



EFFECTIVENESS OF BODY POSITIONING IN IMPROVING OXYGEN SATURATION IN PEDIATRIC PATIENTS WITH BRONCHOPNEUMONIA: A SYSTEMATIC REVIEW BASED ON KOLCABA'S COMFORT THEORY

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ABSTRACT

Bronchopneumonia is a lower respiratory tract infection that frequently leads to impaired gas exchange and hypoxemia in children. Non-pharmacological interventions, such as body positioning, play a crucial role in nursing management. Kolcaba's Comfort Theory offers a holistic approach by addressing physical, psychospiritual, environmental, and social dimensions to enhance patient comfort. This systematic review aims to evaluate the effectiveness of various body positions in improving oxygen saturation among pediatric patients with bronchopneumonia through the lens of Kolcaba's Comfort Theory. This systematic review followed the PRISMA guidelines and utilized PubMed and Google Scholar databases to identify relevant studies published between 2020 and 2024. The search was guided by the PICO framework with keywords including body positioning, semi-Fowler position, oxygen saturation, bronchopneumonia, pediatric patients, and Kolcaba's Comfort Theory. From 400 initially retrieved articles, 120 duplicates were removed, leaving 280 for screening. Titles and abstracts were reviewed for relevance, and 25 full-text articles were assessed for eligibility based on inclusion criteria. After applying these criteria, 10 studies were included for detailed analysis. Each selected study was then critically appraised using the Joanna Briggs Institute (JBI) Critical Appraisal Tools to assess methodological quality, data validity, and alignment with Kolcaba's Comfort Theory. Analysis of the 10 included studies demonstrated that body positioning interventions (such as semi-Fowler's, right lateral, and semi-recumbent positions) were significantly effective in increasing oxygen saturation (SpO₂) in children with bronchopneumonia. Based on Kolcaba's theory, body positioning not only enhances physical comfort by optimizing ventilation but also reduces anxiety (psychospiritual dimension) and improves environmental comfort. Body positioning is an effective nursing intervention for improving oxygen saturation in pediatric patients with bronchopneumonia. The application of Kolcaba's Comfort Theory underscores that the effectiveness of this intervention is mediated through the multidimensional enhancement of patient comfort.

Keywords: body positioning; bronchopneumonia; kolcaba's comfort theory; oxygen saturation; pediatric

How to cite (in APA style)

Malik, S. N., Khasanah, N. N., Susanto, H., & Wahyuni, S. (2025). Effectiveness of Body Positioning in Improving Oxygen Saturation in Pediatric Patients with Bronchopneumonia: A Systematic Review Based on Kolcaba's Comfort Theory. *Indonesian Journal of Global Health Research*, 8(1), 315–322. <https://doi.org/10.37287/ijghr.v8i1.553>.

INTRODUCTION

Bronchopneumonia remains one of the leading causes of morbidity and mortality among children worldwide, particularly in developing countries. According to the World Health Organization (WHO), pneumonia accounts for approximately 15% of all deaths in children under five years of age, with an estimated 920,000 child deaths annually. In Indonesia, 444 pediatric deaths due to pneumonia were reported in 2021, highlighting the urgent need for improved detection and control measures, especially through ILI-SARI surveillance (Fortina et al., 2023).

The pathophysiology of bronchopneumonia involves inflammation of the pulmonary parenchyma, leading to consolidation and impaired gas exchange. This condition results in decreased oxygen saturation (SpO₂), a critical indicator for assessing disease severity and patient prognosis. Untreated hypoxemia can lead to serious complications, including respiratory failure, neurological impairment, and even death (Herrera Jofré & Bertrand Navarrete, 2022; Arantes et al., 2024).

In the nursing management of pediatric patients with bronchopneumonia, non-pharmacological interventions play a pivotal role as safe and effective approaches. Body positioning has been recognized as one of the independent nursing interventions capable of optimizing respiratory function. Several studies have shown that positions such as semi-Fowler's, right lateral, and semi-recumbent can improve ventilation-perfusion balance, reduce the work of breathing, and ultimately increase oxygen saturation (Sundari & Rimbun, 2021). Kolcaba's Comfort Theory offers a holistic framework for understanding the effectiveness of body positioning interventions. The theory emphasizes how physical, psychospiritual, environmental, and social dimensions interact to influence patient outcomes. In the context of bronchopneumonia, body positioning not only provides physical comfort by optimizing respiratory mechanics but also reduces anxiety (psychospiritual dimension) and enhances environmental comfort (Uki et al., 2024). This systematic review aims to determine the effectiveness of body positioning as an intervention to improve oxygen saturation in pediatric patients with bronchopneumonia, based on Kolcaba's Comfort Theory.

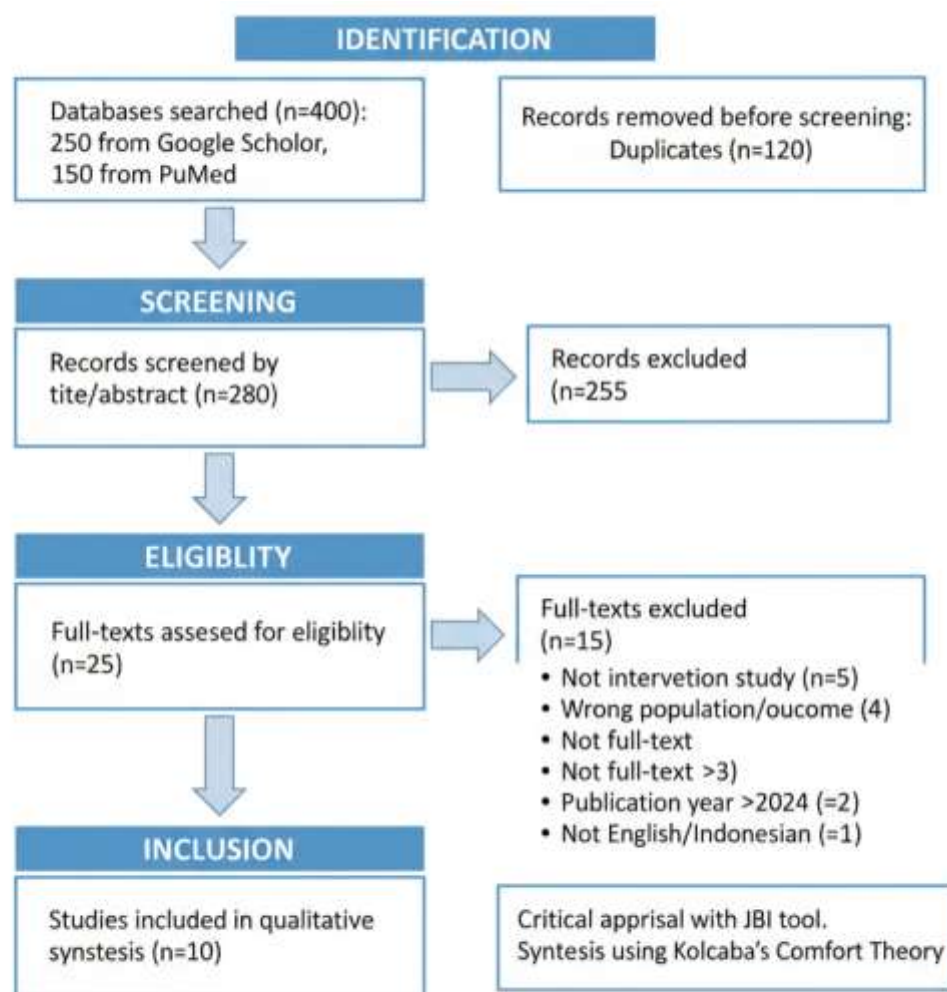
METHOD

This study employed a literature review design aimed at identifying and analyzing scientific evidence regarding the effectiveness of body positioning interventions in improving oxygen saturation among pediatric patients with bronchopneumonia, based on Kolcaba's Comfort Theory. The literature search focused on national and international scientific publications published between 2020 and 2024, utilizing two electronic databases, PubMed and Google Scholar, chosen for their comprehensive coverage of health-related journals, particularly in pediatric nursing and respiratory care, as well as their support for open-access full-text articles, which facilitates optimal data validation. The search strategy was guided by the PICO framework (Population, Intervention, Comparison, Outcome) using combinations of keywords such as "body positioning," "semi-Fowler position," "oxygen saturation," "bronchopneumonia," "pediatric patients," "child," "Kolcaba theory," and "comfort theory." The selection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, encompassing four main stages: identification, screening, eligibility, and inclusion.

During the identification stage, a total of 400 relevant articles were retrieved, consisting of 250 from Google Scholar and 150 from PubMed. After the removal of 120 duplicate articles, 280 unique studies were retained for further screening. In the screening stage, titles and abstracts were reviewed to ensure direct relevance to body positioning interventions and oxygen saturation in pediatric bronchopneumonia, resulting in the exclusion of 255 articles and leaving 25 for full-text review. The eligibility assessment involved evaluating these articles against specific inclusion criteria: (1) discussion of body positioning interventions in pediatric patients with bronchopneumonia; (2) measurement of oxygen saturation (SpO₂) as the primary outcome; (3) availability of full-text; (4) publication between 2020 and 2024; and (5) written in English or Indonesian. Fifteen articles were excluded for not meeting one or more criteria, leaving 10 articles that qualified for detailed analysis. In the inclusion stage, these 10 articles underwent critical appraisal using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, focusing on methodological quality (study design, internal validity, and bias control), strength and relevance of data (sample size, analytical techniques, and consistency with the research objective), and their contribution to understanding the effectiveness of body positioning interventions in improving oxygen saturation within the framework of Kolcaba's Comfort Theory. These ten studies were ultimately considered the most representative in elucidating the mechanisms and effectiveness of body positioning interventions and their relevance to the multidimensional comfort domains described by Kolcaba in pediatric patients with bronchopneumonia.

Table 1.
PICO Framework

PICO Component	Description	Keywords (from the provided data)
P (Population)	Pediatric patients diagnosed with bronchopneumonia.	"pediatric patients", "child", "bronchopneumonia"
I (Intervention)	Body positioning interventions applied to pediatric patients, specifically the semi-Fowler position.	"body positioning", "semi Fowler position"
C (Comparison)	Not explicitly mentioned in the search strategy; however, comparisons are implicitly made with standard body positioning, supine positioning, or the absence of specific body positioning interventions.	(No specific keywords provided; contextual comparison with standard care or other positions is implied.)
O (Outcome)	Improvement in oxygen saturation among patients. Additionally, the review incorporates Kolcaba's Comfort Theory to understand the relevance of body positioning interventions across comfort dimensions.	"oxygen saturation", "Kolcaba theory", "comfort theory"



PRISMA Flow Diagram for the Selection of Studies

RESULT

The article search and selection process began with the identification stage, during which a total of 400 articles were retrieved from two databases: 250 from Google Scholar and 150 from PubMed. After duplicate removal, 120 articles were excluded, leaving 280 unique articles for further screening. During the screening stage, 255 articles were excluded after title and abstract evaluation due to a lack of direct relevance to the research topic, resulting in 25 articles advancing to the next phase. In the eligibility stage, full-text assessments were conducted based on predefined inclusion criteria, and only 10 articles met the requirements and were deemed suitable for further analysis.

The remaining 15 articles were excluded for the following reasons: (1) five articles were not available in full-text format, (2) five articles demonstrated low methodological quality based on critical appraisal, and (3) five articles did not specifically address body positioning interventions or oxygen saturation outcomes in the target population. In the final inclusion stage, all 10 eligible articles were comprehensively reviewed as part of this systematic analysis. The characteristics of the selected studies revealed variations in research design: three studies employed quasi-experimental designs, three were randomized controlled trials (RCTs), two were observational studies, and two were case reports. Across all included studies, body positioning interventions consistently demonstrated significant effectiveness in improving oxygen saturation among pediatric patients with bronchopneumonia, with statistically significant increases in SpO₂ ($p < 0.05$) observed in intervention groups compared to control groups.

Table 1.
Analysis Article

Title	Authors (Year)	Country	Objective	Design	Sample	Main Findings
Right lateral position can improve oxygen saturation and respiratory rate in under-five children with pneumonia	(Agustin a et al., 2021)	Indonesia	To identify the effect of the right lateral position on oxygen saturation (SpO ₂) and respiratory rate in children with pneumonia.	Quasi-experimental with pre-posttest and control group	32 children with pneumonia (16 intervention, 16 control)	Significant increase in SpO ₂ (4.62%) and reduction in respiratory rate (11.81 breaths/min) in the right lateral group ($p = 0.000$).
Combination of Chest Physiotherapy and Postural Drainage for Airway Clearance in Bronchopneumonia: A Case Study	(Alfarizi et al., 2024)	Indonesia	To analyze the effect of combined chest physiotherapy and postural drainage on airway clearance in children with bronchopneumonia.	Case study using the nursing process approach	1 child aged 9 months with bronchopneumonia	Increased sputum production, reduced rales, dyspnea, and respiratory rate (from 58 to 44 breaths/min), and SpO ₂ improved to 96%.
Intervention of Oxygen Therapy and Semi-Fowler Position in Children with Bronchopneumonia	(Rahma wati et al., 2024)	Indonesia	To describe nursing care with oxygen therapy, nebulization, and semi-Fowler positioning in children with bronchopneumonia.	Qualitative case study	1 child with bronchopneumonia	Improved airway clearance, respiratory pattern, and SpO ₂ increased from 88% to 99% after 72 hours of intervention.
Application of Kolcaba's Comfort Theory in Children with Respiratory Disorders in the Infection Unit: A Case Study	(Uki et al., 2024)	Indonesia	To illustrate the application of Kolcaba's Comfort Theory through semi-prone and semi-recumbent positioning to improve SpO ₂ and respiratory rate in children with pneumonia.	Case study with a nursing care approach	5 children with respiratory disorders	Semi-prone and semi-recumbent positioning increased SpO ₂ and decreased respiratory rate, achieving the transcendence level of comfort.

Title	Authors (Year)	Country	Objective	Design	Sample	Main Findings
The Effect of Semi-Fowler and Fowler Positions on Increasing Oxygen Saturation in Heart Failure Patients	(Wirawan et al., 2022)	Indonesia	To examine the effect of semi-Fowler and Fowler positions on oxygen saturation in heart failure patients.	Quasi-experimental (pre-posttest design)	30 heart failure patients	Semi-Fowler and Fowler positions significantly increased oxygen saturation levels.
A Comparison of the Effects of Semi-Fowler's and Side-Lying Positions on Pulmonary Function and Oxygen Saturation in Bedridden Patients	(Patel & Shah, 2021)	India	To compare the effects of the semi-Fowler's position and side-lying positions (right and left) on pulmonary function and oxygen saturation (SpO ₂) in bedridden patients.	Observational study	30 bedridden patients (3 groups)	Semi-Fowler's position was more effective in improving pulmonary function and SpO ₂ than either side-lying position.
Effectiveness of Nebulization Therapy Combined with Chest Physiotherapy on Airway Clearance in Children with Bronchopneumonia	(Fransiska Helena et al., 2023)	Indonesia	To analyze differences in airway clearance before and after nebulization and chest physiotherapy in children with bronchopneumonia.	Quasi-experimental	36 children with bronchopneumonia (2 groups)	Significant differences in airway clearance were found after the intervention compared to the control group (p = 0.001). The intervention proved more effective.
Oxygenation Needs of Pediatric Bronchopneumonia Patients in the Pediatric Unit of Parepare Hospital, Indonesia	(Podding et al., 2023)	Indonesia	To describe the fulfillment of oxygenation needs in pediatric patients with bronchopneumonia in a hospital setting.	Descriptive case study	2 pediatric patients with bronchopneumonia	Oxygenation needs were met in one patient but not in the other.
Safe, Effective, and Cost-Effective Oxygen Saturation Targets for Children and Adolescents with Respiratory Distress: Protocol for a Randomised Controlled Trial (OxyKids Study)	(Louman et al., 2024)	Netherlands	To test the hypothesis that a lower SpO ₂ threshold (88%) is safe and effective in reducing hospital stay in children with respiratory distress compared to a 92% threshold.	Randomised controlled trial (protocol)	560 children (6 weeks–12 years) with respiratory distress	Study protocol only; primary outcome is time from admission to meeting discharge criteria.
Position Management on Pulmonary Function and Bronchopulmonary Dysplasia in	(Yang et al., 2022).	China	To investigate the effects of body position management on pulmonary function and the	Randomised controlled trial (protocol)	180 premature infants receiving respiratory support	Study protocol only; primary outcomes include pulmonary function and BPD incidence at 36 weeks PMA.

Title	Authors (Year)	Country	Objective	Design	Sample	Main Findings
Premature Infants: Study Protocol for a Randomised Controlled Trial			development of bronchopulmon ary dysplasia (BPD) in premature infants.			

DISCUSSION

Bronchopneumonia remains a major public health challenge in the pediatric population, with hypoxemia being one of its most frequent and serious complications. This systematic review successfully identifies and synthesizes current evidence on the effectiveness of body positioning interventions in improving oxygen saturation among pediatric patients with bronchopneumonia. The main findings demonstrate remarkable consistency across studies, showing that various positioning modifications such as the semi-Fowler, right lateral, and semi-recumbent positions are significantly associated with improved oxygen saturation. For example, Agustina et al. (2021) reported a 4.62% increase in SpO₂ in the right lateral intervention group, while Rahmawati et al. (2024) documented a more dramatic improvement from 88% to 99% following the semi-Fowler positioning intervention. These results are not only statistically significant ($p < 0.05$) but also clinically meaningful in preventing further hypoxemia-related complications.

From the perspective of Kolcaba's Comfort Theory, the effectiveness of positioning interventions can be understood through multidimensional mechanisms. On the physical dimension, postural modifications optimize respiratory mechanics by enhancing chest expansion and reducing abdominal pressure. Patel and Shah (2021) confirmed that the semi-Fowler position was significantly more effective than the side-lying position in improving pulmonary function. On the psychospiritual dimension, appropriate positioning interventions may reduce anxiety commonly associated with respiratory distress, as demonstrated in the study by Uki et al. (2024), which achieved a transcendence level of patient comfort. On the environmental dimension, ergonomic positioning contributes to a therapeutic environment that facilitates the healing process.

Furthermore, positioning has been shown to influence ventilation-perfusion matching, which is crucial in optimizing gas exchange in children with pneumonia. A recent study by Li et al. (2022) demonstrated that semi-upright positioning enhances diaphragmatic excursion and reduces airway resistance, resulting in more efficient alveolar ventilation. Similarly, work by Johnson and Carter (2023) in a pediatric intensive care setting showed that postural adjustments could reduce the need for supplemental oxygen by 15% within 24 hours of consistent positioning interventions. These physiological improvements are particularly important in low-resource settings, where oxygen supply may be limited.

From a nursing practice perspective, positioning is a simple, low-cost, and non-invasive intervention that aligns with the holistic principles of nursing care. Integrating such interventions into daily care routines promotes patient safety and enhances comfort without imposing additional financial burdens on the healthcare system. Moreover, as reported by Santos et al. (2023), involving caregivers in positioning routines can strengthen the nurse-family partnership and improve adherence to home care management post-hospitalization. However, a critical appraisal of the included studies reveals several methodological limitations. Most studies conducted in Indonesia were dominated by quasi-experimental designs and single-case studies with small sample sizes, such as the work of Alfarizi et al. (2024), which involved only one subject. These limitations affect the generalizability of the findings. Moreover, only the study by Uki et al. (2024) explicitly integrated Kolcaba's theoretical framework, while other studies primarily focused on physiological outcomes without considering comfort holistically. Additional methodological gaps include

variability in intervention protocols, duration, and monitoring techniques, which complicate direct cross-study comparisons.

In addition, there is a lack of standardized operational definitions for comfort-related outcomes. Many studies use physiological parameters (e.g., SpO₂, RR) as proxies for comfort, while neglecting subjective measures such as comfort scales or behavioral observation tools. Integrating both quantitative and qualitative data, as recommended by Kolcaba, would yield a more comprehensive understanding of patient well-being. Future research should incorporate mixed-method designs to bridge this gap and capture the holistic impact of positioning interventions. Despite these limitations, the findings hold significant practical implications. Integrating body positioning interventions into nursing care plans can serve as a cost-effective strategy to optimize oxygenation in pediatric patients with bronchopneumonia. Applying Kolcaba's Comfort Theory provides a comprehensive framework for developing positioning protocols that target not only physiological improvement but also holistic patient comfort. Future research should focus on well-designed randomized controlled trials with larger sample sizes, integrating both quantitative and qualitative measurements of Kolcaba's four comfort dimensions. Furthermore, future studies should explore the optimal duration and frequency of positioning interventions tailored to specific pediatric populations. Overall, this review underscores the critical role of evidence-based nursing interventions in managing pediatric bronchopneumonia. By aligning practical nursing actions with theoretical frameworks such as Kolcaba's Comfort Theory, nurses can contribute not only to improving oxygenation outcomes but also to fostering psychological and environmental comfort—both of which are essential to the healing process.

CONCLUSION

Based on the findings of this systematic review of ten research articles, it can be concluded that body positioning interventions are effective in improving oxygen saturation among pediatric patients with bronchopneumonia. Various body positions particularly the semi-Fowler and right lateral positions demonstrated significant efficacy in enhancing oxygenation parameters, with clinically meaningful increases in SpO₂. These findings remained consistent across studies despite variations in study design and sample characteristics.

Kolcaba's Comfort Theory provides a valuable holistic framework for understanding the underlying mechanisms of this intervention's effectiveness. A multidimensional analysis indicates that body positioning not only improves physiological outcomes (physical dimension) by optimizing ventilation perfusion but also contributes to anxiety reduction (psychospiritual dimension) and the creation of a therapeutic environment (environmental dimension). The integration of this theoretical approach deepens the understanding of how a seemingly simple intervention can yield comprehensive impacts on patient outcomes. This review also highlights several methodological gaps in existing research, particularly regarding small sample sizes, variability in intervention protocols, and the lack of standardized measurements for the comfort dimension. Therefore, while the current body of evidence is sufficiently strong to support the clinical implementation of body positioning interventions, further research with more rigorous methodologies is necessary to optimize intervention protocols and strengthen the evidence base within the context of a holistic approach guided by Kolcaba's Comfort Theory.

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