

# BLOWING EXERCISE IN INCREASING LUNG CAPACITY IN CHILDREN WITH LUNG DISEASE: *SYSTEMATIC REVIEW*

**Authors: Afifah Ayu Syaiful<sup>1\*</sup>, Dessie Wanda<sup>2</sup>, Nur Agustini<sup>3</sup>, Imami Nur Rachmawati<sup>4</sup>**

<sup>1</sup>Afifah Ayu Syaiful: Magister Ilmu Keperawatan Universitas Indonesia, Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424

<sup>2</sup>Dessie Wanda: Departemen Keperawatan Anak Universitas Indonesia, Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424

<sup>3</sup>Nur Agustini: Departemen Keperawatan Anak Universitas Indonesia, Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424

<sup>4</sup>Imami Nur Rachmawati: Departemen Keperawatan Maternitas Universitas Indonesia, Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424

\*) Korespondensi: [afifah.ayu21@ui.ac.id](mailto:afifah.ayu21@ui.ac.id)

## About the Author

1. 1st Author : Ns. Afifah Ayu Syaiful, S. Kep  
Affiliation : Magister Ilmu Keperawatan, Fakultas Ilmu Keperawatan, Universitas Indonesia  
Mailing address : Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424  
Email of author : [afifah.ayu21@ui.ac.id](mailto:afifah.ayu21@ui.ac.id)  
Orcid ID : <https://orcid.org/0000-0002-2273-5695>  
Google Scholar URL : <https://scholar.google.com/citations?user=ju5oM7MAAAAJ&hl=id&authuser=1>  
Phone number : 081393953386
- 2nd Author : Dessie Wanda, S.Kp., M.N., Ph.D  
Affiliation : Departemen Keperawatan Anak, FIK UI  
Mailing address : Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424  
Email of author : [dessie@ui.ac.id](mailto:dessie@ui.ac.id)  
Orcid ID : <https://orcid.org/0000-0003-0659-1748>  
Google Scholar URL : <https://scholar.ui.ac.id/en/persons/dessie-wanda>
- 3rd Author : Dr. Nur Agustini, S.Kp., M.Si  
Affiliation : Departemen Keperawatan Anak, FIK UI  
Mailing address : Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424  
Email of author : [tufahati@ui.ac.id](mailto:tufahati@ui.ac.id)  
Orcid ID : <https://orcid.org/0000-0003-0483-1429>  
Google Scholar URL : <https://scholar.ui.ac.id/en/persons/nur-agustini>
- 4th Author : Dr. Imami Nur Rachmawati, S.Kp., M.Sc.  
Affiliation : Departemen Keperawatan Maternitas, FIK UI  
Mailing address : Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat-16424  
Email of author : [inrachma@ui.ac.id](mailto:inrachma@ui.ac.id)  
Orcid ID : <https://orcid.org/0000-0002-9252-7736>  
Google Scholar URL : <https://scholar.ui.ac.id/en/persons/imami-nur-rachmawati>

### **ABSTRACT**

*Diseases of the lungs and airways are the most common conditions in the world, which can cause problems not only in the respiratory organs, but also abnormalities in the body's organ systems due to impaired air exchange during the breathing process. Infectious causes of lung and respiratory tract disease originate from bacterial, viral, fungal and parasitic infections, such as tuberculosis and pneumonia. Non-communicable causes of lung and respiratory diseases, originating from cigarettes or cigarette smoke, including pollution and hazardous materials, as well as genetics, such as COPD, asthma and lung cancer. The objective of this systematic review is to analyze blowing exercise by increasing lung capacity in children with lung disease. Methods used in compiling systematic reviews with electronic searches: ProQuest, ScienceDirect, SpingerLink, and SAGE Journals. The writing criteria are full text, keywords, abstract and publications in the 2019-2023 period. The research search found 11 articles that had been extracted. The results obtained, namely blowing exercise to increase lung capacity in children with pneumonia, have received a positive response and need to be developed dynamically.*

Keywords: Lung disease, blowing, lung capacity

### **ABSTRACT**

Diseases of the lungs and airways are the most common conditions in the world, which can cause problems not only in the respiratory organs, but also abnormalities in the body's organ systems due to impaired air exchange during the breathing process. Infectious causes of lung and respiratory tract disease originate from bacterial, viral, fungal and parasitic infections, such as tuberculosis and pneumonia. Non-communicable causes of lung and respiratory diseases, originating from cigarettes or cigarette smoke, including pollution and hazardous materials, as well as genetics, such as COPD, asthma and lung cancer. The objective of this systematic review is to analyze blowing exercise by increasing lung capacity in children with lung disease. Methods used in compiling systematic reviews with electronic searches: ProQuest, ScienceDirect, SpingerLink, and SAGE Journals. The writing criteria are full text, keywords, abstract and publications in the 2019-2023 period. The research search found 11 articles that had been extracted. The results obtained, namely blowing exercise to increase lung capacity in children with pneumonia, have received a positive response and need to be developed dynamically.

Keywords: Lung disease, blowing, lung capacity

### **INTRODUCTION**

Age is a factor that can identify the risk of the disease being experienced. Different ages have different challenges and health problems experienced, especially at the age of children. This age is a vulnerable period in the emergence of disease. One of the health problems that often occur in children is lung disease. Lung and respiratory diseases are the most common conditions in the world. Which can cause problems not only in the respiratory organs but cause abnormalities in other systems that occur due to impaired respiratory air exchange (Robinson, 2018). It is estimated that the top 10 causes of death in the world in 2040 (Metrics, 2017). The morbidity of lung and respiratory tract diseases varies from mild and can heal on its own, for example, such as the flu to those that are severe and require treatment, such as tuberculosis, asthma, pneumonia to lung cancer. Infants and children are the most vulnerable groups to suffer and die from this disease. In fact, there is the nickname "The Big Five" for lung and airway diseases with the highest number of incidents and producing the world's largest burden of Disability-Adjusted Life-Years (DALYs), namely COPD (Chronic Obstructive Pulmonary Disease), asthma, acute respiratory infections, Tuberculosis (Tuberculosis), and lung cancer (Enarson, 2013).

Infectious causes of lung and respiratory tract disease originate from bacterial, viral, fungal and parasitic infections, such as tuberculosis and pneumonia. Non-communicable causes of lung and respiratory diseases, originating from cigarettes or cigarette smoke, including pollution smoke and other hazardous materials, as well as genetic/inherited, for example COPD, asthma and lung cancer (WHO, 2007). Compared with adults, the airways of children are more susceptible to obstruction because of their unique key anatomic attributes. Smaller radius causes higher resistance in the airways and increases the workload of breathing and susceptibility to inflammation. Consequently, the resulting increased work of breathing rapidly progresses to respiratory failure because the child has less respiratory reserve (Pfleger & Eber, 2013).

Abnormal breathing patterns can exacerbate respiratory muscle fatigue, causing dyspnea, low exercise capacity (Walsh & Oliver, 2016). In recent years, breathing exercises have attracted attention as a non-pharmacological breathing strategy aimed at correcting abnormal breathing patterns and promoting gas exchange between the lungs and capillaries to improve lung ventilation (Ozalevli et al., 2010). Several studies have shown that breathing exercises can improve gas exchange, encouraging the rehabilitation of COPD and asthma patients (Gosselink, 2003). Breathing is necessary for the purpose of maintaining active activity (Edwards, 2008), and regular breathing exercises increase lung capacity and increase respiratory support during a child's verbal activity. Following a program of breathing exercises can be a matter of life and death (Lange et al., 2011). However, it is difficult for children to remain interested in boring and long-lasting training models (Sonne & Jensen, 2016). Studies have concluded that play-based breathing systems are an effective way to increase children's compliance with breathing exercises. There are several methods for measuring respiration, including chest and abdominal movement detection, optical-based respiratory rate monitoring, and airflow-based methods (Al-Khalidi et al., 2011).

Patients with respiratory disorders experience decreased muscle strength and endurance, respiratory muscle fatigue, and energy consumption. Several studies, such as (BISaccioni et al., 2009), have shown that exercise programs and motor and respiratory therapy improve aerobic capacity, breathing patterns, muscle strength, and quality of life in patients with breathing, swallowing, and voice problems. Lung disease experienced by children can reduce the capacity of their lung organs. Therefore, it is necessary to do exercises that can be done by children, one of which is blowing exercise, which aims to increase lung capacity. So that children can continue their survival and development.

## **MATERIALS AND METHOD**

Databases used in compiling this systematic review topic: ProQuest, ScienceDirect, SpringerLink, and SAGE Journals. Using the PICO format in identifying problems, interventions, group comparisons and outcomes, namely in children with lung disease is blowing exercise more effective than standard care in increasing lung capacity. By using the types of articles: Cohort studies, Case-Control studies, and Randomized Controlled Trials.

### *Inclusion and exclusion criteria*

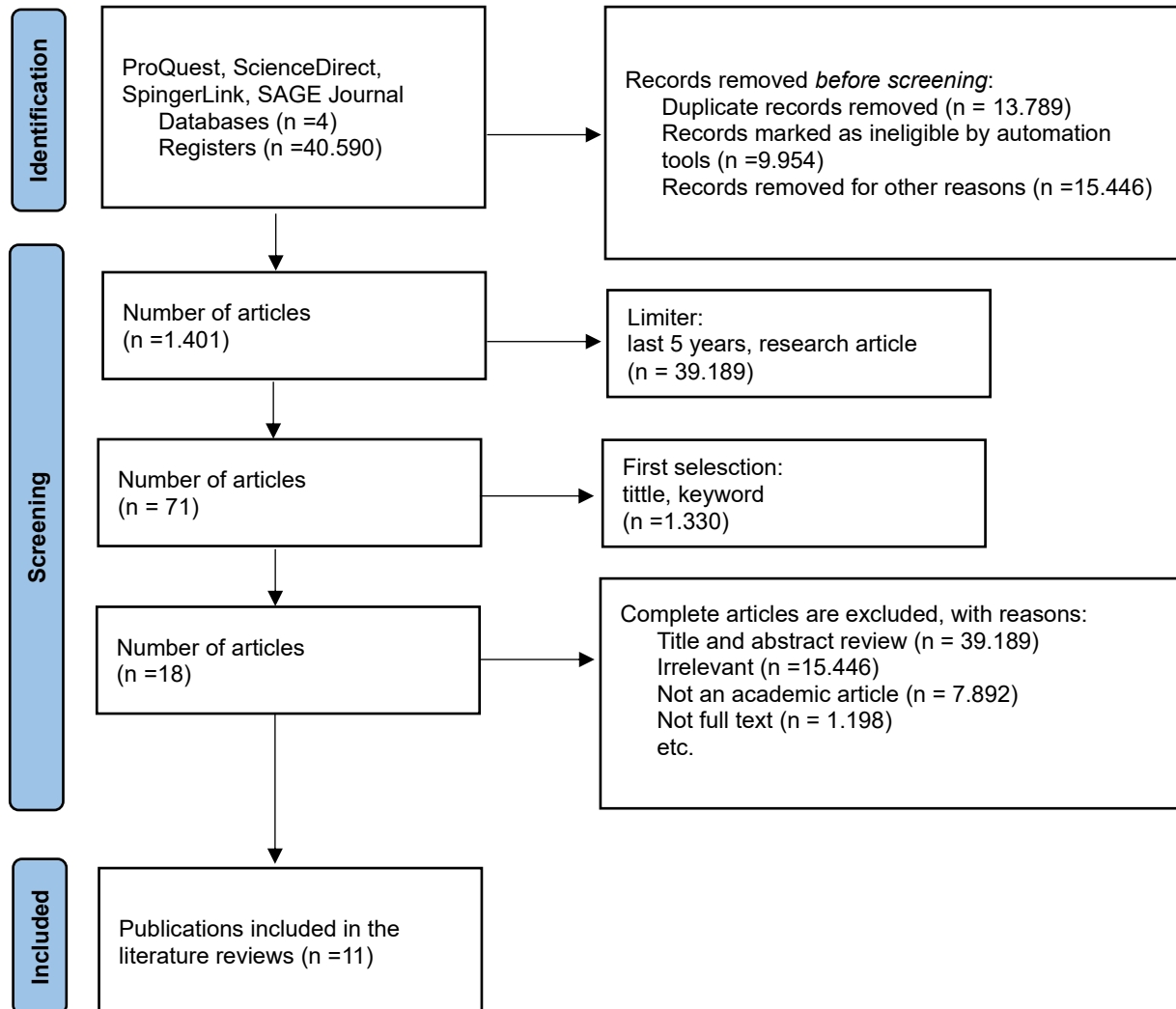
Inclusion criteria: patients with pulmonary disease, using English and Indonesian language references.

Exclusion criteria: patients with disabilities, patients with psychiatric problems, articles included in the literature review, systematic review, and umbrella review.

### Identifications of studies

Concepts and alternative PICO question formats: children with breathing disorders, Impact of blowing exercise, Standard care for children with lung disease, and measurement of lung capacity.

### Study selection



## RESULTS

Based on the results of the publications included in the literature review in this article as many as 11 articles are summarized in the following table.

**Table 1.** Extraction of data results

No.	Database	Authors, country, year	Article title	Journal title	Aim	Design	Sample	Result (can be expanded)
1.	ProQuest	Mohammad Bargahi et al, Iran, 2022  (Bargahi et al., 2022)	Tehran University of Medical Sciences	Effect of Balloon-Blowing and Oxygenation in Hospitalized COVID-19 Patients: A Pilot Study	This study was conducted to evaluate the effect of BBE (Balloon Exercise) on dyspnea and oxygenation in acute phase COVID-19 patients.	A Randomized Controlled Trial	Respondents from patients treated in the non-intensive care unit (ICU) of Booali-Sina Medical and Education Hospital, from August 15, 2020, to October 31, 2020.	The results showed that there was no statistically significant difference in SpO <sub>2</sub> with/without treatment on the first, second, and third days between the two groups. Although the severity of dyspnea was not significantly different between the two groups, the mean dyspnea scores at rest ( $2.72 \pm 2.25$ vs. $1.6 \pm 1.21$ , $P=0.007$ ) and after activity ( $4.53 \pm 2.04$ vs. $3.52 \pm 1.66$ , $P = 0.017$ ) improved in the third day of the intervention group. Balloon blowing exercises improve dyspnea in non-critical Covid-19 patients, but do not significantly improve oxygenation.
2.	ProQuest	Kevin J. O'Sullivan et al, Ireland, 2021  (O'Sullivan et al., 2021)	BMC Pulmonary Medicine	A short-term evaluation of a prototype disposable Oscillating Positive Expiratory Pressure (OPEP) device in a cohort of children with cystic fibrosis	Evaluate use of LIL-PEEP devices in children with FF at 1 month and determine their effectiveness in comparison with current standards of care (ie, use of existing devices).	Cohort Study	36 responders at the University of Limerick Hospital (UHL) Central West Ireland pediatric CF service	31 participants completed the study: ages range 4-16 years. Lung function (mean difference $\pm$ SD, %FEV <sub>1</sub> = $1.69 \pm 11.93$ ; %FVC = $0.58 \pm 10.04$ ; FEV <sub>1</sub> : FVC = $0.01 \pm 0.09$ ), LCI (difference mean $\pm$ SD, $0.08 \pm 1.13$ ), six-minute walk test, and CFQ-R did not change post-intervention. The device experiences that participants reported were mostly positive. Single-use OPEP devices maintain patient lung function over short-term ( $\leq 1$ month) use, and are subject to positive feedback regarding functionality while reducing the risk of airway contamination associated with ineffective cleaning.
3.	ProQuest	Qibin Lin et al, China, 2019  (Lin et al., 2019)	British Medical Journal	Effects of breathing exercises using home-based positive pressure in the	Evaluating pulmonary rehabilitation developed to combat PIPi and modulation of	A Randomized Controlled Trial	64 respondents with a diagnosis of stage III/IV COPD. Randomized into two groups: standard treatment and standard treatment combined with	The results showed no significant difference between the two groups at the start of the study, while the 6MWT and CAT scores showed a clinically and statistically significant increase ( $p < 0.001$ ) at the end of the study. At 18 months, the predicted change in forced expiratory volume

				expiratory phase in patients with COPD	pulmonary function, exercise tolerance, hospitalization and HRQoL in COPD patients.		rehabilitation exercises.	breathing percentage in 1 second (FEV1% pred) was different between the two groups (p<0.05). In addition, there was a statistically significant difference in the 6MWT outcome, CAT score and FEV1% pred score between baseline and 18 months (p<0.0001) in the intervention group.
4.	ScienceDirect	Haoyu Zou et al, China, 2022  (Zou et al., 2022)	Geriatric Nursing	ABCDEF pulmonary rehabilitation program can improve the mid-term lung function of lung cancer patients after thoracoscopic surgery: A randomized controlled study	Evaluating the effect of the ABCDEF pulmonary rehabilitation program in lung cancer patients who have undergone surgery.	A Randomized Controlled Trial	The 90 respondents who underwent thoracoscopic pneumonectomy were divided into two groups of 45, using a completely randomized model.	The ABCDEF program of thoracoscopic pneumonectomy patients was found to be more effective in improving lung function at 3 months after discharge (p<0.05). There is no statistically significant difference (p>0.05). Different exercise tolerance (p<0.05). The incidence of postoperative complications in the experimental group was lower (p<0.05). Length of stay after surgery (p<0.05), but length of chest tube insertion was not significantly different between the intervention and control groups (p>0.05).
5.	ScienceDirect	G, Atakul et al, Turkey, 2022  (Atakul et al., 2022)	Elsivier Masson France	The effect of block flute breathing exercise on pulmonary function tests in children with asthma	Show how pulmonary function tests in children who play the block flute regularly affect diaphragmatic breathing	A Case-Controlled and Prospective y Designed Study	25 respondents aged over 10 years with a diagnosis of mild to moderate asthma in the Pediatric Immunology and Allergy Department of our hospital.	There was no significant difference in PFT values between the asthma and control groups before and after breathing exercises (P > 0.05). In the asthma group, there was a positive correlation between the percentage change in FEV1/FVC, FEF25-75 observed after breathing exercises and body mass index, waist circumference (P<0.05 each). In the healthy group, the percentage change in FVC was higher (P<0.05). Among children with asthma, there was a greater increase in the percentage change in FEV1/FVC and in the percentage change in FEF25-75 in the treatment-free group of asthma (P < 0.05).
6.	ScienceDirect	Ya-Qing Wang et al, China, 2020  (Y. Q. Wang et al., 2020)	European Journal of Integrative Medicine	Effect of breathing exercise in patients with non-small cell lung cancer receiving surgical	To determine the effect of giving breathing exercises to non-small cell lung cancer patients receiving surgical treatment	A Randomized Controlled Trial	65 respondents were randomly assigned to the breathing exercise group or the control group (routine care).	After preoperative breathing exercises, the intervention group differed significantly in terms of inspiratory capacity (P < 0.001) and walking distance of 6 minutes (P = 0.035) compared to the control group. On the first day after surgery, the intervention group had better inspiratory capacity and dyspnea than the control group. At discharge, dyspnea (P < 0.001), inspiratory capacity (P =

				treatment: A randomized controlled trial					0.003), anxiety (P < 0.001) and depression (P < 0.001) for patients in the intervention group improved significantly compared to controls.
7.	SpringerLink	Studer et al, Switzerland, 2019  (Studer et al., 2019)	PLOS ONE	Does trumpet playing affect lung function? A case-control study	The purpose of this study was to investigate the effect of playing the trumpet/corned beef/flugelhorn on lung function	A Case Control Study	Respondents were recruited from one different place throughout Switzerland, obtained as many as 147 respondents who fell into the category of both the control group and the treatment group.		147 subjects were involved in this study. Control (n = 48) was significantly younger, more often male, current smokers and had a lower body mass index compared to trumpet/corned/flugelhorn players (n = 99). There was no significant difference in predicted FEV1% (91.9% vs 94.2%; p = 0.316) or % predicted FVC (89.4% vs 92.6%; p = 0.125) between control and trumpeter/corned player /horn flugel, respectively, in crude oil and adjusted analysis.
8.	SAGE journals	Koolen et al., Netherlands, 2021  (Koolen et al., 2021)	Canadian Journal of Occupational Therapy	Effectiveness of Home-Based Occupational Therapy on COPM Performance and Satisfaction Scores in Patients with COPD	To evaluate the effectiveness of home monodiscipline OT in COPD patients.	A Case Control Study	Respondents to this study were respondents with COPD, referred to a COPD-specific occupational therapist in the primary care setting, a total of 84 respondents.		During the study period, a total of 84 COPD patients were referred to OT, of which 41 patients completed baseline measurements and follow-up measurements regarding age (63 + 7.3 versus 64 + 11.3; p ¼ 0.671), prior FEV1%. (50.5 + 16.6 versus 49.4 + 14.0; p ¼ 0.764), and the total CCQ score (2.1 + 0.9 versus 2.0 + 1.1; p ¼ 0.327).
9.	SAGE journals	Wang et al., China, 2021  (J. Wang et al., 2021)	CLINICAL REHABILITATION	Liuzijue qigong versus traditional breathing training for patients with post-stroke dysarthria complicated by abnormal respiratory control: Results of a single center randomized controlled trial	The purpose of this study is to investigate whether liuzijue qigong can improve the ability to control breathing and comprehensive speech in dysarthria stroke patients.	A Randomized Controlled Trial	Overall, a total of 98 stroke patients with dysarthria participated in this study. Patients were randomly divided into two groups (experimental group: basic articulation + liuzijue qigong, 48 patients or control group: basic articulation + traditional breathing training, 50 patients). All therapies were carried out once a day, five times a week for three weeks.		At three weeks, there was a significant difference between the two groups in changes in rate of speech respiration (81% vs. 66%, P=0.011), Modified Frenchay Dysarthria Rating (5.54 (4.68–6.40) vs. 3.66 (2.92–4.40), P=0.001), maximum phonation time (5.55(4.92–6.18) vs. 3.01 (2.31–3.71), P<0.01), maximum numeracy ability (3.08 (2.45-3.71) vs. 2.10 (1.53-2.67), P = 0.018), and /s/ (3.08 (2.39-3.78) vs. 1.87 (1.23-2.51), P=0.004

## **DISCUSSION**

Quality assessment for the determination of the article is carried out by the author by creating a frame of mind that raises the topic of discussion. A literature search based on keywords was carried out, thus obtaining the topic, "Clinical Issues of Blowing Exercise in Increasing Lung Capacity in Children with Lung Disease". The preparation of this literature review uses research articles or journals published for 5 years (2019-2023). Journal criteria are research articles in English with research subjects being children with lung disease. Next, the authors began searching for articles in the database and screened the appropriate titles and abstracts to determine which articles were relevant to the topics discussed.

Data analysis through a literature search conducted by the author relevant to the topic according to the provisions, all international articles. Furthermore, from the articles collected, a systematic analysis is carried out for each article with the results of using tools that have been adjusted to the types of articles found by the author.

There are 4 databases used in screening for systematic review, namely from ProQuest, Science Direct, SpringerLink, and SAGE Journals. A total of 9 articles were obtained after screening based on keywords and according to the research questions. All articles have research categories in the last 5 years with randomized controlled trial and case-control study designs. Search for articles through the keywords Lung Diseases, Blowing, and Lung Capacity. Through screening titles and abstracts in accordance with the limitations that have been made, including children with lung disease, blowing, standard care, and lung capacity.

## **CONCLUSIONS AND SUGGESTIONS**

Diseases of the respiratory system often occur at the age of children; this is because the child's organs are still developing. Children with lung disease are often found when children are undergoing treatment in hospital which is the main cause of childcare or as a complication of other diseases. Lung disease also affects the capacity for lung expansion which can cause shortness of breath in children, obstruction in the airways, exudate buildup and decreased lung function. Care is needed in optimizing the recovery of children's health even in hospitalization conditions. However, it is not uncommon for hospitalization to result in child-care trauma. Therefore, atraumatic treatment is needed to reduce the impact of hospitalization trauma on children. one of them is by breathing relaxation using blowing. So that there is an increase in lung capacity in children with pulmonary disease. To restore function in the recoil and compliance.

The results of research conducted by Barghi et. al (2022) showed that evaluating the effect of BBE (Ballon blowing Exercise) on dyspnea and oxygenation in acute phase COVID-19 patients showed a statistically significant difference in SpO<sub>2</sub> in the two groups. Evaluation of use of the UL-OPEP device in children with CF for 1 month, determining its effectiveness compared to current standards of care (ie, use of existing devices) in a total of 36 responders in a local hospital's CF pediatric service (O' Sullivan et al, 2021). Another study stated that pulmonary rehabilitation developed to combat PEEPi and modulate lung function, exercise tolerance, hospitalization and HRQoL in COPD patients had clinically and statistically significant differences ( $p < 0.001$ ) at the end of the study, namely at 18 months (Lin et al., 2019).

Zou et al., (2022) in their study stated that there was an effect of the ABCDEF pulmonary rehabilitation program on lung cancer patients who had undergone surgery in respondents who underwent thoracoscopic pneumonectomy which were divided into two groups with a completely randomized model found significant results. Meanwhile, other tests show

how pulmonary function tests in children who play the block flute regularly affect diaphragmatic breathing (Atakul et al., 2022). There is an effect of giving breathing exercises to non-small cell lung cancer patients who receive surgical treatment at random to 65 respondents after preoperative breathing exercises (Y. Q. Wang et al., 2020).

The results of research conducted by Struder et al., (2019) stated that playing the trumpet had a significant effect on lung function by recruiting 147 respondents. The effectiveness of home monodisciplinary OT in COPD patients is mentioned in a study conducted by Koolen et al., (2021) that it is effective for respondents with COPD disease. Another study stated that liuzijue qigong could improve the ability to control breathing and comprehensive speech in dysarthria stroke patients in all study respondents, a total of 98 patients participated for three weeks, significant in both groups.

### ACKNOWLEDGEMENT

Breathing exercises using the blowing technique in children who are hospitalized with lung disease are effective in reducing the traumatic impact of hospitalization while children are undergoing treatment. Among them are using Pulse Lip Breathing, blowing trumpets, using traditional toys, balloon blowing, applications used for monitoring, using OT, chest breathing exercises with deep breaths, blowing beam flutes, pulmonary rehabilitation programs with ABCDEF and PEEPi, and using comparison devices. . Lung diseases that children suffer from include dyspnea in acute phase COVID-19 patients, cystic fibrosis, COPD patients, lung cancer, asthma, patients undergoing surgery, COPD patients, and patients with abnormal respiratory control.

Interventions in the form of breathing exercises with blowing are effective in children with lung disease when compared to those given standard care to increase lung capacity. Increased lung capacity will also have an impact on the length of stay in children in the hospital. Many studies have been carried out by adjusting the characteristics and goals of the treatment.

The results of the analysis of the articles in this systematic review have complied with the rules of searching the literature in accordance with the guidelines and tools used. This has been explained through in-depth criticism of roles that are in accordance with the articles design.

### REFERENCES

- Al-Khalidi, F. Q., Saatchi, R., Burke, D., Elphick, H., & Tan, S. (2011). Respiration rate monitoring methods: A review. *Pediatric Pulmonology*, 46(6), 523–529. <https://doi.org/10.1002/ppul.21416>
- Atakul, G., Bostanci, I., Ercan, N., Ertugrul, A., & Ozmen, S. (2022). The effect of block flute breathing exercise on pulmonary function tests in children with asthma. *Revue Francaise d'Allergologie*, 63(1), 103246. <https://doi.org/10.1016/j.reval.2022.08.001>
- Balaji, R., Ramanathan, M., Bhavanani, A., Ranganadin, P., & Balachandran, K. (2019). Effectiveness of adjuvant yoga therapy in diabetic lung: A randomized control trial. *International Journal of Yoga*, 12(2), 96. [https://doi.org/10.4103/ijoy.ijoy\\_20\\_18](https://doi.org/10.4103/ijoy.ijoy_20_18)
- Bargahi, M., Rastgoo, N., Aryanejad, F., Esmailzade, S., Nemati, R., Ghaebi, M., Bajelan, A., & Soltani, S. (2022). Effect of Balloon-Blowing on Dyspnea and Oxygenation in Hospitalized COVID-19 Patients: A Pilot Study. *Acta Medica Iranica*, 60(6), 338–344. <https://doi.org/10.18502/acta.v60i6.1003>
- Bisaccioni, C., Aun, M. V., Cajuela, E., Kalil, J., Agondi, R. C., & Giavina-Bianchi, P. (2009).

- Comorbidities in severe asthma: Frequency of rhinitis, nasal polyposis, gastroesophageal reflux disease, vocal cord dysfunction and bronchiectasis. *Clinics*, 64(8), 769–773. <https://doi.org/10.1590/S1807-59322009000800010>
- Edwards, S. D. (2008). Breath psychology: Fundamentals and applications. In *Psychology and Developing Societies* (Vol. 20, Issue 2). <https://doi.org/10.1177/097133360802000201>
- Enarson, D. (2013). *Respiratory diseases in the world : realities of today - opportunities for tomorrow*. 9(1).
- Gosselink, R. (2003). Controlled breathing and dyspnea in patients with chronic obstructive pulmonary disease (COPD). *Journal of Rehabilitation Research and Development*, 40(5 SUPPL. 2), 25–33. <https://doi.org/10.1682/JRRD.2003.10.0025>
- Koolen, E. H., Spruit, M. A., de Man, M., Antons, J. C., Nijhuis, E., Nakken, N., Janssen, D. J. A., & van 't Hul, A. J. (2021). Effectiveness of Home-Based Occupational Therapy on COPM Performance and Satisfaction Scores in Patients with COPD. *Canadian Journal of Occupational Therapy*, 88(1), 26–37. <https://doi.org/10.1177/0008417420971124>
- Lange, B., Flynn, S., Chang, C.-Y., Rizzo, A., & Bolas, M. (2011). Breathe: A Game to Motivate the Adherence of Breathing Exercises. *Journal of Physical Therapy Education*, 25(1), 30–35. <https://doi.org/10.1097/00001416-201110000-00006>
- Lin, Q., Zhuo, L., Wu, Z., Li, C., Zhou, M., & Cai, C. (2019). Effects of breathing exercises using home-based positive pressure in the expiratory phase in patients with COPD. *Postgraduate Medical Journal*, 95(1127), 476–481. <https://doi.org/10.1136/postgradmedj-2019-136580>
- Metrics, I. for H. (2017). *Global Burden of Disease Study 2017*. file:///C:/Users/Harrison/AppData/Local/Mendeley Ltd./Mendeley Desktop/Downloaded/Unknown - 2017 - Global Burden of Disease Study 2017.pdf
- O'Sullivan, K. J., Power, V., Linnane, B., McGrath, D., Mulligan, M., White, R., O'Sullivan, L. W., & Dunne, C. P. (2021). A short-term evaluation of a prototype disposable Oscillating Positive Expiratory Pressure (OPEP) device in a cohort of children with cystic fibrosis. *BMC Pulmonary Medicine*, 21(1), 1–10. <https://doi.org/10.1186/s12890-021-01525-3>
- Ozalevli, S., Ilgin, D., Kul Karaali, H., Bulac, S., & Akkoçlu, A. (2010). The effect of in-patient chest physiotherapy in lung cancer patients. *Supportive Care in Cancer*, 18(3), 351–358. <https://doi.org/10.1007/s00520-009-0659-6>
- Pfleger, A., & Eber, E. (2013). Management of acute severe upper airway obstruction in children. *Paediatric Respiratory Reviews*, 14(2), 70–77. <https://doi.org/10.1016/j.prrv.2013.02.010>
- Sonne, T., & Jensen, M. M. (2016). *ChillFish*. 271–278. <https://doi.org/10.1145/2839462.2839480>
- Studer, L., Schumann, D. M., Stalder-Siebeneichler, A., Tamm, M., & Stolz, D. (2019). Does trumpet playing affect lung function?—A case-control study. *PLoS ONE*, 14(5), 1–10. <https://doi.org/10.1371/journal.pone.0215781>
- Walsh, N. P., & Oliver, S. J. (2016). Exercise, immune function and respiratory infection: An update on the influence of training and environmental stress. *Immunology and Cell Biology*, 94(2), 132–139. <https://doi.org/10.1038/icb.2015.99>
- Wang, J., Li, G., Ding, S., Yu, L., Wang, Y., Qiao, L., Wu, Q., Ni, W., Fan, H., Zheng, Q., Zhang, Y., & Li, H. (2021). Liuzijue qigong versus traditional breathing training for patients with post-stroke dysarthria complicated by abnormal respiratory control: Results of a single-center randomized controlled trial. *Clinical Rehabilitation*, 35(7), 999–1010. <https://doi.org/10.1177/0269215521992473>
- Wang, Y. Q., Cao, H. P., Liu, X., Yang, Z., Yin, Y. Y., Ma, R. C., & Xie, J. (2020). Effect of breathing exercises in patients with non-small cell lung cancer receiving surgical

- treatment: A randomized controlled trial. *European Journal of Integrative Medicine*, 38(October 2019), 101175. <https://doi.org/10.1016/j.eujim.2020.101175>
- Zou, H., Qin, Y., Gong, F., Liu, J., Zhang, J., & Zhang, L. (2022). ABCDEF pulmonary rehabilitation program can improve the mid-term lung function of lung cancer patients after thoracoscopic surgery: A randomized controlled study. *Geriatric Nursing*, 44, 76–83. <https://doi.org/10.1016/j.gerinurse.2021.12.021>
- WHO. (2007). Global surveillance, prevention, and control of Chronic Respiratory Diseases: A comprehensive approach. Available from: <https://www.who.int/gard/publications/GARD%20Book%202007.pdf>
- Robinson, J. (2018). Lung disease overview. Available from: <https://www.webmd.com/lung/lung-diseases-overview#1>