

# Non-pharmacological Approaches to Pediatric Pain: Insights from Nursing Practice – A Narrative Review

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**Received:** 20th Feb, 2026 | **Revised:** 4th Mar, 2026 | **Accepted:** 25th Mar, 2026 | **Available Online:** 10th Apr, 2026

## ABSTRACT

**Background:** Pain is a common and often under-recognized issue in pediatric care, with many children experiencing moderate to severe procedural pain. Non-pharmacological interventions offer effective strategies to reduce pain and anxiety.

**Objective:** To evaluate the effectiveness of nurse-led non-pharmacological interventions in reducing pain among pediatric patients and to examine the role of nursing in their implementation.

**Methods:** A narrative review was conducted using a comprehensive literature search across databases including PubMed, Scopus, Web of Science, Embase, CINAHL, Cochrane Library, ProQuest, EBSCOhost, ScienceDirect, and Google Scholar. Data were synthesized using a qualitative, theme-based approach.

**Results:** Non-pharmacological interventions, including aromatherapy, cutaneous sensory modulation, cognitive distraction techniques, breastfeeding, tactile neuromodulation, and mind–body relaxation strategies, demonstrated significant effectiveness in reducing pain intensity and procedural anxiety. Multimodal approaches were found to enhance outcomes by targeting both physiological and psychological components of pain. Nursing professionals played a central role in assessment, implementation, monitoring, and education, contributing significantly to improved clinical outcomes.

**Conclusion:** Non-pharmacological interventions are safe and effective in pediatric pain management. Their success depends on active nursing involvement and integration into routine clinical practice.

**Keywords:** Pediatric pain; Non-pharmacological interventions; Pain management; Procedural pain; Child-centered care.

**How to cite this article:** Meena R, Patra B, Takawale P, Kumar R, Prakash P. Non-pharmacological Approaches to Pediatric Pain: Insights from Nursing Practice – A Narrative Review. *Int J Drug Deliv Technol.* 2026;16(28s):777-784. DOI: 10.25258/ijddt.16.28s.97

**Source of support:** Nil.

**Conflict of interest:** The authors declare no conflict of interest.

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## INTRODUCTION

Pain remains one of the most frequently encountered and clinically significant symptoms in pediatric healthcare, yet it continues to be inadequately assessed and managed across various care settings<sup>1</sup>. Over time, the understanding of pain has shifted from a purely physiological phenomenon to a multidimensional experience influenced by biological, psychological, and social factors. This evolution

reflects a growing recognition that pain perception in children is complex and highly individualized, requiring a holistic and patient-centered approach to management<sup>2</sup>.

The International Association for the Study of Pain has played a central role in shaping contemporary concepts of pain. Its earlier definition emphasized pain as an unpleasant sensory and emotional experience linked to actual or potential tissue damage<sup>3</sup>. However,

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in its 2020 revision, pain was redefined to highlight its subjective and personal nature, acknowledging that pain may occur even in the absence of clear tissue injury and cannot be solely explained by nociceptive activity. This updated framework also underscores that children learn and express pain through experience, communication, and environmental influences, reinforcing the need for careful interpretation and validation of their pain reports<sup>4</sup>.

Pediatric pain represents a substantial clinical burden worldwide. Recent evidence suggests that approximately 50–60% of children presenting to healthcare facilities, particularly emergency departments, experience pain, with nearly 30–40% reporting moderate to severe intensity<sup>5</sup>. Despite advances in pain science, pain in children remains frequently under-recognized and undertreated, with studies indicating that up to 40% of pediatric patients do not receive adequate analgesia during clinical care. These gaps are often attributed to communication barriers, developmental variability, and persistent misconceptions regarding children's pain perception<sup>6</sup>. Unrelieved pain in early life is associated not only with immediate consequences, such as heightened anxiety and procedural distress, but also with long-term effects, including altered pain sensitivity, increased risk of chronic pain, and adverse behavioral and psychological outcomes<sup>7</sup>.

In response to these challenges, there has been a growing emphasis on non-pharmacological approaches to pain management in pediatric populations. These methods are grounded in the understanding that factors such as fear, anxiety, previous painful experiences, and environmental stressors can amplify the perception of pain in children<sup>8</sup>. Interventions such as distraction, cognitive-behavioral strategies, parental involvement, and physical comfort measures aim to modulate these influences and reduce pain without relying exclusively on medications. Emerging evidence from recent clinical studies supports the effectiveness of these techniques in reducing pain intensity, improving procedural cooperation, and enhancing overall patient and family satisfaction<sup>9</sup>.

Importantly, the successful implementation of non-pharmacological pain management strategies is closely linked to the role of nurses, who serve as primary caregivers in most pediatric settings. Nurses are uniquely positioned to assess pain using validated tools, select developmentally appropriate interventions, and provide continuous emotional

support to both the child and family. Their involvement extends beyond direct care to include education, advocacy, and the integration of evidence-based practices into routine clinical workflows. With appropriate training and institutional support, nursing professionals can effectively deliver non-pharmacological interventions either as standalone therapies for minor procedures or as complementary approaches alongside pharmacological treatment<sup>10-11</sup>.

Given the increasing recognition of holistic and child-centered care, a comprehensive evaluation of non-pharmacological pain management strategies and the pivotal role of nursing is essential.

## OBJECTIVES

To evaluate the effectiveness of nurse-led non-pharmacological interventions in reducing pain among pediatric patients, and to analyze the role of nursing in implementing these strategies based on current scientific evidence.

## METHODS

### Research Design

This study was conducted as a narrative review to evaluate the effectiveness of non-pharmacological interventions in reducing pain among pediatric patients and to explore the role of nursing in their implementation.

### Keywords and Search Strategy

A comprehensive literature search was undertaken using predefined keywords and controlled vocabulary related to pediatric pain and non-pharmacological management. Key terms included pediatric pain, child pain, pain management, non-pharmacological interventions, distraction therapy, cognitive behavioral therapy, complementary therapies, and nursing role. Electronic databases searched included PubMed, Scopus, Web of Science, Embase, CINAHL, Cochrane Library, ProQuest, EBSCOhost, ScienceDirect, and Google Scholar. Search strategies were developed using Boolean operators (AND, OR, NOT) to combine terms. Representative search strings included (“pediatric pain” OR “child pain”) AND (“non-pharmacological interventions” OR “non-drug therapy”) AND (“nursing” OR “nurse-led care”). Truncation and phrase searching were applied where appropriate to optimize retrieval.

### Selection Criteria

Studies were included if they focused on pediatric patients, addressed non-pharmacological pain

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management strategies, and highlighted nursing involvement. Articles not relevant to the topic, duplicate studies, and those lacking sufficient data were excluded.

## Study Selection Process

The identified articles were screened based on title and abstract, followed by full-text review. Relevant studies that aligned with the objectives of the review were selected for final analysis. Studies published in English language were selected.

## Data extraction and synthesis

Data were extracted from the included studies and organized according to key characteristics, including intervention type and outcomes related to pain reduction. A qualitative, theme-based approach was used for data synthesis. Non-pharmacological interventions were categorized based on their type and mode of application, enabling a structured narrative analysis of their effectiveness in reducing pain among pediatric patients.

## SYNTHESIS OF EVIDENCES

### Aromatherapy-based interventions

Aromatherapy has been explored as a non-pharmacological approach for pain relief in pediatric patients, particularly during painful procedures such as burn dressing and wound care<sup>12</sup>. Various essential oils, including lavender, chamomile, rose, and orange blossom, have been investigated for their analgesic and anxiolytic properties. Evidence indicates that pre-procedural inhalation of these aromatic agents is associated with a significant reduction in pain intensity compared with standard care. Pain assessments using validated pediatric scales demonstrate consistently lower scores in children receiving aromatherapy both immediately after procedures and during subsequent evaluation periods<sup>13-15</sup>.

The mechanism of action is primarily mediated through olfactory stimulation of the limbic system, which regulates emotions and pain perception. Inhaled aromatic compounds activate neural pathways linked to the amygdala and hypothalamus, leading to reduced anxiety, modulation of stress responses, and potential release of endogenous neurotransmitters such as endorphins. This neurophysiological modulation contributes to decreased perception of pain and improved relaxation during procedures<sup>16</sup>.

Overall, aromatherapy represents a simple, non-invasive, and easily implementable intervention that can contribute to reducing procedural pain and

distress in pediatric patients, particularly in settings involving repetitive and anxiety-inducing procedures.

### Cutaneous sensory modulation

Cutaneous sensory modulation using combined vibration and localized cryotherapy has emerged as an effective non-pharmacological strategy for reducing procedural pain in pediatric patients. This approach, commonly delivered through handheld devices, provides simultaneous mechanical and thermal stimulation at or near the site of the procedure<sup>17</sup>.

Evidence shows that children who receive combined vibration and cold application during needle procedures such as venipuncture and phlebotomy report significantly lower pain scores than those receiving standard care. These interventions have also been associated with lower fear and anxiety levels, suggesting a broader effect on the child's procedural experience. In some studies, reduced pain was observed consistently across child self-report and observer ratings, including parent, nurse, and researcher assessments<sup>18-20</sup>.

The underlying mechanism is explained by the gate control theory of pain, whereby activation of large-diameter sensory nerve fibers through vibration inhibits the transmission of nociceptive signals at the spinal level. Concurrently, localized cooling reduces nerve conduction velocity and provides a numbing effect, further attenuating pain perception<sup>21</sup>.

Overall, this combined sensory approach represents a rapid, non-invasive, and clinically feasible intervention that can be easily integrated into routine pediatric procedures, particularly in younger children who demonstrate greater responsiveness to sensory-based analgesia.

### Cognitive distraction-based interventions

Cognitive distraction-based interventions are widely recognized as effective non-pharmacological strategies for reducing procedural pain and anxiety in pediatric patients. These approaches, including music therapy, visual engagement tools such as kaleidoscopes, and immersive technologies like virtual reality (VR), function by redirecting the child's attention away from the painful stimulus<sup>22</sup>.

Evidence consistently demonstrates that children exposed to distraction-based interventions report significantly lower pain scores on validated assessment scales compared with standard care. In addition to analgesic effects, these interventions are associated with substantial reductions in procedural anxiety and behavioral distress<sup>23</sup>.

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Among the available modalities, immersive VR appears to provide the greatest benefit. Its ability to engage multiple sensory pathways creates a highly absorbing environment that limits attentional capacity for processing nociceptive input. This results not only in reduced perceived pain intensity but also in a decreased frequency of moderate-to-severe pain experiences. Furthermore, VR has been associated with increased pain thresholds and enhanced emotional regulation, reflecting both cognitive and neurophysiological modulation of pain perception<sup>24-25</sup>.

Overall, cognitive distraction-based interventions—particularly immersive VR—represent effective, non-invasive, and adaptable strategies that can be readily integrated into pediatric clinical practice to improve procedural outcomes and patient experience.

### Feeding and maternal-infant soothing interventions

Breastfeeding is a well-established, evidence-based non-pharmacological intervention for procedural pain management in neonates. Evidence indicates that breastfeeding, particularly when incorporated within multisensory approaches, is associated with significant attenuation of pain responses during invasive procedures. Neonates exposed to breast milk-based interventions consistently demonstrate lower pain scores on validated assessment scales compared with those receiving oral sucrose alone, with comparable or enhanced analgesic effects<sup>26</sup>.

The analgesic effect of breastfeeding during neonatal procedures is likely multifactorial, involving suckling-related orotactile stimulation, analgesic effects associated with sweet taste, thermal and tactile regulation from skin-to-skin contact, and attenuation of stress through maternal contact and bonding. Together, these mechanisms may promote physiologic stability and reduce behavioral distress during painful procedures<sup>27</sup>.

From a clinical perspective, breastfeeding represents a safe, cost-effective, and readily implementable intervention that can be seamlessly integrated into routine neonatal care. Its use not only reduces procedural pain but also strengthens maternal involvement and supports family-centered care, reinforcing its role within holistic pediatric pain management strategies.

### Tactile neuromodulation interventions

Tactile neuromodulation strategies, including Yakson and gentle human touch, have demonstrated efficacy as non-pharmacological interventions for the management of procedural pain in preterm infants.

Evidence indicates that infants receiving structured tactile stimulation exhibit significantly reduced pain scores during and following procedures such as heel prick compared with standard care. Beyond analgesic effects, these interventions are associated with improved physiological regulation, particularly reflected by lower and more stable heart rates, suggesting attenuation of autonomic stress responses.<sup>28-29</sup>

The underlying mechanism is thought to involve modulation of the autonomic nervous system, with enhanced parasympathetic activity and reduced hypothalamic-pituitary-adrenal axis activation, contributing to decreased cortisol levels and improved behavioral organization<sup>30</sup>.

Collectively, tactile neuromodulation represents a developmentally appropriate, low-risk intervention that can be effectively integrated into neonatal care to support both analgesia and physiological stability.

### Mind-body relaxation interventions

Mind-body relaxation interventions, including guided imagery and controlled breathing, are non-pharmacological approaches that modulate pain perception through the interaction between cognitive processes and physiological responses. These techniques engage higher-order neural pathways to influence emotional regulation and autonomic function, thereby reducing the subjective experience of pain<sup>31</sup>. Evidence suggests that such interventions are associated with decreased pain intensity and procedural anxiety, primarily through attenuation of sympathetic nervous system activity and enhancement of parasympathetic tone<sup>32</sup>. Guided imagery promotes cognitive redirection by encouraging visualization of calming scenarios, while controlled breathing facilitates physiological relaxation and stabilization of stress responses<sup>33</sup>.

The effectiveness of these interventions is influenced by the child's developmental stage, as they require a degree of cognitive maturity and active participation. As safe, low-cost, and easily implementable strategies, mind-body relaxation interventions can be incorporated into nurse-led care to complement other non-pharmacological modalities and support holistic pediatric pain management.

### ROLE OF NURSING IN PEDIATRIC PAIN REDUCTION USING NON-PHARMACOLOGICAL INTERVENTIONS

Evidence from the included studies highlights the pivotal role of nursing professionals in the

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implementation of non-pharmacological strategies for pediatric pain management. Nurses are central to ensuring that these interventions are appropriately selected and adapted according to the child's age, developmental level, and clinical condition. Interventions such as aromatherapy, vibration and cold therapy, distraction techniques, breastfeeding, and therapeutic touch have demonstrated effectiveness when applied under nursing supervision, reflecting their feasibility and clinical utility in routine care<sup>34</sup>.

Beyond implementation, nursing involvement extends across multiple dimensions of care, contributing to both clinical outcomes and the overall patient experience. The role of nursing in this context can be summarized as follows:

- Assessment of pain using validated, age-appropriate tools
- Selection of appropriate non-pharmacological interventions based on clinical context
- Application and supervision of interventions during procedures
- Monitoring of physiological and behavioral responses to pain
- Provision of emotional support and reassurance to the child
- Education and guidance of parents or caregivers
- Promotion of family-centered care practices
- Evaluation of intervention effectiveness and necessary modifications

Overall, the effectiveness of non-pharmacological pain management is closely linked to the knowledge, skills, and active involvement of nursing professionals, underscoring their essential role in delivering holistic pediatric care.

## IMPLICATIONS FOR PRACTICE

The findings of this review support the integration of non-pharmacological interventions into routine pediatric care, in line with recommendations from the World Health Organization and the International Association for the Study of Pain, which advocate for multimodal and patient-centered pain management strategies.

Key implications include:

- Incorporation of non-pharmacological methods as first-line or adjunct strategies in pediatric pain protocols
- Strengthening nursing education and training in evidence-based pain management techniques
- Development of standardized clinical guidelines for age-appropriate interventions

Promotion of family-centered care, including parental involvement in pain management

Integration of innovative technologies such as virtual and augmented reality into clinical practice

Overall, the adoption of these strategies can enhance the quality of pediatric care, reduce reliance on pharmacological interventions, and improve both short- and long-term outcomes for children.

## CONCLUSION

Non-pharmacological interventions are effective, safe, and feasible strategies for reducing pain and anxiety in pediatric patients. Approaches such as distraction techniques, sensory-based interventions, and therapeutic touch demonstrate consistent benefits across different age groups and clinical contexts. The effectiveness of these strategies is further enhanced when implemented in a multimodal manner. Nursing professionals play a pivotal role in the successful application of these interventions, contributing to improved clinical outcomes and patient experiences. Their involvement ensures a holistic, child-centered approach to pain management that extends beyond pharmacological treatment.

## Limitations

- Narrative review design, which may limit methodological rigor and reproducibility.
- Absence of a PRISMA protocol as this is narrative review.

- Limited quantitative analysis, with findings primarily based on qualitative interpretation.

- Variability in sample sizes and clinical settings across included studies .

- Lack of direct comparison between different non-pharmacological interventions.

- Dependence on short-term outcomes, with insufficient evidence on long-term impact.

**Data Availability:** No new data was generated or analyzed in this study. All information is derived from previously published literature.

## Ethical considerations

Ethical approval was not required for this study, as it is a narrative review based on previously published literature and does not involve human participants, patient data, or direct clinical intervention.

**Conflict of Interest:** The authors declare no conflict of interest.

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