MINH
MALAHAYATI INTERNATIONAL JOURNAL OF NURSING AND HEALTH SCIENCE
ISSN 2620-9152 (Print)
ISSN 2621-4083 (Online)
DOI: 10.33024
Nomor: 79/E/KPT/2023

ARTICLE INFORMATION
Received: August, 30, 2025
Revised: December, 31, 2025
Available online: December, 31, 2025
at : https://e-jurnal.iphorr.com/index.php/minh

The role of parental embrace in children's pain management during invasive procedures: A systematic review

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Abstract

Background: Children undergoing invasive procedures in hospitals, such as IV insertion or injection, often experience significant pain and anxiety, especially in critically ill children. Non-pharmacological interventions such as parental holding have been studied as an effective approach in reducing children's pain responses during procedures.
Purpose: To analyze the scientific evidence regarding the role of parental holding in pain management in children during invasive procedures, including in critically ill children.
Method: A search was conducted through PubMed, Scopus, and ScienceDirect databases following PRISMA guidelines. Inclusion criteria included RCT design, population of children undergoing invasive procedures, parental holding intervention, and outcomes in the form of pain intensity and/or anxiety. A total of 1,324 articles were identified, while 8 studies met the criteria and were analyzed narratively.
Results: Showed that parental holding is effective in reducing children's pain and anxiety, as well as increasing emotional comfort for both children and parents. Despite its proven benefits, implementation of this intervention is still limited in clinical practice and lacks standardized guidelines, especially in pediatric intensive care units.
Conclusion: Parental hugs have been shown to be effective in reducing procedural pain in infants and children during invasive procedures.

Keyword: Family Centered Care; Invasive Procedure; Pain Management; Parental Holding.

INTRODUCTION

Children hospitalized in critical condition often undergo invasive medical procedures such as IV lines, intravenous injections, or blood draws. These procedures not only cause physical pain but also trigger profound anxiety and emotional stress (Tao, Zhang, Tang, He, Liu, Li, & Chen, 2025). Without an appropriate psychological approach, these medical procedures can leave psychological trauma that impacts the child's overall healing process (Gastaldi, Delmonego, Plautz, Cavichioli, Packer, de Oliveira Weinfurter, & Delwing-de Lima, 2024). The fear, panic, and discomfort that arise before and during medical procedures pose significant challenges for children who are physiologically vulnerable. Therefore, pain management interventions are needed that are not only pharmacological but also consider the child's emotional aspects holistically (Roshanray, Rayyani, Dehghan, & Faghih, 2020).

Pain experienced by children during invasive procedures is a serious issue in pediatric healthcare globally (Palomares González, Hernández Caravaca, Gómez García, & Sánchez-Solís de Querol, 2023). According to a 2022 report by the *World Health Organization* (WHO) and research published in the Journal of Pediatrics, more than 60% of hospitalized children worldwide experience pain due to invasive procedures such as venipuncture, injections, or IV lines (World Health Organization, 2022). The

DOI: https://doi.org/10.33024/minh.v8i10.1483

prevalence of pain in children during invasive procedures in Indonesia is also high. A previous study showed that approximately 65% of children in hospital inpatient units experienced moderate to severe pain during invasive procedures. This study, which examined the incidence of pain during invasive procedures in children at Dr. Cipto Mangunkusumo National Hospital between January and April 2023, found that 70% of children in the pediatric unit experienced fear and high levels of pain during invasive procedures, especially when unaccompanied by a parent. The study also emphasized the importance of emotional support through hugging or caressing as part of an effective and child-friendly non-pharmacological pain management strategy (Hanafi, Daryanto, & Gunawan, 2024).

One non-pharmacological approach that is beginning to receive widespread research is parental holding (Rahyanti, Nurhaeni, & Wanda, 2017). Parental holding is a form of physical and emotional support from parents while their child undergoes a medical procedure (Rheel, Malfliet, Van Ryckeghem, Pas, Vervoort, & Ickmans, 2022). This holding involves the parent's direct presence to hug, accompany, or provide reassuring touch to the child (Lass & Nunn, 2023). Research shows that parental holding can reduce pain, anxiety, and resistance to procedures in children and can provide a sense of security for children adapting to their illness (Treiman-Kiveste, Kangasniemi, Kalda, & Pölkki, 2023). A close emotional bond between parents and children is fundamental to the effectiveness of this intervention and reflects the values of family-centered care in pediatric nursing (Santy, Ugrasena, Arief, Hidayah, Firdaus, & Utami, 2021).

Currently, parental holding is not yet part of standard nursing practice in many hospitals, particularly in pediatric intensive care units (Hauck, 2024). The focus of healthcare services remains predominantly on pharmacological interventions, while psychosocial interventions such as parental holding are often neglected (Hignell, Carlyle, Bishop, Murphy, Valenzano, Turner, & Sgro, 2020). The lack of implementation guidelines and evaluation instruments hinders the systematic implementation of parental holding (Ponthier, Ensuque, Guigonis, Bedu, Bahans, Teynie, & Medrel-Lacorre, 2020). Parental involvement in child care has a significant impact on reducing pain and long-term trauma resulting from medical procedures in children (Cobo, Moultrie, Hauck, Crankshaw, Monk, Hartley, & Slater, 2022). In Indonesia, the use of parental holding has not been consistently integrated into pediatric pain management efforts in hospitals.

Various international studies have demonstrated the benefits of parental holding, both in stable children and in intensive care (Hashavya, Pines-Shwartz, Guzner, Ohana Sarna Cahan, & Gross, 2023). However, most scientific evidence still focuses on neonates or non-critically ill children. There are limited studies specifically evaluating the effectiveness of parental holding in critically ill children who require significant psychological support and adaptive care approaches (Klug, Hall, Delaplane, Meehan, Negrin, Mieczkowski, & Sood, 2020). Furthermore, variations in intervention methods and pain and anxiety measurement tools in children make it difficult to generalize results across studies (Filippa, Poisbeau, Mairesse, Monaci, Baud, Hüppi, & Kuhn, 2022). This gap between practice and scientific evidence highlights the need for a systematic synthesis to provide a comprehensive and relevant understanding for clinical practice.

RESEARCH METHOD

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The study aimed to synthesize scientific evidence on the role of parental hugging in pain management among children undergoing invasive procedures under critical conditions. A comprehensive literature search was performed across three electronic databases—PubMed, Scopus, and ScienceDirect—to identify relevant studies.

The search strategy employed combinations of keywords including *parent, hugging, touch, pain, child, pediatric, infant, and critical condition*, using Boolean operators (AND/OR). The search was restricted to articles published in English or Indonesian between 2018 and 2025. Eligible studies were original research articles utilizing a randomized controlled trial design that examined the effect of parental hugging on pain experienced by children aged 0–18 years during invasive procedures in healthcare settings. Narrative reviews, editorials,

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study protocols, and articles without accessible full texts were excluded.

The methodological quality of the included studies was appraised using the Joanna Briggs Institute (JBI) critical appraisal tools appropriate for randomized controlled trials. Only studies rated as having moderate to high methodological quality were included in the narrative synthesis. Study selection, quality assessment, and data analysis were independently performed by two reviewers, with discrepancies resolved through consensus or consultation with a third reviewer.

The study selection process followed the four PRISMA stages: identification, screening, eligibility, and inclusion. Initially, 1,324 records were identified (603 from Scopus, 60 from PubMed, and 661 from ScienceDirect). After removal of duplicates, 820 records remained. Title and abstract screening yielded 74 potentially relevant articles, which were subsequently assessed in full text for eligibility. Of these, 28 studies met the inclusion criteria. Following methodological quality assessment, eight studies were deemed suitable for inclusion in the final analysis.

RESEARCH RESULTS

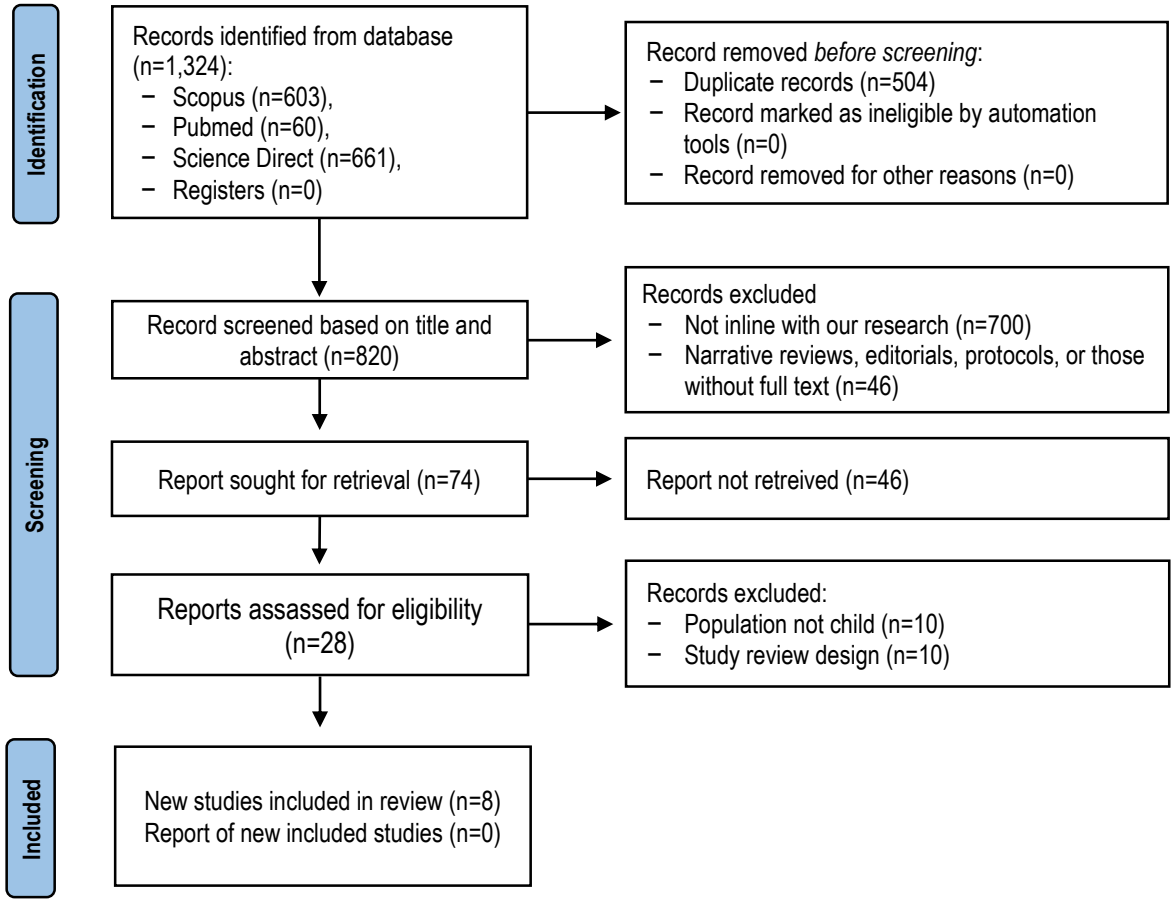


Figure PRISMA Flow Diagram

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Table Characteristics of the Included Studies

(Author, Year) Country	Purpose	Method (Sample, Intervention, Duration)	Final Results (Statistics)
(Rahyanti et al., 2017) Indonesia	To determine the effect of parental holding and an upright position on children's pain during intravenous injection procedures.	- RCT - 60 infants - Parental cuddles: baby held in an upright position during vaccination - During the procedure (±2–3 minutes)	The cuddling intervention significantly reduced FLACC scores ($p<0.001$) and shortened crying duration compared to the control group.
(Sağlık & Cağlar, 2019) Turkey	To determine the effect of parental involvement, parental presence and parental absence on pain and anxiety levels of children who underwent invasive procedures upon admission to the pediatric emergency units.	- RCT - 111 cases in the Pediatric Emergency Department - Active parental involvement: parents accompanying, holding, and comforting the child during invasive procedures - During the procedure (±5–10 minutes)	Active parental involvement reduced child pain with an average score of 3.15±2.79, lower than the non-parental intervention (6.00±2.88) ($p<0.001$).
(Roshanray et al., 2020) Iran	To compare the effect of a mother's hug and massage on pain behaviors during and after blood sampling in neonates	- RCT - 135 healthy neonates - Maternal hugs: mother's tight embrace during blood draw - Before, during, and 5 minutes after the procedure	Maternal cuddling resulted in lower NIPS scores, heart rate, and crying duration compared to massage or the control group ($p< 0.001$).
Özdemir et al., (2025) Turkey	To investigate whether the MHC and PCH methods helped neonates feel less pain and cry during heel pricks.	- Quasi-experimental study - 80 infants - Maternal cuddles: mother's tight embrace during venepuncture - During the procedure (±3–5 minutes)	Maternal cuddling significantly reduced FLACC scores ($p<0.001$), stabilized heart rate, and shortened infant crying duration.

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(Author, Year) Country	Purpose	Method (Sample, Intervention, Duration)	Final Results (Statistics)
(Cobo et al., 2022) United Kingdom	To determine whether parental touch prior to a painful clinical procedure provides effective pain relief in neonates.	- Multicenter RCT - 112 neonates - Parental touch: parents stroking the baby's skin before heel lance insertion - 2 minutes before the procedure	Parental touch decreased pain brain activity by 40% (p=0.03), decreased PIPP-R scores, and reduced post-procedure tachycardia (p=0.04).
(Girgin & Gol, 2019) Turkey	To determine and compare the effects of balloon inflation, ball squeezing, and coughing methods on levels of pain and fear during venipuncture in children aged 7-12 years.	- RCT - 120 children - Distraction with parental support: balloons, balls, or coughs during venipuncture - During the procedure	Distraction techniques involving parents reduced children's pain and fear scores (p=0.001), with coughing techniques having the greatest effect.
(Conde-Agudelo et al., 2018) USA	To determine whether there is evidence to support the use of KMC in LBW infants as an alternative to conventional neonatal care.	- RCT - >20,000 LBW infants (124 RCTs) - Kangaroo mother care (KMC): parent-infant skin-to-skin contact - Minimum 1 hour/day, continuous/ intermittent	KMC consistently reduced procedural pain, decreased cortisol levels, and increased physiological stability (HR,SpO_2) with significant results across studies (p<0.05).
(Letzkus et al., 2021) USA	To develop a baseline understanding of the presence of sleep and pain symptoms among children <2 years at high risk for CP to establish a baseline estimate for future quality improvement initiatives	- Retrospective chart review - 40 NICU infants - Parental massage: parent-led massage - 15 minutes, 3x/week for 2 weeks	Massage by parents reduced procedural pain scores (p<0.05), increased infant comfort, and decreased parental stress levels.

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DISCUSSION

Based on a review of eight articles on non-pharmacological interventions involving parents in procedural pain management in infants and children, the total number of subjects involved reached more than 21,600 infants and children. The largest number came from a systematic review that included 124 randomized controlled trials with more than 20,000 low birth weight infants across multiple continents (Conde-Agudelo, Belizán, & Diaz-Rossello, 2012). While the smallest number came from a study involving 60 infants in Indonesia. This variation in sample size reflects a diverse population, from small clinic-based studies to international multicentric studies (Rahyanti et al., 2017).

The types of interventions provided also vary, with a primary focus on parental cuddling or holding, either in the form of simple holding or kangaroo mother care (KMC) (Rahyanti et al., 2017; Özdemir, Kurt, Küçükoğlu, Atay, Aşki, & Aylanç, 2025; Conde-Agudelo et al., 2012). Several studies have evaluated parental touch, such as stroking and parent-led massage. Other interventions emphasize active parental involvement in calming the child during the procedure or providing distraction with balloons, balls, and coughing (Cobo et al., 2022; Letzkus, Frazier, & Keim-Malpass, 2021; Sağlık & Cağlar, 2019; Girgin & Göl, 2019).

The duration of interventions varies from very short, such as 2 minutes before the procedure to relatively long and repeated, such as 15 minutes, 3 times a week for 2 weeks (Cobo et al., 2022; Letzkus et al., 2021). In most procedural studies, the intervention is given during the invasive procedure and lasts between 2 and 10 minutes (Rahyanti et al., 2017; Roshanray et al., 2020; Sağlık & Cağlar, 2019; Özdemir et al., 2025). Meanwhile, in large-scale studies such as KMC, the intervention is carried out for a longer period of time and can be repeated daily for at least an hour (Conde-Agudelo et al., 2012).

The effectiveness of interventions consistently demonstrates positive results. In short procedural studies, interventions such as cuddling or stroking the child have been shown to reduce pain scores (FLACC, NIPS, PIPP-R), shorten crying duration, and stabilize physiological parameters such as heart rate and oxygen saturation (Cobo et al., 2022; Rahyanti et al., 2017; Roshanray et al., 2020; Özdemir et al., 2025). Other studies have found that parental involvement also significantly reduces children's pain and fear scores (Girgin et al., 2019). Longer-term interventions have found additional benefits such as increased infant comfort and reduced parental stress, as well as increased physiological stability and decreased cortisol levels in infants with KMC (Letzkus et al., 2021; Conde-Agudelo et al., 2012).

Overall, the results of these eight studies indicate that parental involvement in the form of cuddling, touching, or active presence during the procedure has a significant effect on pain reduction, physiological stabilization, and stress reduction in both infants and children. Evidence from a large population, further strengthens the case for integrating parental engagement-based strategies into daily clinical practice across pediatric and neonatal care settings (Conde-Agudelo et al., 2012)

Eight analyzed studies found that parental hug interventions were effective in reducing procedural pain in infants and children during invasive procedures. Previous research reported that infants held in an upright sitting position during vaccination experienced a significant reduction in face, legs, activity, cry, consolability (FLACC) scores ($p<0.001$) and shorter crying duration compared to the control group (Rahyanti et al., 2017). Similar results also showed that a close maternal hug during blood draw reduced FLACC scores ($p<0.001$), stabilized heart rate, and shortened crying duration (Özdemir et al., 2025). Another study showed that maternal hugs before, during, and five minutes after blood draw significantly reduced neonatal infant pain scale (NIPS) scores, heart rate, and crying duration compared to the massage group and the control group ($p<0.001$) (Roshanray et al., 2020). In line with previous research that reported lower pain scores in children in the group accompanied and comforted by parents (3.15±2.79) compared to the group without parents (6.00±2.88; $p<0.001$) (Sağlık & Cağlar, 2019).

There are other studies that use distraction techniques such as balloons, balls, or coughing during venous blood collection and show a decrease in children's pain and fear scores ($p=0.001$), with coughing techniques having the best effect (Girgin et al., 2019). Other studies also emphasize that stroking the baby's skin by parents before heel blood

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collection reduces pain brain activity by 40% (p=0.03) and reduces post-procedure tachycardia (p=0.04) (Cobo et al., 2022). Studies have reported that KMC can improve infant comfort and reduce parental stress (Letzkus et al., 2021). Another study added that KMC significantly reduced procedural pain, cortisol levels, and improved physiological stability (HR, SpO_2) in low birth weight (LBW) infants ($p<0.05$). Analysis of the duration and intensity of the intervention showed variation, ranging from a few minutes during the procedure (2–5 minutes) to at least one hour per day for KMC. Forms of hugs also varied, including sitting upright, close hugs, skin-to-skin contact, and parent-led massage. Overall, the longer and more intense the physical interaction with parents, the more significant the reduction in pain and distress experienced by children (Conde-Agudelo et al., 2012).

Parental hugs influence children's pain experiences through several mechanisms, including biological effects such as decreased cortisol levels, heart rate stabilization, increased oxytocin, and oxygen saturation regulation (Meert, Clark, & Eggly, 2013). Previous research has shown that parental skin stimulation in infants reduces pain-related brain activity, while other studies have consistently shown that KMC reduces physiological stress (Cobo et al., 2022; Conde-Agudelo et al., 2012). Psychological effects arise from the sense of security provided by parents, reduced anxiety, and reduced distress during invasive procedures (Hauck, 2024). Parental presence and hugs facilitate children's emotional comfort, which directly reduces reactivity to pain (Sağlık & Cağlar, 2019; Rahyanti et al., 2017). Neurological effects stem from the activation of endogenous pain inhibitory pathways through tactile stimulation, which can modulate pain perception in the central nervous system. An electroencephalogram (EEG) study showed a 40% reduction in pain-related brain activity when infants were touched by their parents, supporting the concept of pain modulation through physical contact. Through a combination of biological, psychological, and neurological effects, parental hugs not only reduce pain perception but also modulate the child's physiological and emotional responses to invasive procedures (Cobo et al., 2022).

Various non-pharmacological interventions have also been shown to be effective in reducing pain in infants and children during invasive procedures, in addition to parental hugs, although the mechanisms and degree of effectiveness vary (Sabeti, Mohammadpour, Pouraboli, Tahmasebi, & Hasanpour, 2021). Some interventions, including distraction techniques such as balloon use or coughing techniques, have been reported to reduce pain scores and reduce children's fear during blood draws. However, the effects of distraction are more psychological and tend to be limited to distraction, while parental hugs have additional effects on physiological responses, including heart rate stability and crying duration (Girgin et al., 2019). Parent-led massage has also shown positive results, consistent with research finding that massage increases infant comfort and reduces parental stress levels. However, massage requires longer duration and specific parental skills to be effective (Letzkus et al., 2021). Kangaroo mother care (KMC), which involves intensive skin-to-skin contact between infant and parent, has also been shown to significantly reduce procedural pain, cortisol levels, and improve physiological stability (Conde-Agudelo et al., 2012). KMC has similar effects to cuddling, but is typically performed for a longer duration and can be done continuously or intermittently throughout the day (Kılınc & Çağlar, 2025). Pharmacological analgesics were not widely discussed in the studies analyzed, so direct comparisons between cuddling and minimal analgesics are limited. Overall, parental cuddling has more holistic benefits compared to other non-pharmacological interventions. Cuddling not only provides psychological effects through a sense of security and anxiety reduction, but also reduces physiological responses and plays a role in the neurological modulation of pain, making it a comprehensive and practical intervention for pain management in infants and children during invasive procedures.

Parental cuddling supports attachment theory, which states that the emotional bond between a child and a parent provides a sense of security and reduces distress. The results of this study indicate that direct physical contact helps infants and children feel safe during invasive procedures. This attachment theory aligns with previous research (Rahyanti et al., 2017; Sağlık & Cağlar, 2019). Based on self-regulation, cuddling allows infants to regulate physiological responses to pain, including heart rate,

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oxygen saturation, and crying expression (Roshanray et al., 2020; Özdemir et al., 2025). This suggests that non-pharmacological interventions can improve children's ability to manage procedural stress. Pain modulation theory states that touch stimulation and skin contact can activate endogenous pain inhibitory pathways, reducing subjective pain perception and physiological responses (Cobo et al., 2022; Conde-Agudelo et al., 2012). Previous research on touch, comfort, and distress reduction supports these findings. This theory suggests that the role and involvement of parents is important in non-pharmacological pain management in children.

CONCLUSION

Parental hugs have been shown to be effective in reducing pain in infants and children during invasive procedures. Hugs not only reduce pain scores and crying duration, but also stabilize physiological responses such as heart rate and oxygen saturation through biological, psychological, and neurological effects.

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