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The Effect of Active Cycle of Breathing Techniques (ACBT) on Shortness of Breath and Facilitation of Airway Clearance in Obstructive Pulmonary Disease: Literature Review

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ABSTRACT

Introduction: Obstructive lung disease is characterised by airflow obstruction due to airway narrowing or damage. The Active Cycle of Breathing Techniques (ACBT) is designed to address issues arising from this by mobilising and clearing secretions from the airways, as well as improving breathing mechanics to reduce dyspnea. This study aims to determine the effect of Active Cycle of Breathing Techniques (ACBT) on dyspnea and airway clearance in cases of obstructive lung disease. **Results:** A review of 7 previous studies revealed the effects of Active Cycle of Breathing Techniques (ACBT) in reducing dyspnea and clearing the airways in patients with obstructive lung disease. **Method:** This study uses a literature review method. Articles published from 2014 to 2024, related to the effects of ACBT on airway clearance in patients with obstructive lung disease, were identified through relevant databases (Google Scholar, PubMed, and ScienceDirect) using predetermined keywords. Articles that met inclusion criteria, such as appropriate study design, publication year, and language, were selected for analysis. **Results:** A review of 7 previous studies revealed the effects of Active Cycle of Breathing Techniques (ACBT) in reducing dyspnea and clearing the airways in patients with obstructive lung disease. **Conclusion:** There is an impact of Active Cycle of Breathing Techniques (ACBT) exercises in reducing dyspnea and clearing the airways in patients with obstructive lung disease

Keywords: *Active Cycle of Breathing (ACBT), dyspnea, airway clearance, obstructive lung disease*

INTRODUCTION

Lung disease is a condition of disorders in the lungs or their channels that can be classified into restrictive lung disease and obstructive lung disease (Jaime and Michele 2014). Restrictive lung disease is a group of lung disorders that produce restrictive pattern values on spirometry examination. Restrictive lung conditions can be caused by damage to the distal lung parenchyma, such as due to toxins, inflammatory infiltrates, or other extra parenchymal conditions (Martinez-Pitre et al. 2023).

Obstructive pulmonary disease is a condition that leads to airway disorders that result in reduced airflow out of the lungs as a result of the narrowing of the airway lumen. This causes an increase in dead space and a decrease in the surface area for gas exchange (Jaime and Michele 2014).

Data-wise, obstructive pulmonary disease is more common because restrictive disease accounts for about one-fifth of total lung disease while obstructive syndrome is the majority (80%) (Martinez-Pitre et al. 2023). Some examples of obstructive pulmonary disease are asthma, chronic bronchitis, emphysema, and bronchiectasis (Jaime and Michele 2014).

Obstructive pulmonary disease can generally provide various similar signs and symptoms to sufferers. Symptoms that appear can include shortness of breath, fatigue, accumulation of secretions, coughing, and other symptoms that may differ in each sufferer (Jaime and Michele 2014).

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Untreated obstructive pulmonary disease can develop into Chronic Obstructive Pulmonary Disease (COPD). COPD is the final condition of various lung diseases that are persistent and progressive. According to WHO, COPD rose from the 6th cause of death in 1990 to the 5th in 2002 and is estimated to be the 3rd in 2030 after cardiovascular disease and cancer (Budhi et al. 2023). Seeing this impact, of course, treatment of obstructive pulmonary disease is very necessary to avoid unwanted complications. Pulmonary rehabilitation is one solution that can be applied (Saeed et al. 2022). Active Cycle of Breathing Technique (ACBT) as part of pulmonary rehabilitation is a collection of breathing techniques that aim to mobilize and clean excessive lung secretions and generally improve lung function. ACBT consists of 3 phases of exercise, namely breathing control, deep breathing exercises or thoracic expansion exercises, then ending with huffing or forced expiratory technique. All of these exercises are a single exercise known as the ACBT technique which is carried out simultaneously with positioning techniques according to the patient's condition (Salehi Derakhtanjani et al. 2019).

Various previous studies have proven the effectiveness of ACBT in treating obstructive pulmonary disease. The variety of existing studies produces various results and theories that are also diverse. Literature review studies are expected to be the answer to the various results of existing studies. Through this, the author is interested in conducting a literature review study on "The Effectiveness of ACBT on Airway Clearance in Patients with Obstructive Pulmonary Disease" so that it can provide an overview of the effectiveness of administering ACBT specifically in treating cases of obstructive pulmonary disease based on the results of previous studies.

METHODS

This study was conducted using the literature review method. The search for research articles was obtained from three databases, namely Google Scholar, Pubmed, and Science Direct, with the keywords "Active Cycle of Breathing Technique, Airways Clearance, and Chronic Obstructive Pulmonary Disease (COPD). The data processing process used the PRISMA flow chart with inclusion and exclusion criteria. The inclusion criteria set include, articles in full-text form, the research design in the article is a cohort, randomized controlled trial, quasi-experimental, cross-sectional, articles using English and Indonesian, articles with publication years in the last 10 years (2014-2024), and articles with human research objects. The exclusion criteria in this study include, articles that are not full text, research designs that do not meet the inclusion criteria, and publication years exceeding the last 10 years.

There were 2,189 articles identified based on keywords after screening according to inclusion and exclusion criteria. Researchers obtained 7 articles which were then reviewed and analyzed using a synthesis matrix (figure 1).

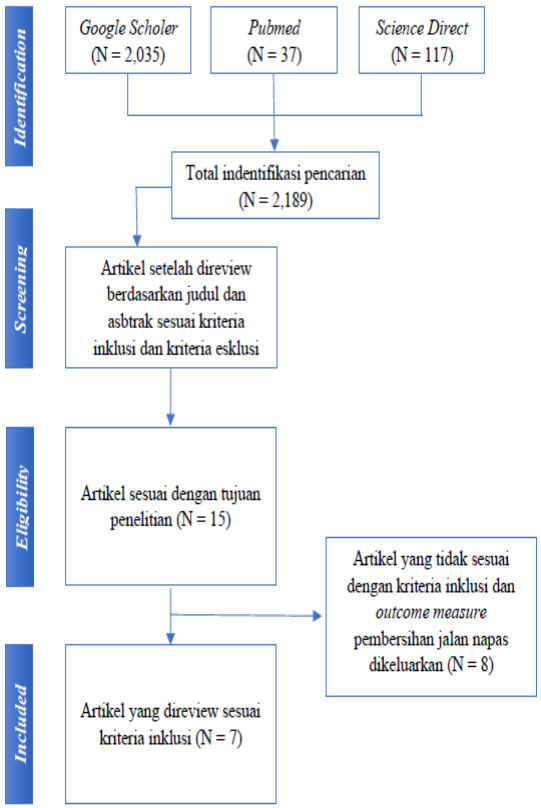

Figure 1. Prisma *Flow Chart*

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RESULT

Table 1. Research results in reviewed articles

Title	Types of research	Results
The Efficacy of Flutter® and Active Cycle of Breathing Techniques in Patients with Bronchiectasis: A Prospective, Randomized, Comparative Study (Uzmezoglu *et al.* 2018)	*Prospective Randomized Study*	After 4 weeks of physiotherapy, there was a decrease in cough, wheezing, and fatigue, as well as an improvement in appetite. The experimental group, namely those given ACBT, experienced a significant decrease in cough. Wheezing was also reduced in the ACBT group. In both groups, there was a significant increase in sputum production and a significant decrease in dyspnea scores.
An Immediate Effect of Conventional Physiotherapy versus ACBT with Autogenic Drainage on Dyspnoea and Cough in Patient with COPD - A Randomized Control Trial (Gulati 2020)	*Randomized Controlled Trial (RCT)*	The results showed that the control group and the experimental group were equally effective in reducing dyspnea whereas the experimental group given ACBT combined with Autogenic Drainage (AD) was very significant in reducing dyspnea with a p-value of 0.00. In addition, the experimental group was also significant in increasing sputum output with a p-value of 0.009 while the control group was not significant in increasing sputum output.
Effect of Home-Based Pulmonary Training Program on Functional Exercise Capacity and Quality of Life in Patients with Chronic Obstructive Pulmonary Disease (Haider *et al.* 2024)	*Randomized Controlled Trial (RCT)*	The effect of combining ACBT with a home exercise program provides significant benefits for COPD patients in improving functional exercise capacity. This is evidenced by the increasing value of 6 MWT in group B. In addition, the measurement of quality of life using the St. George's Respiratory Questionnaire (SGRQ) which consists of several questions about dyspnea experienced a significant increase which means that the shortness of breath experienced has decreased after being given ACBT and pulmonary training at home.
Comparison Between Active Cycles of Breathing with Postural Drainage Versus Conventional Chest Physiotherapy in Subjects with Bronchiectasis (Abdel Halim *et al.* 2016)	*Randomized Controlled Trial* (RCT)	Active Cycles of Breathing with Postural Drainage was found to be more effective than conventional Chest Physiotherapy. Significant improvement occurred in FVC and MMEF values after ACBT administration and regarding mMRC dyspnea score, spirometry, arterial blood gas data, Leicester cough questionnaire (LCQ) and sputum wet volume also experienced significant improvement in the management of bronchiectasis during exacerbation of infection.
Comparison of the Active Cycle of Breathing Technique (ACBT) versus the Active Cycle of Breathing Technique with Flutter in Bronchiectasis (Athawale *et al.* 2021)	*Experimental Study*	Saturation and shortness of breath levels improved in the group given ACBT as well as in the group given a combination of ACBT and flutter.
Comparative Effects of Buteyko Breathing Technique and Active Cycle of Breathing Technique on Dyspnea and Quality of Life in Patients with Chronic Obstructive Pulmonary Disease (Baig *et al.* 2024)	*Randomized Controlled Trial* (RCT)	Both ACBT and Buteyko Breathing Technique (BBT) have similar effects, namely reducing complaints of shortness of breath and improving quality of life in samples with COPD.
Impact Of Active Cycle of Breathing Technique on Functional Capacity In Patients with Bronchiectasis (Elsayed *et al.* 2015)	*Cohort Study*	After 8 weeks of ACBT administration, there was a significant increase in functional capacity as measured using the 6MWT as well as a significant decrease in dyspnea scores before and after the intervention.

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DISCUSSION

Baseline Characteristics

The baseline characteristics of the various studies that have been conducted show that there is diversity in the study population. The age of the study subjects varies between 40 and 85 years, with the average age varying between studies. This indicates that the studies have involved populations with a fairly wide age range, ranging from young adults to the elderly. In addition, the proportion of gender also varies, with some studies dominating female subjects and others being more balanced. This difference in gender distribution may be influenced by factors such as the prevalence of the disease in each sex and the availability of research subjects. The diagnosis of underlying obstructive lung disease also showed variability, including chronic bronchitis, COPD, and bronchiectasis. This variation in diagnosis reflects the heterogeneity of obstructive lung disease and the complexity of the clinical conditions faced by patients. However, there was a similarity in the diagnosis of underlying obstructive lung disease, namely the presence of airflow obstruction. This suggests that these studies generally focused on populations with similar lung function impairments.

ACBT and its Dosage

Based on 10 selected articles from 3 databases, namely Google Scholar, Science Direct and Pubmed. ACBT exercises applied in various studies vary. These exercises generally include breathing control, thoracic expansion exercises, and forced expiration techniques. In addition, several studies also combine ACBT with other therapies, including postural drainage, home-based pulmonary exercise and flutter to increase the effectiveness of airway clearance. (table 2).

Table 2. Exercise Dosage

Study	Exercise	Dose
(Uzmezoglu *et al.* 2018)	ACBT with postural drainage: 1. Breathing control, namely breathing at normal speed and depth using the lower chest. 2. Place 1 hand on the epigastrium, breathe slowly and deeply using the lower chest (pause), then exhale completely, but not forcefully. Repeat 2-3 times then control breathing. 3. Expelling phlegm by taking a slightly deeper breath while keeping the mouth open and in an O shape. The subject exhales more forcefully by contracting the abdominal muscles while keeping the mouth and throat open. Then it returns to breathing control until the patient is ready to start the next cycle.ACBT is done with postural drainage, namely a special position so that gravity will increase sputum transportation.	Each standard ACBT cycle lasts about 2 minutes and is repeated for 15-20 minutes. The procedure is repeated twice a day for 4 weeks with a minimum duration of 6 hours.
(Gulati 2020)	ACBT with autogenic drainage where the subject is asked to sit relaxed without pressure and tension. Then the subject performs 10 repetitions of ACBT, 10 repetitions of autogenic drainage and 10 repetitions of active ROM exercise for both upper extremities. The ACBT techniques provided are: Breathing control where participants breathe at a normal rate and depth using the lower chest. Next, by placing one hand on the epigastrium, the participant breathes slowly and deeply using the lower chest (pause), then exhales completely but not forcefully. Repeated 2 to 3 times. Back to Breathing Control 1. Sputum removal, which is the participant taking a	10 repetitions for each intervention (ACBT, autogenic drainage, active ROM exercise) Exercise frequency not specified

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Study	Exercise	Dose
	slightly larger breath than usual, making the participant open his mouth and keep it in an O shape. Breathe harder by tightening the abdominal muscles while keeping the mouth and throat open. It sounds like a forced sigh like huffing.	
(Haider *et al.* 2024)	Providing ACBT with Home-Based Pulmonary Exercise which includes 1. *Breathing Control* 2. *Diaphragmatic breathing* 3. *Sniffing* 4. *Huffing*	Each ACBT cycle is repeated three times with a break in between.
(Abdel Halim *et al.* 2016)	ACBT with *Postural Drainage* 1. Breathing control where participants breathe at normal speed and depth using the lower chest. 2. Next, by placing one hand on the epigastrium, the participant breathes slowly and deeply using the lower chest (pause), then exhales completely but not forcefully. Repeat 2 to 3 times. Return to breathing control 3. *Sputum removal, which is the participant taking a slightly larger breath than usual, making the participant open his mouth and keep it in an O shape. Breathe harder by tightening the abdominal muscles while keeping the mouth and throat open. It sounds like a forced sigh like huffing.*	Each standard ACBT cycle lasts about 2 minutes and is repeated for 15–20 minutes. It is repeated twice daily for a minimum of 6 hours.
(Athawale *et al.* 2021)	ACBT in this study consists of: *Breathing control* *1. Thoracic expansion exercise* 2. *Forced expiratory technique* ACBT + Flutter A Flutter is a small, portable, tube-like device with a steel ball placed in a cone. As the steel ball moves, it creates an oscillating pressure wave. This positive expiratory pressure helps to thin secretions, prevent bronchial closure, and mobilize sputum.	Flutter is used for expiratory exercises and is done for 20 minutes, 3 repetitions.
(Baig *et al.* 2024)	ACBT in this study consists of: *1. Breathing control* *2. Thoracic expansion exercise* *3. Forced expiratory technique*	ACBT was conducted in 3 sessions, 1 session lasting 10 minutes. Interspersed with a break at the 20th minute, and the total training was 35 minutes. Conducted 3x/week, for 6 weeks.
(Elsayed *et al.* 2015)	ACBT training 1. *Chest expansions* - Breathe gently at normal speed and depth (breath control). - Take a slow, deep breath using your lower chest then pause. - Exhale completely but not forcefully. - Repeat for the next two breaths. Return to breath control. - Take three more slow deep breaths. - - Return to breath control. *2. Forced expiratory technique* - Take a slightly deeper breath than usual. - Open your mouth and shape your mouth like the letter O. - Exhale longer and more cheerfully using your	The procedure is repeated 2 times a week for 8 weeks.

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Study	Exercise	Dose
	abdominal muscles to help. It should sound like a forced sigh. This is called abseiling. - Repeat for the next two breaths. - Return to breath control. - Cough to expel phlegm if necessary. - Return to breath control until you are ready to start the next cycle.	

Effectiveness of ACBT

The ACBT technique is one method for treating obstructive pulmonary disease. ACBT helps clear mucus from the airways, improve airflow, and reduce shortness of breath through a series of cycles. In this way, ACBT can help prevent mucus buildup that can cause complications, while improving lung function and the patient's quality of life (Denny Pratama 2021). The advantages of ACBT lie in its non-invasive application, flexibility to be applied independently, and the potential to reduce the risk of exacerbations due to mucus accumulation (table 1).

In the study of Uzmezoglu et al. (2018) ACBT as a single method or combined modality has a positive effect on airway clearance by increasing sputum production. Dyspnea that occurs early in the course of bronchiectasis also results in avoidance of physical activity because patients feel increasingly unmotivated to do physical activity with dyspnea. In addition, bronchiectasis is also associated with a significant decrease in quality of life due to the natural course of the disease that causes coughing and purulent sputum production which can cause severe restrictions on social life. That is why, providing ACBT interventions that affect increasing sputum production will certainly make the airway better so that it provides a more comfortable feeling for patients and will indirectly affect dyspnea and improve their quality of life. A similar study was also conducted by Gulati (2020) regarding ACBT combined with autogenic drainage is effective in reducing dyspnea and cough production compared to conventional physiotherapy. Active chest physiotherapy techniques together with medical treatment are certainly more effective in acute exacerbations of COPD than medical treatment alone. This may be because chest wall mobilization has a significant effect on peak expiratory flow rate, chest expansion, and dyspnea in COPD patients. Several existing studies also support this study that ACBT and autogenic drainage are effective in clearing secretions acutely in patients with acute exacerbation of COPD.

The study of Haider et al. (2024) stated that COPD is a long-term respiratory condition characterized by limited airflow in the lungs, with symptoms such as wheezing, phlegm production, and difficulty breathing so that appropriate therapeutic and interdisciplinary interventions are needed to help in the recovery of symptoms experienced by patients with COPD. ACBT as an independent intervention or in conjunction with home-based pulmonary exercise based on increasing lung capacity by performing breathing techniques, has been shown to increase exercise capacity and respiratory function (quality of life). This is evidenced by an increase in scores on the Respiratory Questionnaire Symptoms scale consisting of several question items regarding coughing, phlegm, shortness of breath felt by patients with COPD and an increase in exercise capacity seen in the 6-minute walk test value which is higher than before being given exercise. In addition, the research of Abdel Halim et al. (2016) also provided ACBT with postural drainage, where this technique cleans and mobilizes excessive lung secretions from small airways in the periphery so that there is a change in thoracic expansion by holding the breath which is continued with forced expiration technique with an open glottis which is

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connected with postural drainage so that it produces advantages in the form of significant differences in the amount of phlegm expelled per day and can increase alveolar oxygen and ultimately increase tissue oxygenation.

The study conducted by Athawale et al. (2021) applied an experimental method and involved a total of 40 samples divided into 2 groups. Group A (n=20) received ACBT treatment alone while group B (n=20) received ACBT treatment given together with the flutter technique. Flutter was used for expiration exercises and was carried out for 20 minutes for 3 repetitions. Sample measurements were taken before and after the intervention. A significant increase in oxygen saturation levels was found in group A (p-value = 0.0003) and group B (p-value <0.0001). Significant changes were also found in the level of shortness of breath, both in group A (p-value = 0.0081) and group B (p-value <0.0001). However, in the data analysis comparing the results in the two groups, no significant differences were found in either oxygen saturation measurements or shortness of breath levels. Based on this, it can be concluded that administering the ACBT technique, either ACBT alone or combined with the flutter technique, can be equally effective in increasing oxygen saturation and reducing shortness of breath in cases of bronchiectasis.

Based on the research of Baig et al. (2024) conducted in Pakistan using a randomized clinical trial method, where a total of 40 samples were then grouped into 2 groups, namely Group A (n = 20) which received BBT treatment and Group B (n = 20) which received ACBT treatment. Measurements in this study were carried out before and after the intervention. The measurements carried out were the level of shortness of breath measured using the Borg dyspnea scale and found significant changes in both Group A (p-value = 0.000) and Group B (p-value = 0.000). Another measurement carried out was the quality of life measured using the St. George's Respiratory Questionnaire and found significant changes in both Group A (p-value = 0.000) and Group B (p-value = 0.000). Based on this, it can be concluded that the provision of ACBT techniques in COPD cases can be given to help reduce shortness of breath and improve quality of life.

The study by Elsayed et al. (2015) was designed to investigate the effects of ACBT on the functional capacity of patients with bronchiectasis. This study was assessed by applying a 6 MWT and shortness of breath questionnaire. Dyspnea or shortness of breath is a common symptom in various respiratory conditions, including bronchiectasis. This condition is often associated with obstruction or narrowing of the airways, which can inhibit airflow and cause difficulty breathing. Airway clearance is a process that aims to remove mucus, phlegm, or foreign particles that block the airways. This process is very important for maintaining optimal lung function. Performing ACBT regularly in patients with bronchiectasis can increase airflow, reduce inflammation, and ultimately relieve symptoms of shortness of breath. The movements in ACBT, such as strong exhalation, deep breathing, and chest expansion help move mucus, open blocked airways, and facilitate ventilation.

CONCLUSION

Based on the results of a literature review of 7 articles related to the effect of ACBT breathing techniques on shortness of breath and airway clearance in patients with obstructive pulmonary disease, it was found that there was an effect on the effectiveness of ACBT in reducing shortness of breath and increasing airway clearance.

REFERENCES

Abdel Halim HA, Abo El Naga HH, Fathy KA. 2016. Comparison between active cycles of breathing with postural drainage versus conventional chest physiotherapy in subjects with bronchiectasis. Egyptian Journal of Chest Diseases and Tuberculosis. 65(1):157–165. https://doi.org/10.1016/j.ejcdt.2015.08.006

Athawale VK, Lalwani LL, Mishra GP. 2021. Comparison of the Active Cycle of Breathing Technique (ACBT) versus the Active Cycle of Breathing Technique with

ISSN 2722 – 9610
E –ISSN 2722 - 9629

Flutter in Bronchiectasis. National Journal of Medical Research [Internet]. [accessed 2024 Aug 11] 10(4):178–180. https://njmr.in/index.php/file/article/view/88

Baig B, Anwar M, Rasheed M, Rasul A, Fiaz A, Faisal S. 2024. Comparative Effects of Buteyko Breathing Technique and Active Cycle of Breathing Technique on Dyspnea and Quality of Life in Patients with Chronic Obstructive Pulmonary Disease. Journal of Health and Rehabilitation Research. 4(1):250–255. https://doi.org/10.61919/jhrr.v4i1.192

Budhi A, Arief B, Wiwien Heru W. 2023. Penyakit Paru Obstruktif Kronik (PPOK) Pedoman Diagnosis Dan Penatalaksanaan Di Indonesia. Jakarta: Perhimpunan Dokter Paru Indonesia.

Denny Pratama, A. (2021). Efektivitas Active Cycle Of Breathing Technique (Acbt) Terhadap Peningkatan Kapasitas Fungsional Pada Pasien Bronkiektasis Post Tuberkulosis Paru. *Jurnal Vokasi Indonesia*, 9(1). Doi:https://doi.org/10.7454/jvi.v9i1.247.

Elsayed S, Kamal W, Fathy K. 2015. Impact Of Active Cycle Of Breathing Technique On Functional Capacity In Patient With Bronchiectasis. International Journal of Therapies and Rehabilitation Research. 4(5):287. https://doi.org/10.5455/ijtrr.000000105

Gulati M. 2020. An Immediate Effect of Conventional Physiotherapy versus ACBT with Autogenic Drainage on Dyspnoea and Cough in Patient with COPD - A Randomized Control Trial. Int J Res Appl Sci Eng Technol. 8(9):709–713. https://doi.org/10.22214/ijraset.2020.31518

Haider S, Ain QU, Amjad M, Sajjad Y, Javed Z, Kausar F. 2024. Effects of Home-Based Pulmonary Training Program on Functional Exercise Capacity and Quality of Life in Patients with Chronic Obstructive Pulmonary Disease. Journal of Health and Rehabilitation Research. 4(1):1474–1478. https://doi.org/10.61919/jhrr.v4i1.659

Jaime CP, Michele PW. 2014. Acute Care Handbook for Physical Therapists. [place unknown]: Elsevier. https://doi.org/10.1016/C2011-0-05707-1

Martinez-Pitre PJ, Sabbula BR, Cascella M. 2023. Restrictive Lung Disease [Internet]. https://www.ncbi.nlm.nih.gov/books/NBK560880/

Reina-Gutiérrez S, Torres-Costoso A, Martínez-Vizcaíno V, Núñez de Arenas-Arroyo S, Fernández-Rodríguez R, Pozuelo-Carrascosa DP. 2021. Effectiveness of Pulmonary Rehabilitation in Interstitial Lung Disease, Including Coronavirus Diseases: A Systematic Review and Meta-analysis. Arch Phys Med Rehabil. 102(10):1989-1997.e3. https://doi.org/10.1016/j.apmr.2021.03.035

Saeed A, Arshad MU, . W, Khalid MU, Shahid A. 2022. A Review on Implications of Physiotherapy Techniques in COPD: A Review Article. Pakistan Journal of Medical and Health Sciences. 16(10):3–5. https://doi.org/10.53350/pjmhs2216103

Salehi Derakhtanjani A, Ansari Jaberi A, Haydari S, Negahban Bonabi T. 2019. Comparison the Effect of Active Cyclic Breathing Technique and Routine Chest Physiotherapy on Pain and Respiratory Parameters After Coronary Artery Graft Surgery: A Randomized Clinical Trial. Anesth Pain Med. 9(5). https://doi.org/10.5812/aapm.94654

Uzmezoglu B, Altiay G, Ozdemir L, Tuna H, Sut N. 2018. The Efficacy of Flutter® and Active Cycle of Breathing Techniques in Patients with Bronchiectasis: A Prospective, Randomized, Comparative Study. Turk Thorac J. https://doi.org/10.5152/TurkThoracJ.2018.17050

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