Reference ***(include title, author, journal title, year of publication, volume and issue, pages)***	**Evidence level (I-VII)**	**Key findings, outcomes or recommendations**
Stevens, B., Yamanda, J., Lee G., & Ohlsson, A. Sucrose for analgesia in newborn infants undergoing painful procedures. Cochrane Database if Systematic Reviews, 2013, Issue 1 Art. No.: CD001069.DOI:10.1002/14651858.CD001069.pub4.	I	Systematic review of 57 RCT's in which neonates term (29) preterm (27) or both (1) received sucrose for procedural pain. **Sucrose is safe and effective for reducing procedural pain from single events** Sucrose is most effective for heel lancing and has some effectiveness for venipuncture. **Optimal dosing yet to be established, inconsistency in effective sucrose dosing evidence:** • Recommended use of sucrose 0.012 to 0.12 g (0.05ml to 0.5ml of 24% sucrose) be administered **approximately two minutes prior** to single heel lances and venipunctures in neonates. • **The peak effect appears to occur at two minutes and lasts approximately four minutes**; the analgesic effect may wear off for prolonged procedures. • Small doses of 24% sucrose (0.01 to 0.02 ml) are efficacious in very-low birthweight infants while larger doses (0.24 to 0.50 ml) reduce crying time in term infants. • **Sucrose was effective** in reducing crying behaviours, grimacing, and vagal tone. Unidimensional, multidimensional and composite pain scores were reduced during heel lance with **volumes and concentrations ranging from 0.5 to 2 mL of 12% to 50% solution.** **Further investigation required:** • The repeated administration of sucrose in neonates • The use of sucrose with other interventions e.g. NNS and kangaroo care • The minimal effective dose of sucrose during a single painful procedure • Sucrose use in extremely preterm, unstable, ventilated neonates (or a combination) • The effectiveness of sucrose for longer procedures such as ROP examinations, bladder catheterisation, venipuncture and circumcision. • The effect of repeated sucrose administration on immediate (pain intensity) and long-term (neurodevelopmental) outcomes • No studies reported on long-term neurodevelopmental outcomes

Harrison, D., Yamada, J., Adams-Webber, T., Ohlsson, A., Beyene, J., Stevens, B. Sweet tasting solutions for reduction of needle related procedural pain in children aged one to 16 years. Cochrane Database of Systematic Reviews, 2015, Issue 5. Art. No.: CD008408.DOI:10.1002/14651858.CD008408.pub3.	I	Systematic review of RCT's, 7 Published and 1 unpublished, in which children aged one year to 16 years, received a sweet tasting solution or substance for needle-related procedural pain. **Efficacy of sweet tasting solutions or substances for reducing needle-related procedural pain in children beyond one year of age:** • The evidence is insufficient and conflicting in determining the analgesic effects of sweet tasting solutions or substances during acutely painful procedures in young children (one to four years of age) • There is no evidence of analgesic effects of sweet taste in school-aged children.
Beuno, M.,Yamada, J., Harrison, D., Khan, S., Ohlsson, A.,Adams-Webber, T., Beyene, J., and Stevens, B. (2013). A systematic review and meta-analyses of non-sucrose sweet solutions for pain relief in neonates. Pain Research Management, 18(3), 151-163.	I	Systematic review and meta-analyses of thirty-eight studies (3785 neonates) Glucose was investigated in 35 trials, with doses ranging from 0.2 mL to 2 mL of 5% to 50% solutions. Other solutions studied were artificial sweeteners, fructose, glycine, honey and maltitol. **Efficacy and safety of sweet-tasting solutions other than sucrose during acute procedural pain in neonates:** • Glucose reduces pain scores and crying during single heel lance and venipuncture. • 20% to 30% glucose solutions have analgesic effect and can be an alternative to sucrose for procedural pain reduction in healthy term and preterm neonates undergoing a single heel lance and venipuncture **Further investigation to establish the efficacy and safety of non-sucrose solutions:** • Current research demonstrates considerable variability in outcome measurements, due to the volumes and concentrations of non-sucrose solutions administered • No studies measured the effects of repeated doses of glucose for procedural pain

Shah, P., Herbozo, C., Aliwalas, L., Shah, V. Breastfeeding or breast milk for procedural pain in neonates. Cochrane Database of Systematic Reviews 2012, Issue 12. Art. No.: CD004950. DOI: 10.1002/14651858.CD004950.pub3.	I	Systematic review of 28 RCTs or quasi-RCTs of breastfeeding or supplemental breast milk versus no treatment/other measures in neonates, reporting on either physiologic markers of pain or validated pain scores. **Breastfeeding or breast milk should be used to alleviate procedural pain in neonates:** • In reducing procedural pain the administration of glucose/sucrose had similar effectiveness as breastfeeding • Breast milk by syringe was not as efficacious as breastfeeding • Effective for a single painful procedure compared to no intervention **Future investigation required:** • The effectiveness of breast milk for painful procedures in the preterm population • Efficacy and safety of repeated administration of breast milk or breastfeeding for painful procedures
Harrison, D., Stevens, B., Bueno, M., Yamada, J., Adams-Webber, Beyene, J and Ohlsson, A. (2010) Efficacy of sweet solutions for analgesia in infants between one and 12 months of age: A systematic review. Archives of Disease in Childhood,95(6), 406-413	I	Systematic review of 695 studies, revealed 14 RCTs (1674 injections) meeting the inclusion criteria of sucrose, glucose or other sweet solutions administered orally during immunisations in infants beyond the neonatal period to 12 months. **Efficacy of sweet solutions for analgesia in infants between 1 and 12 months of age:** • Infants aged 1–12 months who had sucrose or glucose administered before immunisation have moderately reduced incidence and duration of crying • Healthcare professionals should consider using sucrose or glucose before and during immunisation • Use sucrose or glucose with other recommended procedural pain management strategies e.g. NNS, breastfeeding and distraction for immunisation • Effective doses for neonates ranged between 0.05ml and 2 ml of 24% sucrose • Infants one to 12 months, require higher concentrations of either sucrose or glucose for effectiveness compared to neonates • Non-sucrose sweet solutions of sufficient concentration are analgesic **Further studies in infants beyond the neonatal period required**: • Comparison of single dose to divided doses, of sweet solution, given over the duration of a prolonged procedure • Evaluation of different concentrations of sucrose and glucose
Slater, R., Cornelissen,L., Fabrizi, L., Patten, D., Yoxen, J., Worley, A.,Boyd, S., Meekt, J., Fitzgerald, M.(2010) Oral sucrose as an analgesic drug for procedural pain in newborn infants: a randomised controlled trial. The Lancet, 376(9748), 1225–32.	II	This RCT demonstrated no significant differences in the nociceptive brain activity measured with neonatal EEG or magnitude or latency of the spinal nociceptive reflex withdrawal measured with EMG between neonates given sucrose versus sterile water. **Cochrane review (Stevens, et.al., 2013)) revealed a number of methodological issues:** • small sample size, study may have been underpowered • moderate attrition rates • questionable methods used to measure and analyse EEG and EMG recordings • potentially insufficient doses of sucrose (i.e. 0.5 mL) administered to full-term infants

Harrison, D. (2008). Oral sucrose for pain management in infants: Myths and misconceptions. Journal of Neonatal Nursing, 14(2), 39-46.	VII	• Oral sucrose, when administered to both healthy and sick hospitalised infants, in small volumes, prior to acute painful procedures is a safe, effective, economic, and feasible pain reduction strategy • **There is no evidence of increased risk of necrotising enterocolitis, dental caries, bacterial overgrowth or hyperglycemia associated with oral sucrose** • Sucrose used for pain management is endorsed by the Baby Friendly Health Initiative (BFHI)
Blass, E., & Ciaramitaro, V. (1994). A new look at some old mechanisms in human newborns. Monographs for the Society for research in child development. 59(1).	II	• **Oral sucrose failed to calm newborn infants born to mothers on methadone, due to their low levels of circulating endogenous opioids** • The same newborn infants were calmed when sucking on a dummy
Leng, H.Y, Zheng, X.L, Zhang, X.Y, He, H.Y, Tu, G.F, Fu, Q, Shi, S.N, Yan, L. (2010) Combined non-pharmacological interventions for newborn pain relief in two degrees of pain procedures: a randomized clinical trial. European Journal of Pain 989-997.	II	In this multi-centered RCT newborns behavioral responses to shallow or deep heel stick procedures on neonates were prospectively reviewed. • Deeper heel lance procedures causes more pain to the neonates enrolled. • Combined oral sucrose administration with non-nutritive sucking (NNS) and swaddling provided the best overall pain relief for neonates undergoing deep heel stick procedure. • Heart rate and oxygen saturations will return to baseline more quickly and crying time will be reduced with swaddling. • Oral sucrose use, NNS, swaddling, facilitated tucking and kangaroo care is supported for neonatal pain management.
Matsuda, E. (2017) Sucrose as analgesia in neonates undergoing painful procedures, Cochrane Corner, Advanced Journal of Nursing, Vol 117, No 8.	I	Systematic review of 74 RCT's. • For neonates undergoing venipuncture, composite and multidimensional pain scores and cry variables were reduced by sucrose concentrations of 24% to 30%.
Stevens.B, Yamada.J, Ohlsson.A, Haliburton.S, July 2016, Sucrose for analgesia in newborn infants undergoing painful procedures, Cochrane neonatal group, the Cochrane library.	I	Systematic review (Cochrane review) looking at 74 studies enrolling 7049 infants. • Sucrose has been found to be effective in providing relief for single events procedures, such as heel lance, venipuncture and intramuscular injection in both term and preterm infants. • Does not provide effective pain relief for circumcision.
Wilkinson.D.J.C, Savulescu.J, Slater.R, 2012, Sugaring the pill- ethics and uncertainties in the use of sucrose for newborn infants,Arch pediatr Adolesc Med, Vol 166 (no.7).	II	• Evidence of long-term neurodevelopmental consequences of pain, such as altered sensory processing, in the newborn period. • When admitted to neonatal units, infants undergo a large number of painful procedures • Studies that use near-infared spectroscopy have demonstrated cortical activity in response to acute noxious stimuli in infants as low as 25 weeks gestation.