An Evidence-based Practice Project to Evaluate Breathing Exercises on Dyspnea in Patients with Chronic Lung Diseases

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Abstract

Introduction: Dyspnea, or difficulty breathing, is a common symptom that affects individuals with chronic lung diseases, such as Chronic Obstructive Pulmonary Disease (COPD), lung cancer, idiopathic pulmonary fibrosis, mesothelioma, and others. Nurses are the most frequently encountered providers at the bedside and have a unique obligation to treat the symptomology of these lung diseases. Nurses are charged with doing no harm and acting in the best interest of the patient; therefore, reducing dyspnea addresses these key ethical considerations (American Nurses Association, 2015).

Methods: A literature review using the Johns Hopkins Evidence-based Practice model was conducted based on the following PICO question: In clients with chronic lung disease (P), how does a nurse-led breathing exercise program (I) compare to the standard of care (C) on shortness of breath? Databases searched included Nursing and Allied Health (ProQuest), Pubmed/Medline, Cumulative Index of Nursing and Allied Health Literature (CINAHL) with Full Text, and Cochrane Library (Reviews). Retained articles addressed the PICO question, and the results of the retained articles were assessed for quality and level of evidence.

Results: The body of literature has found that breathing exercises significantly reduce dyspnea in chronic lung disease patients; however, the body of evidence is of mixed quality.

Implications: It is recommended that healthcare organizations continue to perform research on the effectiveness of breathing exercise programs, but there is no reason to delay the implementation of the intervention. The intervention is feasible to implement, low risk, and fit for units that care for chronic lung disease patients.

Introduction

Dyspnea, or shortness of breath, is a common symptom that is associated with several chronic lung diseases, including but not limited to chronic obstructive pulmonary disease (COPD), idiopathic pulmonary fibrosis, lung cancer, and others. Lowered quality of life, high consumption of hospital resources during exacerbations, and extended hospital admissions have been associated with dyspnea and dyspnea exacerbations. Kharbanda & Anand (2021) found that when calculating the health-related quality of life using the St. George’s Respiratory Questionnaire (SGRQ)—which assesses activity level, impact of the disease, and symptoms—the mean scores of individuals with COPD were 48.5, with scores increasing based on younger age group.
life (American Nurses Association [ANA], 2015). The ANA (2015) ethical provisions of preventing maleficence and acting in beneficence are integral to the nursing care of the patient with dyspnea. The patient with dyspnea, due to compromised effort of breathing, requires breathing treatments in the plan of care to improve ventilation and reduce negative symptoms. The goal of this evidence-based practice (EBP) project was to determine whether the body of literature supports the implementation of a breathing-exercise program to improve dyspnea scores, compared to the standard of care, for patients with chronic lung diseases.

Breathing exercises can be performed by patients using various techniques. Diaphragmatic breathing is, according to the Cleveland Clinic (2022), an exercise that involves conscious control of the diaphragm to expand the lungs and take in more air (the inspiratory reserve volume) as compared to regular tidal volume breaths (about 500 mL / breath). Pursed-lip breathing is another form of breathing exercise characterized by slow inhalation, the pursing of the lips, and slow exhalation through the pursed lips, which prolongs the exhalation period (Sharaf et al., 2020). Active mind-body movement therapy (AMBMT) can be described as a purposeful regiment designed to aid patients in controlling breathing and moving joints in a purposeful manner; whereas pulmonary rehabilitation (PR) can be described generally as an in-patient or out-patient rehabilitation breathing exercise program, usually provided by a multidisciplinary team, that lasts one month (Gendron et al., 2018). Similarly, progressive muscle relaxation (PMR) has been defined as a set of relaxation techniques aimed at releasing tension in muscles and decreasing ventilatory effort, thereby reducing dyspnea (Neşe & Bağlama, 2022).

**PICO Question**

A PICO question format was utilized to guide this evidence-based practice (EBP) project. The (P) stands for Population, the (I) stands for Intervention, the (C) stands for Comparison, and the (O) stands for Outcome. Therefore, the following PICO question was utilized for this project: In clients with chronic lung disease (P), how does a nurse-led breathing exercise program (I) compare to the standard of care (C) on shortness of breath? For this project, the population investigated included patients with chronic obstructive pulmonary diseases (COPD) (i.e. chronic bronchitis, emphysema), idiopathic pulmonary fibrosis, mesothelioma, and lung cancer. Additionally, the standard of care for dyspnea treatment within a hospital setting has traditionally included pharmacological measures, position changes, as well as the use of oxygen therapy (DynaMed, 2023).

**Methodology**

**Search Strategy**

A literature search was conducted to assess whether the current body of evidence has demonstrated the effectiveness of breathing exercise programs in alleviating dyspnea compared to the standard of care. The databases that were searched included the Cumulative Index of Nursing and Allied Health Literature with Full Text (CINAHL), the Cochrane Library (Reviews), PubMed, and the Nursing & Allied Health Databases (ProQuest). Several key terms were utilized in combinations and connected using Boolean operators, including: chronic lung disease, emphysema, lung cancer, pulmonary fibrosis, difficulty breathing, dyspnea, shortness of breath, and breathing exercise. Only articles that were peer-reviewed, in the English language, and included human participants who were aged eighteen years and above were included for this EBP project. The search timeline was in the past five years (January 2018 to October 2023). Articles utilized in this search must have had the full text available for review. Handsearching was completed which aided in the identification of additional articles that addressed the PICO question. Appendix A includes the complete search strategy utilized for this EBP project.

A total of ninety-three articles were initially identified by the literature search. Of these articles, two were identified as duplicates and discarded. The titles and abstracts of the remaining ninety-one articles were screened for eligibility. A total of seventy-five articles were excluded from the final review due to inapplicability in answering the PICO question, leaving sixteen articles deemed eligible for further review. A further three articles were discarded, with reason, leaving thirteen articles that were included in this EBP project. The Prisma Flow Diagram located...
in Appendix B has reflected these decisions.

**Review of the Evidence**

The thirteen retained articles, which underwent the final review, were assessed using the Johns Hopkins evidence-based Practice Model quality appraisal tools. Dang et al. (2022) specifies that a grade of (A) indicates an article of high quality, a grade of (B) indicates an article of good quality, and a grade of (C) indicates an article of low quality. The individual evidence summary tool, which summarizes key findings of the appraised articles as well as the level of evidence and quality of the article using the Dang et al. (2022) framework, is provided in Appendix C. A numerical summary of the quantity of articles by level of evidence as well as the range of quality for each level of evidence, is provided in Appendix D.

A systematic review (Level 1, B quality) of nine RCTs by Ya-Qing & Jiao (2019) found breathing exercises significantly reduced dyspnea scores. The authors found there to be significant improvement in dyspnea scores in an intervention group that received breathing treatment as compared to usual care. The intervention group that received a breathing exercise treatment had statistically improved dyspnea scores using the visual analog scale for dyspnea and dyspnea-12 scale (p=0.001) compared to the control group. Additionally, the authors compared the dyspnea scores in two subgroups of patients with lung cancer: a surgical subgroup and a subgroup that received chemotherapy or other treatments and found that after implementing a breathing treatment in both groups, the dyspnea scores were significantly improved compared to the control group (p<0.05). Rui-Chen et al. (2021) also conducted a study on the effectiveness of a breathing exercise program versus a control group that received usual care in lung cancer patients to undergo surgical removal of the cancer. Researchers found that when the physical exercise and breathing exercise combined intervention was compared to the breathing exercise alone group, the dyspnea scores were significantly improved in the combined group (p=0.027). Another RCT by Neşe & Bağlama (2022) found that implementing a deep-breathing or progressive muscle relaxation treatment intervention significantly improved dyspnea scores compared to the control group that received usual care. However, the Neşe & Bağlama (2022) article utilized the dyspnea-12 scale and Chronic Obstructive Pulmonary Disease and Asthma Fatigue Scale (CAFS) scale, indicating that all three articles used different scales and measuring tools to assess for dyspnea and other outcomes.

Several quasi-experimental designs retained for review also supported breathing exercises as an intervention. Two studies, of Level II, High (A) quality, found a significant improvement in dyspnea scores from the pre- to post-test scores of the intervention group (Sharaf, Ghaleb, & Ahmed, 2020; Saetan et al., 2020). Indeed, Sharaf, Ghaleb, & Ahmed (2020) found that there was a significant difference in the dyspnea scores after the pursed-lip breathing exercise was completed (p<0.001), as well as in the scores of other outcomes such as chest retraction scores (p<0.001) and accessory muscle usage (p<0.001). Similarly, Saetan et al. (2020) found that after initiating a respiratory rehabilitation program that included breathing exercises, the dyspnea scores were significantly improved compared to the previous baseline at each time of evaluation at weeks one, four, and eight of the treatment program (p<0.001). Again, the two articles were similar to the three aforementioned RCTs in that all of the studies used different dyspnea scales as opposed to a standardized scale.

Five of the thirteen articles were Level I and Level II studies that supported the use of a breathing exercise program, but were of Low (C) quality surgery, and day of discharge), the intervention group had significantly improved dyspnea scores compared to the control group (p<0.05).
(Singh, 2022; Muthukumaran, Danasu, & Kosalai, 2020; Agustiyaningsih, Amin, & Makhfudli, 2018; Ningsih, Amin, & Bakar, 2018). These studies had found significant improvement in dyspnea scores when comparing an intervention group and control group; however, these articles had similarities in the significant number of grammatical errors (which impaired understanding), failed to discuss and represent the data in a legible manner, and had an inadequate explanation of the key results found.

Two non-research articles (Level V, High (A) and Good (B) quality, respectively [Brandt & Cook, 2018; Kuebler, 2019]) were retained which supported breathing exercises as an intervention. The Brandt & Cook (2018) case study on a 93-year-old woman with COPD found, that the exercise programs and breathing habit changes were effective in improving her symptomology (including dyspnea). Kuebler (2019) presented a summary of the literature and advised nurse practitioners to consider, in late stages of chronic lung diseases, the implementation of palliative care interventions (like breathing exercises), to help alleviate the symptoms of the disease and to improve the quality of life of the individual.

Finally, of the thirteen articles retained, only one article, which was a systematic review (Level I, A quality) found inclusive results (Gendron et al., 2018). The systematic review compared the results of ten randomized controlled trials (RCTs) that used AMBMT versus PR or added to PR or PR alone. The findings were inconclusive in that they were unable to determine which breathing exercise was most effective. A limitation of this systematic review was that it did not compare the efficacy of these interventions to usual care.

The retained articles provided little guidance on the suggested length of the exercise program and none discussed the long-term follow up of patients using the breathing exercises. However, Han-Bing et al. (2022) reviewed the effectiveness of a breathing-exercise program on the perioperative outcomes of lung-cancer surgery; the authors found that by the time of discharge (typically one week after surgery), patients who received the breathing exercise program had lower dyspnea scores compared to the control group that only received usual care. This article was alone among the body of retained evidence as providing a long-term impact on dyspnea scores for lung cancer patients specifically, but this impact may differ for patients admitted for COPD exacerbation or other similar conditions. However, providing the breathing exercise program for the duration of the hospital admission has appeared to be a uniting theme among all the retained articles.

Among the retained articles, a consistent theme emerges that participants who are enrolled in the breathing exercise intervention have lowered dyspnea scores compared to a group that receives usual care. In addition, the American Lung Association (2022) acknowledged that breathing exercises are considered to be beneficial, low-risk interventions. Thus, when dyspnea is assessed to be an active concern for the present patient admission, it is recommended for the healthcare organization include a breathing exercise program in the plan of care.

Translation

Based on the available evidence, the implementation of a breathing exercise program by nurses for patients with chronic lung diseases to alleviate dyspnea is appropriate and indicated. Breathing exercise programs have been shown to be low-risk to patients and not difficult to implement by healthcare organizations. While the literature has been inconsistent on the type of breathing exercise program used, as well as the tool that is used to measure the dyspnea score, the aggregate of all breathing exercise programs produced significantly improved results in dyspnea than no usage of such breathing programs. Healthcare organizations should consider conducting further research on the effectiveness of a breathing exercise program on patients with dyspnea; however, there is no reason to delay implementation of breathing exercise programs.

Conclusion

This evidence-based practice (EBP) project reviewed the efficacy of breathing exercises on the symptom of dyspnea in chronic lung disease patients and discussed its clinical significance and unique ethical significance to nursing. The EBP project investigated the following PICO question: In clients with chronic lung disease (P), how does a nurse-led breathing exercise program (I) compare to the
standard of care (C) on shortness of breath? The body of literature was searched using a comprehensive search strategy, and thirteen articles were retained for the final analysis and appraisal. The thirteen retained articles were composed mostly of RCTs, quasi-experimental studies, and systematic reviews. The literature review supports that breathing exercise programs help alleviate dyspnea in patients with chronic lung disease. It is indicated that change is feasible because of low-risk to patients and fit for clinical environments because of easy integration into daily care for patients, especially in the population of patients who have experienced hospitalization from COPD or other chronic lung disorders. The determination of the specific breathing exercise program is left to the specific unit, with singular breathing exercises like diaphragmatic pursed-lip breathing being more fit for large units with fewer resources, while bundled breathing exercise programs like PR and AMBMT are more fit in units with greater resources. Implementation of any of the breathing exercise programs can be assessed as still feasible for hospitals and other clinical settings to use.

References


Muthukumaran, D., Danasu, & Kosalai. (2020). An experimental study to assess the effectiveness of incentive spirometry exercise on pulmonary parameters of patients with lower


## Appendix A
### Search Strategy Table

<table>
<thead>
<tr>
<th>Date</th>
<th>Database/Website</th>
<th>Keywords/Synonyms Phrase</th>
<th>Search Strategy*</th>
<th>Yield**</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/18/2023</td>
<td>Cumulative Index of Nursing and Allied Health Literature (CINAHL) w/ Full Text</td>
<td>(“chronic lung diseases” OR “chronic lung disorder” OR “COPD” OR “chronic obstructive pulmonary disorder” OR “emphysema” OR “chronic lung disorder” OR “chronic pulmonary disorder” OR “chronic pulmonary diseases” OR “idiopathic pulmonary fibrosis” OR “mesothelioma” OR “chronic bronchitis” OR “lung cancer”) AND (“respiratory exercise” OR “breathing exercise” OR “pursed-lip breathing” OR “diaphragmatic breathing” OR “meditative breathing”) AND (“difficulty breathing” OR “dyspnea” OR “shortness of breath”)</td>
<td>After 2018. English-language only. Human. Peer Reviewed.</td>
<td>27 - 7 retained</td>
</tr>
<tr>
<td>9/19/2023</td>
<td>Cochrane Library of Reviews</td>
<td>(“chronic lung NEXT diseases” OR “chronic lung disorder” OR “COPD” OR “chronic obstructive pulmonary disorder” OR “emphysema” OR “chronic lung disorder” OR “chronic pulmonary disorder” OR “chronic pulmonary NEXT diseases” OR “idiopathic pulmonary fibrosis” OR “mesothelioma” OR “chronic bronchitis” OR “lung cancer”) AND (“respiratory NEXT exercise” OR “breathing NEXT exercise” OR “pursed lip breathing” OR “diaphragmatic breathing” OR “meditative breathing”) AND (“difficulty breathing” OR “dyspnea” OR “shortness of breath”)</td>
<td>Title Abstract. Cochrane Reviews. After 2018.</td>
<td>0 found.</td>
</tr>
<tr>
<td>9/19/2023</td>
<td>Cochrane Library of Reviews</td>
<td>(“chronic lung NEXT diseases” OR “chronic lung disorder” OR “COPD” OR “chronic obstructive pulmonary disorder” OR “emphysema” OR “chronic lung disorder” OR “chronic pulmonary disorder” OR “chronic pulmonary NEXT diseases” OR “idiopathic pulmonary fibrosis” OR “mesothelioma” OR “chronic bronchitis” OR “lung cancer”) AND (“respiratory NEXT exercise” OR “breathing NEXT exercise” OR “pursed-lip breathing” OR “diaphragmatic breathing” OR “meditative breathing”) AND (“difficulty breathing” OR “dyspnea” OR “shortness of breath”)</td>
<td>All Text. Cochrane Reviews. After 2018.</td>
<td>8 – 1 retained</td>
</tr>
<tr>
<td>9/22/2023</td>
<td>PubMed</td>
<td>(“chronic lung diseases” OR “chronic lung disorder” OR “COPD” OR “chronic obstructive pulmonary disorder” OR “emphysema” OR “chronic lung disorder” OR “chronic pulmonary disorder” OR “chronic pulmonary diseases” OR “idiopathic pulmonary fibrosis” OR “mesothelioma” OR “chronic bronchitis” OR “lung cancer”) AND (“respiratory exercise” OR “breathing exercise” OR “pursed-lip breathing” OR “diaphragmatic breathing” OR “meditative breathing”) AND (“difficulty breathing” OR “dyspnea” OR “shortness of breath”)</td>
<td>After 2018. Humans. English-language only. Adults 19+ years old.</td>
<td>32 – 2 duplicates, 0 retained.</td>
</tr>
<tr>
<td>9/23/2023</td>
<td>Nursing and Allied Health Databases (ProQuest)</td>
<td>(“chronic lung diseases” OR “chronic lung disorder” OR “COPD” OR “chronic obstructive pulmonary disorder” OR “emphysema” OR “chronic lung disorder” OR “chronic pulmonary disorder” OR “chronic pulmonary diseases” OR “idiopathic pulmonary fibrosis” OR “mesothelioma” OR “chronic bronchitis” OR “lung cancer”) AND (“respiratory exercise” OR “breathing exercise” OR “pursed-lip breathing” OR “diaphragmatic breathing” OR “meditative breathing”) AND (“difficulty breathing” OR “dyspnea” OR “shortness of breath”)</td>
<td>After 2018. English-language only. Peer-reviewed. Scholarly journals. Adults 19+ years old.</td>
<td>21 – 3 retained</td>
</tr>
<tr>
<td>9/24/2023</td>
<td>Hand searching</td>
<td>N/A</td>
<td>N/A</td>
<td>5 retained.</td>
</tr>
</tbody>
</table>
Appendix B
PRISMA Flow Diagram

Records identified:
Through database searching (n = 88)
Through hand searching (n = 5)

Duplicates excluded
(n = 2)

Records screened
(n = 91)

Records excluded
(n = 75)

Articles assessed for eligibility
(n = 16)

Articles excluded, with reasons:
(n = 3)
(Exclusion criteria: no full-text article available, does not address the PICO)

Full-text articles included for analysis
(n = 13)

Quantitative research studies included
(n = 11)

Qualitative research studies included
(n = 0)

Non-research studies included
(n = 2)
# Appendix C
## Individual Summary Tool

<table>
<thead>
<tr>
<th>Article Number</th>
<th>Author, Date &amp; Title</th>
<th>Evidence Type</th>
<th>Sample, Sample Size, Setting</th>
<th>Intervention</th>
<th>Findings That Help Answer the EBP Question</th>
<th>Measures Used</th>
<th>Limitations</th>
<th>Strength &amp; Quality Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Singh, R. (2022). A quasi experimental study to evaluate the effectiveness of pursed lip breathing exercise on reduction of dyspnea among chronic obstructive pulmonary disease patients in selected hospital in Panipat, Haryana.</td>
<td>Research Quasi-experimental study</td>
<td>N=60, control=30, experimental=30, among patients with COPD in hospitals in Panipat, Haryana.</td>
<td>Experimental group received pursed-lip breathing exercises. Control and experimental groups assessed using pre/post-tests evaluating for severity of dyspnea using a numeric scale.</td>
<td>Based on a p&lt;0.05, the authors conclude that the experimental group’s post-test scores were statistically significantly different from the pre-test scores, indicating that the intervention of pursed-lip breathing exercises is effective in reducing dyspnea.</td>
<td>Pre- and post-test numerical dyspnea scores</td>
<td>- Article included mostly out-of-date references.</td>
<td>Level II, Low (C)</td>
</tr>
<tr>
<td>2</td>
<td>Brandt, N. &amp; Cook, H. (2018). Chronic obstructive pulmonary disease in older adults: Part 1: Case study.</td>
<td>Non-research Case Report</td>
<td>One, 93-year-old woman diagnosed with COPD and other comorbidities, who lives in a long-term care facility.</td>
<td>N/A</td>
<td>- Article mentions that staying active and engaging in exercise, as well as habituating to breathe more effectively when diagnosed with COPD, are effective in minimizing COPD.</td>
<td>N/A</td>
<td>- Only one individual.</td>
<td>Level V, High (A)</td>
</tr>
<tr>
<td>3</td>
<td>Gendron et al. (2018). Active mind-body movement therapies as an adjunct to or in comparison with pulmonary rehabilitation for people with chronic obstructive pulmonary disease.</td>
<td>Research Systematic Review of Randomized Controlled Trials (RCTs)</td>
<td>10 RCTs, included, 762 participants, in Hong Kong and various Chinese provinces.</td>
<td>Active mind-body movement therapies (AMBMT) vs. pulmonary rehabilitation (PR)</td>
<td>Both PR and AMBMT were considered therapies that improve reported dyspnea in patients with chronic lung disease. AMBMT was favored over PR by the COPD assessment tool (CAT) and the St. George's Respiratory Questionnaire (SGRQ), whereas neither PR or AMBMT were favored in the modified Medical Research Council Scale (mMRCS), the Borg Scale, or the Chronic Respiratory Questionnaire (CRQ) Dyspnea Scale.</td>
<td>COPD Assessment Tool (CAT), St. George’s Respiratory Questionnaire (SGRQ), modified Medical Research Council Scale (mMRCS), Borg Scale, and Chronic Respiratory Questionnaire (CRQ) Dyspnea Scale.</td>
<td>- Compares the results of these two interventions, as opposed to each by itself compared to standard of care / usual care.</td>
<td>Level I, High (A)</td>
</tr>
<tr>
<td>4</td>
<td>Neşe, A. &amp; Samancioğlu Buğlama, S. (2022). The effect of progressive muscle relaxation and deep breathing exercises on dyspnea and fatigue symptoms of COPD patients: A randomized controlled study.</td>
<td>Research RCT</td>
<td>N=128 participants with 8 excluded due established exclusion criteria, remaining 120 participants divided into three groups of 40 participants each (two experimental, one control group). Four patients lost to Progressive muscle relaxation (PMR) exercise experimental group and deep breathing (DB) exercise experimental group</td>
<td>Physical and emotional subscales of the Dyspnea Scale, and the CAFS total scores, of participants in both experimental groups were statistically significantly different from the scores in these categories as compared to the control group. The authors conclude that both PMR and DB exercises are effective in reducing dyspnea</td>
<td>Physical and emotional subscales of the Dyspnea Scale, and the CAFS total scores, of participants in both experimental groups were statistically significantly different from the scores in these categories as compared to the control group. The authors conclude that both PMR and DB exercises are effective in reducing dyspnea</td>
<td>FEV1/FVC ratios in pre and post tests for each group.</td>
<td>- Only one hospital setting used.</td>
<td>Level I, High (A)</td>
</tr>
<tr>
<td>Page</td>
<td>Study Title</td>
<td>Study Design</td>
<td>Sample Size</td>
<td>Setting</td>
<td>Intervention</td>
<td>Outcomes</td>
<td>Notes</td>
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<td>5</td>
<td>Rui-Chen et al. (2021). Multimodal Exercise Program: A pilot randomized trial for patients with lung cancer receiving surgical treatment.</td>
<td>Research RCT</td>
<td>N=143 participants, with 38 excluded due to exclusion criteria. N=105 randomized into three groups; further 4 participants lost to attrition. Setting is a teaching hospital in Gaziantep, Turkey.</td>
<td>Combined exercise and breathing exercise group vs. breathing exercise alone group vs. control group receiving usual care.</td>
<td>No statistical difference between the reported dyspnea (p=0.244) and other measurements between the breathing exercise only group and the combined exercise group; statistically significant difference between improvement in reported dyspnea in combined exercise group (p=0.027) versus the breathing exercise group alone compared to the control group.</td>
<td>mMRCS, 6-minute walk distance (6MWD), incentive spirometry.</td>
<td>Study was conducted in a single-center. Mostly male subjects. No long-term follow-up of effectiveness of the interventions. Participants also received surgical procedure to remove lung cancer mass, as opposed to non-surgically treated patients. Level I, High (A)</td>
<td></td>
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<tr>
<td>6</td>
<td>Han-Bing et al. (2022). Active cycle of breathing technique: A respiratory modality to improve perioperative outcomes in patients with lung cancer.</td>
<td>Research RCT</td>
<td>N=94 participants, with 26 excluded due to exclusion criteria. N=68 participants randomly assigned to control and intervention group, with n=34 participants in each group. Setting is a teaching hospital in Jilin, China.</td>
<td>Control group received usual care instructions regarding breathing exercises at home, intervention group received Active Cycle of Breathing Technique (ACBT)</td>
<td>A statistical difference in the reported mMRCS scores on day before surgery (p&lt;0.057), day after surgery (p&lt;0.012), and day of discharge (p&lt;0.003) was determined between the intervention and control group, indicating that supplementing usual care with ACBT is effective in producing less dyspnea than receiving usual care alone. This effect is noticed on mMRCS, 6MWD, HADS.</td>
<td>Mostly female subjects. Study was conducted in a single-center. No long-term follow-up of the effectiveness of the interventions. Participants also received surgical procedure to remove lung cancer mass, as opposed to non-surgically treated patients. Level I, High (A)</td>
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<tr>
<td>7</td>
<td>Xiao et al. (2019). Effects of breathing exercises on patients with lung cancer.</td>
<td>Research Systematic review of RCTs</td>
<td>15 RCTs retained, with n=870 participants located in the United Kingdom, China, Germany, Italy, Spain, Poland, and Denmark.</td>
<td>N/A</td>
<td>Nine RCTs compared dyspnea scores between intervention and control groups and determined that the dyspnea scores in the intervention group were significantly improved over the control group (p&lt;0.001). Seven of the nine RCTs found that the intervention group receiving breathing exercises had significantly improved dyspnea scores than the control group (p&lt;0.008). Additionally, two of the nine RCTs compared the effects of a breathing exercise subgroup with other exercise subgroups and determined a significant difference between these groups (p&lt;0.0001). Six RCTs found that participants in a surgical subgroup had significant improvement of dyspnea in the intervention group compared to the control group (p&lt;0.01); the remaining two RCTs included other treatment.</td>
<td>6MWD, visual analog scale for dyspnea, Dyspnova-12 scale.</td>
<td>All participants in the RCTs evaluated by the researchers underwent some additional medical treatment (i.e. chemotherapy, surgery, combinations thereof). Includes outdated studies in the total review. Authors state that this review only contained 870 participants, which is less than in other similar reviews. Authors included multiple kinds of breathing exercises, and it is unknown if one specific breathing exercise had the greatest improvement in dyspnea over others. Lack of PRISMA flow table, no discussion of the level and quality of the retained RCTs. Level I, Good (B)</td>
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<tr>
<td>No.</td>
<td>Reference</td>
<td>Design</td>
<td>Sample Size</td>
<td>Intervention Description</td>
<td>Outcome Measures</td>
<td>Quality Score</td>
<td>Quality Rating</td>
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<td>8</td>
<td>Saelan et al. (2020)</td>
<td>Quasi-experimental study</td>
<td>N=28 participants, divided into n=14 for both control and intervention group. Setting is an oncology clinic in Bangkok, Thailand.</td>
<td>Control group received usual care and intervention group received Respiratory Rehabilitation program (RRP). Participants that received the RRP had a significantly improved dyspnea score (p&lt;0.009) compared to the control group. There was also a statistical difference between the dyspnea scores at weeks 1, 4, and 8 (p&lt;0.001), indicating a progressive improvement in the dyspnea scores in the intervention group between those three weeks.</td>
<td>Cancer Dyspnea Scale</td>
<td>Level II, High (A).</td>
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<tr>
<td>9</td>
<td>Muthukumaran et al. (2020)</td>
<td>Research RCT</td>
<td>N=60 participants, randomly divided in to n=30 participants in control and experimental group. Setting is Puducherry, India.</td>
<td>Control group received routine hospital care and experimental group received incentive Spirometry exercises. Dyspnea grade in the experimental group had mean of 4.3667 while the dyspnea grade in the control group was 2.2, which the authors found to be significantly different (p&lt;0.001). The effects of incentive spirometry exercise on the experimental group produced improved dyspnea scores compared to the control group who received routine care.</td>
<td>mMRCS, Borg Visual Analogue Respiratory Assessment Scale (BVARAS),</td>
<td>Level I, Low (C).</td>
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<td>10</td>
<td>Kuebler, K. (2019)</td>
<td>Non-research Literature review</td>
<td>Groups of individuals who have COPD, idiopathic pulmonary fibrosis, pulmonary hypertension.</td>
<td>N/A</td>
<td>Aggressive palliative care (including breathing exercises and interventions aimed at addressing symptoms) should be considered in the case management of individuals with COPD, idiopathic pulmonary fibrosis, and other obstructive and restrictive pulmonary disease, in combination with pharmacological interventions tailored to each specific chronic pulmonary disease.</td>
<td>N/A</td>
<td>Level V, Good (B)</td>
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<td>11</td>
<td>Agustiyangsir et al. (2018)</td>
<td>Research Systematic review of RCTs and experimental designs</td>
<td>Twelve articles retained, n=1040 participants. Majority of articles and participants from South and Southeast Asia.</td>
<td>Intervention groups received breathing exercises and relaxation techniques, control groups received usual care.</td>
<td>N/A</td>
<td>Level II, Low (C).</td>
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<td>12</td>
<td>Sharaf et al. (2020). Effect of pursed lip breathing exercise on physiological parameters among patients with chronic obstructive pulmonary disease</td>
<td>Research Quasi-experimental</td>
<td>N=50 convenience sample of men and women with COPD. Setting is a Chest Outpatient Clinic in Alexandria, Egypt.</td>
<td>Intervention group only. Intervention group received pursed-lip breathing exercises (PLB).</td>
<td>Utilizing the modified respiratory status assessment scale, researchers determined that the difference in pre-PLB and post-PLB scores were significantly improved in chest retraction scores (p&lt;0.001), use of accessory muscles (p&lt;0.001), air entry (p&lt;0.001), and breathing sounds (p&lt;0.001). Researchers determined that there is a clinically significant difference in the improvement of dyspnea signs in the post-PLB scores as compared to the pre-PLB scores. The researchers also conclude that self-report scores of dyspnea were significantly improved in post-PLB scores compared to pre-PLB scores (p&lt;0.001).</td>
<td>Modified Respiratory Status Assessment Scale</td>
<td>-Inclusion of sources beyond five years of the search frame and publish date. -Study participants majority male and living in urban areas.</td>
<td>Level II, High (A)</td>
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</table>

| 13 | Ningish et al. (2018). The effect of walking exercise and pursed lips breathing on signs and symptoms of COPD patients: A systematic review. | Research Systematic review of RCTs and experimental designs | Sixteen articles included. N=539 participants. Participants located in North & South America, Europe, and Asia. | Intervention groups received pursed-lip breathing exercises or walking exercises. Control groups received standard of care. | Six articles retained found significant improvement in the dyspnea scores following pursed-lip breathing exercises. | Visual Analog Scale, mMRCs, Borg Scale, CRQ | -Numerous typos and syntax errors. -Lack of tables to represent data. -Lack of discussion of results and whether it is statistically significant. -No discussion of review limitations -No level and quality assigned to included articles | Level II, Low (C) |

Notes: Use this area to define any abbreviations entered within your table

Active Cycle of Breathing Technique (ACBT), Active mind-body movement therapies (AMBMT), Chronic Obstructive Pulmonary Disease (COPD), Chronic Respiratory Questionnaire (CRQ) Dyspnea Scale, COPD Assessment Tool (CAT), Hospital Anxiety and Depression Scale (HADS), modified Medical Research Council Scale (mMRCs), Pulmonary Rehabilitation (PR), Pursed-lip breathing exercise (PLB) Randomized Controlled Trial (RCT), Respiratory Rehabilitation Program (RRP), St. George’s Respiratory Questionnaire (SGRQ).
# Appendix D

**Articles Appraised by Level of Evidence and Quality**

<table>
<thead>
<tr>
<th>Level</th>
<th>Quantity</th>
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<tr>
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<td>A-C</td>
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<tr>
<td>Level II</td>
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<td>A &amp; C</td>
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<tr>
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<tr>
<td>Level IV</td>
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<tr>
<td>Level V</td>
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