

Effectiveness of Nursing Interventions on the Pain Levels of School-Age Children

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ABSTRACT

Introduction: Pain is a common issue experienced by school-aged children undergoing invasive procedures such as venipuncture, injection, or catheter insertion. Inadequate pain management

may lead to anxiety, fear of hospitals, and long-term behavioral changes. This study aims to determine the effectiveness of nursing interventions in reducing pain levels among school-aged children during invasive procedures.

Methods: This research employed a quasi-experimental design with a pre-test and post-test control group. A total of 60 children aged 7–12 years who underwent invasive procedures in a pediatric ward were selected through purposive sampling. The intervention group received non-pharmacological pain management techniques such as deep breathing, distraction, and cold compresses, while the control group received standard care. Pain levels were measured using the Wong-Baker FACES Pain Rating Scale before and after the procedure.

Results: The results showed a significant decrease in pain scores in the intervention group compared to the control group ($p < 0.05$). Children who received the nursing interventions reported lower pain intensity and showed improved coping behaviors during the procedure.

Conclusions: Nursing interventions utilizing non-pharmacological techniques are effective in reducing pain levels in school-aged children undergoing invasive procedures. It is suggested that pediatric nurses incorporate these interventions as standard practice to enhance the quality of care and comfort for pediatric patients.

Keywords: Children, Invasive procedure, Nursing intervention, Pain management, School-age

INTRODUCTION

Children undergoing medical procedures often experience pain, which, if not managed properly, can lead to negative emotional and physical outcomes (Sabetsarvestani, Geçkil and Köse, 2024). Pain in children is not only a physical sensation but also an emotional and psychological experience that can be influenced by fear, anxiety, and previous encounters with healthcare settings (Hasanul Huda *et al.*, 2025). Among school-aged children, who are typically more aware and cognitively developed compared to younger age groups, the anticipation and perception of pain during invasive procedures can be particularly distressing (Suleman *et al.*, 2024). Invasive procedures such as injections, venipuncture, and catheter insertions are routine but potentially traumatic, especially if performed without appropriate pain relief strategies (Ates Besirik and Canbulat Sahiner, 2024). Pain is a universal experience that can significantly impact a child's physical and emotional well-being, especially during medical procedures. Among pediatric patients, school-age children (ages 7–12) are particularly vulnerable to the effects of pain due to their developing cognitive and emotional capacity (Koç and Küçük Alemdar, 2024). Invasive procedures, such as venipuncture, injections, or catheter insertions, are commonly performed in hospital settings and often cause moderate to severe discomfort (de Souza *et al.*, 2025). Without appropriate pain management, these experiences may lead to long-lasting negative effects, including increased anxiety, needle phobia, or avoidance of medical care in the future (Zhuang *et al.*, 2025).

Nurses play a critical role in the assessment and management of pain in pediatric settings. Effective nursing interventions, particularly non-pharmacological approaches such as distraction, deep breathing, and the application of cold compresses, have been increasingly recognized for their benefits in reducing pain perception in children (Savaş, Akça Sümengen and Semerci, 2025). These methods are not only safe and simple to implement but also empower children to take part in managing their own discomfort (Sönmez Düzkaya *et al.*, 2024). Nurses play a vital role in managing pain in pediatric patients. While pharmacological approaches remain essential, non-pharmacological interventions such as distraction techniques, deep breathing, or cold compress application have gained increasing attention due to their safety, accessibility, and effectiveness (Chen *et al.*, 2024). These interventions are especially useful in settings with limited resources and can be implemented quickly by nursing staff without the need for physician orders or specialized equipment (Santos *et al.*, 2024).

Despite the availability of various techniques, pain management in children is often inadequate, and there remains a gap in clinical practice, especially in consistently integrating non-pharmacological interventions (Sarman and Tuncay, 2024). Addressing this gap is important to improve the quality of pediatric nursing care and to ensure that children receive comprehensive and compassionate support during medical procedures. Despite growing evidence supporting non-pharmacological methods, their application in clinical practice is often inconsistent (De Souza *et al.*, 2025). Many pediatric units still rely heavily on medications alone or lack standardized protocols to manage procedural pain effectively. This highlights the need to evaluate and reinforce the implementation of simple yet effective nursing strategies to support children during painful medical experiences (McGrath and Palmer, 2024). This study was conducted to examine the effectiveness of nursing interventions in reducing the pain levels experienced by school-aged children undergoing invasive procedures. By evaluating these methods, the research aims to provide evidence that supports the integration of simple, yet effective, nursing strategies into everyday pediatric clinical practice.

MATERIALS AND METHODS

This study utilized a quasi-experimental design with a pre-test and post-test control group to evaluate the effectiveness of nursing interventions on pain levels among school-age children undergoing invasive procedures. The research was conducted in the pediatric inpatient ward of a general hospital located in South Selatan, Indonesia. The data collection period took place over three months, from January to March 2025. The main variables in this study were the independent variable nursing interventions in the form of non-pharmacological pain management techniques (including deep breathing exercises, distraction using toys or videos, and cold compress application) and the dependent variable pain intensity measured during invasive procedures such as venipuncture or injection.

The target population included all school-age children (aged 7 to 12 years) who were admitted to the pediatric ward and underwent at least one minor invasive procedure during hospitalization. Using

purposive sampling, a total of 60 respondents were selected and divided equally into two groups: 30 children in the intervention group and 30 children in the control group. Inclusion criteria included children who were conscious, able to communicate pain levels using the Wong-Baker FACES Pain Rating Scale, and had no neurological or developmental disorders that could affect pain perception. Children whose parents did not provide consent were excluded.

Data collection instruments included a demographic data form and the Wong-Baker FACES Pain Rating Scale, a validated tool widely used for assessing pain in children. Pain levels were recorded both before and after the procedure in both groups. The intervention group received the specified nursing interventions 5–10 minutes prior to and during the procedure, while the control group received standard nursing care without specific pain management techniques.

Data were analyzed using SPSS version, with descriptive statistics to summarize demographic characteristics and paired and independent t-tests to compare pre- and post-test pain scores within and between groups. A significance level of $p < 0.05$ was considered statistically meaningful.

Prior to data collection, ethical clearance was obtained from the Health Research Ethics Committee of Politeknik Sandi Karsa, with approval number B-003/PT19/II/2025. Written informed consent was also obtained from the parents or legal guardians of all participants after a thorough explanation of the study's aims, methods, and confidentiality assurances. Children were also asked for verbal assent as part of ethical child-centered research practice.

RESULTS

The study involved 60 school-age children who underwent invasive procedures, with 30 children in the intervention group and 30 in the control group. The demographic characteristics of participants were comparable across both groups, with no statistically significant differences in age, gender, or type of invasive procedure performed ($p > 0.05$). The average age of participants was 9.3 ± 1.5 years, and 53.3% were male. The primary outcome of this study was the reduction in pain levels, measured using the Wong-Baker FACES Pain Rating Scale, which ranges from 0 (no pain) to 10 (worst pain). In the intervention group, the mean pain score decreased significantly from 7.1 ± 1.2 before the intervention to 3.4 ± 1.1 after the nursing interventions were applied. In contrast, the control group showed a less marked reduction in pain levels, from 6.9 ± 1.4 to 6.1 ± 1.2 . The difference in post-procedure pain scores between the two groups was statistically significant ($p < 0.001$), indicating the effectiveness of the nursing interventions in pain reduction. To visually present these findings, the following bar chart illustrates the difference in pain scores before and after intervention in both groups:

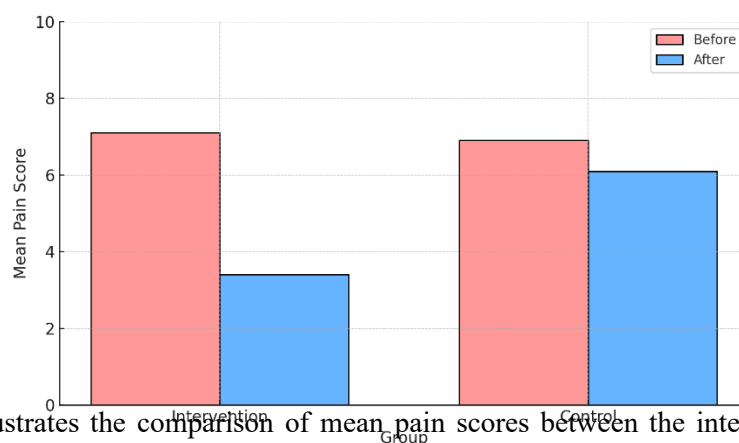


Figure 1 illustrates the comparison of mean pain scores between the intervention and control groups before and after undergoing invasive procedures. In the intervention group, the mean pain score significantly decreased from 7.1 before intervention to 3.4 after intervention. This indicates that the application of non-pharmacological nursing interventions such as deep breathing, distraction, and cold compress had a considerable effect in alleviating the children's perception of pain. On the other hand, the control group, which received standard care without specific pain-relieving techniques, showed only a slight reduction in pain scores, from 6.9 to 6.1. This relatively small change suggests that standard care alone was less effective in managing procedural pain in school-age children. The contrast between the two groups is clearly visible in the graph, where the bars representing post-procedural pain in the

intervention group are markedly lower than those in the control group. These findings support the use of simple, nurse-led interventions as effective strategies in pediatric pain management.

DISCUSSION

Effectiveness of Nursing Interventions

The findings of this study indicate that non-pharmacological nursing interventions significantly reduce pain levels in school-age children undergoing invasive procedures. The intervention group experienced a notable decline in pain scores from 7.1 to 3.4, while the control group showed only a minor reduction. This supports the hypothesis that simple, nurse-administered techniques such as deep breathing, distraction, and cold compresses are effective in mitigating procedural pain. Which found that distraction techniques reduce procedural pain in pediatric patients. Psychological and sensory interventions can meaningfully decrease pain and distress during needle-related procedures. distraction techniques and breathing exercises can decrease pain perception in children undergoing venipuncture or injections. The combination of cognitive-behavioral techniques during medical procedures is associated with lower pain intensity and distress in pediatric patients (Kolukisa *et al.*, 2025).

The significant pain reduction in the intervention group may be attributed to the fact that school-age children are developmentally capable of following instructions and using coping strategies when guided appropriately. These interventions not only serve as distractions but also give children a sense of control, which can lessen their pain perception (Kos *et al.*, 2025). Meanwhile, the minimal pain change observed in the control group reflects the limitations of standard care in addressing psychological aspects of pain. This underscores the need for a more holistic approach in pediatric nursing care, one that includes both pharmacological and non-pharmacological methods (Farahani and Ozturk, 2025). The results of this study suggest that incorporating non-pharmacological interventions into routine pediatric care is both feasible and effective (Wu *et al.*, 2025). These interventions are low-cost, require minimal training, and can be implemented across various clinical settings. Their application could improve the overall quality of care, reduce anxiety and trauma associated with medical procedures, and build a more child-friendly healthcare environment (Çiçek and Topan, 2024). The significant difference between the two groups indicates that these interventions are not only effective but also feasible for routine application by nurses (Can and Özalp Gerçeker, 2024). Since the children in the intervention group were more cooperative and calmer during procedures, the findings also imply potential secondary benefits such as shorter procedural time and reduced anxiety (Dinç, Kurt and Güneş Şan, 2024). These interventions require minimal resources and can be applied in various hospital settings without altering existing workflows. The use of the Wong-Baker FACES Pain Rating Scale, a validated and widely accepted tool, further reinforces the reliability of these findings. Additionally, the consistency of reduced pain scores regardless of the type of invasive procedure suggests that these interventions are versatile and can be generalized across various routine clinical practices (Canbulat Sahiner *et al.*, 2025).

The significant reduction in pain scores among children who received non-pharmacological nursing interventions confirms the effectiveness of these methods in managing procedural pain. Techniques such as deep breathing, distraction using visual or auditory stimuli, and cold compress application directly engage the child's sensory and cognitive pathways, thereby modulating the pain perception mechanism (Gerçeker, Bektaş and Yardımcı, 2024). These findings emphasize the role of nurses not only as caregivers but also as therapeutic agents in pediatric pain management. From a physiological standpoint, deep breathing promotes relaxation by activating the parasympathetic nervous system, which can reduce pain sensitivity. Distraction techniques, on the other hand, shift the child's attention away from the painful stimulus, interrupting the pain signal processing in the brain. Cold compresses provide localized numbing, which can reduce the intensity of pain experienced during skin puncture or injection. Furthermore, the interventions showed consistent efficacy regardless of the specific procedure performed (e.g., venipuncture or injection), suggesting a broad applicability across common clinical situations (Taspınar and Turkmen, 2024). This finding is essential for pediatric nurses, as it encourages the integration of such interventions into routine nursing care without the need for additional equipment or medication. Ultimately, these results validate the hypothesis that non-pharmacological nursing interventions are both effective and practical. Their consistent use could improve patient experiences, reduce procedural distress, and enhance overall quality of pediatric

healthcare services (Christian, 2024).

Limitations and Future Directions

This study did not account for variables such as previous medical experiences, parental presence, or individual pain thresholds, which may influence pain perception. Future studies could explore the long-term psychological impact of repeated procedural pain and the role of parental involvement in pain management.

CONCLUSIONS

This study concludes that non-pharmacological nursing interventions specifically deep breathing, distraction, and cold compress techniques are effective in significantly reducing pain levels in school-age children undergoing invasive procedures. The hypothesis that structured nursing interventions contribute to lower pain intensity has been supported by the findings, with a substantial decrease in mean pain scores observed in the intervention group compared to the control group. These results highlight the potential of simple, nurse-led approaches to improve procedural experiences for pediatric patients. The study contributes new evidence to pediatric nursing practice, reinforcing the value of incorporating low-cost, non-invasive, and easily administered pain management strategies into standard care. These interventions not only alleviate physical discomfort but also enhance emotional well-being and procedural cooperation in children. It is recommended that pediatric nurses routinely apply non-pharmacological interventions during invasive procedures as part of standard clinical protocols. Hospital management should also provide structured training and guidelines to ensure consistent application of these techniques. For future research, a larger sample size and multicenter studies are suggested to strengthen generalizability and explore long-term impacts of repeated interventions on children's coping mechanisms and hospital experiences.

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Availability of data and materials

Data and materials of this study are available upon reasonable request

Authors' contributions

Both of the authors have contributed to all aspects of this study

Conflict of Interest

No potential conflicts of interest

REFERENCES

- Ates Besirik, S. and Canbulat Sahiner, N. (2024) 'Comparison of the effectiveness of three different distraction methods in reducing pain and anxiety during blood drawing in children: A randomized controlled study', *Journal of Pediatric Nursing*, 79, pp. 225–233. doi: <https://dx.doi.org/10.1016/j.pedn.2024.09.009>.
- Can, M. and Özalp Gerçeker, G. (2024) 'The effect of the Veinlite PEDI2 and passive virtual reality distraction on peripheral catheter insertion-related emotional behavior, pain, fear, and anxiety of children: A randomized controlled trial', *Journal of Pediatric Nursing*, 78, pp. e227–e235. doi: <https://dx.doi.org/10.1016/j.pedn.2024.07.010>.
- Canbulat Sahiner, N. *et al.* (2025) 'The effectiveness of using animal-themed vacutainers to reduce pain

- and fear in children during bloodletting', *International Emergency Nursing*, 78, p. 101549. doi: <https://dx.doi.org/10.1016/j.ienj.2024.101549>.
- Chen, S.-R. *et al.* (2024) 'Effects of Virtual Reality on Pain and Anxiety During Children's Circumcision: A Systematic Review and Meta-Analysis', *Pain Management Nursing*, 25(6), pp. 652–658. doi: <https://dx.doi.org/10.1016/j.pmn.2024.06.007>.
- Christian, B. J. (2024) 'Translational research – Pain management in premature infants and children and self-management of chronic conditions by adolescents', *Journal of Pediatric Nursing*, 79, pp. 266–268. doi: <https://dx.doi.org/10.1016/j.pedn.2024.11.004>.
- Çiçek, Ç. and Topan, A. (2024) 'The Effect of Stress Ball Use Applied by Emergency Nurses During Swabbing Procedure on the Pain and Fear Levels of Children Admitted to the Pediatric Emergency Service With the Suspicion of COVID-19: A Randomized Controlled Trial', *Journal of Emergency Nursing*, 50(1), pp. 126–134. doi: <https://dx.doi.org/10.1016/j.jen.2023.09.011>.
- Dinç, F., Kurt, A. and Güneş Şan, E. (2024) 'The effect of three different methods on pain and anxiety in children during blood sampling procedure in pediatric emergency department: Finger puppet, abeslang puzzle, pinwheel', *Journal of Pediatric Nursing*, 79, pp. e203–e212. doi: <https://dx.doi.org/10.1016/j.pedn.2024.10.023>.
- Farahani, P. V. and Ozturk, C. (2025) 'The effect of pranic healing based on Rogers' therapeutic touch on cardiorespiratory indices and pain during venipuncture in pediatrics: A randomized clinical trial', *Journal of Pediatric Nursing*, 80, pp. e120–e126. doi: <https://dx.doi.org/10.1016/j.pedn.2024.12.001>.
- Gerçeker, G. Ö., Bektaş, İ. and Yardımcı, F. (2024) 'The effects of virtual reality and stress ball distraction on procedure-related emotional appearance, pain, fear, and anxiety during phlebotomy in children: A randomized controlled study', *Journal of Pediatric Nursing*, 79, pp. 197–204. doi: <https://dx.doi.org/10.1016/j.pedn.2024.08.029>.
- Hasanul Huda, M. *et al.* (2025) 'A systematic review and network meta-analysis of non-pharmacological interventions involving parents on pain during invasive procedures among newborns', *Journal of Neonatal Nursing*, 31(1), pp. 178–185. doi: <https://dx.doi.org/10.1016/j.jnn.2024.07.022>.
- Koç, S. and Küçük Alemdar, D. (2024) 'Effect of a musical toy used during peripheral venous access on children's pain, fear and parental satisfaction: Randomized controlled trial', *Journal of Pediatric Nursing*, 77, pp. e573–e582. doi: <https://dx.doi.org/10.1016/j.pedn.2024.05.024>.
- Kolukisa, T. *et al.* (2025) 'The effect of breast milk and other odor interventions applied during venous procedures in the neonatal intensive care unit on the pain and comfort level of premature neonate: Systematic review and meta-analysis', *Journal of Neonatal Nursing*, 31(3), p. 101625. doi: <https://dx.doi.org/10.1016/j.jnn.2025.101625>.
- Kos, F. M. *et al.* (2025) 'The effect of mother's voice and music therapy on pain and physiological parameters during the endotracheal suctioning procedure: A randomized controlled study', *Journal of Pediatric Nursing*, 81, pp. e47–e56. doi: <https://dx.doi.org/10.1016/j.pedn.2025.01.030>.
- McGrath, T. M. and Palmer, S. T. (2024) 'Integrated hip surveillance pathways for pain, function and quality of life in children with Cerebral Palsy: A systematic literature review', *European Journal of Paediatric Neurology*, 53, pp. 166–173. doi: <https://dx.doi.org/10.1016/j.ejpn.2024.10.012>.
- Sabetsarvestani, R., Geçkil, E. and Köse, S. (2024) 'A meta-synthesis of the language of pediatric pain', *Journal of Pediatric Nursing*, 79, pp. 32–41. doi: <https://dx.doi.org/10.1016/j.pedn.2024.08.020>.
- Santos, V. S. *et al.* (2024) 'Evaluation of methodological and reporting quality of systematic reviews on conservative non-pharmacological musculoskeletal pain management in children and adolescents: A methodological analysis', *Musculoskeletal Science and Practice*, 69, p. 102902. doi: <https://dx.doi.org/10.1016/j.msksp.2023.102902>.
- Sarman, A. and Tuncay, S. (2024) 'Goldfish or aquatic turtle? Impact of two animal assisted interventions on children's pain, anxiety, and fear during IV catheterization: A randomized

- controlled trial', *Journal of Pediatric Nursing*, 75, pp. 116–124. doi: <https://dx.doi.org/10.1016/j.pedn.2023.12.017>.
- Savaş, E. H., Akça Sümengen, A. and Semerci, R. (2025) 'Effectiveness of Technology-Based Intervention in Symptom Management in Pediatric Oncology Patients: A Systematic Review and Meta-Analysis', *Seminars in Oncology Nursing*, 41(2), p. 151808. doi: <https://dx.doi.org/10.1016/j.soncn.2025.151808>.
- Sönmez Düzkaya, D. *et al.* (2024) 'Effects of the Helper skin tap technique and Buzzy® application on the levels of pain and fear experienced by children during vaccination: A randomized controlled trial', *Journal of Pediatric Nursing*, 79, pp. e278–e284. doi: <https://dx.doi.org/10.1016/j.pedn.2024.10.037>.
- de Souza, D. M. *et al.* (2025) 'Effectiveness of a therapeutic bath for pain relief in hospitalized children with respiratory conditions: Randomized controlled clinical trial', *Journal of Pediatric Nursing*, 80, pp. 24–31. doi: <https://dx.doi.org/10.1016/j.pedn.2024.10.043>.
- De Souza, D. M. *et al.* (2025) 'How frequently do hospitalized children undergo painful procedures? A longitudinal study on the number of procedures and associated factors', *Journal of Pediatric Nursing*. doi: <https://dx.doi.org/10.1016/j.pedn.2025.03.025>.
- Suleman, S. K. *et al.* (2024) 'Comparing the use of colored Trace Images in Kids' Books with passive distractions to decrease pain and fear during cannulation in children: A randomized clinical trial', *European Journal of Integrative Medicine*, 69, p. 102379. doi: <https://dx.doi.org/10.1016/j.eujim.2024.102379>.
- Taspinar, F. and Turkmen, A. S. (2024) 'The impact of kaleidoscope on children's pain and fear during sutures', *International Emergency Nursing*, 77, p. 101521. doi: <https://dx.doi.org/10.1016/j.ienj.2024.101521>.
- Wu, R.-Y. *et al.* (2025) 'The effect of social robot interventions on anxiety in children in clinical settings: a systematic review and meta-analysis', *Journal of Affective Disorders*. doi: <https://dx.doi.org/10.1016/j.jad.2025.04.102>.
- Zhuang, Q. *et al.* (2025) 'Effect of music therapy on relieving the pain and distress of children undergoing venipuncture: A systematic review and meta-analysis', *Complementary Therapies in Clinical Practice*, 60, p. 101994. doi: <https://dx.doi.org/10.1016/j.ctcp.2025.101994>.