptability of CART in adults with COPD is being assessed for the first time in a qualitative study. Our study was limited by the fact that four participants who received (at least one) CART session were not interviewed; this could have affected how they perceived CART. A more thorough qualitative assessment of CART acceptability might have been obtained through repeated interviews with longer follow-up, but this was not feasible. To assess the effectiveness of CART in managing symptoms and enhancing the results of pulmonary rehabilitation and its use in COPD, more research is required. In a subsequent study, it will also be crucial to examine the effects of CART independently of pulmonary rehabilitation.

### **Conclusion:**

Our main discovery was that patients with COPD thought individually tailored CART was acceptable. In order to improve the quality and adherence monitoring of home-based exercises and to extend the program and offer it prior to pulmonary rehabilitation, specific feedback will be used to optimize and refine the CART dose. This study addressed the need for novel, patient-centered, mind-body techniques and comprehensive breathing therapy to alleviate the distressing symptoms of anxiety and dyspnea associated with chronic lung diseases. CART has the potential to improve the way pulmonary rehabilitation is implemented and symptoms are managed, which will improve quality of life and lessen disability in COPD patients. Therefore, more research on CART is necessary.

### **References:**

1. Siu AL, Bibbins-Domingo K, Grossman DC, et al. . Screening for chronic obstructive pulmonary disease: US preventive services task force recommendation statement. *JAMA* 2016; 315: 1372–1377.
2. Terzikhan N, Verhamme KM, Hofman A, et al. . Prevalence and incidence of COPD in smokers and non-smokers: the Rotterdam study. *Eur J Epidemiol* 2016; 31: 785–792.
3. Kummer F. Panic attacks in COPD and the somato-psycho-somatic feedback. *Eur Respir J* 2010; 36: 457.; author reply 457–458.
4. O'Donnell DE, Banzett RB, Carrieri-Kohlman V, et al. . Pathophysiology of dyspnea in chronic obstructive pulmonary disease: a roundtable. *Proc Am Thorac Soc* 2007; 4: 145–168.
5. Cooper CB. The connection between chronic obstructive pulmonary disease symptoms and hyperinflation and its impact on exercise and function. *Am J Med* 2006; 119: 10

Suppl. 1, 21–31.

6. Macklem PT. Therapeutic implications of the pathophysiology of COPD. *Eur Respir J* 2010; 35: 676–680.
7. O'Donnell DE, James MD, Milne KM, et al. . The pathophysiology of dyspnea and exercise intolerance in chronic obstructive pulmonary disease. *Clin Chest Med* 2019; 40: 343–366.
8. Laviolette L, Laveneziana P. Dyspnoea: a multidimensional and multidisciplinary approach. *Eur Respir J* 2014; 43: 1750–1762.
9. Reardon JZ, Lareau SC, ZuWallack R. Functional status and quality of life in chronic obstructive pulmonary disease. *Am J Med* 2006; 119: 10 Suppl. 1, 32–37.
10. O'Donnell DE, Ora J, Webb KA, et al. . Mechanisms of activity-related dyspnea in pulmonary diseases. *Respir Physiol Neurobiol* 2009; 167: 116–132.
11. Mularski RA, Reinke LF, Carrieri-Kohlman V, et al. . An official American Thoracic Society workshop report: assessment and palliative management of dyspnea crisis. *Ann Am Thorac Soc* 2013; 10: S98–106.
12. Effing TW, Bourbeau J, Vercoulen J, et al. . Self-management programmes for COPD: moving forward. *Chron Respir Dis* 2012; 9: 27–35.