

# Non-pharmacological interventions in painful needle procedures in children: integrative review

*Intervenções não farmacológicas em procedimentos dolorosos com agulha em crianças: revisão integrativa*

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## ABSTRACT

**BACKGROUND AND OBJECTIVES:** The World Health Organization recommends that pain in children should be treated as a fundamental human right. Children in health services are exposed to numerous painful procedures as part of their treatment, for instance, immunization and blood testing. Painful experiences during such procedures can cause extreme anxiety in future conducts, making children more vulnerable to pain. The present study's objective was to examine the non-pharmacological interventions most described in the literature for pain management during painful procedures with needles in children above the age of one.

**CONTENTS:** Integrative literature review from CINAHL, Embase, Scopus, Web of Science and Pubmed databases. The publications researched were from between 2010 and 2020. The leading question was "Which are the non-pharmacological interventions most described in the literature for pain control in children undergoing needle procedures"? The database search found 252 articles, six were included in the review and distraction was the most observed strategy for non-pharmacological intervention.

**CONCLUSION:** The results of this study indicate that the most used strategy for pain relief was distraction, in special the audiovisual distraction.

**Keywords:** Child, Pain management, Pain procedural.

## RESUMO

**JUSTIFICATIVA E OBJETIVOS:** A Organização Mundial da Saúde preconiza que a dor na criança seja tratada como um direito humano fundamental. Crianças em serviços de saúde são expostas a diversos procedimentos dolorosos como parte do seu tratamento, a exemplo de imunizações e exames de sangue. Experiências dolorosas durante estes procedimentos podem causar consequências negativas como ansiedade extrema em procedimentos futuros, tornando a criança mais vulnerável à dor. Este estudo teve como objetivo investigar quais são as intervenções não farmacológicas mais descritas na literatura para o controle da dor em procedimentos dolorosos com agulha em crianças acima de um ano.

**CONTEÚDO:** Trata-se de uma revisão integrativa, utilizando as bases de dados CINAHL, Embase, Scopus, *Web of Science* e Pubmed. O recorte das publicações foi entre 2010 e 2020. A questão norteadora foi "Quais são as intervenções não farmacológicas mais descritas na literatura para o controle da dor em crianças sob procedimentos com agulha"? Foram encontrados 252 artigos, incluídos seis artigos para análise e a distração foi a estratégia mais observada para intervenção não farmacológica.

**CONCLUSÃO:** Os resultados deste estudo indicam que a estratégia mais utilizada para o alívio da dor foi a distração, sobressaindo a distração audiovisual.

**Descritores:** Criança, Dor processual, Manejo da dor.

## INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage<sup>1,2</sup>. It is a complex, subjective and multidimensional phenomenon, with sensory, physiological, cognitive, affective, behavioral, and spiritual components<sup>3,4</sup>.

One of the first phenomena ever experienced in childhood is pain<sup>4,5</sup>. The World Health Organization (WHO) recommends that pain in children should be treated as a fundamental human right<sup>3</sup>. In Brazil, the *Conselho Nacional dos Direitos da Criança e do Adolescente* (CONANDA - National Council for the Rights of Children and Adolescents) guarantees the right to not feel pain when there are means to avoid it<sup>6</sup>.

Although the progress on pain assessment and treatment in pediatrics is well documented in the literature, there are still some challenges and difficulties, such as lack of understanding on how to conceptualize and quantify a subjective experience and lack

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of knowledge on pain treatment<sup>7</sup>. In this sense, pain is still undertreated, especially acute pain related to painful procedures<sup>8</sup>. Children in health care services are exposed to several painful procedures as part of their treatment, such as immunizations and blood tests<sup>4,9</sup>. Venipuncture and intravenous cannula insertion have been described as the two most common sources of pain in hospitalized children<sup>8,10,11</sup>. There is ample evidence in the literature showing that young children, preadolescents, and adolescents submitted to venipuncture had high intensity of pain and distress<sup>12,13</sup>. Painful experiences during these procedures can cause negative consequences such as extreme anxiety in future procedures and extreme physiological reactions during the actual procedure<sup>14</sup>. In fact, studies have shown that early experiences with pain have been associated with a number of adverse behavioral and physiological consequences<sup>15,16</sup>, and may generate increased pain sensitivity and avoidance of health care in the adult<sup>17,18</sup>. Painful experiences make the child more vulnerable to pain. Since it's impossible to completely eliminate the experience of pain in pediatric patients, the adequate management becomes crucial<sup>9</sup>. The objective of the present study is to investigate the non-pharmacological interventions most described in the literature for pain control in painful needle procedures in children over one year.

## CONTENTS

An integrative review that gathers findings from studies developed using different methodologies, allowing the reviewers to synthesize results without hindering the epistemological affiliation of the included studies<sup>19</sup>.

The review was developed in five stages: problem formulation, data collection, data assessment, data analysis and interpretation, and data disclosure<sup>19,20</sup>.

In the first stage, the formulation of the problem and guiding question was developed using the PICO strategy (Patient - pediatric patient undergoing painful needle procedures; I - non-pharmacological interventions; Control - no comparative; Outcome - pain relief). As of this, the following guiding question was formulated: "What are the non-pharmacological interventions most described in the literature for pain control in children undergoing needle procedures"? In the second stage, data collection was performed during the months from September to December 2020. The databases selected were CINAHL (The Cumulative Index to Nursing and Allied Health Literature), Embase, Scopus, Web of Science, and Pubmed, which encompasses Medline.

For the articles search, different strategies were used according to the specificity of each database. Descriptors from the Medical Subject Headings indexing vocabulary (MeSH terms), CINAHL terms, Emtree terms, and free terms were elected.

The descriptors for CINAHL were "pain, procedural", "pain management" (MeSH terms), "procedural pain", "pain relief" and "pain control" combined with the Boolean operator OR, as well as "non-pharmacological intervention", "non-pharmacological interventions", "child", "preschool", "adolescent". Then the Boolean operator AND was used between these.

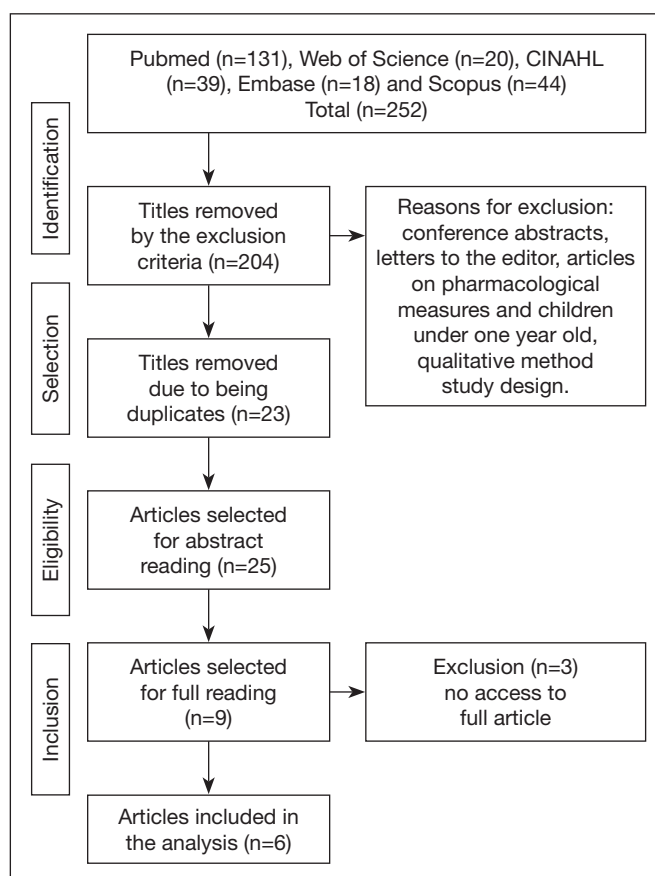
The search strategy used in PubMed included the MeSH terms "pain procedural," "pain management," "child," "preschool

child," "adolescent," and "non-pharmacological interventions," "non-pharmacological intervention" as free terms. The operators OR and AND were used between the descriptors.

For the Embase, Scopus, and Web of Science databases, the following Emtree terms and free terms were used: "procedural pain" OR "injection" OR "vein puncture" OR "catheter" OR "phlebotomy" AND "non-pharmacological intervention" OR "non-pharmacological interventions" AND "adolescent" OR "child" OR "preschool" OR "school".

The following inclusion criteria were defined: studies specifically addressing the research guiding theme, publications from between 2010 and 2020, children aged 1 to 18 years old, articles available for full reading in Portuguese, English, Spanish or French, systematic reviews and meta-analyses, randomized and controlled studies, experimental and quasi-experimental studies. Exclusion criteria were editorial articles, case reports, narrative reviews, studies that presented pharmacological interventions, and articles with children under one year old. This last criterion was defined for exclusion because there are several studies about non-pharmacological interventions in painful procedures for newborns and infants.

In the third stage, the studies were selected by two reviewers, first by reading the titles and abstracts, and then by reading in full those that met the inclusion criteria. The process of identification, selection, eligibility and inclusion of articles, according to PRISMA<sup>21</sup> recommendations, is shown in Figure 1.



**Figure 1.** Flowchart of identification, selection, eligibility and inclusion of studies following PRISMA<sup>21</sup> recommendations

In the fourth stage, the articles were read in full and analyzed by two reviewers. A synoptic table containing year, journal, intervention, objective, methods, results, conclusion, and level of evidence was created to organize and synthesize the data from the selected studies (Table 1).

The articles were categorized into levels of evidence by two reviewers, according to the classification proposed by Melnyk and Fineout-Overholt<sup>22</sup>. This classification presents seven levels of evidence. At level one, the evidence comes from systematic reviews or meta-analysis of randomized controlled trials or from clinical guidelines based on systematic reviews of randomized controlled trials; at level two, evidence derives from at least one well-designed randomized controlled trial; at level three, from well-designed clinical trials without randomization; at level four, from well-designed cohort and case-control studies; at level five, from systematic review of descriptive and qualitative studies; at level six, from a single descriptive or qualitative study; at level seven, from experts opinion and/or expert committee report obtained.

## RESULTS

Initially, 252 articles were found in the chosen databases. After reading the title and identifying duplicates, 227 articles were excluded. Of the 25 articles selected for abstract reading, 9 were selected for the full reading. Three articles were excluded for not being fully available, and six articles were selected for the present review, as shown in table 1.

All selected articles were written in English. The studies were developed in several countries, two of them in India<sup>24,25</sup> and the others in Brazil<sup>23</sup>, Turkey<sup>26</sup>, Italy<sup>27</sup>, and Iran<sup>28</sup>.

As for the year of publication, two articles dated from 2020<sup>25,27</sup> and the others were published in the years 2018<sup>27</sup>, 2017<sup>23</sup> and another two in 2013<sup>25,27</sup>. Of the six articles, two were published in journals specific to the field of pediatric nursing<sup>26,27</sup>, one was published in European pain-specific journals<sup>22</sup> and only one was published in a pediatric journal<sup>26</sup>.

The professionals who conducted the research were in their majority nurses<sup>23,26,27,28</sup>, followed by pediatricians<sup>24,25</sup>. As for the implementation of the interventions, two studies<sup>25,26</sup> informed they were carried out by nurses, while the others did not specify which professional applied them<sup>23,24,25,28</sup>. All studies state that the puncture was performed by specific nurses or by nurses with extensive experience in puncturing children.

Regarding the age of the participating children, one study included only infants<sup>25</sup>, while two articles analyzed from infants to preschoolers<sup>24,27</sup> and four articles analyzed only schoolchildren<sup>23,24,27,28</sup>. As for the scales used, two studies evaluated pain through the Face, Legs, Activity, Cry, Consolability (FLACC) scale<sup>24,25</sup>. In the other studies, the Visual Analog Scale (VAS) and Faces Pain Scale-Revised<sup>23</sup>, Wong-Baker Faces Pain Rating Scale<sup>27</sup>, Ocher's Pain Score<sup>28</sup>, and Children's Anxiety Pain Scale<sup>25</sup> were used.

The painful needle procedure most performed was the peripheral access insertion (5 of 6 articles)<sup>23,24,26-28</sup>, followed by vaccination (1 article)<sup>25</sup>.

**Table 1.** Distribution of studies included in the synthesis according to authors, year, journal, intervention, objective, methodology, results, conclusion, and level of evidence. São Paulo, SP, Brazil 2020

Authors	Intervention	Objective	Methodology	Results and Conclusion	Level of evidence
Oliveira, Santos and Linhares <sup>23</sup>	Audiovisual distraction (animated movies)	Examine the effectiveness of audiovisual distraction for the relief of acute pain in hospitalized pediatric patients.	Cross-over clinical trial	A significant difference was found between the periods with and without distraction in both groups, in which the scores on both pain scales were lower during distraction compared to no intervention.	2
Gupta et al. <sup>24</sup>	Audiovisual distraction	Evaluate and compare the analgesic effect of a family member holding the child versus a family member holding the child along with an animation distraction intervention on the level of pain perception during venipuncture in children up to seven years old.	Quasi-experimental study	The average pain score of the group without intervention was 3.86, while the group with intervention was 2.43. During venipuncture, offering a non-pharmacological intervention such as distraction with animations along with participation of a family member helps the child to manage their pain.	3
Gedam et al. <sup>25</sup>	Audiovisual distraction	Evaluate the effectiveness of audiovisual distraction techniques in children during and after vaccination.	Quasi-experimental study	The distraction technique with toys that produce light and sound, and cartoon movies are practical interventions that reduce the child's pain during vaccination. The average pain score of the test group during the procedure (Group-1: 2.30 and Group-2: 3.65) was lower than the score of the control group (Group-3: 5.30). Likewise, after the procedure, the score (Group-1: 4.62 and Group-2: 2.79) was lower than the score of the control group (Group-3: 6.20).	3

Continue...

**Table 1.** Distribution of studies included in the synthesis according to authors, year, journal, intervention, objective, methodology, results, conclusion, and level of evidence. São Paulo, SP, Brazil 2020 – continuation

Authors	Intervention	Objective	Methodology	Results and Conclusion	Level of evidence
Yildizeli et al. <sup>26</sup>	Chewing gum	Investigate the effect of chewing gum on pain and anxiety during intravenous cannulation (IV) in children.	Randomized controlled clinical trial	The children's pain levels were significantly lower in the experimental group (average = 1.27 ± 0.96) than in the control group (average = 1.42 ± 0.91, p = 0.040).	2
Bergomi et al. <sup>27</sup>	Audiovisual distraction and vibration combined with cryotherapeutic topical analgesia	Evaluate two non-pharmacological techniques for pain and anxiety relief during venipuncture in children: vibration associated with cryotherapeutic topical analgesia using the Buzzy® device and cartoons.	Randomized clinical trial	There was a statistically significant difference in the children's perception of pain in the cartoon group (p=0.02); however, secondary analysis showed that Buzzy® was highly effective in children younger than nine years old (p=0.04). In addition, a significant efficacy was recorded in the Buzzy® and cartoon groups (p=0.04) for the nurse's perception of the child's pain, and in the Buzzy® group for the mother's perception of the child's pain (p=0.002).	2
Momenabadi, Radmehr and Sadeghi <sup>28</sup>	Distraction with music and massage	Investigate the effects of distraction technique with music and Hugo Point massage (compressive effect on the back of the hand, between the first and second metacarpal bone, next to the base of the second metacarpal) in pain relief during insertion of intravenous access in children.	Semiexperimental study	The Hugo Point massage and musical distraction proved effective in reducing pain intensity during IV access insertion in children. The average pain score in the music group was 5.50±1.55, the Hugo point acupressure was 5.50±1.57 and the control was 7.57±1.45	3

Of the selected articles, three are quasi-experimental studies<sup>24,25,28</sup>, two are randomized controlled studies<sup>26,27</sup> and one is a randomized crossover clinical trial<sup>24</sup>. According to the Melnyk & Fineout-Overholt<sup>22</sup> classification, three articles present level 2 of evidence<sup>23,26,27</sup> and the others level 3<sup>24,25,28</sup>.

In this review's studies, three non-pharmacological intervention strategies were used: distraction, chewing gum and cryotherapy combined with vibratory stimulation with Buzzy®. The most frequent strategy was distraction, and the audiovisual distraction stands out as the most used.

All studies showed results in favor of non-pharmacological interventions for pain relief during painful needle procedures in children.

## DISCUSSION

Pain control includes both pharmacological and nonpharmacological measures. Different non-pharmacological methods can be applied and have been shown to be effective for pain relief in children<sup>29-31</sup>. Non-pharmacological interventions can be grouped in the following categories: behavioral, cognitive, complementary, and physical. The behavioral techniques include coaching and training; the cognitive ones include distraction techniques; the complementary ones include toy therapy techniques and, finally, the physical ones consist of comfort position methods and heat therapy<sup>32</sup>.

Distraction is a technique that aims to redirect attention from the aspects of health care that are threatening and provoke pain and anxiety to non-threatening and ideally pleasant and enga-

ging objects or situations<sup>33</sup>. Therefore, changes in the nociceptive response, pain suppression, and the potential to modify cognitive perceptions of pain may be possible to achieve<sup>34</sup>.

This technique can be classified into active or passive, being the active a method in which the child is engaging in an activity during the procedure, such as video games and virtual reality goggles. Passive distraction, on the other hand, is a method that allows the child to be calm and relaxed during the procedure, making use of music and cartoons (animated films), for example. However, when to start the technique and what types of music and cartoons to use have not been described<sup>35</sup>.

A systematic review with meta-analysis on psychological interventions for pain relief in needle procedures included 59 trials and 5550 child participants, describing distraction as the most common, present in 32 trials, and although distraction was the most mentioned intervention, the quality of future studies needs to be improved<sup>36</sup>.

In another meta-analysis that sought to determine the effect of distraction on venipuncture pain in children, distraction techniques were shown to be effective in reducing venipuncture pain<sup>37</sup>. A similar result was identified in a meta-analysis which showed that distraction was a promising intervention for pain in painful procedures<sup>38</sup>.

In the present review, only passive distractions with cartoons, music and acupressure were found. However, a randomized controlled trial compared the effectiveness of passive and active distractions and showed that the type of distraction has no significant influence on the outcome variables related to pain during venipuncture in children<sup>39</sup>.

Audiovisual distraction with cartoons was the most employed type of distraction. In this review's studies, this technique was compared with not receiving any intervention<sup>23</sup>, with parents holding the child without other interventions<sup>24</sup>, with toys that produce light and sound during vaccination<sup>25</sup> and with the Buzzy<sup>®27</sup> device.

The crossover clinical trial<sup>23</sup> showed that distraction was an effective non-pharmacological intervention for pain relief in hospitalized pediatric patients. The study also suggests that distraction interventions during painful procedures may help children to have more adaptive attitudes in future contexts. This result opposes another study which reveals that the children's memory of pain influences their next painful experience, so that children who have had positive experiences feel less pain in subsequent experiences<sup>40</sup>.

During vaccination, audiovisual distraction had a positive effect on pain relief in infants, with a lower average pain score in the group that watched cartoons during and after vaccination compared to the control group<sup>26</sup>. A clinical trial conducted in Italy with six-year-old children showed lower levels of pain and distress in the group that was distracted with cartoons compared to children who received traditional distraction techniques during immunization<sup>41</sup>.

Audiovisual distraction has also been compared with Buzzy<sup>®</sup>, a bee-shaped device that produces vibrations and cools by means of freezable wings<sup>27</sup>. The objective of Buzzy<sup>®</sup> is to block the transmission of pain signals through cold and vibrations, and its effect is based on the Gate Control Theory proposed by Melzack & Wall, in which barriers are capable of controlling the flow of pain information through the activation of nociceptive fibers<sup>42</sup>.

A study observed that the cartoons intervention had superior results for pain relief when compared to Buzzy<sup>®27</sup>. In a recently published study, Buzzy<sup>®</sup> was shown to be less effective than lidocaine patches, and most of the children wanted to remove the freezable wings before the end of the procedure because they started to feel uncomfortable with the cold<sup>43</sup>. Other studies showed that Buzzy<sup>®</sup> was not effective in reducing pain in peripheral venous access puncture<sup>44,45</sup>.

Music and acupressure at the Hugo Point were also passive distraction strategies that had positive results in pain control<sup>24</sup>. The Hugo Point is located on the back of the hand between the first and second metacarpal bones, next to the base of the second metacarpal bone, so that acupressure on this point reduces pain by blocking the transmission of nociceptive impulses<sup>46</sup>. A randomized clinical trial conducted in Turkey showed that children who received acupressure experienced less pain than children in the control group<sup>47</sup>. Therefore, acupressure can be a simple and affordable non-pharmacological strategy to be employed during needle procedures.

Distraction strategies using high technology are being increasingly applied in health care services. Tablets, video games, and virtual reality<sup>36,48,49</sup> have been shown to be effective or moderately effective in reducing pain during painful needle procedures in children<sup>36,50,51</sup>, however, no studies about this technology were observed in this review.

As for the use of chewing gum, it was shown to be less effective in reducing pain, but effective in reducing stress and anxiety. A

similar result was found in a randomized clinical trial, in which chewing gum did not reduce pain<sup>52</sup>.

The age of the children in this review ranges from newborns to schoolchildren. Newborns, because they are not able to conceptualize pain, benefit from active distraction strategies such as looking at cards, blowing soap bubbles (which was not mentioned in this review). Preschoolers, in turn, can decrease their perception of pain and cope better with the procedure through distraction, which can be audiovisual or in the form of cards. Schoolchildren, on the other hand, have a better understanding of the procedure, of pain, and coping, thus benefiting from distraction strategies such as cartoons, video games, and virtual reality<sup>53,54</sup>.

Different scales were used to assess pain in this review's studies. On one hand, it's coherent since it's necessary to consider the children's age. On the other hand, it causes differences in assessment since it makes comparison between studies difficult.

The FLACC scale was applied in two studies with infants and preschoolers; although it is known and commonly used to assess pain in young, noncommunicative children, a recent systematic review of FLACC clinimetry concluded that there is currently insufficient data to accept the scale as reliable and valid for pain assessment during procedures<sup>54</sup>.

Other scales used were the Faces Pain Scale-Revised, Wong-Baker Faces Pain Rating and Ocher's Pain Score, which are self-report and easy expression assessment scales, in addition to the VAS, in which the child scores the pain from zero to 10, zero being no pain and 10 being the most intense pain. Because it's a subjective experience, the self-report in communicative patients is commonly used in evaluations, especially in schoolchildren who can characterize the pain<sup>55</sup>. It's noteworthy that only one study used a specific scale to assess pain in painful procedures, the Children's Anxiety Pain Scale.

In addition to pain relief, half of the studies in this review also evaluate psychological aspects, such as distress, fear and anxiety. Because pain is a multidimensional experience, it's necessary to take into account the affective dimension of pain and the suffering caused in the child<sup>56</sup>.

A study sought to know the representations of pain in schoolchildren who had undergone venipuncture and found that pain is often considered a triggering factor of suffering, often exteriorized through crying and associated with fear of being hospitalized<sup>57</sup>.

Negative experiences can generate needle phobia, anxiety, and exacerbated reactions in future procedures<sup>15,17,18,40</sup>. Therefore, by managing children's pain during painful procedures with needles, their emotional health is taken care of, allowing them to create coping strategies for future experiences<sup>40</sup>.

Furthermore, only one intervention other than distraction was identified, although other strategies such as using clowns, soap bubbles, cards, and therapy with dogs<sup>58,59,59-62</sup> exist in the literature.

This study's limitations comprise a small sample of articles, the low level of methodological evidence of the articles, methodological differences between articles, and the use of different scales to assess pain.

## CONCLUSION

The results indicate that the most commonly used strategy for pain relief was distraction, and audiovisual distraction stands out.

## AUTHORS' CONTRIBUTIONS

### Barbara Vitória Mendes

Data Collection, Writing - Preparation of the original, Writing - Review and Editing

### Maryana da Silva Furlan

Writing - Review and Editing, Supervision

### Mariana Bucci Sanches

Project Management, Writing - Review and Editing, Supervision

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