

ORIGINAL ARTICLE

Perceptions and Clinical Practice of Using Airway Clearance Devices in Chronic Obstructive Pulmonary Disease: A Cross-Sectional Survey of Respiratory Care and Physiotherapy Practitioners in Saudi Arabia

Ahmed A. Alzahrani^{1,3,4}, Saeed M. Alghamdi², Mansour S. Majrshi^{3,4,8}, Ali M. Alasmari¹, Ziyad D. Alshehri¹, Fahad H. Alahmadi¹, Sultan Ali Qahtani⁹, Abdulrahman Alhawsawi¹, Ahmed H. Alasimi⁵, Owis Eilayyan⁶, Michael I Polkey^{3,4}, Surinder S Birring⁷, Hopkinson N.S.^{3,4}

¹Respiratory Therapy Department, Medical Rehabilitation Sciences College, Taibah University, Medinah, Saudi Arabia

²Clinical Technology Department, Respiratory Care Program, Faculty of Applied Medical Sciences, Umm Al-Qura University, Makkah, Saudi Arabia

³National Heart and Lung Institute, Imperial College London, London, UK.

⁴Respiratory Medicine, Royal Brompton Hospital, London, UK

⁵Department of Respiratory Therapy, GA State University, Atlanta, GA, USA

⁶Al-Ahliyya Amman University, Department of Physical Therapy, Amman, Jordan

⁷Centre for Human & Applied Physiological Sciences, School of Basic & Medical Biosciences, Faculty of Life Sciences & Medicine, King's College London

⁸King Abdulaziz University Hospital, Respiratory Therapy Department, King Abdulaziz University, Jeddah, Saudi Arabia

⁹Sheikh Shakhbout Medical City, Abu Dhabi, United Arab Emirates

Address for correspondence:

Ahmed A. Alzahrani, MScs
Respiratory Therapy
Department, Medical
Rehabilitation Sciences
College, Taibah University,
Medinah, Saudi Arabia

E-mail:

aazahrani@taibahu.edu.sa

Submission: 08-05-2025

Accepted: 18-08-2025

Published: 01-09-2025

This article can be accessed
online at:
<https://journals.kau.edu.sa/index.php/JRS/index>
Doi: 10.4197/Mrs.2-2.5

Abstract

Background: Effective airway clearance is a critical component of chronic obstructive pulmonary disease (COPD) management. Airway clearance devices (ACDs) can assist this, but their effectiveness relies on consistent use in clinical practice. **Objectives:** To identify awareness and clinical practice related to device use for people with COPD among respiratory therapists and physiotherapists in Saudi Arabia. **Materials and Methods:** The study employed A cross-sectional online survey was conducted across Primary and secondary healthcare among respiratory care and physiotherapy practitioners working in various healthcare settings across Saudi Arabia. The survey assessed familiarity with, attitudes towards, and utilisation of different types of ACDs in different clinical scenarios. **Results:** 423 healthcare practitioners completed the survey. The survey participants were predominantly male (57%), with a median age range of 20–30 years. They were predominantly Saudi citizens (89.4%), bachelor's degree holders (82.5%), respiratory therapists (84.2%), and worked in governmental hospitals (58.9%). Almost all participants were aware of at least one ACD, with Flutter devices (58%) being the most recognised, followed by Acapella (30%). 77.5% of participants reported always or usually using devices in patients with daily difficulty in clearing thick sputum, but there was less consistency where the sputum burden was not as severe. The Acapella device was preferred by 56%, with 18% preferring the Flutter. 85% of participants reported basing device use on clinical practice guidelines, with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines being the most cited. **Conclusion:** Awareness of sputum clearance devices is high among this group of healthcare professionals in Saudi Arabia, but variation in practice highlights the need for further research.

Keywords: Chronic Obstructive Pulmonary Disease; Airway Clearance Devices; Adjunct for Sputum Clearance; Respiratory Therapy, Physiotherapy, Saudi Arabia

Alzahrani (2025). Open access. The Journal of Medical Rehabilitation Science is an Official Publication of King Abdulaziz University. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

How to cite this article: Alzahrani AA, Alghamdi SM, Majrshi MS, et al. Perceptions and clinical practice of using airway clearance devices in chronic obstructive pulmonary disease: A cross-sectional survey of respiratory care and physiotherapy practitioners in Saudi Arabia. *J Med Rehab Sci.* 2025; 2(2):82-93.

Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive and debilitating respiratory condition that affects millions of individuals worldwide. Characterised by persistent airflow limitation and chronic respiratory symptoms, such as breathlessness, chronic cough, and excessive mucus production, COPD is a major cause of morbidity and mortality globally. According to the World Health Organisation, COPD ranks as the third leading cause of death, with over 3 million deaths annually attributed to the disease. The primary risk factors for developing COPD include smoking, exposure to harmful pollutants, early life disadvantage, and genetic predispositions, including alpha-1 antitrypsin deficiency [1,2]. As the disease progresses, COPD patients often experience acute exacerbations, marked by worsening respiratory symptoms and increased mucus production, which can significantly reduce quality of life and lead to frequent hospitalisations.

Airway clearance is a central component of COPD management, particularly for patients who experience frequent mucus retention. Mucus hypersecretion and impaired mucociliary clearance are characteristic features of COPD, which can contribute to the obstruction of airways, increase the risk of infections, and exacerbate the inflammatory processes within the lungs. Standard therapeutic interventions include smoking cessation, pharmacological treatments such as bronchodilators and corticosteroids to reduce inflammation and improve airflow, as well as learning chest physiotherapy manoeuvres like the Active Cycle of Breathing (ACBT). However, for patients who struggle with effective mucus clearance, additional non-pharmacological interventions, such as the use of airway clearance devices (ACDs), can be recommended [3–6].

These devices facilitate the clearance of secretions from the airways by generating positive expiratory pressure or oscillations that loosen mucus, making it easier to expectorate. Several types of ACDs are commonly used, including positive expiratory pressure (PEP) devices, oscillating PEP devices such as the Acapella and Flutter, and high-frequency chest wall oscillation devices. Clinical studies have shown that these devices not only improve mucus clearance but also enhance exercise capacity, reduce the frequency of exacerbations, and improve overall quality of life for COPD patients [5,7,8]. The use of ACDs in COPD management varies significantly across different healthcare systems and geographic regions [9–11].

Studies conducted in the UK indicate a significant discrepancy has been noted between the prescription of carbocysteine, a mucolytic agent, and ACDs such as

the Acapella or Flutter devices, with the former being prescribed at a much higher rate [3,7]. While the clinical benefits of ACDs may be acknowledged, possible barriers related to clinician familiarity, device accessibility, or patient preference limit their widespread use.

Airway Clearance Devices in Saudi Arabia

Saudi Arabia faces significant challenges in addressing COPD due to rapid industrialisation, rising human activity emissions, increased prevalence of smoking, and environmental factors such as frequent dust storms, all of which contribute to the rising burden of respiratory diseases in the country [12]. According to local health statistics, COPD remains underdiagnosed and undertreated in many regions, particularly in rural areas where access to specialised respiratory services remains limited [13–15].

Although national guidelines, such as those from the Saudi Thoracic Society, outline general management strategies for COPD, they provide limited guidance on Airway Clearance Devices (ACDs), including oscillatory positive expiratory pressure (OPEP) devices, which are suggested as additional support for patients with persistent mucus production [16]. Devices like the Flutter and Acapella are recognised for their effectiveness in sputum clearance, yet their integration into COPD care in Saudi Arabia is often overlooked. This may stem from a lack of detailed protocols for incorporating these devices into standard practice. Additionally, while international guidelines, such as the GOLD recommendations, endorse airway clearance techniques for suitable patients, the implementation of ACDs in Saudi Arabia remains inconsistent. A previous survey revealed that although healthcare providers in Saudi Arabia are aware of the existence and benefits of ACDs, their use in clinical practice was limited [9]. The study highlighted that while devices like the Flutter and Acapella are known to many practitioners, they are often underutilised, with pharmacological treatments such as bronchodilators and mucolytics taking precedence [9].

Several factors contribute to the limited use of ACDs in Saudi Arabia. These include a lack of training and education among healthcare providers regarding the proper use of these devices, variability in clinical practice guidelines, and limited access to respiratory physiotherapists who are trained to prescribe and manage ACD therapy. There is a need for more robust clinical data from local studies to support the routine use of ACDs in COPD management, as much of the current research is based on studies conducted in Western populations with potentially different disease phenotypes and healthcare contexts [10,11,17].

Materials and Methods

Study Design

This study used a cross-sectional survey design to evaluate perceptions and clinical practice regarding the utilisation of airway clearance devices (ACDs). The survey was conducted online, specifically targeting healthcare professionals specialising in respiratory therapy and physiotherapy within Saudi Arabia.

Participants

The database from the Saudi Commission for Health Specialties (SCFHS) was used to identify and access the contact information of certified/ registered respiratory therapists (RTs) and physiotherapists (PTs), who were contacted by email to invite them to participate in the study. The invitation was also distributed via the WhatsApp mobile application for the Saudi Respiratory Therapy Group and the Physiotherapy Group. The included population in this study was licensed RTs and PTs who worked with COPD patients, and this was stated clearly in the consent form as well as the invitation to this study. Exclusion criteria were RTs and PTs students, administrative staff, or those not involved in direct COPD care.

Sample size

The sample size for this study was determined using a standard formula for descriptive cross-sectional studies. According to the recent data, the number of respiratory therapists in Saudi Arabia is around 3618, and assuming a 95% confidence level, a 5% margin of error, and an expected response distribution of 50% (the most conservative estimate to ensure maximum sample size), the minimum required sample size was calculated to be 348 participants [18,19].

Questionnaire Development

The questionnaire used in this study was a validated tool previously employed by Alghamdi et al. to collect data on mucus clearance devices among healthcare practitioners. It was originally developed to assess key aspects of clinical practice related to the use of airway clearance devices (ACDs) in the management of COPD patients [9]. It included questions to evaluate awareness of devices such as Flutter, Acapella, Aerobika, and PEP masks, as well as the frequency of use in specific clinical scenarios rated on a 5-point Likert scale (always to never). Participants were asked about the number of patients started on these devices in the past year, their preferred device, and how they provide devices to patients (e.g., prescription or patient purchase). Additionally, the survey addressed adherence to clinical practice guidelines as detailed in

Table 1. The mixed format of closed-ended and scenario-based questions ensured a detailed understanding of both knowledge and practice trends.

Data Analysis

The data gathered from the survey were analysed using Statistical Package for the Social Sciences (SPSS) software to extract descriptive statistics and identify trends. The descriptive statistics provided a detailed overview of the sample, including demographic information, levels of experience, and the professional roles of the participants. For questions about the frequency of device use in different clinical scenarios, responses were initially categorised on a 5-point Likert scale: “always,” “usually,” “sometimes,” “rarely,” and “never.” Data were reported using frequencies and percentages.

Results

Participant Characteristics

A total of 423 healthcare providers participated in the online survey. The demographic characteristics of the participants are detailed in Table 2. The majority of respondents were male ($n = 241$, 57%) and aged between 20 and 30 years ($n = 287$, 67.8%). Most participants held a bachelor's degree ($n = 349$, 82.5%) and were Saudi nationals ($n = 378$, 89.4%). Respiratory therapists constituted the largest professional group ($n = 356$, 84.2%), and physiotherapists ($n = 67$, 15.8%). The predominant workplace setting was governmental hospitals ($n = 365$, 86.3%). In terms of clinical experience, the largest group had 3–4 years of experience ($n = 156$, 36.9%), followed closely by those with 1–2 years ($n = 108$, 25.5%) and 5–6 years ($n = 115$, 27.2%). Table 2 presents the characteristics of survey participants.

Awareness of Airway Clearance Devices

Participant awareness of various airway clearance devices ACD was assessed. All participants (423 out of 423) reported awareness of at least one ACD. The most commonly recognized devices were Acapella and Flutter. As shown in Figure 1, awareness of the different types of ACDs generally increased with years of clinical experience. For instance, awareness of Flutter increased from 50% among those with 1–2 years of experience to 70% among those with more than 8 years. Similarly, awareness of a cappella increased from 30% to 50%, PEP Mask from 10% to 30%, Aerobika from 5% to 15%, and Aerosure from 3% to 10% across the same experience ranges. Figure 1 presents awareness of ACDs in relation to years of experience.

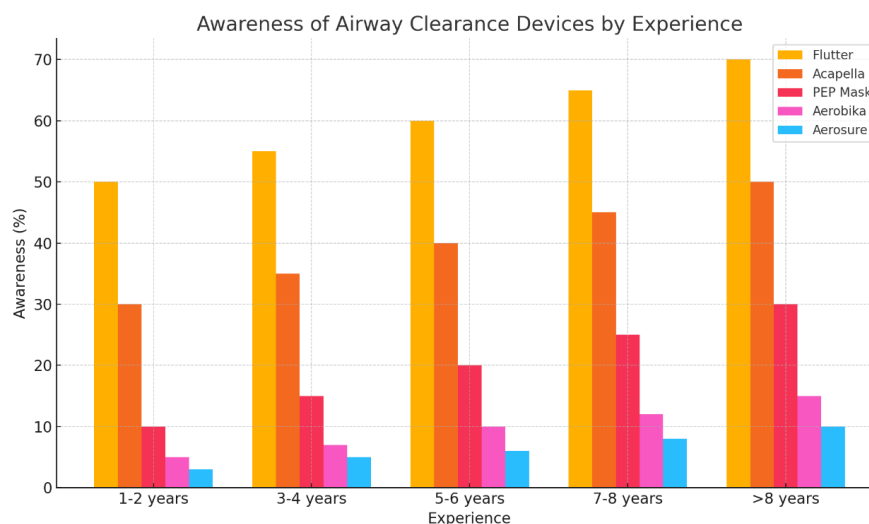
TABLE 1. SURVEY ON USE OF AIRWAY CLEARANCE DEVICES IN COPD CARE

Items	Questions	Options/Scenarios	Response	Additional Information
Awareness	Which of the following sputum clearance devices are you aware of?	<ul style="list-style-type: none"> Flutter Acapella Aerobika Bubble Positive Expiratory Pressure (PEP) OPEP mask Other (please specify) 	Pick one of them (Pictures of the devices were provided in the survey)	
Consideration of using ACDs with COPD	How often would you consider the use of an Airway clearance device to help with Airway clearance in the following situation?	<ul style="list-style-type: none"> COPD patient with daily difficulty clearing thick sputum. COPD patient producing sputum throughout the day, but is able to clear it. COPD patient with morning sputum only. COPD patient who only have sputum with exacerbations. Has 0-1 exacerbations/year. COPD patients who only has sputum with exacerbations. Has 2-3 exacerbations/year 	<ul style="list-style-type: none"> Always Usually Sometimes Rarely Never 	For this question, assume that the person has been taught an active cycle of breathing techniques or standard care for Airway clearance in your place
Consideration of using ACDs with COPD	How many patients with COPD have you actually started on the following devices in the last 12 months?	<ul style="list-style-type: none"> Flutter Acapella Aerobika PEP mas Other devices, please specify 	<ul style="list-style-type: none"> None 1-2 3-5 >5 	
Preference	Device preference - if only one device were available for COPD patients, which would you choose?	<ul style="list-style-type: none"> Flutter Acapella Aerobika PEP mask Other (please specify) 	Pick one of them	
Preference	How would you usually provide an Airway clearance device to a COPD patient?	<ul style="list-style-type: none"> I do not provide them. I have them available to give to patients. Prescription. Advise the patient to buy their own. Other (please specify) 	Pick the one that applies most commonly	
Guidelines adhering	Do you recommend the use of an Airway device in COPD based on the clinical practice guidelines?	<ul style="list-style-type: none"> YES NO 	Choose one of them	
Guidelines adhering	If yes, could you please select the most suitable clinical practice guideline you adhere to?	<ul style="list-style-type: none"> Saudi Thoracic Society. Domestic clinical practice guidelines at your centre/ hospital. GOLD guidelines for COPD. NICE guidelines for COPD. AARC guidelines for COPD 	Choose one of them	

Note: GOLD; Global Initiative for Chronic Obstructive Lung Disease, AARC; American Association for Respiratory Care, NICE; National Institute for Health and Care Excellence, COPD; Chronic Obstructive Pulmonary Disease. Demographic data were collected as part of this questionnaire. Also, there was a statement and consent form to check as "Yes" or "No" before the participants could proceed to the questionnaire.

TABLE 2. CHARACTERISTICS OF SURVEY PARTICIPANTS (N = 423)

Variable	N (%)
Gender	
Male	241 (56.9%)
Female	182 (43.1%)
Age range	
20–30	287 (67.8%)
31–40	105 (24.8%)
41–50	26 (6.1%)
51–60	4 (0.9%)
61–70	1 (0.2%)
Level of education	
Associate diploma	19 (4.5%)
Bachelor's Degree	349 (82.5%)
Master	46 (10.9%)
PhD	9 (2.1%)
Workplace	
Governmental Hospital	365 (86.3%)
Non-Governmental Hospital/Private	58 (13.7%)
Nationality	
Saudi	378 (89.4%)
Non-Saudi	45 (10.6%)
Profession	
Respiratory Therapists	356 (84.2%)
Physiotherapists	67 (15.8%)
Experience	
1-2 years	108 (25.5%)
3-4 years	156 (36.9%)
5-6 years	115 (27.2%)
7-8 years	17 (4%)
>8 years	27 (6.4%)

**FIGURE 1. AWARENESS OF ACDS AND THE EXPERIENCE YEARS.**

Use of Airway Clearance Devices for COPD Management in Clinical Scenarios

Figure 2 presents clinicians' reported frequencies of using ACDs across six distinct clinical scenarios. The data show substantial variation in ACD use depending on the severity and nature of the patient's symptoms. Patients with daily thick sputum demonstrated the highest rates of consistent ACD use. In this group, 37.1% of clinicians reported "Always" using ACDs, while 32.0% reported "Usually," and none reported "Never." This indicates a strong consensus on the clinical value of ACDs in managing persistent and severe sputum production. For individuals who produce sputum but are able to clear it, the use of ACDs was more moderate and varied. Only 11.3% of clinicians reported "Always" using ACDs, while the majority chose "Sometimes" (34.8%) or "Usually" (26.3%). A notable portion (11.5%) reported "Never" using ACDs, suggesting that ACDs are less commonly recommended when patients can self-clear. In cases with morning sputum only, clinicians predominantly selected "Sometimes" (44.4%) or "Rarely" (22.3%), and just 9.6% reported "Always" using ACDs. This scenario reflects a more conservative use pattern, likely due to the transient or less bothersome nature of symptoms. For patients experiencing 1–2 exacerbations per year, a substantial proportion of clinicians reported "Usually" (41.3%) or "Always" (29.8%) using ACDs. As the frequency of exacerbations increased to 2–3 per year, the preference for regular ACD use grew stronger, with 41.0% selecting "Always" and 34.5% "Usually." The scenario of more than four exacerbations per year showed the highest level of ACD utilization, with 58.7% of clinicians choosing "Always" and 31.4% "Usually." Only 1.8% reported "Never" using ACDs in this group, reflecting a

nearly universal consensus on the importance of ACDs for patients with frequent exacerbations (Figure 2). Detailed responses for all participants were provided in supplementary file.

Clinical Practice for Using Airway Clearance devices

The bar chart below (Figure 3) illustrates clinicians' overall clinical practice patterns in using ACDs. The most common response was "Usually", reported by 35.8% of participants, followed by "Sometimes" at 27.7%. "Always" using ACDs was selected by 26.6%, indicating that just over a quarter of clinicians use them routinely. Less frequent use was less common, with "Rarely" at 7.4% and "Never" at only 2.5%. This distribution reflects a moderate to high adoption of ACDs in clinical practice, suggesting that while consistent use is not universal, most clinicians incorporate ACDs in some capacity. The relatively low rates of "Rarely" and "Never" indicate general agreement on the clinical utility of ACDs, though variability remains in the degree of implementation.

Recommend Airway Devices for COPD Based on Clinical Practice Guidelines.

Healthcare professionals were asked if they recommend using ACDs for COPD patients and whether they base their recommendations on clinical practice guidelines. If they said yes, they were then asked to choose which guideline they followed. This helped identify the most commonly used guidelines in their practice. RTs were found to be more guideline-compliant compared to PTs, where the data shows that RTs had a higher adherence

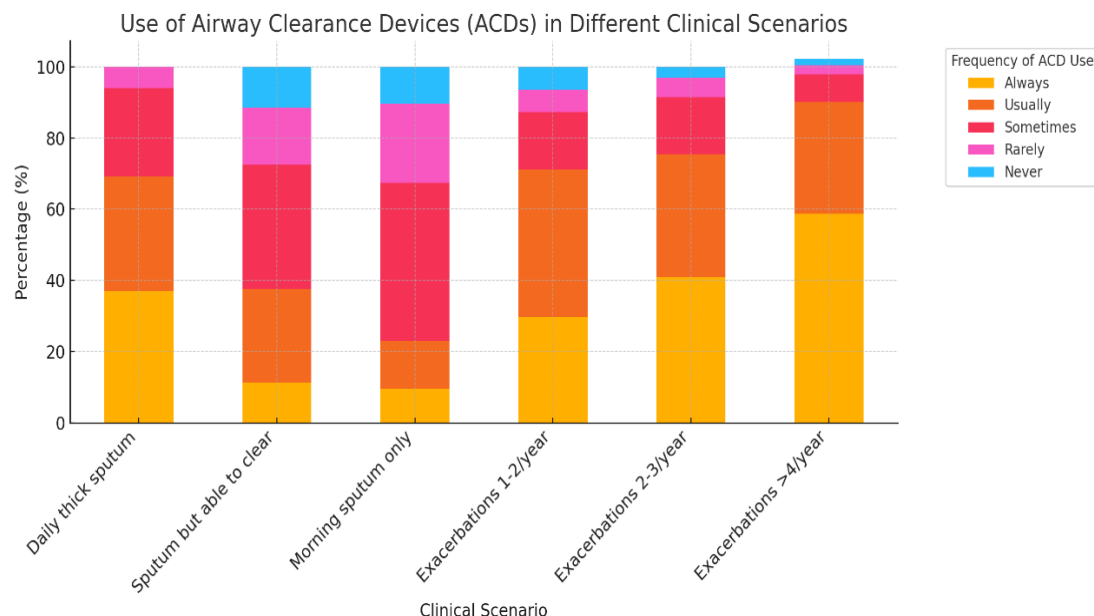


FIGURE 2. USE OF ACDs IN DIFFERENT CLINICAL SCENARIOS.

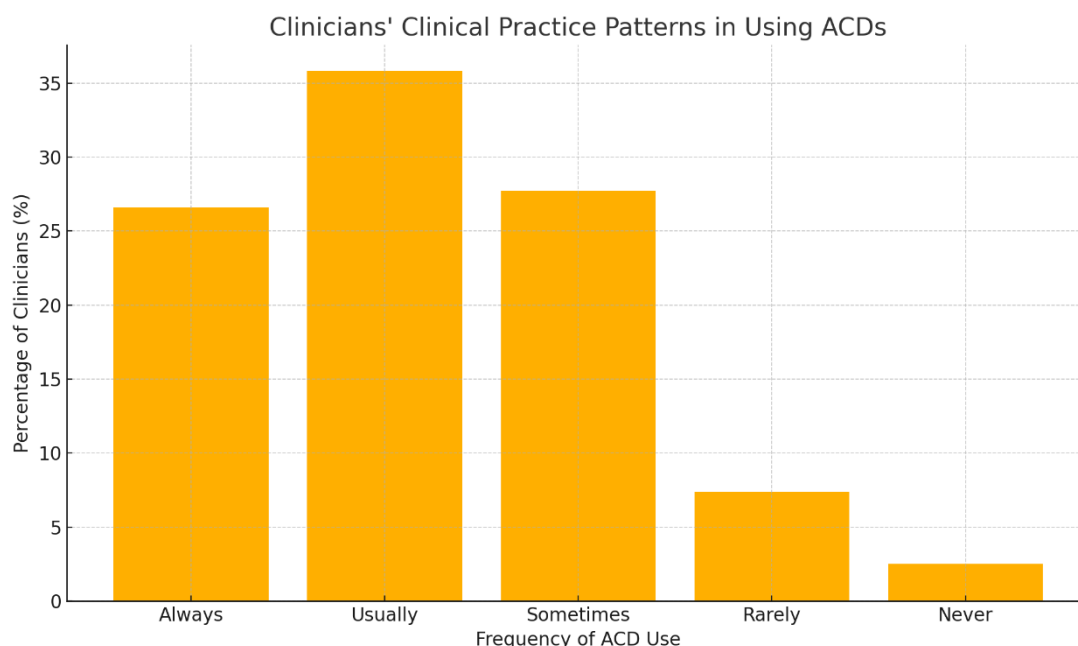


FIGURE 3. CLINICAL PRACTICE FOR USING AIRWAY CLEARANCE DEVICES ORGANISED BY YEARS OF EXPERIENCE.

percentage across all major guidelines, including GOLD, AARC, and the Saudi Thoracic Society guidelines. For instance, 90% of RTs adhered to the AARC guidelines, which emphasise the importance of oscillatory devices like Acapella, as these align closely with their specialised respiratory training focused on enhancing mucus clearance. Similarly, RTs adherence to GOLD guidelines was about 85%, reflecting their strong inclination towards evidence-based practice in managing sputum clearance. On the other hand, PTs demonstrated a slightly lower level of guidelines compliance, with adherence ranging from 55% to 85% depending on the specific guidelines. This lower adherence can be partly attributed to the broader focus of physiotherapy, which integrates respiratory care with overall patient mobility and physical rehabilitation. For example, adherence to NICE guidelines among PTs was around 55%, suggesting that their selective prioritising use of devices primarily in severe cases where cost-effectiveness and practical considerations are more relevant. Overall, the higher compliance rate between RTs reflects their specialised role and deeper focus on respiratory interventions, which aligns closely with the recommendations in established guidelines. PTs, while also adhering to guidelines, balance respiratory care with other therapeutic aspects, leading to slightly lower but still significant levels of adherence. The majority of participants report that their practice to prescribe or recommend ACDs is based on clinical guidelines [20–22]. Figure 4 presents adherence to clinical guidelines as reported by participants.

Discussion

The findings of this survey confirm that the majority of participants were aware of Flutter and Acapella, with these devices preferred by most participants. Generally, the RTs and PTs in this study considered using the ACDs with people with COPD and were more likely to use them in more severe disease. However, there was more variability in participants' responses regarding the use of ACDs with exacerbating patients.

The literature supported that the use of ACDs with people with COPD reduced the exacerbation frequency and symptoms and improved airway clearance [23–25]. The results of this study and previous work [26] showed that healthcare providers (HCPs), including RTs were aware of ACDs to help people with COPD, but there was variety in the perceptions of HCPs regarding the role of ACDs in treating COPD. This might be due to unclear evidence of the effect of ACDs on COPD symptoms [27,28] or that COPD treatment guidelines do not include clear recommendations to guide which people with COPD should receive them [27, 29–31].

A previous Saudi national study investigated the use of ACDs in clinical practice for COPD management [26]. However, the present study targets only RTs and PTs, who are the responsible for respiratory rehabilitation of people with COPD. The preference among RTs and PTs in Saudi Arabia to use Acapella for people with COPD, is similar to two studies that used a survey on PTs in the UK [32] and HCPs in Saudi Arabia [26]. Acapella is a

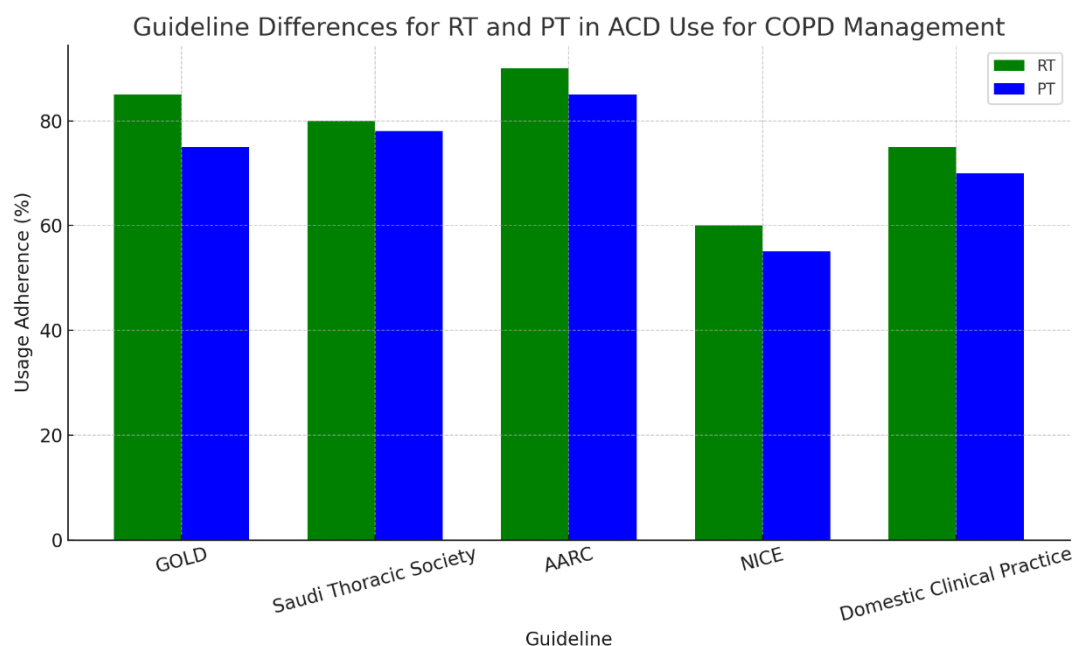


FIGURE 4. ADHERENCE TO GUIDELINES AS REPORTED BY THE PARTICIPANTS. DATA SHOW AS PERCENTAGES.

gravity-independent device (i.e., patients are able to use it at any position) [33], and it can generate “oscillating positive expiratory pressure” at very low expiratory flows [34].

Mucus clearance is one of the treatment goals for COPD, using ACDs is an approach that can be implemented for airway clearance in people with COPD. Participants in this study reported using the ACDs for COPD management regardless of the threshold of patients’ symptoms. In detail, ACDs have received more attention for COPD management for people with severe COPD symptoms, while ACDs have been used less frequently as a treatment for stable and less exacerbated COPD patients. This is consistent with the findings of the UK and Saudi studies [26,32]. The participants used different guidelines to prescribe or recommend ACDs. This is in line with other studies worldwide [20–22].

Looking to the results from this study, training and awareness remain critical components for the effective integration of ACDs in COPD management. The findings highlight the need for structured training programs to enhance clinicians’ proficiency, particularly among RTs and PTs. Strategies to enhance awareness—such as continuous professional development sessions, integration of ACD use into clinical competency evaluations, and targeted educational workshops—should be prioritized to strengthen clinical practice. Furthermore, given the geographical diversity of the Kingdom of Saudi Arabia, there is a pressing need to include a broader representation of healthcare practitioners from different regions to ensure generalizability and equity in access to ACD training. Lastly, the current study focused on clinicians’ perspectives; however, future research

should incorporate patient-reported outcomes, including satisfaction and perceived effectiveness of ACDs, to provide a more comprehensive evaluation of their impact on patients’ health.

Strengths and limitations

A key strength is the large and diverse sample of 423 RTs and PTs from various regions and healthcare settings across Saudi Arabia who are directly involved in the management of COPD patients, making the findings broadly representative and relevant.

The study addresses a gap in the literature by providing insights into the use of ACDs in COPD management, an area that has received limited attention in Saudi Arabia. However, the study’s cross-sectional design limits its ability to capture changes over time, and reliance on self-reported data introduces the potential for recall and social desirability bias.

The absence of qualitative data restricts a deeper exploration of the reasons behind certain practices, and the study does not extensively examine barriers to ACDs use, such as resource availability or patient adherence. Additionally, we were unable to assess the extent of participants’ awareness regarding the indications, contraindications, phenotypes, and proper storage of airway clearance devices, as these aspects should be evaluated in alignment with current clinical guidelines for COPD. Finally, while the findings are highly relevant within the context of Saudi Arabia, they may not be fully generalisable to healthcare systems in other countries with different clinical guidelines and resources.

Conclusion

There is still insufficient evidence to guide the precise use of ACDs in COPD management within the Kingdom of Saudi Arabia. These results support the need for further work to identify the extent of benefit in specific COPD phenotypes and to integrate the utilisation of ACDs into clinical guidelines for the management of COPD patients within the Kingdom.

Authors Contributions

Study collectively conceived and designed: Ahmed A. Alzahrani

Data collecting and analysis: Ahmed A. Alzahrani, Saeed M. Alghamdi, Ali M. Alasmari, Ziyad D. Alshehri, Fahad H. Ahmadi, Abdulrahman Alhawsawi, and Ahmed H. Alasimi.

Interpretation of data involved: Ahmed A. Alzahrani, Mansour S. Majrshi, Sultan Ali Qahtani, and Owis Eilayyan.

Manuscript draft and critical revision: Ahmed A. Alzahrani, Mansour S. Majrshi, Owis Eilayyan, Michael I. Polkey, Surinder S. Birring, and Hopkinson, N. S, Saeed M. Alghamdi.

All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Ethical Considerations

This study was reviewed and approved by the research ethics committee at Umm Al-Qura University at Makkah, ID UTBE050525. Participants were asked to consent before voluntary participation in the survey.

Funding

None

Competing Interest

None

Patient Consent Form

None

Data Sharing

All data is presented within the manuscript.

References

1. Hopkinson NS, Bush A, Allinson JP, Faner R, Zar HJ, Agustí A. Early Life Exposures and the Development of Chronic Obstructive Pulmonary Disease across the Life Course. *Am J Respir Crit Care Med*. 2024;210(5):572-580.
2. Williams PJ, Buttery SC, Lavery AA, Hopkinson NS. Lung Disease and Social Justice: Chronic Obstructive Pulmonary Disease as a Manifestation of Structural Violence. *American Journal of Respiratory and Critical Care Medicine*. 2024;209(8):938-946.
3. Barker R, Lavery AA, Hopkinson NS. Adjuncts for sputum clearance in COPD: clinical consensus versus actual use. *BMJ Open Respir Res*. 2017;4(1):e000226.
4. Hopkinson NS, Molyneux A, Pink J, Harrisingh MC. Chronic obstructive pulmonary disease: diagnosis and management: summary of updated NICE guidance. *BMJ*. 2019;366:l4486.
5. Poncin W, Schröder C, Oliveira A, Herrero B, Cnockaert P, Gely L, et al. Airway clearance techniques for people with acute exacerbation of COPD: a scoping review. *European Respiratory Review*. 2025;34(175).
6. Cross JL, Elender F, Barton G, Clark A, Shepstone L, Blyth A, et al. Evaluation of the effectiveness of manual chest physiotherapy techniques on quality of life at six months post exacerbation of COPD (MATREX): a randomised controlled equivalence trial. *BMC pulmonary medicine*. 2012;12:1-9.
7. Lewis A, Osadnik CR. Changing practice by changing pressures: a role for oscillating positive Expiratory pressure in chronic obstructive pulmonary disease. Vol 78: *BMJ Publishing Group Ltd*; 2023:113-115.
8. Waeijen-Smit K, Crutsen M, Keene S, Miravittles M, Crisafulli E, Torres A, et al. Global mortality and readmission rates following COPD exacerbation-related hospitalisation: a meta-analysis of 65 945 individual patients. *ERJ Open Research*. 2024;10(1).
9. Alghamdi SM, Alzahrani A, Alshahrani YM, Al Ruwaithi AA, Aldhahir AM, Alsulayyim AS, et al. Perception and clinical practice regarding mucus clearance devices with chronic obstructive pulmonary disease: a cross-sectional study of healthcare providers in Saudi Arabia. *BMJ open*. 2023;13(9):e074849.
10. Cooper L, Johnston K, Williams M. Australian airway clearance services for adults with chronic lung conditions: A national survey. *Chronic Respiratory Disease*. 2023;20:14799731221150435.
11. Hanrahan C, Pedlow K, Osadnik C. Airway clearance techniques for patients experiencing acute exacerbations of chronic obstructive pulmonary disease in the Republic of Ireland. *Physiotherapy Practice and Research*. 2021;42(2):165-172.
12. Al Ghobain M, Farahat F, Zeitouni M, Alsowayan W, Al-Awfi S, AlBarrak A, et al. The Saudi thoracic society guidelines for vaccinations in adult patients with chronic respiratory diseases. *Annals of Thoracic Medicine*. 2025;20(1):36-48.
13. Alshehri F, Alghamdi M, Aloqabi FA, Ibrahim A, Tayeb N, Hassosah M, et al. Prevalence and Clinical Outcomes of Eosinophilic COPD in a Saudi Population: A Retrospective Study. *Saudi Journal of Medicine & Medical Sciences*. 2025;13(1):53-60.
14. Al Ghobain M. The state of COPD in Saudi Arabia. *The Health Policy Partnership* 2024.
15. Alqarni AA, Badr OI, Aldhahir AM, Alqahtani JS, Siraj RA, Naser AY, et al. Obesity Prevalence and Association with Spirometry Profiles, ICU Admission, and Comorbidities Among Patients with COPD: Retrospective Study in Two Tertiary Centres in Saudi Arabia. *International Journal of Chronic Obstructive Pulmonary Disease*. 2024:111-120.
16. Al-Jahdali H, Al-Lehebi R, Lababidi H, Alhejaili FF, Habis Y, Alsowayan WA, et al. The Saudi Thoracic Society Evidence-based guidelines for the diagnosis and management of chronic obstructive pulmonary disease. *Annals of Thoracic Medicine*. 2025;20(1):1-35.

Perceptions and Clinical Practice of Using Airway Clearance Devices in Chronic Obstructive Pulmonary Disease

17. Flume PA, Robinson KA, O'Sullivan BP, Finder JD, Vender RL, Willey-Courand D-B, et al. Cystic fibrosis pulmonary guidelines: airway clearance therapies. *Respiratory care*. 2009;54(4):522-537.
18. Al-Otaibi HM. Performance of respiratory therapy programs in the Saudi Respiratory Care Licensure Examination: Cross-sectional national results. *Nutrition and Health*. 2024;02601060241300568.
19. Al-Otaibi HM. Characteristics and distribution of respiratory therapy practitioners in Saudi Arabia: national cross-sectional results. *Human Resources for Health*. 2024;22(1):80.
20. Westerdahl E, Osadnik C, Emtner M. Airway clearance techniques for patients with acute exacerbations of chronic obstructive pulmonary disease: Physical therapy practice in Sweden. *Chron Respir Dis*. 2019;16:1479973119855868.
21. Bourbeau J, McIvor RA, Devlin HM, Kaplan A. Oscillating positive expiratory pressure (OPEP) device therapy in Canadian respiratory disease management: Review, care gaps and suggestion for use. *Canadian Journal of Respiratory, Critical Care, and Sleep Medicine*. 2019;3(4):233-240.
22. Yohannes AM, Connolly MJ. A national survey: percussion, vibration, shaking and active cycle breathing techniques used in patients with acute exacerbations of chronic obstructive pulmonary disease. *Physiotherapy*. 2007;93(2):110-113.
23. Daynes E, Jones AW, Greening NJ, Singh SJ. The Use of Airway Clearance Devices in the Management of Chronic Obstructive Pulmonary Disease. A Systematic Review and Meta-analysis of Randomized Controlled Trials. *Annals of the American Thoracic Society*. 2021;18(2):308-320.
24. Alghamdi SM, Alsulayyim AS, Alasmari AM, Philip KEJ, Buttery SC, Banya WAS, et al. Oscillatory positive expiratory pressure therapy in COPD (O-COPD): a randomised controlled trial. *Thorax*. 2023;78(2):136-143.
25. Osadnik CR, McDonald CF, Jones AP, Holland AE. Airway clearance techniques for chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews*. 2012(3).
26. Alghamdi SM, Alzahrani A, Alshahrani YM, Al Ruwaithi AA, Aldhahir AM, Alsulayyim AS, et al. Perception and clinical practice regarding mucus clearance devices with chronic obstructive pulmonary disease: a cross-sectional study of healthcare providers in Saudi Arabia. *BMJ Open*. 2023;13(9):e074849.
27. Khan JH, Lababidi HM, Al-Moamary MS, Zeitouni MO, Al-Jahdali HH, Al-Amoudi OS, et al. The Saudi Guidelines for the Diagnosis and Management of COPD. *Annals of thoracic medicine*. 2014;9(2):55-76.
28. Lewis A, Osadnik CR. Changing practice by changing pressures: a role for oscillating positive expiratory pressure in chronic obstructive pulmonary disease. *Thorax*. 2023;78(2):113-115.
29. Miravittles M, Vogelmeier C, Roche N, Halpin D, Cardoso J, Chuchalin AG, et al. A review of national guidelines for management of COPD in Europe. *The European respiratory journal*. 2016;47(2):625-637.
30. Vestbo J, Hurd SS, Agusti AG, Jones PW, Vogelmeier C, Anzueto A, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *American journal of respiratory and critical care medicine*. 2013;187(4):347-365.
31. Excellence" NifHaC. Chronic obstructive pulmonary disease in over 16s: diagnosis and management. 2019; [https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-\(copd\)#:~:text=Overview,damaged%20or%20clogged%20with%20phlegm](https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)#:~:text=Overview,damaged%20or%20clogged%20with%20phlegm). Accessed July 9, 2024.
32. Barker R, Lavery AA, Hopkinson NS. Adjuncts for sputum clearance in COPD: clinical consensus versus actual use. 2017;4(1):e000226.
33. Poncin W, Reychler G, Liistro M, Liistro G. Comparison of 6 Oscillatory Positive Expiratory Pressure Devices During Active Expiratory Flow. *Respir Care*. 2020;65(4):492-499.
34. Volsko TA, DiFiore J, Chatburn RL. Performance comparison of two oscillating positive expiratory pressure devices: Acapella versus Flutter. *Respir Care*. 2003;48(2):124-130

التصورات والممارسات السريرية حول استخدام أجهزة تنظيف مجرى الهواء في مرض الانسداد الرئوي المزمن: دراسة استقصائية مقطعية لممارسي الرعاية التنفسية والعلاج الطبيعي في المملكة العربية السعودية

احمد الزهراني^{١,٣,٤}, سعيد الغامدي^٢, منصور المجري^{٣,٤,٥}, زياد الشهري^١, فهد الاحمدي^١, سلطان القحطاني^١, عبد الرحمن الهوساوي^١, احمد العصيمي^٥, اويس ايليان^٦, مايك بولكي^{٣,٤}, سريندر بارينق نك هوبكينز^{٣,٤}.

الانتماءات:

- ^١ قسم العلاج التنفسي، كلية علوم التأهيل الطبي، جامعة طيبة، المدينة المنورة، المملكة العربية السعودية.
- ^٢ قسم التكنولوجيا السريرية، برنامج الرعاية التنفسية، كلية العلوم الطبية التطبيقية، جامعة أم القرى، مكة المكرمة، المملكة العربية السعودية.
- ^٣ المعهد الوطني للقلب والرئة، إمبيرال كوليدج لندن، لندن، المملكة المتحدة.
- ^٤ طب الجهاز التنفسي، مستشفى رويال برومبتون، لندن، المملكة المتحدة.
- ^٥ قسم العلاج التنفسي، جامعة ولاية جورجيا، أتلانتا، جورجيا، الولايات المتحدة الأمريكية.
- ^٦ جامعة عمان الأهلية، قسم العلاج الطبيعي، عمان، الأردن.
- ^٧ مركز العلوم الفسيولوجية البشرية والتطبيقية، كلية العلوم الحيوية الأساسية والطبية، كلية علوم الحياة والطب، كلية كينجز كوليدج لندن.
- ^٨ مستشفى جامعة الملك عبد العزيز، قسم العلاج التنفسي، جامعة الملك عبد العزيز، جدة، المملكة العربية السعودية.
- ^٩ مدينة الشيخ شخبوط الطبية، أبوظبي، الإمارات العربية المتحدة.

المستخلص

الخلفية: يُعدّ تنظيف مجرى الهواء من المكونات الأساسية في إدارة مرض الانسداد الرئوي المزمن (COPD) وتُسهّم أجهزة تنظيف مجرى الهواء (ACDs) في تحقيق ذلك، إلا أن فعاليتها تعتمد بشكل رئيسي على الاستخدام المنتظم في الممارسة السريرية.

الأهداف: تحديد مستوى الوعي والممارسة السريرية المتعلقة باستخدام هذه الأجهزة لمرضى الانسداد الرئوي المزمن بين اختصاصي العلاج التنفسي وأخصائي العلاج الطبيعي في المملكة العربية السعودية.

التصميم: دراسة مقطعية. (Cross-sectional survey).

المكان: الرعاية الأولية والثانوية في المملكة العربية السعودية.

المواد والطرق: تم إجراء استبيان إلكتروني شمل ممارسي الرعاية التنفسية والعلاج الطبيعي العاملين في مختلف القطاعات الصحية بالمملكة. وقد تضمن الاستبيان تقييم مستوى المعرفة، المواقف، وأنماط استخدام الأنواع المختلفة من أجهزة تنظيف مجرى الهواء في الممارسات السريرية.

النتائج: استجاب ٤٢٣ ممارساً صحياً للاستبيان: ٥٧٪ منهم ذكور، ومتوسط الفئة العمرية ٢٠-٣٠ عاماً، و ٨٩,٤٪ سعوديون، و ٨٢,٥٪ حاصلون على درجة البكالوريوس، و ٨٤,٢٪ من اختصاصي العلاج التنفسي، و ٥٨,٩٪ يعملون في مستشفيات حكومية. أظهر معظم المشاركين معرفة بجهاز واحد على الأقل من أجهزة تنظيف مجرى الهواء، حيث كان جهاز Flutter الأكثر شيوعاً (٥٨٪)، يليه جهاز Acapella (٣٠٪). كما أشار ٧٧,٥٪ من المشاركين إلى أنهم دائماً أو غالباً ما يستخدمون هذه الأجهزة مع المرضى الذين يعانون يومياً من صعوبة في إخراج البلغم الكثيف، إلا أن الاستخدام كان أقل انتظاماً مع الحالات الأخف. وقد كان جهاز Acapella هو المفضل لدى ٥٦٪ من المشاركين، مقارنة بـ ١٨٪ يفضلون جهاز Flutter. كما ذكر ٨٥٪ من المشاركين أنهم يستندون إلى الإرشادات السريرية في استخدام هذه الأجهزة، وكانت إرشادات المبادرة العالمية لمرض الانسداد الرئوي المزمن (GOLD) هي الأكثر استشهاده.

الاستنتاج: يتمتع أخصائيو الرعاية التنفسية والعلاج الطبيعي في المملكة بمستوى عالٍ من الوعي بأجهزة تنظيف مجرى الهواء، إلا أن التباين في الممارسة يشير إلى الحاجة لمزيد من الدراسات المستقبلية.

الكلمات المفتاحية: مرض الانسداد الرئوي المزمن، أجهزة تنظيف مجرى الهواء، وسائل مساعدة لإخراج البلغم، العلاج التنفسي، العلاج الطبيعي، المملكة العربية السعودية.
نقاط القوة والقيود في الدراسة:
شملت الدراسة ٤٢٣ ممارسًا للعلاج التنفسي والعلاج الطبيعي من مختلف المناطق والقطاعات الصحية في المملكة العربية السعودية.
يتيح حجم العينة جعل النتائج ممثلة بدرجة جيدة للسياقات الصحية المختلفة داخل المملكة.
غياب البيانات النوعية (Qualitative data) حدّ من القدرة على استكشاف الأسباب الكامنة وراء محدودية وصف أو استخدام أجهزة تنظيف مجرى الهواء بشكل أعمق.