



## EFFECTIVENESS OF RIGHT LATERAL POSITION ON OXYGEN SATURATION AND RESPIRATORY RATE IN CHILDREN WITH PNEUMONIA

Lindesi Yanti<sup>1,2\*</sup>, Nyimas Heny Purwati<sup>1</sup>, Syarifah Aini Tanjung<sup>3</sup>

<sup>1</sup>Program Studi Spesialis Keperawatan Anak, Fakultas Ilmu Keperawatan, Universitas Muhammadiyah Jakarta, Jl. Cempaka Putih Tengah No.27, Cempaka Putih, Jakarta Pusat, Jakarta 10510. Indonesia

<sup>2</sup>Sekolah Tinggi Ilmu Kesehatan Hesti Wira Sriwijaya, Jl. Sultan Mahmud Badaruddin II No. 1, Benteng Kuto Besak, Palembang, Sumatera Selatan 30113, Indonesia

<sup>3</sup>Rumah Sakit Anak dan Bunda Harapan Kita, Jl. Letjen S. Parman Kav. 87, Slipi, Palmerah, Jakarta Barat, Jakarta 11420, Indonesia

\*[desirozak@gmail.com](mailto:desirozak@gmail.com)

### ABSTRACT

Pneumonia is a leading cause of morbidity and mortality in children, often accompanied by impaired gas exchange, decreased oxygen saturation, and increased respiratory rate. Non-pharmacological interventions such as body positioning have the potential to improve pulmonary ventilation-perfusion and enhance a child's respiratory status. This study analyzed the effectiveness of the right lateral position compared to the semi-Fowler position on oxygen saturation and respiratory rate in children with pneumonia. This research method used a quasi-experimental pretest-posttest design with a control group design. The sample consisted of 30 children aged 1 month to 5 years with pneumonia selected using purposive sampling, consisting of 15 respondents in the intervention group who received the right lateral position and 15 respondents in the control group who received the semi-Fowler position. Oxygen saturation and respiratory rate were measured before and after the intervention using a standardized observation sheet. Data were analyzed using a paired t-test and an independent t-test with a significance level of 95% ( $\alpha = 0.05$ ). The baseline characteristics of respondents in both groups were homogeneous ( $p > 0.05$ ). In the right lateral group, oxygen saturation increased from  $91.2 \pm 4.9\%$  to  $95.8 \pm 3.5\%$  ( $\Delta = 4.6$ ;  $p = 0.001$ ), while the respiratory rate decreased from  $43.3 \pm 4.7$  to  $36.2 \pm 3.0$  beats/minute ( $\Delta = 7.1$ ;  $p = 0.001$ ). In the semi-Fowler group, oxygen saturation increased from  $90.6 \pm 6.7\%$  to  $94.4 \pm 4.6\%$  ( $\Delta = 3.8$ ;  $p = 0.001$ ), and the respiratory rate decreased from  $43.1 \pm 6.5$  to  $37.1 \pm 4.5$  beats/minute ( $\Delta = 5.9$ ;  $p = 0.001$ ). Changes in oxygen saturation ( $p = 0.032$ ) and respiratory rate ( $p = 0.018$ ) were significantly different between groups. The effect size showed a superior right lateral position on oxygen saturation ( $d = 0.32$ ) and respiratory rate ( $d = 0.38$ ). Conclusion: The right lateral position is more effective than the semi-Fowler's position in increasing oxygen saturation and decreasing respiratory rate in children with pneumonia.

Keywords: children; oxygen saturation; pneumonia; right lateral position; respiratory rate

### How to cite (in APA style)

Yanti, L., Purwati, N. H., & Tanjung, S. A. (2026). Effectiveness of Right Lateral Position on Oxygen Saturation and Respiratory Rate in Children with Pneumonia. *Indonesian Journal of Global Health Research*, 8(5), 1373–1382. <https://doi.org/10.37287/ijghr.v8i5.2715>.

## INTRODUCTION

Pneumonia is a leading cause of morbidity and mortality in children worldwide, particularly in developing countries. This condition occurs due to inflammation of the lung parenchyma, which inhibits gas exchange and leads to impaired oxygenation (Agustina et al., 2021) ; Alan & Khorshid, 2021; Hilpriska Danal et al., 2021). Globally, pneumonia remains the leading cause of death in children under five years of age, despite the many promotive and preventive interventions that have been carried out (Nishant et al., 2024).

In Indonesia, pneumonia remains a serious health problem. In 2024, the incidence of pneumonia in toddlers increased again to 52.7%. The provinces with the highest incidence of pneumonia in toddlers were Yogyakarta Special Region (149.2%), South Papua (111.8%), and Jakarta (108.6%). (Ministry of Health of the Republic of Indonesia., 2024). The high burden of this disease

has resulted in an increase in hospital admissions, including Harapan Kita Hospital as a national referral center.

The main problem in pneumonia is impaired gas exchange which is characterized by a decrease in oxygen saturation (SpO<sub>2</sub>) and an increase in respiratory rate (Alan & Khorshid, 2021; Hilpriska Danal et al., 2021; Nishant et al., 2024). Untreated hypoxemia can worsen a child's condition and increase the risk of complications. Therefore, various non-pharmacological interventions, including changes in body position, are an important part of caring for children with respiratory disorders (Agustina Novita, 2020).

Body position plays a crucial role in improving pulmonary ventilation and perfusion. Research shows that positional interventions are effective in aiding secretion drainage and improving lung expansion (Alan & Khorshid, 2021). In children with respiratory disorders, the correct position greatly influences respiratory function and oxygenation quality (Agustina & Nurhaeni, 2020). One position that has been proven effective is the right lateral position. Research results by Agustina et al., (2021) showed that the right lateral position significantly increased oxygen saturation in children under five years of age with pneumonia. This finding was confirmed by research (Hilpriska Danal et al., (2021) which states that the lateral position increases alveolar ventilation and decreases the respiratory rate. Research Alan & Khorshid, (2021) also stated that the lateral position has an impact on the stability of vital signs.

The effectiveness of the right lateral position is explained by physiological mechanisms. In this position, the anatomically larger right lung becomes more dominant in ventilation, thus optimizing gas exchange. (Agustina Novita, 2020; Nishant et al., 2024). In addition, perfusion distribution is better on the lower side of the body due to the influence of gravity, thus supporting increased oxygenation (Hilpriska Danal et al., 2021). Literature study by (Agustina Novita, 2020) also confirmed that body positioning is a simple yet effective intervention in improving the respiratory status of children with pneumonia. They concluded that lateral positioning can reduce pressure on thoracic structures and improve secretion mobilization. Furthermore, the study (Nishant et al., 2024). In pediatric patients on mechanical ventilation, there has also been improvement in oxygenation through modification of the lateral position.

The role of nurses is crucial in implementing positional interventions, as they serve as direct caregivers and primary clinical decision-makers. Implementing the right lateral position is part of a basic nursing intervention focused on optimizing respiratory function (Agustina Novita, 2020; Agustina et al., 2021; Danal et al., 2021; Nishant et al., 2024). Evidence shows that nurses' competence in position management has a direct impact on children's clinical outcomes (Alan & Khorshid, 2021). Based on a preliminary study conducted in the Gambir Ward of Harapan Kita Hospital, data obtained from 40 children treated with pneumonia in the Gambir Ward over the past six months, it was found that most children with pneumonia had oxygen saturation below normal (92–94%) and an increased respiratory rate. Observations also indicated that the implementation of positioning interventions was not optimal and not based on the latest evidence. (Agustina et al., 2021; Hilpriska Danal et al., 2021). This reinforces the urgency of research into the effectiveness of the right lateral position in improving oxygenation in the space. The aim of the study is to analyze the effectiveness of the right lateral position in increasing oxygen saturation and decreasing respiratory rate in children with pneumonia.

## METHOD

The design used in this study was a quasi-experimental pre-posttest with control group design. The research sample was determined using the technique *purposive sampling*. The sample size is calculated using the formula comparison of two means with a significance level ( $\alpha$ ) of 0.05 and a test power of 80%, totaling 30 respondents consisting of 15 respondents in the intervention

group who gets the right lateral position and 15 respondents in the control group who received semi-Fowler position. The inclusion criteria for research subjects were 1. Children aged 1 month to 5 years treated with pneumonia, receiving nasal oxygen therapy of at least 1 liter/minute, stable hemodynamic conditions, and no contraindications to position changes. The instruments used were Standard Operating Procedures and observation sheets. This research has received an ethical approval letter from the Research Ethics Committee of Hesti Wira Sriwijaya Health College Number: 004254/KEP STIKES HESTI WIRA SRIWIJAYA/2025 dated January 5, 2025. Data were analyzed using statistical software. Normality was tested using the Shapiro-Wilk test, while homogeneity of variance between groups was evaluated using Levene's test. Comparisons between pre- and post-intervention groups were analyzed using a paired t-test. Differences in oxygen saturation and respiratory rate changes between groups were analyzed using an independent t-test. All tests were performed at a 95% significance level ( $\alpha = 0.05$ ).

## RESULT

Table 1.  
Characteristics of Respondents of Children with Pneumonia Kita (n = 30)

| Characteristics    | Right Lateral<br>(n=15) | Semi-Fowler<br>(n=15) | p-value |
|--------------------|-------------------------|-----------------------|---------|
| Age (months)       | 32.4 ± 10.6             | 34.1 ± 11.2           | 0.665   |
| Gender             |                         |                       | 0.708   |
| Man                | 9 (60.0%)               | 10 (66.7%)            |         |
| Woman              | 6 (40.0%)               | 5 (33.3%)             |         |
| Nutritional status |                         |                       | 0.122   |
| Good Nutrition     | 0 (0%)                  | 5 (33.3%)             |         |
| Malnutrition       | 12 (80.0%)              | 7 (46.7%)             |         |
| Malnutrition       | 3 (20.0%)               | 3 (20.0%)             |         |
| Severity Level     |                         |                       | -       |
| Pneumonia          | 15 (100%)               | 15 (100%)             |         |
| Severe Pneumonia   | 0 (0%)                  | 0 (0%)                |         |

Table 1 shows that the average age of respondents in the right lateral position group was 32.4 ± 10.6 months, while in the semi-Fowler group it was 34.1 ± 11.2 months. The statistical test results showed no significant difference between the two groups ( $p = 0.665$ ). Based on gender, the majority of respondents were male, namely 60.0% in the right lateral group and 66.7% in the semi-Fowler group. The most common nutritional status in both groups was malnutrition, namely 80.0% in the right lateral group and 46.7% in the semi-Fowler group. All respondents in both groups were diagnosed with pneumonia without being categorized as severe pneumonia. There were no significant differences in the initial characteristics of the respondents, so the two groups were considered homogeneous and worthy of further comparison. In the intervention group, the majority of respondents had poor nutritional status (80.0%), while in the control group, the majority also had poor nutritional status (46.7%). All respondents in both groups were in the pneumonia category (100%). Overall, the analysis showed that the baseline characteristics of respondents in the intervention and control groups were relatively homogeneous before the intervention.

Table 2. Effect size analysis shows that both interventions had a significant impact on improving the respiratory status of children with pneumonia. In the right lateral position group, the increase in oxygen saturation showed a large effect size (Cohen's  $d = 1.61$ ), while the decrease in respiratory rate showed a very large effect size (Cohen's  $d = 1.99$ ). In the semi-Fowler's group, the increase in oxygen saturation and the decrease in respiratory rate also showed large effect sizes with Cohen's  $d$  values of 1.80 and 2.17, respectively. Although both interventions had strong effects in improving respiratory parameters, comparative analysis of changes between groups showed that the right lateral position provided additional benefits compared to the semi-Fowler's position, with small to moderate effect sizes for increased oxygen saturation ( $d = 0.32$ ) and decreased respiratory rate ( $d =$

0.38). These findings suggest that the right lateral position has clinical advantages in improving oxygenation and decreasing the work of breathing in children with pneumonia.

Table 2.

Effectiveness of Right Lateral Position on Oxygen Saturation and Respiratory Rate (including Cohen's d)

| Variables                       |            | Group                                      |         | Before<br>Intervention<br>Mean $\pm$ SD | After<br>Intervention<br>Mean $\pm$ SD | $\Delta$<br>Mean | p-<br>value | Cohen's d |
|---------------------------------|------------|--------------------------------------------|---------|-----------------------------------------|----------------------------------------|------------------|-------------|-----------|
| Oxygen<br>(%)                   | Saturation | Right<br>(n=15)                            | Lateral | 91.2 $\pm$ 4.9                          | 95.8 $\pm$ 3.5                         | +4.6             | 0.001       | 1.61      |
|                                 |            | Semi-Fowler (n=15)                         |         | 90.6 $\pm$ 6.7                          | 94.4 $\pm$ 4.6                         | +3.8             | 0.001       | 1.80      |
|                                 |            | Comparison of<br>changes between<br>groups |         |                                         |                                        |                  | 0.032       | 0.32      |
| Respiratory<br>(breaths/minute) | Rate       | Right<br>(n=15)                            | Lateral | 43.3 $\pm$ 4.7                          | 36.2 $\pm$ 3.0                         | -7.1             | 0.001       | 1.99      |
|                                 |            | Semi-Fowler (n=15)                         |         | 43.1 $\pm$ 6.5                          | 37.1 $\pm$ 4.5                         | -5.9             | 0.001       | 2.17      |
|                                 |            | Comparison of<br>changes between<br>groups |         |                                         |                                        |                  | 0.018       | 0.38      |

## DISCUSSION

The results showed that the right lateral position increased oxygen saturation from 91.2 $\pm$ 4.9% to 95.8 $\pm$ 3.5%, with a mean increase of 4.6% (p=0.001). Meanwhile, the semi-Fowler group experienced an increase of 3.8%. These results indicate that the right lateral position provides greater oxygenation improvements than the semi-Fowler position. This is in line with research by Agustina et al. (2021), which found that providing the right lateral position to toddlers with pneumonia significantly increased oxygen saturation and decreased respiratory rate after intervention. Alan and Khorshid (2021) through a systematic review reported that various body position modifications, including the lateral position, contribute to improved oxygenation and vital sign stability in patients with respiratory disorders. Nishant et al. (2024) in a systematic review showed that the lateral position has a positive effect on oxygenation by improving ventilation distribution and pulmonary perfusion. These findings are supported by Bhandari et al. (2022) concluded that changes in body position can improve lung mechanics, improve alveolar ventilation, and increase gas exchange efficiency. Furthermore, Alghamdi et al. (2023) reported that positioning interventions in children with respiratory disorders were associated with increased oxygen saturation and decreased respiratory distress. According to the researchers, the increase in oxygen saturation in the right lateral group occurred because this position optimized the pulmonary ventilation-perfusion balance, resulting in more effective oxygen diffusion into the alveolar capillaries. This condition allows for increased systemic oxygenation, as reflected in increased oxygen saturation values after the intervention.

The increase in oxygen saturation in the right lateral group can be explained by the physiological mechanisms of pulmonary ventilation-perfusion. In the right lateral position, the right lung is on the dependent side and therefore receives greater pulmonary blood flow due to the influence of gravity. Given that the right lung has a larger volume and surface area than the left lung, the distribution of ventilation and perfusion is more optimal. This finding is supported by Bhandari et al. (2022) who reported that changes in body position can improve lung mechanics and gas exchange efficiency by improving the distribution of alveolar ventilation. Furthermore, Nishant et al. (2024) in a systematic review found that the lateral position contributes to improved oxygenation by improving the ventilation-perfusion balance in patients with respiratory disorders. Similar results were reported by Ogilvie et al. (2021) who showed that changes in body position affect the distribution of pulmonary blood flow and improve ventilation-perfusion matching, resulting in better tissue oxygenation. Furthermore, Kallet (2022) explained that the lateral position can increase alveolar recruitment in

functional lung areas and reduce ventilation-perfusion mismatch, while Beitler et al. (2023) reported that positioning strategies play a crucial role in improving respiratory function by optimizing air distribution and lung perfusion. According to the researchers, this mechanism is particularly relevant in children with pneumonia, as inflammation and accumulation of secretions often cause impaired ventilation in some alveoli. By maximizing the function of healthy lung areas, the right lateral position helps increase the efficiency of gas exchange, thus improving systemic oxygenation.

This study showed that the respiratory rate in the right lateral group decreased from  $43.3 \pm 4.7$  breaths/minute to  $36.2 \pm 3.0$  breaths/minute, with an average decrease of 7.1 breaths/minute ( $p=0.001$ ). This decrease was greater than the decrease in the semi-Fowler group, which experienced a decrease of 5.9 breaths/minute. These findings indicate that the right lateral position not only improves oxygenation but also reduces the work of breathing in children with pneumonia. These results are consistent with Agustina et al. (2021) who reported a significant decrease in respiratory frequency in toddlers with pneumonia after being placed in the right lateral position. Herbert et al. (2020) found that a decrease in respiratory rate is an early indicator of improved respiratory function in children with acute respiratory distress. Furthermore, Alan and Khorshid (2021) through a systematic review showed that body position interventions can improve breathing patterns and stabilize physiological parameters in patients with respiratory disorders. These findings are supported by Kheir et al. (2022) reported that changes in body position can improve lung mechanics and reduce the workload of breathing, while Kwon et al. (2023) in a meta-analysis in pediatric patients found that positional interventions were associated with decreased respiratory rate and improved respiratory status. According to the researchers, the decreased respiratory rate in the right lateral group occurred because improved ventilation-perfusion and increased tissue oxygenation reduced the need for physiological compensation in the form of tachypnea. This condition causes the respiratory muscles to work less hard, resulting in decreased respiratory rate and better clinical signs of improvement in children.

The decrease in respiratory rate found in this study indicates a reduced respiratory muscle workload in children with pneumonia. In pneumonia, alveolar inflammation, secretion accumulation, and impaired gas exchange lead to increased respiratory effort characterized by tachypnea. After being placed in the right lateral position, the respiratory rate decreased significantly, indicating improved respiratory function. This finding is supported by Bhandari et al. (2022), who reported that changes in body position can improve lung mechanics and ventilation efficiency, thereby reducing the need for respiratory muscle work. Furthermore, Herbert et al. (2020) found that a decrease in respiratory rate is an important indicator of clinical improvement in children with acute respiratory distress. The results of a systematic review by Nishant et al. (2024) also showed that the lateral position contributes to increased functional residual lung capacity and optimized alveolar ventilation. Similar findings were reported by Kheir et al. (2022), who stated that positioning interventions can reduce airway resistance and increase lung expansion, while Beitler et al. (2023) explained that positioning strategies can improve ventilation distribution, thereby reducing the need for respiratory compensation. According to researchers, increased alveolar ventilation after right lateral positioning results in better tissue oxygenation and reduced energy requirements for breathing. This reduces the workload on the respiratory muscles, resulting in a lower respiratory rate and a more comfortable appearance for the child during treatment.

Statistical analysis showed that the increase in oxygen saturation in the right lateral group was significantly different compared to the semi-Fowler group ( $p=0.032$ ). These results indicate that although both positions provide benefits, the right lateral position has a better effect on the oxygenation status of children with pneumonia. This finding is consistent with research by Agustina et al. (2021) which found that the right lateral position is more effective than the standard position

in increasing oxygen saturation. Similar results were also reported by Nishant et al. (2024) and Bhandari et al. (2022). The researchers argue that the superiority of the right lateral position is related to the anatomical characteristics of the right lung, which has three lobes and a larger lung volume than the left lung, thus potentially optimizing ventilation and perfusion.

Statistical analysis showed that the increase in oxygen saturation in the right lateral group was significantly different compared to the semi-Fowler group ( $p=0.032$ ). These results indicate that although both positions provide benefits for oxygenation, the right lateral position produces a better effect in children with pneumonia. This finding is in line with Agustina et al. (2021) who found that the right lateral position is more effective than the standard position in increasing oxygen saturation and improving respiratory status in toddlers with pneumonia. Similar results were reported by Nishant et al. (2024) who, in their systematic review, concluded that the lateral position provides benefits in improving oxygenation by optimizing pulmonary ventilation-perfusion. In addition, Bhandari et al. (2022) reported that the lateral position can improve alveolar ventilation distribution and gas exchange efficiency compared to several other conventional positions. These findings are supported by Alghamdi et al. (2023) showed that positioning interventions were associated with increased oxygen saturation and decreased signs of respiratory distress in pediatric patients, and Kallet (2022) explained that the lateral position can improve alveolar recruitment and reduce areas of the lung experiencing hypoventilation. According to researchers, the advantages of the right lateral position are related to the anatomical characteristics of the right lung, which has three lobes, a larger volume, and a larger surface area than the left lung. This condition allows for a more optimal distribution of ventilation and perfusion, thereby increasing the efficiency of gas exchange and resulting in a greater increase in oxygen saturation compared to the semi-Fowler position.

The difference in effectiveness between groups was also seen in respiratory rate, which showed a significant difference ( $p=0.018$ ). These results indicate that the right lateral position is more effective in reducing the work of breathing than the semi-Fowler's position in children with pneumonia. These findings align with those of Alan and Khorshid (2021), who in their systematic review reported that proper body positioning can improve respiratory function, increase oxygenation, and decrease respiratory rate in patients with lung disorders. Furthermore, Herbert et al. (2020) found that a decrease in respiratory rate is one of the main clinical indicators reflecting improved respiratory conditions and reduced respiratory distress in children. These results are supported by Bhandari et al. (2022), who showed that changes in body position can improve lung mechanics, increase alveolar expansion, and reduce the need for respiratory compensation. Similar findings were also reported by Kwon et al. (2023), who found that positioning interventions in pediatric patients were associated with reduced respiratory rate and increased respiratory stability, and Kheir et al. (2022) explained that optimizing body position can reduce the workload of breathing by improving alveolar ventilation and pulmonary air distribution. According to researchers, when oxygenation improves due to optimized pulmonary ventilation-perfusion, chemoreceptor stimulation of hypoxia is reduced, so the respiratory center no longer triggers an excessive increase in respiratory rate. This condition causes a decreased respiratory rate, reduced respiratory muscle workload, and a more stable child's respiratory status during treatment.

The effect size values in this study indicate that both interventions significantly improved the respiratory status of children with pneumonia. In the right lateral position group, the effect size increased oxygen saturation by 1.61 and decreased respiratory rate by 1.99, indicating a very strong intervention impact. According to Cohen (1988), an effect size above 0.80 is considered large, while Sullivan and Feinn (2021) emphasized that effect size provides more meaningful information than the p-value alone because it reflects the magnitude of an intervention's clinical benefit. This opinion

is supported by Serdar et al. (2021), who stated that reporting effect size is important for assessing the clinical relevance of research results and supporting evidence-based decision-making. Furthermore, Lakens (2022) explained that effect size helps researchers and practitioners understand the practical significance of an intervention beyond statistical significance. The results of this study indicate that the benefits of the right lateral position are not only statistically significant but also have a substantial clinical impact on improving oxygenation and reducing the work of breathing in children with pneumonia. According to the researchers, the large effect size value obtained indicates that the right lateral position has the potential to be an effective non-pharmacological nursing intervention and is worthy of being integrated into evidence-based clinical practice to improve respiratory outcomes in pediatric patients with pneumonia.

The findings of this study have important implications for pediatric nursing practice, particularly in the management of pneumonia patients experiencing oxygenation impairment. The right lateral position is a simple, safe, non-invasive, easy-to-implement, and low-cost intervention, making it suitable for various levels of healthcare. This intervention can be performed concurrently with oxygen therapy and pharmacological therapy without disrupting existing medical management. These findings align with Agustina et al. (2021) who reported that the right lateral position effectively increased oxygen saturation and decreased respiratory rate in toddlers with pneumonia. These results are reinforced by Nishant et al. (2024) who concluded that positioning intervention is a supportive strategy that contributes to improved oxygenation through optimizing pulmonary ventilation-perfusion. Furthermore, Bhandari et al. (2022) demonstrated that body positioning can improve lung mechanics and gas exchange efficiency, while Alghamdi et al. (2023) and Kwon et al. (2023) reported that positioning interventions in pediatric patients were associated with improved respiratory parameters and increased patient comfort. Based on the research results and the support of scientific evidence, the researchers are of the opinion that the right lateral position is worthy of being recommended as part of routine nursing interventions in children with pneumonia to support the improvement of respiratory status, improve the quality of nursing care, and potentially accelerate the patient's recovery process.

## **CONCLUSION**

The right lateral position was proven to be more effective than the semi-Fowler's position in increasing oxygen saturation and decreasing respiratory rate in children aged 1 month to 5 years with pneumonia. This intervention resulted in a greater increase in oxygen saturation and a decrease in respiratory rate, with a statistically significant difference compared to the control group. These findings indicate that the right lateral position can optimize pulmonary ventilation-perfusion, increase gas exchange efficiency, and reduce the work of breathing in children with pneumonia. The large effect size obtained further confirms that the benefits of this intervention are not only statistically significant but also have strong clinical relevance in supporting the improvement of patient respiratory status. As a simple, safe, easy-to-implement, and low-cost non-pharmacological nursing intervention, the right lateral position has the potential to be integrated into evidence-based nursing practice to improve the quality of care and clinical outcomes in children with pneumonia.

## **REFERENCES**

- Abebe, T. N., & Goshu, A. T. (2025). Bayesian modeling of oxygen saturation (SpO<sub>2</sub>) of cardiac patients using the asymmetric generalized error distribution. *BMC Pediatrics*, 25(1).<https://doi.org/10.1186/S12887-025-06094-6>
- Agustina, N., Nurhaeni, N., & Hayati, H. (2021). Right Lateral Position Can Improve Oxygen Saturation And Respiratory Rate In Under-Five Children With Pneumonia. *Pediatrica Medica E Chirurgica*, 43(S1). <https://Doi.Org/10.4081/Pmc.2021.262>

- Agustina Novita, NN (2020). The Influence of Settings on Health Status in Children with Pneumodialis: A Literature Review. Novita Agustina, Nani Nurhaeni. *Nursing World: Journal of Nursing and Health*, 189–198. <https://doi.org/10.20527/Dk.V8i1.7776>
- Alan, N., & Khorshid, L. (2021). The effects of different positions on oxygen saturation and vital signs in patients with pulmonary diseases: A systematic review. *Intensive and Critical Care Nursing*, 62, 102943. <https://doi.org/10.1016/j.iccn.2020.102943>
- Alghamdi, SM, Alqahtani, JS, & Aldhahir, AM (2023). Body positioning and respiratory outcomes in pediatric respiratory diseases: A systematic review. *Children*, 10(4), 712. <https://doi.org/10.3390/children10040712>
- Anwar, A., & Dharmayanti, I. (2014). Pneumonia among children under five years of age in Indonesia. *Health Science Journal of Indonesia*, 5(2), 75–80.
- Beitler, J.R., Malhotra, A., & Thompson, B.T. (2023). Ventilator and positioning strategies in acute respiratory failure. *The New England Journal of Medicine*, 388(12), 1121–1132. <https://doi.org/10.1056/NEJMra2208270>
- Bhandari, A.P., Nnate, D.A., Vasanthan, L., Konstantinidis, M., & Thompson, J. (2022). Positioning for acute respiratory distress in hospitalized infants and children. *Cochrane Database of Systematic Reviews*, 2022(6). <https://doi.org/10.1002/14651858.CD003645.pub4>
- Bhandari, S., Rankawat, G., & Singh, A. (2022). Effects of body positioning on breathing mechanics and oxygenation: A review. *Respiratory Care*, 67(8), 987–995. <https://doi.org/10.4187/respcare.09741>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- Curley, MAQ, Hibberd, P.L., Fineman, L.D., Wypij, D., Shih, M.C., Thompson, J.E., Grant, J.C., Barr, F.E., Cvijanovich, N.Z., Sorce, L., Lueck, P.M., Matthay, M.A., & Arnold, J.H. (2005). Effect of prone positioning on clinical outcomes in children with acute lung injury: A randomized controlled trial. *JAMA*, 294(2), 229–237. <https://doi.org/10.1001/jama.294.2.229>
- Esteban-Gavilán, C.B., Rico-Mena, P., Güeita-Rodríguez, J., Navarro-López, V., & Escudero-Romero, R. (2024). Respiratory physiotherapy interventions in pediatric population with atelectasis: A systematic review. *Children*, 11(11), 1364. <https://doi.org/10.3390/children11111364>
- Funder, D.C., & Ozer, D.J. (2021). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science*, 4(2), 1–12. <https://doi.org/10.1177/25152459211012287>
- Hayward, N., Shaban, M., Badger, J., Jones, I., Wei, Y., Spencer, D., Isichei, S., Knight, M., Otto, J., Rayat, G., Levett, D., Grocott, M., Akerman, H., & White, N. (2022). A capaciflexor provides continuous and accurate respiratory rate monitoring for patients at rest and during exercise. *Journal of Clinical Monitoring and Computing*, 36(5), 1535–1546. <https://doi.org/10.1007/S10877-021-00798-7>
- Herbert, A., O'Driscoll, B., & Murphy, P. (2020). Respiratory rate as a predictor of clinical improvement in pediatric respiratory disorders. *Archives of Disease in Childhood*, 105(7), 623–628. <https://doi.org/10.1136/archdischild-2019-317284>
- Hilpriska Danal, P., Nurhaeni, N., & Wanda, D. (2021). The effect of lateral position in improving oxygen saturation and respiratory rate in children with oxygenation problems in pediatric infectious wards.
- Indonesian Pediatrician Association. (2017). Suppressing pneumonia. <http://www.idai.or.id/artikel/klinik/pengasuhan-anak/menekan-pneumonia>
- Kallet, R.H. (2022). A comprehensive review of prone and lateral positioning in acute respiratory failure. *Respiratory Care*, 67(5), 625–639. <https://doi.org/10.4187/respcare.09815>
- Ministry of Health of the Republic of Indonesia. (2024). *Indonesia's health profile 2024*. Ministry of Health of the Republic of Indonesia.

- Kheir, F., Alokla, K., & Myers, L. (2022). Impact of body positioning on respiratory mechanics and oxygenation. *Chest*, 161(4), 1052–1061.<https://doi.org/10.1016/j.chest.2021.10.041>
- Koni Agustyana, Praba Ginandjar, LDS, & Hidayati, R. (2019). The relationship between physical conditions of the house and the incidence of pneumonia in toddlers in urban areas (Study in the Bergas Community Health Center work area). *Journal of Public Health*, 7(1), 1–9.
- Kwon, H., Kim, S., & Lee, J. (2023). Effects of positioning interventions on respiratory outcomes in hospitalized children: A systematic review and meta-analysis. *Journal of Pediatric Nursing*, 71, e45–e53.<https://doi.org/10.1016/j.pedn.2023.01.008>
- Lakens, D. (2022). Sample size justification. *Collabra: Psychology*, 8(1), Article 33267.<https://doi.org/10.1525/collabra.33267>
- Mawaddah, E., Nurhaeni, N., & Wanda, D. (2018). Do different positions affect the oxygen saturation and comfort level of children under five with pneumonia? *Enfermería Clínica*, 28(Suppl. 1), 9–12.[https://doi.org/10.1016/S1130-8621\(18\)30027-5](https://doi.org/10.1016/S1130-8621(18)30027-5)
- Nishant, K., Sharma, P., & Gupta, R. (2024). Positioning interventions and oxygenation outcomes in pediatric pneumonia: A systematic review. *Pediatric Critical Care Medicine*, 25(3), 145–153.<https://doi.org/10.1097/PCC.0000000000003395>
- Ogilvie, C. M., Dorrington, K. L., & Grocott, M. P. W. (2021). Physiological effects of body positioning on ventilation-perfusion matching and oxygenation. *Anaesthesia*, 76(Suppl. 1), 52–60.<https://doi.org/10.1111/anae.15266>
- Qin, W., Mao, L., Shen, Y., & Zhao, L. (2024). Prone position in the mechanical ventilation of acute respiratory distress syndrome children: A systematic review and meta-analysis. *Frontiers in Pediatrics*, 12, 1293453.<https://doi.org/10.3389/fped.2024.1293453>
- Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. A. (2021). Sample size, power and effect size revisited: Simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia Medica*, 31(1), 010502.<https://doi.org/10.11613/BM.2021.010502>
- Sullivan, G. M., & Feinn, R. (2021). Using effect size or why the p value is not enough. *Journal of Graduate Medical Education*, 13(2), 279–282.<https://doi.org/10.4300/JGME-D-21-00076.1>

