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The Effect of Pursed-Lips Breathing on Children's Respiratory Rate with Pneumonia in Cempaka High Care Unit, Dr. Moewardi Regional Hospital

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Abstract

Background: Pneumonia is a lower respiratory tract infection that can be fatal in children, caused by bacteria, viruses, or fungi. Symptoms include fever, cough, and dyspnea. One non-pharmacological therapy to address ineffective breathing patterns is Pursed Lips Breathing (PLB), which can improve alveolar expansion in each lung lobe, normalize respiratory rates, and promote relaxation in children with pneumonia. **Objective:** This study aimed to determine the effect of PLB on respiratory frequency in childrens with pneumonia at Cempaka High Care Unit, Dr. Moewardi Regional Hospital, Surakarta. **Methods:** A descriptive case study approach was used, involving two respondents diagnosed with pneumonia. Respiratory rate (RR) was measured before and after PLB intervention, administered twice daily (morning and evening) for three days. **Results:** Post-intervention, Respondent R's RR decreased from 44 to 32 breaths/minute, while Respondent S's RR improved from 32 to 20 breaths/minute. **Conclusion:** PLB therapy demonstrated changes in respiratory frequency for both respondents. Respondent R's rate remained indicative of tachypnea, whereas Respondent S achieved a normal range, marked by improved breathing patterns.

Keywords: Children, Pursed-Lips breathing, Pneumonia, Respiratory rate

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1. BACKGROUND

A child is an individual aged 0 to 18 years, a period of growth and development requiring special care, love, and affection (Hasibuan & Suryana, 2021). During this stage, a child's organs are not yet fully developed, making them more susceptible to diseases, including pneumonia (Anjaswanti et al., 2022).

Pneumonia is a leading infectious cause of death in children, characterized by inflammation of the lower respiratory tract due to bacterial, viral, or fungal infections. Common pathogens include Streptococcus pyogenes, Staphylococcus aureus,

Haemophilus influenzae, Mycobacterium tuberculosis, Salmonella, pneumococcal bacteria, Haemophilus influenzae type b (Hib), and respiratory syncytial virus (RSV). Symptoms include fever, cough, dyspnea, and rapid breathing (Noviana & Faozi, 2023).

According to the World Health Organization (WHO), pneumonia is the leading cause of death in children under five, accounting for 15% of global child mortality, with 740,180 deaths in 2019. In Indonesia, an estimated 19,000 children died from pneumonia that year (Faisal et al., 2024). National data reveals 79,320 pneumonia cases in infants (<1 year) with 169 deaths and 118,769 cases in toddlers (1-4 years) with 275 deaths (Indonesian Ministry of Health, 2021). In Central Java, pneumonia prevalence rose from 1.6% in 2018 to 1.8% in 2023, with 52,033 cases reported in toddlers (Central Java Health Office, 2024). Similarly, Surakarta City saw a surge from 233 cases in 2022 to 473 in 2023 (BPS Surakarta, 2023).

Hospitalized pneumonia patients often experience respiratory distress, marked by tachypnea, chest retractions, nasal flaring, and abnormal breath sounds (Faisal et al., 2024). Nursing challenges include ineffective breathing patterns, airway clearance issues, hyperthermia, impaired gas exchange, activity intolerance, nutritional deficits, and hypovolemia. Inflammation from pneumonia often leads to airway obstruction, exacerbating clinical symptoms (Kosutova & Mikolka, 2021). Management includes pharmacological and non-pharmacological interventions, such as chest physiotherapy, vibration, nebulization, and effective coughing techniques like Pursed Lips Breathing (PLB). According to Reni et al. (2024), PLB improves alveolar expansion, increases alveolar pressure, aids secretion clearance, and normalizes breathing patterns. This technique involves inhaling through the nose for 3 counts and exhaling slowly through pursed lips for 7 counts, promoting slow, deep breathing and better respiratory control (Zulkifli et al., 2022).

Reni et al. (2024) found that the mean respiratory rate (RR) dropped from 41.33 breaths/min to 27.73 breaths/min post-PLB, compared to 40.93 to 36.60 breaths/min in controls. PLB strengthens respiratory muscles, slows expiration, prevents small airway collapse, and regulates breathing rate and depth.

A preliminary study at Dr. Moewardi Hospital (February 2025) revealed 56 pneumonia cases in the Cempaka HCU (November 2024–January 2025),

with respiratory distress as the dominant complication. Interviews indicated that patients and families lacked knowledge about PLB for dyspnea relief.

2. METHODS

This research utilized a descriptive case study design, aiming to analyze the implementation outcomes or phenomena occurring within a specific population by describing the current conditions of the research subjects based on observable and factual situations. The subjects of the study were two respondents receiving treatment in Cempaka High Care Unit, Dr. Moewardi Regional Hospital, selected based on predetermined inclusion and exclusion criteria. The inclusion criteria consisted of pediatric patients aged 3–17 years diagnosed with pneumonia and having a respiratory rate greater than 24 breaths per minute, who were cooperative in communication, along with their parents or guardians who agreed to participate as respondents, and patients using respiratory support devices such as NRM, HFNC, or ventilator. Conversely, the exclusion criteria included patients in emergency condition with respiratory arrest, as well as those with contraindications or medical diagnoses of pneumothorax, hemoptysis or active bleeding, cardiovascular disorders, and pleural effusion.

In this case study, two respondents were selected: Respondent 1, An. R, and Respondent 2, An. S. Both respondents met the inclusion and exclusion criteria of the study. Subjective and objective data obtained through observation and interviews with the respondents and their families led to identifying nursing problems. Based on these findings, a nursing diagnosis was established according to NANDA-I (2018): Ineffective Breathing Pattern related to depression of the respiratory center (D.0005). The nursing intervention used was Airway Management (I.01011). Based on the identified nursing problems, it is expected that after implementing nursing care for 3x8 hours, there will be improvement in breathing pattern, as defined by outcome criteria from NOC (2018), including improved respiratory rate, improved depth of breathing, and decreased use of accessory muscles. According to NIC (2018), the interventions for this problem include monitoring breathing patterns (rate, depth, effort), monitoring adventitious breath sounds, positioning in semi-Fowler's position, administering oxygen therapy, teaching pursed-lip breathing exercises, and collaborating in

the administration of pharmacological therapy (bronchodilators, expectorants, mucolytics) if indicated.

Data collection refers to the techniques or methods researchers use to gather information. According to Makbul (2021), data collection can function as an independent method from data analysis or even serve as the primary tool for both data collection and analysis. In this study, data were collected through respondent characteristic instruments. The researcher conducted data gathering along with treatment through pursed lips breathing therapy to measure respiratory frequency over three consecutive days. Pre-test and post-test data were collected before and after the intervention, respectively. The collected data were analyzed using descriptive analysis. The data collection methods in this research consist of: 1) Primary Data: data obtained directly from respondents, including the effectiveness of Pursed Lips Breathing therapy on respiratory frequency in children with pneumonia in Cempaka High Care Unit, Dr. Moewardi Regional Hospital; and 2) Secondary Data: data sourced indirectly, typically derived from existing records such as names, ages, and laboratory or medical examination results.

In this case study, data analysis began with detailed data collection, followed by data reduction to select relevant data categorized into subjective and objective data. This allowed for accurate nursing problem identification. All data collected from assessment, diagnosis, planning, implementation, and nursing evaluation were recorded and documented according to standard nursing care documentation formats. The documented nursing care results from the two managed patients were presented narratively. Nursing research ethics are crucial, especially since this study involved human subjects. Therefore, ethical considerations were strictly observed. The research was conducted after obtaining approval from the Head of the Ners Profession Study Program at the Faculty of Health Sciences, Universitas 'Aisyiyah Surakarta, and permission from Dr. Moewardi Regional General Hospital. Ethical principles applied included informed consent, where respondents were given detailed information about the study and could choose to participate voluntarily; anonymity, ensured by replacing respondents' names with codes; confidentiality, guaranteed by protecting all personal information and destroying data after two years; veracity, involving

honest disclosure of the study's purpose, benefits, and potential effects; self-determination, allowing respondents to decide their participation without pressure freely and justice, ensuring fair and non-discriminatory treatment of all participants, regardless of whether they agreed or declined to participate in the study.

3. RESULTS

Table 1. Respiratory rate before the application of Pursed Lips Breathing in children with pneumonia in Cempaka High Care Unit, Dr. Moewardi Regional Hospital, Surakarta.

Day	Child R		Child S	
	Respiratory rate (times/minute)	Description	Respiratory rate (times/minute)	Description
Day 1	44	Tachypnea	32	Tachypnea
Day 2	42	Tachypnea	28	Tachypnea
Day 3	38	Tachypnea	22	Normal

Based on Table 1, before receiving Pursed Lips Breathing therapy on February 14, Child R had a respiratory rate of 44 breaths per minute with signs of tachypnea and dyspnea, while Child S had a respiratory rate of 28 breaths per minute, also showing symptoms of dyspnea. On February 15, Child R's respiratory rate was 42 breaths per minute, and Child S's rate was 24 breaths per minute. On February 16, Child R's respiratory rate decreased to 38 breaths per minute, and Child S's respiratory rate reached normal limits at 22 breaths per minute.

Table 2. Respiratory rate after the application of Pursed Lips Breathing in children with pneumonia in Cempaka High Care Unit, Dr. Moewardi Regional Hospital, Surakarta.

Day	Child R		Child S	
	Respiratory rate (times/minute)	Description	Respiratory rate (times/minute)	Description
Day 1	40	Tachypnea	28	Tachypnea (decreased dyspnea)
Day 2	38	Tachypnea	22	Normal
Day 3	48	Tachypnea	20	Normal

Based on Table 2, after receiving Pursed Lips Breathing on February 14, Child R had a respiratory rate of 40 breaths per minute and Child S had a respiratory rate of 28 breaths per minute, both still experiencing dyspnea. On February 15, Child R's respiratory rate decreased to 38 breaths per minute and Child S's rate dropped to 22 breaths per minute. By February 16, Child R's respiratory rate

further improved to 32 breaths per minute and Child S's rate reached 20 breaths per minute, indicating a significant improvement.

Table 3. The development of respiratory rate before and after the implementation of Pursed Lips Breathing in children with pneumonia in Cempaka High Care Unit, Dr. Moewardi Regional Hospital, Surakarta.

Day	Child R			Child S		
	Respiratory rate (times/minute)			Respiratory rate (times/minute)		
	Pre	Post	Change	Pre	Post	Change
Day 1	44	40	Yes	32	28	Yes
Day 2	42	38	Yes	28	26	Yes
Day 3	38	32	Yes	22	20	Yes

Based on Table 3, the application of Pursed Lips Breathing over three days from February 14–16, 2025, showed changes and improvements in respiratory frequency for both respondents who initially experienced tachypnea and dyspnea, with their respiratory rates gradually approaching normal levels.

On day 1, Child R had a pre-intervention respiratory rate of 44 breaths per minute (tachypnea), which decreased to 40 breaths per minute after the intervention. Child S had a pre-intervention rate of 32 breaths per minute (tachypnea), which decreased to 28 breaths per minute.

On day 2, Child R's pre-intervention rate was 42 breaths per minute (tachypnea), decreasing to 38 breaths per minute afterward. Child S had a pre-intervention rate of 28 breaths per minute (tachypnea), which improved to 26 breaths per minute.

On day 3, Child R's pre-intervention respiratory rate was 38 breaths per minute (tachypnea), which improved to 32 breaths per minute after the intervention. Child S had a pre-intervention rate of 22 breaths per minute (normal), which further decreased to 20 breaths per minute (normal).

Table 4. Comparison of the final respiratory frequency before and after the application of Pursed Lips Breathing.

Measurement	Respiratory rate (times/min)	
	Child R	Child S
Before	44	32
After	32	20
Improvement	**12**	**12**

Based on Table 4, before the intervention, Child R had a respiratory rate of 44 breaths per minute and Child S had 32 breaths per minute. After three

consecutive days of Pursed Lips Breathing therapy, Child R's respiratory rate improved to 32 breaths per minute, and Child S's rate improved to 20 breaths per minute. These results indicate that the application of Pursed Lips Breathing significantly improved the respiratory frequency in both respondents.

4. DISCUSSION

Observation Results of Respiratory Frequency Before the Application of Pursed Lips Breathing Therapy

The observation results showed that before receiving Pursed Lips Breathing therapy, both respondents experienced tachypnea (above normal respiratory rate) with a nursing diagnosis of ineffective breathing pattern. In Child R, an 8-year-old, the respiratory rate on the first day was 44 breaths per minute. The child exhibited short and rapid breathing patterns, used accessory muscles for breathing, and reported experiencing dyspnea. In the second patient, Child S, aged 12, the patient complained of dyspnea and was using nasal oxygen at 6 liters per minute (NRM). The respiratory rate was 32 breaths per minute.

According to Adawiah & Yanto (2021), pneumonia can cause ineffective breathing patterns due to resistance in breathing efforts, leading to dyspnea. Hypoxemia can cause tissue and organ damage, which may lead to severe damage, organ failure, permanent organ damage, or even death. Symptoms observed include dyspnea, prolonged expiratory phase, and abnormal breathing patterns.

The impact of pneumonia in children leads to edema in lung alveoli, which allows organisms to enter and cause pneumonia. The inflammatory process in the lungs affects tissues, reduces lung capacity, narrows bronchial passages, and increases mucus production. These conditions increase airway retention and reduce expiratory volume, potentially causing hypoxemia. To prevent this, monitoring and evaluation of oxygen administration are necessary, as suggested by Togodly (2022). To optimize breathing in children with pneumonia, breathing exercises such as Pursed Lips Breathing can be performed.

This study aligns with Reni et al. (2024), who found that the average respiratory rate before Pursed Lips Breathing in the intervention group was 41.33 breaths per minute, while in the control group it was 40.93 breaths per minute. Another study conducted by Azizah et al. (2023) showed a significant difference in respiratory rate (RR) between before and after Pursed Lips Breathing intervention, with a p-value of 0.000 < 0.05.

These theories correspond with the actual observations made in both

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respondents. Child R experienced dyspnea and rapid breathing due to fever and a history of pneumonia. Child S also experienced these symptoms due to pneumonia and fever.

Observation Results of Respiratory Frequency After the Application of Pursed Lips Breathing Therapy

Based on the results shown in Table 2, respiratory frequency decreased after the implementation of Pursed Lips Breathing therapy in both patients. Both respondents showed changes in their breathing patterns after the therapy. Child R reported that after receiving Pursed Lips Breathing, breathing became more controlled, dyspnea reduced, and the respiratory rate dropped to 32 breaths per minute. Similarly, Child S reported improved breathing patterns, reduced dyspnea, and felt more relaxed, with the respiratory rate reaching a normal level of 20 breaths per minute.

Pursed Lips Breathing is a breathing exercise consisting of two mechanisms: deep inhalation and active, prolonged exhalation. Normally, exhalation occurs without excessive energy use. However, Pursed Lips Breathing involves prolonged exhalation. Deep inhalation and prolonged exhalation strengthen abdominal muscles, increasing intra-abdominal pressure. This pressure pushes the diaphragm upward, reducing thoracic cavity size and increasing alveolar pressure, thus facilitating air expulsion. Prolonged exhalation during Pursed Lips Breathing decreases respiratory frequency, improves airflow, and reduces dyspnea (Ramadhani et al., 2022).

These findings align with Adawiah & Yanto (2021), who found that implementing Pursed Lips Breathing for two days reduced respiratory rate from 22.5 to 21 breaths per minute, indicating its effectiveness in lowering abnormal respiratory rates. Sadat et al. (2022) also confirmed that performing Pursed Lips Breathing for 15–20 minutes twice daily for two days significantly lowered respiratory rate, improved breath sounds, and reduced dyspnea levels. Therefore, regular practice of Pursed Lips Breathing can improve lung capacity, strengthen respiratory muscles, and enhance overall respiratory status.

Development of Respiratory Frequency Before and After Pursed Lips Breathing Implementation

Based on Table 3, measurements taken over three consecutive days of Pursed Lips Breathing practice showed changes in respiratory frequency in both respondents. Each day, there was a noticeable improvement. For Child R, the respiratory

rate decreased from 44 breaths per minute before the intervention to 32 breaths per minute on the third day. This improvement was supported by the use of high-flow nasal cannula (HFNC) oxygen therapy at 10 LPM FiO2 40%, along with other pharmacological and inhalation therapies. In Child S, the respiratory rate was initially 32 breaths per minute with NRM oxygen at 6 LPM. By days 2 and 3, oxygen support was changed to nasal cannula at 5 LPM, and the patient reported reduced dyspnea. After Pursed Lips Breathing, the respiratory rate reached a normal level of 20 breaths per minute. These results indicate that both patients improved from tachypnea to within the normal respiratory range (18–30 breaths per minute).

To optimize breathing in children with pneumonia, Pursed Lips Breathing helps train the lungs to perform diaphragmatic breathing. This exercise enhances residual lung capacity after inhalation, activates alveolar pressure in each lobe, improves air circulation during exhalation, and supports better gas exchange. Pursed Lips Breathing involves exhaling through pursed lips, which strengthens respiratory muscles, slows down exhalation, prevents airway collapse, and controls breathing depth and speed (Reni et al., 2024).

Karnianti & Kristinawati (2023) found that before Pursed Lips Breathing, the average RR was 25 breaths per minute, but decreased by an average of 2.5 breaths per minute over three days. Adriadi et al. (2025) also reported a significant decrease in respiratory rate from 31.125 to 26.250 breaths per minute, with a p-value of 0.000 ‹ 0.05, confirming the effectiveness of Pursed Lips Breathing in improving respiratory parameters.

Comparison of Final Respiratory Rate Before and After Pursed Lips Breathing Intervention

Based on Table 4, after three consecutive days of Pursed Lips Breathing therapy, respiratory frequency decreased. In Child R, the rate remained above normal but showed improvement. In contrast, Child S achieved a normal respiratory rate of 20 breaths per minute. The faster improvement in Child S compared to Child R may be due to the more severe condition in Child R, who required HFNC oxygen support at 10 LPM FiO2 40% and additional inhalation therapy, whereas Child S only needed nasal cannula oxygen at 3 LPM on the third day.

Regular practice of Pursed Lips Breathing is recommended to enhance its benefits. This technique stimulates endorphin release, promoting relaxation

and comfort, thereby reducing respiratory rate. Consistent breathing exercises stimulate autonomic nervous system responses, decreasing sympathetic nerve activity and enhancing parasympathetic function. This results in slower heart rate and vasodilation in blood vessels (Handayani et al., 2023).

5. CONCLUSION

The results of the study conducted by the researcher on respondents Child R and Child S regarding the application of Pursed Lips Breathing exercise therapy on respiratory frequency in children with pneumonia at Dr. Moewardi Regional General Hospital indicate that before the intervention, both respondents experienced tachypnea, characterized by abnormally high respiratory rates, with Child R having a respiratory rate of 44 breaths per minute and Child S at 32 breaths per minute, both showing signs of dyspnea and using accessory muscles for breathing. Following the implementation of Pursed Lips Breathing over three consecutive days, there was a noticeable improvement in respiratory patterns, as Child R's respiratory rate decreased to 32 breaths per minute, still above normal, while Child S reached a normal respiratory rate of 20 breaths per minute, indicating better breathing control and reduced dyspnea. The improvement in both respondents suggests that Pursed Lips Breathing helps enhance diaphragmatic breathing, increase alveolar pressure, improve air circulation during exhalation, and support better gas exchange, which aligns with previous studies showing its effectiveness in reducing respiratory rate and improving overall respiratory status. The faster improvement observed in Child S compared to Child R may be attributed to the more severe condition of Child R, who required higher oxygen support through HFNC at 10 LPM FiO2 40% along with pharmacological and inhalation therapies, whereas Child S only needed nasal cannula oxygen at 3 LPM on the third day. Regular practice of Pursed Lips Breathing is recommended as it stimulates endorphin release, promotes relaxation, reduces sympathetic nerve activity, enhances parasympathetic function, lowers heart rate, and facilitates vasodilation, all of which contribute to improved respiratory outcomes. Therefore, this non-pharmacological intervention should be encouraged in clinical settings and incorporated into routine care for children experiencing dyspnea due to pneumonia.

AUTHOR CONTRIBUTIONS

The author contributes in conceptualization, data collection and

analysis Arini Nurhidayati, Zulfa Mahdiartur Rasyida, Suciana Ratriningsih. Writing and manuscript revisions: Arini Nurhidayati, and Zulfa Mahdiartur Rasyida.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest in this research.

DATA AVAILABILITY STATEMENT

The data are available from the corresponding author upon reasonable request.

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