Effectiveness of Sucrose Versus Traditional Comfort Measures in Reducing Pain During Infant Vaccinations

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ABSTRACT

Infant vaccinations are among the most common sources of procedural pain and distress for infants, parents, and healthcare providers. Effective pain management is essential for enhancing clinical experiences, alleviating parental anxiety, and promoting adherence to recommended immunization schedules. The purpose of this paper was to evaluate the effectiveness of traditional non-pharmacological comfort measures compared with oral sucrose administration in reducing pain and parental concern during routine infant vaccinations. Guided by the following PICO question that was formulated and discussed in a real clinical setting: In infants aged 6–12 months, does administering a sucrose mixture, compared with traditional comfort methods, reduce pain and parental concern during immunizations? A comprehensive literature review was conducted using peer-reviewed randomized controlled trials, systematic reviews, meta-analyses, and observational studies published within the last two decades. In most studies, pain outcomes were assessed using validated instruments, including the Modified Behavioural Pain Scale, Neonatal Infant Pain Scale, and Face, Legs, Activity, Cry, and Consolability (FLACC**)** scale, as well as measures of crying duration and behavioural distress. Findings indicate that both sucrose and traditional comfort measures significantly reduce procedural pain, with the greatest analgesic effect observed when these interventions are combined. Evidence further supports the safety, efficacy, and accessibility of oral sucrose, with no documented long-term adverse neurodevelopmental effects. These findings underscore the critical role of nurses in advocating for evidence-based pain management and educating caregivers to ensure consistent implementation in clinical practice, and improving adherence to recommended immunization schedules across diverse healthcare settings worldwide.

Keywords*: Infant vaccinations; pain reduction methods that include sucrose and traditional comfort measures; nursing interventions*

Introduction and Background

Recently, more research has been conducted to assess the effectiveness of traditional comfort measures and the use of sweet solutions, such as sucrose and glucose, in relieving pain during infant vaccinations. This increase has been observed in the literature, supporting parent-led interventions such as breastfeeding, skin-to-skin care, and non-nutritive sucking. However, there are still noticeable gaps in the actual implementation and parental education of these interventions in health care settings. There is an abundant and ever-growing body of literature supporting the efficacy and safety of sweet solutions, breastfeeding and skin-skin for pain reduction, yet the ongoing reports of inconsistent usage of these strategies are occurring in the context of an increasing and concerning body of literature about long-term effects of repeated pain exposure (Harrison, 2020; Harrison & Bueno, 2023).

Although there has been an increase in evidence supporting effective pain-reduction interventions, there are still gaps in the consistency with which comfort measures are used in practice. A study by Ávila Carrasco et al. (2018) assessed nurses' knowledge of pain-relief interventions when administering vaccines to infants and whether they incorporated comfort measures into their vaccination routine. The study found that most nurses were aware of these techniques, but not all applied them in their professional practice, despite their simplicity, ease, and effectiveness. The authors recommended that nurses be aware of these techniques, apply them, and encourage other nursing professionals to do so, as proper application has been shown to be highly effective in minimizing vaccination-related pain. In addition, combining different non-pharmacological measures can enhance their effects, potentially minimizing pain and stress in the pediatric population (Ávila Carrasco et al., 2018; Kassab et al., 2020). Parents play a significant role alongside nurses in reducing infant pain during vaccination. However, many factors contribute to the gap between health care professionals and parents. These include limited education from health care providers on how parents can contribute to comfort measures for their infants, a lack of integration of interventions during immunization appointments, and the fact that these are not standard pain-relief measures used consistently. Additionally, a lack of parental education and awareness from the provider can result in these interventions being omitted from the infant's care. It is evident that implementing pain management methods during infant vaccination is an effective strategy for overcoming parental vaccine hesitancy (Abukhaled & Cortez et al., 2021; Taş, Sari, & Taşkıran, 2025).

Non-pharmacological methods such as breastfeeding, swaddling, skin-to-skin contact, non-nutritive sucking, music, and distraction are frequently used for their ability to provide comfort and reduce distress. Additionally, combining these interventions with the usage of oral sweet solutions has had a positive effect on reducing pain and crying time during infant vaccinations. Addressing parental concerns about vaccine-related pain is essential for combating vaccine hesitancy (Abukhaled et al., 2021). Non-pharmacological and behavioral methods of pain management encourage parent-infant bonding and provide natural analgesia for infants with

minimal risk for adverse reactions. These evidence-based pain-mitigating strategies significantly reduce vaccine-associated discomfort in infants while alleviating parental concerns (Abukhaled et al., 2021; Harrison & Bueno, 2023; Kassab et al., 2020). Education and support from nurses and other health care providers play a critical role in facilitating the effective use of pharmacological and non-pharmacological interventions that reduce infant pain during vaccination and alleviate parental concern about their infant's pain.

Infant distress and parental concern centred around the infant experiencing pain during immunizations is an extremely relevant concern, especially with the recent stigma regarding vaccine hesitancy. It is important for nurses to implement comfort measures as frequently as possible to prevent long-term negative effects on the infant. Over time, failure to treat a child's pain from vaccine- related injections has been associated with increased sensitivity to future pain, at least in part due to changing pain transmission pathways encoding pain memories or even the development of needle phobia, which is further associated with an increased risk of nonadherence to recommended vaccine schedules or for the "optional" vaccines (Killian et al., 2024; Shah et al., 2009). The acute pain associated with administering vaccinations is a common source of distress in infants and children, as well as for their parents and the clinician administering the medication (MacNiel et al., 2024; Shah et al., 2009). It has been shown that experiences that increase fear, pain, and stress can have lasting effects on a patient's perception of healthcare into adulthood (Killian et al., 2024). Despite their known importance, the use of mitigation interventions in clinical settings, carried out by both parents and clinicians, remains suboptimal (MacNiel et al., 2024).

The World Health Organization claims that mitigation interventions targeting vaccine-induced pain in infants and children are clinically important in promoting optimal experiences with pain and healthy coping behaviours (MacNiel et al., 2024). When infants have more positive experiences during pain-inducing procedures, such as vaccinations, parental satisfaction, trust in clinicians, compliance with future vaccination schedules, and overall health status, increase (Abukhaled et al., 2021; Harrison & Bueno, 2023; Kassab et al., 2020; MacNiel et al., 2024). As these identified statements suggest, implementing comfort and pain-relieving measures during infant vaccinations can improve the experience for everyone involved. In addition, there is less trauma induced on the child and overall, the infant would benefit the most from the experience in the long-term because they would feel less pain during immunizations.

This paper explores the effectiveness of oral sucrose compared with traditional comfort measures in reducing parental distress and infant pain during routine vaccinations, to inform evidence-based practice. While reviewing literature for this evidence-based project, a few papers considered sucrose or glucose solutions as an intervention on their own; most examined interventions combined with non-pharmacological approaches, such as breastfeeding or non-nutritive sucking, and others mentioned previously. This will be taken into consideration when exploring the effectiveness of the intervention, as well as feedback on its use and accompanying nursing recommendations. In this paper, the PICO [Patient, Intervention, Comparison, and

Outcome] question will be used to determine whether using a sweet solution is more effective than traditional comfort measures at reducing parental concern and infant pain during vaccinations. Additionally, the PICO question will be used to provide more insight into which interventions work best in reducing infant pain, if the combination of sucrose and traditional comfort measures is more effective than using them separately, and if these interventions were successful in reducing parental concern.

PICO Question

The PICO question for this evidence-based project was discussed with health care professionals at the Bridgewater Family Health Center in Nova Scotia, who provide children with their routine vaccinations. It was evident from a newly graduated nurse who works in the health center that non-pharmacological interventions, such as oral sweeteners, had rarely been used by health care providers and parents. Most comfort measures were implemented by caregivers, who attempted to soothe their infants by holding and swaddling them. They also expressed that they had not used any pharmacological interventions during their experience providing infant vaccinations. This information influenced the formation of our PICO question; it is aimed at trying to find a safe and effective way to treat infant pain and parental distress without causing any long-term adverse effects on the infant. With this information at the center, the PICO question for this paper is: In infants aged 6-12 months, does administering a sucrose mixture, compared with traditional comfort methods, reduce pain and parental concern during immunizations?

Method

The first two authors are second-year nursing students who searched the CINAHL, MEDLINE, Embase, PubMed, Google Scholar, Scopus, and ProQuest databases for research articles. A sufficient search was conducted using keywords such as “vaccine”, “pain”, “sucrose”, “pharmacological” and “infant”. The year of publication was taken into consideration due to the growth and research that have been done based on studies from over 20 years ago. The reason is that most of these sources had been reevaluated, and some new theories and findings had emerged; as a result, we did not use any information from this period that had not been republished in a more recent paper. A total of 33 research articles were identified and examined to assess the relevance and significance of reducing pain during vaccinations. In addition, each article was appraised to determine the study's aim, methods, statistical methods used, sample population, results, recommendations for nursing practice, quality appraised, strengths and limitations, and whether the article was used (see Appendix A). Six literature reviews were also examined to identify relevant background information and provide insights from prior research on comfort measures used during infant vaccinations.

Eleven research articles and four literature reviews were excluded from this review because they did not directly measure pain from vaccination or use sucrose as the sole intervention. The main limitation of not using certain articles is that they don't directly measure the effects of sucrose or comfort measures on vaccinations alone. Many articles used sucrose as an analgesic for heel lance or venipuncture procedures and did not mention vaccinations. However, there was some useful information on the effect of sucrose from articles that can be used with vaccinations, since they are similar invasive procedures. Some of the articles found that they have different populations, such as neonates aged 0-6 months or those older than 19 months. Many of the studies centred around infants aged 0-6 can be related to the 6-12-month age group. However, the 19-month-and-older age group has shown different effects; therefore, it is more difficult to apply to the 6-12-month age group. Many articles were also found that examined multiple interventions in combination with oral sucrose. This can make it difficult to determine which intervention truly worked independently, rather than when used in combination with other measures. The articles ultimately excluded were too extraneous to use because their procedures and interventions differed from or were unrelated to this topic.

The sixteen research articles and two literature reviews included in this paper were sufficient to provide accurate information on the effects of nonpharmacological interventions during vaccinations. As mentioned before, some articles contained different procedures such as heel lancing or venipuncture. These articles were carefully examined, and relevant information applicable to infant vaccinations was used to better understand the effect of sucrose during an invasive procedure. Other articles included in the paper were related to parental concern and to how the use of interventions during their child's vaccinations can reduce parental concern. Many of the articles used randomized controlled trials or meta-analyses to gather information and employed tools such as pain scales, crying time, video recordings, and pre- and post-intervention surveys to assess the effectiveness of the interventions. Additionally, articles examining the effectiveness of interventions administered by health care professionals, as well as their knowledge and application of comfort measures, were consistently included.

Description of Literature Review

How is pain assessed?

Measuring the amount of pain an infant has during an invasive procedure is relatively difficult to obtain, given that infants cannot verbally express that they are in pain or have discomfort. Many researchers must rely on both their own and their parents' observations or use different measurement scales and tests to determine the level of discomfort during vaccinations. Many of these scales measure infant behavior that can be recorded directly through observation. The Modified Behavioral Pain Scale (MBPS) is a validated procedural unidimensional pain measurement tool (Kassab et al., 2020). This was used to measure behavioural pain outcome during (from initial insertion of the injection needle for administration of the first vaccination until withdrawal of the needle after administration of the last injection) and immediately after

administration of the last injection (Kassab et al., 2020). Another observational indicator of pain in infants is the duration of crying during the procedure and immediately after completion. Crying was identified as the presence of audible negative vocalization in combination with facial grimacing (Kassab et al., 2020; Taş, Sari, & Taşkıran, 2025). An infant crying in response to pain is considered a normal reflex to painful stimuli. Both the intensity of crying (e.g., gentle, whimpering) and the duration of the cry are valid measures (Kassab et al., 2020). All acute pain scales for neonates and young children include crying as a valid measure of pain response. In addition, crying is included in most unidimensional and multidimensional infant pain scales (Kassab et al., 2020; Taş, Sari, & Taşkıran, 2025).

These objective pain scales can also be applied to caregivers and clinicians using the Measure of Adult and Infant Soothing and Distress (MAISD). The MAISD is a valid and reliable behaviour observation scale used to examine the discrete behaviours exhibited by infants, parents, and clinicians during invasive medical procedures. (MacNiel et al., 2024). The MAISD is comprised of eight infant behaviors (i.e., engage in distraction, play with object alone, suck, consume food, smile/coo, cry, scream, flail) and ten adult (parent and clinician) behaviors (i.e., distract, offer object, offer pacifier, offer food, breastfeed, rub/massage/pat, kiss, hug, rock, verbally reassure) (MacNiel et al., 2024). Many standardized scales are available to measure pain scores in newborns and infants. These include the Children's Revised Impact of Event Scale (CRIES), the Face, Legs, Activity, Cry, and Consolability (FLACC), the Premature Infant Pain Profile (PIPP), and the Neonatal Infant Pain Score (NIPS) pain scales (Kaur et al., 2024). The Neonatal Infant Pain Scale (NIPS) is based on six parameters: facial expression, cry, breathing patterns, arms, legs, and state of arousal. (Kaur et al., 2024; Taş, Sari, & Taşkıran, 2025) Since infants cannot communicate their pain verbally, it is crucial for nurses to have access to user-friendly and precise neonatal pain scales to provide optimal care. It is important to assess both behavioral and physiological responses to pain and gain a comprehensive understanding of the infant's pain experience. By examining these indicators, nurses can ensure the right delivery of high-quality care to infants in pain (Kaur et al., 2024).

Some additional tests conducted include measuring the infant's saliva Substance P levels (Substance P is a neurotransmitter that carries pain signals from injured tissues to the brain and stimulates the inflammatory process). The salivary SP level was also measured in participants as an indicator of pain and associated distress (Kassab et al., 2020). A commercially available competitive enzyme-linked immunosorbent assay (ELISA) was performed according to the manufacturer's instructions to measure SP levels in saliva (Kassab et al., 2020). Accurately measuring the pain and distress experienced by an infant during vaccinations relies on collecting both qualitative and quantitative data. These are all extremely relevant and important examples of measurement scales and tests that can be used to assess the infant's pain level while also considering the impact of parents and clinicians.

What Interventions are Used to Minimize Infant Pain and Parental Concern?

Effectiveness of Sucrose Versus Traditional Comfort Measures in Reducing Pain During Infant Vaccinations

Many studies have been conducted to determine which comfort measure is most effective in reducing infant pain during vaccinations. This paper focuses on the effects of sucrose or sweet solutions compared with traditional comfort measures, including breastfeeding, swaddling, holding, soothing, music, distraction, and non-nutritive sucking. In Taddio's (2015) randomized controlled trial, a sucrose solution was used in conjunction with the oral rotavirus vaccine to try to reduce pain during the following two vaccines administered either before or after the oral rotavirus vaccine. These vaccines are part of the infants' required vaccination schedule. Given that sucrose is known to be analgesic in infants, the option of mixing sucrose with the oral vaccine was considered to reduce the pain that would follow. The results were collected using the MBPS scale and crying time (in seconds) and showed no difference in analgesic effects during the following two injections. These findings show that the sweetened rotavirus solution is as effective as an oral sucrose solution in reducing infant pain during vaccinations. There are very few studies that consider oral sucrose solution as an intervention in its own right; this can make it difficult to evaluate its effectiveness independently. However, some studies have shown the effective dose required to provide analgesic relief during invasive procedures. In Stevens's (2018) study on determining the minimally effective dose of sucrose for procedural pain relief in neonates, it was found that oral administration of a very small dose (0.1ml) appears to be as effective as larger doses at reducing pain during a single painful procedure. This study evaluated the PIPP scores of infants receiving a sucrose solution before and during invasive procedures, such as heel lancing. Although this study was conducted in an infant undergoing a heel lancing procedure, the intervention can still be implemented during vaccinations.

Parental concern regarding their infants undergoing pain and distress can often leave parents unsure about how to approach situations such as this and provide comfort to their child. Comforting and distraction, although cost-neutral, require training. It is often supported by clinicians that pain from vaccinations is a short-lived phenomenon and therefore not worthy of treatment (Taddio et al., 2017). Poorly treated procedural pain, however, is believed to be associated with the development of fear of pain over time and higher levels of distress before, during and after future procedures (Taddio et al., 2017). Parents reported that fears develop in their infants as early as the first year of life, a time when infants routinely receive repeated vaccinations (Taddio et al., 2017). A randomized controlled trial by McNair (2017) included parents in providing comfort measures during vaccinations. The results demonstrate that parents commonly used non-pharmacological methods such as holding, distracting, and acting calm. Parents used pharmacological methods such as topical anesthetics or oral sucrose less frequently (McNair et al., 2017). Parents also indicated that topical anesthetics and oral sucrose solutions would be utilized more if they were provided by the clinic. Making these strategies more accessible and convenient for parents to use may lead to higher utilization rates (McNair et al., 2017).

In Kaur's (2024) experiment, the impact of breastfeeding, music therapy, and oral sucrose on pain relief during pentavalent vaccination was compared. Findings were measured using the NIPS scale, and participants were divided into three equal groups and given an

intervention. The results suggest significant differences in pain scores among the three groups, with breastfeeding showing significantly higher scores than both musical therapy and oral sucrose. However, no significant difference was observed between musical therapy and oral sucrose (Kaur et al., 2024). Similarly, Helemani (2025) found that non-invasive therapies such as breastfeeding, sucrose solution, and skin-to-skin contact have analgesic effects in children. These non-pharmacological interventions are safe and have fewer side effects than pharmacological management (Helemani et al., 2025).

What are the outcomes of using sucrose as an Intervention?

Using sucrose ultimately provides pain relief when used as an intervention for pain related to invasive procedures, which includes pain from immunizations and vaccinations. Repeated sucrose was very effective in reducing behavioural pain responses, as well as composite pain responses related to multiple or repeated procedures. In addition, there is no evidence of poor neurological development or long-term developmental disruptions following repeated sucrose administration (Gao et al., 2016). Non-invasive therapies such as breastfeeding, sucrose, and hot/cold applications were very effective at reducing pain from vaccinations in infants. These nonpharmacological interventions are ideal and produce analgesic effects in infants independently, as well as combined, with little to no side effects. The evidence backs up the use of sucrose as the most effective of all the interventions tested (Halemani et al., 2025). Sucrose has been shown to be safe for the neurodevelopment of children receiving it repeatedly (Holsti et al., 2010). One study found that 2mL of 75% sucrose solution administered orally reduced infant crying time and lowered distress scores after immunizations (Lewindon et al., 1998). Another study found that you need at least 0.24g for it to achieve the maximum intended analgesic effect (Benis, 2002). Sucrose is shown to be more effective when combined with other comfort measures, particularly non-nutritive sucking. The combined use of sucrose and non-nutritive sucking is more effective than either intervention alone. Overall, these combined showed superiority in relieving pain during painful procedures endured by infants compared to each administered/performed singularly. The sucrose enhances the effects of non-nutritive sucking (Li et al., 2022). The combination of sucrose and a pacifier for non-nutritive sucking was very effective in relieving pain and discomfort from needle procedures and was shown to be safe for neonates (Elserafy et al., 2009).

Strength, Quality, and Adequacy of Evidence

Overall, the types of studies used include randomized controlled trials, meta-analyses, surveys, randomized double-blind trials, systematic reviews, PRISMA guidelines, Cochrane guidelines, quasi-experimental sampling, placebo-controlled, evidence-based, and observational study methods. A randomized controlled trial uses random assignment: one group receives the intervention or experimental treatment, and the other receives a placebo, no intervention, or standard care. This is effective, as it had no bias in selecting which participants should be in

which group, and it addressed this by having one group receive the sucrose solution while the other received either a placebo or nothing at all. A placebo is a substance administered to a participant that has no effect on the participant, while the participant believes it is the intervention or what is involved in the experiment. Meta-analysis combines data from numerous independent studies to draw a conclusion about a treatment or a research question. Surveys can be conducted anonymously, where participants answer a set of questions without providing identifying information, and the responses are compiled with those from other completed surveys into a single dataset to either support or refute the proposed question or statement. A randomized double-blind trial uses a placebo, but differs from how placebos are normally used in that the researcher and the person conducting the experiment do not know who is receiving a placebo and who is receiving the intervention. Placebos are typically used so that the researcher knows who's receiving them, but the participant does not know which treatment they are receiving. Quasi-experimental sampling differs from random sampling: it assigns participants to groups based on the independent variable. All these methods were used in the research and reviews that we found for this paper.

There are numerous strengths and minimal limitations associated with the use of sucrose. Across a couple of studies, we found a knowledge gap between pharmacological pain-reduction methods and their actual use, and no comparison of which intervention was more effective; the studies mainly described what knowledge was obtained and how it was implemented. The strength of this was that they acknowledged this gap and its relevance to the subject of study (Avila et al., 2018). In one study by Gao et al. (2016), the authors conducted eight trials and a systematic review, drawing on numerous sources. They also assessed risk of bias using quality appraisal criteria from the Cochrane Handbook. All the information was entered into a standardized form. The limitations of this study were that they used repeated procedural pain as their variable rather than immunizations or needle-related pain. Although this is with repeated procedural pain, repeated procedural pain is very broad and can include procedures that require the use of needles (Gao et al., 2016). Another study used evidence-based approaches, including numerous studies. The authors used a control group with more than one alternative intervention, specifically no treatment and placebo-like water. The limitation of this study is that the participants are 1 year old or older. It still supports the research question because it is 6 to 18 months old, but a 1-year-old can be 12 to 23 months. They also used only 4 studies, which is fewer than ideal; more studies are better (Harrison et al., 2011). A study comparing oral sucrose, non-nutritive sucking, and breastfeeding showed promising results. It was a good quality improvement project because it had many participants, which in turn yielded a large sample size and a wealth of information. The results were consistent with improvement in pain reduction across all ages. The limitations with this were that it unfortunately did not directly record the effectiveness of oral sucrose (Killian et al., 2024). The strengths and limitations of the other studies in our research showed similar findings. Generally, there are far more strengths than limitations.

Thirty-three resources were used, twenty-six being peer-reviewed sources and the remaining six being literature reviews. Each resource used several studies in its research. One resource used four studies with three-hundred-thirty participants (Harrison et al., 2011), another used sixty-six studies that included six-hundred-seventy-seven infants (Li et al., 2022), another searched through three-thousand-one-hundred-ninety-three articles (Sridharan et al., 2018), and another used seventy-four studies with seven-thousand-forty-nine infants (Stevens et al., 2017). Each resource used numerous sources, all credibly cited at the end of the article. We tended to use more information from those with larger numbers of studies and participants, as they are more likely to yield more accurate results. Realistically, more research is needed on sucrose and its effects on infants to understand how it works and the pathways it mediates analgesia. There was a lot of research to look through and a lot that was available, but there was not nearly as much as you see with other subjects or questions. More research is needed on combinations to fully leverage their analgesic properties and enhance what is already working well. As stated, there is insufficient research on the effectiveness of sucrose as a pain reliever in infants. Another reason there should be more research is that it is easily administered and a very simple, non-pharmacologic intervention that is readily prepared and accessible.

Recommendations and Implications for Practice

We recommend that nurses become advocates for these simple non-pharmacological interventions, as infants are more vulnerable and fragile than older children and adults to pharmacological interventions. Nurses should be further educated on using sucrose as a pain intervention. It is stated that nurses have knowledge, and it explains the knowledge that nurses are provided with. We recommend that this knowledge be expanded and made more well-known. One of the references discussed that most nurses know about pain relief strategies and interventions, but do not apply them in practice (Avila et al., 2018). We would also recommend implementing multiple non-pharmacologic strategies simultaneously, including swaddling, facilitated tucking, skin-to-skin/kangaroo care, breastfeeding, and pacifiers. (Stevens et al., 2018). Pain relief matters in practice because, contrary to prior belief, infants feel the same level and types of pain that we do. It was a common myth that infants did not feel pain, or that they felt less pain than children and adults do, but that has since been proven to be the exact opposite. Infants feel just as much pain, if not more than, children and adults do. It is important for pain relief in infants that this becomes common practice because they are unable to say to us what hurts, where or how much pain they are in. Sucrose, being non-pharmacological, is a better option for the infants because pharmacological interventions can be more damaging to their little bodies.

Pharmacological interventions can also have long-term side effects and cause developmental problems or delays. One study reported no evidence that neonates would experience poor neurological development or long-term developmental delays if they are subjected to repeated sucrose administration for pain reduction (Gao et al., 2016). This finding was common across the majority of studies involving sucrose as the main intervention: sucrose

has no adverse reactions or side effects and produces no short- or long-term effects on development.

Conclusion

In conclusion, infantile immunizations are evidently the main source of pain and discomfort for the infant, parent, and nurse. The purpose of this paper was to evaluate the effectiveness and analgesic properties of traditional comfort measures versus the administration of a sucrose mixture orally. We used evidence-based literature to research the following PICO question: In infants aged 6-12 months, does administering a sucrose mixture, compared with traditional comfort methods, reduce pain and parental concern during immunizations? This PICO question was generated with the help of a new grad nurse, who expressed concern that interventions such as sweet oral solutions were rarely used by healthcare professionals despite their efficacy in pain relief. We evaluated this question and conducted the following research. The use of non-pharmacological interventions such as breastfeeding, non-nutritive sucking, swaddling, and distraction to provide comfort and reduce stress is more effective when combined with sweet-tasting oral solutions. This has a positive effect in reducing pain and crying times during immunizations and needle-related procedures in infants. It is important that nurses and healthcare professionals use comfort measures as often as possible to prevent negative effects on the infant in both the short and long term. Repeated sucrose was very effective in reducing pain responses to invasive procedures such as immunizations. It is evident that no developmental interruptions or poor neurological development occur when infants are exposed to repeated PO administration of sucrose. 2 mL of 75% sucrose solution, administered orally, reduced crying time and distress after vaccinations in two of our sources. Another study reports 0.24g as the minimum dose to achieve analgesic effects. The combination of a pacifier (non-nutritive sucking) and a sucrose mixture has been shown to be more effective than administering sucrose alone. Non-pharmacological interventions should be used before pharmacological interventions because they can have drastic effects on the developing body and brain. If sucrose were to be added to non-pharmacological interventions, that is one more intervention to try that effectively reduces pain before going the pharmacological route. Pain relief is extremely important in clinical practice, especially for infants, because despite past beliefs that infants do not feel pain, they feel just as much pain as we do, with the limitation of very little ability to communicate their pain. After conducting research, weighing the strengths and limitations, and considering practicality, we recommend that nurses receive further education on using sucrose administration as the primary intervention. Yes, administering a sucrose mixture, compared with traditional comfort methods, reduces pain and parental concern during immunizations.

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Appendix A

Reference/ Citation	Aim of the study	Methods and statistical methods used	Sample population	Results	Recommendation	Quality appraisal Strengths, limitations	Did we use this article? Why?
Abukhaled, M., & Cortez, S. (2021). Nonpharmacological Methods for Reducing Parental Concern for Infant Vaccine-Associated Pain. *Journal of Pediatric Health Care*, *35*(2), 180–187. https://doi.org/10.1016/j.pedhc.2020.09.006	The aim of this study was to evaluate whether non-pharmacological interventions such as breastfeeding or oral sucrose solution would be more effective at reducing parental concern about their infant's pain during painful procedures.	A validated survey for measuring the level of parental concern for infant vaccine-related pain using a 5-point Likert scale. Pre and post intervention surveys were done- 15 minutes before and 15 minutes after regarding parent satisfaction, willingness to recommend interventions and lack of knowledge (barriers to using these methods). Statistical test- Parental concern was measured pre- and post-intervention using the Fisher exact test, as well as the Wilcoxon-Mann-Whitney test for statistical significance.	A convenience sample of infants aged 0 to 6 months, who presented to the pediatric clinic for routine well baby examination and vaccination, was selected for participation in the project. Split into two groups: Breastfeeding and 24% SS	Nonpharmacological methods (breastfeeding or a 24% Sucrose Solution) Breastfeeding and SS administration provide adequate pain relief during infant vaccination, and therapeutic pain modulation can be achieved in just 2 min. This project's findings demonstrate that these two interventions reduce infant vaccination-related pain, help alleviate parental concerns, and minimize vaccine hesitancy. (p=0.035) -Both groups showed improvement and differences in experience -Results indicated that parental concern decreased after interventions were done. These data indicated that parents in both groups tended to be less concerned about infant vaccine-related pain after performing pain management interventions. In addition, parents indicated that the most common reasons for not using pain management during vaccination were that they had "never heard of this" (27%) or "the doctor never discussed" (24%) options. In total, 92% of parents stated that they wanted to learn about vaccine pain relief strategies, 96% of parents (92% breastfeeding, 100% SS) would recommend the	Parents reported a gap in knowledge about not knowing it was possible, or their doctors never discussing it. Surveys were consistent with results, Nurses support the usage of the sucrose with regards to reducing vaccination pain.	Used evidence-based interventions The design of the experiment allowed for comparison Practical and can be applied to real world settings- they performed a statistical analysis- based on the p-value of 0.035 Some limitations- did not measure infant pain directly more so the parental concern of their child being in pain and how to reduce it. This study is supported by many other studied done previously as well as systematic reviews for background information Still, a relevant study can be applied in clinical settings and by nurses. Similarities- they are both non-pharma logical interventions, low cost, both reduce infant pain and parental concern and both rely on caregiver involvement Differences- breastfeeding promoted bonding and can be helpful for the child going through this experience, sucrose is good when breastfeeding can't be used Found that a combination use of	Yes, this article was used because it provided adequate information about how parental concern can impact vaccination. It also provides insight in the importance of distress and pain. It gave very strong evidence of parents being involved with providing care along with the health care professional to reduce distress in the infant.

				nonpharmacological intervention. 87% of parents reported higher levels of satisfaction with the pain intervention. Results worked best when given before, during and after, combined with parental measures. Barriers: a lack of awareness in hospitals to implement these non-pharmacological methods. This can be due to health care providers not discussing options with parents.		comfort measures like holding or a pacifier (non-nutritive sucking) along with either breastmilk or 24%SS is equally effective Parents also provided comfort by holding the infants and giving reassurance and support during the vaccination. As well as the use of non-nutritive sucking like a pacifier, which supports breastfeeding and/or 24% SS	
Ávila Carrasco, M., Carbonell Muñoz, L., Gómez Merino, A., Méndez Perruca, M., & Rodríguez Besada, M. J. (2018). Can primary care nurses contribute to the reduction of pain when vaccinating? *Vacunas (Barcelona. Internet. English Ed.)*, *19*(1), 8–11. https://doi.org/10.1016/j.vacune.2018.03.003	The objective of the study was to determine the level of awareness of techniques for pain relief when vaccinating among full- and part-time nursing professionals caring for the pediatric population at any primary care center belonging to the western healthcare management division of the autonomous community of Madrid, as well as the extent to which they use these techniques in their day-to-day practice. (Ávila Carrasco et al., 2018)	A cross-sectional descriptive population study was conducted. Surveys using Google Forms were anonymous and sent to nurses belonging to the study population by email. Data was analyzed using the SPSS program. Qualitative variables underwent statistical analysis with mean and standard deviation (SD). Pearson's Chi squares test used to examine the association of the variable's studies.	The study population consisted of 89 nurses. From these 61 surveys were gathered from a primary care facility. Pediatric and community specialist nurses, and a mix of those who worked in rural and urban healthcare settings.	Results found that 93.4% of the nurses were aware that breastfeeding is an effective technique for decreasing pain when vaccinating. 45.9% of nurses were aware that a topical anesthetic is a useful technique in reducing pain when vaccinating. 96% of the nurses were aware that some vaccines are more painful than others.	Experts agree that breastfeeding constitutes the best method of non-pharmacological analgesia and comfort for managing pain. If breastfeeding is not possible, a combination of oral sucrose administration and non-nutritive sucking is highly effective for procedures of mild to moderate intensity and short duration, such as vaccine administration. (Ávila Carrasco et al., 2018) Breastfeeding is most effective and oral sucrose is a great alternative	Limitations: there is a gap between knowledge of nonpharmacological pain reduction methods and their actual usage. There was no comparison on which method worked better; they mainly stated what knowledge the nurses knew and how/ if they implemented them. Strengths: acknowledges the gap between knowledge and practice, and it is relevant to this subject.	Yes, this article was used because it provides adequate insight as to what nurses know about interventions and if they implement them. Although this study did not look at sucrose specifically, it still shows that there needs to be more access to different interventions for nurses to use during vaccination

Benis, M. M. (2002). EFFICACY OF SUCROSE AS ANALGESIA FOR PROCEDURAL PAIN IN NEONATES. *Advances in Neonatal Care*, *2*(2), 93–100. https://doi.org/10.1053/adnc.2002.32049	The aim of this study was to determine the efficacy and optimal dosage of sucrose for neonatal procedural pain.	They used a literature search, which identified 5 studies that met the criteria for inclusion in the meta-analysis for a total of 271 infants. They measured using crying time for 3 minutes post-procedure following either administration of water or a dose of sucrose.	The sample population was infants; they were studied 271 total across 5 studies with specific criteria. They used randomized controlled trials that examined sucrose as an analgesic for infants during procedures to manage pain.	The results showed that there was no difference in crying times between the water group and the group that was administered only 0.18g of sucrose. The crying time was significantly less in the other sucrose groups; doses of at least 0.24g were found to be the most effective. There were no adverse effects recorded or observed.	The evidence supports the results and findings by the CAT, which systematically appraised the meta-analysis, provided clinical bottom lines, and included all safety recommendations for practice. The evidence supports the results.	Limitations: It is procedural pain, not specifically immunization. Strengths: They used 5 studies with 271 participants, which is a decent sample size. It provides a minimum dosage for efficacy.	Yes, we decided to use this because it explains the minimum dosage to carry out therapeutic effects of pain relief for the infant.
Bueno, M., Candido, L., Hu, J., Fiander, M., Cracknell, J., Xu, E., Kang, J., Yamada, J., & Group, S. B. T. C. N. (2026). Sucrose analgesia for venepuncture in neonates. *Cochrane Database of Systematic Reviews*, *2026*(3), CD015221. https://doi.org/10.1002/14651858.cd015221.pub2	The aim of this study was to evaluate the harms and the benefits of sucrose PO for pain relief from venipuncture in preterm and term neonates compared to receiving no interventions at all, standard care, and other analgesic interventions.	They searched numerous databases for information used in this study. The references were studied as well. They included RCTs, crossover and cluster RCTs which evaluated the effects of sucrose in terms of analgesia in neonates, including term and preterm infants.	No sample population.	The results concluded that sucrose reduces crying times and distress after venipuncture. These results apply to almost every intervention they compared it with.	The evidence supports that sucrose reduced pain scores during and shortly after venipuncture compared to no intervention, water, or standard care.	Limitations: It is only supportive of venipuncture in neonates and not immunizations in infants. Strengths: It supports that sucrose reduces crying times and distress in infants.	No, we did not use this source because it shows sucrose being effective with venipuncture and we are focused on vaccination and immunization.
Cochrane Central Register of Controlled Trials (CENTRAL). (2011). *Effect on Pain of Oral Sucrose Versus Placebo in Children 1 to 3 Months Old Needing Venipuncture*. Cochrane Central Register of Controlled Trials. https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01531921/full	The aim of this study is to compare the efficacy of 88% sucrose as an oral solution to a placebo solution in terms of reducing pain assessed using the FLACC scale in children of 1 to 3 months during venipuncture.	They used summaries from randomized controlled trials among hospitalized neonates of 32 to 40 weeks' gestation. It was a randomized double-blind trial.	The sample population was infants from 0-3 months and 0-6 months. Each was separated into groups to be administered either a placebo or the sucrose solution.	The results supported the belief that providing an oral sucrose solution during venipuncture will decrease pain levels in infants 1 to 3 months of age.	Evidence supports that acute pain is one of the most common stimuli experienced by children, and the long-term unmanaged side effects greatly outweigh the trial of sucrose to reduce the pain experienced. Evidence supports the theory that sucrose decreases pain with no adverse or long-term side effects reported, observed or otherwise noted.	Limitations: It is more general in terms of providing information rather than giving an accurate answer. It was also difficult to differentiate between what they spoke about as theory and what they had proven with evidence from the study(ies).	No, we did not use this source because the age group did not align with the desired population. The invasive procedure was also not the same as the one we were looking for. Therefore, we decided to exclude this resource.

Gao, H., Gao, H., Xu, G., Li, M., Du, S., Li, F., Zhang, H., & Wang, D. (2016). Efficacy and safety of repeated oral sucrose for repeated procedural pain in neonates: A systematic review. *International Journal of Nursing Studies, 62,* 118–125. https://pubmed.ncbi.nlm.nih.gov/27474944/	This source mainly highlights how underused sucrose is in routine health care, and highlights misconceptions people have regarding this, including that continuous dosages would harm brain development, which they found that the trauma of the pain itself is more harmful than repeated dosages of glucose. It is also not often documented so it is hard to keep track of what is used and when	This systematic review aimed to identify and assess the evidence demonstrating the efficacy and safety of repeated sucrose for repeated procedural pain in neonates, to provide health-care professionals with the necessary information for neonatal pain management. We can use this study as evidence that it has had no long-term or adverse effects	The sample population included preterm infants less than 31 weeks' gestation in neonatal intensive care units, since they are exposed to painful stimuli and procedures as often or more often than daily.	The study found that repeated sucrose was very effective in reducing behavioural pain responses and composite pain responses with pain related to multiple or repeated procedures. The study also reported there is no evidence suggesting the neonates would endure poor neurological development or long-term developmental interruptions if they were subjected to repeated sucrose administration for pain reduction.	Evidence to support the efficacy and safety of repeated sucrose administration to help relieve pain in neonates is limited. The evidence that is present supports that repeated sucrose is effective in pain reduction for neonates and does not cause any adverse side effects or interruptions in their developmental abilities and growth.	They used 8 trials and conducted a systematic review of numerous sources. A risk of bias was assessed using quality critical appraisal criteria that were found and highly recommended by the Cochrane Handbook. The extraction of information was entered into a standardized form. Limitations: the only con that is obvious is that the study used repeated procedural pain as a variable instead of what was stated in our PICO question, which is in immunizations or needle-related procedural pain. It still supports that pain reduction during repeated procedures and exposure to painful stimuli is effectively reduced with sucrose administration. It also states/supports that there are no significant or adverse effects that would stop parents/HCPs from using this method.	Yes, we used this study because it has multiple trials, very minor limitations and it supports our PICO question.
Halemani, K., Vitale, E., Shetty, A., Thimmappa, L., Issac, A., Vr, V., & Mishra, P. (2025). Nonpharmacological Interventions on Intramuscular Vaccination Pain among Infants: A Systematic Review and Meta-Analysis of Randomized Control Trials. *Journal of Caring Sciences, 14*(3), 139–150. https://pubmed.ncbi.nlm.nih.gov/41200701/	The aim of this study is to further understand the significance in non-pharmacological interventions and the impact they have on vaccination pain in infants.	The study followed PRISMA and Cochrane guidelines. By doing that, they were able to analyze the data using a random-effects model with a 95% confidence interval.	A total of 1739 infants are included in 19 trials. 1055 infants received interventions, and 684 infants received usual care. 8 trials used breastfeeding as an intervention, 6 trials used sucrose solution, 3 used kangaroo	The study found that noninvasive therapies like breastfeeding, sucrose, KMC, and hot/cold applications were very effective in reducing pain from vaccinations in infants. It also proved that the nonpharmacological interventions were ideal and produced analgesic properties in infants with fewer side effects.	The evidence points towards sucrose as being the most effective of all the interventions tested, breastfeeding being the second and the kangaroo mother care with hot/cold application being the third most effective of all conducted during the study. The study also shows there are fewer side effects with sucrose,	Strengths: They used 19 studies/trials that are stated and a total of 1739 infants from those 19 trials. The infants were separated into their groups with different interventions appointed to each group. Used a wide range of research analysis.	Yes. This source had great information regarding the effect of interventions used during vaccinations. It also provided good recommendations on what has better analgesic effects and highlights the importance of using these measures with parent sand in clinical practice.

			mother care with hot and cold applications.		breastfeeding, and KMC with hot/cold application than there are with alternatives for pain management in infants.	Limitations: The information and evidence support and is for more than just sucrose, so the results are a little broader, but it ultimately still supports our research.	
Harrison, D. (2021). Pain management for infants – Myths, misconceptions, barriers; knowledge and knowledge gaps. *Journal of Neonatal Nursing : JNN*, *27*(5), 313–316. https://doi.org/10.1016/j.jnn.2020.12.004	The aim of this literature review is to understand more about myths and misconceptions that were generalized around infant pain management. This review attempts to fill the gaps in knowledge that have been addressed through further studies that have been done. Mainly focuses on the efficacy and safety of sweet solutions, breastfeeding and skin to skin for pain reduction.	Focused on evidence-based pain management methods such as oral sucrose/glucose, breastfeeding, and skin contact. No statistical test is done.	Not a research study so there is no sample population. This review is based on other previous studies	It was found that there is strong evidence that repeated doses of oral sucrose during frequently occurring painful procedures did not increase the risk of poor outcomes. There is no evidence that using sucrose for pain management is harmful. Health care providers need to be aware that they are using the SS promptly because it has a short analgesic window	Recommendation would be for health care providers to implement these evidence-based practices more frequently in patient care. Also, health care providers include parents more in the care of their child and educate them on techniques and comfort measures they can implement to reduce pain and distress in children.	Limitation: Usage of sucrose solutions is rarely documented, so it is difficult to keep track of when they are used. The question of when sucrose solutions are appropriate as analgesia has not been well addressed in the literature. Strengths: Identify real life problems that are seen in clinical settings. Healthcare providers need to be the ones to implement and educate them the most.	Yes, this literature review was used because it had good information about concerns that healthcare professionals and parents had that should be addressed. It also gave a perspective about myths or misconceptions that I was not aware of from other literature reviews, and was helpful in highlighting areas of concern or uncertainty.
Harrison, D., Yamada, J., Adams-Webber, T., Ohlsson, A., Beyene, J., & Stevens, B. (2011). Sweet tasting solutions for reduction of needle-related procedural pain in children aged one to 16 years. *Cochrane Database of Systematic Reviews, 10, https://pubmed.ncbi.nlm.nih.gov/21975781/*	The objective of this study is to determine the reduction of needle-related procedure pain when using sweet-tasting solutions and/or substances.	In this study, they searched numerous databases to find randomized controlled trials on children of one year of age who received the sweet-tasting solution or substances before needle-related procedures. They applied no language or document restrictions.	They reported mean differences with 95% confidence intervals using fixed-effect or random-effects models as appropriate for ongoing outcome measures. They reported risk ratios and risk differences for dichotomous outcomes. The Chi test was also used and statistic for heterogeneity.	They included 4 studies, which had 330 participants in total. Two studies focused on toddlers receiving the sucrose mixture to reduce immunization pain compared with the control group that received either water or no treatment at all. Those participating in the sucrose group had shown significantly lower cry duration and behavioural scores of pain compared to the control group that received water or no intervention. This study helps us because it proves our research question to be true. That sucrose helps decrease pain from immunizations.	In the study, the evidence shows that although there is no sufficient evidence about sucrose or sweet-tasting solutions working for toddlers and children greater than one year of age, there is sufficient evidence to suggest there is a relationship between pain reduction in needle-related procedures and sucrose administration in those one year of age or younger.	Strengths: Used evidence-based approach, including multiple studies, used a control group with more than one alternative (using no treatment as well as administering a placebo like water). Limitations: Their research participants are one-year-olds and not less than one year of age; it still supports our research question, but our research question is about infants, not one-year-olds. They only used 4 studies instead of more; the	No. We decided not to use this source because they only used four studies and their participants were one-year olds, one-year olds can range from 12-23 months and our age range is 6-18.

						more studies used, the better.	
Habibzadeh, H., Bakhsh, M. S., Hosseini, M., & Khalkhali, H. R. (2024). Comparing sucrose solution with distilled water for pain management in premature infant venipuncture: randomized clinical trial. *Annals of Medicine and Surgery*, *86*(8), 4512–4520. https://doi.org/10.1097/ms9.0000000000002227	The objectives for this study are to manage pain for premature infants undergoing frequent painful procedures.	This is a randomized controlled trial conducted in a double-blind manner which was set to meet research goals. The primary goal is to assess the compared impact of sucrose to distilled water on pain reduction in premature infants admitted to the NICU. It is a double-blind clinical trial.	The sample population used infants born between the 32nd and 36th week of pregnancy, weighing 1.5kg or more, aged 1-2 days with no history of undergoing painful procedures as well as a few more parameters.	The results from this study were in favor of the group that was administered sucrose instead of distilled water. They have the results grouped by placebo or sucrose, birth weight, Apgar score, and sex of the infant.	Evidence shows that the pain scores were the most accurate way to measure and that the sucrose is effective in eliciting analgesic properties.	Limitations: There is a lot of information and statistics, and the study is not organized very well to read.	No. We decided not to use this source because the population was too young. Although, it did have very good evidence.
Holsti, L., & Grunau, R. E. (2010). Considerations for using sucrose to reduce procedural pain in preterm infants. *PEDIATRICS*, *125*(5), 1042–1047. https://doi.org/10.1542/peds.2009-2445	The goal of this was to further examine sucrose since it is becoming the accepted clinical standard of nonpharmacologic interventions in managing acute procedural pain.	They conducted research from 2 literature sources to provide an impetus to initiate further research on the effects of sucrose.	There is no sample population.	The results were that the mechanism of action of sucrose is through opioid pathways and are linked to the calming mechanisms of sucrose in infants born preterm or ill.	The evidence proved sucrose to be safe for neurodevelopment and effective in pain relief over short periods of time with repeated sucrose use while undergoing procedures that break the skin.	Limitations: here is not too much information supporting the claim of this study, but there is enough to include it in this paper.	Yes. We decided to use this source because it provides information and evidence supporting the safety for infant neurodevelopment with sucrose administration.
Kassab, M., Almomani, B., Nuseir, K., & Alhouary, A. (2020). Efficacy of Sucrose in Reducing Pain during Immunization among 10- to 18-Month-Old Infants and Young Children: A Randomized Controlled Trial. *Journal of Pediatric Nursing*, *50*, e55–e61. https://doi.org/10.1016/j.pedn.2019.11.010	The aim of the study was to determine the effectiveness of oral sucrose in reducing immunization pain during 10–18-month-old	This was a double blinded randomized controlled trial conducted in Jordan over 1 year. Used random sampling across	The sample population is a total of 132 infants and young children between the ages of 10 –18 months.	Sucrose- 2ml of 50% sucrose solution was given immediately before immunization, sublingually over 30 seconds. Placebo (sterile water)- 2 ml	Compared to a placebo group, the sucrose group had significantly less pain post immunization- substance P was lower in the sucrose group, could be a	Limitations are that the results are only related to success, including the consideration of breastfeeding, holding, parental comfort/soothing,	Yes. This article had very good information regarding the type of scales/test used to measure infant pain and distress including MBPS and Salivary Substance P (ELISA).

	infant vaccinations.	multiple clinics and centers. To obtain a population of study. Used MBPS as a unidimensional pain measurement tool (measures facial expression, cry, body movement). Recorded before, during, and immediately after. The crying time was recorded (reliable behavioral indicator of infant pain). The levels of salivary Substance P were measured as indicators of pain and associated stress. This was measured using (ELISA) Analyzed using chi-squares or independent t-tests as appropriate.	Were divided into two groups by age: Infants' age 10-12 months and young children 15-18 months	The sucrose group showed lower MBPS scores than the non-intervention group. Total crying time (in seconds) was significantly shorter for participants in the intervention group compared to the control group. Substance P levels in the intervention group were also lower than in the non-intervention group. Gives us strong evidence to use for the effectiveness of sucrose against pain reduction. Helps with behavioural stability in a shorter time. Sucrose was effective across both groups 10-12,15-18.	good predictor of pain reduction associated with immunization pain Had strong statistical support This is a strong, randomized controlled trial design that recorded multiple outcomes of the effects of intervention or non-intervention. Including behavioural and physiological.	and other comfort measures. This study only compares sucrose, so no additional comfort measures (breastfeeding, non-nutritive sucking, other comfort strategies) were directly tested in this trial Was only conducted in one country And the measurement of Substance P was only done one time. Reduction of bias by random selection and double-blind study.	
Kaur, H., Charan, G. S., Kaur, R., Narang, G. S., & Khurana, M. S. (2024). Comparison of breastfeeding, music therapy, and oral sucrose's impact on pain relief among infants during pentavalent vaccination. *Journal of education and health promotion*, *13*, 49. https://doi.org/10.4103/jehp.jehp_860_23	Aimed to compare the effectiveness of breastfeeding, musical therapy and oral sucrose in reding infants' pain relief during pentavalent vaccination Breastfeeding compared with, 1-2ml of 25% sucrose mixture or music therapy with a toy	Quasi-experimental purposive sampling from infants receiving their 1st, 2nd or 3rd dosage of pentavalent vaccine. Group assignment was determined by dropping names into a box and picked using a lottery method. Pain was measured using Neonatal Infant Pain Scale (NIPS)	The sample population was 150 infants in total, split into 3 groups of 50. 50 breastfeeding, 50 musical therapy and 50 oral sucrose. The intervention was initiated two minutes before the pentavalent vaccination and continued during and after the vaccine for up to 5 minutes.	Between the breastfeeding group and music/oral sucrose it showed that all methods were somewhat effective, but that breast feeding worked better more of the time in reducing pain during pentavalent vaccination. Newborns' responses to oral sucrose have been thoroughly examined, and they appear to be both effective and developmentally appropriate for reducing newborns' pain during procedures. The use of oral sucrose has	Research studies have provided evidence that breast milk effectively reduces neonatal pain during minor painful procedures. Due to its widespread availability and its positive impact on the mother–baby bond, breastfeeding is considered the most used non-pharmacological method for pain relief. (Kaur et al., 2024) Breastfeeding had the highest median scores overall in preventing severe pain	Limitations: The pain assessment was only based on NIPS assessment. Pain scores were only measured once. Only explored 3 interventions which limit access to other one's comfort measures that could be used. The study was only conducted on one clinical center, so results can only be generalized to this specific group but still had a good sample size.	Yes. This study was found to be very useful in providing the effects of oral sucrose in comparison with breastfeeding and music.

		Statistical analysis was performed using SPSS Statistics software. Statistical significance was determined by p-value. The Mann-Whitney test was used to find statistical significance between the groups. The Kruskal-Wallis's test was used to examine whether there were differences in the pain scores among these groups.		received the most research attention in baby pain management to date (Kaur et al., 2024) Within all the methods oral sucrose was still found to be effective; this can be supported by many other studies that have been conducted about this.	It is recommended that breastfeeding is encouraged during vaccination visits and that it can be used as a great nonpharmacological intervention in reducing infant vaccination pain. Sucrose is a great alternative to reduce infant vaccine pain when breastfeeding in unavailable.	Highlights the need for more research on these subjects	
Killian, H. J., Deacy, A., Edmundson, E., Raab, L., & Schurman, J. V. (2024). If we know better, why don't we do better? A rapid quality improvement project to increase utilization of comfort measures to reduce pain and distress in children in a COVID-19 mass vaccination clinic. *Journal of Pediatric Nursing*, *76*. https://doi.org/10.1016/j.pedn.2024.01.024	A quality improvement project was conducted prior to COVID-19 to increase the use of comfort promise measures during needle procedures. Showed that oral sucrose and breastfeeding were used as interventions The aim of the quality improvement project was to increase the usage of comfort measures during vaccinations and to assess whether they have an impact on improving pain and distress.	Each PDSA cycle All patients and caregivers were given the opportunity to receive comfort measures and complete an optional survey. Objective data were collected based on the usage of evidence-based elements of the comfort measure used, and qualitative feedback from families, nursing staff, and administrative leaders was also received to determine specific targets for improvement in the next cycle. Statistical: descriptive statistics	COVID-19 mass vaccination clinics. 3 waves: 1st wave or Cycle 1-Children ages 12 and older. They receive shot blockers and pain relief. 2nd wave or Cycle 2-Children between ages 5 and 11. They receive comfort positioning and an alternative focus 3rd wave or cycle 3-Children between ages 6 months and 4 years. They receive Breastfeeding or sucrose and comfort positioning.	Comfort measures assessed Pain Ease, Shot Blockers, Comfort Positioning, Alternative Focus, Topical Lidocaine, and Breastfeeding/Sucrose) Throughout the waves increased and generally remained stable. CMs also seemed to decrease pain/distress with vaccinations (70.5 to 88.7%), and children/caregivers intended to use some combination for future vaccinations (82.5 to 98.5%) Provided adequate education and implementation of the comfort measures. Overall, 70-88% reported improvement in reducing pain during vaccination using these comfort measures. Compared to all the other measures, only 16.1% of the sample of patients under 2 years of age used breastfeeding, oral	Oral sucrose, non-nutritive sucking, breast feeding is recommended for 6-18 months Recommended to combine comfort strategies for nurses to integrate into the vaccine routine. This is also important in educating parents by providing comfort measures for themselves.	Strengths: This was a good quality improvement project because there were many participants which gave a large sample size to get lots of information. The results also showed consistent improvement i the reduction of pain across all ages. Limitations: not directly recording oral sucrose effectiveness.	Yes, this article was very helpful in providing information regarding the regularity of interventions. It was also helpful in determining the effectiveness of these interventions.

				sucrose/ non-nutritive sucking.			
Lewindon, P. J., Harkness, L., & Lewindon, N. (1998). Randomized controlled trial of sucrose by mouth for the relief of infant crying after immunization. *Archives of Disease in Childhood 78*(5), 453–456. https://pubmed.ncbi.nlm.nih.gov/9659093/	The objective of this study was to evaluate the effects of sucrose solutions PO on infant crying times and distress measurement present in the immunization clinic.	They used a randomized, double blind, placebo-controlled trial of a sucrose solution of 75% wt/vol sterile water as the control. The duration of infant crying was recorded during and immediately after the injection. Infant distress was assessed by visual analogue scales independently by a nurse and a parent.	The study used 107 healthy infants who were attending 2-, 4-, or 6-month immunizations for polio, DTP, and influenza B. These infants were to receive 2mL 75% sucrose or sterile water by mouth before the injections.	The results concluded that the administration of 2mL of the 75% sucrose solution PO had reduced the infant crying time and lowered distress scores after the immunizations listed in the study across each age group studied.	The evidence shows that during a distressing procedure like immunizations, infant distress is reduced upon administration of sucrose at high concentrations and is very helpful and safe for use in clinical settings.	Strengths: They used randomized, double blind, and placebo-controlled methods for the trial. They had multiple groups of interventions, and they had multiple age variation (even though only varies by 2 months) in which they separated equally between each age to determine efficacy in each. They used multiple measures to confirm or disprove the reduction in distress and pain. Limitations: they did not have much for statistics for this study; they had only the statements and findings. There were no confidence intervals or ratios.	Yes. We decided to use this source because it has specific dosages that work. It also supports another study that had the same dosages.
Li, Q., Tan, X., Li, X., Tang, W., Mei, L., Cheng, G., & Zou, Y. (2022). Efficacy and safety of combined oral sucrose and nonnutritive sucking in pain management for infants: A systematic review and meta-analysis. *PloS One*, *17*(5), e0268033. https://doi.org/10.1371/journal.pone.0268033	The aim of this study is to evaluate the effectiveness of combining interventions while monitoring adverse effects compared to using the single intervention methods including non-nutritive sucking NNS, oral sucrose (OS) alone, and breast milk and oral glucose combined. It also explores the possible controversy about oral glucose potentially inducing adverse effects.	A combination of 66 studies included 677 infants assessing the pain in the group applying sucrose alone. Another study containing 66 term newborns set glucose+ NNS as the control group. Meta-analysis on pain score measured in different Painful procedures include Neonatal Infant Pain Scale (NIPS), Neonatal Facial Coding System (NFCS), Neonatal Pain Agitation, and	Participants were preterm or full-term neonates without severe illness. Various populations across studies. Randomized groups should contain at least an intervention groups applied with oral sucrose combined with NNS	Meta-analysis showed a significant effect of the combined interventions of OS and NNS than OS alone. NIPS scores were lower in the NNS+ oral sucrose group compared to the NNS and glucose group. During venipuncture. Five trials observed that the occurrence rate of adverse events was zero in all treatment groups. They observed a significant effect of NNS + sucrose on oxygen saturation and heart rate but not significant enough to be adverse.	The combination usage of sucrose with NNS in more effective than single interventions. Overall, the combined interventions of the NNS and sucrose showed superiority in relieving mild pain during the painful procedures compared to using only NNS alone, sucrose alone, or standard care. Sucrose enhances the effects of NNS. However, this method is still inferior to breastfeeding, These interventions are best used for mild to moderate procedural pain,	Limitations: These studies don't highlight specifically vaccinations of pain, but they still research if infant pain is alleviated using evidence based on non pharmacological comfort measures. These studies also investigate babies younger than 6 months old, still the research can be applied to older infants. Strengths: Use multiple pain scales to measure across different interventions. And they used multiple randomized controlled trials that	Yes, we decided to use this because it explains that sucrose is more effective when combined with other methods like non-nutritive sucking.

		Sedation Scale (N-PASS). Results were presented as continuous variables. Evaluated during the procedure phase and in the recovery phase.			such as venipuncture and heel lancing. Health care providers should use them, when possible, to reduce procedural pain in infants.	yielded similar results.	
McCall, J. M., DeCristofaro, C., & Elliott, L. (2012). Oral sucrose for pain control in nonneonate infants during minor painful procedures. *Journal of the American Association of Nurse Practitioners*, *25*(5), 244–252. https://doi.org/10.1111/j.1745-7599.2012.00783.x	The purpose of this study is to provide information about effective use of oral sucrose as an oral analgesic for pain related to immunizations or venipuncture.	They used evidence-based literature, including the original clinical trials, reviews, and clinical practice guidelines.	The sample population is infants aged 1-12 months old.	The results concluded that oral sucrose solutions should be used as pain regulation/reduction mechanisms and interventions for infants up to 12 months old who are having painful procedures (minor).	The evidence proves its effectiveness as an analgesic, with low to no minor adverse events; easy administration and increased availability make it a good choice for this. Although the study states that additional research is needed regarding the proper dose response in the different age groups.	Limitations: the study only states this effectiveness for infants ages 1-12 months, and our age group is 6-18 months.	No> we did not use this source because the sample population was out of our age range, most of the data supporting our question was for those younger than 6 months rather than 6-12.
MacNeil, M., Hundert, A., & Campbell-Yeo, M. (2024). Soothing and Distress Behaviors of Infants, Parents, and Clinicians During Childhood Vaccinations. *Pain Management Nursing*, *25*(5), e327–e335. https://doi.org/10.1016/j.pmn.2024.05.002	The aim of this study was to examine the behaviours of preterm infants, their parents, and clinicians during 2-, 6-, 12-, and 18-month vaccinations.	A secondary descriptive analysis of data was conducted in a randomized controlled trial. Observational study: Two recordings were obtained, one with a view of the child's face, and the other of the parents and clinicians. Lasted 3-5 minutes. The measure of Adult and Infant Soothing and Distress (MAISD) was used to assess pain-	All vaccination occurred at the Canadian Center for Vaccination at IWK health. 24 infants in 2 months category. 34 infants in 6 months category. 48 infants in the 12-month category. 54 infants in the 18-month category.	Results found that behaviors such as crying and screaming increased during the vaccination. They also found that these soothing techniques were used more at the end and recovery phase of injection. The research shows that these comfort techniques are more effective during the anticipatory and recovery phases. The use of interventions such as sucrose, breastfeeding, holding, skin-skin, non-nutritive sucking and topical anesthetic	Parents had the informed option to use pain relief without interference from researchers. Clinicians and providers were trained in needle-related pain-related strategies.	Limitations: MSAID can have subjectivity within the coder's response. Even though there are descriptions for each behavior listed, there can be subjectivity in the way the coder interprets the behavior themselves. Even though two video recordings were taken, there can still be some information that was potentially missed. There was only one painful procedure used, so it may not be	Yes. This study was used in this paper. It was helpful in providing information about the MAISD scale. This helped to determine what interventions are typically used and not used during routine vaccinations. As well as recommendations for nursing practice.

		related soothing and distress behaviours.		were barely used or brough up to parent by the health care provider.		applicable to other procedures. Strength: This is a problem that many vaccine clinics must dela with and are trying to work, they also recorded multiple time points, and two views of the camera allows for a more accurate reading of behaviors of everyone involved.	
McNair, C., Fung, M., Taddio, A., Ipp, M., Moss, S., Baker, S., Tolkin, J., Dave, M., Feerasta, S., Govan, P., & Riddell, R. P. (2017). Parent-led interventions in reducing infant vaccination pain after participation in a longitudinal randomized control trial. *Paediatrics & Child Health*, *22*(4), 217–219. https://doi.org/10.1093/pch/pxx040	The aim of this research was to determine whether parents continued to use non-pharmacological pain-reducing strategies after participating in the randomized controlled trial.	Observational study. Treatments were given to participants in a blind manner. Infants were randomized to four analgesic treatments, increasing intensity for each visit. Standard dare, then a parent-directed educational video with information on calming and distracting infants, video and oral sucrose solution, and then the video, sucrose solution and liposomal lidocaine cream (lidocaine)	The sample population is 130 parents and their children receiving vaccinations. They were part of a randomized controlled trial, and they followed up on the interventions they used on the 18-month vaccinations.	Out of all the interventions offered, 98.5% of parents held their infant close and acted during the injection. 73.1% distracted the infant, 13.1% used their pacifier, and 8.5% used a topical anesthetic to numb the skin. Oral sucrose solution was not used once. Parents who did not use sucrose or a topical anesthetic reported they did not find these interventions to be necessary. Parents reported enjoying the learning process the most, and witnessing their child during vaccination pain was the least favourite part. Learning about interventions during randomized trials was the reason for parents to use them during the 18-month visit.	Parents indicated that topical anesthetics and sucrose solutions would be used more if they were provided by the clinic. Which can make these interventions more accessible and convenient for parents to use. Oral sucrose can easily be incorporated into waiting time. It is important for health care providers to take an active role in facilitating pain mitigation during vaccination by properly educating parents about evidence-based interventions and making them available for use.	Limitations: there were only significant analgesic effects in the video, oral sucrose and lidocaine group, suggesting that lidocaine is the main reason this intervention is so effective. Strengths: Based on randomized controlled trials, so no bias to interventions. This study identifies the behaviour of parents and how they intervene for their child's pain during vaccination. And highlights barriers that are found withing the knowledge and education of the parents.	Yes. This research was helpful in determining what interventions parents use during their child's vaccinations. Explained what they did use and what was not used.

Effectiveness of Sucrose Versus Traditional Comfort Measures in Reducing Pain During Infant Vaccinations

Elserafy FA, Alsaedi SA, Louwrens J, Bin Sadiq B, Mersal AY. (2009). Oral sucrose and a pacifier for pain relief during simple procedures in preterm infants: a randomized controlled trial. Ann Saudi Med, 29(3):184-8. doi: 10.4103/0256-4947.52821. PMID: 19448377; PMCID: PMC2813645. *PubMed.* https://pubmed.ncbi.nlm.nih.gov/19448377/	The aim of this study is to assess the analgesic effects of a sucrose and water mixture versus a pacifier in preterm infants in relieving pain during painful procedures.	This study or trial was conducted as a double-blind, randomized, controlled study. This study was recreated to clarify and retest the results of a previous study.	The sample population consists of 36 preterm infants (with a mean of 31 weeks' gestation, and a range of 27 to 36 weeks). They split them into 6 groups at random, each with a different regimen for study.	The study shows that all the regimens tested were the most effective in lowering pain scored with the 24% sucrose solution combined with the pacifier. The mean pain score/scale for this combination was 0.7, compared to that of the sterile water and pacifier being 1.4.	The evidence shows that the effect of a combination of sucrose and the pacifier (non-nutritive sucking for soothing) was very effective and safe in relieving needle-related pain and discomfort in neonates.	Limitations: There is a limitation because the results show that pain reduction occurs with the sucrose and pacifier combined. Even though this proves the efficacy of them combined, it also proves our point because it states that the sucrose works as well.	Yes, we used this because it has lots of information on the combination of sucrose and non-nutritive sucking, and the safety of this combination. It supports other studies that have researched this combination as well.
Riddell, R. R. P., Bucsea, O., Shiff, I., Chow, C., Gennis, H. G., Badovinac, S., DiLorenzo-Klas, M., Racine, N. M., Kohut, S. A., Lisi, D., Turcotte, K., Stevens, B., & Uman, L. S. (2023). Non-pharmacological management of infant and young child procedural pain. *Cochrane Database of Systematic Reviews*, *2023*(6), CD006275. https://doi.org/10.1002/14651858.cd006275.pub4	The objective of this study was to assess the effectiveness and adverse events of non-pharmacological intervention, including PO sucrose administration.	This study was conducted using the Cochrane risk of bias tool and the GRADE approach. They analyzed the standardized mean difference using the generic inverse variance method to determine the effect size. They used infants from birth to three years old in randomized controlled trials or cross-over RCTs with no treatment control comparison	No sample population was used.	The results were supportive of sucrose producing minimal pain-relieving effects, as other interventions had proved to be more successful. Overall, non-nutritive sucking, facilitated tucking, and swaddling may reduce the pain behaviours in preterm neonates.	There is a lack of confidence in the evidence of what is more effective, but the evidence that is present supports sucrose and its pain-relieving factors, even though they are present minimally.	Limitations: It does not have sucrose as the main pain reliever, but it still states that it has pain-relieving factors, even though minimal, they still exist.	No, we did not use this source because the main pain relievers were interventions like swaddling, non-nutritive sucking, instead of sucrose being the main successor.
Sasidharan, R., Gupta, N., Yadav, B., Chawla, D., Singh, K., & Singh, A. K. (2022). 25% dextrose versus 24% sucrose for heel lancing in preterm infants: a noninferiority RCT. *PEDIATRICS*, *149*(5). https://doi.org/10.1542/peds.2021-054618	The aim of this was to compare the efficacy of 25% dextrose with 24% sucrose for heel-lance analgesia in preterm infants admitted to the NICU.	The study was conducted as a noninferiority, double-blind, randomized controlled trial. They used preterm infants born at 28 weeks and 0 days to 35 weeks and 6 days of gestation who had been scheduled for a heel-lance procedure.	There is no sample population.	The study resulted in dextrose being equally effective as 24% sucrose for the needle-prick related pain in infants.	The evidence shows that the results and scores of infant pains were relatively similar and noninferior. They could not compare to each other for one relieving more pain than the other.	Limitations: It does not state that sucrose is better than dextrose, but it still has evidence to prove that the sucrose is effective in relieving pain during procedures that involve needle prick and breaking of the skin.	No, we did not use this source because it did not research the same procedure as what we were looking for. As well as the age and conditions of the infants, this was directed towards preterm infants.

Sen, E., & Manav, G. (2020). Effect of kangaroo care and oral sucrose on pain in premature infants: a randomized controlled trial. *Pain Management Nursing, 21*(6), 556–564. https://pubmed.ncbi.nlm.nih.gov/32768272/	The objectives of this study were to compare the effects of kangaroo care and sucrose PO for pain relief in preterm infants during needle-related procedure pain, such as heel-pricking.	The study used 64 infants who were divided into groups using a randomized block design of drawing from a thick, non-transparent envelope. 64 slips were put in the envelope, 32 for kangaroo care and 32 for oral sucrose. In both groups, they measured heart rate, oxygen saturation, and pain score. Pain score was evaluated by 2 people using the PIPP, or premature infant pain profile, before, during, and after 2 minutes.	The sample population included 64 infants randomly divided into 2 groups. Kangaroo care was given to group 1, and oral sucrose was given to group 2.	The study resulted in favour of the kangaroo care in terms of effectiveness, but sucrose demonstrated effectiveness as well. The kangaroo care is just more effective than sucrose during heel lancing in preterm infants.	The evidence shows that although sucrose has many benefits in pain relief, kangaroo care can be used to reduce pain in premature infants more effectively.	Limitations: The study shows that kangaroo care is more effective than sucrose, but sucrose is also effective, just not as effective as kangaroo care. We can still use this because it does not nullify that sucrose is ineffective, even though it does not fully support the question.	No, we did not use this source because it shows throughout the study that kangaroo care is more effective than sucrose. It does show that sucrose is effective; it just does not show sucrose as being the most effective.
Sridharan, K., & Sivaramakrishnan, G. (2018). Pharmacological interventions for reducing pain related to immunization or intramuscular injection in children: A mixed treatment comparison network meta-analysis of randomized controlled clinical trials. *Journal of Child Health Care*, *22*(3), 393–405. https://doi.org/10.1177/1367493518760735	The aim of this study was to see which intervention was more effective in providing pain relief during child/infant vaccinations.	Found through randomized controlled trials using meta-analysis. Interventions were sucrose (24, 25, 50, and 75%, 25% dextrose, glucose (25 and 30) EMLA, vapocoolant spray, amethocaine, paracetamol, and ibuprophen.	Search through 3193 articles, picked 23 in the meta-analysis. 20 of the studies were conducted on children receiving vaccination and the other 3 in children administered other intramuscular injections.	The results we used were focused on oral sugar in infants. Topical EMLA cream was observed to be better than 25% dextrose and 50% sucrose. Crying time and the mixed treatments were better for 25% glucose, 25% sucrose, and vapocoolant spray. Found that 25% sucrose and topical EMLA cream is associated with significantly lower pain scores.	Nonpharmacological interventions should be used alongside pharmacological interventions such as sucrose solution or use of a topical anesthetic such as EMLA.	Limitations: Risk of bias that the topical EMLA cream has a high probability of being the best in the pool to reduce pain in the vaccinations. This study is also limited because it does not consider other non-pharmacological measures such as distraction. Some strengths are that this is the first meta-analysis comparing the pharmacological agents used for reducing vaccine pain in children.	No, we will not use this source Only mainly focused on the usage of topical interventions which would be very different then sucrose solution This source was only used to cite the number of studies and participants in the paragraph elaborating on our research sources. It was not used anywhere else.

Effectiveness of Sucrose Versus Traditional Comfort Measures in Reducing Pain During Infant Vaccinations

Stevens, B., Yamada, J., Campbell-Yeo, M., Gibbins, S., Harrison, D., Dionne, K., Taddio, A., McNair, C., Willan, A., Ballantyne, M., Widger, K., Sidani, S., Estabrooks, C., Synnes, A., Squires, J., Victor, C., & Riahi, S. (2018). The minimally effective dose of sucrose for procedural pain relief in neonates: A randomized controlled trial. *BMC Pediatrics*, *18*(1). https://doi.org/10.1186/s12887-018-1026-x	The aim of this study was to determine the minimally effective dose of 24% sucrose needed for reducing pain in hospitalized neonates undergoing heel lancing procedure.	A prospective multicenter single-blind randomized controlled trial was conducted. The treatment intervention was videotaped. Pain intensity measured with the PIPP-R. Physiological and behavioural/facial indicators of pain intensity were collected using an infant monitoring system.	A total sample size of 213 split into 3 intervention groups. Parents were still encouraged to use non pharmacological interventions such as swaddling, skin to skin/kangaroo care, and breastfeeding)	Results: There were adverse effects due to some neonate chocking/gagged when administered the sucrose solution, and one whose oxygen saturation dropped following sucrose administration. Small amounts of sucrose appear to be equally effective at reducing pain in neonates during painful procedures, such as larger doses. Pain scores seemed to be higher in preterm neonates.	It is still recommended to use sucrose in relieving pain during vaccination, using a small dosage of 0.1ml is equally effective and safter for the neonate. It is also important to incorporate it with non-pharmacological interventions like non-nutritive sucking or swaddling/holding.	Limitations: There were discrepancies in the past usage of sucrose solution due to a lack of documentation. The effectiveness of the PIPP-R measure may leave some gaps in determining the effectiveness of the intervention. Some strengths would be that they used a randomized controlled trial to conduct the study. They also use a large sample for each of the interventions used.	Yes. This source was useful in determining the minimum amount of sucrose that would be needed to produce an analgesic effect in infants.
Stevens, B., Yamada, J., Ohlsson, A., Haliburton, S., & Shorkey, A. (2017). Sucrose for analgesia in newborn infants undergoing painful procedures. *Cochrane Database of Systematic Reviews*, *2016*(2). https://doi.org/10.1002/14651858.cd009.pub5	The aim of this study was to determine the efficacy, effect of dosage, and administration of oral sucrose for procedural pain relief in neonates.	A systematic review and Meta-analysis of Cochrane Neonatal was used to gather research. Searched Interventions were sucrose and non-nutritive sucking vs sterile water, glucose, breastfeeding, skin-skin and other comfort measures. Pain scores were measured using PIPP. Recorded behavioural indicators such as crying and facial expression. And they also recorded physiological indicators such as HR and O2 saturation. Used the GRADE system for evidence	Total of 74 studies using 7049 infants Preterm and neonates	The result found that sucrose significantly reduces procedural pain compared to other comfort measures; this was shown by the lower PIPP score. Also found that sucrose was not effective for more invasive procedures like circumcision pain.	Heel lancing showed the most improvement in the usage of sucrose solutions. It is recommended to use measures like NNS in combination with sucrose.	Strengths: high level of appraisal and evidence using Cochrane systematic review. Uses RTC. Use the GRADE to record infant pain. Limitations- there is not much certainty as to whether a sucrose solution is very effective as there is little evidence of long-term use outcomes.	No, we won't be using this article This source was only used to cite the number of studies and participants in the paragraph elaborating on our research sources. It was not used anywhere else.

Effectiveness of Sucrose Versus Traditional Comfort Measures in Reducing Pain During Infant Vaccinations

Shahid, S., Acosta-Reyes, J., & Florez, I. D. (2025). Sucrose or glucose compared to breast milk for pain control in preterm infants: a systematic review and meta-analysis. *Journal of Perinatology*, *45*(12), 1664–1674. https://doi.org/10.1038/s41372-025-02423-w	The aim of this study was to determine the efficacy of sucrose or glucose in preterm infants requiring heel lancing and venipuncture compared to breast milk or expressed milk for pain control and crying duration.	Systematic review and meta-analysis of randomized clinical trials. Measuring pain intensity using PIPP-R and the Comfort neo pain scale, Neonatal pain, and N-PASS scales. Crying duration measured in seconds from the beginning of the procedure until the end.	A total of 760 records were screened from a total of 875 records from the databases.	The results showed that there was no significant difference between sucrose and breast milk use during venipuncture. Sucrose and glucose reduced crying duration.	This study highlights the importance of providing oral sucrose before painful procedures and that this will be effective in reducing pain associated with venipuncture and heel lancing.	Limitations: There is a risk of bias with each study to be aware of when comparing research. The findings may be less consistent because there is a different amount of sucrose concentrations being used, which can make them harder to compare. This research is geared towards venipuncture and heel lancing, not vaccinations. Strengths: Used meta-analysis to find good randomly controlled trials and used good measurements of pain tools that assess physiological behavior and emotional behavior.	No, we did not use this study because of the risk of bias. This source is also focused more on venipuncture than immunizations, which supports needle-related procedural pain fitting with immunization, but it is more general than what we need.
Shah, V., Taddio, A., & Rieder, M. J. (2009). Effectiveness and tolerability of pharmacologic and combined interventions for reducing injection pain during routine childhood immunizations: Systematic review and meta-analysis. *Clinical Therapeutics, 31,* S104–S151. https://pubmed.ncbi.nlm.nih.gov/19781433/	The aim of this study was to assess the effectiveness and tolerability of interventions to reduce pain experienced during immunization. One of the interventions used is a sucrose solution.	The study researched numerous resources to identify randomized controlled trials and quasi-RCTs with evidence and information relating to interventions to reduce injection pain. They used observers to report assessments of child pain and distress. They included trials that compared 2 interventions.	The sample included 32 studies involving 3856 infants and children from 2 weeks old to 15. I will be pulling the information from the studies that include infants from 2 weeks to 18 months old. There are a lot of statistics for this study.	The study found that administration of sucrose with or without nonnutritive sucking is associated with less pain than the group with no interventions or those who received sterile water. As well as that, the total cry duration was lower in the infants who received sucrose than in those who received sterile water.	The evidence shows that sweet-tasting solutions were associated with reduced pain during childhood immunizations and should be recommended for use in clinical settings and practice.	Limitations: The con for this study is that there is such a broad age range, instead of being solely focused on infants in our age range. It focuses on infants from 2 weeks old to 18 years old, and our age range is 6 to 18 months.	No, we did not use this in out paper because the population used does not align with what we were looking for.

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Taddio, A., Flanders, D., Weinberg, E., Lamba, S., Vyas, C., Ilersich, A. F., Ipp, M., & McNair, C. (2015). A randomized trial of rotavirus vaccine versus sucrose solution for vaccine injection pain. *Vaccine*, *33*(25), 2939–2943. https://doi.org/10.1016/j.vaccine.2015.04.057	The aim of study was to see if administering oral rotavirus with a sucrose solution would reduce the pain leading up to the following two vaccinations	Pain was assessed using the Numerical Rating Scale for parents and clinicians, the Modified Behavioural Pain Scale, and cry duration. Data was analyzed using a t-test.	A total of 120 infants participated- 60 were randomized to the rotavirus vaccine first.	There was no difference in groups during the duration of cry time. There was no statistical difference between groups 2 in receiving the sucrose rotavirus vaccine before or after the other two vaccines. Pain scores were lower with rotavirus than without.	Reducing vaccination pain is important for health outcomes in infants as untreated pain can lead to negative experiences with vaccinations. Sucrose is not currently routinely administered in infants undergoing vaccines.	Strengths: Used randomized controlled trials, which reduce selection bias. Limitations: small sample size and healthy infant from a single clinic finding can be generalized to this population. Multiple pain interventions were used at once, so it can be hard to find the connection between what really worked better.	Yes. This study was useful in determining whether a sucrose solution was effective at providing analgesia in childhood routine vaccinations.
Taddio, A., Riddell, R. P., Ipp, M., Moss, S., Baker, S., Tolkin, J., Dave, M., Feerasta, S., Govan, P., Fletcher, E., Wong, H., McNair, C., Mithal, P., & Stephens, D. (2017). A Longitudinal Randomized Trial of the Effect of Consistent Pain Management for Infant Vaccinations on Future Vaccination Distress. *The Journal of Pain*, *18*(9), 1060–1066. https://doi.org/10.1016/j.jpain.2017.04.002	The aim of the study was to determine if consistent pain management during infant vaccinations would affect levels of reactivity and distress.	Randomized. Double-blind design. Control trial Infants were randomized into 4 groups. 1- 88 were assigned to placebo control (standard care), 2- 89 were assigned to a parent education video about infant soothing, 3- 88 were assigned to a video and oral sucrose solution, 4- 87 were assigned to a video, oral sucrose solution and liposomal lidocaine. Pain was measured at 15-monthand all three interventions were used. Using the Modified Behavioural Pain Scale. Statistical analysis: ANOVA	The total population consisted of 352 healthy infants who were receiving routine vaccinations. The trial was set within 3 clinics.	The results showed no differences in the effectiveness of pain interventions at the 15-month visit. Showed that there was no benefit in pain reduction with repeated usage of interventions.	The ANOVA results provide no significant differences across all 3 phases; it provides the strongest evidence for this. Recommendations would be that, although it is shown that these interventions have no long-term benefit, they still have a benefit when it comes to receiving the vaccination. There should be more research done on the long-term effects of these interventions to reduce infant pain. This is highly relevant to nursing practice and infant care, this research helped to determine which interventions would be most effective over time- Up to 15-months	Strengths: Using a randomized controlled trial, using a double blinded approach leaves out any bias or premeditated assumptions' double-dummy design ensures parents watched a video to understand the importance and how to use these comfort interventions. Used a validated measurement tool, MBPS, to record pain. Limitations: did not include all non-pharmacological interventions, such as breastfeeding, into consideration. The trial may not have been going long enough to really get an accurate picture of the long-term effects.	Yes. This study provides great information and insight about parental concern with their child undergoing painful invasive procedures like vaccinations in the long-term.
Wu, Y., Zhao, Y., Wu, L., Zhang, P., & Yu, G. (2022). [Rev. of *Non-Pharmacological Management for Vaccine-Related Pain in Children in the Healthcare Setting: A Scoping Review*]. *Journal*	The aim of this literature review is to examine how research was conducted on non-pharmacological management in	A literature review. Used databases such as CINAHL, PubMed, MEDLINE,	This study used 22 total literature, 18 randomized controlled trials, 3 quasi-	The results of this review conclude that the usage of non-pharmacological management is effective in mitigating	For reducing vaccine-related pain in newborns and infants, breastfeeding is recommended first, then sweeteners,	Strengths: Includes the reviews of many randomized controlled trials, and a comprehensive search was made of	Yes, this literature review was used. This has great information about what is recommended first as pain relief for newborns and infants.

of Pain Research, *15*, 2773–2782. https://doi.org/10.2147/JPR.S371797	children with vaccine-related pain in the healthcare setting.	Cochrane Library, etc.	experimental studies, and 1 cohort study. The population mainly consisted of neonates and infants.	vaccine-related pain in children. Regarding the analgesic effects of taste interventions, breastfeeding was better than oral sweeteners, and sweeteners were better than sterile water or non-nutritive sucking.	then non-nutritious sucking. A combination of non-pharmacological interventions is recommended to maximize analgesic effects.	the literature. Used a good systematic framework. Limitations: Only English language studies were used- can lead to some bias.	
Yamada, J., Bueno, M., Santos, L., Haliburton, S., Campbell-Yeo, M., & Stevens, B. (2023). Sucrose analgesia for heel-lance procedures in neonates. *Cochrane Database of Systematic Reviews*, *2023*(8). https://doi.org/10.1002/14651858.cd014806	The aim of this review was to evaluate the effectiveness of oral sucrose in reducing pain in neonatal infants during heel lance procedures	Meta-analysis using standard Cochrane methods of research on this topic using CENTRAL, MEDLINE, Embase, PsycINFO, CINAHL, Web of Science and three trial registries. Included Randomized control trials from term and/or preterm neonates receive sucrose for heel lance procedures. Crying time was measured, Pain score measured with NIPS.	The population consists of 55 trials containing 6753 infants, 29 term infants, 22 preterm infants, 4 included.	Results showed that there was a reduction in NIPS with the usage of sucrose vs just using sterile water. Shows that sucrose alone can be effective for short-term pain relief They also found that sucrose, compared to glucose, expressed milk, and skin-skin care shows little to no difference in pain scores.	Recommended to use sucrose with caution for short-term pain relief. It is safe to use for routine procedures such as vaccinations and heel lancing. Limited evidence of using it with combined comfort methods.	Strengths: Good level of appraisal of research and analysis. Used strong evidence to support the findings that include RTC. Limitation: the research they searched for focuses mainly on heel lance procedures, not really on vaccinations. Also, the population is mainly neonates and our sin 6-18 months.	No, we did not use this source because the population is younger than what we need, and the research is not focused on immunizations or vaccines.
Yilmaz, G., Caylan, N., Oguz, M., & Karacan, C. D. (2014). Oral sucrose administration to reduce pain response during immunization in 16–19-month infants: a randomized, placebo-controlled trial. *European Journal of Pediatrics*, *173*(11), 1527–1532. https://doi.org/10.1007/s00431-014-2358-7	The aim of this study was to determine whether oral sucrose solution would reduce pain and crying time during immunizations in 16–19-month-old infants.	The children were randomly assigned to one of three treatment groups. 1- Experimental 75% sucrose solution 2-experimetal 25% sucrose solution 3-a control sterile water Single-blinded parents and nurses had no idea what solution they were given.	A total of 537 infants aged 16-19 months were randomized.	The experimental 75% sucrose group noted significantly reduced pain and crying time compared to the sterile water and 25% sucrose solution group. The experimental 25% also noticed a reduction in pain and crying time, but less than the 75% solution. The finding showed that sucrose dosage affected the infant's pain level.	It is recommended to use oral sucrose as an effective method to reduce pain during infant vaccination. The higher the concentration up to 75% would be more effective to use. Can be implemented in clinical settings without any specialized training.	Strength: They recorded behavioural expressions. Used RTC and used a big sample population. Used strong statistical analysis tools like ANOVA. Limitations: did not record physiological indicators like HR, 02 sat. It only focused on the short-term effects, like crying, and did not consider much of the long-term effects. They did use other	No, we did not use this study because it did not focus on long-term effects, but only on the short-term. The direction of our research needs both short-term and long-term effects to fully interpret the differences in pain reduction.

		Acute behavioural pain was assessed using CHEOPS ANOVA was used to investigate differences in means. The Chi- square test was used to compare rates between groups.				comfort methods on top of the sucrose so it can be hard to tell what truly the reason for decreased pain relief was.	

