

Implementation of Pursed-Lips Breathing on Respiratory Status in Children with Pneumonia at RSUD Dr. Moewardi Surakarta

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ABSTRACT

Introduction: Pneumonia is a frequent lower respiratory tract infection in children that can impair respiratory function, leading to an ineffective breathing pattern characterized by dyspnea, tachypnea, reduced oxygen saturation, use of accessory respiratory muscles, and rhonchi. As a non-pharmacological breathing exercise, Pursed Lips Breathing (PLB) has the potential to enhance ventilation and improve oxygenation.

Objectives: To describe the implementation of Pursed Lips Breathing in improving the respiratory status of children with pneumonia at RSUD Dr. Moewardi Surakarta.

Methods: A descriptive case study with a nursing process approach was conducted involving two pediatric patients diagnosed with pneumonia and an ineffective breathing pattern. PLB was performed once daily for 10–15 minutes over three consecutive days. Respiratory rate, oxygen saturation, accessory respiratory muscle use, and adventitious breath sounds were evaluated before and after each session.

Results: Respiratory status improved in both patients after the intervention. Respiratory rate declined from 32 to 24 breaths/minute and oxygen saturation increased from 93% to 98% in the first patient. In the second patient, respiratory rate decreased from 34 to 25 breaths/minute, while oxygen saturation improved from 92% to 97%. Accessory respiratory muscle use resolved, and rhonchi became less evident in both cases.

Conclusions: Pursed Lips Breathing was associated with improved respiratory status, reflected by lower respiratory rate, higher oxygen saturation, resolution of accessory respiratory muscle use, and reduced rhonchi. This technique may be considered a supportive non-pharmacological nursing intervention for children with pneumonia.

Keyword: children, pneumonia, pursed lips breathing

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Introduction

Pneumonia is an acute infection affecting the lower respiratory tract that results in inflammation of the lung parenchyma caused by bacteria, viruses, or fungi. The inflammatory process interferes with normal gas exchange, leading to clinical manifestations such as fever, cough, dyspnea, and tachypnea (Noviana & Faozi, 2023). Despite advances in healthcare, pneumonia continues to be a major public health concern and remains one of the leading causes of death among children worldwide. According to the World Health Organization, an estimated 740,180 children under five years of age died from pneumonia in 2019, representing 14% of global deaths in this age group (WHO, 2022). Similarly, UNICEF reported that more than 700,000 children under five die from pneumonia each year, highlighting the persistent global burden of this disease (UNICEF, 2024).

The burden of pediatric pneumonia is also substantial in Indonesia. National data from the Ministry of Health recorded 79,320 pneumonia cases among infants and 118,769 cases among children aged 1–4 years in 2021 (Kementerian Kesehatan RI, 2021). Regional surveillance has likewise demonstrated an increasing trend, with the prevalence among toddlers in Central Java rising from 41% in 2023 to 63.7% in 2024 (Dinas Kesehatan Jawa Tengah, 2024). A comparable increase has been reported in Surakarta, where documented cases grew from 233 in 2022 to 520 in 2024 (BPS Surakarta, 2025).

Children with pneumonia commonly experience impaired respiratory function manifested by tachypnea, reduced oxygen saturation, use of accessory respiratory muscles, and adventitious breath sounds resulting from impaired ventilation and gas exchange (Febriyanti et al., 2025). Without timely management, these respiratory abnormalities may progress to hypoxemia, respiratory muscle fatigue, and, in severe cases, respiratory failure (Faisal et al., 2024). Besides pharmacological treatment, supportive non-pharmacological interventions are recommended to optimize respiratory function. One of these interventions is Pursed Lips Breathing (PLB), a breathing exercise that promotes slow nasal inspiration followed by prolonged expiration through pursed lips, thereby improving ventilation efficiency and oxygenation (Mustika et al., 2025).

Previous studies have demonstrated the beneficial effects of PLB in patients with pneumonia. Dev K & Naveen (2022) reported that PLB reduced the mean respiratory rate from 23.91 to 19.00 breaths/minute while increasing oxygen saturation from 93.91% to 97.75%. Likewise, Nurhidayati et al. (2025) found that three consecutive days of PLB effectively reduced respiratory rate in pediatric pneumonia patients. Nevertheless, the study evaluated only respiratory rate, providing limited information regarding overall respiratory status.

Therefore, this case study implemented Pursed Lips Breathing in children with pneumonia to evaluate its effects on multiple indicators of respiratory status, including respiratory rate, oxygen saturation, accessory respiratory muscle use, and adventitious breath sounds, at RSUD Dr. Moewardi Surakarta.

Method

This study adopted a descriptive case study design based on the nursing process to describe the implementation of Pursed Lips Breathing (PLB) in improving the respiratory status of children diagnosed with pneumonia and experiencing an ineffective breathing pattern. The research was conducted at RSUD Dr. Moewardi Surakarta in May 2026. Ethical approval was granted by the Ethics Committee of RSUD Dr. Moewardi Surakarta (No. 2.701/XII/HREC/2025), confirming that the study met ethical standards. Permission to conduct the study was also obtained from the hospital under reference number 893/864/2026.

Two pediatric patients were recruited using a purposive sampling technique based on predefined eligibility criteria. Eligible participants were children aged 6–12 years with a confirmed diagnosis of pneumonia, fully conscious, able to communicate effectively, and willing to participate in the PLB intervention. Children with respiratory disorders other than pneumonia, musculoskeletal, neuromuscular, or cardiovascular diseases, as well as those with unstable psychological conditions, were excluded from the study.

Data collection was carried out using a nursing assessment form, a respiratory status observation sheet, a pulse oximeter for measuring oxygen saturation, and a stopwatch to determine respiratory rate. The observed indicators included respiratory rate, oxygen saturation, accessory respiratory muscle use, and adventitious breath sounds, which were assessed before and after each intervention.

Before data collection, the participants and their parents or legal guardians received an explanation regarding the study objectives and procedures, followed by written informed consent. Baseline assessment included patient identification, medical history, physical examination, and review of supporting clinical data. Initial measurements of respiratory rate, oxygen saturation, accessory respiratory muscle use, and adventitious breath sounds were then recorded. The PLB intervention was administered for 10–15 minutes once daily over three consecutive days. Each session consisted of slow inhalation through the nose for

approximately four seconds, breath holding for two seconds, and gradual exhalation through pursed lips for four seconds according to the standard operating procedure (Prasetyo, 2023). Following each intervention session, all respiratory parameters were reassessed using the same measurement procedures.

The collected data were analyzed descriptively by comparing respiratory status before and after the implementation of PLB throughout the three-day intervention period for each participant. The findings were presented in tables and narrative descriptions and interpreted in relation to relevant theories and previous studies.

Results

1. Respiratory Rate

Table 1. Respiratory Rate

	Patient M		Patient F	
	Pre-test	Post-test	Pre-test	Post-test
Day 1	32 breaths/minute	29 breaths/minute	34 breaths/minute	31 breaths/minute
Day 2	30 breaths/minute	27 breaths/minute	31 breaths/minute	28 breaths/minute
Day 3	28 breaths/minute	24 breaths/minute	29 breaths/minute	25 breaths/minute

Based on Table 1, both participants experienced a progressive reduction in respiratory rate following the implementation of Pursed Lips Breathing (PLB) over three consecutive days. In Patient M, the respiratory rate decreased from 32 to 29 breaths/minute on the first day, from 30 to 27 breaths/minute on the second day, and from 28 to 24 breaths/minute on the third day. A similar pattern was observed in Patient F, whose respiratory rate declined from 34 to 31 breaths/minute on day one, 31 to 28 breaths/minute on day two, and 29 to 25 breaths/minute on day three. Overall, both participants demonstrated a consistent downward trend in respiratory rate throughout the intervention period.

2. Oxygen Saturation

Table 2. Oxygen Saturation

	Patient M		Patient F	
	Pre-test	Post-test	Pre-test	Post-test
Day 1	93%	95%	92%	94%
Day 2	94%	96%	94%	95%
Day 3	96%	98%	95%	97%

Based on Table 2, both participants demonstrated a gradual improvement in oxygen saturation following the implementation of Pursed Lips Breathing (PLB) over three consecutive days. In Patient M, oxygen saturation increased from 93% to 95% on the first day, 94% to 96% on the second day, and 96% to 98% on the third day. Likewise, Patient F showed a steady increase, with oxygen saturation rising from 92% to 94% on day one, 94% to 95% on day two, and 95% to 97% on day three. Overall, both participants exhibited a consistent upward trend in oxygen saturation throughout the intervention period.

3. Use of Accessory Breathing Muscles

Table 3. Use of Accessory Breathing Muscles

	Patient M		Patient F	
	Pre-test	Post-test	Pre-test	Post-test
Day 1	There is mild subcostal retraction	Subcostal retraction has decreased	There is mild subcostal retraction and nasal flaring	Subcostal retraction has decreased Nasal flaring is still present
Day 2	Mild subcostal retraction present	No subcostal retraction	Mild subcostal retraction and nasal flaring present	Subcostal retraction has decreased No nasal flaring
Day 3	No retractions	No retraction	No retraction and nasal flaring	No retractions and no nasal flaring

Based on Table 3, the use of accessory respiratory muscles decreased progressively in both participants following the Pursed Lips Breathing (PLB) intervention over three consecutive days. In Patient M, mild subcostal retraction was observed before the intervention on the first day and became less noticeable afterward. On the second day, subcostal retraction was still present before the intervention but was no longer observed afterward. By the third day, no subcostal retraction was detected either before or after the intervention. Similarly, Patient F initially presented with mild subcostal retraction and nasal flaring on the first day. Following the intervention, both signs persisted, although the subcostal retraction became less pronounced. On the second day, subcostal retraction remained mild before the intervention, while nasal flaring resolved after treatment. By the third day, neither subcostal retraction nor nasal flaring was observed before or after the intervention, indicating complete resolution of accessory respiratory muscle use in both participants.

4. Accessory Breathing Sounds

Table 4. Additional Breathing Sounds

Table 1: Additional Breathing Sounds				
	An. M		An. F	
	Pre-test	Post-test	Pre-test	Post-test
Day 1	Rhonchi are clearly audible in both lungs	Rhonchi in both lungs are still distinct	Rhonchi in both lungs are distinct	Rhonchi in both lungs are still distinct
Day 2	Rhonchi in both lungs are moderate	Rhonchi in both lungs have decreased	Rhonchi in both lungs are moderate	Rhonchi in both lungs have decreased
Day 3	Faint rhonchi in both lungs	Rhonchi in both lungs have decreased	Rhonchi in both lungs are faint	Rhonchi in both lungs decreased

Based on Table 4, both participants demonstrated a gradual reduction in the intensity of adventitious breath sounds following the implementation of Pursed Lips Breathing (PLB) over three consecutive days. In Patient M, rhonchi were clearly audible in both lung fields on the first day and remained present after the intervention. On the second day, the intensity of bilateral rhonchi decreased from moderate before the intervention to less pronounced afterward. By the third day, faint rhonchi were still detected in both lung fields; however, their intensity had diminished further compared with the previous day. A similar pattern was observed in Patient F. Bilateral rhonchi were clearly audible on the first day and remained detectable after the intervention. On the second day, the intensity of rhonchi decreased from moderate before the intervention to milder afterward. On the third day, faint bilateral rhonchi persisted but became less prominent than those observed on the previous day, indicating progressive improvement throughout the intervention period.

Discussion

1. Respiratory Rate

Following the implementation of Pursed Lips Breathing (PLB) for three consecutive days, both participants experienced a reduction in respiratory rate. In Patient M, the respiratory rate declined from 32 to 24 breaths/minute, whereas Patient F showed a decrease from 34 to 25 breaths/minute. These changes suggest an improvement in respiratory pattern after the intervention.

PLB is a breathing exercise designed to optimize alveolar ventilation, decrease the work of breathing, and promote a slower, more controlled respiratory pattern (Rumilang & Sari, 2024). In addition, this technique enhances ventilatory efficiency and reduces dyspnea by encouraging relaxation of the respiratory muscles during exhalation (Andayani & Badriyah, 2024). The observed findings are in line with those reported by Dewi et al.

(2023), who found that PLB effectively reduced respiratory rate in pediatric patients with pneumonia.

The decline in respiratory rate observed in both participants may also be explained by the underlying pathophysiology of pneumonia. Inflammatory processes and the accumulation of secretions within the alveoli interfere with ventilation and gas exchange, leading to an increased respiratory workload (Romadhon & Adi, 2025). Despite sharing the same medical diagnosis, Patient F presented with more severe respiratory compromise at baseline, as reflected by a higher respiratory rate, nasal flaring, and subcostal retractions. These clinical manifestations indicate greater respiratory distress, which may explain the slightly slower improvement compared with Patient M. Nevertheless, both participants demonstrated a progressive reduction in respiratory rate throughout the three-day intervention. This observation supports the findings of Khoerunisa (2021), who reported that PLB contributes to reduced respiratory effort and improved breathing patterns in children with pneumonia.

2. Oxygen Saturation

An improvement in oxygen saturation was observed in both participants after three consecutive days of Pursed Lips Breathing (PLB). Patient M showed an increase in oxygen saturation from 93% to 98%, whereas Patient F improved from 92% to 97%. These changes reflect better oxygenation following the breathing exercise.

From a physiological perspective, PLB enhances alveolar ventilation by prolonging expiration and maintaining alveolar patency, thereby facilitating more efficient gas exchange. Improved ventilation promotes greater oxygen diffusion across the alveolar-capillary membrane, leading to higher arterial oxygen saturation (Lestari et al., 2023). Similar outcomes have been reported by Ambarwati & Irdawati (2024) as well as Arisa et al. (2023), both of whom found that PLB contributes to increased oxygen saturation in patients with respiratory disorders.

Although both participants experienced clinically meaningful improvement, Patient M achieved a slightly higher oxygen saturation at the end of the intervention (98%) than Patient F (97%). This difference may be attributed to the more severe respiratory impairment observed in Patient F at baseline, including lower initial oxygen saturation, a higher respiratory rate, subcostal retractions, and nasal flaring. In children with pneumonia, inflammatory exudates and secretions accumulate within the alveoli, disrupting oxygen diffusion into the pulmonary capillaries and consequently reducing oxygen saturation (Fidayana et al., 2023). Despite these differences in baseline condition, both participants demonstrated a steady improvement in oxygen saturation throughout the intervention period. These findings suggest that PLB supports oxygenation by improving ventilation efficiency and facilitating pulmonary gas exchange in children with pneumonia.

3. Use of Accessory Breathing Muscles

Following three consecutive days of Pursed Lips Breathing (PLB), both participants demonstrated a reduction in the use of accessory respiratory muscles. In Patient M, the mild subcostal retraction observed during the initial assessment had completely resolved by the third day. Likewise, Patient F no longer exhibited subcostal retraction or nasal flaring at the completion of the intervention. The disappearance of these clinical signs reflects reduced respiratory effort and improved ventilatory function.

The improvement may be explained by the physiological effects of PLB. In children with pneumonia, inflammation and airway secretions interfere with ventilation, increasing the work of breathing and leading to the recruitment of accessory respiratory muscles to maintain adequate oxygen delivery (Fidayana et al., 2023). By promoting more effective alveolar ventilation and improving breathing efficiency, PLB reduces the workload of the respiratory muscles, thereby decreasing the need for accessory muscle involvement (Tukang et al., 2023). These observations are consistent with the findings of Lestari et al. (2023), who reported that PLB improves breathing patterns and alleviates signs of respiratory distress in pediatric patients with pneumonia.

Although both participants responded positively to the intervention, Patient M showed earlier improvement than Patient F. At baseline, Patient M presented only with mild subcostal retraction, whereas Patient F exhibited both subcostal retraction and nasal flaring, indicating greater respiratory distress associated with more severe ventilatory impairment (Ambarwati & Irdawati, 2024). Despite these differences in initial clinical presentation, accessory respiratory muscle use was no longer observed in either participant by the end of the intervention, suggesting that three days of PLB contributed to improved respiratory status.

4. Additional Breath Sounds

Following three consecutive days of Pursed Lips Breathing (PLB), both participants demonstrated a reduction in the intensity of bilateral rhonchi. At the initial assessment, rhonchi were clearly audible in both lung fields in each participant. By the end of the intervention, rhonchi remained detectable; however, their intensity had become noticeably fainter, indicating an improvement in airway condition.

The presence of rhonchi in children with pneumonia is primarily associated with the accumulation of airway secretions and inflammatory exudates that obstruct airflow during respiration (Agustina et al., 2020). By promoting more effective ventilation and improving expiratory airflow, PLB facilitates secretion mobilization and contributes to a gradual reduction in adventitious breath sounds (Gelok & Mukin, 2024). Similar observations were reported by Andayani & Badriyah (2024), who found that PLB improved breathing patterns and enhanced oxygenation in patients with pneumonia.

Both participants exhibited comparable clinical responses. Although rhonchi did not disappear completely after the three-day intervention, their intensity progressively decreased compared with the initial assessment. This outcome may be explained by the persistence of airway inflammation and residual secretions, as the resolution of these pathological changes requires time (Fidayana et al., 2023). Consequently, improvements in respiratory rate and oxygen saturation may occur earlier than the complete resolution of adventitious breath sounds. The reduced intensity of bilateral rhonchi observed in both participants suggests that PLB supported airway clearance and contributed to the overall improvement in respiratory status.

Conclusion

The implementation of Pursed Lips Breathing (PLB) for 10–15 minutes once daily over three consecutive days was associated with improved respiratory status in two children with pneumonia. Both participants demonstrated lower respiratory rates, higher oxygen saturation levels, reduced use of accessory respiratory muscles, and decreased intensity of bilateral rhonchi following the intervention. These findings suggest that PLB may be an

effective supportive non-pharmacological nursing intervention for enhancing respiratory function in pediatric patients with pneumonia.

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