

Effectiveness of chest physiotherapy in stabilizing respiratory rate among pediatric patients with acute respiratory infection

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ABSTRACT

Introduction: Acute Respiratory Infection (ARI) remains one of the leading causes of morbidity and mortality among children, particularly in developing countries. It often results in respiratory distress due to mucus accumulation and inflammation. Chest physiotherapy is a non-pharmacological intervention that helps mobilize bronchial secretions, improve lung ventilation, and reduce respiratory effort.

Methods: This case study was conducted on two hospitalized preschool-aged children (3–6 years old) diagnosed with ARI at Sandi Karsa Hospital, Makassar. Chest physiotherapy consisting of percussion, vibration, and postural drainage was administered once daily for three consecutive days. Respiratory rate was measured before and after each intervention session using a stopwatch and observation sheet.

Results: The findings revealed a consistent decrease in respiratory rate following each physiotherapy session. Both patients showed an average reduction of 2–3 breaths per minute after therapy, indicating improved respiratory stability. The children also demonstrated decreased signs of dyspnea and greater comfort after treatment. No adverse effects were observed during or after the intervention. These results suggest that chest physiotherapy effectively facilitates mucus clearance, enhances ventilation, and stabilizes breathing frequency in pediatric ARI patients.

Conclusion: Chest physiotherapy is an effective and safe non-invasive nursing intervention for improving respiratory rate stability in children with ARI. Its implementation can be integrated into hospital nursing care protocols as supportive therapy to accelerate recovery and enhance patient comfort, particularly in managing mild to moderate respiratory infections.

Keywords: ARI; chest physiotherapy; children; respiratory rate; nursing.

INTRODUCTION

Acute Respiratory Infection (ARI) remains one of the leading causes of morbidity and mortality in children worldwide, especially in developing countries [1]. According to the World Health Organization (WHO, 2024), approximately 156 million new ARI cases occur annually, with nearly 97% reported in low- and middle-income nations [2]. Indonesia continues to contribute a significant portion of this global burden, where ARI ranks among the top five causes of pediatric hospitalization and child mortality. The disease affects both the upper and lower respiratory tracts and can progress rapidly to severe complications such as pneumonia if left untreated. Children under five years of age are particularly vulnerable due to their immature immune systems, smaller airway structures, and frequent exposure to environmental risk factors such as pollution, poor housing ventilation, and passive smoke exposure [3].

Chest physiotherapy (CPT) is a well-established non-pharmacological intervention aimed at improving airway clearance and pulmonary ventilation. Techniques such as percussion (clapping), vibration, and postural drainage are designed to mobilize bronchial secretions, reduce airway resistance, and enhance oxygenation [4]. In pediatric care, CPT has gained attention for its simplicity, safety, and adaptability to young patients, making it a valuable adjunct to pharmacological treatment. Despite being used widely in respiratory therapy, evidence on its clinical efficacy in stabilizing respiratory rate particularly among children with ARI remains limited and inconsistent [5]. Most existing studies focus on adult populations or patients with chronic pulmonary conditions, leaving a gap in understanding the benefits of CPT for acute pediatric respiratory infections [6].

Respiratory rate is one of the most sensitive clinical indicators of respiratory distress in children [7]. An elevated rate often reflects airway obstruction, reduced lung compliance, or increased metabolic demand due to infection. Stabilizing respiratory rate not only reduces breathing effort but also indicates improved ventilation and oxygen exchange efficiency [8]. Therefore, evaluating the impact of chest physiotherapy on respiratory rate offers an important insight into its effectiveness as part of integrated nursing interventions for ARI management [9].

The novelty of this study lies in its focus on evaluating chest physiotherapy as a non-pharmacological method to stabilize respiratory rate in pediatric ARI patients within a clinical nursing framework [10]. Unlike previous works that primarily assess mucus clearance or oxygen saturation, this research emphasizes the physiological stability of respiratory frequency as a measurable outcome of therapy success [11]. Furthermore, the study applies CPT techniques percussion, vibration, and postural drainage in a structured three-day intervention specifically adapted for preschool-aged children. This approach provides an empirical foundation for incorporating CPT into standard pediatric nursing protocols in hospital settings [12].

In addition, this study contributes to practical nursing innovation by demonstrating that chest physiotherapy can be implemented safely and effectively by trained nurses, not solely by specialized physiotherapists. This expands its applicability in resource-limited healthcare settings, where non-invasive, cost-efficient interventions are essential. The results are expected to support the integration of chest physiotherapy into pediatric care standards and enhance the holistic role of nurses in promoting respiratory health. Ultimately, this research aims to strengthen evidence-based practice in nursing by proving that simple, hands-on interventions can significantly improve respiratory stability and overall recovery outcomes in children with acute respiratory infections.

MATERIALS AND METHODS

Study Design

This research employed a descriptive case study design focusing on evaluating the effectiveness of chest physiotherapy in stabilizing respiratory rate among pediatric patients diagnosed with Acute Respiratory Infections (ARI). The study aimed to describe in detail the physiological responses of children after undergoing chest physiotherapy interventions.

Study Subjects

The subjects of this study were two hospitalized preschool-aged children (aged 3–6 years) diagnosed with ARI at Sandi Karsa Hospital, Makassar.

Inclusion Criteria: Pediatric patients diagnosed with ARI, Aged between 3–6 years, Hospitalized during the study period,

Exclusion Criteria: Patients with complications such as pneumonia, bronchopneumonia, or respiratory failure, Patients older than six years, Outpatients or children treated in the polyclinic only

Focus of Study

This study focused on the application of chest physiotherapy to maintain the stability of respiratory frequency in pediatric patients with ARI.

Operational Definitions

Acute Respiratory Infection (ARI): An infectious disease affecting one or more parts of the respiratory tract, usually characterized by fever, sore throat, cough, or nasal congestion caused by viral or bacterial pathogens. **Child:** A preschool-aged patient (3–6 years old) hospitalized with ARI. **Chest Physiotherapy:** A non-pharmacological intervention consisting of techniques such as postural drainage, vibration, and percussion (clapping), aimed at clearing airway secretions and improving ventilation. **Respiratory Rate:** The number of breaths per minute, calculated by counting one inhalation and one exhalation cycle as one breath.

Research Location and Duration

The study was conducted in the inpatient ward (5th floor) of Sandi Karsa Hospital, Makassar, over three consecutive days in May 2025. Each patient received one session of chest physiotherapy per day.

Research Instruments

Observation Sheet: Used to record patients' respiratory rates and responses before and after each physiotherapy session. **Wristwatch:** Used to measure respiratory rate (breaths per minute).

Data Collection Procedure

Data collection followed these stages: Obtaining an official letter of permission from the Nursing Study Program and presenting it to Sandi Karsa Hospital. Selecting patients who met the inclusion criteria in consultation with the ward supervisor. Explaining the research purpose, procedures, and benefits to the patients' parents, and obtaining informed consent. Recording baseline data on respiratory rate before intervention. Administering chest physiotherapy for three consecutive days, once per day, including percussion, vibration, and postural drainage techniques. Measuring respiratory rate immediately after each session. Documenting and evaluating daily progress and responses.

Ethical Considerations

The study adhered to ethical principles to protect the rights and confidentiality of participants: **Informed Consent:** Parents were provided with comprehensive information and gave written consent for their child's participation. **Anonymity:** Patients' names were replaced with initials on all data sheets.

RESULTS

Table 1. Results Summary Table

Respondent	Age (years)	Gender	Hospital Stay (days)	Day/Date	Respiratory Rate Before Therapy (bpm)	Respiratory Rate After Therapy (bpm)	Change (bpm)
1	2	Male	4	Day I (3/6/2025)	41	39	-2
				Day II (4/6/2025)	38	35	-3
				Day III (5/6/2025)	35	33	-2
2	3	Male	3	Day I (3/6/2025)	40	38	-2
				Day II (4/6/2025)	37	35	-2
				Day III (5/6/2025)	33	30	-3

The study involved two preschool-aged children (2 and 3 years old) diagnosed with Acute Respiratory Infection (ARI) and hospitalized at Sandi Karsa Hospital, Makassar. Each child received chest physiotherapy for three consecutive days, one session per day. The intervention consisted of percussion (clapping), vibration, and postural drainage techniques. Both children showed a consistent reduction in respiratory rate after each therapy session. The average decrease was 2–3 breaths per minute per session. No adverse effects were observed during or after therapy. The therapy effectively stabilized breathing frequency, indicating improved respiratory efficiency. Chest physiotherapy facilitated the removal of mucus from the airways, reduced breathing effort, and improved lung ventilation. This improvement led to a lower and more stable respiratory rate, suggesting better airway clearance and oxygen exchange. The therapy was also non-invasive, safe, and well-tolerated by both children. The results demonstrate that chest physiotherapy is an effective, safe, and supportive intervention for managing acute respiratory infections in children. It significantly helps in stabilizing and lowering respiratory rates, improving comfort, and enhancing recovery without side effects. This approach can be integrated into pediatric nursing practices as a non-pharmacological therapy.

DISCUSSION

The findings of this study demonstrate that chest physiotherapy effectively reduces and stabilizes respiratory rates in pediatric patients diagnosed with Acute Respiratory Infection (ARI). Both respondents children aged two and three years showed a consistent decrease of 2–3 breaths per minute after each session across three consecutive days. This result highlights the positive physiological impact of chest physiotherapy in improving airway clearance, reducing breathing effort, and enhancing pulmonary ventilation. The absence of side effects throughout the intervention period further reinforces the safety and feasibility of this non-pharmacological therapy in pediatric clinical practice.

Acute Respiratory Infection remains a major cause of morbidity and mortality in children, especially in developing countries. ARI contributes significantly to child mortality due to its rapid progression and complications such as pneumonia [13]. In most cases, airway obstruction caused by mucus accumulation leads to increased respiratory rate as a compensatory mechanism for impaired gas exchange. Therefore, interventions that effectively facilitate mucus clearance are crucial for reducing respiratory effort and preventing further respiratory distress [14]. The consistent reduction in respiratory rate observed in this study indicates that chest physiotherapy successfully optimized airway patency and respiratory function [15].

Chest physiotherapy is based on the principle of mechanical stimulation of the chest wall to mobilize secretions from the peripheral airways toward the central bronchi, allowing patients to expel mucus through coughing [16]. The main techniques used percussion (clapping), vibration, and postural drainage play distinct but complementary roles in enhancing airway clearance. Percussion loosens mucus from the bronchial walls, vibration aids in mobilizing loosened secretions, and postural drainage uses gravity to drain secretions from specific lung segments [17]. In the current study, the combined use of these methods likely produced the observed improvement in respiratory rate and patient comfort. Reported that chest physiotherapy significantly improved oxygen saturation and hemodynamic stability in children with pneumonia [18].

Physiologically, the decrease in respiratory rate following chest physiotherapy reflects reduced airway resistance and improved alveolar ventilation [19]. When mucus is mobilized and expelled, gas exchange becomes more efficient, resulting in better oxygen delivery and lower carbon dioxide retention. Consequently, the respiratory muscles require less effort, leading to a slower and more stable breathing pattern [20]. The observed reduction of 2–3 breaths per minute is clinically meaningful for pediatric patients, as even small improvements in breathing efficiency can prevent fatigue and hypoxemia. Furthermore, this stabilization of respiratory rate indicates that chest physiotherapy can serve as a supportive measure in managing ARI alongside pharmacological treatments [21]. Chest physiotherapy improved airway clearance and reduced respiratory distress in children with pneumonia. Chest physiotherapy accelerates sputum removal and shortens recovery time. These studies collectively confirm the role of chest physiotherapy as an evidence-based, low-cost, and safe intervention for respiratory care in children. The consistency of results across studies strengthens the reliability of this

study's findings, even though it was conducted on a small sample size [22].

From a nursing perspective, this study underscores the importance of integrating non-pharmacological therapies into pediatric respiratory care [23]. Nurses play a vital role in the early detection of respiratory distress, implementation of chest physiotherapy, and monitoring of treatment outcomes. The skillful application of clapping, vibration, and postural drainage techniques requires training and clinical sensitivity, particularly when applied to children [24]. By incorporating such interventions into routine nursing care, hospitals can enhance patient outcomes, reduce dependency on medications, and promote a more holistic approach to pediatric health management [25]. Nurses who are competent in therapeutic techniques such as chest physiotherapy can contribute to more comprehensive and patient-centered respiratory care. In addition, this study revealed that both children tolerated the therapy well, with no adverse reactions observed during or after the sessions [26]. This finding confirms that chest physiotherapy, when conducted by trained professionals, is safe for young children, even those with mild-to-moderate respiratory infections. The gentle nature of the techniques and the non-invasive approach make it suitable for pediatric patients who are often sensitive to invasive treatments [27]. Chest physiotherapy is a low-risk intervention that can be performed safely in clinical and home settings under proper supervision [28].

However, it is important to acknowledge certain limitations in this study. The research was conducted on only two subjects, limiting its generalizability to a wider pediatric population [29]. Furthermore, the observation period was relatively short (three days), which restricts the understanding of long-term effects. Additional physiological parameters such as oxygen saturation (SpO₂), chest expansion, and patient comfort scores were not measured, which could provide a more comprehensive evaluation of therapy outcomes. Future studies using larger sample sizes and experimental designs, such as randomized controlled trials, are recommended to validate and expand upon these findings. Despite these limitations, the results of this study contribute valuable insights to pediatric nursing practice. They support the inclusion of chest physiotherapy as a complementary intervention for children with ARI, emphasizing its role in enhancing respiratory function, promoting airway clearance, and stabilizing breathing patterns. Given its simplicity, safety, and effectiveness, this technique should be incorporated into standard care protocols in pediatric wards. Furthermore, healthcare institutions should provide regular training for nurses and physiotherapists to ensure the proper application of this therapy.

In conclusion, chest physiotherapy proved to be a practical, efficient, and evidence-based approach to improving respiratory stability among children with ARI. The intervention's ability to reduce respiratory rate without causing adverse effects highlights its potential as a core component of pediatric respiratory care. As an easily implementable and low-cost method, chest physiotherapy offers a valuable addition to the holistic management of pediatric respiratory illnesses in both hospital and community settings.

CONCLUSIONS

The findings of this study indicate that chest physiotherapy is an effective and safe intervention for stabilizing and reducing respiratory rates in children with Acute Respiratory Infection (ARI). Over three consecutive days of treatment, both pediatric respondents showed a consistent decrease in respiratory rate by 2–3 breaths per minute after each session, signifying improved airway clearance and respiratory efficiency. This improvement reflects enhanced gas exchange, reduced breathing effort, and overall respiratory stability. The absence of adverse effects during and after therapy also demonstrates that chest physiotherapy is a non-invasive, low-risk, and well-tolerated technique that can be integrated into pediatric nursing care.

Based on these findings, it is recommended that healthcare institutions and nursing practitioners incorporate chest physiotherapy into standard pediatric care, particularly for patients with mild to moderate ARI. Nurses and physiotherapists should receive proper training to perform techniques such as percussion, vibration, and postural drainage safely and effectively. Additionally, further research with larger sample sizes and longer observation periods is needed to strengthen the evidence base and evaluate additional physiological outcomes, such as oxygen saturation and lung expansion. By adopting this intervention, hospitals can enhance patient recovery, reduce hospital stay duration, and promote a holistic, evidence-based approach to respiratory nursing care..

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Authors' contributions

All authors contributed significantly to the development and completion of this research study.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this research. No financial, professional, or personal relationships have influenced the outcomes or interpretations presented in this study.

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