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homepage: https://rr.esenfc.pt/rr/

ISSNe: 2182.2883



RESEARCH ARTICLE (ORIGINAL) &

# Non-Pharmacological Strategies Used by Nurses In Pain Management During Childhood Vaccination: A Comparative Study

Estratégias não Farmacológicas Utilizadas pelo Enfermeiro na Gestão da Dor Durante a Vacinação Infantil: Estudo Comparativo

Estrategias no Farmacológicas Utilizadas por el Personal de Enfermería en el Tratamiento del Dolor Durante la Vacunación Infantil: Estudio Comparativo

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#### Abstract

**Background:** Childhood vaccination is associated with fear and pain, and non-pharmacological strategies are effective in reducing them.

**Öbjective:** To describe the non-pharmacological strategies used by family health nurses to relieve pain during the vaccination of children up to 10 years of age and to assess their knowledge of the guidelines issued by the *Ordem dos Enfermeiros* (Portuguese Nursing Regulator) and the Portuguese Directorate-General of Health.

**Methodology:** An observational and comparative study was conducted using convenience sampling and a digital questionnaire that included variables such as socioprofessional characteristics, knowledge, and non-pharmacological pain control strategies, which were analyzed according to children's age.

**Results:** Sixty-four family health nurses participated. Most were unaware of the recommendations of the *Ordem dos Enfermeiros* and the Portuguese Directorate-General of Health. The most frequently reported strategies were rocking and gentle stroking (75%), distraction (67.2%), positioning (59.4%), and breastfeeding (50%) for children up to 6 months of age; after 5 years of age, cognitive-behavioral strategies predominated.

**Conclusion:** Family health nurses demonstrated limited knowledge regarding non-pharmacological strategies for pediatric pain control, highlighting the need for targeted training in this area.

Keywords: family nurse practitioners; pain management; vaccination; infant; child, preschool; child

#### Resumo

**Enquadramento:** A vacinação infantil está associada ao medo e à dor, sendo eficaz o uso de estratégias não farmacológicas para a sua redução.

**Objetivo:** Descrever as estratégias não farmacológicas utilizadas por enfermeiros de família no alívio da dor durante a vacinação de crianças até aos 10 anos e analisar o seu conhecimento sobre as diretrizes da Ordem dos Enfermeiros (OE) e da Direção-Geral da Saúde (DGS).

**Metodologia:** Estudo observacional e comparativo, com amostragem por conveniência e aplicação de questionário digital, incluindo variáveis socioprofissionais, conhecimento e estratégias não farmacológicas de controlo da dor, comparadas segundo a idade da criança.

gicas de controlo da dor, comparadas segundo a idade da criança. **Resultados:** Participaram 64 enfermeiros de família. A maioria desconhecia as recomendações da OE e da DGS. As estratégias mais referidas foram o embalo e as carícias (75%), distração (67,2%), posicionamento (59,4%) e amamentação (50%) até aos 6 meses; após os 5 anos, prevaleceram estratégias cognitivo-comportamentais

**Conclusão:** Os enfermeiros de família revelaram pouco conhecimento sobre estratégias não farmacológicas para o controlo da dor em crianças, sendo necessário promover a formação nesta área.

Palavras-chave: enfermeiros de saúde da família; manejo da dor; vacinação; lactente; pré-escolar; criança

#### Resumen

Marco contextual: La vacunación infantil se asocia con el miedo y el dolor, por lo que resulta eficaz el uso de estrategias no farmacológicas para reducirlos.

**Objetivo:** Describir las estrategias no farmacológicas utilizadas por los enfermeros de familia para aliviar el dolor durante la vacunación de niños de hasta 10 años y analizar sus conocimientos sobre las directrices del Colegio de Enfermería (OE) y de la Dirección General de Salud (DGS).

**Metodología:** Estudio observacional y comparativo, con muestreo por conveniencia y aplicación de un cuestionario digital, que incluye variables socioprofesionales, conocimientos y estrategias no farmacológicas para el control del dolor, comparadas según la edad del niño.

**Resultados:** Participaron 64 enfermeros de familia. La mayoría desconocía las recomendaciones de la OE y la DGS. Las estrategias más mencionadas fueron el mecer y las caricias (75 %), la distracción (67,2 %), el posicionamiento (59,4 %) y la lactancia materna (50 %) hasta los 6 meses; después de los 5 años, predominaron las estrategias cognitivo-conductuales.

Conclusión: Los enfermeros de familia mostraron pocos conocimientos sobre estrategias no farmacológicas para el control del dolor en niños, por lo que es necesario promover la formación en esta área.

Palabras clave: enfermeras de família; manejo del dolor; vacunación; lactante; preescolar; niño



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How to cite this article: Fernandes, F. A., Barroso, I. M., Alvarelhão, J. J., & Melo, E. M. (2025). Non-Pharmacological Strategies Used by Nurses In Pain Management During Childhood Vaccination: A Comparative Study. *Revista de Enfermagem e Saúde*, 6(4), 41002. https://doi.org/10.12707/RVI25.40.41002





#### Introduction

Vaccines play a key role in strengthening the immune system, reducing disease risk, and significantly decreasing global mortality. Consequently, vaccination has become one of the most important areas of public health intervention (World Health Organization, 2025). In Portugal, within the healthcare system, children receive several vaccines during their first decade of life, with most administered in the first year (Serviço Nacional de Saúde, 2020).

However, childhood vaccination is often associated with needle-related pain and discomfort, which can cause stress for the child, parents, and family health nurses. Needle fear may lead to anxiety and distress, particularly if the child's previous experiences were unpleasant, potentially resulting in heightened fear during future healthcare procedures (Slater et al., 2025).

Pain management is internationally recognized as a standard indicator of care quality (World Health Organization, 2016). Previous painful experiences, combined with individual factors, influence pain perception during vaccination (Taddio et al., 2022).

The Ordem dos Enfermeiros ([OE - Portuguese Nursing Regulator], 2013) emphasizes that the differentiated management of children's pain and well-being is a nursing responsibility, recommending the use of non-pharmacological strategies alone or in combination with pharmacological approaches. However, the pain associated with childhood vaccination has often been underestimated by nurses, leading to inadequate or insufficient management (Ordem dos Enfermeiros, 2013; Royal College of Nursing, 2019). Scientific evidence on nurses' use of non-pharmacological strategies to control childhood pain remains limited both nationally and internationally. A gap persists between evidence-based recommendations and their implementation in clinical practice (Guillari et al., 2024). Although there is strong scientific support for using these strategies during childhood vaccination, many nurses do not deepen their understanding of these methods and, consequently, fail to integrate them into their practice.

This study aims to analyze family health nurses' knowledge of pain management guidelines established by the OE and the Portuguese Directorate-General of Health (DGS) and to describe the non-pharmacological strategies they employ for pain relief during vaccination in children up to 10 years of age. This research is expected to add value to clinical practice in the Portuguese context, particularly in family and community health nursing, by identifying existing knowledge and practices related to non-pharmacological pain management in children. These findings may inform the adaptation of professional training and support the development of continuous improvement initiatives in this field, specifically targeting family health nursing interventions. Furthermore, they may reinforce the adoption of evidence-based practices, promoting the humanization and quality of care provided to children.

### **Background**

Pain is a complex phenomenon, and when uncontrolled, it is particularly significant in early life, as it can compromise brain development and alter future pain responses (Waisman & Katz, 2024). In primary health care, pain assessment and management remain insufficient, largely due to the lack of adequate assessment tools, especially in the context of vaccination (Schurman et al., 2017). Pain associated with childhood vaccination has specific characteristics that family health nurses should recognize in order to better understand it, assess it, and manage it. Both pharmacological and non-pharmacological strategies are recommended for preventing, treating, and relieving pain (Gorrotxategi Gorrotxategi et al., 2022; Wang et al., 2025; Wu et al., 2022).

The use of non-pharmacological strategies modifies the meaning of pain by cognitively restructuring pain expectations and experiences, transforming the mental processes that drive fear, anxiety, and depressive reactions (McMurtry et al., 2015; Wu et al., 2022).

Non-pharmacological analgesia offers several advantages: it improves adherence to vaccination, incurs no additional costs, and has demonstrated benefits for children (Wu et al., 2022). Therefore, nurses must adopt non-pharmacological strategies tailored to the child's age and understand their importance in pain control. These strategies are effective alternatives for the management of mild pain, as they do not require medication or medical prescriptions, enhance the autonomy of children and families, and contribute to the humanization of nursing care (Mendes et al., 2022). Within the context of family health nursing practice, humanization should prevail, integrating psychological, social, and ethical dimensions into the care provided to children and families.

Non-pharmacological strategies for pain control can be classified (Mendes et al., 2022; Wang et al., 2025) as follows: (i) Cognitive – mental methods for managing pain, such as explaining how the procedure will occur; (ii) Behavioral – strategies that promote distraction and muscle or body relaxation; (iii) Cognitive-behavioral – combined cognitive and behavioral strategies that modify pain perception and improve coping ability, such as distraction and guided imagery; (iV) Physical or peripheral – strategies that reduce the intensity of the painful stimulus, the inflammatory response, and muscle tension, such as applying dry or moist heat, external cold, superficial touch or massage, positioning, or transcutaneous electrical nerve stimulation (TENS); (v) Emotional support - the presence of a significant person providing comfort; (vi) Environmental – interventions that enhance environmental conditions such as light, noise, temperature, and decoration; and; (vii) Complementary - including art therapy, music therapy, and humor, among others. According to Galvão et al. (2015), although nurses acknowledge the importance of pain relief during childhood vaccination, breastfeeding is generally not perceived as a non-pharmacological pain control strategy for breastfed children. There are multiple non-pharmacological strategies available for pediatric pain management and

relief. Thus, the choice of approach depends on available resources, the child's age, pain assessment, the nurse's knowledge, and existing vaccination pain management protocols.

## Research questions

Pain management by family health nurses during childhood vaccination, through the use of non-pharmacological strategies for pain relief, guided the formulation of the following research questions: i) What is the knowledge level of family health nurses regarding the pain management guidelines established by the DGS and the OE?; ii) What non-pharmacological strategies do family health nurses use for pain relief during vaccinations for children up to 10 years of age?; iii) What differences exist in the application of non-pharmacological strategies according to the child's age?

## Methodology

#### Type of Study, Ethical Issues, and Data Protection

This was an observational, cross-sectional study conducted within the context of primary health care in northern Portugal. The study was approved by the Clinical Council and the Ethics Committee of the health unit (Opinion 64/2018). All participants provided informed consent before data collection. Data were stored in a secure data-base managed by the researcher responsible for fieldwork and were anonymized before analysis. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations for descriptive and cross-sectional research.

#### **Participants**

The target population consisted of 156 family health nurses from the Family Health Units and Personalized Health Care Units of a Local Health Unit located in northern Portugal.

# Procedures, Variables, and Data Collection Instruments

The data collection questionnaire was administered digitally and comprised three sections:

sociodemographic and professional characteristics of the participants;

questions assessing nurses' knowledge of the guidelines issued by the OE and the DGS regarding pain management; and

questions related to the use of non-pharmacological strategies for pain relief during childhood vaccination.

This instrument was developed by the study authors and validated by a panel of experts consisting of three clinical nurses with more than two years of professional experience in family health nursing and three professors or researchers in the field of nursing. The panel evaluated the clarity, relevance, and appropriateness of the questionnaire items. A pre-test was conducted with six nurses, also with a minimum of two years of experience in family health nursing, to assess the instrument's clarity, relevance, and completion time. The questionnaire was deemed adequate for data collection.

#### **Data Analysis**

Data analysis was performed using IBM SPSS Statistics 29.0 software, with statistical significance set at  $\alpha=0.05$ . Descriptive analysis included absolute and relative frequencies for qualitative variables and the mean and standard deviation for quantitative variables. Fisher's exact test or the chi-square test were used to assess associations between categorical variables. Differences between groups for quantitative variables were analyzed using the nonparametric Mann–Whitney or Kruskal–Wallis tests. Simple correspondence analysis, an exploratory technique for simplifying data variability structures based on contingency tables, was also performed to identify relationships between the rows and columns of the matrix.

#### Results

Regarding socio-professional characteristics, 64 family health nurses participated in the study, with a mean age of  $42.4 \pm 6.8$  years. Most participants were female (n = 61; 95.3%). The mean number of years of professional experience was  $20.1 \pm 6.7$ . Concerning educational background, most nurses held a bachelor's degree (n = 58; 90.6%) and had no additional specialization (n = 50; 78.0%).

Most participants reported having no specific training in the area of pain (93.7%) or, at most, 100 hours of training. Only 3.1% (n = 2) were members of working groups in this field (Table 1).

 Table 1

 Socio-professional characteristics of family health nurses

Variables	Categories	Values	
Age, mean (SD)		42.4 ± 6.8	
Gender, <i>n</i> (%)	Female	61 (95.3)	
	Male	3 (4.7)	
Length of professional experience, mean (SD)		20.1 ± 6.7	
Educational background	Bachelor's degree	58 (90.6)	
	Master's degree	6 (9.4)	
Specialization	Community Nursing	3 (4.7)	
	Family Health Nursing	3 (4.7)	
	Mental Health and Psychiatric Nursing	1 (1.6)	
	Maternal Health and Obstetric Nursing	2 (3.1)	
	Rehabilitation Nursing	2 (3.1)	
	Gerontology and Geriatrics	1 (1.6)	
	Nursing Supervision	1 (1.6)	
	Chiropractic Massage	1 (1.6)	
	No specialization	50 (78.0)	
Specific training in pain management	Yes. ≥ 100 hours	3 (4.7)	
	Yes. < 100 hours	1 (1.6)	
	No	60 (93.7)	

*Note. SD* = Standard deviation.

Regarding their perceived knowledge of non-pharmacological strategies, most participants rated their knowledge as adequate (n = 30; 46.9%), while 20.3% (n = 13) considered it insufficient.

Most nurses (n = 58; 90.6%) indicated general awareness of national guidelines for pain assessment and management.

However, 9.4% (n = 6) were unfamiliar with DGS Circular 09/2003, 65.6% (n = 42) were unaware of DGS Circular 14/2010, and 54.7% (n = 35) were unaware of DGS Circular 22/2012. The OE's Best Practices Guide for Non-Pharmacological Pain Management Strategies in Children was also unknown to 54.7% (n = 35) of participants (Table 2).

Table 2

Nurses' knowledge of guidelines on pain management in children

	Categories	Frequency $n$ (%)
	Very good	0 (0)
Variable of an above relative and formation	Good	21 (32.8)
Knowledge of non-pharmacological pain relief strategies	Adequate	30 (46.9)
	Insufficient	13 (20.3)
	Knows	58 (90.6)
DGS Circular: Pain as the Fifth Vital Sign	Doesn't know	6 (9.4)
	Knows	22 (34.4)
DGS Circular: Technical Guidelines on Pain Management in Newborns (0-28 days)	Doesn't know	42 (65.6)
DGS Circular: Technical Guidelines on Pain Management in Invasive Procedures in Chil-	Knows	29 (45.3)
dren (1 month to 18 years)	Doesn't know	35 (54.7)
OE Guidelines: Best Practices Guide for Non-Pharmacological Pain Management Strategies	Knows	29 (45.3)
in Children	Doesn't know	35 (54.7)

Note. DGS = Portuguese Directorate-General of Health; OE = Ordem dos Enfermeiros (Portuguese Nursing Regulator).

A comparative analysis of the application of non-pharmacological pain management strategies according to child age revealed that during vaccination of 2-month-old children, family health nurses predominantly used breastfeeding (n = 48; 75.0%), rocking or gentle stroking (n = 47; 73.4%), and positioning (n = 39; 60.9%). At 4 months, rocking or gentle stroking (n = 48; 75.0%), positioning (n = 40; 62.5%), and breastfeeding (n = 38; 59.4%) were the most frequent strategies. At 6 months, the most commonly used approaches were rocking or gentle stroking (n = 48; 75.0%), distraction (n = 43; 67.2%), and positioning (n = 38; 59.4%). Among children aged 12 to 18 months, the most frequent strategies were distraction (n = 55; 85.9% and n = 56; 87.5%), positioning (n = 44; 68.8% and n = 39; 60.9%), and rocking or gentle stroking (n = 38; 59.7% and n = 34; 53.1%) (Table 3).

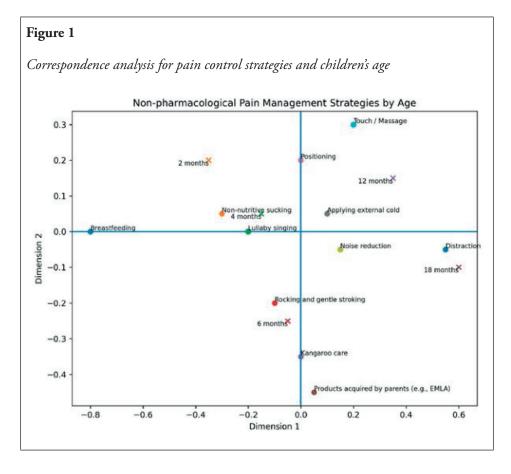
Table 3

Comparison of non-pharmacological strategies used by nurses during vaccination in children aged 2 to 18 months

	2 months	4 months	6 months	12 months	18 months
	n (%)				
Breastfeeding	48 (75.0)	38 (59.4)	32 (50.0)	14 (20.3)	8 (12.5)
Kangaroo care	6 (9.4)	6 (9.4)	8 (12.5)	7 (10.9)	7 (10.9)
Swaddling/ Facilitated tucking	8 (12.5)	9 (14.1)	9 (14.1)	8 (12.5)	9 (14.1)
Positioning	39 (60.9)	40 (62.5)	38 (59.4)	44 (68.8)	39 (60.9)
Non-nutritive sucking	14 (21.9)	14 (21.9)	11 (17.2)	8 (12.5)	7 (10.9)
Touch/ Massage	36 (56.3)	35 (53.1)	32 (51.6)	36 (56.3)	32 (50.0)
Distraction	26 (40.6)	38 (59.4)	43 (67.2)	55 (85.9)	56 (87.5)
Rocking and gentle stroking	47 (73.4)	48 (75.0)	48 (75.0)	38 (59.4)	34 (53.1)
Noise reduction	11 (17.2)	11 (17.1)	11 (17.2)	10 (15.6)	10 (15.6)
Lullaby singing	17 (26.6)	17 (26.6)	17 (26.6)	15 (23.4)	15 (20.3)
Applying external cold	10 (15.6)	11 (17.2)	10 (15.6)	11 (17.2)	10 (15.6)
Products acquired by parents (e.g., EMLA)	12 (18.8)	13 (20.3)	15 (23.4)	11 (17.2)	10 (15.6)

Simple correspondence analysis revealed the relationship between children's ages and specific strategies. Breastfeeding and non-nutritive sucking were the most common strategies for children aged 2 to 4 months. Breastfeeding was particularly prevalent during the first months of life (Figure 1, first quadrant, top left). By 6 months of age, the most common strategies were rocking or gentle stroking and

using products acquired by parents (third quadrant, bottom left). During the first year, the most associated strategies were positioning, application of external cold, and touch or massage (second quadrant, top right). Though located in the fourth quadrant, the distraction strategy was related to 18-month-olds. Several other strategies were reported but did not show a clear association with specific ages.



In 5-year-old children, family health nurses primarily used rewards (n = 49; 76.6%), favorite toys and humor (n = 38; 59.4%), and playful or therapeutic games (n = 37; 57.8%). For 10-year-old children, the most common strategies were humor (n = 42; 65.6%), encouragement of slow, deep breathing (n = 39; 60.9%), and touch or massage (n = 32; 50.0%). No statistically significant differences were identified between nurses' knowledge of non-pharmacological strategies or relevant guidelines (DGS and OE) and their sociodemographic or professional characteristics.

#### Discussion

The results indicate that family health nurses have limited knowledge of the standards and guidelines related to pain prevention and management in children, which may negatively influence the quality of nursing interventions. Although most participants reported general awareness of guidelines on pain assessment and management, many were unfamiliar with specific DGS circulars. Furthermore, more than half of the participants were unaware of the OE's Best Practices Guide for Non-Pharmacological Pain Management Strategies in Children, a key document for evidence-based practice. The discrepancy between perceived and actual knowledge suggests a lack of mastery of current regulations, which can compromise the adequacy of pain management strategies and, consequently, the quality of care.

Specific training in pain management was also found to be scarce, with nearly all participants reporting no formal training in this area. This gap may directly influen-

ce the use of inconsistent or less effective strategies for pain management in children. The literature emphasizes that updated knowledge and continuing education are essential for the effective application of best practices in pain management, particularly in pediatric contexts (Australian and New Zealand College of Anaesthetists, 2023; Guarda et al., 2022).

Regarding nurses' perception of their knowledge of non-pharmacological strategies, approximately one fifth of the participants rated it as insufficient, highlighting the need for additional training and support to encourage the use of evidence-based methods for minimizing pain in children, considering their proven relevance (Gorrotxategi Gorrotxategi et al., 2022).

This study demonstrates that, during the first six months of life, family health nurses primarily use breastfeeding, rocking, and gentle stroking as non-pharmacological strategies. After six months, products provided by parents become more common. These results raise important questions about the interaction between health professionals, parents, and children. Since vaccinations typically occur during brief, episodic encounters and to ensure the effective implementation of the vaccination program, nurses should prioritize developmentally appropriate strategies that reduce discomfort and improve the overall vaccination experience. These findings align with those of Bezerra et al. (2024), who reported that physical contact and breastfeeding are remarkably effective in early infancy. Breastfeeding, in particular, remains an effective strategy through the first year of life (Viggiano et al., 2021).

Correspondence analysis confirmed relationships between certain ages and specific strategies, showing a strong association between early infancy and both breastfeeding and non-nutritive sucking. Throughout the first year, positioning, application of external cold, and massage were the most commonly used strategies, while distraction increased notably at around 18 months. Emerging technological tools for distraction also present new opportunities for pediatric pain management, showing promising results in reducing procedural pain (Rossi et al., 2020; Sánchez-López et al., 2025).

Cognitive-behavioral strategies, particularly the use of rewards, favorite toys, and humor, were predominant for 5-year-old children. Similarly, humor and slow, deep breathing were the most frequent approaches for 10-year-olds. Concerning pain prevention during needle-related procedures, these findings support the idea that children's autonomy in pain management increases as they develop. The literature also suggests that strategies based on cognitive and behavioral engagement, such as guided imagery, relaxation, or humor, enhance coping and self-regulation, reducing the impact of pain (McMurtry et al., 2015). The lack of specific training in pain management, reported

The lack of specific training in pain management, reported by more than 90% of participants, represents a major barrier to effective practice. This deficit may explain the limited diversity of strategies used and the inconsistent integration of evidence-based recommendations.

This study presents certain limitations, including the non-random recruitment of participants from a single geographical region, which limits generalizability. Additionally, digital data collection may have affected participation rates. A potential bias should also be considered, as respondents might have provided answers they perceived as professionally acceptable rather than fully reflective of their actual practices.

In terms of implications for practice and research, the study's findings were presented to the Local Health Unit where data collection occurred, promoting critical reflection among professionals and reinforcing the need for continuous, structured training in non-pharmacological pain relief strategies. A guidance protocol for family health nurses on non-pharmacological pain relief strategies for children was also developed. Additionally, it was noted that training should focus not only on theoretical knowledge but also on developing practical skills to enhance the safety and quality of pediatric vaccination care.

For future research, multicenter studies with larger and more diverse samples, as well as longitudinal designs, are recommended to evaluate the effectiveness of training programs and monitor the ongoing use of non-pharmacological strategies in clinical practice.

#### Conclusion

This study demonstrated that family health nurses are aware of and employ several non-pharmacological strategies during vaccination of children up to 10 years of age. However, notable knowledge gaps persist, particularly regarding the guidelines of the DGS and the OE, which may hinder the consistent and appropriate application of these strategies.

The most frequently used strategies for children up to 18 months were breastfeeding, positioning, touch or massage, rocking and gentle stroking, distraction, and relaxation. For 5-year-olds, rewards and favorite toys were the most common strategies, while for 10-year-olds, humor and playful or therapeutic games were the most common. Using these age-appropriate strategies improves the vaccination experience, fosters cooperation, and promotes adherence to the national vaccination program, as well as positive experiences with needle-related procedures in children.

Despite the study's limitations, the findings underscore the urgent need for specific and continuous professional training in pediatric pain management. Prioritizing such training at the organizational level will enable family health nurses to effectively apply non-pharmacological strategies, reducing fear and anxiety, humanizing care, and positively shaping children's perceptions of pain.

Further research employing varied methodological approaches is essential to evaluate the effectiveness of these strategies and explore the perceptions of children and families, thereby contributing to improved nursing care quality and measurable health gains.

#### Thesis/Dissertation

This article is derived from the thesis entitled *Estratégias* não farmacológicas utilizadas no alívio da dor durante a vacinação em crianças: intervenção do enfermeiro de família, presented at the University of Aveiro in 2020.

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Writing - Review& editing: Barroso, I. M., Alvarelhão, J. J., Melo, E. M.

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